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Information in support of the evaluation of Ecologically and Biologically Significant Areas (EBSA) in the Eastern Arctic Biogeographic Region

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Foreword

This series documents the scientific basis for the evaluation of aquatic resources and ecosystems in Canada. As such, it addresses the issues of the day in the time frames required and the documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

Research documents are produced in the official language in which they are provided to the Secretariat.

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ABSTRACT

The identification of ecologically and biologically significant areas (EBSAs) is an important tool for highlighting areas that have particularly high ecological or biological importance. Periodic re-evaluation of EBSAs to integrate information and/or data from new studies and/or enhanced techniques in the application of EBSA criteria is prudent and essential to the Ecosystem Based Management (EBM) approach. This will assist in ensuring management decisions are made with the best available information. Canadian Arctic EBSAs were identified by Fisheries and Oceans Canada (DFO) in 2011. DFO Oceans Program requested that DFO Science re-examine the EBSAs within the Eastern Arctic Biogeographic Region using DFO's national criteria.

Twelve EBSAs in the Eastern Arctic Biogeographic Region, originally identified in 2011, were re-examined as part of this review. The re-evaluation resulted in the identification of 20 EBSAs in the Eastern Arctic Biogeographic Region considering the three main EBSA criteria (uniqueness, aggregation and fitness consequences). Two EBSAs were unchanged. Several EBSAs were subdivided into multiple EBSAs and others were reduced in size. The modified EBSAs are generally smaller and focused on their key ecological/biological features.

An additional four EBSAs from 2011 (Baffin Bay, Davis Strait, Hatton Basin offshore areas) were not included in the re-evaluation as they require further data analysis.

Uncertainties with EBSA identification and boundary delineation remain as a result of limited data for the Arctic, changing climate and environmental conditions, and seasonal and annual variability in habitat use (e.g., ice-associated species, migratory species). As a result, EBSAs will continue to require re-examination as new information becomes available.

Information à l'appui de l'évaluation des zones d'importance écologique et biologique (ZIEB) dans la région biogéographique de l'est de l'Arctique

RÉSUMÉ

La désignation des zones d'importance écologique et biologique (ZIEB) est un outil important pour mettre en évidence des zones qui présentent une importance écologique et biologique particulièrement élevée. La réévaluation périodique des ZIEB en vue d'intégrer des renseignements ou des données tirés de nouvelles études ou de techniques améliorées dans l'application des critères relatifs aux ZIEB est un élément prudent et essentiel de l'approche de la gestion écosystémique. En effet, elle contribue à garantir que les décisions de gestion sont fondées sur la meilleure information disponible. Pêches et Océans Canada (MPOP) a désigné les ZIEB de l'Arctique canadien en 2011. Le Programme des océans a demandé au Secteur des sciences de réexaminer les ZIEB de la région biogéographique de l'est de l'Arctique selon les critères nationaux du MPO.

Douze ZIEB situées dans la région biogéographique de l'est de l'Arctique, désignées initialement en 2011, ont ainsi été réexaminées dans le cadre de cet examen. La réévaluation a entraîné la désignation de 20 ZIEB dans la région biogéographique de l'est de l'Arctique si l'on prend en compte les trois critères principaux relatifs aux ZIEB (caractère unique, concentration et conséquences sur la valeur adaptative). Deux ZIEB sont demeurées inchangées. Plusieurs ont été subdivisées en de multiples ZIEB et d'autres ont vu leur taille réduite. Les ZIEB modifiées sont généralement plus petites et axées sur leurs principales caractéristiques écologiques/biologiques.

Quatre autres ZIEB de 2011 (baie de Baffin, détroit de Davis, zones hauturières du bassin Hatton) n'ont pas été incluses dans la réévaluation, car il faut analyser d'autres données.

Des incertitudes demeurent autour de la désignation des ZIEB et de la définition de leurs limites en raison des données limitées sur l'Arctique, de l'évolution des conditions environnementales et climatiques, ainsi que de la variabilité saisonnière et annuelle de l'utilisation de l'habitat (espèces associées à la glace, espèces migratoires, etc.). Il faudra donc continuer de réexaminer les ZIEB à mesure que de nouveaux renseignements seront disponibles.

INTRODUCTION

Under Canada's *Oceans Act*, Fisheries and Oceans Canada (DFO) is authorized to provide enhanced management to areas of the oceans and coasts which are ecologically and biologically significant (DFO 2004). To accomplish this, DFO has adopted a set of guiding principles which includes the ecosystem-based approach to management (EBM). EBM considers all components of the ecosystem based on best available scientific, local, and traditional ecological knowledge. Along with other guiding principles, the approach will help to ensure effective coordination of policies and key programs within DFO, across government and collaborating stakeholders. To maintain the structure and function of the ecosystem within these management frameworks, a clear understanding of the interactions of environmental components within the ecosystem is critical.

As part of the EBM approach, the Canadian Arctic is divided into five marine biogeographic regions: Hudson Bay Complex, Eastern Arctic, Western Arctic, Arctic Basin and Arctic Archipelago (Figure 1; DFO 2009a). For each biogeographic region, DFO Science has provided advice on the identification of Ecologically and Biologically Significant Areas (EBSA) using national guidance and criteria (DFO 2004). From 2009 to 2012, EBSAs were identified, mapped and described within each of the five biogeographic regions (DFO 2011a, 2014a, b).

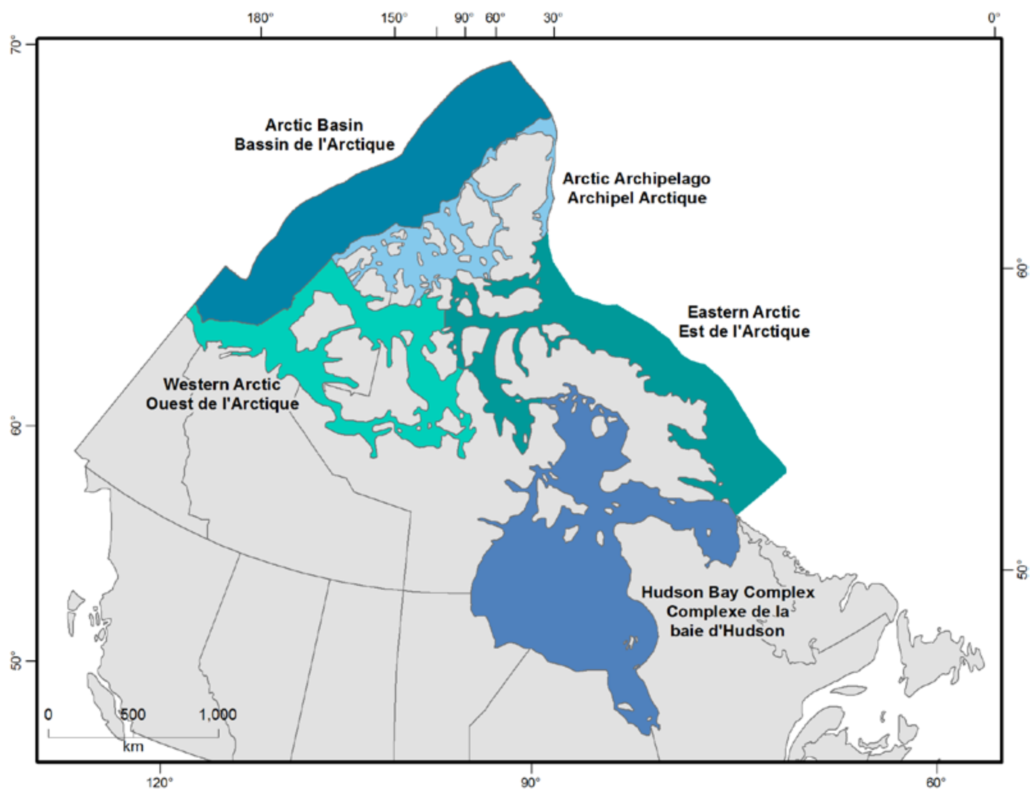

Figure 1. Canadian Arctic Biogeographic Regions (modified from DFO 2009a).

Periodic re-evaluation of EBSAs based on new knowledge and application of EBSA criteria is prudent and essential to the EBM approach to ensure management decisions are made with the best available information. Experience in the review of material and application of EBSA criteria within different Canadian biogeographic regions has resulted in refinement of approaches and recommendations for future assessments (DFO 2011b). Current surveys, scientific analysis and new knowledge can also be considered during re-evaluations. In 2012, EBSAs in the Beaufort Sea were re-evaluated using refined approaches (DFO 2014b).

DFO Oceans Program has requested a re-evaluation of EBSAs in the Eastern Arctic Biogeographic Region against the national criteria and to identify where the key ecological features are located within each EBSA. DFO (2015a) describes the ecologically and biologically significant areas identified in the Eastern Arctic Biogeographic Region in 2015.

EASTERN ARCTIC BIOGEOGRAPHIC REGION

The Eastern Arctic Biogeographic Region (Figure 2) is considered a highly productive and dynamic ecosystem. The region is approximately 780,000 km2 with the longest latitudinal range of all Arctic biogeographic regions. The region extends from Smith Sound (~78° N) in the north to Cape Chidley (60° 22′ 40″ N) to the south (Figure 2). The region includes Baffin Bay, Davis Strait and the Hatton Basin and extends eastward to Canada’s Exclusive Economic Zone. It extends west to include Jones Sound, Barrow Strait, Lancaster Sound, Peel Sound, and the Gulf of Boothia (Figure 2).

Physical Oceanography

General surface circulation for the biogeographic region is shown in Figure 3. Cold and freshened Arctic waters enter northern Baffin Bay through Nares Strait, Jones and Lancaster sounds to form the Baffin Island Current, an important component of the counter-clockwise circulation in the biogeographic region (Münchow et al. 2015). The Baffin Island Current flows southward along the east coast of Baffin Island and into the western half of Davis Strait, eventually feeding the Labrador Current. Along the west Greenland slope and shelf, the West Greenland Current and further offshore West Greenland Shelf Current transports cold, fresher Arctic water northward as a continuation of the flow from the East Greenland Current, and relatively warm and salty waters from the Irminger Sea further offshore. Most Irminger water is redirected south at Davis Strait, although a portion continues northward along the slope into Baffin Bay with the West Greenland Current (Bourke et al. 1989). Surface and mid-level waters follow a cyclonic circulation pattern. The deep bottom water in Baffin Bay is old and relatively isolated (Rudels et al. 2004).

Within the Canadian Archipelago, surface waters generally flow west to east (i.e., Pacific water) from the Beaufort Sea and Canada Basin driven by sea surface slope. Warmer and saltier Atlantic sourced subsurface water flows east to west along the south coast of Devon Island in Lancaster Sound at depths from 100–150 m. This water is limited to the region east of the sill at Barrow Strait.

The continental shelf region is characterized by a maze of islands, fiords, channels, straits, troughs and basins of widely different character. These features contribute to rotational hydraulics, flows and counterflows, tidal mixing and upwelling of different water masses which can influence productivity and ecological significance at a local scale. Oceanic fronts regulate the distribution of heat, salt and mass budgets and exert control over the location of ice-edges, and often play significant roles in setting ecosystem boundaries (Muench 1990). In some cases, fronts are recognized as regions of elevated biological activity on continental shelves, where predators may aggregate to exploit prey concentrations supported by elevated production (Hyrenback et al. 2000). Persistent frontal features modelled by Cyr and Larouche (2015) indicate areas where ocean dynamics can lead to conditions that support ecological significance, and/or confirm the locations of many frontal features that have been previously described in the literature (Figure 3).

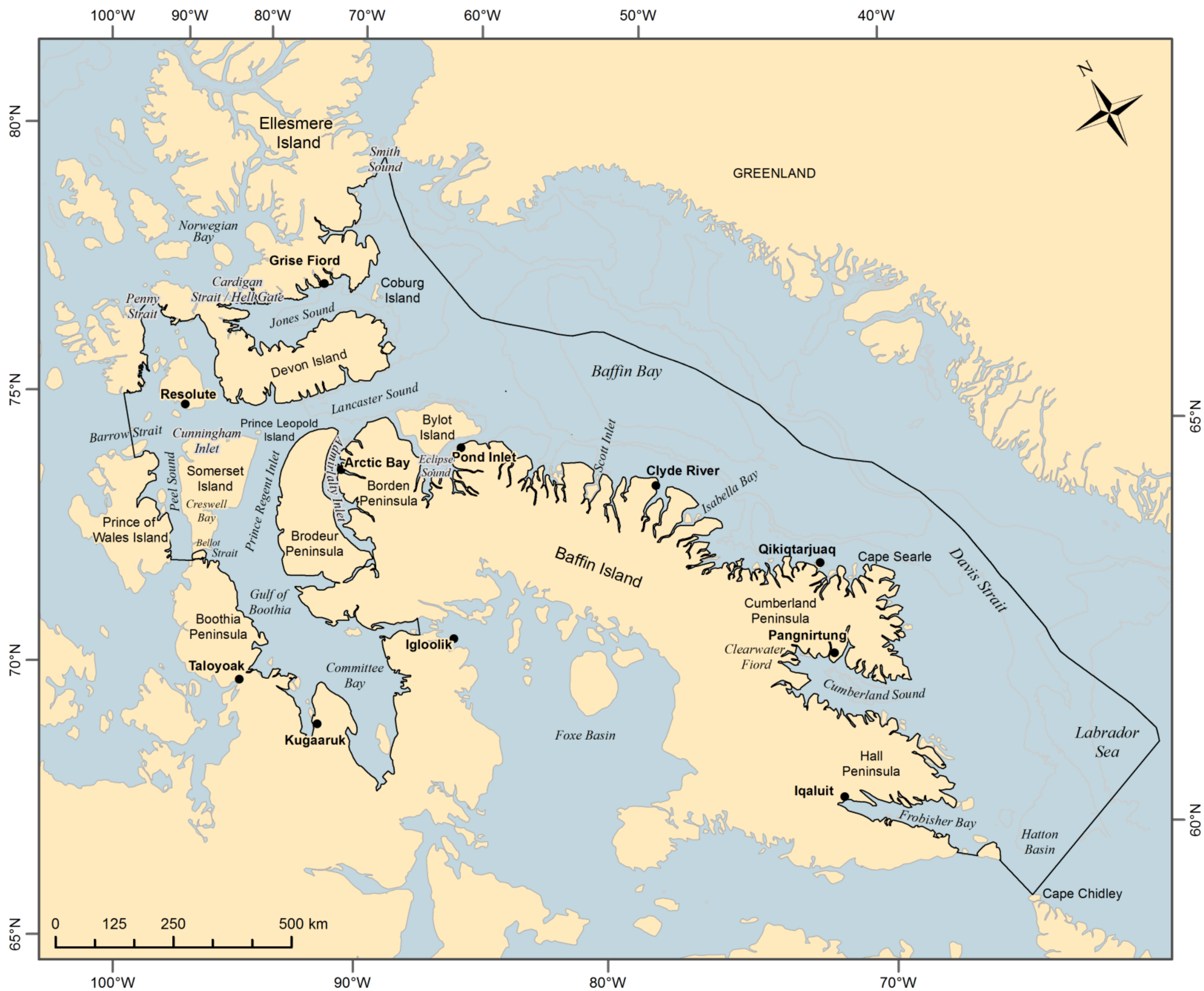

Figure 2. Eastern Arctic Biogeographic Region identifying communities and locations mentioned in the text.

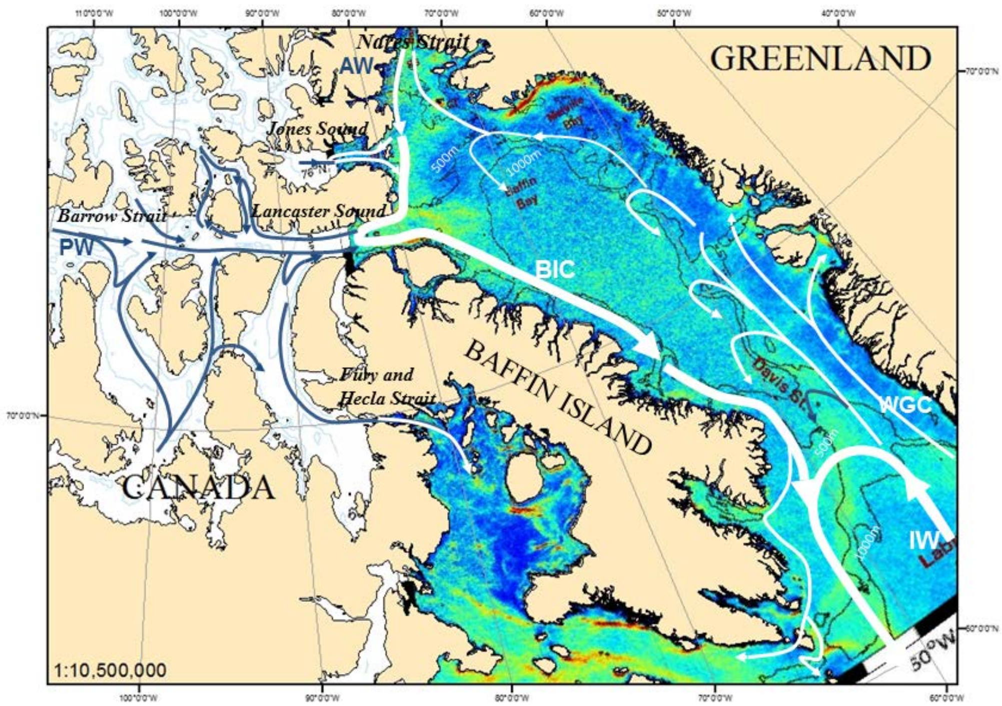

Figure 3. General surface circulation (arrows) in the Eastern Arctic Biogeographic Region (from Curry et al. 2011 and McLaughlin et al. 2000). Arctic water (AW), Pacific water (PW), Baffin Island Current (BIC), Irminger water (IW) and West Greenland Current (WGC) are identified. Mean sea surface temperature-derived frontal frequency from Cyr and Larouche (2015) illustrated by transition colour zones (light green to red).

A large front forms in northern Baffin Bay (~75.25°N) in the general region of the North Water Polynya between Atlantic-derived water carried by the West Greenland Current and Arctic-derived waters exiting southward through Nares Strait and Jones Sound via the Baffin Island Current. Based on its location, the front plays a contributing role in the formation of the Baffin Island Current and eventual export of freshwater to the North Atlantic (Lobb et al. 2003).

A large and strong frontal boundary zone occurs in Davis Strait separating Arctic Water from the West Greenland Current and Irminger water. Strong opposing currents at the frontal boundary are present in all months but April, and are strongest in autumn and winter.

In Lancaster Sound, the most biologically productive areas occur at the eastern end of the sound where different currents converge (Grebmeier and Barry 1991, Cyr and Larouche 2015). Cyr and Larouche (2015) also identified an area of high frontal probability in Cumberland Sound.

Bathymetry

The Eastern Arctic Biogeographic Region includes waters within the Arctic Archipelago, Baffin Bay, and Davis Strait. Bathymetry (Figure 4) influences oceanographic currents and water stratification, resulting in zones of upwelling, a range of habitats and associated species assemblages.

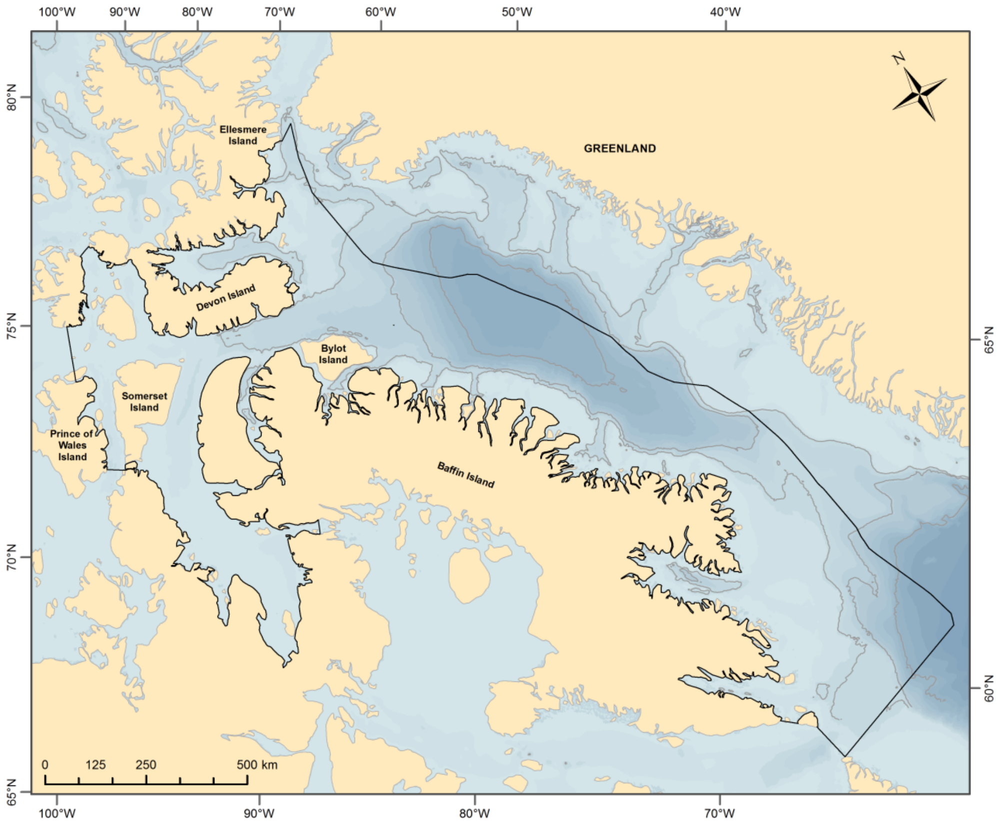

Figure 4. General bathymetry in the Eastern Arctic Biogeographic Region. The 500 m, 1,000 m, 2,000 m water depth contours are marked.

Slopes (Figure 5) and their glacial or erosional deposition features may be important to the regional ecosystem. Baffin Bay is a deep basin (maximum depth > 2,300 m) between Baffin Island and Greenland. Nares Strait, which includes the shallow sills at Smith Sound and Kennedy Channel (~200 m), is located to the north of Baffin Bay which extends southward to the 70th parallel. Davis Strait extends between the 70th and 60th parallel separating Baffin Bay from the Labrador Sea. At its narrowest point Davis Strait consists of an undersea ridge, a continuation of the mid-Labrador ridge, extending from the coast of Baffin Island to Greenland. The shallowest waters in the strait are found along this sill (350–550 m depth) between Baffin Bay and the Labrador Sea and acts as a large sill area. The Hatton Basin is the large basin in Davis Strait which lies on the continental shelf east of Resolution Island and the sill at the entrance to Hudson Strait.

The continental shelf on the east coast of Baffin Bay runs the entire length of the island from Bylot Island in the north to Resolution Island in the south. The shelf is approximately 50–60 km wide with the shelf break occurring in about 300 m water depth. The shelf generally widens towards the south, and is transected by deep U-shaped troughs which are a continuation of coastal fiords. Troughs, visible along the Baffin Island coastline in Figure 5, have steep side profiles that can be eroded more than 600 m below the adjacent shelf. The continental slope has a regular form and has a gradient of about 2–3° in most areas, though steeper slopes up to 10° do occur in localized areas. Even more extereme slopes (up to 25°) are obsereved on the trough margins.

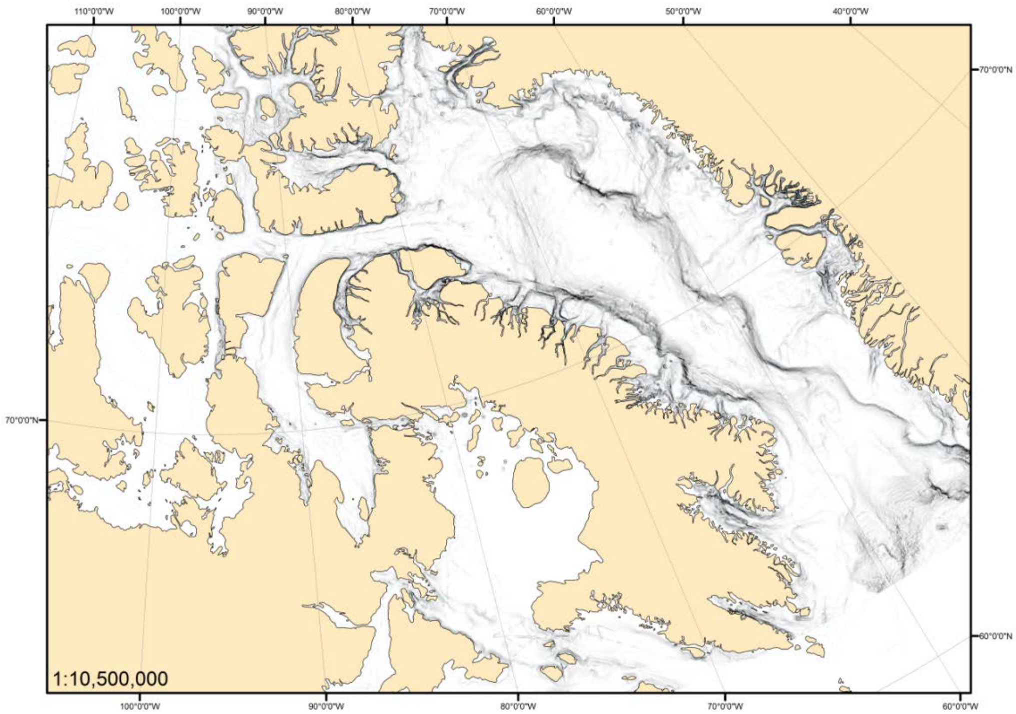

Figure 5. Slopes in the Eastern Arctic Biogeographic Region. Dark shade indicates slope >20 % and gradually reduces to light shade, where white indicates 0 % (flat).

Sea Ice and Related Habitats

Sea ice is a dominant feature of the Arctic environment and directly or indirectly influences all aspects of the Arctic ecosystem. For many Arctic species the presence or absence of suitable sea-ice conditions can influence distribution, density, trophic interactions, and reproductive success. For example, the timing of arrival to summering areas for many marine mammals is dependent on the presence or absence of sea ice.

Freeze-up (Figure 6) and break-up (Figure 7) dates are highly variable within the region. Freeze-up begins in September in the north and in late November in the south. Ice remains in some areas year-round (e.g., Gulf of Boothia). Break-up begins in June in Baffin Bay, Davis Strait and Lancaster Sound, while ice within the archipelago typically does not begin to break-up until August, if at all (Figures 6 and 7).

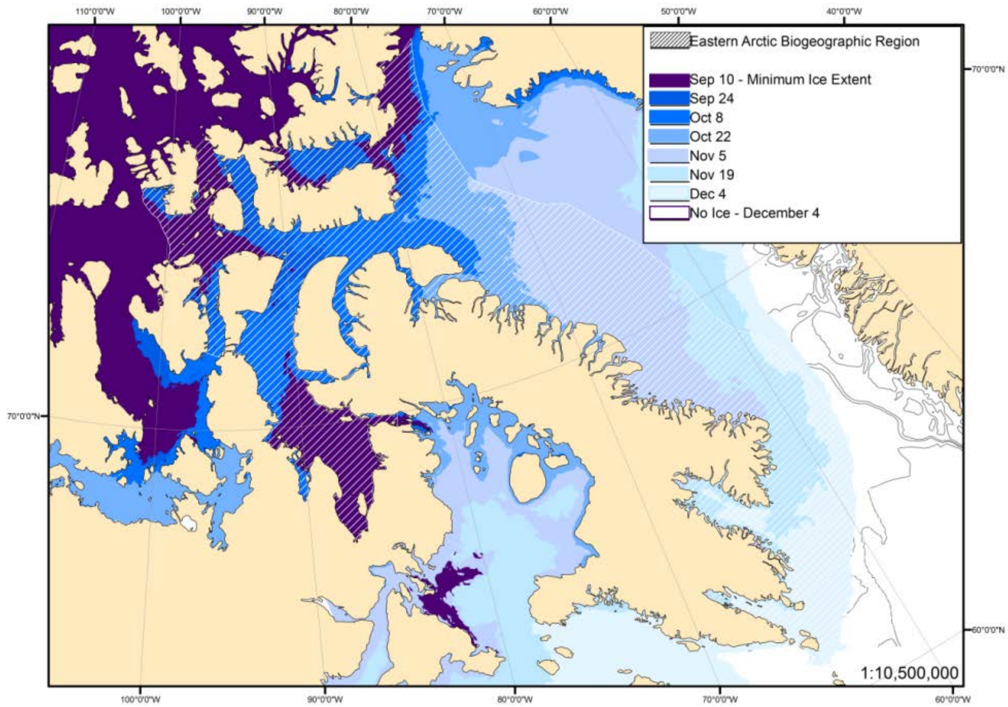

Figure 6. Median dates of ice freeze-up (1981–2010) for the Eastern Arctic Biogeographic Region. Minimum ice extent on September 10 (darkest shade) and maximum ice extent from December to June (lightest shade). (modified from [CIS 2013]).

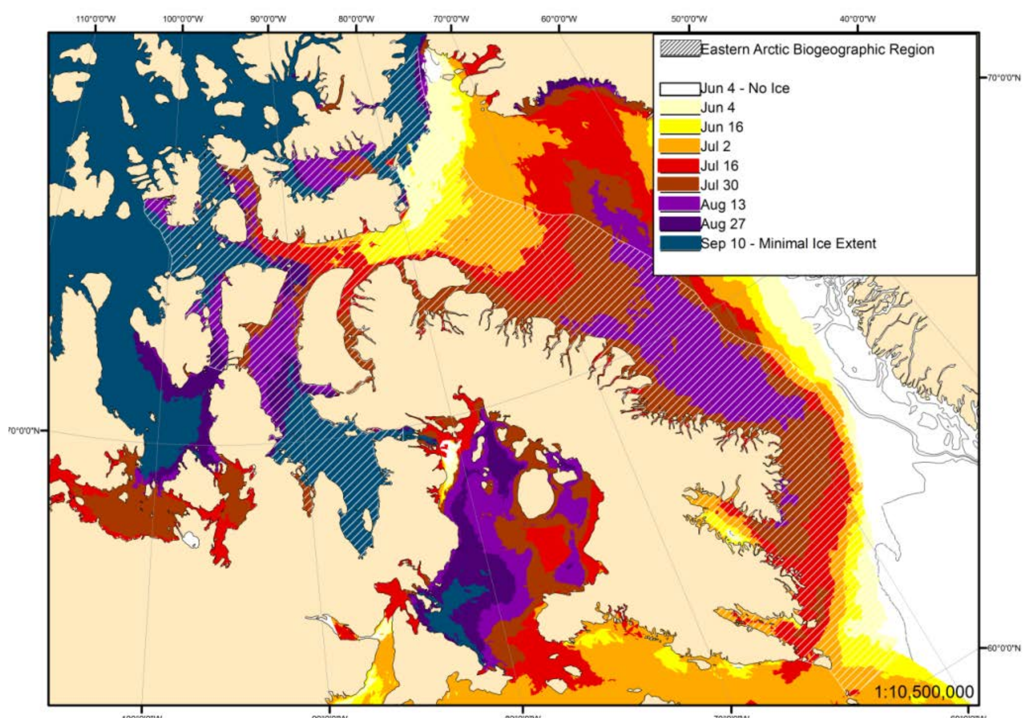

Figure 7. Median dates of ice break-up (1981–2010) in the Eastern Arctic Biogeographic Region. Minimum ice extent on September 10 (darkest shade) and maximum ice extent from December to June (lightest shade). (modified from [CIS 2013]).

Various types of ice or ice-related features occur in the Arctic (e.g., multi-year ice, first-year ice, landfast ice, polynyas, flaw leads). Sea ice is a dynamic feature with extensive inter-annual variation in concentration/extent, mobility and timing of formation and melt. Sea ice features (e.g., cracks) vary seasonally and annually. Landfast ice occurs along coastlines paralleling the mobile pack ice. The advancing and retreating ice edges and the marginal ice zone are important habitat features.

Polynyas and flaw leads are persistent and recurring areas of thin ice and/or open water within ice-covered waters. They are considered some of the most important ecological features of ice covered seas and generally represent areas of higher productivity (Stirling et al. 1981). Their characteristics are dependent on a combination of oceanographic, bathymetric, coastal and atmospheric forcing variables. For example, tides can play an important role in ice motion and the formation of polynyas, openings and leads. Hannah et al. (2009) correlated many of the polynyas of the Canadian Archipelago with modelled tidal currents and vertical excursions, indicating the importance of tides and tidal forcing to these polynyas.

General locations of polynyas and flaw leads are often identified by averages of sea ice presence, type and thickness. The following polynyas have been identified; Committee Bay, Frobisher Bay, Cumberland Sound, Franklin Strait, Bellot Strait, Prince Regent Inlet, Lancaster Sound, Karluk Brooman, Queens Channel and Penny Strait, Dundas Island, Hell Gate-Cardigan Strait, Lady Ann Strait, Bylot Island, Coburg Island and North Water (Figure 8).

Flaw leads occur as a result of ice movement and as part of the ice-breakup process. Two places where flaw leads occur consistently are around the Cumberland peninsula and the area connecting the North Water Polynya with Lancaster Sound.

The biological importance of polynyas varies based on the location, type and characteristics (Tremblay and Smith 2007). They are generally recognized as sites with high primary production and abundant planktivorous birds and marine mammals (Stirling 1997). As polynyas are expected to have high and extended periods of productivity (e.g., timing, magnitude) it is expected they would also be associated with enhanced benthic and higher trophic level productivity (Arrigo and van Dijken 2003). Higher observed productivity may not occur directly below the polynya but rather downstream of them (Grebmeier and Barry 2007). Polynyas are important winter habitat for a number of species in the Arctic (Stirling 1980). Mammals and birds use the polynya to gain access to open water for breathing and foraging. The complex of flaw leads and polynyas allow birds and marine mammals early access to staging, breeding, foraging and summering sites which may have a positive influence on species fitness and survival.

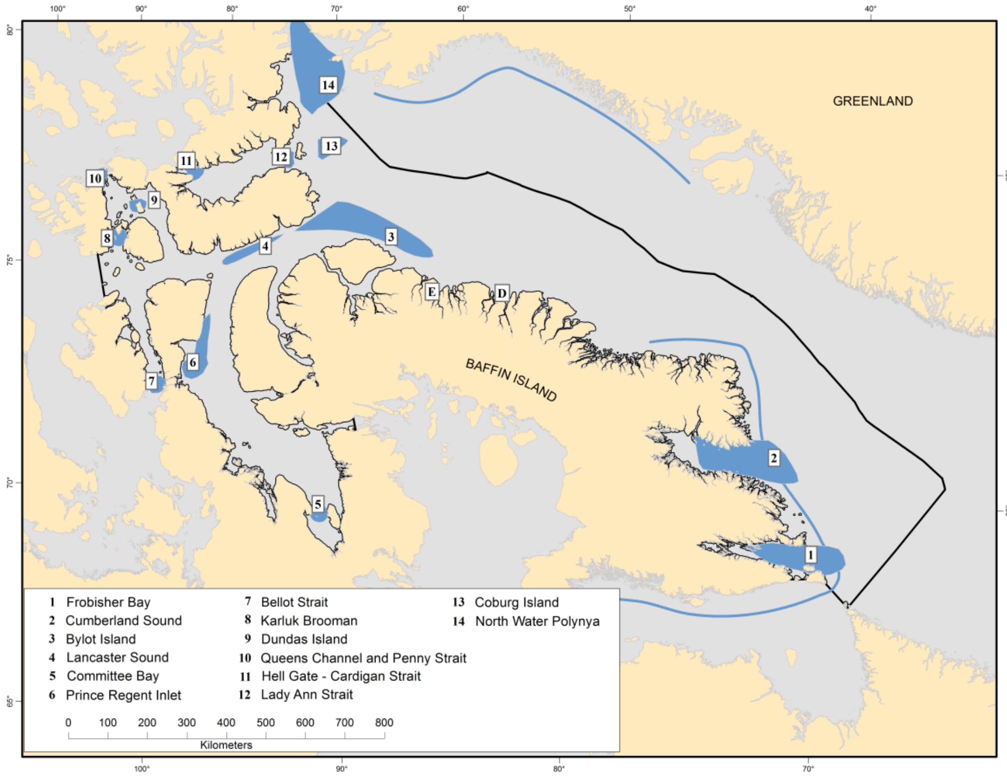

Figure 8. Schematic with general locations of polynyas and flaw leads in the Eastern Arctic Biogeographic Region (modified from Hannah et al. 2009).

Primary Production

Thirty year chlorophyll *a* (Chl *a*) climatology (1998–2010) for the Eastern Arctic biogeographic region is shown in Figure 9. The Chl *a* trends provide a proxy for average surface primary productivity biomass in the region (Cyr and Larouche 2015). Primary productivity is controlled by factors altering light (i.e., irradiance) and nutrient availability and includes the growth of hundreds of phytoplankton, ice algae and macroalgal species.

Phytoplankton

In early spring, increasing light and ice melt enhance water column stability and result in phytoplankton blooms within the marginal ice zones. These algal blooms follow the sea ice retreat and make up 50 % of the total primary production in Arctic waters (Sakshaug 2004). Ice-edge blooms occur within about 20 days of ice retreat, sometimes forming long belts along the ice-edge (Perrette et al. 2011). These algal blooms occur prior to algal growth within the adjacent open water.

As the melt continues into the spring season, the sympagic algae sloughs off the sea ice, and becomes part of the phytoplankton community. Maximum abundance occurs near the surface at the beginning of July and deepens over time (Grondin et al. 2016). The phytoplankton community shifts towards a planktonic community largely dominated by *Thalassiosira* spp. and *Chaetoceros* spp., with limited occurrences of < 10 µm flagellates and dinoflagellates (Grondin et al. 2016).

In waters >50 m deep, the phytoplankton bloom occurs earlier in Baffin Bay than in the archipelago regions and the magnitude of surface water blooms is greater in Baffin Bay than the archipelago (Ardyna et al. 2013). Both summer and fall blooms can occur but the summer bloom is of larger magnitude (Ardyna et al. 2013).

Ice algae

In addition to the photosynthesis that occurs in open water, the ice algal community provides an important source of primary production particularly in land fast-ice areas. Ice algae are found in and on the bottom side of sea ice and can provide planktonic grazers with an early and concentrated food source before phytoplankton are readily available (Bradstreet and Cross 1982, Michel et al. 2006). Ice algal communities in the Canadian Archipelago have high recorded biomass (Michel et al. 2006) and ice algae have been reported to contribute on average 57 % to the total Arctic marine primary production (Gosselin et al. 1997). Inter-annual variability in sea-ice algal biomass and productivity is influenced by changes in ice thickness, precipitation, timing of snow melt and the distribution of snow cover (Welch and Bergmann 1989, Agnew and Silis 1995, Mundy et al. 2005).

Ice algae are more significant contributors to total primary productivity when compared to ice algae growing in polynya areas. In the North Water Polynya area and in the Eastern Canadian Arctic, ice algae represents < 3 % of the total algal biomass (phytoplankton + ice algae), therefore the potential contribution of ice algal carbon to planktonic grazers is relatively small in comparison to phytoplankton carbon (Michel et al. 2002).

The secondary production associated with the sea ice communities provides an important link between primary productivity and marine mammals in the Arctic.

Macroalgae

Cross et al. (1987) indicated that macrophytic algae are a common feature of arctic and subarctic nearshore waters, both on exposed rocky coasts and on soft bottoms. In their description of the algal community at Cape Hatt in Eclipse Sound they identified 60 species of benthic macroalgae. Thomson et al. (1986) found benthic macroalgae in trawls or observed by divers at most sites sampled in the central and eastern Arctic. They found kelp wherever rock substrate formed a suitable site for attachment and most macroalgal biomass was due to Laminariales, especially *Agarum cribrosum*, *Alaria grandifolia*, *Laminaria solidungula* and other species of *Laminaria*. At Cape Hatt, beyond the initial intertidal zone at depths > 5 m to at least 30 m, the kelp *Agarum cribosum was* dominant (Cross et al. 1987). Kelp carbon contributes significantly to the diet of many benthic animals and can provide important habitat for spawning, and protection and is therefore potentially important to overall nearshore ecosystem structure. However, kelp production was estimated to have a relatively small contribution to the Arctic marine food web in Lancaster Sound when compared with phytoplankton or ice algae (Welch et al. 1992).

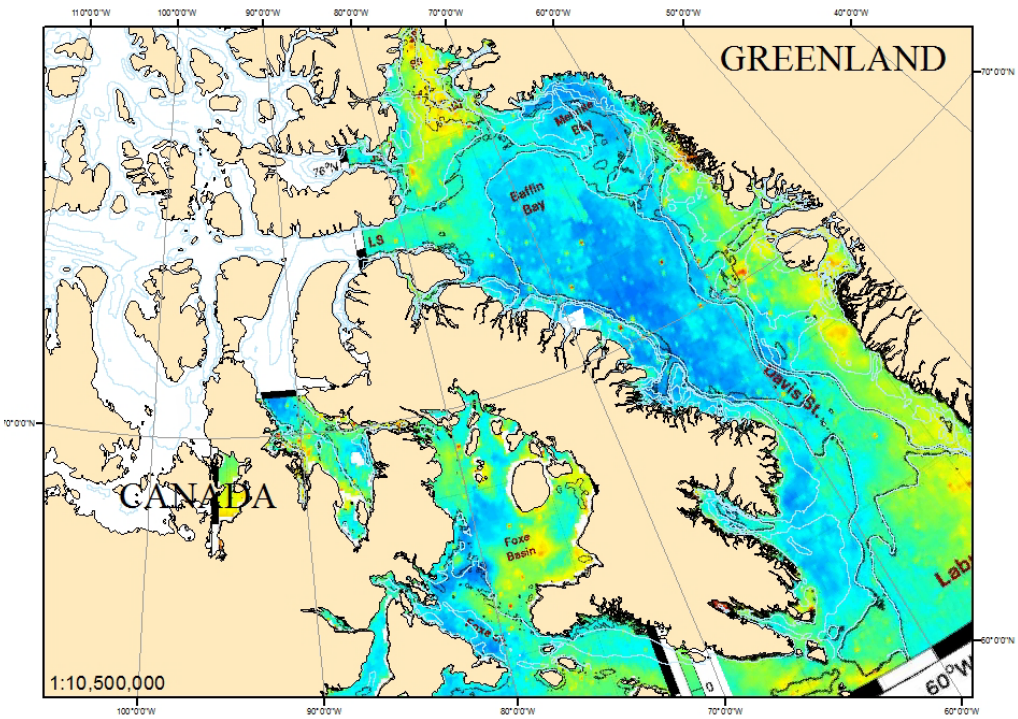

Figure 9. Thirty year Chlorophyll a climatology (1998–2010) in the Eastern Arctic Biogeographic Region (from Cyr and Larouche 2015). Data from Lancaster Sound/Barrow Strait are not available.

Invertebrates

Pelagic, benthic and ice-associated communities of invertebrates are important in the Arctic marine ecosystem. For herbivorous zooplankton, surviving the arctic winter requires that sufficient energy be stored in summer to enable ten months or more of reduced resources. Their reproduction is synchronized with season and environmental conditions to enable offspring to exploit the brief period of intense primary production. A large percentage of primary production is consumed by zooplankton or recycled via microbial loop in the water column. Therefore pelagic food webs have a direct impact on the benthic community abundance and biomass.

In Arctic waters, *Calanus* spp. often dominate copepod biomass. Saunders et al. (2003) found that large copepods were able to respond rapidly to the spring bloom via upward migration of overwintering individuals. The weight specific herbivory rate of copepod assemblages was positively related to phytoplankton concentration (Saunders et al. 2003).

The pelagic food webs impact the amount of organic matter reaching the benthos, particularly in areas where zooplankton and bacterial population levels intercept fluxes between water column primary productivity and the benthos. This is particularly evident in the continental shelf region where high benthic biomass can occur due to a tight coupling between water column primary production and benthic secondary production (Grebmeier and Barry 1991). The highest benthic biomass and fluxes in the Canadian Eastern Arctic occurs in northwestern Baffin Bay and Lancaster Sound (Kenchington et al. 2011). The rest of the Canadian Eastern Arctic has much lower biomass due to lower nutrients and primary production in the overlying water column (Thomson 1982).

In benthic environments, release of inorganic nutrients back into the water column by re-mineralization of detritus is another important process for the functioning of marine ecosystems.

In the Canadian Eastern Arctic, the highest carbon remineralisation rates were recorded in Barrow Strait/Lancaster Sound whereas comparatively lower carbon fluxes were measured in the North Water Polynya (Darnis et al. 2012). Remineralization of silicic acid is also higher in Barrow Strait/Lancaster Sound.

Polynyas may influence benthic communities. However, for coastal polynyas and on continental shelves underlying seasonal ice zones the largest benthic populations in the Arctic are not found directly beneath polynyas, but rather downstream of them (Grebmeier and Barry 2007).

A diverse community of organisms that are benthic or pelagic at other times of the year make use of the temporary soft undersurface of spring sea ice (Pike and Welch 1990). An algal layer, composed principally of diatoms (Bradstreet and Cross 1982), is linked to a community of invertebrates composed mainly of gammarid amphipods and mysids (Pike and Welch 1990). Sympagic amphipods were limited to water depths less than 100 m and were most important at < 50 m. This sub-ice macrofauna is used by seabirds (Bradstreet 1980), ringed seal (Bradstreet and Cross 1982) and Arctic Cod (Bradstreet and Cross 1982).

Benthic organisms are classified as infauna (i.e., living within the substrate) or epibenthic (i.e., living on the substrate). Infauna includes polychaetes, bivalves, amphipods, ostracods and cumaceans. Amphipods and polychaetes are most abundant at shallowest depths while bivalves are most abundant at 6–55 m (Thomson et al. 1986). Siferd and Welch (1992) identified seven bivalve taxa in Barrow Strait: *Mya truncata*, *Serripes groenlandicus*, *Hiatella arctica*, *Musculus* spp. *Astarte* spp., *Macoma* spp. and *Delectopectien greenlandicus*. Epibenthos in the Arctic Archipelago included starfish, sea urchins, anemones, tunicates, isopods, sea spiders and decapods (Thomson et al. 1986).

The intertidal zone is underwater at high tides and most areas of the seabed may be exposed to air during low tide. Thomson et al. (1986) found infaunal animals were scarce in shallow water and these areas tend to be inhabited by mobile species. The zone from 0 to 3–5+ m depth is generally depauperate, inhabited by amphipods and in some areas by mysids as a result of the presence of fast ice during winter, and variations in temperature, salinity and ice scour during summer (Ellis 1960 cited by Thomson 1982, Thomson et al. 1986). Thomson et al. (1986) found that beyond the barren zone, predation and mortality of the infauna appeared to be at low levels and the benthos was dominated by slow growing, large, old individuals. The feeding strategy of benthic animals appeared to be well adapted to a pulsed productivity regime. Dale et al. (1989) and Aitken and Fournier (1993) describe benthic macrofauna in fiords along eastern Baffin Island including bivalves, gastropods, echinoderms, polychaetes, ascidians, bryozoans, sea cucumber (Holothuroidea), sea pens (Pennatulacea), sea spider (Pycnogonida), and sponges.

Stewart et al. (1985) found patterns in benthic fauna to be more consistent with water mass and temperature distribution than with substrate distributions in southern Davis Strait and Ungava Bay. Thomson et al. (1986) found that depth, substrate, predation, food supply and exposure influenced species composition and abundance/biomass in the central and eastern Arctic islands. Thomson et al. (1986) found maximum average biomass in 6–20 m depths in Eclipse Sound and Barrow Strait, and 56–105 m depths in northwestern Baffin Bay and Lancaster Sound. Beyond the depth of maximum biomass there was a progressive decrease in biomass with increasing depth (Thomson et al. 1986). Thomson (1982) identified 492 species of molluscs, echinoderms, crustaceans and polychaetes in their benthic samples from southern Davis Strait and Ungava Bay (Hudson Strait).

DFO undertakes research bottom-trawl surveys in Baffin Bay and Davis Strait associated with assessments of Northern Shrimp (*Pandalus borealis*), Striped Shrimp (*P. Montagui*), the two commercially harvested shrimp species, and Greenland Halibut (*Reinhardtius hippoglossoides*) in water depths generally between 400 m and 1,500 m. Invertebrate species identified during

DFO’s research surveys generally include octopus, squid, crab, shrimp, molluscs, coral, sponges, sea stars, and sea pens..

The research surveys provided bycatch data including data used to identify the distribution of corals and sponges. Large aggregations of sea pens, large gorgonian corals and sponges were found in Baffin Bay-Davis Strait and in Baffin Bay, particularly important populations of Pennatulacean sea pens are found at the outflow of Lancaster Sound and along the continental slope off Baffin Island (Kenchington et al. 2011). In Davis Strait, particularly abundant beds of large gorgonian coral and sponges are found in the Hatton Basin east of Hudson Strait (Kenchington et al. 2011). Black corals were also identified, and although relatively rare, were widespread in their distribution (Kenchington et al. 2011). The distribution of coral and sponge beds were generally outside the EBSAs re-evaluated during the current review process and would be considered in the re-evaluation of the offshore EBSAs in Baffin Bay, Davis Strait and the Hatton Basin.

Fishes

Twenty six species of fishes representing 11 families have been identified within the High Arctic Archipelago (Hunter et al. 1984, Coad and Reist 2004). They include eelpouts (Zoarcidae), cods (Gadidae), gunnels (Pholidae), lumpfishes (Cyclopteridae), flounders (Pleuronectidae), poachers (Agonidae), salmons (Salmonidae), sculpins (Cottidae), snailfishes (Liparidae), sticklebacks (Gasterosteidae) and wolffishes (Anarhichadidae).

DFO’s research bottom-trawl surveys in Baffin Bay and Davis Strait have provided data on fish species found in Baffin Bay and Davis Strait some of which are likely to occur in inshore waters of the region.

Siferd (2010) summarized the bycatch data from the shrimp fishery conducted in Davis Strait as recorded by the fisheries observer program from the start of the fishery (1979 in southern Davis Strait, 1985 in northern Davis Strait) to the 2008/09 management year. Data spanned the period prior to, and following, use of the Nordmore separator grate which was made mandatory in 1997 to minimize bycatch of non-target species. The grate filters the catch entering the trawl allowing animals larger than the grate size to escape through an opening in the top of the net. Bycatch from the shrimp fishery in Davis Strait from 1979–2008/09 included 77 families of fishes (Appendix 1).

The following species that occur in the region are listed under the *Species at Risk Act* (SARA):

- Northern Wolffish *Anarhichas denticulatus* Threatened on Schedule 1 of SARA (COSEWIC 2012a)
- Spotted Wolffish *Anarhichas minor* Threatened on Schedule 1 of SARA (COSEWIC 2012b)
- Atlantic Wolffish *Anarhichas lupus* Special Concern on Schedule 1 of SARA (COSEWIC 2012c)

COSEWIC has also assessed the following fishes that occur in this region as at risk:

- Roughhead Grenadier *Macrourus berglax* was designated as Special Concern in 2007 (COSEWIC 2007a)
- Roundnose Grenadier *Coryphaenoides rupestris* was designated as Endangered in 2008 (COSEWIC 2008a)
- American Plaice (Arctic population) *Hippoglossoides platessoides w*as designated as Data Deficient in 2009 (COSEWIC 2009a)

- Deepwater Redfish (Northern population) *Sebastes mentella* was designated as Threatened in 2010 (COSEWIC 2010a)
- Acadian Redfish (Atlantic population) *Sebastes fasciatus* was designated as Threatened in 2010 (COSEWIC 2010a)
- Atlantic Cod (Arctic marine population) *Gadus morhua* was designated as Data Deficient in 2010 (COSEWIC 2010b)
- Thorny Skate *Amblyraja radiata* was designated as Special Concern in 2012 (COSEWIC 2012d)

The following species are of particular interest within the Eastern Arctic Biogeographic Regions:

Arctic Cod

Arctic Cod is a small pelagic fish found widely distributed throughout the Arctic, generally in the upper water column and associated with the ice edge. They are known to live in close association with landfast ice and the marginal ice zone, where they are a significant food source for higher trophic species (Bradstreet and Cross 1982). Trophic analysis by Welch et al. (1992) estimated that about 148,000 tonnes of Arctic Cod are consumed annually by seabirds and mammals in the Lancaster Sound ecosystem. Under ice, Arctic Cod have been known to form aggregations at depth in relation to food availability during this time (Benoit et al. 2010).

Arctic Cod is a relatively short-lived species with a high growth rate. Arctic Cod spawn under sea ice in mid-winter. Their buoyant eggs rise to the ice–water interface (Graham and Hop 1995) and hatch after an incubation time that depends on temperature. Adult Arctic Cod were able to tolerate conditions from near freshwater to saltwater (3–28 ‰) and temperatures from -1.5–13.5 °C (Craig et al. 1982, Graham and Hop 1995) though small temperature changes can have a large effect on the development, growth rate and success of larval and juvenile Arctic Cod (Graham and Hop 1995). The low temperature at under ice and the ice-water interface is thought to be important to embryonic development and success, possibly linked to favourable feeding during early spring plankton bloom in the marginal ice zone (Graham and Hop 1995). Pelagic juveniles grow successfully by taking daily migrations within the surface layer in areas where food is abundant after hatching. The vertical distribution of Arctic Cod changes from a strong surface orientation of egg and larval stages to deeper (> 300 m) water (Geoffroy et al. 2011), including demersal habitats (Hop and Gjøsæter 2013). They may also occur close to the bottom, associated with the benthic habitat. Arctic Cod may be found inshore or offshore, scattered or highly aggregated.

In Arctic and sub-arctic ecosystems, Arctic Cod is a keystone species linking trophic levels. Arctic Cod generally feed on mysids, amphipods, copepods and other zooplankters (Craig et al. 1982). Welch et al. (1993) observed Arctic Cod in large dense aggregations in nearshore, shallow waters where they were subjected to intense predation by thousands of seabirds, primarily black-legged kittiwake and northern fulmar, and marine mammals, primarily harp seals, beluga and narwhal. Other seabird and marine mammal species are able to take advantage of the aggregated food source. Matley et al. (2015) found Arctic Cod to be the main seasonal prey for ringed seal which fed on smaller non-schooling cod while beluga and narwhal also fed on Arctic Cod seasonally but consumed larger individuals in schools.

Arctic Char

Arctic Char (*Salvelinus alpinus*) is widely distributed throughout the Arctic and is an important commercial and subsistence resource for Inuit. Arctic Char exists as both a freshwater and an anadromous form. The anadromous form overwinters and spawns in freshwater and migrates into marine waters during the summer. Spawning occurs in redds, shallow excavations in areas of lake bottoms or river beds with suitable substrate usually in September or October. Post-spawning fish remain in lakes to overwinter and migrate downstream the following spring to the sea to feed. Arctic Char juveniles usually remain in freshwater for 4–5 years before they migrate to the sea for the first time. Migration begins as soon as river ice breakup allows (typically in early June to July). They return to freshwater from July to September.

Arctic Char use the nearshore marine environment to feed. Arctic Char are capable of surviving in high salinity and in low temperatures for extended periods of time. Most Arctic Char remain along the shorelines feeding in both inter- and subtidal zones (Spares et al. 2012), although some have been caught up to 5 km offshore (Rikardsen and Amundsen 2005). Arctic Char are opportunistic feeders consuming invertebrates such as pelagic amphipods, copepods and fishes (Moore and Moore 1974), including Capelin, Sand Lance, Arctic Cod and young Greenland Cod (*Gadus ogac*), sculpins, (Dempson et al. 2002, Spares et al. 2012).

Greenland Halibut

Greenland halibut is widely distributed throughout the Northwest Atlantic from as far north as Smith Sound (78°N latitude) off the West Greenland coast to as far south as the eastern Grand Banks of Newfoundland, and eastward to the deep slopes of the Flemish Cap. Greenland Halibut are found inshore and offshore at depths down to at least 2,000 m (Jørgensen 2013). An offshore Greenland Halibut commercial fishery occurs in Baffin Bay and Davis Strait annually while an inshore winter exploratory fishery occurs in Cumberland Sound.

The Baffin Bay-Davis Strait Greenland Halibut stock is thought to originate primarily in the deep-water (800–2,000 m) extended spawning grounds from Davis Strait (about 67°N) to south of Flemish Pass off Newfoundland (Boje 2002).

On the west Greenland shelf area of Baffin Bay and Davis Strait, Jørgensen (2013) found large numbers of one year old Greenland Halibut (> 10,000 fish $\cdot$ km^{-2}) west of Disko (Greenland waters) and abundant (> 1,000 fish $\cdot$ km^{-2}) between 300 and 500 m. This relatively shallow water is considered nursery area where fish are thought to spend the first few years of their lives (Jørgensen 2013). Larger fish are found at greater depths and it is believed that the fish migrate off the banks into deeper waters, i.e., eastward into the fiords of northwest Greenland and south and westward into Baffin Bay and Davis Strait (Jørgensen 2013).

Greenland Halibut have demonstrated long distance movements. Some fish tagged and released in Davis Strait, Baffin Bay, were recaptured up to 2,500 km away from south to the northern slopes of the Grand Banks of Newfoundland and as far east as Denmark Strait (between Greenland and Iceland) (Boje 2002). However, Boje (2002) indicated most recoveries illustrated limited movements.

Pelagic invertebrates and fishes are the predominant prey of Greenland Halibut (Orr and Bowering 1997). Orr and Bowering (1997) found small fish (< 20 cm) feed on small pelagic crustaceans, while intermediate-sized fish (about 20-60 cm) feed mainly on a variety of small fish (including Arctic Cod), squid and northern shrimp (Pandalidae) wherever these are abundant. Larger Greenland Halibut (> 60 cm) feed mostly on other fish, preferring larger species such as redfish (*Sebastes* spp.) and grenadiers (Macrouridae) (Orr and Bowering 1997). Dwyer et al. (2010) identified Greenland Halibut diet shifts associated with prey availability and ecosystem change.

Predators of larvae and juvenile Greenland Halibut include various fishes; Greenland Shark (*Somniosus microcephalus*), whales and seals are considered to be the main predators of adult Greenland Halibut in Baffin Bay and Davis Strait (Crawford 1992).

Marine Mammals

The Eastern Arctic Biogeographic Region provides seasonal or year-round habitat for 23 species of marine mammals. The year-round inhabitants include ringed seal (*Pusa hispida*), bearded seal (*Erignathus barbatus*), Atlantic walrus (*Odobenus rosmarus*), beluga (*Delphinapterus leucas*), narwhal (*Monodon monoceros*), bowhead whale (*Balaena mysticetus*), polar bear (*Ursus maritimus*), hooded seal (*Crystophora cristata*), and harbour seal (*Phoca vitulina*).

Fourteen species are found in the region seasonally. Harp seal (*Pagophilus groenlandicus*) migrate into the region annually in summer as do killer whale (*Orcinus orca*) and Northern bottlenose whale (*Hyperoodon ampullatus*).

The remaining species are occasionally found in the region:

- Common minke whale (*Balaenoptera acutorostrata*) is found in Davis Strait and the Labrador Sea in summer. They have been seen on occasion in Cumberland Sound and in Hudson Strait.
- Fin whale (*Balaenoptera physalus*) is found in Davis Strait and the Labrador Sea in summer. COSEWIC designated the Atlantic population of fin whale as Special Concern in 2005 (COSEWIC 2005).
- Blue whale (*Balaenoptera musculus*) is found in Davis Strait, Hudson Strait and the Labrador Sea in summer. COSEWIC designated the Atlantic population of blue whale as Endangered in 2002 (COSEWIC 2002).
- Sei whale (*Balaenoptera borealis*) is found in Davis Strait, Hudson Strait, and the Labrador Sea from August to September.
- Humpback whale (*Megaptera novaeangliae*) is occasionally found in southern Baffin Bay, Davis Strait and the Labrador Sea in summer.
- Male sperm whale (*Physeter macrocephalus*) is occasionally seen in Nunavut waters in summer. They are found offshore in Davis Strait and the Labrador Sea and on occasion have entered Hudson Strait and Ungava Bay.
- Harbour porpoise (*Phocoena phocoena*) is found infrequently in western Davis Strait and the Labrador Sea; they are more common on the eastern side of Davis Strait.
- Atlantic white-sided dolphin (*Lagenorhynchus acutus*) is rarely seen in the waters off Nunavut; they are distributed offshore in Davis Strait and the Labrador Sea.
- White-beaked dolphin (*Lagenorhynchus albirostris*) is found in Davis Strait and the Labrador Sea. They are seen offshore and in coastal waters.
- Long-finned pilot whale (*Globicephala melas*) is found offshore in Davis Strait and the Labrador Sea.
- Grey seal (*Halichoerus grypus*) are typically found in the Gulf of St. Lawrence off the shores of Quebec, New Brunswick, Prince Edward Island, Nova Scotia and Newfoundland. However, grey seal was identified in the observer records as bycatch in the Davis Strait shrimp fishery in 1993 (Siferd 2010).

Information on the marine mammal species regularly using the Eastern Arctic Biogeographic region is generally taken from Richard (2009) unless otherwise indicated.

Ringed seal

Ringed seal is the most abundant marine mammal in the Arctic. Ringed seal are found throughout the Eastern Arctic Biogeographic Region. The population abundance for the entire Baffin Bay was estimated to be from at least 417,000 (Finley et al. 1983) on pack ice in 1978 and 1979 to about 787,000 ringed seals in 1979 (Laidre et al. 2015).

In winter, they prefer coastal fast ice although they are also found in consolidated pack ice. Throughout the winter ringed seals are able to maintain breathing holes in solid ice and they are seldom seen before May and June when they begin to haul out on the ice near their holes. They may also make use of tidal cracks to breathe. During the winter they may rest in snow lairs usually dug in snow drifts that form on the lee side of ice ridges. In Nunavut, during March and April, adult females give birth to young, using the lairs to shelter newborn pups. Females nurse their pups for up to 2 months then abandon them to mate in May or June. During surveys of hauled-out ringed seals in late spring, Kingsley et al. (1985) found that they preferred annual ice, fast or cracking, of high cover and they avoided deep water. Ringed seals can be found along flaw leads in spring. They are usually solitary although groups form along cracks or at the edge of fast ice during the moult in May or in fall before freeze up where they may gather in small bays with plentiful food. They bask on ice during favourable weather. During the summer they remain in the water usually along the coast. As fast-ice disappears ringed seal may disperse (Heide-Jørgensen et al. 1992).

The diet of ringed seal in the high Arctic is dominated by Arctic Cod, pelagic amphipods and mysids (Bradstreet and Cross 1982, Finley et al. 1983). Ringed seal are the primary prey of polar bear while Atlantic walrus occasionally prey on them and seal pups may be eaten by Arctic fox. They are also hunted by Inuit.

Bearded seal

Bearded seal are large, solitary seals with continuous circumpolar distribution in arctic and subarctic waters. They are found throughout the Eastern Arctic Biogeographic Region. Laidre et al. (2015) reported abundance estimates for Canadian waters from 1958–1979 of around 190,000 bearded seals. Bearded seal prefer broken pack ice and shallow open water; they generally avoid fast ice. During the summer they haul out on reefs or sand banks and feed in the shallow surrounding waters. They are capable of diving to 200 m although in the Beaufort Sea, Stirling et al. (1977) found them to be more abundant in areas with 25–75 m of water than in deeper areas. In the North Water Polynya they were found in areas where water depths exceeded 200–500 m (Finley and Renaud 1980).

Females give birth to a single pup in April or May. The pup joins its mother in the water soon after birth. Pups are nursed for 12–18 days before they are abandoned and mating occurs. Bearded seals form small aggregations during the mating and moulting seasons. During mating (mid-April to mid-May) males emit long songs which can be heard for tens of kilometres. They are benthic feeders, eating various invertebrates (e.g., clams, whelks, crab) and fishes. Polar bear are their main predator although they may also be prey for killer whale. They are hunted by Inuit.

Atlantic walrus

Atlantic walrus have a discontinuous distribution through Arctic waters. In Nunavut, they are found from Bathurst Island east and south to Hudson Bay (Figure 10). COSEWIC assessed the Atlantic walrus in 2006 and designated them as Special Concern (COSEWIC 2006). Canadian Arctic walrus are divided into two genetic populations comprised of seven stocks. The high Arctic population is composed of the Baffin Bay, west Jones Sound and Penny Strait-Lancaster Sound stocks; the central Arctic population is composed of the north and central Foxe Basin and Hudson Bay-Davis Strait stocks (DFO 2013). DFO 2013 estimated approximately 1,250 walrus in 2009 in the Baffin Bay stock, 503 walrus in the west Jones Sound stock in 2008 and between 661 and 727 walrus in the Penny Strait-Lancaster Sound stock in 2009. Walrus found off southeastern Baffin Island belong to the Hudson Bay-Davis Strait stock part of which is distributed in the Hudson Bay Complex Biogeographic Region. Estimates of walrus summering in the Hoare Bay area were between 1,420 and 2,533 walrus in 2007 which is a small portion of the Hudson Bay-Davis Strait stock area.

Within the range of each stock, walrus are widely distributed in the open-water season, generally in coastal and shallow waters with depths of over 100 m. In winter, they may be found at the floe edge. They are able to maintain breathing holes in young ice. They prefer floating pack ice but will find shelter on island shores and reefs when pack ice melts. Some summer haulout sites are visited annually and may include hundreds or thousands of animals at a time. In the high Arctic walrus winter around polynyas (Figure 8) and may remain in the same area for the remainder of the year. Males may be separate from females and pups when hauled out. Females produce a single pup once every three years, on average, usually around mid-May. Young walrus remain with their mothers to nurse for approximately one year; mating takes place the following year.

Fisher (1989) found bivalves, gastropods, holothurians, polychaetes and brachiopods in walrus stomachs. *Mya truncata* is a major prey of walrus (Welch and Martin-Bergmann 1990) and are common in the coastal fiords of eastern Baffin Island and in nearshore areas of the Baffin Island shelf (Aitken and Fournier 1993). They maintain a high biomass in the 20–30 m depth range in Lancaster Sound and Barrow strait nearshore areas (Welch et al. 1992) but were common from 5 to 60 m in the coastal waters near Qikiqtarjuaq (T. Siferd, DFO, unpubl. data). Fisher (1989) estimated walrus may consume upwards of 4,500 bivalves per day. Other than man, polar bear is the main predator of walrus.

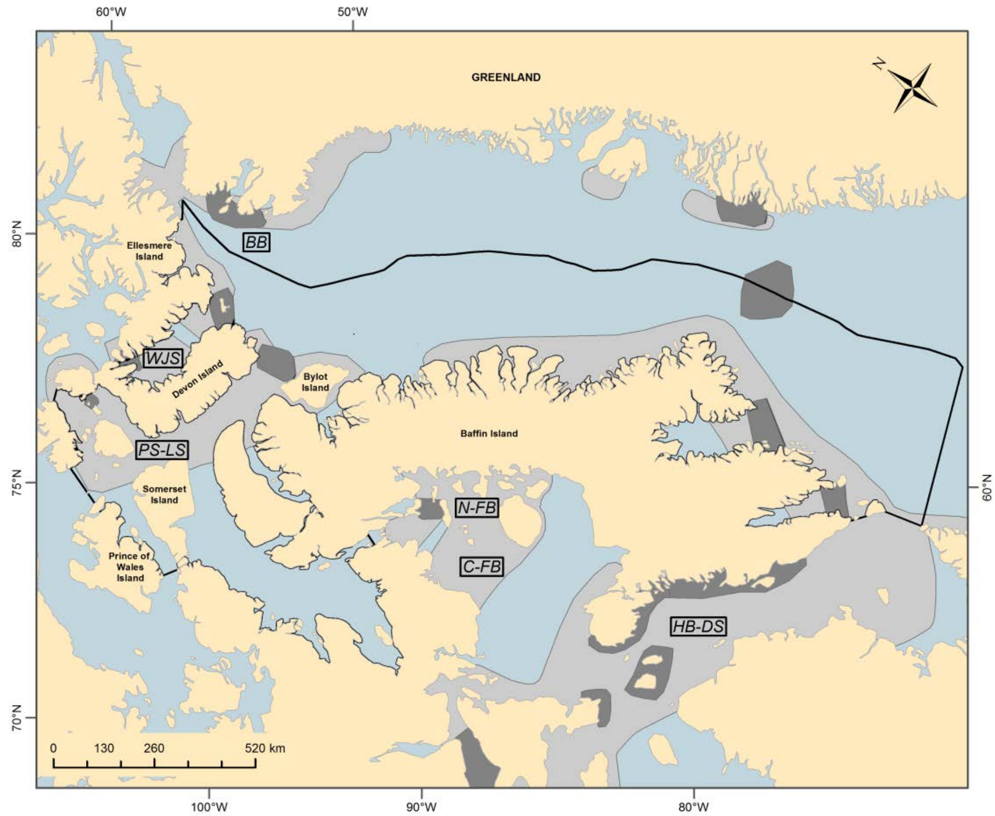

Figure 10. Atlantic walrus distribution (grey) with winter aggregation areas identified in dark grey (modified from Born et al. 1995, Stewart 2008 and DFO 2013). The Eastern Arctic Biogeographic Region is outlined in black. Walrus stocks in the Canadian Arctic: Baffin Bay(BB), western Jones Sound (WJS), Penny Strait-Lancaster Sound (PS-LS), north Foxe Basin (N-FB), central Foxe Basin (CFB) and Hudson Bay-Davis Strait (HB-DS).

Beluga

Beluga are small ice-adapted toothed whales that range throughout the Arctic and sub-arctic waters up to the 80th parallel. There is evidence that Nunavut beluga are segregated geographically on a seasonal basis and, in many cases, year-round, based on genetic, contaminant and morphological differences (DFO 2010a). COSEWIC assessed the beluga in Canada in 2004 and designated the Cumberland Sound population as Threatened, and the Eastern High Arctic/Baffin Bay and western Hudson Bay populations as Special Concern.

There are two summer aggregation areas (Somerset Island and Cumberland Sound) for two beluga populations in the Eastern Arctic Biogeographic Region: Eastern High Arctic-Baffin Bay and Cumberland Sound beluga (Figure 11). Eastern High Arctic-Baffin Bay beluga winter in the North Water, Baffin Bay or along the Greenland coast of Davis Strait while Cumberland Sound beluga are thought to remain in Cumberland Sound year-round. Beluga from the Western-Northern-Southern (WNS) Hudson Bay population winters in Hudson Strait and Davis Strait. Marcoux et al. (2016) estimated 1,200 belugas (corrected for diving animals) from the Cumberland Sound aerial survey flown in August 2014. DFO (2008a) reported the Eastern High Arctic-Baffin Bay beluga to number around 21,200 animals and Western-Northern-Southern Hudson Bay beluga around 63,100 animals.

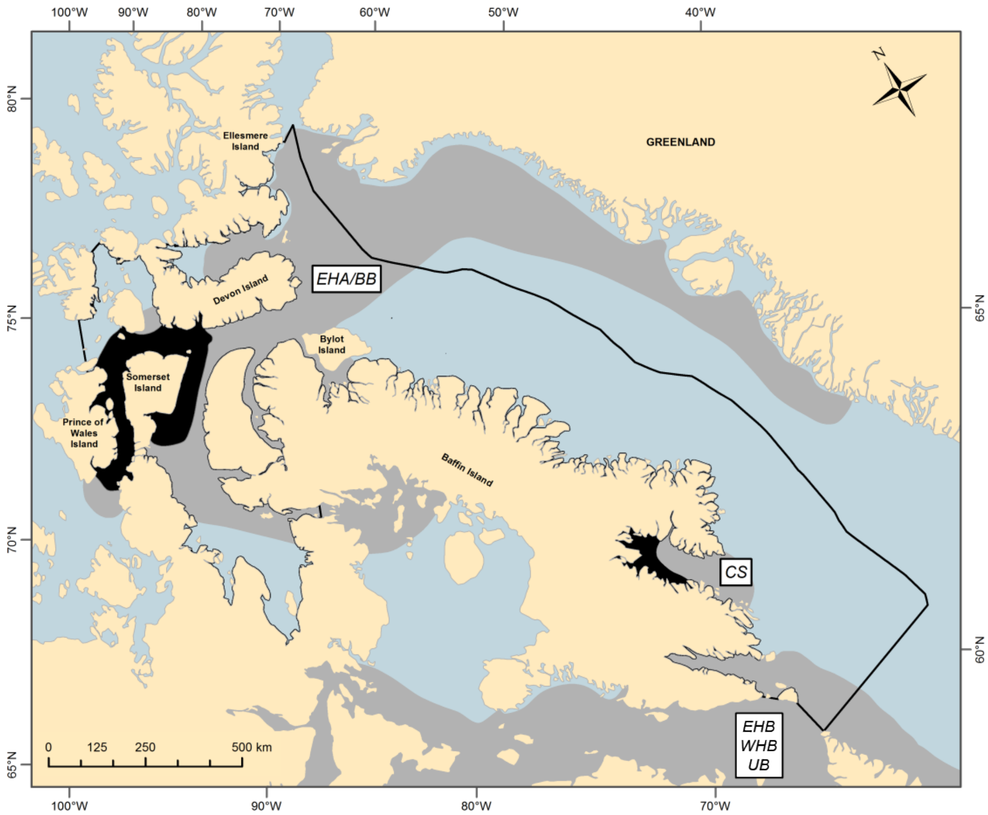

Figure 11. Beluga distribution (grey) in the Eastern Arctic Biogeographic Region with core summer aggregation areas identified (black) (modified from COSEWIC 2004a). Specific overwintering areas for beluga have not been identified. Eastern High Arctic/Baffin Bay (EHA/BB) and Cumberland Sound (CS) beluga populations are present year-round in the region. Eastern and Western Hudson Bay (EHB/WHB) populations and Ungava Bay (UB) also occur in this region.

Beluga instrumented along the coast of Somerset Island in July 1996 generally moved rapidly to southern Peel sound where they spent August making frequent deep dives (Richard et al. 2001). They left Peel Sound between late August and early September moving rapidly to the south coast of Devon Island. They moved east and north along the south coast of Devon Island to the North Water area. One instrumented beluga moved to Greenland waters in late September. Finley and Renaud (1980) reported that by mid-April in 1978, beluga were moving southward to the entrance of Lancaster Sound and then southwest along southeast Devon Island.

Belugas winter in waters where ice is in motion and areas of open water are maintained by winds and currents and where beluga can surface to breathe. On occasion they become trapped when they are unable to maintain breathing holes in the ice. With ice retreat in spring, belugas migrate to their summering areas. Females give birth roughly once every three years between May and September. Newborn calves remain close to their mothers and family groups for several years. In early summer, belugas congregate in some estuaries. Hundreds to thousands of belugas are found in various estuaries for two weeks to three months.

Belugas are able to dive up to ~800 m. They feed on a varied diet of fish and crustaceans. Besides man, polar bear and killer whale are their main predators.

Narwhal

Narwhal are medium sized, toothed Arctic whales. Canadian narwhal are divided into two populations of which the Baffin Bay population is found in the Eastern Arctic Biogeographic Region. In August 2013, a series of aerial surveys were conducted for the four recognized Canadian summering stocks (Admiralty Inlet, East Baffin Island, Eclipse Sound, and Somerset Island of the Baffin Bay narwhal population as well as the putative Jones Sound and Smith Sound stocks (Figure 12). In 2013, abundance of narwhal was estimated to be about 35,000 for Admiralty Inlet, 17,600 for East Baffin Island, 10,500 for Eclipse Sound, 49,800 for Somerset Island, 12,700 for Jones Sound, and 16,400 for Smith Sound for a total estimate of 142,000 narwhal in the Baffin Bay population (DFO 2015b).

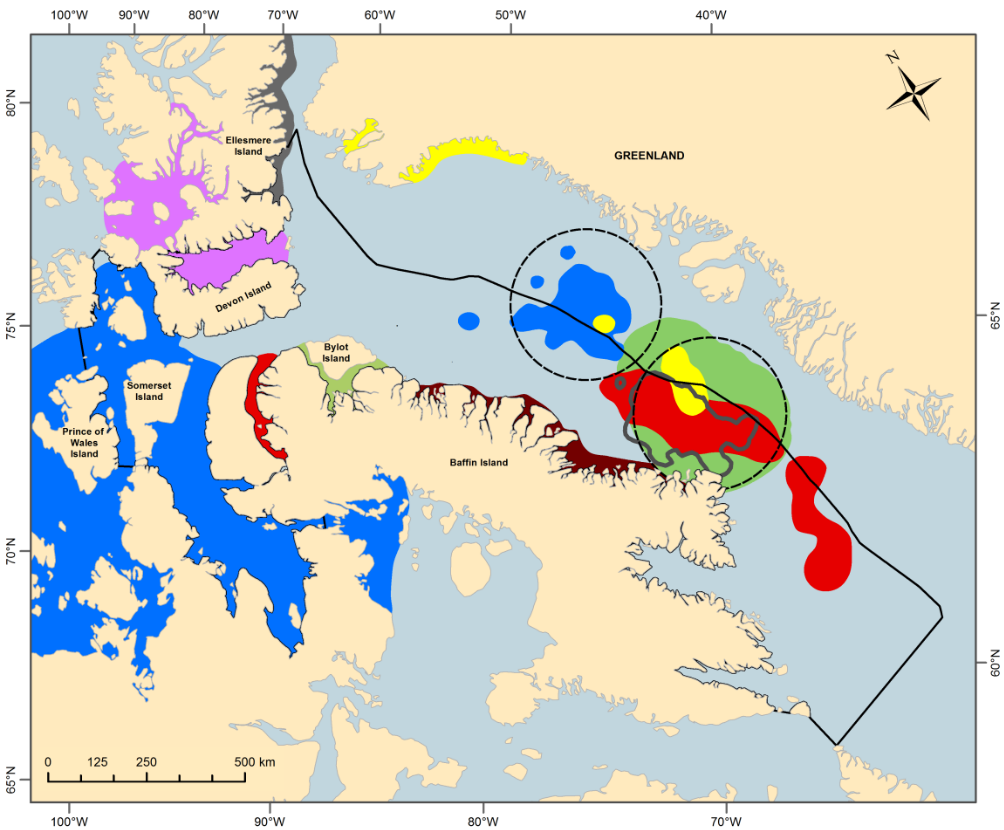

Figure 12. Narwhal in the Eastern Arctic Biogeographic Region (modified from DFO 2014c, 2015b). Jones Sound (pink), Smith Sound (grey), Somerset Island (blue), Admiralty Inlet (red), Eclipse Sound (green), East Baffin Island (burgundy) and Melville Bay (yellow) summering stocks are identified. The general northern and southern overwintering areas in Baffin Bay/Davis Strait are outlined with dashed lines. The grey outlined polygon includes 2009 and 2010 tagging data for Admiralty Inlet narwhal. Solid black lines identify the boundary of the Eastern Arctic Biogeographic Region.

Narwhal summer in waters in or near deep channels of the eastern Arctic (Figure 12). The formation of fast ice forces them to leave these channels for areas with floating pack ice such as Baffin Bay and Davis Strait. On occasion (e.g., 2008, 2015) they become trapped when they do not leave before the formation of winter ice (DFO 2012, DFO unpubl. data). In wintering areas, they can be found in large numbers in heavy pack ice. Two wintering areas have been identified in Baffin Bay and Davis Strait (Figure 12; DFO 2014c). The northern wintering area supports a larger number of whales from the Somerset Island summering stock while the southern wintering area is used by narwhals from the Admiralty Inlet, Eclipse Sound and Greenland's Melville Bay summering stocks (DFO 2014c).

Every three years or so, adult females give birth to a single calf between June and August. The calves nurse for about 20 months. The females may mate the following year.

In summer, Arctic Cod, Polar Cod (*Arctogadus glacialis*), and *Gonatus* squid spp. constituted the narwhal diet. In fall, *Gonatus fabricii* was the only prey item observed. In late fall and winter, Greenland halibut and *G. fabricii* were the dominant prey items (Lairdre and Heide-Jørgensen 2005). They are hunted by man, polar bear and killer whale.

Bowhead whale

Bowhead whale are found in arctic and sub-arctic waters between the 60th and 85th parallels. They are the only a large ice-adapted baleen whale species endemic to the Arctic and they are found year-round in the Eastern Arctic Biogeographic Region. COSEWIC designated the bowhead whale as Special Concern (COSEWIC 2009b)

The Eastern Canada-West Greenland (EC-WG) bowhead population ranges throughout the Arctic Archipelago of the Canadian High Arctic, Foxe Basin, Hudson Bay, Hudson Strait, Baffin Bay, and Davis Strait (Figure 13; DFO 2015c). In 2013, the EC-WG population was estimated to be around 6,500 and 7,600 bowhead whales from aerial surveys and genetic capture-mark-recapture, respectively (DFO 2015c).

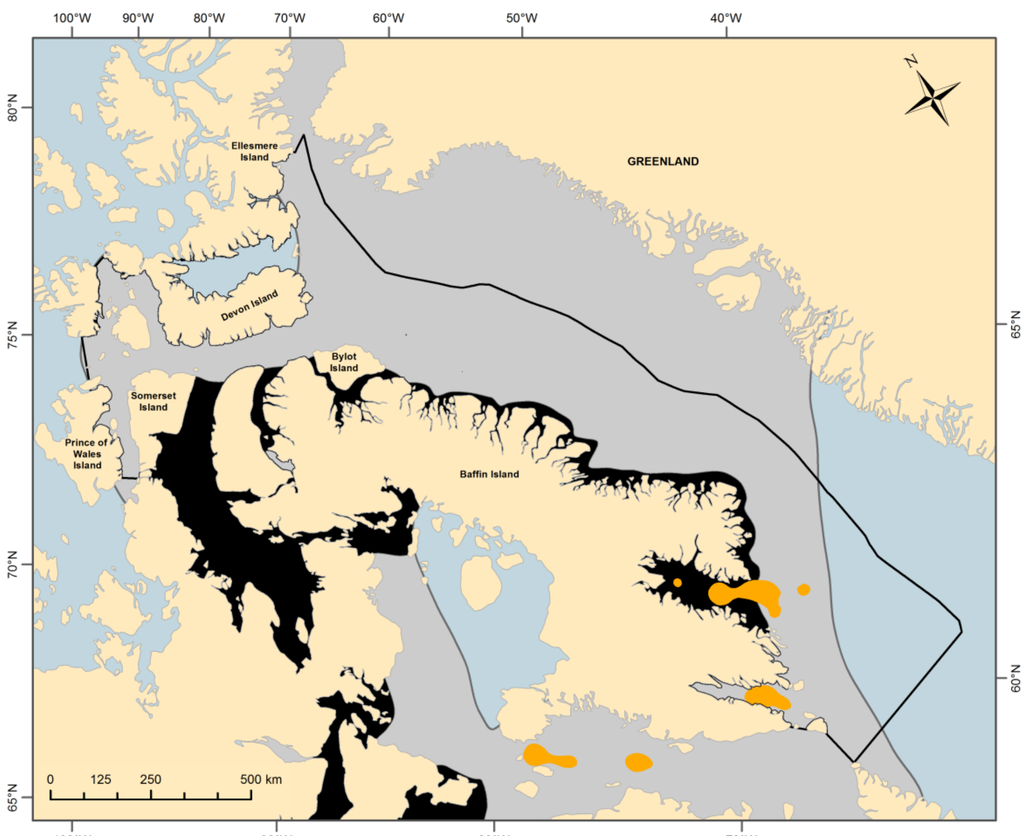

Figure 13. Bowhead whale distribution (grey) in the Eastern Arctic Biogeographic Region. Core summer use areas (black) and known winter areas (orange) are identified (modified from Dueck and Ferguson 2009 and COSEWIC 2009).

Bowhead whales overwinter in Hudson Strait, off Frobisher Bay, Cumberland Sound and in Greenland waters (DFO 2015c). As ice breaks up in spring, whales from southeastern Baffin Island move to summering areas in Prince Regent Inlet and Gulf of Boothia either via a southerly route through Fury and Hecla Strait or a northerly route via Lancaster Sound. Bowheads from west Greenland move across Baffin Bay into Canadian waters. The main summering aggregation areas in are Foxe Basin, Prince Regent Inlet, Gulf of Boothia, Cumberland Sound and Isabella Bay (DFO 2015c). In general, Baffin Bay is more widely used by adult males and resting or pregnant females, while Prince Regent, Gulf of Boothia, Foxe Basin, and northwestern Hudson Bay are used by nursing females, calves, and sub-adults (Heide-Jørgensen et al. 2010).

Ferguson et al. (2010) found bowhead whales selected relatively low ice coverage, thin ice, and small floe areas in winter close to the maximum ice extent, presumably to reduce risk of ice entrapment while remaining within ice. In contrast, they selected high ice coverage, thick ice, and large floe size areas in summer, presumably to reduce risk of killer whale predation while providing enriched feeding opportunities.

Mating is thought to occur in February or March based on back calculation from an estimated 14 month gestation period and peak calving from April to early June (DFO 2008a). They are often found alone but also commonly occur in groups of 2–10 animals.

Pomerleau et al. (2012) found bowhead whales fed primarily on large Arctic calanoid copepods (*Calanus hyperboreus*, *C. glacialis*, *Metridia longa*, and *Paraeuchaeta* spp.), mysids and euphausiids. They usually make shallow dives and spend long periods underwater skimming their prey. Killer whales are likely their only predator. Inuit harvest limited numbers of bowhead whales (DFO 2015c).

Harbour seal

Harbour seal are found in Hudson Bay, Hudson Strait and along Baffin Island's eastern coast north to Clyde River. Although occupying a broad range in Nunavut, they are only found in small numbers throughout the range. Harbour seal inhabit coastal waters, bays, river mouths and estuaries. They prefer shallow waters. Although sedentary, they sometimes swim up rivers. In summer, they spend hours lying on sandbars or reefs exposed at low tide. In winter, they prefer to stay in the water. They avoid pack ice, remaining in water kept open by currents and tides. Females give birth to a single pup in June or July which they nurse for 4–6 weeks. Mating occurs in August or September after weaning.

Harbour seal are known to feed on fish such as herring, plaice, mackerel, sand lance, Capelin and salmon. Man, polar bear, killer whale and sharks are harbour seal predators.

Hooded seal

The hooded seal is a large phocid inhabiting pelagic waters. It is often found on drifting pack ice and in deep water. Hooded seals have an annual migration pattern, with animals breeding in March off southern Labrador and/or the northern Newfoundland coast, the Gulf of St. Lawrence, and in Davis Strait (Anderson et al. 2013). They leave the breeding areas in early April to feed, and migrate to southeast Greenland by late June early July to moult. Following the moult, they migrate along the west coast of Greenland over to the Labrador shelf, Davis Strait, and Baffin Bay area, where they remain prior to returning to their breeding areas in late autumn or early winter

In winter, hooded seal are found congregating in herds on the pack ice of Davis Strait, offshore of Newfoundland and Labrador and in the Gulf of St. Lawrence. In summer, they move to deep waters of the Labrador Sea and Baffin Bay. They are generally solitary outside the pupping, mating and moulting season.

They are deep divers, diving in excess of 900 m. Hooded seal diets included a mixture of deep-water pelagic and demersal species such as halibut, redfish, squid, herring, Capelin, Atlantic Cod, Arctic Cod, Atlantic Argentine, redfish, amphipods and euphausiids (Tucker et al. 2009). Man and killer whale are the main predators of the hooded seal.

Polar bear

Polar bears are distributed throughout the circumpolar Arctic. There are five sub-populations within the Eastern Arctic Biogeographic Region (Figure 14), the Davis Strait (population approximately 2,100), Baffin Bay (> 1,600), Kane Basin (population approximately 164), Lancaster Sound (population approximately 2,541), and the Gulf of Boothia (population approximately 1,528) (COSEWIC 2008b). Individuals are known to travel between these sub-populations (Amstrup et al. 2004) and are generally dispersed across wide geographic ranges at low densities.

Polar bears are year-round inhabitants of the Eastern Arctic Biogeographic Region. They are intimately associated with the sea ice environment, using it as a platform for movement, mating, maternal denning, in some areas, and to gain access to their prey (Stirling and Archibald 1977).

Polar Bears gain most of their body mass in spring and early summer (Atkinson and Ramsay 1995). Polar bear diet consists primarily of ringed seal but also includes, to a lesser extent, bearded seal, harp seal and hooded seal in this region (Stirling and Archibald 1977, Thiemann et al. 2008, Rehger et al. 2010). They have also been known to sometimes prey on, beluga and narwhal (Smith and Sjare 1990). Foraging is less intensive in winter. Taylor et al. (2001) suggests that individuals use the winter months to position themselves in areas where conditions for seal hunting in spring are more favorable.

Sea ice conditions and bathymetry are the primary determinants of polar bear habitat quality (Durner et al. 2009). Sea ice productivity and physical characteristics in turn influence the distribution and productivity of ringed seal populations (Kingsley et al. 1985, Stirling 2002, Stirling and Lunn 1997, Barber and Iacozza 2004). In the Canadian Arctic, polar bear habitat is closely associated with that of the ringed seal (Stirling and Øritsland 1995). This includes areas of sea ice over the continental shelf that contain pressure ridges, cracks, polynyas and consistent flaw leads between pack and landfast sea ice (Stirling et al. 1982, Kingsley et al. 1985, Stirling and Derocher 1993, Stirling et al. 1993, Ferguson et al. 2000, Durner et al. 2009).

Taylor et al. (2001) found that polar bears from the sub-populations in Lancaster Sound and Baffin Bay demonstrated a greater movement of bears than Kane Basin, which is consistent with the size of the geographic regions. Distances travelled by bears, based on the mark-recapture data also demonstrated greater distances travelled between seasons likely attributed to movement from ice onto land (Taylor et al. 2001). Baffin Bay individuals leave the ice in late August and early September (Ferguson et al. 1997), while more southern locations (i.e., Davis Strait) bears retreated to land in early July as the sea ice cleared (Taylor et al. 2001). In the most northern locations, for example Kane Basin, individuals remain in the fiords until midsummer or ventured onto the pack ice continuously, depending on ice availability (Taylor et al. 2001). In Lancaster Sound, bears retreat to deep bays and fiords containing landfast ice (e.g., Radstock, Maxwell and Croker bays) and then later move onto land. This was similar for bears in the Gulf of Boothia (Schweinsburg et al. 1981).

Summer retreats and winter maternity denning/shelters occurs sporadically along much of the coastal regions, including Bylot Island (Schweinsburg et al. 1982, Messier et al. 1994).

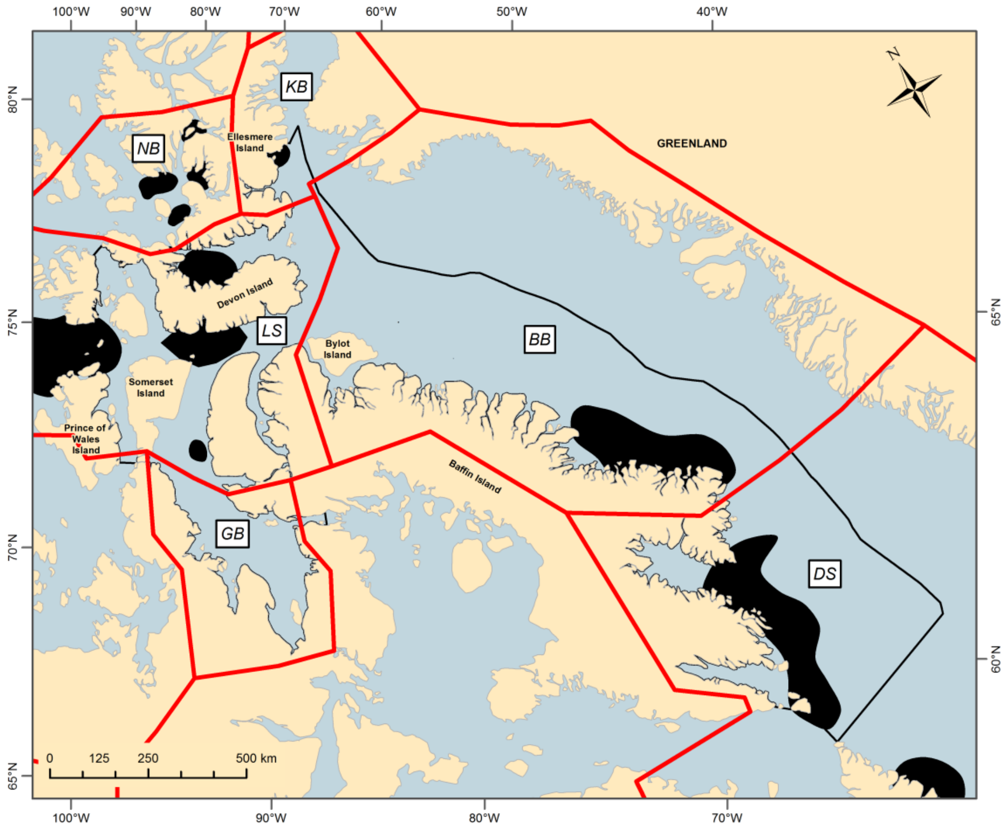

Figure 14. Polar bear sub-population areas identified in red (DS, Davis Strait; BB, Baffin Bay; KB, Kane Basin; LS, Lancaster Sound; GB, Gulf of Boothia; NB, Norwegian Bay) with summer use (black) based on 60 % contours from cluster analysis of median locations for mark-recapture studies (modified from Taylor et al. 2001).

Harp seal

Harp seal migrate into the waters off Nunavut in summer, ranging as far north as the 80th parallel. They are found in Smith Sound, Jones Sound, Lancaster Sound, Baffin Bay and Davis Strait. They are gregarious. They migrate south in autumn and form large herds on the pack ice offshore of Newfoundland and the Gulf of St. Lawrence from February to May during the pupping, breeding and moulting season.

Harp seal consume a mixed diet of pelagic forage fish and invertebrates such as Arctic Cod, Capelin, herring, Sand Lance, redfish, euphausiids and amphipods (Tucker et al. 2009). Man, killer whale, polar bear, walrus and Greenland sharks prey on harp seal.

Killer whale

COSEWIC designated the northwest Atlantic/eastern Arctic population of killer whale as Special Concern (COSEWIC 2008c). Killer whales are frequently reported throughout the region in the summer or early autumn. They occupy coastal waters and open seas; their distribution is limited by pack ice. Their abundance in the Canadian Arctic is small. They are social, often forming groups of 2–25 animals.

Killer whales eat fish, seabirds and marine mammals. In Nunavut waters, they prey on marine mammals and have been observed attacking pods of beluga, narwhal and individual seals. They are known to take walrus and bowhead whales.

Females give birth every 3–8 years to a single calf. They are nursed for about a year. Calves maintain contact with their mother throughout their lives.

Northern bottlenose whale

Northern bottlenose whale range includes all waters off the Canadian east coast deeper than 500 m. They are strongly concentrated along the continental slope (depths 800–1,500 m), with two major concentrations; the northern concentration is found off northern Labrador and in Davis Strait and the southern part of Baffin Bay (COSEWIC 2011). They are found in summer from Resolution Island and north to Cape Dyer on Baffin Island and offshore in Baffin Bay, Davis Strait and the Labrador Sea. Off northern Labrador, Northern Bottlenose Whales seem to have a continuous distribution between the 1,000 m and 2,000 m contours (COSEWIC 2011).

There is some evidence that they migrate north–south seasonally although there have been sightings of northern bottlenose whales in the Baffin Bay-Davis Strait-Labrador Sea in winter. COSEWIC designated the Davis Strait-Baffin Bay-Labrador Sea population as Special Concern (COSEWIC 2011).

Mating occurs in spring or early summer, Females give birth in April–June to a single calf. Females nurse for at least a year and calves maintain contact with females at least for 8–13 years. Northern bottlenose whales are social animals and are usually found in groups of 2–10 animals. They feed mostly on squid and also take herring, and bottom fish like redfish and halibut. They occasionally eat starfish and sea cucumbers. They are attracted to offshore fishing vessels.

Seabirds

The Eastern Arctic Biogeographic Region supports millions of seabirds annually. Each year seabirds return to the region in early spring to either stay in the area or move through to other breeding sites within the Canadian Arctic Archipelago or Greenland. Polynyas are an important feature in the Arctic for returning seabirds. They allow early access to breeding sites and they are known to be areas of increased productivity (Brown and Nettleship 1981). The availability of food is especially important for females pre-breeding, as the energetic costs of producing eggs and to rear young are high (Brown and Nettleship 1981).

The use of polynyas and open water leads are critical to seabirds. Energy required for the long migration period requires staging along the route. Birds often stop to feed at regular sites that provide shelter, and opportunities to rest and forage. Once at the breeding colony, birds will commute long distances to forage and undertake numerous dives to obtain food (Falk et al. 2000). Foraging ranges of seabirds have been estimated for a number of seabirds using the Central Place Foraging (CPF) method (Gaston et al. 2013). Key marine habitat sites for Arctic seabirds have been identified by Mallory and Fontaine (2004) using the CPF method (Figure 15).

The most abundant seabird species breeding in the Eastern Arctic Biogeographic Region are Thick-billed Murre (*Uria lomvia*), Black Guillemot (*Cepphus grylle*), Northern Fulmar (*Fulmarus glacialis*) and Black-legged Kittiwake (*Rissa tridactyla*) (Gaston et al. 2012). The Ross's Gull (*Rhodostethia rosea*), Atlantic Puffin (*Fratercula arctica*), Ivory Gull (*Pagophila eburnean*) and the Dovekie (*Alle alle*) are also found to breed in the region, but in very small numbers (≤ 100 birds) (Gaston et al. 2012).

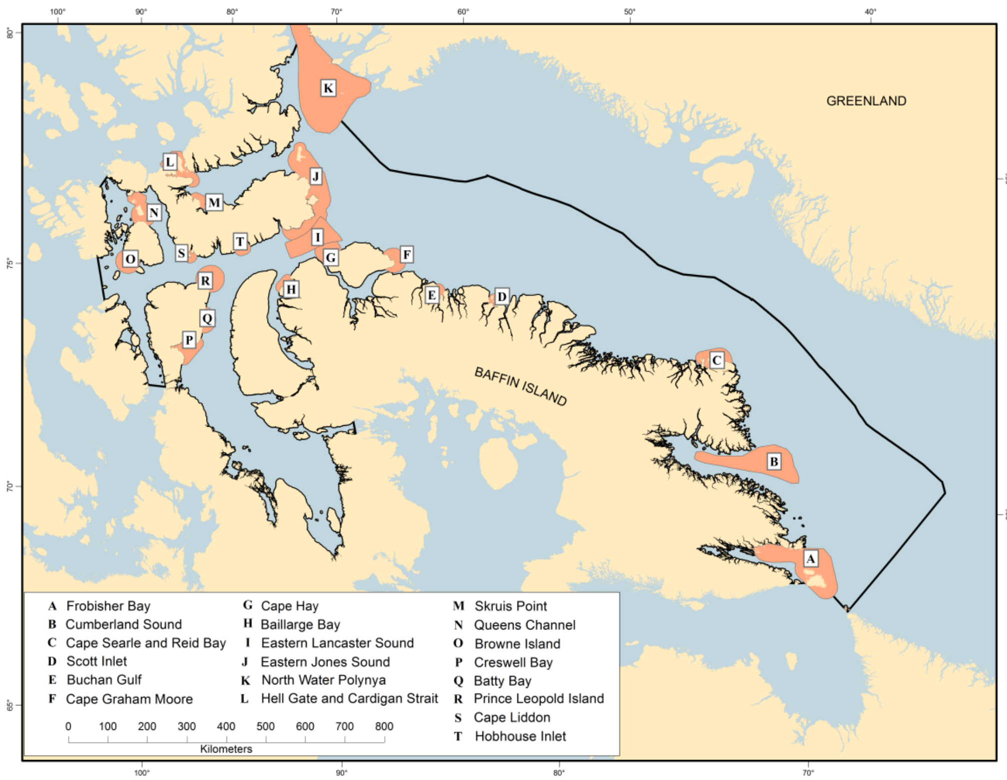

Figure 15. Key Marine Habitat Sites for Arctic seabirds in the Eastern Arctic Biogeographic Region (modified from Mallory and Fontaine 2004).

Seabird breeding habitat includes steep, rocky coasts, and low-lying coasts backed by lowland wet tundra (Gaston et al. 2012). The rocky coasts support colonial cliff- and scree-nesting seabirds. For example, Thick-billed Murre, gulls and Northern Fulmar breed on cliffs and Black Guillemot and Atlantic Puffin breed in crevices (Gaston et al. 2012). Terns, other gulls, and jaegers prefer inland or coastal colonies (Gaston et al. 2012). Coastline and open sea habitats are important for nearshore and offshore piscivores and molliscivores for feeding. A number of key terrestrial habitat sites have been identified by Latour et al. (2008) within the Eastern Arctic Biogeographic Region (Figure 16).

Seabirds are present in the spring through to the fall when sea ice begins to form. Birds generally do not overwinter within the Eastern Arctic Biogeographic Region. The exception to this is the Black Guillemot, (Renaud and Bradstreet 1980). Birds that are present in winter are restricted to areas of open water leads and polynyas (Bradstreet 1982), such as the Eastern Jones Sound, Lancaster Sound and the North Water Polynya.

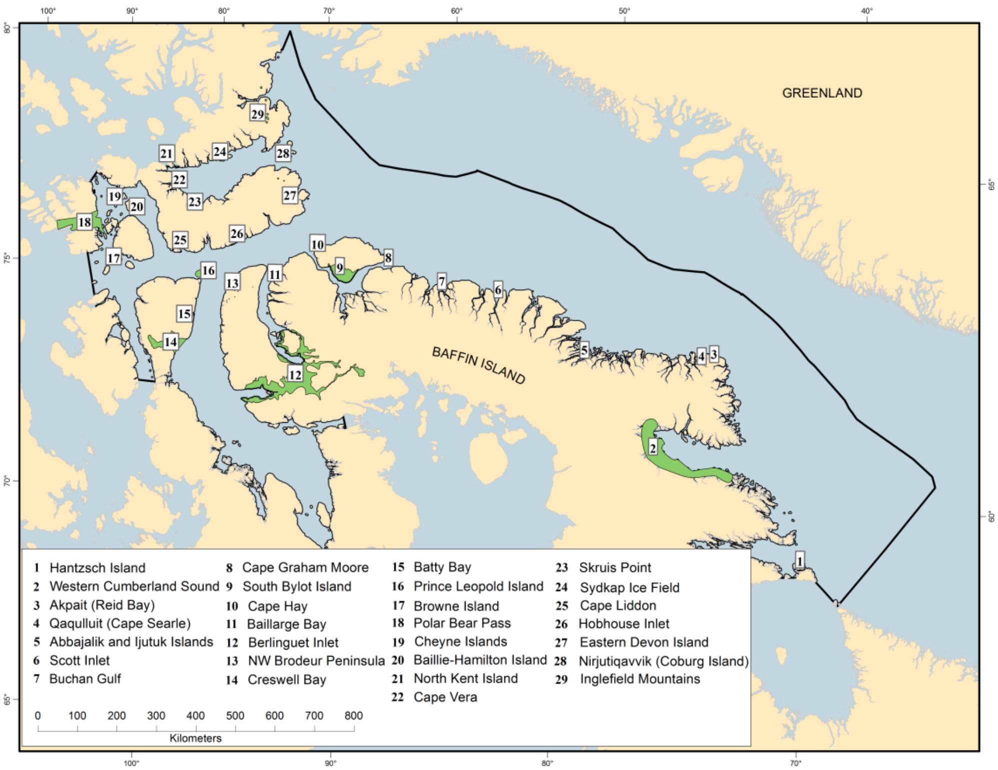

Figure 16. Key terrestrial habitat sites in the Eastern Arctic Biogeographic Region (modified from Latour et al. 2008).

METHODS

EBSAs identified in 2011 (DFO 2011a) from the Eastern Arctic Biogeographic Region were re-evaluated against national DFO criteria. Seasonal extremes (e.g., sea-ice extent), inter-annual variability in oceanographic and climate conditions, seasonal use of areas by some marine mammal and bird species, and data limitations affected the original identification of Arctic EBSAs and the determination of their boundaries. The original EBSAs in this region are large, and when combined, cover about 85 % of the marine biogeographic region.

The goal of this EBSA re-evaluation was to focus the EBSAs on key features or species, review EBSA boundaries and modify if necessary. This was influenced by a better understanding of how EBSAs are being used by managers (e.g., to determine areas of concern, land use planning initiatives).

Figures and/or maps in published literature that provided geospatial and seasonal information on the ecological and biologically significant features/properties identified for EBSAs are listed in Appendix 2.

Within the region, 12 of the 16 original EBSAs were fully re-evaluated, three were not re-evaluated (Northern Baffin Bay, Southern Baffin Bay, Baffin Bay Shelf Break) and the south western portion of the Hatton Basin-Labrador Sea-Davis Strait EBSA was reduced in size. Data for the offshore Baffin Bay and Davis Strait (including Hatton Basin) areas are available from the DFO multi-species bottom trawl survey and from marine mammal tagging. Further analyses of these data are required to re-evaluate the offshore EBSAs.

EBSA IDENTIFICATION CRITERIA

DFO (2004) considers uniqueness, aggregation, and fitness consequence as the main criteria for EBSA identification. Resilience and naturalness identified as criteria by DFO (2004) were not used to evaluate EBSAs as they were considered more relevant for management prioritization than for ecological significance (DFO 2011b). The current re-evaluation process was based solely on ecological and biological properties of areas and did not consider threats and/or risks to them.

For each EBSA, the main criteria (uniqueness, aggregation, fitness consequences) and ecological functions (e.g., spawning, feeding) of a species or species group were identified. All criteria were assessed relative to other areas within the Eastern Arctic Biogeographic Region. Fitness consequences were assessed depending upon how the loss of an area would compromise a population or stock. For each EBSA, detailed descriptions of the underlying ecological properties and the subsequent EBSA boundaries are provided. Information on seasonality was also included as this information may be relevant to management initiatives.

For the evaluation, an area that is determined to meet one or more of the main criteria, either overall or with respect to one or more ecological functions (i.e., spawning/breeding, nursery/rearing, feeding, migrating, refugia), was identified as an EBSA. Each area was evaluated using the national guidance (DFO 2004). Definitions of the criteria used during the re-evaluation are included in Appendix 3.

RESULTS

As a result of the re-evaluation, 20 EBSAs were identified covering 170,427 km^2 of marine area. This is about half the area covered by the original 12 EBSAs (Appendix 4) identified in DFO (2011a). The EBSAs were refined and/or focused based on strict consideration of the three main EBSA criteria (uniqueness, aggregation and fitness consequences) and a more detailed approach to ArcGIS mapping techniques[1] (boundaries match the coastline). These modified EBSAs are generally smaller with more defined boundaries than the previous EBSAs and are based on their key ecological/biological features.

Admiralty Inlet and the North Water Polynya boundaries were not changed from the DFO (2011) evaluation. Clearwater Fiord, Gulf of Boothia, Peel Sound, Penny Strait, Eastern Jones Sound, and Cardigan Strait / Hell Gate were all reduced in size to focus on key features. The Baffin Island Coastline was subdivided into three EBSA (Cape Searle, Scott inlet, Isabella Bay), Prince Regent Inlet was subdivided into three EBSAs (Prince Regent Inlet, Creswell Bay, Bellot Strait) and Lancaster Sound was subdivided into four EBSAs (Lancaster Sound, Resolute Passage, Cunningham Inlet, Prince Leopold Island), each of which was focused on key features and resulted in a reduction in overall EBSA area.

The boundaries of the Eclipse Sound EBSA identified in 2011 were extended to accommodate Narwhal migratory corridors. These changes increased the EBSA area. The three EBSAs identified in Baffin Bay in 2011 (Northern Baffin Bay, Southern Baffin Bay, Baffin Bay Shelf Break) were not re-evaluated. In a fourth, the Hatton Basin-Labrador Sea-Davis Strait EBSA, Frobisher Bay was removed and Eastern Cumberland Sound was separated into its own EBSA. The remainder of the area was not re-evaluated.

[1] In 2011 the EBSA boundaries were mapped in ArcGIS, however the boundaries were not drawn to match the coastline exactly and therefore the area calculations were not accurate (i.e., likely included land based on area calculations).

CLEARWATER FIORD EBSA

The Clearwater Fiord EBSA encompasses the western-most extent of Cumberland Sound and the associated coastal fiords such as Clearwater, Kangilo and Shark fiords (Figure 17). The EBSA covers a marine area of 2,292 km^2. Maximum water depth is 350 m with shallow bays. Shallow estuaries form along the coastline where cold, fresh and heavily silted glacial-fed rivers empty into the area from early spring to freeze-up.

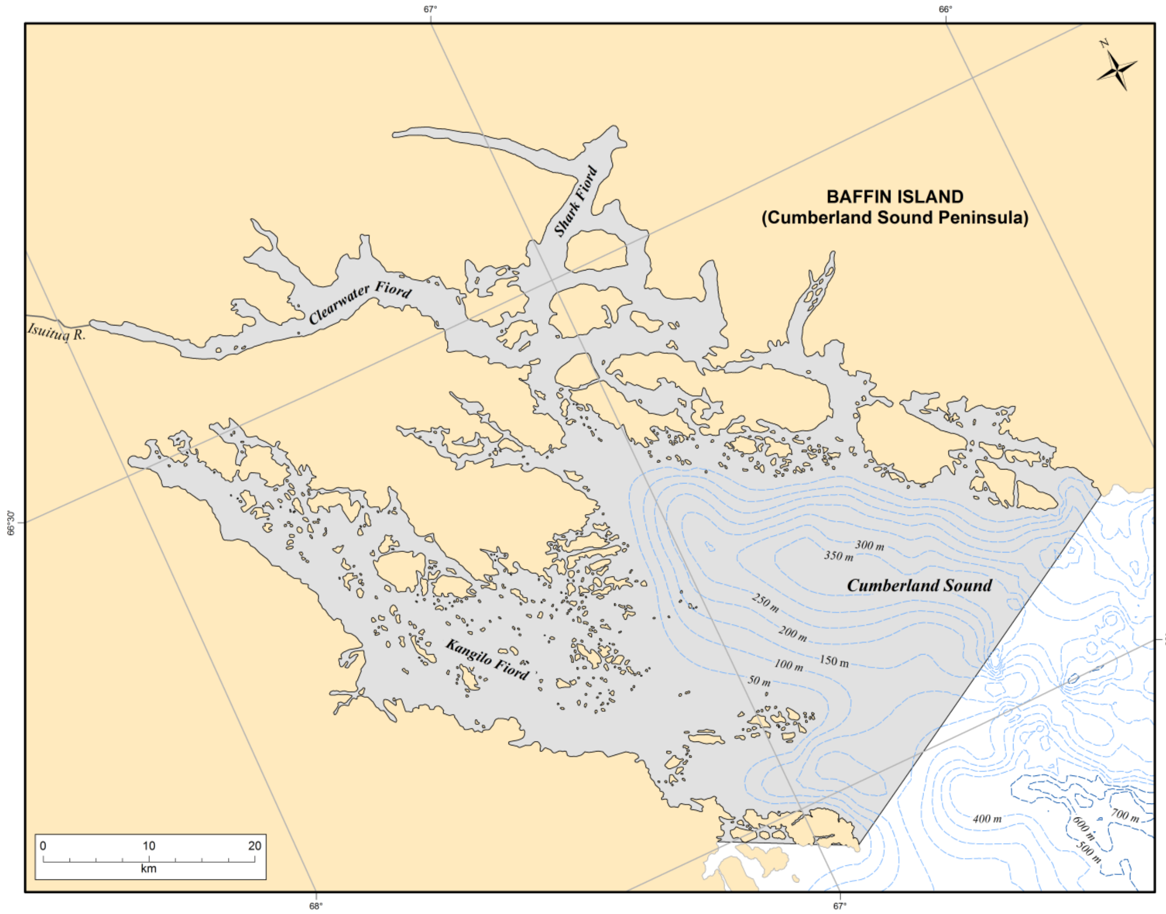

Figure 17. Clearwater Fiord EBSA. Water depth contours within the EBSA are in 50 m increments up to 400 m, after which they are in 100 m increments.

Cumberland Sound beluga is considered a distinct population (Kilabuk 1998, DFO 2002, COSEWIC 2004a) which likely remains in or near Cumberland Sound year-round. This population has a limited migratory range relative to other beluga populations in the Canadian Arctic (DFO 2002). An aerial survey was flown in August 2014 to estimate the abundance of Cumberland Sound beluga. After correcting for animals that were diving and therefore not visible to the survey aircraft, the survey produced an abundance estimate of 1,200 belugas (Standard Error (SE) = 200, rounded to the nearest 100 animals) (DFO 2016).

Cumberland Sound belugas summer in the western end of Cumberland Sound, with about 80 % of the population aggregating in Clearwater Fiord in August (Richard and Stewart 2009). Belugas arrive in the fiord when the ice allows access beginning in late June to early July and leave the area around late August (DFO 2009c). Beluga calve in Clearwater Fiord and the area is used for rearing (Kilabuk 1998). Belugas are reported to be feeding on a variety of fish and invertebrate species in summer in the Clearwater Fiord area (Brodie 1970). Shallow waters in the area may be used as a refuge from killer whales in summer (Ferguson et al. 2012).

EBSA criteria

Aggregation:

- Beluga from late July to late September

Fitness Consequences:

- Beluga feeding and rearing

Additional considerations

Anadromous Arctic Char inhabit a number of river systems that drain into Cumberland Sound. They spawn, overwinter and rear in the freshwater habitats of these systems and typically spend the summers feeding in the marine waters. The Isuituq River system at the head of Clearwater Fiord is one such system (DFO 2010b). Other river systems in this area may also support Arctic Char populations which would use the EBSA for feeding.

DFO (2011a) identified the Clearwater Fiord area as being important for seabird feeding, nesting and foraging (Figures 15 and 16). Many of the Islands within the EBSA support the largest summer (August) breeding concentration of Iceland Gulls in Canada (Snell 2002 cited in Latour et al. 2008).

EASTERN CUMBERLAND SOUND EBSA

The Eastern Cumberland Sound EBSA encompasses the northern coast of Cumberland Sound extending into Davis Strait (Figure 18). Maximum water depths in the EBSA are around 1,200 m. The EBSA covers a marine area of 12,645 km^2. A large recurrent polynya forms at the entrance of Cumberland Sound, likely caused by a combination of winds and frontal currents (Barber and Massom 2007, Cyr and Larouche 2015), which loosens and mobilizes pack ice. The eastern boundary of the EBSA includes the polynya.

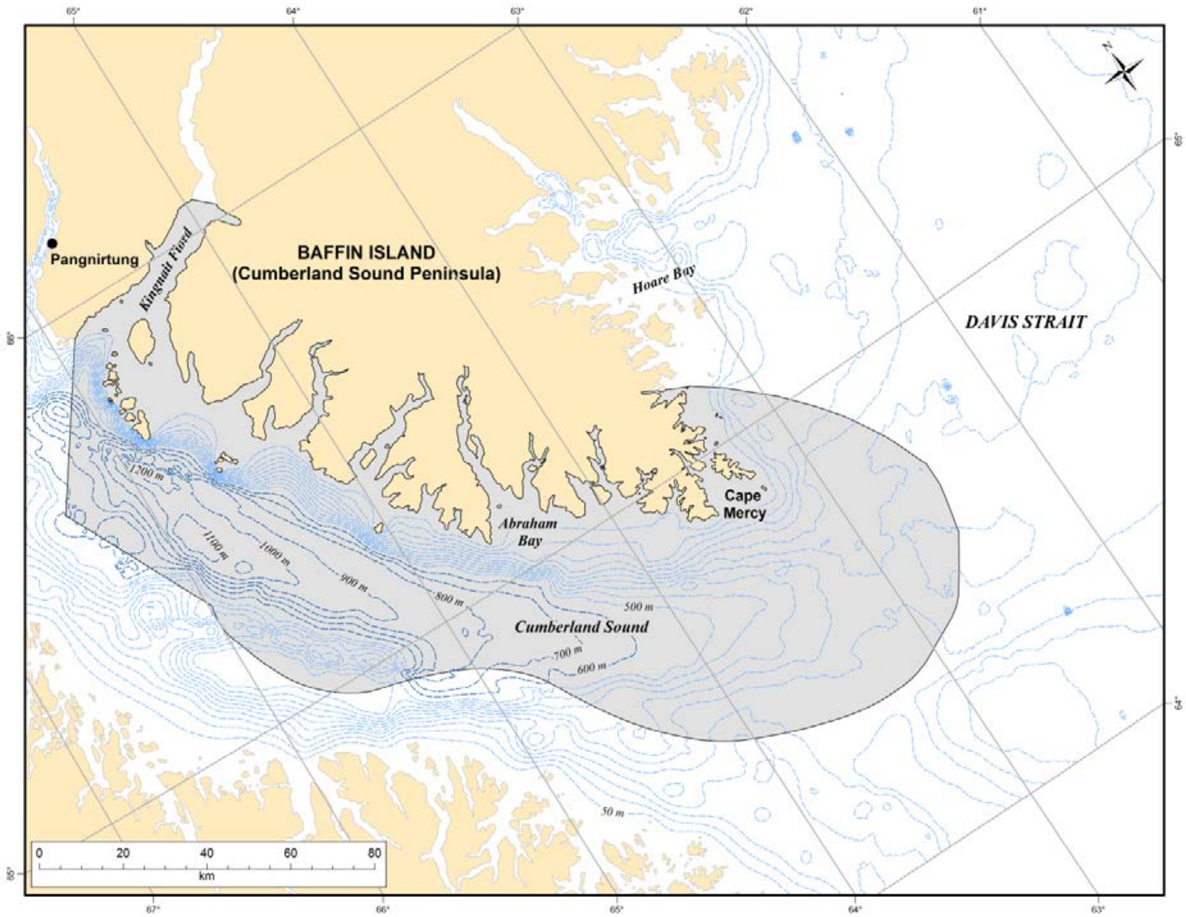

Figure 18. Eastern Cumberland Sound EBSA. Water depth contours within the EBSA are in 50 m increments up to 500 m, after which they are in 100 m increments.

The boundaries of the EBSA were based largely on the Cumberland Sound beluga population winter distribution data (Richard and Stewart 2009, DFO 2002) as the entire beluga population aggregates in the area of the polynya during the winter.

The Cumberland Sound polynya also provides spring and winter habitat for the Eastern Canada–West Greenland population of Bowhead whales (DFO 2009b). Ferguson et al. (2010) characterize the habitat as medium ice cover (35–65 %), first-year ice (30–70 cm) and small ice floes (0–500 m). This habitat type is thought to provide protection from predators (e.g., killer whale), with a generally low risk of ice entrapment (Richard and Stewart 2009, DFO 2009b, Ferguson et al. 2010).

The EBSA boundary was extended into Kingnait Fiord (Figure 18) to include important summer foraging habitat for bowhead whale (Dueck et al. 2006, DFO 2009b, Wheeler et al. 2012).

EBSA criteria

Aggregation:

- Beluga from December to May
- Bowhead Whale year-round

Fitness Consequences:

- Beluga feeding and over-wintering habitat
- Bowhead Whale feeding

Additional considerations

The Cumberland Sound EBSA is important for a variety of marine mammals (e.g., harp seal, ringed seal, narwhal and Atlantic walrus). They make use of the polynya, landfast and coastal pack ice habitats.

The EBSA extends around the end of the Cumberland Sound Peninsula and includes a portion of Hoare Bay, which is an important area for polar bear and Atlantic walrus. Terrestrial haul-outs sites for the Hudson Bay-Davis Strait stock of Atlantic walrus have been identified near Cape Mercy, Abraham Bay and Hoare Bay (Born et al. 1995). Atlantic Walrus also use the Cumberland Sound polynya during winter. A 2007 summer survey estimated between 1,420–2,533 walrus in the Hoare Bay area (DFO 2013).

The Davis Strait polar bear population uses the windward shores of Baffin Island during summer where the sea ice persists the longest (Taylor et al. 2001).

This EBSA is a productive marine area that supports a Greenland Halibut fishery (DFO 2008b). Data collected from the by-catch of the fishery includes Greenland Shark and skates (e.g., Thorny Skate, Arctic Skate) and the occasional wolffish (DFO 2008b).

During the spring and fall migrations, a variety of seabird species use the shore leads and open water polynya as migration corridors and potentially for staging (Figure 15; Mallory and Fontaine 2004). The EBSA may also be used by birds from colonies to the north (Figures 15, 16 and 18; Cape Searle, Reid Bay) during the summer for foraging as the colonies are relatively close to the EBSA (Mallory and Fontaine 2004).

Several thousand Common Eiders aggregate along the coasts of Cumberland Sound in August and September. Dovekies, Black Guillemots, and Black-legged Kittiwakes are found around the mouth of the Sound in August (Mallory and Fontaine 2004). Iceland Gulls which nest in the Clearwater Fiord EBSA forage in the Cumberland Sound EBSA in August (Latour et al. 2008).

CAPE SEARLE EBSA

The boundaries of the Cape Searle EBSA (Figure 19) are based on the area identified as Key Marine Habitat (Figures 15 and 16; Mallory and Fontaine 2004) and generally follow a 15 km radius around the Qaqulluit Northern Fulmar colony (Cape Searle) and a 30 km radius around the Akpait Thick-billed Murre colony. The EBSA encompasses both the Qaqulluit and Akpait National Wildlife Areas established by Environment Canada in 2010 to protect these colonies. These areas are recognized as Important Bird Areas in Canada. The EBSA covers a marine area of 2,909 km^2.

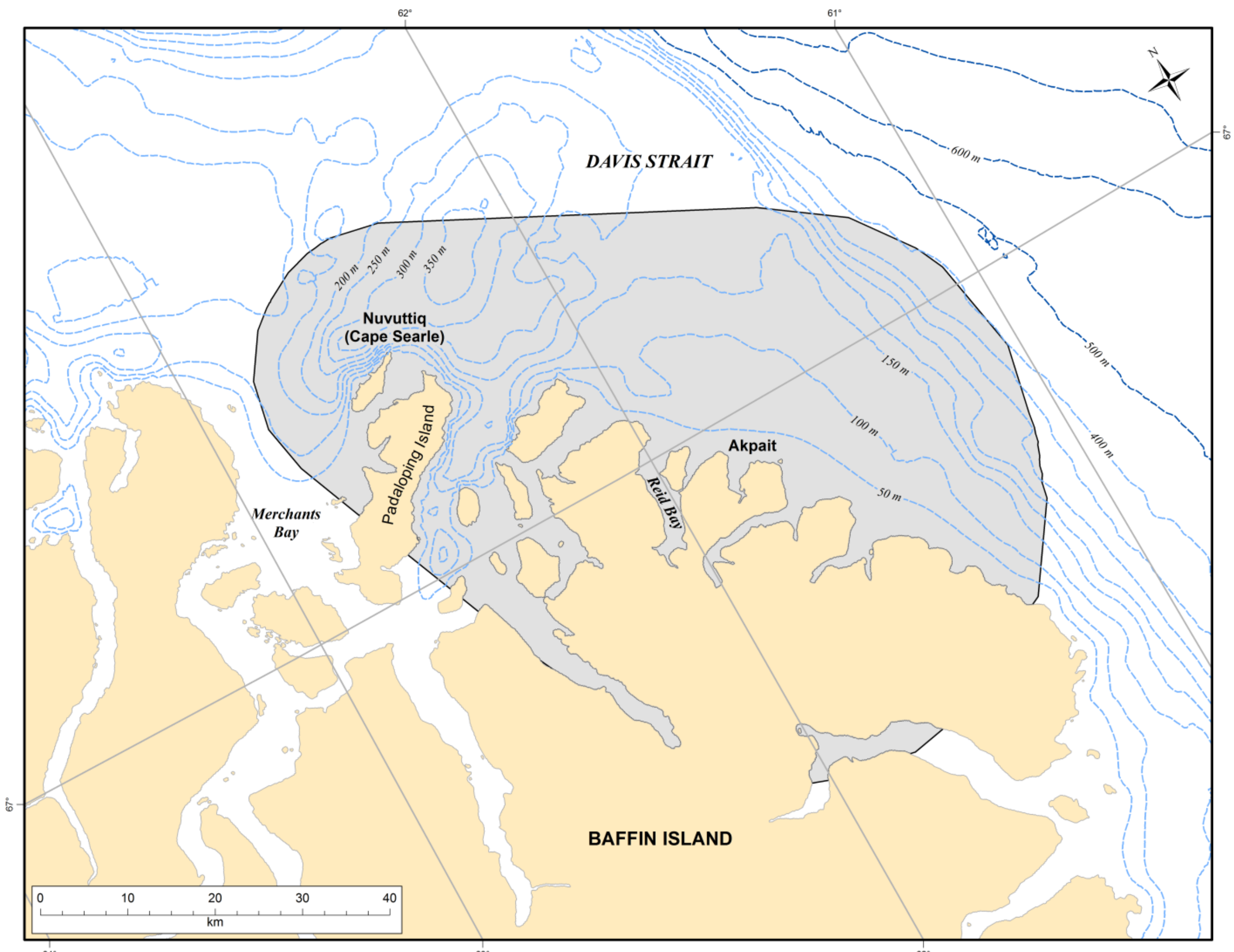

Figure 19. Cape Searle EBSA. Water depth contours within the EBSA are in 50 m increments up to 400 m, after which they are in 100 m increments.

The National Wildlife Areas were established in 2010 to protect Canada's largest colony of breeding Northern Fulmars (22 % of Canadian population), the important marine habitat nearby the islands and other seabirds using the area. The EBSA also includes Reid Bay, which is one of Canada's five largest Thick-billed Murre colonies (10 % of the Canadian population; Gaston and Hipfner 2000, Latour et al. 2008) and a significant Northern Fulmar colony is also present (Gaston et al. 2006). Cape Searle and Reid Bay are Important Bird Areas in Canada. The marine region is used by seabirds from mid-April to October. Northern Fulmars forage as far as 80 km from their colonies, though most birds forage only a few kilometers away (Mallory and Fontaine 2004). Thick-billed Murre foraging range is approximately within 50 km of the colony location, but can be up to 170 km (Gaston et al. 2013).

EBSA criteria

Aggregation:

- Northern Fulmar from mid-April to early October
- Thick-billed Murre from late May to late-August

Fitness Consequences:

- Northern Fulmar nesting and foraging
- Thick-billed Murre nesting and foraging

Additional considerations

In spring, when the Cumberland Sound polynya expands, a shore lead system forms along the Baffin Coast extending from Cumberland Sound north past Cape Dyer to the Cape Searle EBSA (Barber and Massom 2007).

Atlantic Walrus from the Hudson Bay-Davis Strait stock are found along the Southern Baffin Coast. The area is also used by the Baffin Bay polar bear population (Stirling et al. 1980, Taylor et al. 2001). Ringed seal are found in the EBSA.

The area is also an important nesting area for other seabirds including Black-legged Kittiwake, Black Guillemot, Glaucous Gull and Iceland Gull. Inuit knowledge and a single collection specimen from the area also indicate Atlantic Puffins may nest here (Mallory and Fontaine 2004, Gaston and Provencher 2012).

ISABELLA BAY EBSA

The Isabella Bay EBSA includes Isabella Bay and extends north and south along the outer Baffin coast (Figure 20). Isabella Bay is the outer extension of McBeth Fiord, with maximum depth of about 260 m (Finley 1990). The mouth of Isabella Bay, from Cape Raper south to the Henry Kater Peninsula, is 37 km wide (Figure 20). Isabella Bay (Ninginganiq) was designated in 2010 as a National Wildlife Area primarily for its significance to bowhead whales. The EBSA boundaries are consistent with the boundaries of Ninginganiq, which covers a marine area of 2,835 km^2.

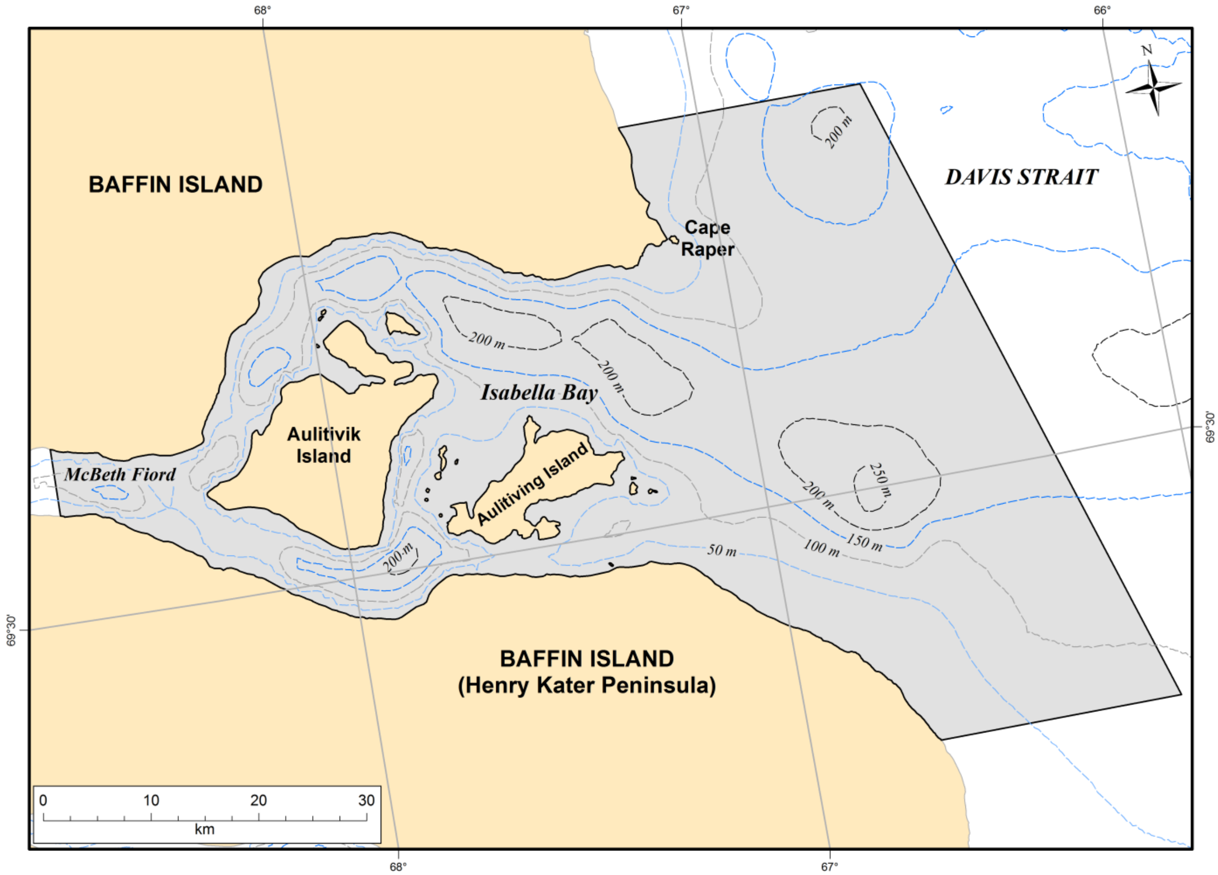

Figure 20. Isabella Bay EBSA. Water depth contours within the EBSA are in 50 m increments.

The importance of Isabella Bay as a summer aggregation area for bowhead whale is well documented historically in whaling records and described by local Inuit (Finley 1990). Finley (1990) confirmed post-whaling aggregations from mid-August through October, with up to 107 whales per day. Whales have been sighted by Inuit as early as May and as late as mid-November (Finley 1990). Bowhead are found in Isabella Bay area throughout the summer and fall, however some whales migrate past the bay and using the Baffin coast during their migrations (Heide-Jørgensen et al. 2006). Distribution and habitat use within the area varies throughout the season and between years, but generally the deeper troughs are used for feeding, and the shallow bank (~30 m depth) just south of Cape Raper is used for socializing/rubbing and possibly to escape predation when ice cover is not available (Finley 1990). Observations by Finley (1990) and further survey and tagging analyses summarized by Heide-Jørgensen et al. (2010) suggest Isabella Bay is important for summer feeding and socialization for adult males and resting females, but not important for calving or rearing young.

Mother-calf pairs and sub-adults were rarely seen along the east coast of Baffin Island in August (Finley 1990, Hansen et al. 2012).

EBSA criteria

Aggregation:

- Bowhead Whale from August to October

Fitness Consequences:

- Bowhead Whale feeding

Additional Considerations

Ringed seal, narwhal, polar bear and seabirds (e.g., King Eider, Long-tailed Duck, Dovekies, Northern Fulmar) are found in the EBSA.

SCOTT INLET EBSA

The Scott Inlet EBSA (Figure 21) includes Scott Inlet and extends seaward encompassing Scott Trough to the shelf break, including the deposition fan. The EBSA covers a marine area of 2,602 km^2. Gibbs and Clark fiords are deeply incised, reaching depths over 700 m. The mouth of Scott Inlet is shallower (< 500 m). Scott Trough is steep-sided with a maximum depth of 840 m (Figure 21; Løken and Hodgson 1971).

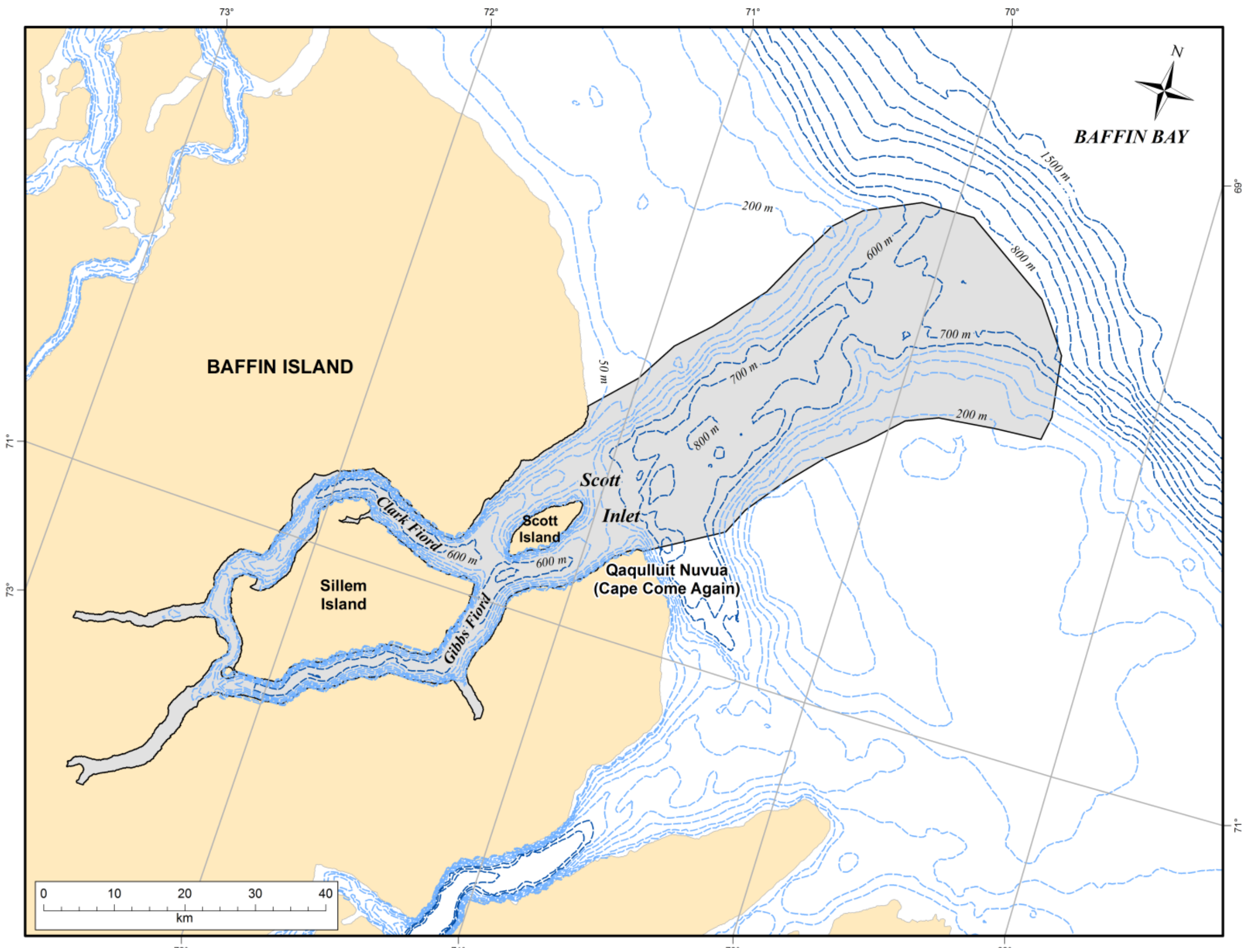

Figure 21. Scott Inlet EBSA. Water depth contours within the EBSA are in 100 m increments. The 50 m contour is shown along the coastline).

An oil slick was first observed near Scott Inlet during the 1976 cruise of the *CCGS Hudson* while carrying out a seismic reflection profiling line (Loncarevic and Falconer 1977). This led to the identification of a naturally occurring seabed hydrocarbon seep. It is not known how long the feature has been active. MacLean et al. (1981) suggested that the hydrocarbons originate from the seabed along the south margin of outer Scott Trough and are confined mostly to the walls of Scott Trough, where Quaternary sediment is thinnest (Praeg et al. 2007).

Submersible dives in 1981 and 1985 observed white bacteria (*Beggiatoa* spp.) covering the seabed in the area of the seep (MacLean et al. 1981, Grant et al. 1986). One submersible dive found a carbonate crust on the sediment that was trapping oil beneath it (Grant et al. 1986). This sample was collected from a circular depression about 30 m wide and 2–3 m deep that may have been a pockmark (Grant et al. 1986). Gas has also been observed escaping from the seabed in remotely operated underwater video (ROV) footage collected onboard the *CCGS Amundsen* in 2009 and in acoustic water column data collected by the *CCGS Hudson* in 2013.

Indicators of petroleum in the Eastern Arctic Biogeographic Region, including the location of the Scott Inlet oil seep, were summarized and mapped by Brent et al. (2013). Scott Inlet is the only known cold seep along the Baffin Island coast.

In 2014, a ROV expedition was conducted from the *CCGS Amundsen*, the dive confirmed earlier information on the cold seep and collected the first video images of fauna in the region (Dr. Evan Edinger, Memorial University, pers. comm.). They reported the presence of a predatory sponge *Claorhiza*, which is indicative of chemolithic communities. This is the only report of this species in Baffin Bay or the Canadian Arctic to date.

EBSA criteria

Uniqueness:

- Hydrocarbon seep
- Chemolithic biological community

Additional considerations

The Scott Inlet area is occupied by seabirds (Figures 15 and 16) from mid-April through October (Riewe 1992). Approximately 10,000 pairs of Northern Fulmars, representing 5 % of the Canadian population, form colonies on Scott Island (Gaston et al. 2006). This fulmar colony is almost totally composed of light-phase birds, anomalous among eastern Canadian Arctic fulmar colonies (Hatch and Nettleship 1998 cited in Latour et al. 2008). There are two colonies of Glaucous Gulls nesting on Scott Island (Nettleship 1980 cited in Latour et al. 2008). A few thousand Black Guillemots overwinter in northwest Baffin Bay and some of these birds may nest near Scott Inlet (McLaren 1982 cited in Latour et al. 2008). Scott Inlet is one of the Important Bird Areas in Canada.

Recurring offshore leads form in sea ice off Scott Inlet although this is highly variable. The floe edge is near to shore. Shore-leads open as early as February but may close again in April or May. The ice edge and shore-lead system is particularly important to migrating birds (Mallory and Fontaine 2004, Latour et al. 2008). The Ivory Gull, a species at risk in Canada, migrates and stages along the ice edge in fall (Spencer et al. 2014).

The area is used by narwhal, beluga, harp seal, bearded seal, ringed seal, and polar bears (Riewe 1992). The extension out to the Baffin Bay shelf break captures a cross section of the Baffin Bay Narwhal migration corridor (Deitz et al. 2001). The East Baffin Island summering stock of the Baffin Bay narwhal population also use the inlet as a nursery area.

A number of other species, including concentrations of the anemone, *Actinoscyphia aurelia*, soft corals from the family Nephtheidae, abundant sea pens (*Ombellula* sp.), and unstalked crinoids were recorded along with redfish and Spotted Wolffish (C. Lovejoy, Université Laval, pers. comm.) in the EBSA.

ECLIPSE SOUND EBSA

The Eclipse Sound EBSA includes the relatively narrow channels (average width of about 20 km) of Navy Board Inlet, Eclipse Sound and Pond Inlet, situated between Bylot Island and northern Baffin Island (Figure 22). The bathymetry in the EBSA is complex, with a maximum depth of 1,000 m. Water depth in Navy Board Inlet is about 100 m, except at the entrance to Lancaster Sound where depths reach 500 m. The EBSA boundary terminates at Lancaster Sound to the north and Baffin Bay to the east. The EBSA includes Milne Inlet and Tremblay Sound, but omits the minor inlets and fiords east of Milne Inlet through to Oliver Sound (Figure 22). The EBSA covers a marine area of 6,871 km^2.

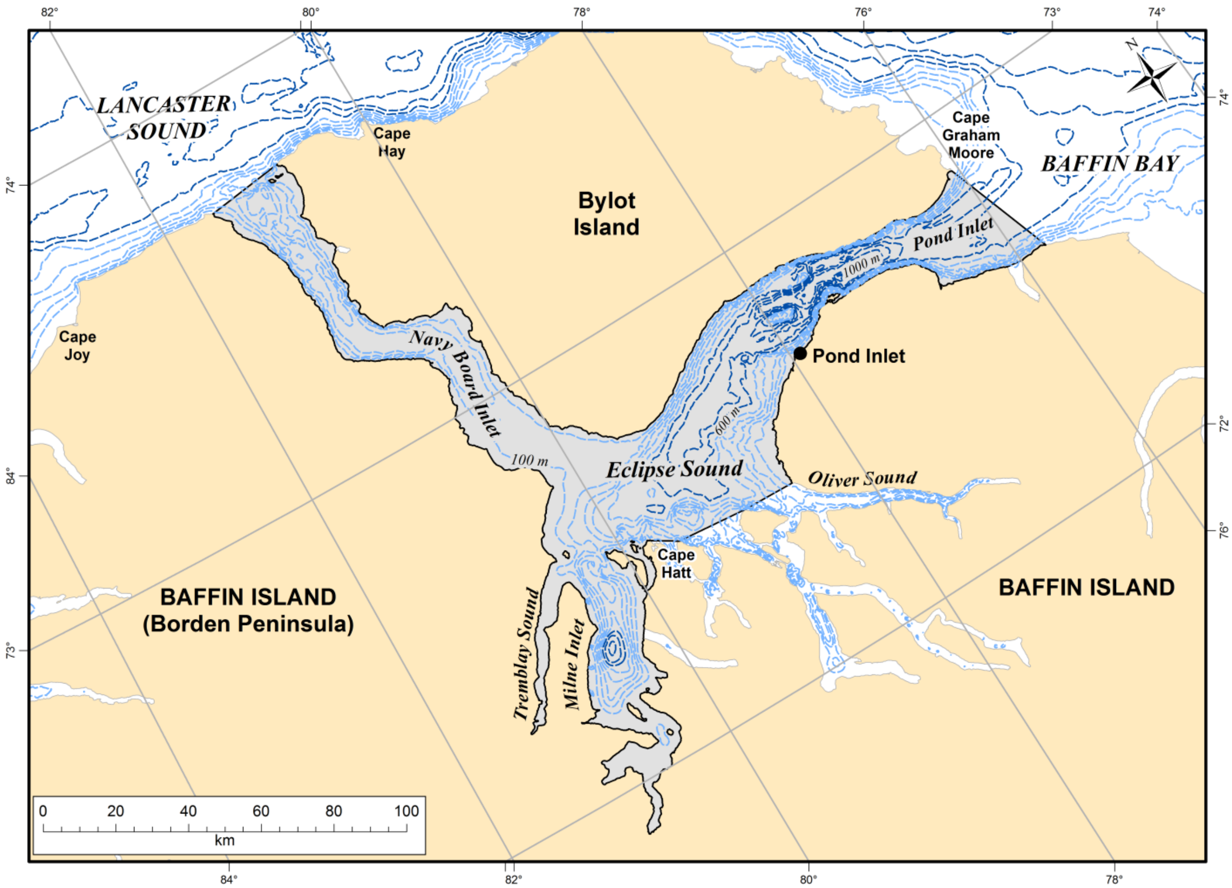

Figure 22. Eclipse Sound EBSA. Water depth contours within the EBSA are in 100 m increments up to 500 m, after which they are in 100 m.

The EBSA is used as a migratory corridor for narwhal stocks during spring and fall migrations. Narwhal arrive in early spring, timed with ice break-up, following the retreating ice-edge until they are able to access the summering areas. Fall migration out of Eclipse Sound generally begins between late September and mid-October (Watt et al. 2012). Instrumented narwhal all left the fiords and inlets of northern Baffin Island in November, and migrated to Davis Strait where they spent the winter (Watt et al. 2012). However, two large ice entrapments have occurred in Eclipse Sound in recent years (2008 and 2015) where large groups of narwhal remained after freeze-up and became trapped in the ice (DFO 2012, DFO unpubl. rep.).

Surveys indicate narwhal have a preference for the deeper fiords Tremblay and Milne Inlet rather than shallower inlets to the east of Milne Inlet (Richard et al. 2010, Dietz et al. 2001) though observations and tagged whales indicate some sporadic use of the deeper Tay Inlet (Miller 1955, Heide-Jørgensen et al. 2002) or Oliver Sound (Dietz et al. 2001). The narrow channels, fiords and inlets in Eclipse Sound may be important as a refuge from predation (C. Watt, DFO pers. comm.).

The Eclipse Sound summering stock of narwhal (~10,500 whales) is found in the EBSA. Most narwhal calves are born in July and August when pregnant females enter their traditional summering areas (Mansfield et al. 1975, COSEWIC 2005). This suggests that narwhal use the Eclipse Sound EBSA (and other summer areas) for calving and rearing young. Narwhal are likely opportunistically foraging in the Eclipse Sound EBSA although this is less important relative to winter feeding in Baffin Bay/Davis Strait (Finley and Gibb 1982, Laidre et al. 2004a).

EBSA Criteria

Aggregation:

- Narwhal from July to mid-November

Fitness Consequences:

- Narwhal rearing
- Narwhal migration corridor

Additional considerations

The area is occupied by seabirds (Figures 15 and 16) from mid-April through October for staging and foraging as part of their migration to the northern colonies (Mallory and Fontaine 2004, Latour et al. 2008). One of five of the largest colonies of Thick-billed Murres is located at Cape Hay, just east of Cape Joy. The EBSA includes portions of the Bylot Island Migratory Bird Sanctuary, Sirmilik National Park, and three identified Important Bird Areas in Canada.

Although polar bears from the Baffin Bay sub-population are found in the Eclipse Sound EBSA (Taylor et al. 2001), the land, rather than the marine waters, are important for them (Taylor et al. 2001). Bylot Island and the northern Borden Peninsula are identified as summer retreats during the open water period (Schweinsburg et al. 1982).

ADMIRALTY INLET EBSA

The Admiralty Inlet EBSA is a relatively narrow inlet south of Lancaster Sound, situated between Brodeur Peninsula and Borden Peninsula on Baffin Island (Figure 23). The inlet is approximately 28 km wide and is about 260 km long. The northern half of Admiralty Inlet reaches depths of 700 m and is shallower south of Yeoman Island (Figure 23). The EBSA covers a marine area of 9,132 km^2.

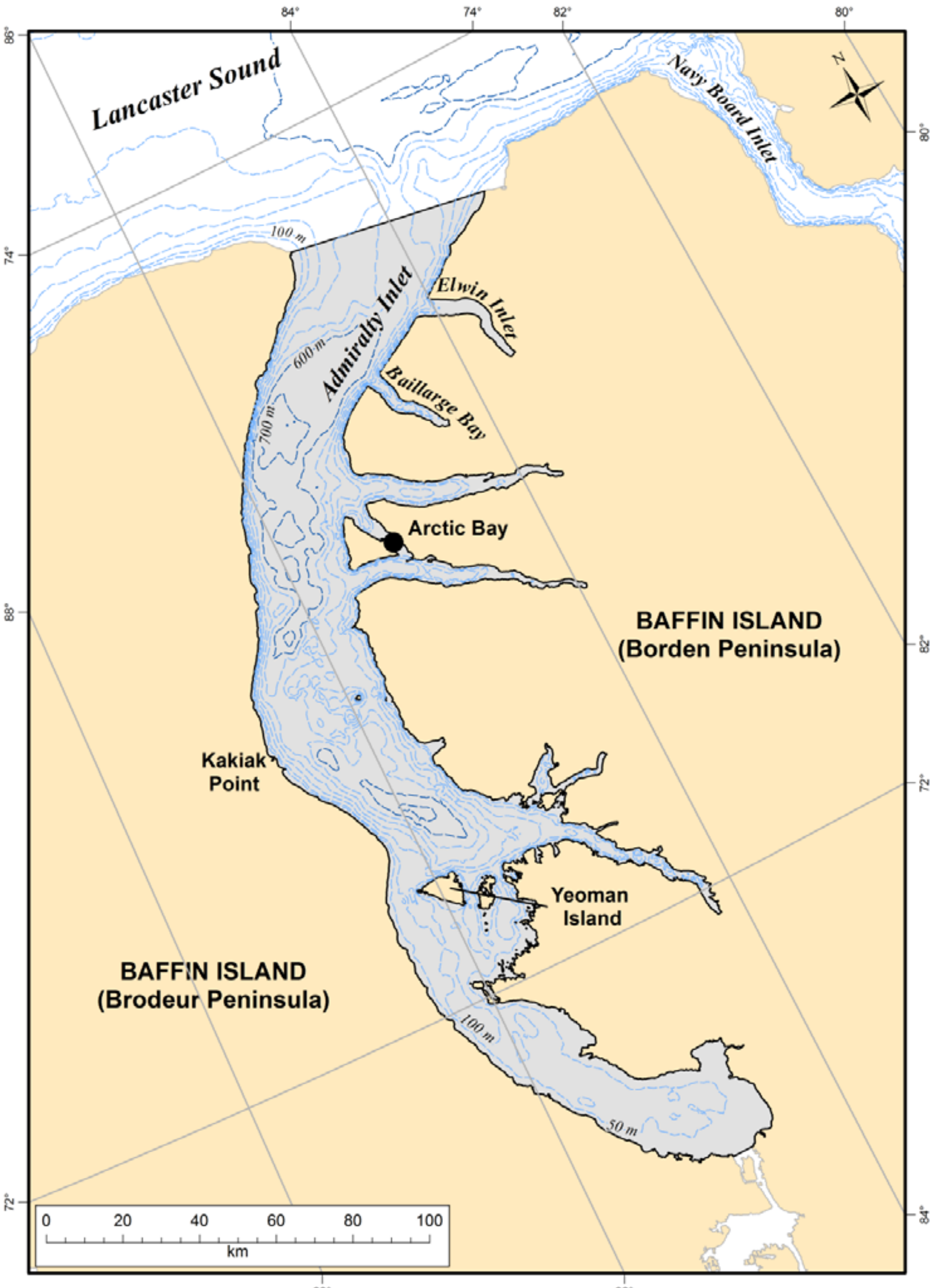

Figure 23. Admiralty Inlet EBSA. Water depth contours within the EBSA are in 100 m increments. The 50 m water depth is also shown along the coastline.

The Admiralty Inlet narwhal summering stock (~35,000 whales) is found in the EBSA (DFO 2015b). Narwhal arrive in early spring, timed with ice break-up, following the retreating ice-edge until they are able to access the summering areas. Watt et al. (2012) followed instrumented narwhals which began moving out of Admiralty Inlet in mid-September to late September. Several moved into Prince Regent Inlet and several moved into Lancaster Sound before heading east then south into Davis Strait. One of the narwhal continued south in Prince Regent Inlet then through Fury and Hecla Strait in late October and remained in northern Foxe Basin until the tagged stopped working in late February. There is evidence for some movement of narwhal between Somerset Island, Admiralty Inlet and Eclipse Sound summering areas (Watt et al. 2012). Narwhal from the Admiralty Inlet summering stock likely use the inlet for calving and rearing young (Cosens and Dueck 1990, Laidre et al. 2004a). Aerial surveys indicate that narwhal appear to favour the western coast and central portion of the inlet near Kakiak Point (Dietz et al. 2008, Richard et al. 2010, Asselin and Richard 2011) although distribution can be highly variable.

Mallory and Fontaine (2004) report strong reversing tidal currents at the mouth of Admiralty Inlet. These currents appear to create localized enrichment of nutrients ideal for seabird foraging (Gaston and Nettleship 1981 as cited by Mallory and Fontaine 2004). A major Northern Fulmar colony, which represents about 13 % of the Canadian population, breeds along 16 km of coast between Baillarge Bay and Elwin Inlet (Mallory and Fontaine 2004). Fulmars rely on the marine waters of the EBSA and Lancaster Sound between April and October to feed, nest and rear young. Baillarge Bay, and Berlinguet Inlet which includes the EBSA region roughly south of Yeoman Island, are Important Bird Areas in Canada.

EBSA criteria

Aggregation:

- Narwhal from July to mid-September
- Northern Fulmar April through October

Fitness Consequences:

- Narwhal rearing
- Northern Fulmar nesting and foraging

Additional considerations:

Bowhead whale aggregate and feed in this EBSA during the summer (Ferguson et al. 2010). Killer Whales are also found in the area during the open-water period (Matthews et al. 2011).

Marine birds (Figures 15 and 16) are distributed throughout this EBSA (Reiwe 1992). Baillarge Bay, at the entrance to Admiralty Inlet, is considered key marine habitat for migratory birds (Mallory and Fontaine 2004). Admiralty Inlet is a breeding area for Glaucous Gull (Latour et al. 2008). From May to September, the area may have large aggregations of marine birds depending on the annual patterns of ice break-up and prey distribution (Gaston and Nettleship 1981 as cited by Mallory and Fontaine 2004).

The waters around Baillarge Bay are also important for many marine mammals, including ringed seal, harp seal and beluga. Polar bears from the Lancaster Sound sub-population are known to use the area as a summer retreat where the ice persists in the deep bays (Schweinsburg et al. 1982).

PRINCE REGENT INLET EBSA

The Prince Regent Inlet EBSA (Figure 24) includes the central portion of Prince Regent Inlet. Prince Regent Inlet, between Somerset Island and Baffin Island, is approximately 100 km in width. The inlet joins Lancaster Sound to the north and Gulf of Boothia to the south. Depths can reach approximately 450 m. The pattern of ice break-up is driven by cyclonic currents that form within the basin and there is a distinct separation of annual ice in Prince Regent Inlet from the multiyear ice in the Gulf of Boothia (Barber and Massom 2007). The EBSA covers a marine area of 12,838 km^2.

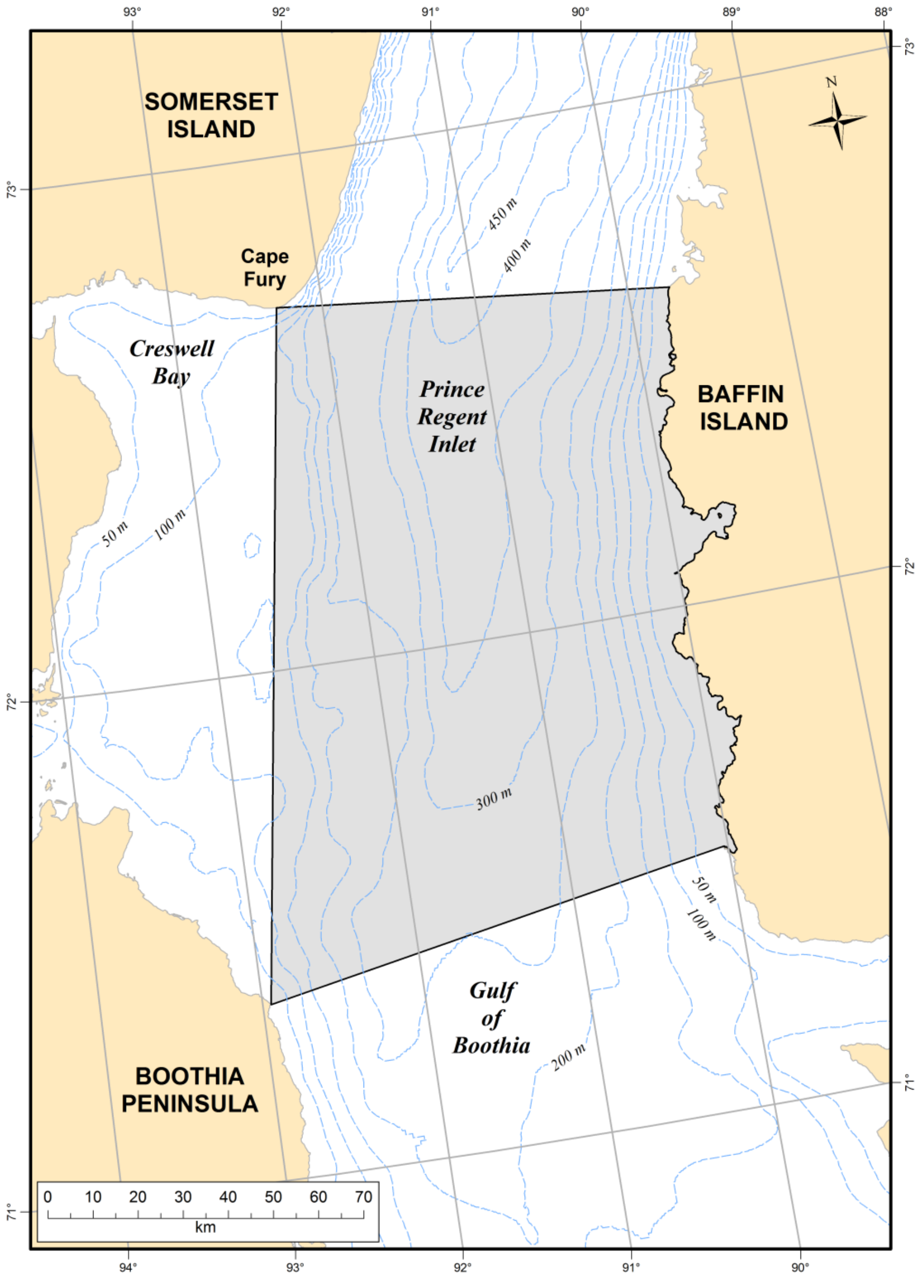

Figure 24. Prince Regent Inlet EBSA. Water depth contours within the EBSA are in 50 m increments.

The EBSA is used as a summer aggregation, feeding and rearing area for bowhead (DFO 2009b, DFO 2015). Bowhead whale migrate into Prince Regent Inlet either from Lancaster Sound or through Fury and Hecla Strait. The duration of ice cover and perennial ice in Prince Regent Inlet create suitable conditions for bowhead feeding and rearing.

The Somerset Island narwhal summering stock (~50,000 whales) use Prince Regent Inlet during summer as a rearing and migratory route (Innes et al. 2002, Richard et al. 2010, DFO 2010a, 2015).

EBSA criteria

Aggregation:

- Narwhal from July to mid-November
- Bowhead Whale from July to mid-November

Fitness Consequences:

- Narwhal rearing
- Bowhead whale feeding and rearing

Additional considerations:

During the ice covered season, ice conditions along the coastlines and across the inlet and bays of Prince Regent Inlet are used by polar bears (Taylor et al. 2001). In spring, Prince Regent Inlet has high densities of polar bears from the Lancaster Sound population, high density of shore-fast ice on both sides of the inlet and 9/10–10/10 unconsolidated annual pack ice in between which are optimal conditions for polar bear movement and feeding (Taylor et al. 2001).

The High Arctic-Baffin Bay population of beluga summer in the waters around Somerset Island (Innes et al. 2002). During surveys in 1996, belugas were concentrated in the central parts of Prince Regent Inlet (Innes et al. 2002).

Killer whales have been studied in Prince Regent Inlet/Gulf of Boothia from August to October using satellite taggs (Reeves and Mitchell 1988 cited in Matthews et al. 2011, S. Ferguson, DFO, pers comm.). Matthews et al. (2011) reports that group sizes varied from 8–20 whales and the individual tagged whale locations overlapped with known seasonal aggregations of potential prey (e.g., narwhal, harp seal, bowhead). Tagged killer whales avoided sea ice, navigating out of the area in October, into Lancaster Sound and ultimately into the ice-free waters of Baffin Bay (Matthews et al. 2011).

CRESWELL BAY EBSA

The Creswell Bay EBSA (Figure 25) is a large bay on southeastern Somerset Island, opening into western Prince Regent Inlet. It is a shallow bay with maximum depths of approximately 100 m. There are several rivers that flow into the bay and large shallow estuaries along the coast. The outer boundary of the Creswell Bay EBSA is a straight line running across the bay from Fury Point to Cape Garry. The EBSA covers a marine area of 1,098 km^2.

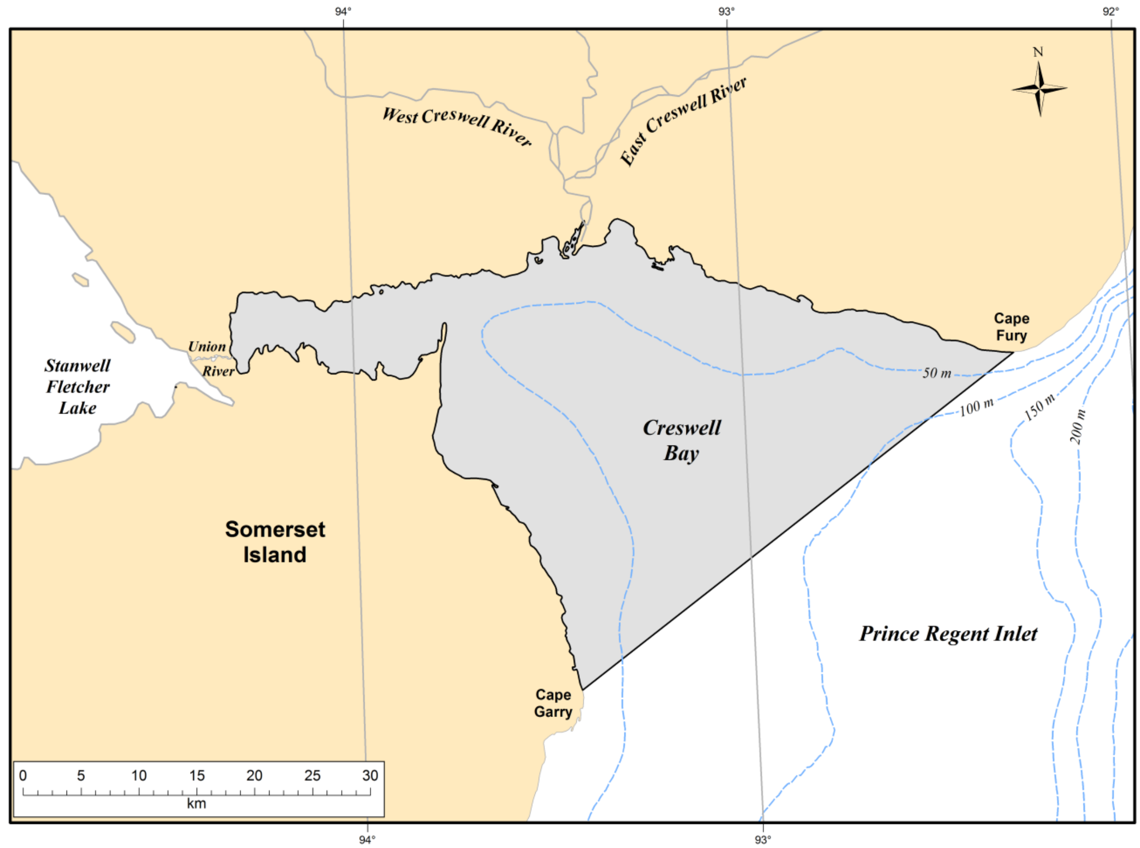

Figure 25. Creswell Bay EBSA. Water depth contours within the EBSA are in 50 m increments.

The Eastern High Arctic-Baffin Bay population of beluga migrate from wintering areas in pack-ice off West Greenland to estuaries on or near Somerset Island (Innes and Stewart 2002, Innes et al. 2002). Beluga arrive via Lancaster Sound following ice break-up in late June to early July and exit the area in late August (Smith and Martin 1994, Richard 2010). Aerial surveys, though infrequent, have identified upwards of 13 estuaries in the general region traditionally used by belugas (Innes et al. 2002, Smith and Martin 1994, Koski et al. 2002). Of these areas, Creswell Bay is the most consistently used bay in the central Canadian High Arctic, and beluga use the area in large numbers (Innes et al. 2002). Smith and Martin (1994) noted that numbers of beluga in Creswell Bay peaked in the early part of August when some 4000+ belugas were found there. Use of estuaries is highly variable; Innes et al. (2002) estimated 910 beluga in Creswell Bay (corrected for availability bias) in 1996. Beluga are known to move throughout the Prince Regent Inlet and Peel Sound areas during the summer.

Though calving was not observed in Creswell Bay, the proportion of neonate whales increased through the 1975 survey season from 3 % on July 24 to 12 % by August 14 (Koski et al. 2002).

There appears to be very little feeding occurring in early spring. Koski et al. (2202) observed beluga feeding intensively from mid-August to September in the centre of Creswell Bay. They were accompanied by narwhal, harp seal, Black-legged Kittiwake and Northern Fulmar feeding on schools of Arctic Cod.

EBSA criteria

Aggregation:

- Beluga from July and August

Fitness Consequences:

- Beluga rearing
- Beluga refugia from Killer Whale

Additional considerations

There are strong tidal currents in the channels between the inner and outer bays, during ebb and flow tides (estimated amplitude 2.9 m), and tidally-driven upwelling may occur off Cape Fury (Webtide Tidal Prediction Model). Creswell Bay probably contributes to primary production by providing nutrient-laden water to Prince Regent Inlet area (Dueck and Ferguson 2009).

The spring and summer season is important for marine birds (Figures 15 and 16), including Common Eider, King Eider, Long-tailed Duck, Northern Fulmars, and Black-legged Kittiwakes. Creswell Bay is a key marine habitat site for migratory birds, an Important Bird Area in Canada (Mallory and Fontaine 2004). The Creswell Bay and Stanwell Fletcher Lake lowlands support a higher abundance and diversity of shorebirds than any other site north of 70°N (Latour et al. 2005).

Narwhals aggregate in the general region, but prefer deeper water than belugas and are frequently sighted in considerable numbers offshore in Prince Regent Inlet and Peel Sound (Smith et al. 1985, Heide-Jørgensen et al. 2003a). Ringed seal and polar bear are found in this area.

Anadromous Arctic Char from Stanwell Fletcher Lake migrate down the Union River annually to feed in Creswell Bay and along the Somerset Island coastline before migrating back to the lake to overwinter (Rust and Coakley 1970).

BELLOT STRAIT EBSA

The Bellot Strait EBSA encompasses Bellot Strait. Bellot Strait is a narrow passage of water separating Somerset Island from Boothia Peninsula, the northernmost part of mainland North America (Figure 26). The 2 km wide, 25 km long strait connects Prince Regent Inlet on the east with Peel Sound on the west (Figure 26). The EBSA covers a marine area of 91 km^2.

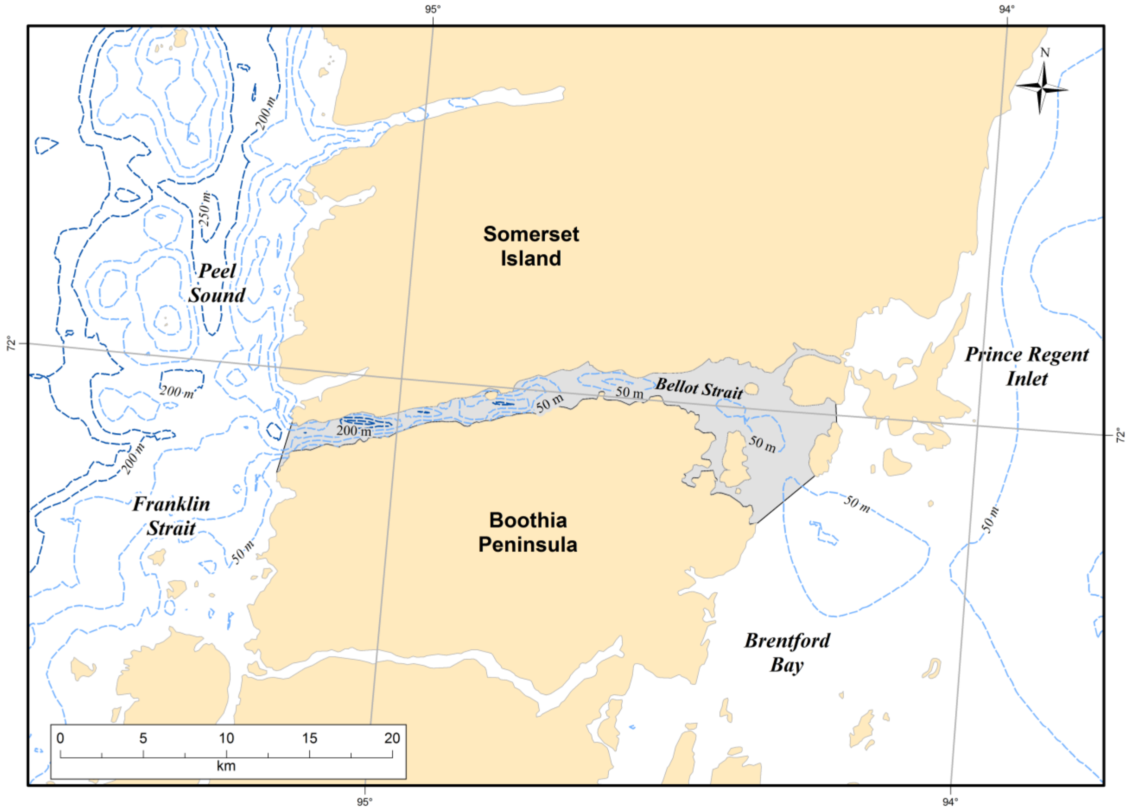

Figure 26. Bellot Strait EBSA. Water depth contours within the EBSA are in 50 m increments.

The current in the strait can run at up to 8 knots and often changes its direction. The western part of the strait is deeper (~300 m) than the eastern entrance (~20 m). Bellot Strait is the narrowest marine corridor in Canada's Arctic. Satellite tracking of narwhal indicates that the Somerset Island narwhal summering aggregation remain around Somerset Island and use the narrow Bellot Strait as a corridor to reach Peel Sound (Heide-Jørgensen et al. 2003a). Bellot Strait is also used by the Eastern High Arctic–Baffin Bay beluga as a migration corridor between Prince Regent Inlet and Peel Sound (Richard et al. 2001). It provides alternate access to Peel Sound; it is a secondary route for the whales to access Peel Sound. The strait is considered a choke point funnelling migrating whales through a relatively narrow passage.

EBSA criteria

Uniqueness:

- Choke point, migration corridor

Fitness Consequence:

- Narwhal migratory corridor in July and August
- Beluga migratory corridor in July and August

Additional considerations

There is a recurrent polynya at Bellot Strait that is created by the strong oceanographic forcing through the narrow channel. Open water occurs in the centre of the strait from late December to March. Ice break-up occurs in late June and remains open until late September. It is ice covered from late September to December. In the spring, the polynya propagates eastward into Brentford Bay due to strong currents and the forcing over the shallow sill in the strait (Barber and Massom 2007). Bellot Strait probably contributes significantly to primary production by providing inputs from Pacific waters into Prince Regent Inlet (Dueck and Ferguson 2009).

Although bowhead whale may enter Bellot Strait, it is not a migratory corridor for them (Stirling et al. 1981). The majority of bowhead whales likely remain in Prince Regent Inlet and the Gulf of Boothia (Dueck et al. 2006). Interacting currents, eddies and upwellings associated with movement of water through the strait are likely important features that provide bowhead feeding opportunities throughout the summer and early fall in Prince Regent Inlet and Gulf of Boothia (Dueck and Ferguson 2009). Polar bear denning occurs along the coastlines of Bellot Strait and polar bear frequent the eastern entrance to the strait (Schweinsburg et al. 1981). The strait could be used by killer whale. Ringed seal (Finley and Johnston 1977, Schweingsburg et al. 1981) and bearded seal (Finley and Johnston 1977,Schweinsburg et al. 1981, Stirling et al. 1981) are found in the EBSA.

Bellot Strait is an important feeding and staging site for a variety of seabirds between May and October (Brown and Nettleship 1981, Riewe 1992), and is a staging area for Common Eider and King Eider in spring (McLaren and Alliston 1985, Riewe 1992).

GULF OF BOOTHIA EBSA

The Gulf of Boothia EBSA is situated between the Brodeur Peninsula, Baffin Island, west of Fury and Hecla Strait and Melville Peninsula (Figure 27). The Gulf of Boothia EBSA is shallower to the west, deepening to ~300 m approaching Fury and Hecla Strait. The EBSA covers a marine area of 24,973 km^2 and includes Lord Mayor and Thom bays (Figure 27).

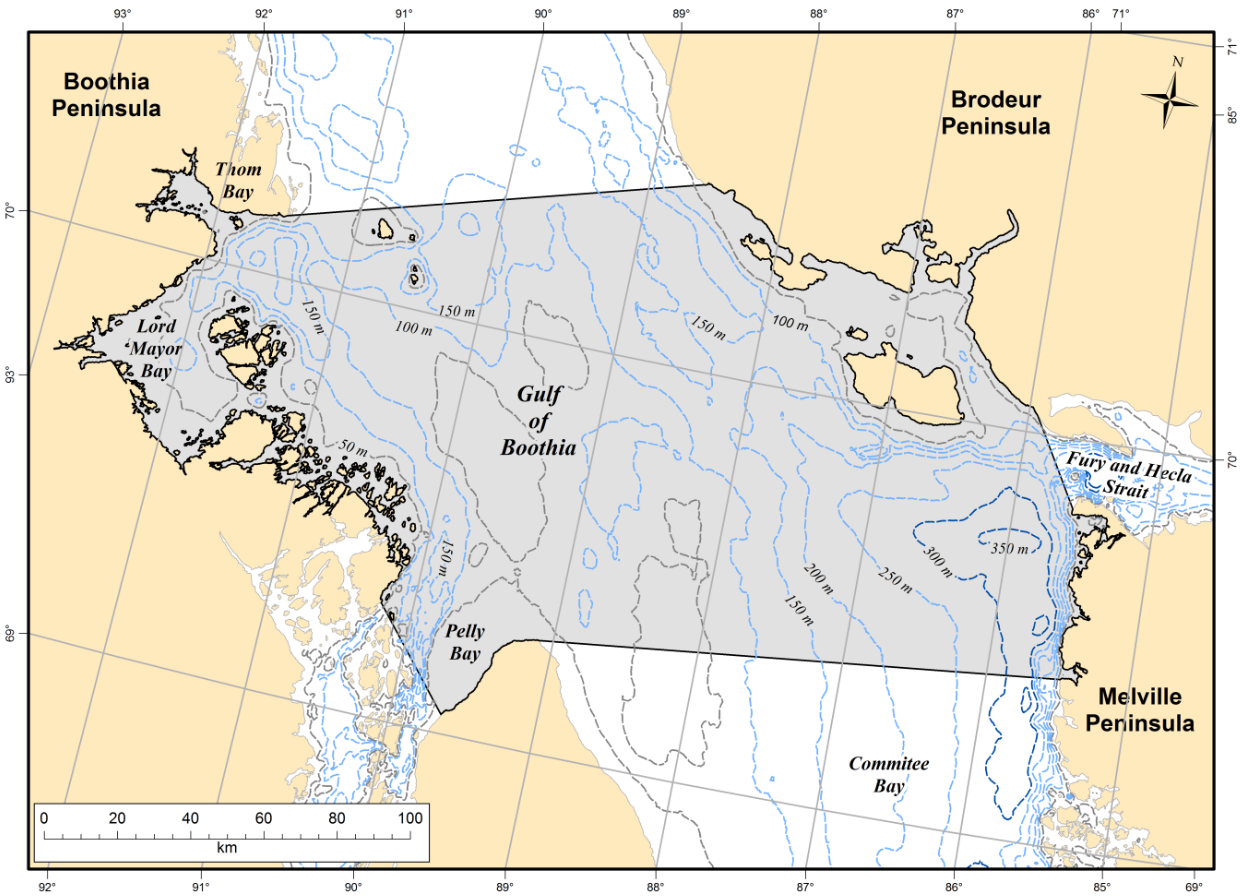

Figure 27. Gulf of Boothia EBSA. Water depth contours within the EBSA are in 50 m increments.

The Gulf of Boothia is an important summer aggregation area for the Somerset Island narwhal stock (Richard 2010). Richard et al. (2010) estimated about 6,700 narwhal in Gulf of Boothia during the 2002 survey. Numbers vary depending on ice conditions.

Eastern Arctic-West Greenland bowhead whale migrate to the Gulf of Boothia summering location either from north of Baffin Island or from Foxe Basin through Fury and Hecla Strait. Survey and tagging data indicate high counts, concentrations and temporal use of bowhead whale use in the Gulf of Boothia EBSA; it is an important summering location for the Eastern Arctic-West Greenland bowhead whale population (Dueck and Ferguson 2009, Ferguson et al. 2010). In the Gulf of Boothia sea ice persists during most summers, providing nursery habitat throughout the summer and fall (Ferguson et al. 2010). The presence of suitable ice cover provides exclusion of killer whale and protection from predation (Ferguson et al. 2012). The area is used for rearing calves and foraging and the ice cover likely provides opportunity for prolonged and undisturbed social encounters (Ferguson et al. 2010).

EBSA criteria

Aggregation:

- Bowhead Whale from late June to mid-November
- Narwhal in July and August

Fitness Consequences:

- Bowhead Whale rearing and feeding area
- Narwhal rearing area
- Bowhead Whale and Narwhal seasonal refugia from Killer Whale

Additional considerations

Cyr and Larouche (2015) identified high Chl *a* concentrations in Lord Mayor and Pelly bays. The western side of the gulf is important for the Gulf of Boothia polar bear sub-population (Schweinsburg et al. 1981).

Ringed seals are observed along the open leads on the east coast of the Boothia Peninsula (Schweinsburg et al. 1981).

PEEL SOUND EBSA

The Peel Sound EBSA is located between Somerset and Prince of Wales islands (Figure 28). Peel Sound opens to Barrow Strait in the north and Franklin Strait to the south. Depths reach 450 m mid-channel, with steeply sloped bathymetry on the west side of the channel and gentler slopes and island clusters along the eastern coast. The EBSA covers a marine area of 7,286 km^2.

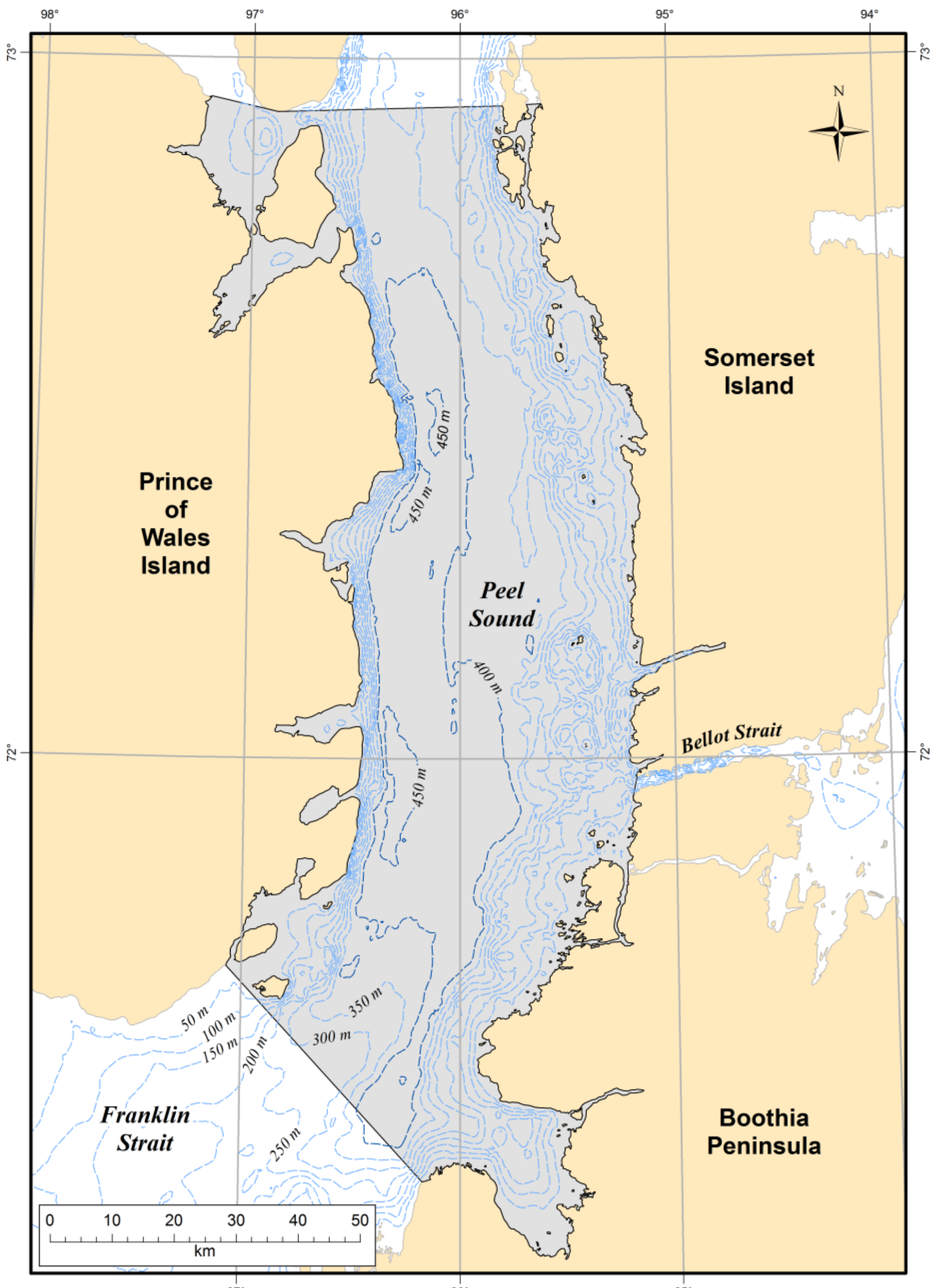

Figure 28. Peel Sound EBSA Water depth contours within the EBSA are in 50 m increments.

Narwhal enter Peel either from the north around Somerset Island or through Bellot Strait (Heide-Jørgensen et al. 2003a). Peel Sound was identified as an EBSA based on summer use of the area by a large portion of the Somerset Island summering stock of the Baffin Bay Narwhal population (Innes et al. 2002, Laidre et al. 2004a). The Somerset Island narwhal summering stock is estimated to be about 50,000 whales (DFO 2015 b). Innes et al. (2002) indicate narwhal use the south-central parts of Peel Sound, primarily offshore and in areas with deeper waters.

EBSA criteria

Aggregation:

- Narwhal in July and August

Fitness Consequences:

- Narwhal rearing and potentially feeding area

Additional considerations

Polar bears hunt seals near the northern part of Peel Sound which is enriched by upwelling currents and has both high ring seal densities and active ice (Taylor et al. 2001). Polar bears mainly used the bays and shoreline tide cracks in northern Peel Sound (Taylor et al. 2001).

Surveys summarized in Innes et al. (2002) and tracking data (Richard et al. 2001) indicate beluga are present in Peel Sound in the summer. Ringed seal and bearded seal are found in the EBSA (Schweinsburg et al. 1981).

LANCASTER SOUND EBSA

The Lancaster Sound EBSA (Figure 29) is located south of Devon Island. The western boundary of the EBSA terminates at the Prince Leopold Island EBSA and includes Maxwell Bay on Devon Island. The eastern boundary of the EBSA was identified based on the Lancaster Sound Polynya and associated flaw leads. The EBSA covers a marine area of 48,131 km^2.

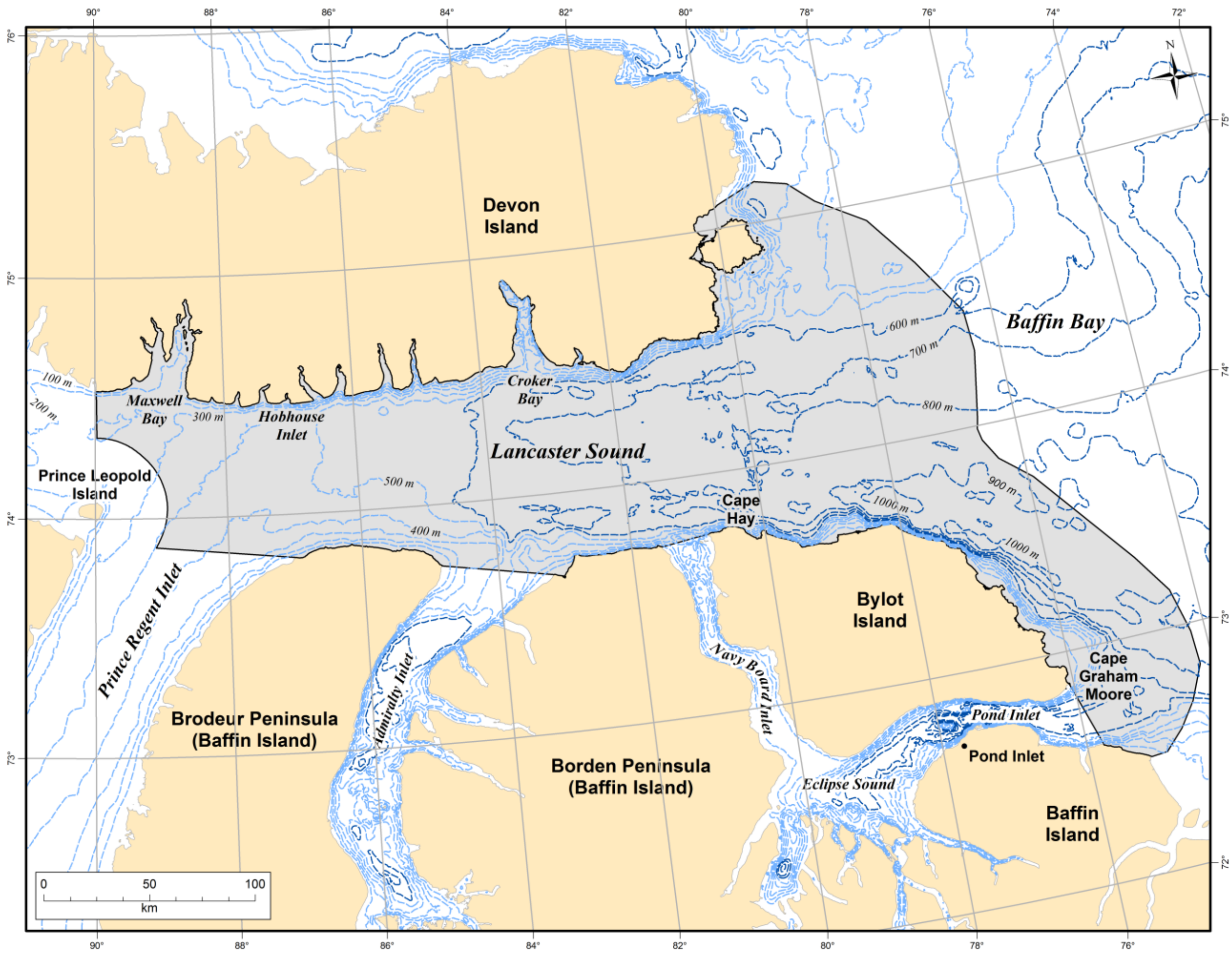

Figure 29. Lancaster Sound EBSA. Water depth contours within the EBSA are in 100 m increments.

Lancaster Sound is a deep wide channel, shallower in the west (300 m) and gradually deepening to 900–1000 m in the east. It is one of the main Arctic through-flow channels connecting Pacific Ocean and Arctic Ocean water to Baffin Bay. Flow is generally in a west-to-east direction, driven by sea surface height dynamics and large scale wind regimes in the Arctic Ocean and Baffin Bay (Wekerle et al. 2013). The Baffin Island Current can enter Lancaster Sound along the southeastern shore of Devon Island in an east to west flow direction, bringing relatively warm water into the eastern side of Lancaster Sound and occasionally carrying icebergs into the sound.

DFO (2014d) describes ice conditions in the EBSA. In fall, Lancaster freeze-up beginning around early October starting in the west. A prominent land-fast ice edge forms across the sound each winter. To the west the ice is stable and increases in thickness throughout the winter. New ice forms to the east and is carried toward Baffin Bay with prevailing winds and currents. Land-fast ice occurs within the archipelago and along coastlines, and mobile pack ice comprises the remaining ice cover. The pack ice can consist of first-year ice as well as multi-year ice that is advected into the area (Howell et al. 2008, Tivy et al. 2011).

Ice break-up commences in early June at the eastern entrance of Lancaster Sound although it may continue into early August in some years at the western end of the sound. As breakup progresses, within the EBSA there are four principal locations for the ice edge, which correspond to the locations of ice arches between the various headlands along the Channel (Peterson et al. 2008). Ice generally clears between the end of June and mid-August, however, ice may remain somewhat longer in deep bays such as Maxwell and Croker Bays. Freeze-up and break-up dates are highly variable.

The Lancaster Sound EBSA is highly productive. Within Lancaster Sound, tidal and bathymetric induced mixing of Pacific and Atlantic waters (Link et al. 2013) results in high primary production rates of 251 ± 203 mg $C{\cdot}m^{-2}{\cdot}d^{-1}$ (Ardyna et al. 2011) and an annual mean of about 60 g $C{\cdot}m^{-2}{\cdot}y^{-1}$ (Welch et al. 1997). Vertical export can be high supporting diverse/abundant benthos. Studies on benthic biomass and diversity report values that are among the highest known from the Canadian Arctic (Link et al. 2013).

This area has relatively high levels of organic enrichment (pigments, organic carbon) suggesting enhanced benthic production generally (Kenchington et al. 2011). Measurements of benthic remineralization processes here show higher recycling of exported organic matter than in all other regions of comparable depth in the Canadian Arctic with the exception of the North Water Polynya. Roy et al. (2014) found high macrofaunal density and diversity with higher biomass and diversity from east to west, and from deep to shallow, in the EBSA. The eastern end of the EBSA supports high benthic community biomass of filter feeders as a result of the strong currents (Roy et al. 2014).

Welch et al. (1992) identified that Arctic Cod play a major role in the Lancaster Sound ecosystem by concentrating small sized particles into large energy packets for efficient consumption by mammals and birds. Welch et al. (1992) estimated that about 148,000 t of Arctic Cod were consumed annually by the seabirds and mammals in the Lancaster Sound ecosystem.

Lancaster Sound is a major migration corridor for many marine species including the Eastern High Arctic-Baffin Bay beluga population, the Eastern Canada-West Greenland bowhead whale population and the Baffin Bay narwhal population. Harp seal can be found in Lancaster Sound (Finley et al. 1990). The Lancaster Sound population of polar bear resides year-round in Lancaster Sound (Schweinsburg et al. 1982) particularly along the southern coast of Devon Island. This area has the highest polar bear density in the Canadian Arctic (COSEWIC 2008b). Schweinsburg et al. (1982) indicated that maternity denning probably occurs sporadically along much of the coastal region.

Central and western Lancaster Sound has relatively high productivity and densities of ringed seal (Schweinsburg et al. 1982, Kinglsey et al. 1985). Atlantic walrus (Born et al. 1995; Stewart et al. 2013a) and bearded seal occur in the EBSA (Sergeant and Hay 1978).

The EBSA is known to support millions of breeding and non-breeding seabirds (Figures 15 and 16) that spend all or part of the summer in the area during periods of nesting, feeding and staging. Several major seabird colonies occur in the EBSA, notably at Cape Hay (Thick-billed Murre, Black-legged Kittiwake), Hobhouse Inlet (Northern Fulmar) and Cape Graham Moore (Black-legged Kittiwake, Thick-billed Murre). Eastern Lancaster Sound and the flaw lead that forms around Bylot Island are important areas for seabird staging and feeding. Bylot Island is a migratory bird sanctuary. Ivory Gull use the polynya and flaw-lead system on their migration to and from the breeding sites further north (Spencer et al. 2014). There are 1.6–2.4 million

Dovekie which migrate in spring to eastern Lancaster Sound where they stage and forage before continuing to their colonies in Greenland (Mallory and Fontaine 2004). The Lancaster Sound Polynya, Hape Hay and Hobouse Inlet, and a portion of the Eastern Devon Island Nunataks are Important Bird Areas in Canada within this EBSA.

EBSA criteria

Aggregation:

- Marine mammals from March to November
- Seabirds from May through September

Fitness Consequences:

- High productivity (at multiple trophic levels) and biological diversity
- Marine mammal migratory corridor
- Seabird nesting, feeding and staging

RESOLUTE PASSAGE EBSA

The Resolute Passage EBSA lies between the southwest coast of Cornwallis Island (near Resolute) and Griffith Island on the north side of Barrow Strait (Figure 30). The passage is generally around 150 m deep. The EBSA covers a marine area of 856 km^2.

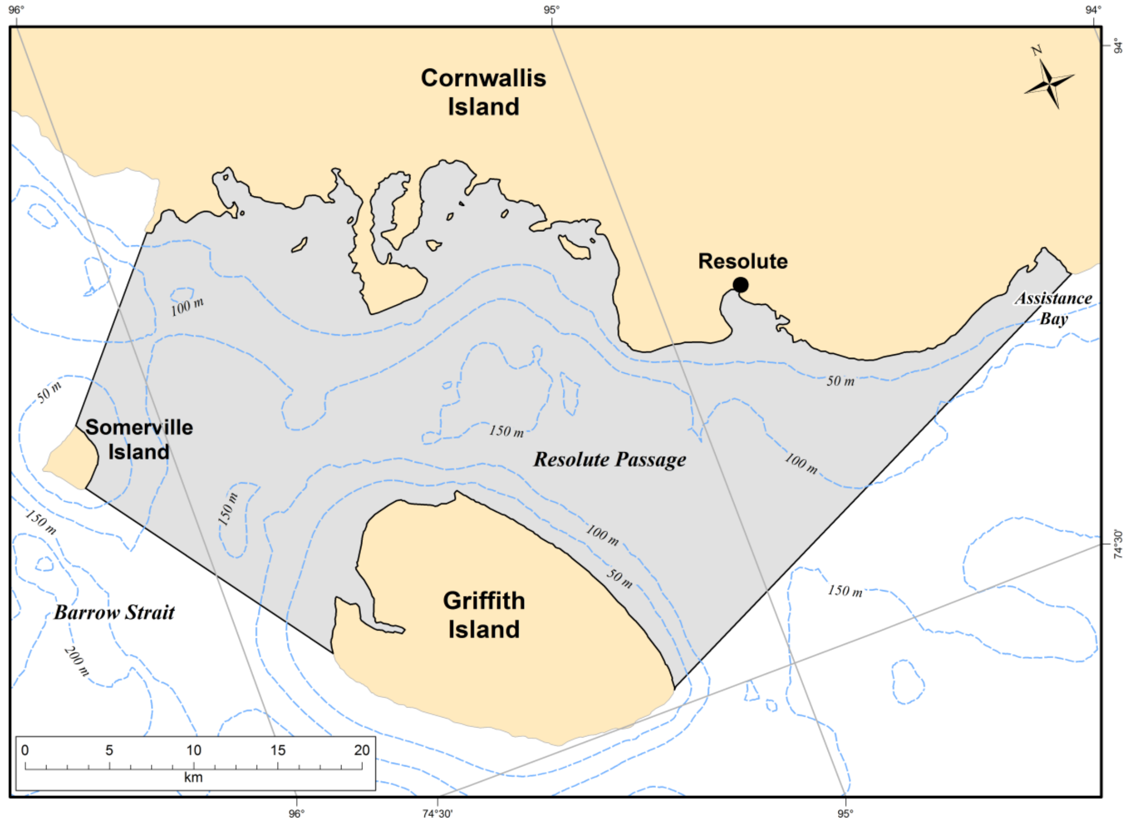

Figure 30. Resolute Passage EBSA. Water depth contours within the EBSA are in 50 m increments.

The ocean near Resolute supports above-average ice algal production (Welch and Bergmann 1989, Michel et al. 2003). The ice algae bloom, which occurs in late winter (March to May), contributes a significant fraction of the total primary production supporting a relatively high annual energy flow in the region, estimated at 120 g O_2 $m^{-2}\cdot y^{-1}$ (Welch and Kalff as cited by Welch and Bergmann 1989). The maximum biomass in Resolute Passage can vary annually, from about 40 to 360 mg Chl *a* m^{-2} (Welch and Bergmann 1989).

Sea ice algae is important for benthic consumers in this region of the Arctic Archipelago. On average, in Arctic seas, ice-algal production contributes only 3 %–30 % of the total annual primary productivity (Carmack et al. 2006). A sudden release of ice algae and a lack of pelagic uptake by grazers can encourage efficient delivery of particulate organic matter to the benthos. Highest ^{13}C enrichments in the benthos were observed in Resolute Passage/Barrow Strait (Roy et al. 2015) where maximal ice-algal biomass has been recorded (Cota et al. 1991).

EBSA criteria

Fitness Consequences:

- High ice algal biomass resulting in high benthic productivity from March to May

Additional considerations

Birds nesting in this EBSA (Figures 15 and 16) include Iceland Gull, Glaucous Gull and a small colony of Black-legged Kittiwake (Mallory and Fontaine 2004).

The diverse epontic community is important within this EBSA because of the high productivity. Pike and Welch (1990) describe this community. Ice algae taxonomy list for this EBSA provided in Riedel et al. 2003.

Ringed seal occur in this area.

CUNNINGHAM INLET EBSA

The Cunningham Inlet EBSA is a small inlet 3 km wide and 8 km in length on the north coast of Somerset Island opening into Barrow Strait (Figure 31). It is a shallow inlet with maximum depths of 20 m. The entrance to the inlet is approximately 300 m wide with drying flats on the west side with a depth of 0.6 m (DFO 2014d). The Cunningham River flows into the head of the inlet through a broad delta at the foot of a wide valley (DFO 2014d). The EBSA covers a marine area of 26 km^2.

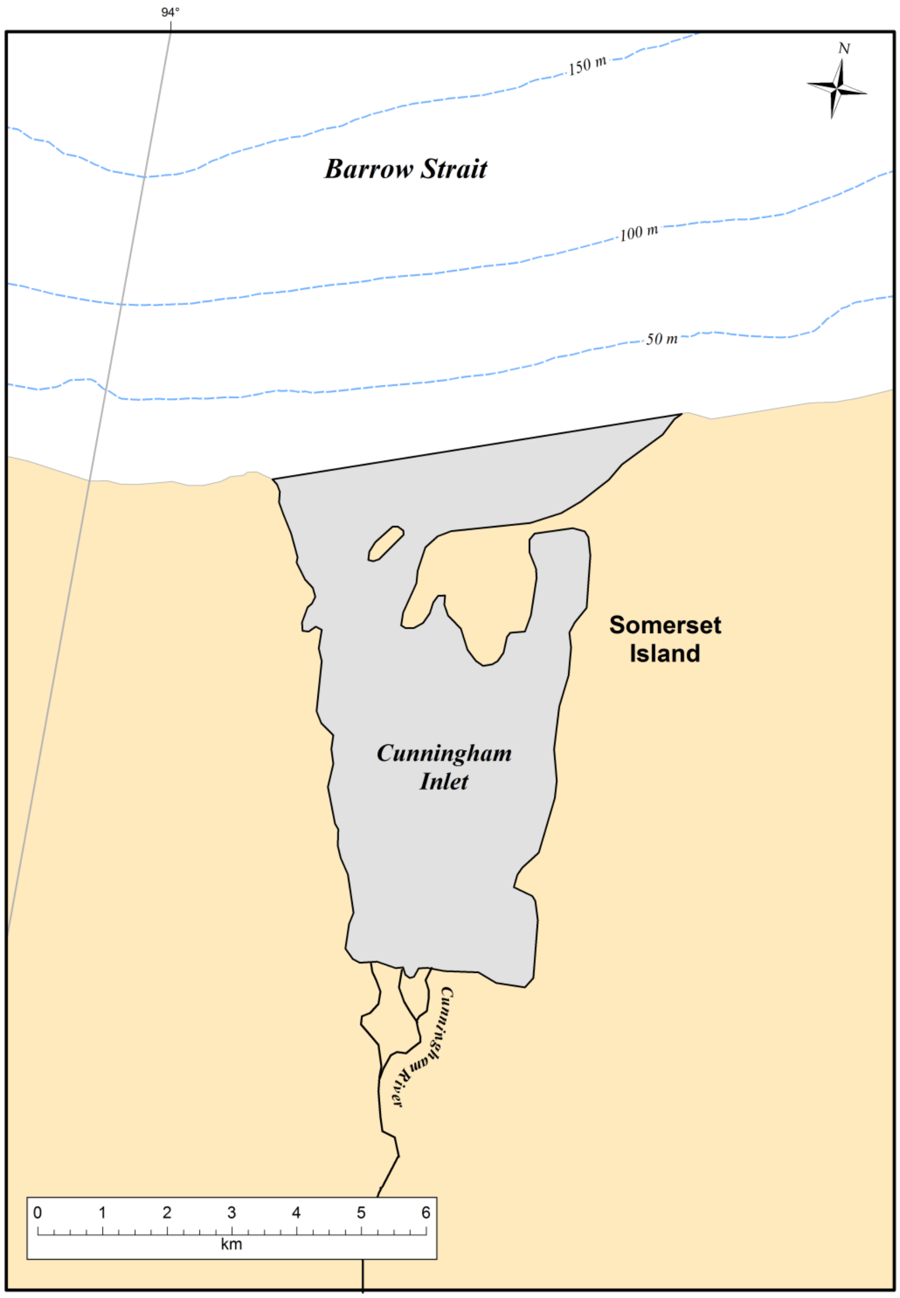

Figure 31. Cunningham Inlet EBSA. Water depth contours are in 50 m increments. Water depth in the EBSA is ≤ 20 m deep.

The Eastern High Arctic-Baffin Bay population of beluga summer in the coastal waters and shallow inlets and bays surrounding Somerset Island. Beluga begin arriving via Lancaster Sound upon ice break-up in roughly late June to early July and exit the area in late August (Smith and Martin 1994, Richard 2010). Seasonal movement patterns indicate well defined use of the estuaries around Somerset Island (Smith and Martin 1994).

Sergeant and Hay (1978) reported adults, immatures and newborn calves were present in Cunningham Inlet during the summer. They spend about four weeks in the inlet and are normally concentrated towards the river mouth. They observed about 1,000 beluga in the inlet. The whole group of beluga were observed to leave the inlet en masse and return sometime later.

It is believed that the narrow and shallow entrance to the Inlet may serve to protect young beluga from predators such as killer whales. Killer whales are known to prey on beluga and are observed in the region from August to October (Matthews et al. 2011). Beluga feed outside of the Inlet in Barrow Strait and other areas where food such as Arctic Cod are available.

An ecotourism site has been established in Cunningham Inlet since 1999.

EBSA criteria

Aggregation:

- Beluga from July and August

Fitness Consequences:

- Beluga summer refugia from predators

Additional considerations

Anadromous Arctic Char occur in the Cunningham River which flows into Cunningham Inlet (Sekerak and Graves 1975, Stewart and MacDonald 1981).

PRINCE LEOPOLD ISLAND EBSA

Prince Leopold Island EBSA includes Prince Leopold Island and the marine waters within 30 km radius around it. It is situated in south-western Lancaster Sound (Figure 32). Prince Leopold Island is a flat topped, oval-shaped island with steep cliffs. The surrounding water depth is 100 m deep within a kilometer of the island to 300 m deep mid-channel Lancaster Sound. The EBSA covers a marine area of 3,268 km^2.

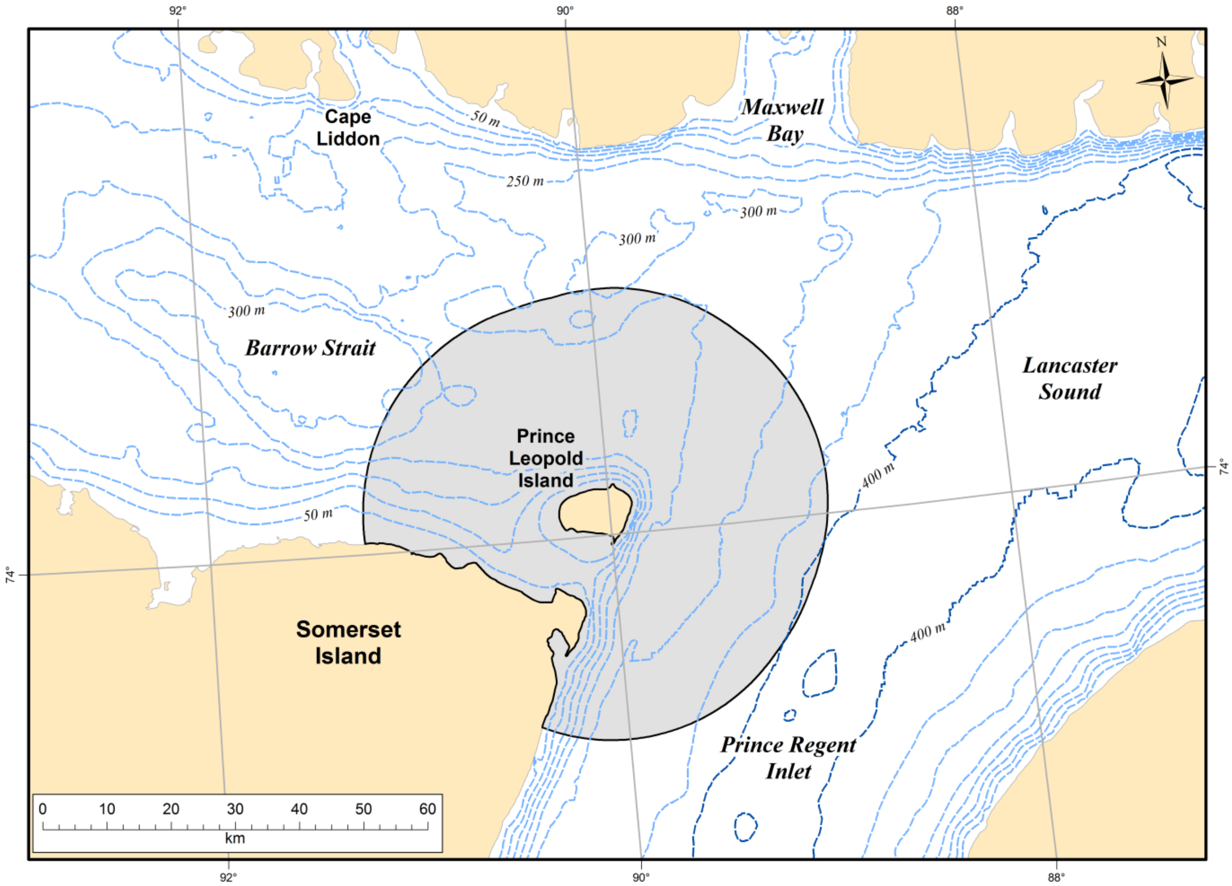

Figure 32. Prince Leopold Island EBSA. Water depth contours within the EBSA are in 50 m increments.

The Prince Leopold Island EBSA (Figure 32) corresponds to the key marine habitat for seabirds (Figures 15 and 16; Mallory and Fontaine 2004). The island is an Important Bird Area in Canada, the Prince Leopold migratory bird sanctuary, and a Key Migratory Bird Terrestrial Habitat site (Mallory and Fontaine 2004). Prince Leopold Island is the largest and may be the most important multi-species seabird breeding site in the Canadian Arctic (Mallory and Fontaine 2004, Latour et al. 2008, Gaston 2014). Unlike some of the other sedimentary rock of high Arctic seabird colonies, the rock at Prince Leopold Island fractures in flat slabs, creating ideal nesting sites (Latour et al. 2008). Marine seabirds breed on the cliffs or in rock stacks around the periphery of the island, with certain species preferring to aggregate on a particular side of the island (Gaston et al. 2005). The island itself and the marine ecosystem in the surrounding waters of Prince Leopold Island are critical for a variety of Arctic seabirds from May through to September (Mallory and Fontaine 2004). Significant concentrations of marine birds may be distributed throughout this region depending on the annual patterns of ice break-up and the distribution of prey (Gaston and Nettleship 1981).

Seven seabird species breed on the island including Common Eider, Northern Fulmar (11 % of the Canadian population), Black-legged Kittiwakes (16 % of the Canadian population), Glaucous Gull, Parasitic Jaeger, Thick-billed Murre (6 % of the Canadian population) and Black Guillemots (5 % of the Canadian population) (Mallory and Fontaine 2004). Birds feed to a large extent on Arctic Cod (Gaston et al. 2005) and marine invertebrates. Interface habitats (i.e., shorelines and ice edges) are key foraging areas that concentrate prey items (Bradstreet 1979, 1980).

The average duration of the open water period at the island is 4–5 months. Floating ice may occur in the vicinity at any time as ice in Parry Channel breaks up. A stable ice edge between consolidated pack ice and open water frequently persists at or near the island in June and early July (Smith and Rigby 1981).

Flaw leads open across Lancaster Sound; locations vary annually. The location of the final consolidated ice edge (ice-bridge) across Lancaster Sound is fairly consistent (> 50 % of years) roughly at Prince Leopold Island to Maxwell Bay (Welch et al. 1992, Gaston et al. 2005). This is the likely the most common location due to currents moving in and out of Prince Regent Inlet preventing ice from becoming landfast. The polynyas and early presence of open water (in May) as well as mixing due to the strong current interactions at this location (Peterson et al. 2008) are thought to create local enrichment.

EBSA criteria

Uniqueness:

- Largest multi-species aggregation of breeding seabirds in the Canadian Arctic

Aggregation:

- Seabirds from May to September

Fitness Consequences:

- Seabird breeding, nesting, rearing, foraging, staging

Additional considerations

Marine mammals including narwhal, bowhead and beluga pass by and through the EBSA during spring and fall migrations. Ringed seal and bearded seal are found in this area.

PENNY STRAIT EBSA

The Penny Strait EBSA (Figure 33) located between Bathurst Island and the Grinnell Peninsula of Devon Island. The EBSA includes Dundas Island. Penny Strait opens to Queens Channel to the south and southeast. The region has a complex seafloor that is relatively shallow with several shoals and islands. Water depths can reach 350 m. The EBSA covers a marine area of 3,961 km^2.

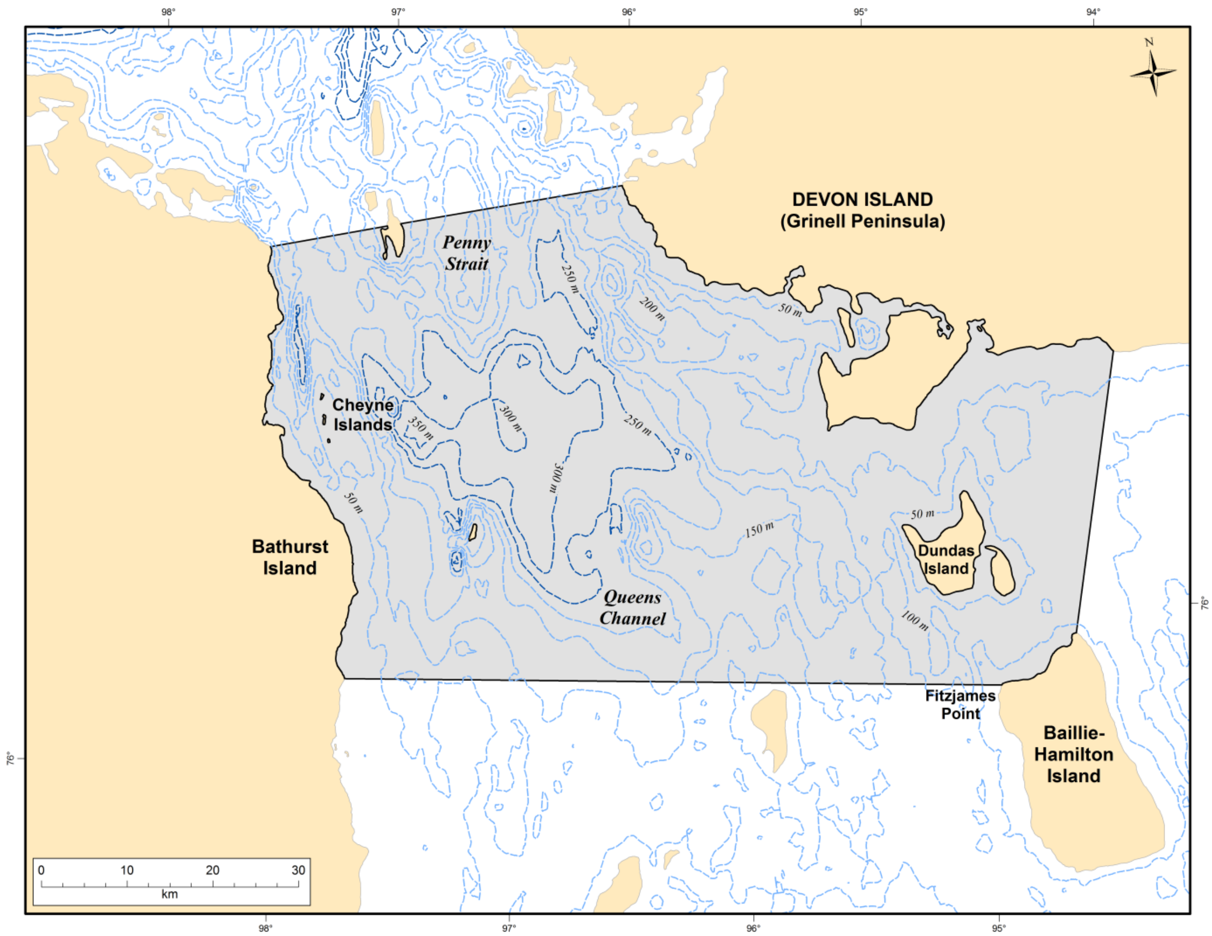

Figure 33. Penny Strait EBSA. Water depth contours within the EBSA are in 50 m increments.

Barber and Massom (2007) describe the polynya complex in the EBSA area. The Queens Channel-Penny Strait polynya forms near Dundas Island in Queens Channel due to shallow waters and strong tidal and wind driven currents. In January, a section of open water appears and is maintained through the winter months. The polynya's maximum extent occurs at the end of April with break-up in June. Several small polynyas also form along eastern Penny Strait and appear to occupy a constant annual location. As break-up in the strait progresses the separate polynyas fuse together. The Dundas Island polynya forms north of Dundas Island, as warm water is transported to the surface from tidal forcing. This polynya is associated with high degree of mixing down to 20 m.

The Cheyne Islands are Important Bird Areas in Canada (Figure 16) and support one of the largest known nesting populations of Ross's Gull in the Canadian Arctic, though the annual use of the site varies possibly due to variation in annual ice (Latour et al. 2008). The area is one of only a four known breeding sites for Ross's Gull in Canada (COSEWIC 2007b). Ross's Gull is listed as Threatened on Schedule I of the *Species at Risk Act*; the known Canadian breeding population ranges from 0 to 10 pairs per year (COSEWIC 2007b). Life history and general ecological information on Ross's Gull is limited (Maftei et al. 2012).

The polynyas in the area support primary and secondary production in adjacent waters.

EBSA criteria

Aggregation:

- Ross's Gull from late May to August

Fitness Consequences:

- Ross's Gull nesting and rearing
- Stimulation of increased primary and secondary production adjacent to the Dundas Island Polynya fast ice or pack ice areas

Additional considerations

The Penny Strait-Lancaster Sound Atlantic walrus stock is one of three stocks in the High Arctic population. In 2009, the Penny Strait-Lancaster Sound stock was estimated to have between 661 and 727 walrus (DFO 2013). Use of terrestrial haulouts is highly variable (Stewart et al. 2013a). Historic surveys of walrus in summer and winter confirm the importance of Penny Strait and Queens Channel to walrus (Kiliaan and Stirling 1978). During winter walrus aggregate in shallow areas with access to open water or in areas where they can maintain breathing holes. The small polynyas throughout this region provide suitable year-round habitat for walrus (Kiliaan and Stirling 1978).

Two other species of pinniped are found in the EBSA: ringed seal and bearded seal. Their distribution varies spatially and temporally relative to presence of preferred habitat (Kingsley et al. 1985, Cleator and Stirling 1990). Spring surveys indicate that ringed seals tend to be found more abundantly in areas of fast ice where cracks are present whereas bearded seals have a preference for broken or rotten ice and flows which tends to correlate with shallower water depths (<100 m).

Other seabirds including Common Eider, King Eider, Black-legged Kittiwake and Black Guillemot are known to nest and use the small polynyas and open leads that occur in this EBSA (Figure 15; Mallory and Fontaine 2004).

NORTH WATER POLYNYA EBSA

The North Water Polynya EBSA (Figure 34) boundaries are based on the general location of the recurrent North Water Polynya. It follows the coastline of Ellesmere Island and eastward to the Canadian Exclusive Economic Zone although the polynya extends eastward towards the Greenland coast. The EBSA extends northward to the limit of the Eastern Arctic Biogeographic Region although the polynya itself extends into the neighboring Arctic Archipelago Biogeographic Region. The EBSA covers a marine area of 19,145 km^2.

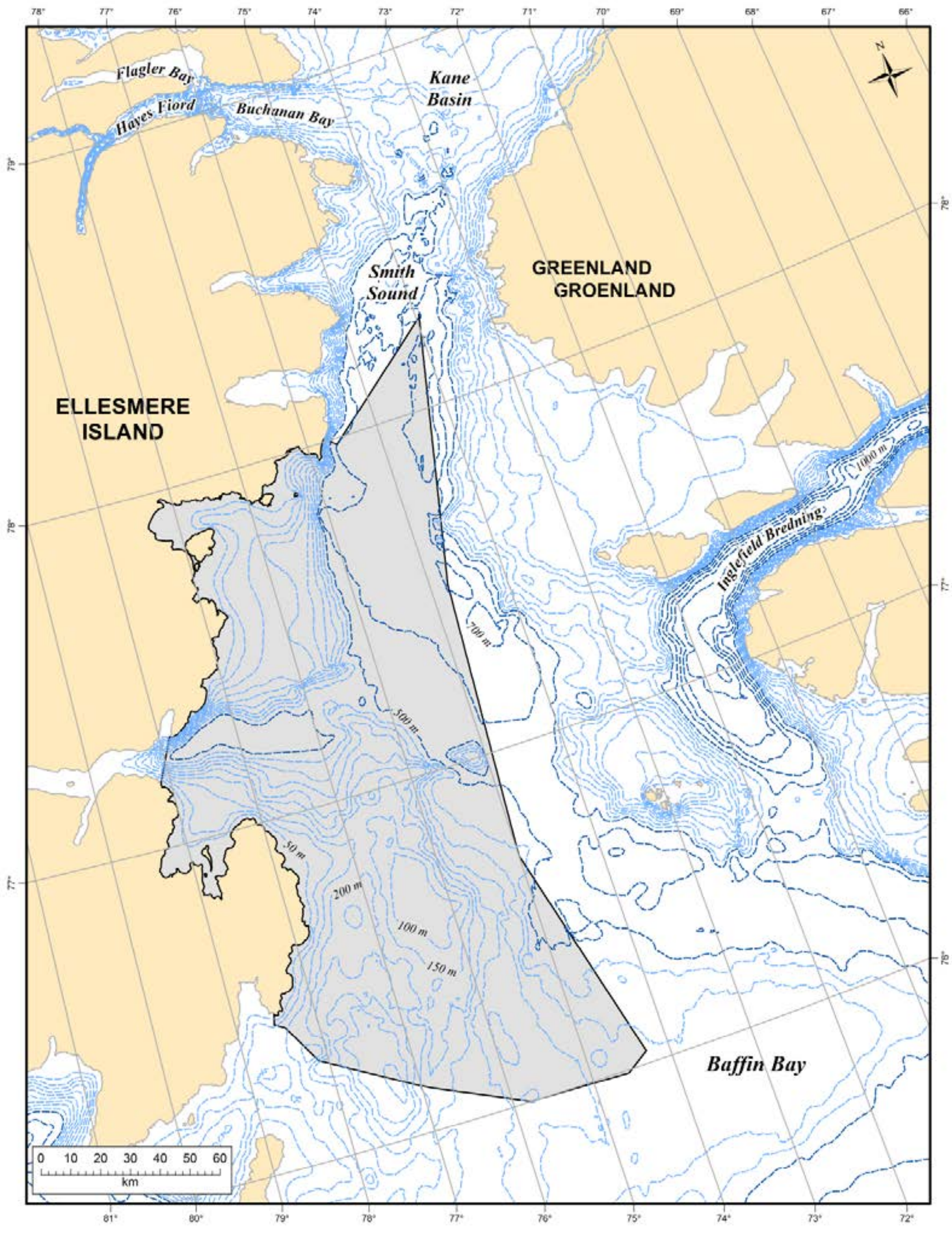

Figure 34. North Water Polynya EBSA. Water depth contours within the EBSA are in 50 m increments up to 500 m, after which they are in 100 m increments.

The polynya develops as an ice bridge forms the narrow channel of Nares Strait below Kane Basin (Dumont et al. 2009) during the winter which allows strong winds and currents to push ice southwards, maintaining a thin drifting ice cover, 50 % of which is < 30 cm in thickness. Relatively deep mixing and strong convection supplies heat on the western (Canadian) side of the polynya, which contributes to the persistence of the polynya by delaying ice formation and consequently speeding spring melt.

Finley and Renaud (1980) described the North Water Polynya area ice conditions. In late winter, the west, east and north margins of the North Water were sharply defined by landfast ice-edges along the periphery of the eastern Canadian Arctic Archipelago and Northwest Greenland, and across Smith Sound. The southern limits of the North Water were defined more diffusely by the heavy pack-ice of Baffin Bay. They indicated that the North Water Polynya is typically most restricted in area during March and begins to enlarge in early spring as the pack-ice in Baffin Bay drifts to the south. As spring progresses, the North Water Polynya extends south beginning in early May and joins with shore leads connected to other polynyas in June with variable amounts of ice-free water (Barber and Massom 2007).

The North Water Polynya is the largest polynya in the Canadian Arctic and has the largest per-unit area biological production of any waters in the Northern Hemisphere (Barber and Massom 2007). The physical mechanisms driving the creation of the polynya create conditions that support heightened and early spring bloom (Karnovsky et al. 2007). Primary production in the North Water Polynya is among the highest recorded in the Arctic Ocean (Carmack and Wassmann 2006). Productivity and abundance however are not uniform throughout the polynya, and both east to west and north to south gradients and spatially variable “hotspots” have been noted (Karnovsky et al. 2007, Holst et al. 2001). Cyr and Larouche (2015) found the entire polynya to be characterized by high satellite-derived Chl *a* concentrations (Figure 9).

An estimated 14 million birds migrate north in spring to the North Water Polynya staging along the lead systems en route to their breeding sites (Figures 15 and 16; Mallory and Fontaine 2004). Seabirds using the North Water Polynya include Dovekie, Thick-billed Murre, Black Guillemot, Black-legged Kittiwake, Ivory Gull, Glaucous Gull, and Northern Fulmar. The area is used for feeding and in some cases overwintering (e.g., Black Guillemot). There are colonies located near the North Water Polynya (e.g., Bylot Island, Coburg Island, Ellesmere and Devon islands). Seabirds are dependent on the early access to their breeding sites and subsequent availability of food.

The North Water Polynya EBSA area is used by Atlantic walrus, beluga, narwhal, bowhead whale, ringed seal and bearded seal throughout the year. Harp seal use the area during the open water season. Heide-Jørgensen et al. (2016) concluded that the North Water Polynya was an important wintering area for Atlantic walrus, beluga, narwhal and bearded seal based on their 2014 survey. Finley and Renaud (1980) had concluded that although marine mammals used the polynya during the winter, it was not a major overwintering area. Both conclusions may reflect differences between the western and eastern sides of the polynya or annual variability in use of the area.

Polar Bear rely on ringed seal in the fast ice adjacent to the polynya over the winter and spring. Stirling and Archibald (1977) suggested that polar bears tend to concentrate in areas of unstable ice where they can prey upon immature ringed seals. During the 1978 and 1979 survey of the North Water Polynya area, all polar bears were seen along the edge of the fast-ice, and most of these were along Southeast Ellesmere Island (Finley and Renaud 1980). More recent studies support these observations (Taylor et al. 2001). Heide-Jørgensen et al. (2013) found most polar bear were found in the southern part of the polynya in May 2009 and 2010.

Ringed seal remain on the eastern side of the polynya based on satellite tagging data which may be attributed to ice condition (Born et al. 2004). Maximum dive depths were over 500 m (Born et al. 2004). Non-adult ringed seal likely exploited ice-associated amphipods and young Arctic Cod, while adults fed on Arctic Cod and cephalopods taken at greater water depths (Born et al. 2004). Immature ringed seal fed primarily on *Themisto libellula* on the western side of the polynya and adults fed on Arctic Cod and Polar Cod (Holst et al. 2001). On the eastern side of the polynya, all ringed seal fed primarily on Arctic Cod (Holst et al. 2001). Finley and Renaud (1980) observed few ringed seal during their 1978 and 1979 surveys. Most were swimming in narrow leads along the fast-ice and several were hauled out on thin ice in Smith Sound in April. Some seal breathing holes were seen in thin ice. Kingsley (1998) estimated 6,200 ringed seal in the shelf-fast ice of the Kane Basin based on modelled ringed seal density versus habitat type. Heide-Jørgensen et al. (2013) found ringed seal in 2010 using the large ice flows in the south eastern part of the North Water Polynya to haul out. Less ice in 2009 hampered observations of ringed seal.

Finley and Renaud (1980) found bearded seal generally along the east coast of Ellesmere Island in areas where water depths exceeded 200 m and in some cases 500 m. These depths are much greater than those where bearded seals have been found previously in the Canadian Beaufort Sea (Stirling et al. 1977) and other areas in the Canadian Arctic (Kingsley et al. 1985). Heide-Jørgensen et al. (2013) found bearded seal in May 2010 using the large ice flows in the south eastern part of the North Water Polynya to haul out. They estimated about 2,400 bearded seal in the North Water Polynya. Heide-Jørgensen et al. (2016) estimated about 6,000 bearded seal in their April 2014 survey of the eastern portion of the North Water Polynya off West Greenland; most were hauled out on ice.

Atlantic walrus were found in the North Water Polynya during surveys in 1978, 1979, and 1993. In March of 1979 about 700 walrus were counted near Southeast Ellesmere Island along the edges of cracks and narrow leads in the pack-ice field close to the fast-ice edges (Finley and Renaud 1980). Most were found in an area where water depths ranged from 200 to over 500 m. Heide-Jørgensen et al. (2013) found Atlantic walrus over both shallow and deep (> 500 m) water with an estimated abundance of about 1,500 individuals in the North Water Polynya. Most terrestrial haul-out sites that are currently surveyed by DFO were found on the eastern coast of Ellesmere Island in several bays (e.g., Buchanen Bay, Flagler Bay, Hayes Fiord) north of the EBSA (Stewart et al. 2013b).

Heide-Jørgensen et al. (2013) found narwhal in water > 500 m depth, widely distributed on the eastern side of the North Water Polynya, with core distribution close to the southern entrance to Inglefield Bredning. Narwhal were also sighted on the Canadian side of the polynya. The two years of surveys estimated an average of about 7,700 narwhal. Narwhal summering in the North Water area and adjacent waters presumably winter further south in Baffin Bay. Timing of arrival into the North Water area is highly variable.

During the fall migration period, beluga summering the Arctic Archipelago, migrate along the southern coast of Devon Island turning northward towards Smith Sound (Richard et al. 2001). Aerial surveys of marine mammals in the North Water Polynya conducted in March–April 1978, March 1979, and March 1993 (Finley and Renaud 1980, Richard et al. 1998), confirm late winter presence of belugas in the North Water's flaw leads and polynya. Finley and Renaud (1980) estimated that about 500 belugas wintered in the western North Water in 1978 and 1979. Heide-Jørgensen et al. (2016) estimated about 2,300 beluga wintered in the eastern part of the North Water polynya in April 2014. Heide-Jørgensen et al. (2013) didn't detect any beluga north of 77° 20′ N and estimated an average of about 2,200 narwhal in the North Water Polynya. On the Canadian side of the survey area, beluga were seen mainly in narrow leads and cracks in winter surveys.

Bowhead whales were observed in the southern part of the North Water Polynya in 2010 which agrees with other observations of use during winter and spring (Heide-Jørgensen et al. 2013).

The surveys revealed an overall spring density of >1 marine mammal and about 600 seabirds per km^2 in the open water part of the North Water, which is considered very high in comparison with density of top predators in other high-latitude areas including other polynyas (Heide-Jørgensen et al. 2013).

Consistent with the timing of the arrival of top predators, the primary production in the North Water is initiated in April (Mei et al. 2002) and reaches the highest values on the eastern side of the polynya in May (Klein et al. 2002).

In addition to the physical mechanisms, the large numbers of marine mammals and millions of seabirds in the North Water Polynya region represent a potential source of nutrient cycling that could enhance primary productivity in spring (Heide-Jørgensen et al. 2013).

Any increased productivity may not be reflected in the yield of higher trophic levels; a large fraction of primary production is expected to sink to deep waters which would result in a relatively efficient biological CO_2 pump and benthic-pelagic coupling (Tremblay and Smith 2007).

The copepods (*Calanus sp.*), the amphipod (*Themisto libellula*) and Arctic Cod contribute to the transfer of energy to higher trophic-levels (Welch et al. 1992). Deibel and Daly (2007) list the species of zooplankton found in the North Water Polynya.

Tremblay et al. (2006) found that most of the primary production between April and July is ingested by pelagic consumers in the upper 50 m and as a result the supply of fresh production to the benthos is relatively low. Kenchington et al. (2011) found that sediment pigment and organic carbon contents are reasonably high throughout the North Water Polynya, suggesting they may support highly productive and rich benthic communities. Kenchington et al. (2011) also found that macrobenthic abundance was highest in the central region of the polynya and lowest on the east side where the highest sediment organic carbon and nitrogen concentrations were found. Benthic remineralization fluxes in the North Water Polynya are the highest reported from the Canadian Arctic (Kenchington et al. 2011). The polynya has a prolonged production season over which the benthos can receive and mineralize organic carbon (Kenchington et al. 2011).

EBSA criteria

Uniqueness:

- Largest and most productive polynya in the Canadian Arctic

Aggregation:

- Marine mammals from March to July
- Seabirds from April to September

Fitness Consequences:

- Seabird feeding and staging
- Marine mammal feeding
- High biological productivity
- High benthic diversity and production area

EASTERN JONES SOUND EBSA

The Eastern Jones Sound EBSA is the area surrounding Coburg Island at the mouth of Jones Sound between Ellesmere Island and Devon Island (Figure 35). It includes marine waters within 30 km of the island's coastline. The EBSA covers a marine area of 5,621 km^2.

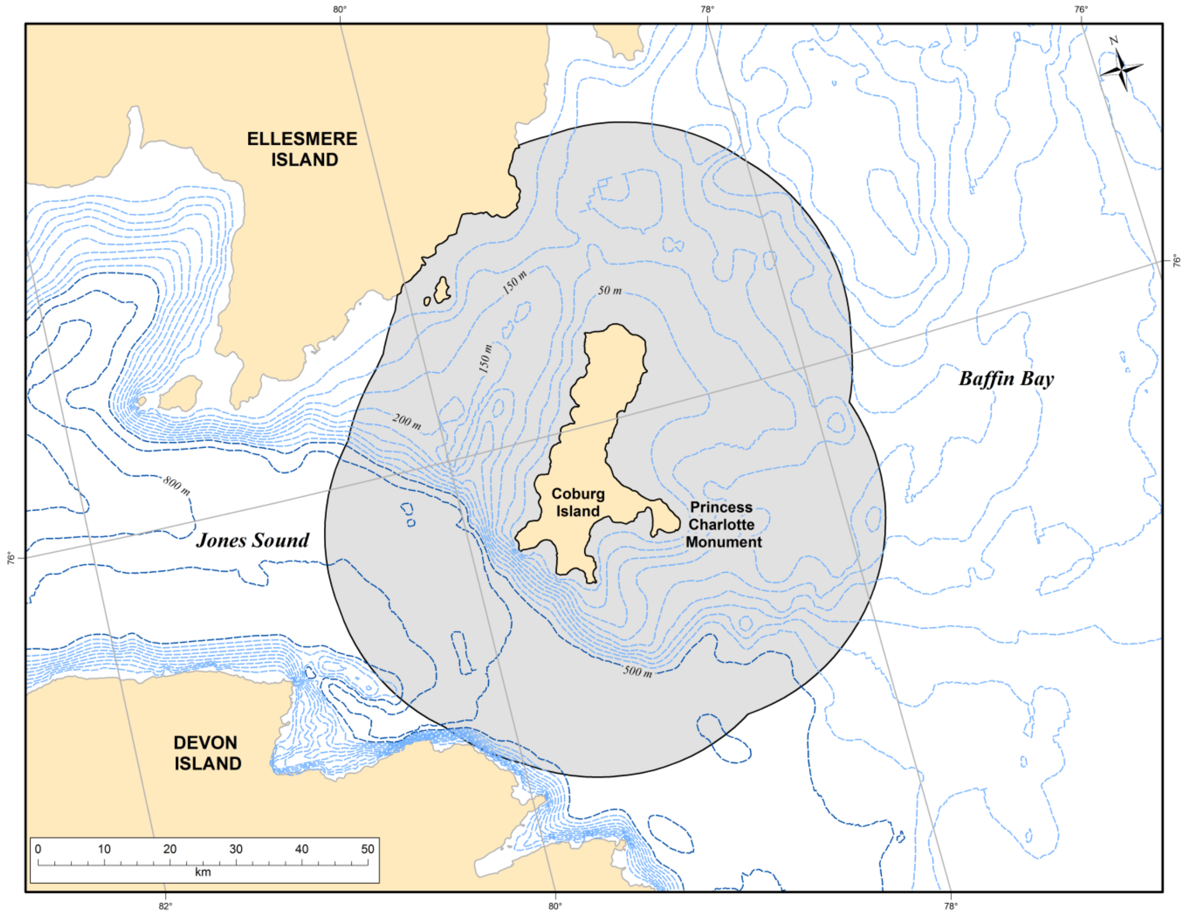

Figure 35. Eastern Jones Sound EBSA. Water depth contours within the EBSA are in 50 m increments up to 500 m, after which they are in 100 m increments.

The Eastern Jones Sound EBSA is the area surrounding Coburg Island at the mouth of Jones Sound between Ellesmere Island and Devon Island (Figure 35). It includes marine waters within 30 km of the Coburg Island coastline. The EBSA covers a marine area of 5,621 km^2.

Coburg Island is an Important Bird Area in Canada, is within the Nirjutiqavvik National Wildlife Area, established in 1995, which includes all the water within a 10 km radius of the island. It is identified as key marine habitat by the Canadian Wildlife Service (Figures 15 and 16; Mallory and Fontaine 2004).

Approximately 30,000 pairs of Black-legged Kittiwakes, representing 16 % of the Canadian population and the largest colony in Nunavut, were observed nesting at Coburg Island (Mallory and Fontaine 2004). The cliffs of Coburg Island also support 12 % (160,000 pairs) of Thick-billed Murre in Canada (Gaston and Hipfner 2000) and about 175 pair of Black Guillemot (Robards et al. 2000). About 250 pairs of Northern Fulmar breed on Princess Charlotte Monument (Gaston et al. 2006). Bird distribution varies based on ice-cover and food availability.

The area is used for breeding, nesting, feeding, staging and, for some individuals, overwintering (Latour et al. 2008).

EBSA criteria

Aggregation:

- Black-legged Kittiwake from late April to September
- Black Guillemot from March to early September
- Thick-billed Murre from late May to late-August

Fitness Consequences:

- Seabird nesting and foraging

Additional considerations

A recurrent area of open water occurs in the vicinity of Coburg Island, opening in January and remaining open typically for the duration of the winter, until it joins with the expanding North Water Polynya (Barber and Massom 2007).

Outside of the breeding season the area of Eastern Devon and Ellesmere Islands supports large numbers of foraging seabirds. Bays on the south end of Coburg Island are used by moulting eiders and long-tailed ducks and a few common eiders. Ivory Gull nest outside of the EBSA but likely use the marine waters within the EBSA for foraging. Atlantic Puffins may nest on Coburg Island, likely the only breeding site in Nunavut (Robards et al. 2000).

Atlantic Walrus from the High Arctic population (DFO 2013) are known to winter in several places around the North Water Polynya and there are haulout sites around Coburg Island (Born et al. 1995).

During the period of maximum ice cover, belugas overwintering in northern Baffin Bay appear to be restricted to isolated areas of open water along southeast Devon Island, in eastern Jones Sound, and in Smith Sound (Finley and Renaud 1980). Overwintering belugas are apparently most numerous in Jones Sound and along southeast Devon Island, which suggests that conditions for overwintering are more favourable or dependable here than in Smith Sound. The extensive formation of new ice that Finley and Renaud (1980) observed in March of 1978 and 1979 along the Smith Sound ice-edge may have precluded continuous occupation of this area by belugas during the winter.

CARDIGAN STRAIT/HELL GATE EBSA

The Cardigan Strait/Hell Gate EBSA includes Cardigan Strait and Hell Gate, the two narrow passages on either side of North Kent Island between Ellesmere Island to the north, and Devon Island to the south (Figure 36). Cardigan Strait and Hell Gate join Norwegian Bay and Jones Sound (Figure 35). The northern boundary of the EBSA coincides with the Arctic Archipelago Biogeographic Region boundary. Maximum depths within the EBSA are < 250 m within Cardigan Strait and Hell Gate (Figure 36). The EBSA covers a marine area of 3,847 km^2.

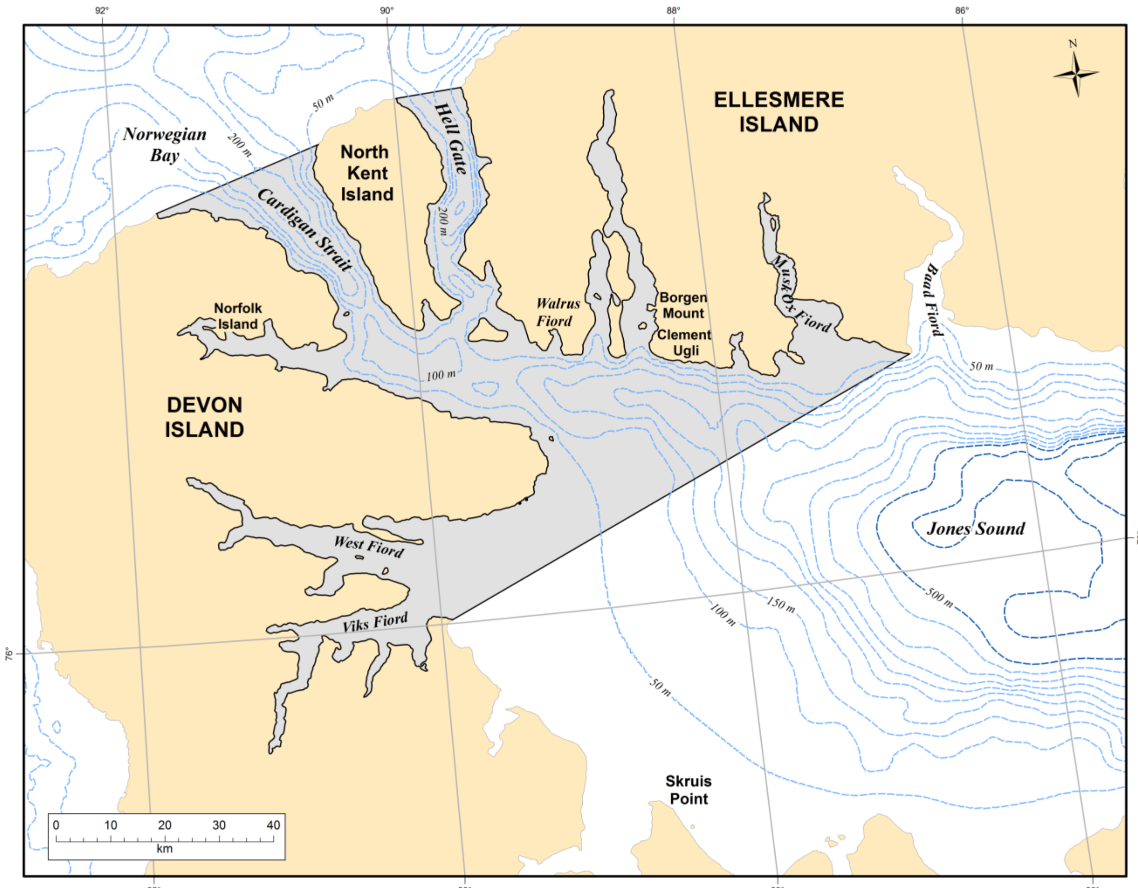

Figure 36. Cardigan Strait / Hell Gate EBSA Water depth contours within the EBSA are in 50 m increments up to 500 m, after which they are in 100 m increments.

A recurrent, tidally driven polynya, forms in Cardigan Strait and Hell Gate (Barber and Massom 2007). There are strong currents flowing from Norwegian Bay to Jones Sound through Cardigan Strait and Hell Gate. Freeze-up occurs in September (Figure 6), though ice in the area remains mobile throughout the winter. Small open water areas are typically present from early December until July (Barber and Massom 2007). Once ice breaks up in Norwegian Bay, advected ice flows south and often blocks Cardigan Strait or Hell Gate. As a result the area rarely becomes ice-free in the summer (Barber and Massom 2007).

The polynya allows the Western Jones Sound Atlantic walrus stock (Stewart 2008, Shafer et al. 2013) to remain in this area year-round (Born et al. 1995, Stewart and Hamilton 2013). DFO (2013) estimated a minimum of 503 walrus in the stock based on 2008 survey data. Atlantic walrus are widely distributed during the open-water season, and can be found at sea and/or hauled out on ice or land, sometimes in large numbers (Stewart et al. 2013a). Walrus distribution is thought to be influenced by the availability of haul-out sites and shallow water (< 100 m). Preference to shallow water is likely due to access and availability of their main prey, a bivalve (*Mya truncata*), which are found mainly in water depths between 10–100 m (Fay and Burns 1988), although walrus are capable of diving deeper (Fay and Burns 1988).

Based on aerial surveys in 1977, 1998–2009 eight terrestrial haulout sites were identified in the EBSA (Figure 36; Stewart 2008, Stewart et al. 2013a). The largest aggregations (> 90 walrus) in 2008 and 2009 were recorded at Clement Ugli and Norfolk Island (Stewart et al. 2013a). There is high variability in the use of haulout sites (Stewart et al. 2013a).

EBSA criteria

Aggregation:

- Western Jones Sound Atlantic Walrus stock year-round use

Fitness Consequences:

- Walrus feeding and overwintering

Additional considerations

The Cardigan Strait/Hell Gate polynya area is used by bearded seal, ringed seal, narwhal and polar bear. The polynya allows early access to feeding and nesting sites for seabirds in the area. Large variability in the use of this area by nesting marine birds may be due to ice.

Based on traditional knowledge, as well as reconnaissance surveys flown by DFO in 2012, it is apparent that there are large numbers of summering narwhals around Ellesmere Island that range over Jones Sound, Smith Sound, Norwegian Bay, and adjacent bays and fiords (Doniol-Valcroze et al. 2015). The 2013 survey estimated 12,694 narwhal in Jones Sound and the adjacent Norwegian Bay (DFO 2015b). Numerous sightings were made in Jones Sound fiords during the 2012 reconnaissance survey, whereas there were very few sightings in fiords in 2013 for this area (Doniol-Valcroze et al. 2015).

Three Important Bird Areas in Canada are located within and near the EBSA; North Kent Island, Cape Vera and Skruis Point. The Cardigan Strait, Hell Gate and Skruis Point are identified as key marine habitat (Figures 15 and 16; Mallory and Fontaine 2004).

Common Eider, Glaucous Gull, Iceland Gull and Arctic Tern all use the area to nest during summer. The most numerous seabirds are the Black Guillemot which occur in the EBSA year-round (Mallory and Fontaine 2004). The highest numbers are found between May and September at colonies on North Kent and Calf islands (Mallory and Fontaine 2004). Skruis Point may represent an important nesting colony (Mallory and Fontaine 2004). Use of the area is highly variable as a result of variability in sea ice (Latour et al. 2009).

Gaston et al. (2012) identified a major seabird colony of Northern Fulmar within this EBSA. About 3 % of the Canadian population of Northern Fulmar nest at Cape Vera between May and October (Mallory and Fontaine 2004, Gaston et al. 2006).

CONCLUSIONS

EBSAs are determined and evaluated based on available knowledge at the time of assessment. New studies will continually improve the knowledge of the ecological and biological significance of the features within the region. In addition to this, the Arctic is changing at an alarming rate. Recent analyses of sea ice conditions demonstrate significant declines in multi-year ice and a redistribution of ice type in the Arctic (Steiner et al. 2013, Meier et al. 2014). The loss of ice in the Arctic will, for example, have an impact on species distribution ranges, including non-indigenous species, changes in trophic interactions, and consequently the overall ecosystem structure and function (e.g., Hollowed et al. 2013).

Potential changes to the Arctic ecosystem have not been considered in this assessment. It is recommended, therefore, that EBSAs undergo periodic re-assessments in light of new knowledge and the rapid changes that are predicted to occur in the region.

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APPENDIX 1. MARINE FISHES AND INVERTEBRATES

Table A1-1. Marine fish families reported from 1979 to 2009 in the Davis Strait commercial bottom trawl shrimp fishery observer data (Siferd 2010) and from 2004 to 2016 DFO multi-species bottom trawl surveys in Baffin Bay and Davis Strait (≤ 1,000 m water depth). The shrimp fishery generally operates in water depths < 500 m.

Scientific name	Common name
Acipenseridae	sturgeons
Agonidae†	poachers
Alepisauridae	lancetfishes
Alepocephalidae†	slickheads
Alopiidae	thresher sharks
Ammodytidae	sand lances
Anarhichadidae†	wolffishes
Anguillidae	freshwater eels
Anoplogastridae†	fangtooths
Apogonidae	cardinalfishes
Argentinidae†	argentines
Bathylagidae†	deep-sea smelts
Bothidae	lefteye flounders
Ceratiidae†	seadevils
Cetorhinidae	basking sharks
Chiasmodontidae †	snaketooth fishes
Chlorophthalmidae	greeneyes
Clupeidae†	herrings
Congridae	conger eels
Cottidae†	sculpins
Cyclopteridae†	lumpfishes
Dactylopteridae	flying gurnards
Dalatiidae	kitefin sharks
Derichthyidae	longneck eels
Diretmidae	spinyfins
Etmopteridae†	lantern sharks
Eurypharyngidae‡	gulpers
Gadidae†	cods
Gasterosteidae	sticklebacks
Gempylidae	snake mackerels
Gigantactinidae‡	whipnose anglers
Gonostomatidae†	bristlemouths
Himantolophidae	footballfishes
Howellidae	oceanic basslets
Lamnidae	mackerel sharks
Linophrynidae	leftvents
Liparidae†	snailfishes
Lophiidae	goosefishes
Lotidae‡	rocklings
Macrouridae†	grenadiers
Malacanthidae	tilefishes
Merlucciidae	merlucciid hakes

Scientific name	Common name
Monacanthidae	filefishes
Moridae†	codlings
Myctophidae†	lanternfishes
Myxinidae†	hagfishes
Nemichthyidae	snipe eels
Notacanthidae†	deep-sea spiny eels
Notosudidae‡	waryfishes
Odontaspididae	sand tigers
Ophichthidae	snake eels
Oneirodidae‡	dreamers
Osmeridae†	smelts
Paralepididae†	barracudinas
Paralichthyidae	sand flounders
Pentanchidae‡	shark
Petromyzontidae	northern lampreys
Pholidae	gunnels
Phycidae†	phycid hakes
Platytroctidae‡	tubeshoulders
Pleuronectidae†	righteye flounders
Polymixiidae	beardfishes
Psychrolutidae†	fathead sculpins
Rajidae†	skates
Rhinochimaeridae	longnose chimaeras
Salmonidae	trouts and salmons
Scomberesocidae	sauries
Scombridae	mackerels
Scophthalmidae	turbots
Scorpaenidae	scorpionfishes
Sebastidae‡	rockfish, ocean perch
Serrivomeridae†	sawtooth eels
Somniosidae†	sleeper sharks
Squalidae	dogfish sharks
Sternoptychidae	marine hatchetfishes
Stichaeidae†	pricklebacks
Stomiidae†	dragonfishes
Synaphobranchidae†	cutthroat eels
Synodontidae	lizardfishes
Tetradontidae	puffers
Trachichthyidae	roughies
Trichiuridae	cutlassfishes
Triglidae	searobins
Xiphiidae	swordfishes
Zoarcidae†	eelpouts

†identified from the fishery and multi-species survey
‡identified only from the multi-species survey

Table A1-2. Marine invertebrate families from the DFO multi-species bottom trawl surveys in Baffin Bay and Davis Strait from 2004 to 2016 (≤ 1,000 m water depth). Invertebrates were identified to the lowest taxonomic level possible.

Scientific name	Common name
Acanthephyridae	shrimp
Acanthogorgiidae	coral
Acarnidae	sponge
Aegidae	isopod
Alcyoniidae	coral
Ampeliscidae	amphipod
Ancorinidae	sponge
Antedonidae	crinoid
Anthoptilidae	sea pen
Arcidae	bivalve
Arcturidae	isopod
Aristeidae	shrimp
Asteriidae	sea star
Astropectinidae	sea star
Axinellidae	sponge
Bathypolypodidae	octopus
Benthesicymidae	shrimp
Benthopectinidae	sea star
Biemnidae	sponge
Brisingidae	sea star
Buccinidae	gastropod
Bythocarididae	shrimp
Calliopiidae	amphipod
Chaetiliidae	isopod
Chalinidae	sponge
Cirroteuthidae	octopus
Cladorhizidae	sponge
Clionaidae	sponge
Coelosphaeridae	sponge
Crangonidae	shrimp
Crellidae	sponge
Ctenodiscidae	sea star
Cucumariidae	sea cucumber
Dendoricellidae	sponge
Desmacellidae	sponge
Dexaminidae	amphipod
Didemnidae	sessile tunicate
Echinarachniidae	sand dollar

Scientific name	Common name
Echinasteridae	sea star
Echinidae	sea urchin
Elpidiidae	sea cucumber
Epimeriidae	amphipod
Euphausiidae	euphausid
Euphausiidae	euphausid
Euplectellidae	sponge
Euretidae	sponge
Eurytheneidae	amphipod
Eusiridae	amphipod
Flabellidae	coral
Gammaridae	amphipod
Geodiidae	sponge
Gnathophausiidae	mysid
Gonatidae	squid
Goniasteridae	sea star
Gorgonocephalidae	basket star
Halipteridae	sea pen
Hamacanthidae	sponge
Hyperiidae	amphipod
Iotrochotidae	sponge
Isididae	coral
Lithodidae	spiny crab
Megaleledonidae	octopus
Microcionidae	sponge
Molpadiidae	sea cucumber
Munididae	malacostracan
Munidopsidae	malacostracan
Mycalidae	sponge
Mysidae	mysid
Nephtheidae	soft coral
Octopodidae	octopus
Oedicerotidae	amphipod
Ophiacanthidae	brittle star
Ophiactidae	brittle star
Ophiuridae	brittle star
Paguridae	hermit crab
Pandalidae	shrimp
Paragorgiidae	coral
Pasiphaeidae	shrimp

Scientific name	Common name
Pectinidae	bivalve
Pennatulidae	sea pen
Phormosomatidae	sea urchin
Plexauridae	black coral
Poeciliidae	priapulid
Polychelidae	malacostracan
Polymastiidae	sponge
Polynoidae	polychaete
Poraniidae	sea star
Primnoidae	coral
Psolidae	sea cucumber
Psychropotidae	sea cucumber
Pterasteridae	sea star
Pyuridae	sessile tunicate
Rossellidae	sponge
Schizasteridae	echinoid
Schizopathidae	coral
Sepiolidae	squid
Sergestidae	shrimp
Sipunculidae	sipunculid
Solasteridae	sea star
Stegocephalidae	amphipod
Strongylocentrotidae	sea urchin
Stylocordylidae	sponge
Suberitidae	sponge
Tedaniidae	sponge
Tethyidae	sponge
Tetillidae	sponge
Theneidae	sponge
Thoridae	shrimp
Umbellulidae	sea pen
Uristidae	amphipod
Velutinidae	gastropod

APPENDIX 2. GEO-REFERENCED INFORMATION

Table A2. Geo-referenced figures that were considered during discussion of ecologically and biologically significant areas (EBSAs) in the Eastern Arctic Biogeographic Region.

Clearwater Fiord

Figure number and description	Species or Feature	Sample Size	Type of Data	Type of Analysis	Survey/Study Location	Period of Study
Fixed-kernel range estimates for Cumberland Sound Beluga distribution in July (Figure 8), August (Figure 9) and September (Figure 10; Richard and Stewart 2009).	Beluga	14	Tags	Kernel Density Analysis	Cumberland Sound	1998–1999, 2006–2007

Eastern Cumberland Sound

Figure number and description	Species or Feature	Sample Size	Type of Data	Type of Analysis	Survey/Study Location	Period of Study
Fixed-kernel range estimates for Cumberland Sound Beluga distribution in February (Figure 15; Richard and Stewart 2009).	Beluga	3	Tags	Kernel Density Analysis	Cumberland Sound	1998–1999, 2006-2007
Temporal concentration (summer) and seasonal distribution of satellite-linked telemetry results for bowhead whales tagged in Canada and west Greenland (Figure 6; Dueck et al. 2006, Figure 1; DFO 2009b).	Bowhead	14	Tags	Seasonal Distribution	Northern Foxe Basin and Cumberland Sound	2001–2005
Temporal concentration (winter) of satellite-linked telemetry results for bowhead whales tagged in Cumberland Sound (Figure 6; Dueck and Ferguson 2009).	Bowhead	6	Tags	Kernel Density Analysis	Cumberland Sound	2004–2006

Cape Searle

Figure number and description	Species or Feature	Sample Size	Type of Data	Type of Analysis	Survey/Study Location	Period of Study
Boundary of the key marine habitat site for migratory birds at Cape Searle (Qaqulluit) and Reid Bay (Akpait) from Mallory and Fontaine (2004) (see page 54).	Key Marine Habitat Site	n/a	Seabird Colony and Foraging Range	Colony location and foraging range	Canadian Arctic	1952–2004

Isabella Bay

Figure number and description	Species or Feature	Sample Size	Type of Data	Type of Analysis	Survey/Study Location	Period of Study
Illustrative map of the boundaries for the Ninginganiq National Wildlife Area.	National Wildlife Area	n/a	Designated Protected Area	n/a	Baffin Bay	n/a

Scott Inlet

Figure number and description	Species or Feature	Sample Size	Type of Data	Type of Analysis	Survey/Study Location	Period of Study
Regional map of Scott Inlet oil seep (Figure 1; Brent et al. 2013).	Petroleum indications	n/a	Locations from survey	Survey	Eastern Arctic	2003, 2010, 2011

Eclipse Sound

Figure number and description	Species or Feature	Sample Size	Type of Data	Type of Analysis	Survey/Study Location	Period of Study
Summer aggregation areas of Nunavut narwhals (Figure 2; Richard 2010).	Narwhal	n/a	Summering stock areas	Stock Delineation	Eastern Arctic	1988–current

Figure number and description	Species or Feature	Sample Size	Type of Data	Type of Analysis	Survey/Study Location	Period of Study
Narwhal aerial survey sightings and group sizes for narwhal in August 2002 (Figure 1; Richard et al. 2010).	**Narwhal**	**155**	**Aerial Survey**	**Sightings and group sizes**	**Eclipse Sound, Admiralty Inlet, Prince Regent Inlet, Gulf of Boothia**	**August 2002**
Narwhal aerial survey sightings and group sizes for narwhal in August 2004 (Figure 3; Richard et al. 2010).	Narwhal	227	Aerial Survey	Sightings and group sizes	Eclipse Sound, Admiralty Inlet, Barrow Strait	August 2004
Map of the seasonal location of satellite tagged narwhal (Figure 1; Laidre et al. 2004a).	Narwhal	26	Tags	Summarized tag locations	Eastern Arctic	1993–2000
Movement paths of narwhal obtained from satellite tracking studies (Figure 1; Laidre et al. 2004b).	Narwhal	20	Tags	Track Lines	Eastern Arctic	1993–2000
Movements of an adult male narwhal (Figure 3; Dietz et al. 2001).	Narwhal	1	Tags	Track Lines	Eclipse Sound	August and September 1997
Movements of an adult female and three adult male narwhal (Figure 4; Dietz et al. 2001).	Narwhal	4	Tags	Track Lines	Eclipse Sound	August and September 1998
Autumn movements of three adult narwhal males tracked from Eclipse Sound and two male narwhals tracked from Melville Bay in West Greenland (Figure 6; Dietz et al. 2001).	Narwhal	4	Tags	Track Lines	Baffin Bay	1997–1998
Tracklines and kernel home range polygons (by stock) for narwhals (Figure 4; Dietz et al. 2008).	Narwhal	13	Tags	Track Lines	Eastern Arctic	2003–2004

Figure number and description	Species or Feature	Sample Size	Type of Data	Type of Analysis	Survey/Study Location	Period of Study
Track lines from five narwhal tagged in 2010 in Eclipse Sound (Figure 3; Watt et al. 2012).	Narwhal	5	Tags	Track Lines	Eastern Arctic	2010
Track lines from seven narwhal tagged in 2011 in Eclipse Sound (Figure 4; Watt et al. 2012).	Narwhal	7	Tags	Track Lines	Eastern Arctic	2011
Tracklines from twelve whales tagged in 2010 and 2011 in Eclipse Sound divided by season (Figure 5; Watt et al. 2012).	Narwhal	12	Tags	Track Lines	Eastern Arctic	2010–2011

Admiralty Inlet

Figure number and description	Species or Feature	Sample Size	Type of Data	Type of Analysis	Survey/Study Location	Period of Study
Summer aggregation areas of Nunavut narwhal (Figure 2; Richard 2010).	Narwhal	n/a	Summering stock areas	Stock Delineation	Eastern Arctic	1988–current
Narwhal aerial survey sightings and group sizes for narwhal in August 2003 (Figure 2; Richard et al. 2010).	Narwhal	8 plus ~500	Aerial Survey	Sightings and group sizes	Admiralty Inlet	August 2003
Map of the seasonal location of satellite tagged narwhal (Figure 1; Laidre et al. 2004a).	Narwhal	26	Tags	Summarized tag locations	Eastern Arctic	1993–2000
Tracklines from 13 narwhals tagged in August 2003 in Admiralty Inlet (Figure 1a), and eight narwhals tagged in Admiralty Inlet in 2004 (Figure 1b; Dietz et al. 2008).	Narwhal	13/8	Tags	Track Lines	Eastern Arctic	2003–2004

Figure number and description	Species or Feature	Sample Size	Type of Data	Type of Analysis	Survey/Study Location	Period of Study
Tracklines and 95 % kernel home range polygons calculated for 21 narwhals tagged in August 2003 and 2004 in Admiralty Inlet (Figure 2a) and tracklines for 15 narwhals that were tracked to their wintering grounds in 2003 and 2004 (Figure 2b; Dietz et al. 2008).	Narwhal	13/8	Tags	Track Lines and Kernel Density Analysis	Eastern Arctic	2003–2004
Tracklines and kernel home range polygons (by stock) for narwhals (Figure 4; Dietz et al. 2008).	Narwhal	n/a	Tags	Track Lines and Kernel Density Analysis	Eastern Arctic	1995, 2001, 2002–2003
Track lines from seven narwhal tagged in 2009 in Admiralty Inlet (Figure 1) and divided by season (Figure 2; Watt et al. 2012).	Narwhal	7	Tags	Track Lines	Eastern Arctic	2009
Boundary of the key marine habitat site for migratory birds at Baillarge Bay from Mallory and Fontaine (2004) (see page 40).	EC Key Marine Habitat Site	n/a	Seabird Colony and Foraging Range	Key colony location and foraging range	Canadian Arctic	1952–2004

Prince Regent Inlet

Figure number and description	Species or Feature	Sample Size	Type of Data	Type of Analysis	Survey/Study Location	Period of Study
Sightings of narwhals made by observers with regions (Figure 6; Innes et al. 2002).	Narwhal	40	Aerial Survey	Sightings and group sizes	Arctic Archipelago	August 1997
Summer aggregation areas of Nunavut narwhals (Figure 2; Richard 2010).	Narwhal	n/a	Summering stock areas	Stock Delineation	Eastern Arctic	1988–current

Figure number and description	Species or Feature	Sample Size	Type of Data	Type of Analysis	Survey/Study Location	Period of Study
Narwhal aerial survey sightings and group sizes for narwhal in August 2002 (Figure 1; Richard et al. 2010).	Narwhal	94	Aerial Survey	Sightings and group sizes	Prince Regent Inlet	August 2002
Map of the seasonal location of satellite tagged narwhal (Figure 1; Laidre et al. 2004a).	Narwhal	26	Tags	Summarized tag locations	Eastern Arctic	1993–2000
Tracklines and kernel home range polygons for narwhals tagged in 2003 and 2004 in Admiralty Inlet (Figure 4; Dietz et al. 2008).	Narwhal	n/a	Tags	Track Lines and Kernel Density Analysis	Eastern Arctic	1995, 2001, 2002–2003
Temporal concentrations of satellite-linked telemetry results for bowhead whales tagged in northern Foxe Basin and Cumberland Sound (Figure 5; Dueck and Ferguson 2009).	Bowhead	14	Tags	Kernel Density Analysis	Eastern Arctic	2002–2006
Temporal concentration (summer) of satellite-linked telemetry results for bowhead whales tagged in northern Foxe Basin and in Cumberland Sound (Figure 8; Dueck and Ferguson 2009).	Bowhead	14	Tags	Kernel Density Analysis	Eastern Arctic	2002–2006

Creswell Bay

Figure number and description	Species or Feature	Sample Size	Type of Data	Type of Analysis	Survey/Study Location	Period of Study
Summer aggregation areas of Nunavut belugas (Figure 1; Richard 2010).	Beluga	n/a	Summering stock areas	Stock Delineation	Eastern Arctic	1969–current
Distribution of belugas at Creswell Bay, Somerset Island, during high and low tides in July (Figure 8; Koski et al. 2002).	Beluga	3094	Aerial Survey	Distribution	Creswell Bay	July 27, 1975

Bellot Strait

Figure number and description	Species or Feature	Sample Size	Type of Data	Type of Analysis	Survey/Study Location	Period of Study
Area use and tracklines of 14 narwhals tagged in Creswell Bay in August (Figure 2; Heide-Jørgensen et. al. 2003b)	Narwhal	14	Tags	Track Lines and Kernel Density Analysis	Eastern Arctic	2000–2001
Movement of male beluga in summer in Bellot Strait (Figure 2; Richard et al. 2001)	Beluga	1	Tags	Track Lines	Bellot Strait	July and August 1996
Movement of female beluga in summer in Bellot Strait (Figure 3; Richard et al. 2001).	Beluga	2	Tags	Track Lines	Bellot Strait	July and August 1996

Gulf of Boothia

Figure number and description	Species or Feature	Sample Size	Type of Data	Type of Analysis	Survey/Study Location	Period of Study
Temporal concentrations of satellite-linked telemetry results for bowhead whales tagged in northern Foxe Basin and Cumberland Sound (Figure 5; Dueck and Ferguson 2009).	Bowhead	14	Tags	Kernel Density Analysis	Eastern Arctic	2002–2006
Temporal concentration (summer) of satellite-linked telemetry results for bowhead whales tagged in northern Foxe Basin and in Cumberland Sound (Figure 8; Dueck and Ferguson 2009).	Bowhead	14	Tags	Kernel Density Analysis	Eastern Arctic	2002–2006
General and individual bowhead whale movements for the Eastern Canada-West Greenland population (Figure 1; Ferguson et al 2010).	Bowhead	27	Tags	Track Lines	Eastern Arctic	2002–2006

Figure number and description	Species or Feature	Sample Size	Type of Data	Type of Analysis	Survey/Study Location	Period of Study
Summer and winter bowhead whale utilization distribution compared to 30 yr (1971 to 2000) median ice concentrations (Figure 5; Ferguson et al. 2010).	Bowhead	27	Tags	Kernel Density Analysis	Eastern Arctic	2002–2006
Summer aggregation areas of Nunavut narwhals (Figure 2; Richard 2010).	Narwhal	n/a	Summering stock areas	Stock Delineation	Eastern Arctic	1988–current
Narwhal aerial survey sightings and group sizes for narwhal in August 2002 (Figure 1; Richard et al. 2010).	Narwhal	10	Aerial Survey	Sightings and group sizes	Gulf of Boothia	August 2002

Peel Sound

Figure number and description	Species or Feature	Sample Size	Type of Data	Type of Analysis	Survey/Study Location	Period of Study
Summer aggregation areas of Nunavut narwhals (Figure 2; Richard 2010).	Narwhal	n/a	Summering stock areas	Stock Delineation	Eastern Arctic	1988–current
Sightings of narwhals made by observers with regions (Figure 6; Innes et al. 2002).	Narwhal	86	Aerial Survey	Sightings and group sizes	Arctic Archipelago	August 1997
Map of the seasonal location of satellite tagged narwhal (Figure 1; Laidre et al. 2004a).	Narwhal	26	Tags	Summarized tag locations	Eastern Arctic	1993–2000
Tracklines and kernel home range polygons for narwhals tagged in 2003 and 2004 in Admiralty Inlet (Figure 4; Dietz et al. 2008).	Narwhal	n/a	Tags	Track Lines and Kernel Density Analysis	Eastern Arctic	1995, 2001, 2002–2003

Figure number and description	Species or Feature	Sample Size	Type of Data	Type of Analysis	Survey/Study Location	Period of Study
Area use and tracklines of 14 narwhals tagged in Creswell Bay in August (Figure 2; Heide-Jørgensen et. al. 2003b)	Narwhal	14	Tags	Track Lines and Kernel Density Analysis	Eastern Arctic	2000–2001

Lancaster Sound

Figure number and description	Species or Feature	Sample Size	Type of Data	Type of Analysis	Survey/Study Location	Period of Study
Boundary of the key marine habitat sites for migratory birds at Cape Liddon (see page 30), Hobhouse Inlet (see page 32), Eastern Lancaster Sound (see page 34) and Cape Hay (see page 38) from Mallory and Fontaine (2004).	Key Marine Habitat Site	n/a	Seabird Colony and Foraging Range	Key colony location and foraging range	Canadian Arctic	1952–2004
Map of the seasonal location of satellite tagged narwhal (Figure 1; Laidre et al. 2004a).	Narwhal	26	Tags	Summarized tag locations	Eastern Arctic	1993–2000
The fixed kernel analysis contours for polar bear sub-populations (Figure 5c; Taylor et al. 2001).	Polar Bear	152	Tags	Kernel Density Analysis	Lancaster Sound	1989–1998
Movement of male belugas in fall tagged at Somerset Island (Figure 4; Richard et al. 2001)	Beluga	4	Tags	Track Lines	Lancaster Sound	August and September 1996
Movement of female belugas in fall tagged at Somerset Island (Figure 5; Richard et al. 2001).	Beluga	8	Tags	Track Lines	Lancaster Sound	August and September 1996

Figure number and description	Species or Feature	Sample Size	Type of Data	Type of Analysis	Survey/Study Location	Period of Study
Bowhead whale movement tracks from satellite telemetry locations derived from bowhead whales tagged in northern Foxe Basin and Cumberland Sound (Figure 4; Dueck and Ferguson 2009).	Bowhead	14	Tags	Track Lines	Eastern Arctic	2002–2006
Map showing the locations of the principal spring consolidated ice edges in eastern Parry Channel (Figure 6; Peterson et al. 2008).	Ice Edges	n/a	Principle Consolidated Ice Edge	n/a	Lancaster Sound	n/a

Cunningham Inlet

Figure number and description	Species or Feature	Sample Size	Type of Data	Type of Analysis	Survey/Study Location	Period of Study
Summer aggregation areas of Nunavut belugas (Figure 1; Richard 2010).	Beluga	n/a	Summering stock areas	Stock Delineation	Eastern Arctic	1969–current

Prince Leopold Island

Figure number and description	Species or Feature	Sample Size	Type of Data	Type of Analysis	Survey/Study Location	Period of Study
Boundary of the key marine habitat site for migratory birds at Prince Leopold Island from Mallory and Fontaine (2004) (see page 36).	Key Marine Habitat Site	n/a	Seabird Colony and Foraging Range	Key colony location and foraging range	Canadian Arctic	1952–2004
Map showing the locations of the principal spring consolidated ice edges in eastern Parry Channel (Figure 6; Peterson et al. 2008).	Ice Edges	n/a	Principle Consolidated Ice Edge	n/a	Lancaster Sound	n/a

Penny Strait

Figure number and description	Species or Feature	Sample Size	Type of Data	Type of Analysis	Survey/Study Location	Period of Study
Boundary of the key marine habitat site for migratory birds at Queens Channel from Mallory and Fontaine (2004) (see page 24).	Key Marine Habitat Site	n/a	Seabird Colony and Foraging Range	Key colony location and foraging range	Canadian Arctic	1952–2004
Observations of overwintering walruses in the waters surrounding Devon and Cornwallis Islands, Northwest Territories (Figure 1; Killiaan and Stirling 1978).	Walrus	215	Observations	Winter observations	Arctic Archipelago	1971–1976
Locations of walrus based on satellite tag data in western Jones Sound (Figure 3; Stewart 2008).	Walrus	16	Tags	Summarized tag locations	Arctic Archipelago	1993, 1998–2004
High Arctic walrus harvesting locations and wintering areas (Figure 4; Stewart 2008).	Walrus	80	Observations	Hunt locations	Arctic Archipelago	n/a
General distribution of walrus stocks in Canada (Figure 1; Stewart and Hamilton 2013).	Walrus	n/a	Stock Areas	Stock Delineation	Eastern Arctic	n/a
Walrus haulout sites surveyed in the West Jones Sound and Penny Strait-Lancaster Sound areas (Figure 1; Stewart et al. 2013a).	Walrus	17–565	Aerial Survey	Haul out survey observations	Lancaster Sound, Arctic Archipelago	1977, 1998–2009

North Water Polynya

Figure number and description	Species or Feature	Sample Size	Type of Data	Type of Analysis	Survey/Study Location	Period of Study
Distribution map of Canadian Arctic polynyas (Figure 1; Barber and Massom 2007).	Polynyas	n/a	Derived locations	General Polynya locations	Canadian Arctic	n/a

Figure number and description	Species or Feature	Sample Size	Type of Data	Type of Analysis	Survey/Study Location	Period of Study
Schematic of polynyas in the Canadian Arctic (Figure 1; Hannah et al. 2009).	Polynyas	n/a	Derived locations	General Polynya locations	Canadian Arctic	n/a
Boundary of the key marine habitat site for migratory birds at North Water Polynya from Mallory and Fontaine (2004) (see page 19).	Key Marine Habitat Site	n/a	Seabird Colony and Foraging Range	Key colony location and foraging range	Canadian Arctic	1952–2004
Chl-a concentration climatology (1998-2010) for Baffin Bay (Figure 16; Cyr and Larouche 2014).	Chlorophyll-A climatology	n/a	Chl-A climatology	Chl-A climatology	Baffin Bay, Davis Strait	1998–2010
Observations of whales, walruses, seals, and three seabirds during the aerial survey of the North Water in May–June 2009–2010 (Figure 5; Heide-Jørgensen et al. 2013).	Whales, walrus, seals, seabirds	n/a	Aerial Survey	Sightings and group sizes	North Water Polynya	2009–2010
Survey tracks and beluga sightings in March 1993 (Figure 2; Richard et al. 1998).	Beluga	453	Aerial Survey	Sightings and group sizes	North Water Polynya	March 20 and 21, 1993
Survey tracks and beluga sightings in late March 1993 (Figure 3; Richard et al. 1998).	Beluga	733	Aerial Survey	Sightings and group sizes	North Water Polynya	March 23–16, 1993
Sightings of bowhead whales (Bw), narwhals (N), and walruses (W) in late March 1993 (Figure 4; Richard et al. 1998).	Bowhead, Narwhal, Walrus	2(Bw), 16(N), 13(W)	Aerial Survey	Sightings and group sizes	North Water Polynya	March 21–26, 1993
Distribution of walruses (W) and bearded seals (bS) in the North Water, late winter 1978 and 1979 (Figure 2; Finley and Renault 1980).	Walrus, Bearded Seal	700(W), 37(bS)	Aerial Survey	Sightings and group sizes	North Water Polynya	1978–1979

Figure number and description	Species or Feature	Sample Size	Type of Data	Type of Analysis	Survey/Study Location	Period of Study
Distribution of belugas in the North Water, late winter 1978 and 1979 (Figure 3; Finley and Renault 1980).	Beluga	500	Aerial Survey	Sightings and group sizes	North Water Polynya	1978–1979
Tracklines of four belugas from Creswell Bay (Figure 2; Heidi- Jørgensen et al. 2003b)	Beluga	4	Tags	Locations	Baffin Bay, Lancaster Sound	2001
Tracklines of beluga tagged in 2001 and 1996 (Figure 3; (Heide-Jørgensen et al. 2003b).	Beluga	2	Tags	Track Lines	Baffin Bay, Lancaster Sound	1996, 2001

Eastern Jones Sound

Figure number and description	Species or Feature	Sample Size	Type of Data	Type of Analysis	Survey/Study Location	Period of Study
Boundary of the key marine habitat site for migratory birds at Eastern Jones Sound from Mallory and Fontaine (2004) (see page 27).	Key Marine Habitat Site	n/a	Seabird Colony and Foraging Range	Key colony location and foraging range	Canadian Arctic	1952–2004

Cardigan Strait / Hell Gate

Figure number and description	Species or Feature	Sample Size	Type of Data	Type of Analysis	Survey/Study Location	Period of Study
Locations of walrus based on satellite tag data in western Jones Sound (Figure 3; Stewart 2008).	Walrus	16	Tags	Summarized tag locations	Arctic Archipelago	1993, 1998–2004
High Arctic walrus harvesting locations and wintering areas (Figure 4; Stewart 2008).	Walrus	80	Observations	Hunt locations	Arctic Archipelago	n/a

Figure number and description	Species or Feature	Sample Size	Type of Data	Type of Analysis	Survey/Study Location	Period of Study
Summer aggregation areas of Nunavut narwhals (Figure 2; Richard 2010).	Narwhal	n/a	Summering stock areas	Stock Delineation	Eastern Arctic	1988–current
Walrus haulout sites surveyed in the West Jones Sound and Penny Strait-Lancaster Sound areas (Figure 1; Stewart et al. 2013a).	Walrus	17–565	Aerial Survey	Haul out survey observations	Lancaster Sound, Arctic Archipelago	1977, 1998–2009

APPENDIX 3. EBSA CRITERIA

UNIQUENESS

Areas whose characteristics are unique, rare, distinct, and for which alternatives do not exist are considered unique. In terms of ecological function:

- for spawning or breeding areas, an area is unique if only one suitable spawning site is known to exist for a species or a site is used for spawning by many species;
- for nursery or rearing areas, an area is unique if only a single nursery/rearing area exists for the species;
- for feeding areas, an area is unique if the area favors the production of a key food source that isn't found in other areas and can't be easily substituted, provides a major food item not found elsewhere to a highly specialized consumer or if there is no alternate area being used by this population or a segment of the population;
- for migration corridors, an area is unique if the route is an obligatory passage (e.g., narrow strait, estuary) for a single species, population or life stage, or if the route is travelled by many species or populations;
- for refuge areas, an area is unique if the refuge utilized by a rare, endemic, or unusual species or population, if the refuge is utilized by many different populations or species, or if the refuge is utilized for an unusual purpose or under unusual conditions.

AGGREGATION

Areas where most individuals of a species are aggregated for some part the year, where most individuals use the area for some important life history function, or where some structural feature or ecological process occurs with exceptionally high density are considered aggregations. In terms of ecological function:

- for spawning or breeding areas, an area is an aggregation if a high percentage of total population uses the area or if a noteworthy percentage of many species uses the area;
- for nursery or rearing areas, an area is an aggregation if larvae/juveniles are found in high concentrations in an area or a number of the species use the area as nursery grounds/rearing;
- for feeding areas, an area is an aggregation if a high concentration of prey occurs in an area, both a large biomass and high productivity, or if it is an intense feeding area for a wide variety of species or for a large proportion of a population and for sessile animals, a feeding area where a species occurs at a high density;
- for migration corridors, an area is an aggregation if most individuals in the population travel along the route or if a noteworthy percentage of several species use the route;
- for refuge areas, an area is an aggregation if a refuge contains a high proportion of a single population or a species during adverse conditions (e.g., low or high temp) or if a refuge demonstrates greater than average biomass under adverse conditions.

FITNESS CONSEQUENCES

This dimension generally applies to areas where the life history activity(ies) undertaken make a major contribution to the fitness of the population or species present. In terms of ecological function:

- for spawning or breeding areas, an area has high fitness consequence if the species present are semelparous, so loss of one spawning event poses risk of loss of lineage or a single site's quality or quantity of breeding habitat greatly affects the productivity of the population;
- for nursery or rearing areas, an area has high fitness consequence if the larvae/juveniles present have increased survivorship/fitness compared to other areas, especially if reasons can be tied to characteristics of the site;
- for feeding areas, an area has high fitness consequence if feeding takes place in periods or in a manner that is more critical to an organism's fitness, if feeding contributes to productivity and/or short-term and long-term population sustainability, if consumers are known to use the area consistently, or if the area's contribution to annual growth, condition and maturation is great;
- for migration corridors; an area has high fitness consequence if the route itself or its endpoints favour population fitness (reproduction and survival), or if alternate routes represent a much greater cost or risk to migrants;
- for refuge areas, an area has a high fitness consequence if the refuge is necessary for the survival of the species, population, or individuals (listed in order of significance) using it, if survival of individuals within a refuge is important for survival of a dependent species or population (e.g., survival of overwintering *Calanus* spp. important for other species) or if use of a refuge coincides with other important life history events such as spawning or breeding.

APPENDIX 4. EBSA COMPARISON

Table A4. Comparison of spatial extent between Arctic EBSAs from 2011 (DFO 2011a) and 2015 (DFO 2015a). Four EBSAs identified in 2011, Baffin Bay Shelf Break, Northern Baffin Bay, Southern Baffin Bay and the Hatton Basin-Labrador Sea-Davis Strait, are not included as they were not reassessed. Note that a change in the area extent may be the result of increased mapping accuracy.

<table>
<tr><th>Eastern Arctic EBSAs 2015</th><th>Area (km²)</th><th>Eastern Arctic EBSAs 2011</th><th>Area (km²)</th><th>Change</th></tr>
<tr><td>Clearwater Fiord</td><td>2,292</td><td>Cumberland Sound</td><td>5,476</td><td>-3,184</td></tr>
<tr><td>Eastern Cumberland Sound[†]</td><td>12,645</td><td></td><td></td><td></td></tr>
<tr><td>Cape Searle</td><td>2,909</td><td rowspan="3">Baffin Island Coastline</td><td rowspan="3">83,237</td><td rowspan="3">-74,891</td></tr>
<tr><td>Scott Inlet</td><td>2,602</td></tr>
<tr><td>Isabella Bay</td><td>2,835</td></tr>
<tr><td>Eclipse Sound</td><td>6,871</td><td>Eclipse Sound / Navy Board Inlet</td><td>6,201</td><td>+670</td></tr>
<tr><td>Admiralty Inlet[‡]</td><td>9,132</td><td>Admiralty Inlet</td><td>8,990</td><td>+142</td></tr>
<tr><td>Prince Regent Inlet</td><td>12,838</td><td rowspan="3">Prince Regent Inlet</td><td rowspan="3">32,109</td><td rowspan="3">-18,082</td></tr>
<tr><td>Creswell Bay</td><td>1,098</td></tr>
<tr><td>Bellot Strait</td><td>91</td></tr>
<tr><td>Gulf of Boothia</td><td>24,973</td><td>Gulf of Boothia</td><td>61,544</td><td>-36,571</td></tr>
<tr><td>Peel Sound</td><td>7,286</td><td>Peel Sound</td><td>24,523</td><td>-17,237</td></tr>
<tr><td>Lancaster Sound</td><td>48,131</td><td rowspan="4">Lancaster Sound</td><td rowspan="4">72,198</td><td rowspan="4">-19,917</td></tr>
<tr><td>Resolute Passage</td><td>856</td></tr>
<tr><td>Cunningham Inlet</td><td>26</td></tr>
<tr><td>Prince Leopold Island</td><td>3,268</td></tr>
<tr><td>Penny Strait</td><td>3,961</td><td>Wellington Channel</td><td>13,470</td><td>-9,509</td></tr>
<tr><td>North Water Polynya[‡]</td><td>19,145</td><td>North Water Polynya</td><td>23,610</td><td>-4,465</td></tr>
<tr><td>Eastern Jones Sound</td><td>5,621</td><td>Eastern Jones Sound</td><td>12,583</td><td>-6,962</td></tr>
<tr><td>Cardigan Strait / Hell Gate</td><td>3,847</td><td>Cardigan Strait / Hell Gate</td><td>6,470</td><td>-2,623</td></tr>
<tr><td>TOTAL COUNT</td><td>20</td><td></td><td>12</td><td>+8</td></tr>
<tr><td>TOTAL AREA km²</td><td>170,427</td><td></td><td>350,411</td><td>-179,984</td></tr>
</table>

[†]Eastern Cumberland Sound EBSA was originally part of the 2011 Hatton Basin-Labrador Sea-Davis Strait EBSA (DFO 2011a).
[‡] The apparent change in area for these two EBSAs was the result of an increase in ArcGIS mapping techniques for the 2015 re-evaluation (i.e., boundaries were delineated to the coast more accurately).