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Ecologically and biologically significant areas (EBSA) in northern Foxe Basin: identification and delineation

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Canada

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.

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ABSTRACT

A regional science peer review meeting was held in June 2009 with science experts from Fisheries and Oceans Canada (DFO), Natural Resources Canada, Environment Canada, Parks Canada Agency and the Government of Nunavut to identify ecologically and biologically significant areas (EBSAs) in the Northern Foxe Basin study area. During the meeting, participants evaluated available scientific information on oceanographic processes, primary and secondary production, benthic invertebrates, marine plants, anadromous and marine fishes, and marine mammals, and identified gaps in knowledge. Marine birds and Polar Bears were also considered, although the primary focus was aquatic marine ecosystems for which DFO has responsibility. The meeting participants also considered available published traditional/local knowledge. Three EBSAs were identified and delineated on the basis of this information. Combined they represent almost 47% coverage (25,550 km^2 of 54,810 km^2) within the study area. The Rowley Island EBSA has high productivity at the sea ice edge and important habitat for Walruses and Bowhead Whales. The Igloolik Island EBSA supports a number of species including Arctic Char, Bowhead Whale, Walrus and Polar Bear during critical periods of their life history. Both EBSAs contain recurring polynyas that serve as important nursery and feeding areas and as a migratory corridor for several species of marine mammals. The Fury and Hecla Strait EBSA has currents that create conditions for biologically and ecologically important habitat in the Rowley Island and Igloolik Island EBSAs. It also has Polar Bear denning sites along the north coast and serves as a migratory corridor for several marine mammal species between northern Foxe Basin and the Gulf of Boothia. The three EBSAs also contain important feeding and/or staging areas for marine birds. As new information comes available and/or effects of human activities like climate change or resource development occur, the boundaries of the three EBSAs and the potential for additional EBSAs in the study area should be re-evaluated.

Zones d'importance écologique et biologique (ZIEB) dans le nord du bassin Foxe : désignation et délimitation

RÉSUMÉ

Une réunion régionale d'examen scientifique par des pairs a eu lieu en juin 2009 avec des experts scientifiques de Pêches et Océans Canada (MPO), Ressources naturelles Canada, Environnement Canada, l'Agence Parcs Canada et le gouvernement du Nunavut pour désigner des zones d'importance écologique et biologique (ZIEB) dans la zone d'étude du nord du bassin Foxe. Au cours de la réunion, les participants ont évalué les données scientifiques existantes sur les processus océanographiques, la production primaire et secondaire, les invertébrés benthiques, les plantes marines, les poissons anadromes et marins ainsi que les mammifères marins. Ils ont aussi signalé les lacunes dans les connaissances. Les oiseaux marins et les ours polaires ont également été pris en considération, bien que l'accent ait été mis sur les écosystèmes aquatiques marins qui relèvent du MPO. Les participants à la réunion ont aussi examiné les publications disponibles en matière de connaissances locales et traditionnelles. En se fondant sur ces informations, on a désigné et délimité trois ZIEB. Ensemble, elles recouvrent presque 47 % de la surface de la zone d'étude (25 550 km^2 sur 54 810 km^2). La ZIEB de l'île Rowley se caractérise par une productivité élevée à la lisière des glaces et par son important habitat de morses et de baleines boréales. La ZIEB de l'île Igloolik soutient plusieurs espèces, telles que l'omble chevalier, la baleine boréale, le morse et l'ours polaire, pendant des périodes critiques de leur cycle biologique. Les deux ZIEB abritent des polynies récurrentes qui en font des zones d'alevinage et d'alimentation importantes ainsi qu'un corridor migratoire pour plusieurs espèces de mammifères marins. Les courants de la ZIEB du détroit de Fury et Hecla créent des conditions favorables à un habitat d'importance écologique et biologique dans les ZIEB de l'île Rowley et de l'île Igloolik. Cette zone offre également des aires de mise bas pour les ours polaires le long de la côte nord et sert de corridor migratoire à plusieurs espèces de mammifères marins entre le nord du bassin Foxe et le golfe de Boothia. Les trois ZIEB présentent aussi des aires de rassemblement et d'alimentation pour les oiseaux marins. Au fur et à mesure que de nouveaux renseignements deviendront disponibles et/ou que les effets des activités humaines comme les changements climatiques ou le développement des ressources se matérialiseront, il faudra réévaluer les limites de ces trois ZIEB et la possibilité de créer des ZIEB supplémentaires dans la zone d'étude.

INTRODUCTION

In 1994, Parks Canada sponsored an Arctic Marine Workshop that brought together experts to map current information, identify gaps in knowledge and identify marine 'hot spots' or areas of high biological diversity (Mercier et al. 1995). In total, nine hot spots were identified, one of which was Foxe Basin. This was considered one of the most important sites with a high diversity of species using the area, yet very little was known scientifically about the area. Foxe Basin is known to have the largest concentration of Atlantic Walrus (*Odobenus rosmarus rosmarus*) in Canada and to be a summering ground for Bowhead Whales (*Balaena mysticetus*). Although the relative productivity of the area is unknown there are several polynyas in the area likely increasing nutrient concentrations and, thus, secondary productivity.

Canada's *Oceans Act* (1997) authorizes Fisheries and Oceans Canada (DFO) to provide enhanced management to areas of the oceans and coasts which are ecologically and biologically significant (DFO 2004). The identification of an Ecologically and Biologically Significant Area (EBSA) is considered a useful tool to call attention to areas that have particular ecological or biological significance, in order to facilitate a greater-than-usual degree of risk aversion in the management of activities (DFO 2004). The identification of EBSAs requires an inclusive and transparent process that gathers both scientific and traditional/local knowledge and integrates the results to achieve a final EBSA map.

In fall 2008/winter 2009, DFO's Oceans Program conducted meetings in Nunavut with the Regional Inuit Associations (RIAs), Nunavut Tunngavik Inc. (NTI), Nunavut Wildlife Management Board (NWMB) and Government of Nunavut (GN) to consider areas in Nunavut that might be considered for Marine Protected Area designation. The Northern Foxe Basin Study Area, which includes Fury and Hecla Strait, was selected as one possible area (Figure 1). DFO Science was then asked to identify areas which could be considered as being ecologically or biologically significant within this study area.

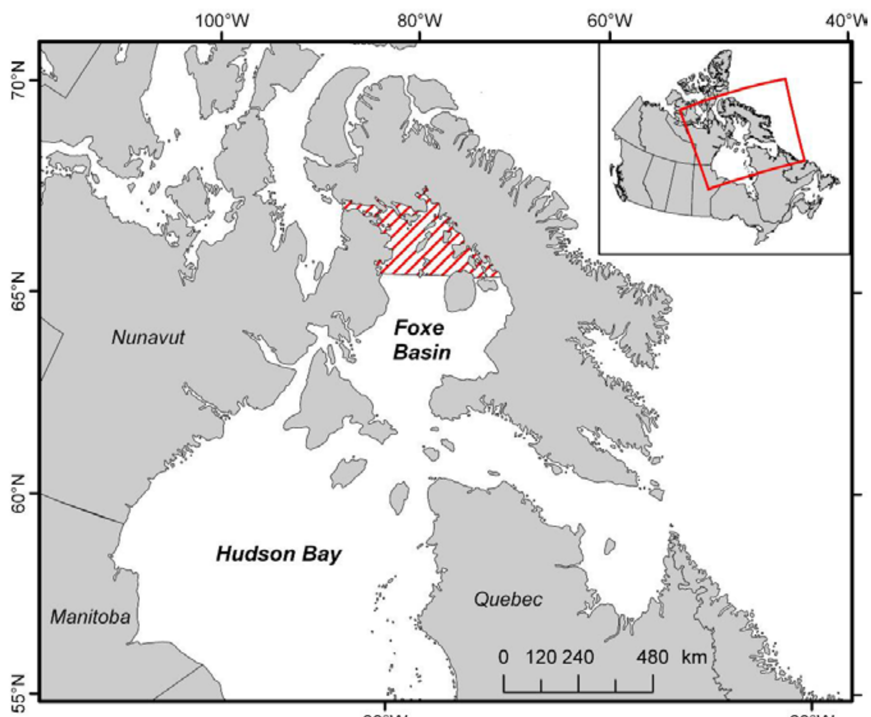

Figure 1. Northern Foxe Basin study area (red diagonal lines) with southern boundary line set at 68˚N for the EBSA selection process.

A science advisory meeting was held in June 2009 to assess the available scientific knowledge for northern Foxe Basin to determine whether one or more locations/areas within it would qualify as an EBSA. Participants also considered available published traditional/local knowledge. This document presents the information peer reviewed during the meeting. The meeting discussions are summarized in DFO (2010).

Subsequent meetings were held in the communities of Igloolik and Hall Beach during which the science advice was presented to and discussed by local knowledge holders, and they contributed their knowledge to the process. The results of those meetings are presented in DFO (2010). The scientific and traditional/local knowledge were later integrated and summarized in DFO (2014).

ASSESSMENT

BATHYMETRY AND GEOLOGY

Northern Foxe Basin is a shallow oceanic basin (Figure 2) located in Canada's eastern Arctic between Baffin Island, the Melville Peninsula and Southampton Island, Nunavut (Figure 3). The basin is connected to the High Arctic via the Gulf of Boothia and Fury and Hecla Strait and to the Labrador Sea via Foxe Channel and Hudson Strait. Generally, Foxe Basin is less than 100 m in depth with several small depressions that reach approximately 300-350 m (Figure 3). Multi-beam data have also been collected during navigation by vessels in the area, however these data are sparse and not easily accessible.

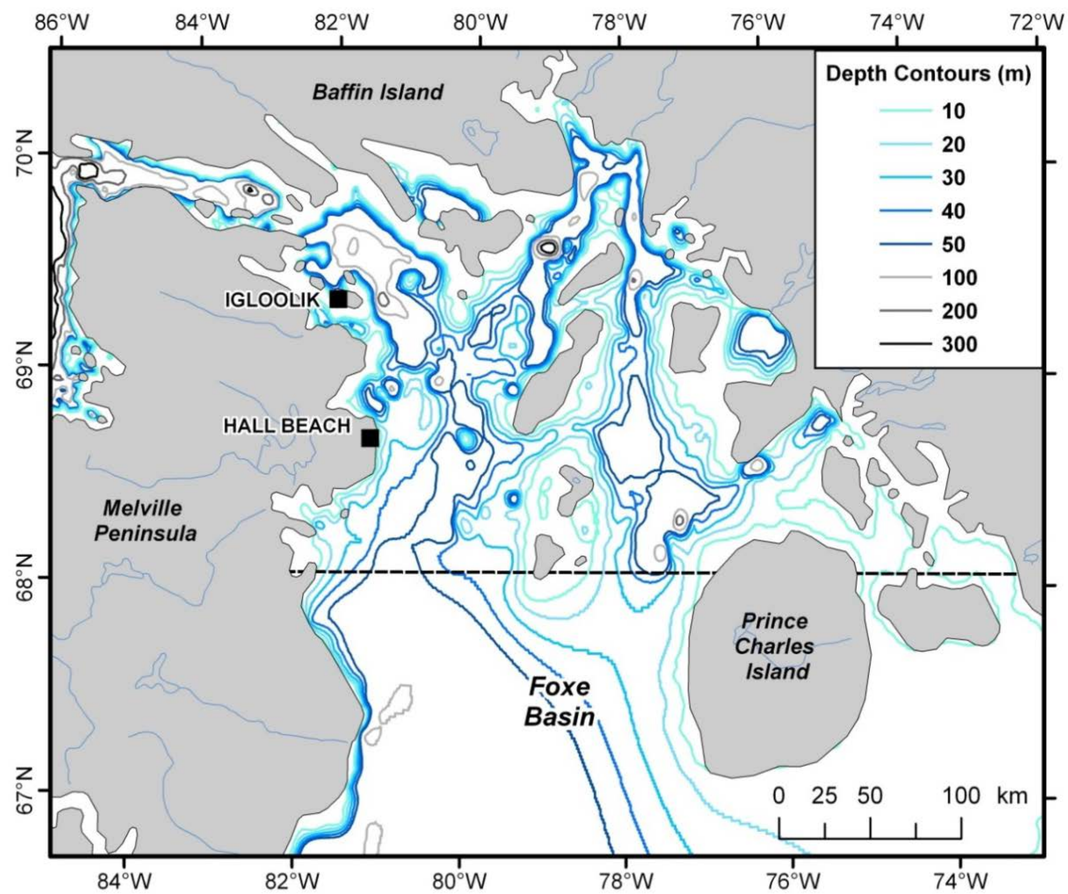

Figure 2. Depth contours (m) for northern Foxe Basin study area (modified from Jakobsson et al. 2008).

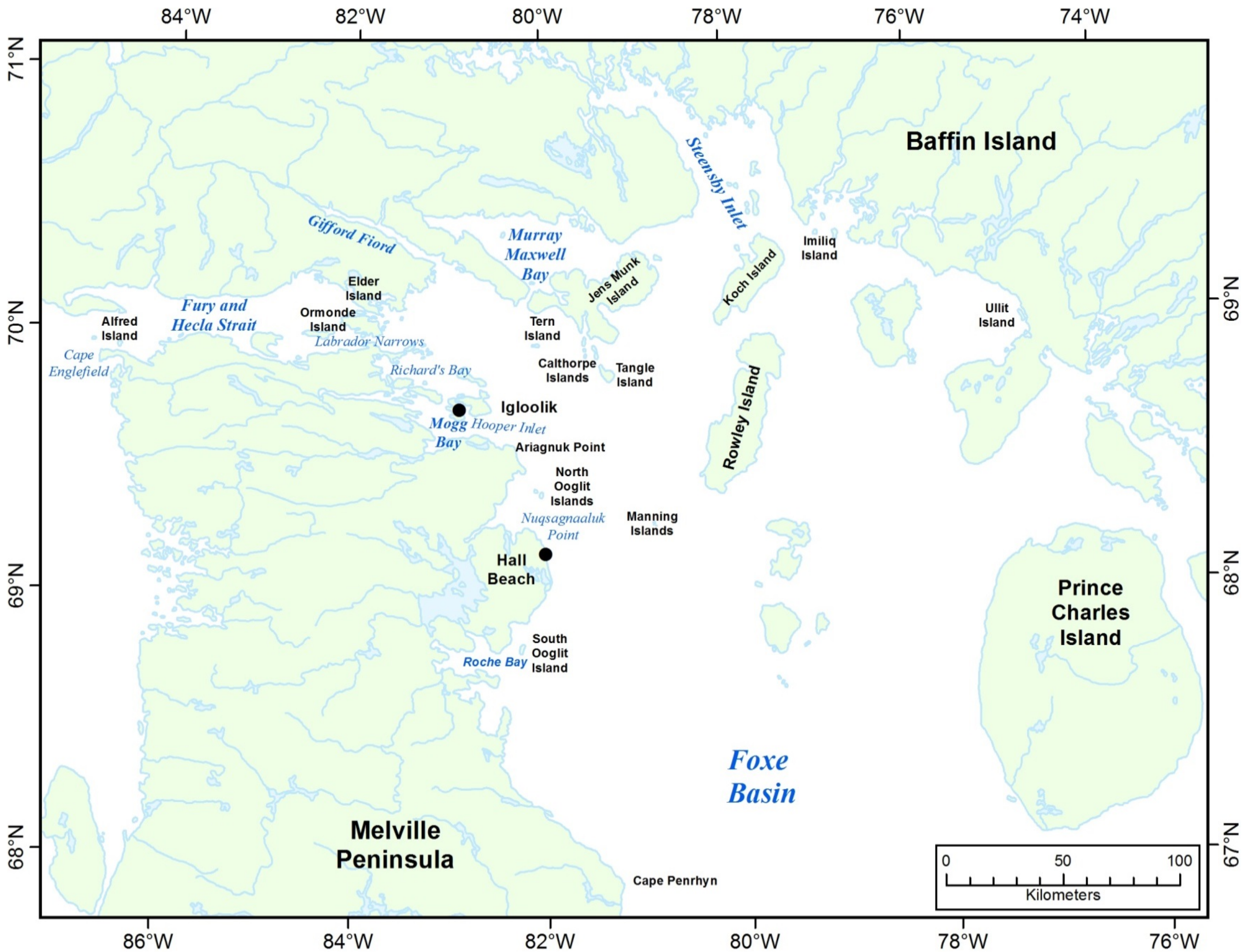

Figure 3. Place names in northern Foxe Basin mentioned in the text.

There is limited information available on the geology of northern Foxe Basin though it is generally considered to be mostly bedrock with some gravel outcroppings near Igloolik and southwest towards the community of Hall Beach (Robbie Bennett, pers. comm.). To date, no seismic work has been conducted in Foxe Basin and only one hydrocarbon exploration well has been drilled. Overall, limited geosciences information is available for the northern Foxe Basin study area.

ICE AND HYDROLOGICAL PROCESSES

There is limited available oceanographic information or data for this region (Defossez et al. 2010; DFO 2010; Saucier et al. 2004). The data tend to be spatially and temporally sparse and most is from the mid-1980s (Drinkwater 1986; Prinsenberg 1986 a,b,c; Prinsenberg 1988; Prinsenberg and Freeman 1986; Ingram and Prinsenberg 1998). However, there is a general understanding of the circulation patterns, sea ice trends and the formation of polynyas in the area.

Circulation

Some of the Arctic surface waters that enter the Atlantic Ocean travel via surface currents from the Canadian Archipelago through Foxe Basin (Figure 4). The surface waters flow eastward through Fury and Hecla Strait where there is intense tidal mixing, resulting in vertically homogeneous Arctic waters entering Foxe Basin (Ingram and Prinsenberg 1998). This water tends to be lighter than the water present in the basin so it flows over top. In late winter, the Arctic water enters the basin at a rate of 0.04×10^6 m^3 s^{-1} and typically has a temperature of -1.71˚C and salinities between 32.0 and 32.1 ppt (Prinsenberg 1988; Ingram and Prinsenberg 1998). In summer, the rate of input is reduced to 0.01×10^6 m^3 s^{-1} and the waters are warmer (0.5-0.75˚C) and less saline (31.0-32.0; Prinsenberg 1988; Ingram and Prinsenberg 1998). Based on salinity distributions and ice break-up patterns in Foxe Basin, both surface and deep water circulation are cyclonic (Saucier et al. 2004).

Surface currents continue to transport the Arctic waters south along the Melville Peninsula through western Foxe Basin (Ingram and Prinsenberg 1998). Once it reaches the most southern part of the basin, some of these waters enter Hudson Bay and join a cyclonic circulation around the bay before exiting and re-joining the other portion of Arctic water from Foxe Basin to form the southeast surface flow in Hudson Strait (Figure 4) (Ingram and Prinsenberg 1998).

Circulation is generally strongest along the western side of Foxe Basin and reaches a maximum at depth during winter and spring (5-10 $cm \cdot s^{-1}$) (Saucier et al. 2004). Deep dense waters are produced at latent heat polynyas, such as the one located near Hall Beach. These waters mix with the lighter water from Fury and Hecla Strait and spread south along the eastern coast of Melville Peninsula into Foxe Channel (Defossez et al. 2010). Polynyas north of Hall Beach do not likely produce dense water due to significant mixing and freshwater input (Defossez et al. 2010).

Currents play an important role in sea ice movement and the transport of nutrients in northern Foxe Basin. Sadler (1982) calculated that the net annual transport into northern Foxe Basin was 1.5×10^{12} m^3, which is approximately equal to the total annual transport into Foxe Basin. This would have an important influence on the oceanography of the region and the distribution of several species which rely on these currents to produce areas of increased productivity.

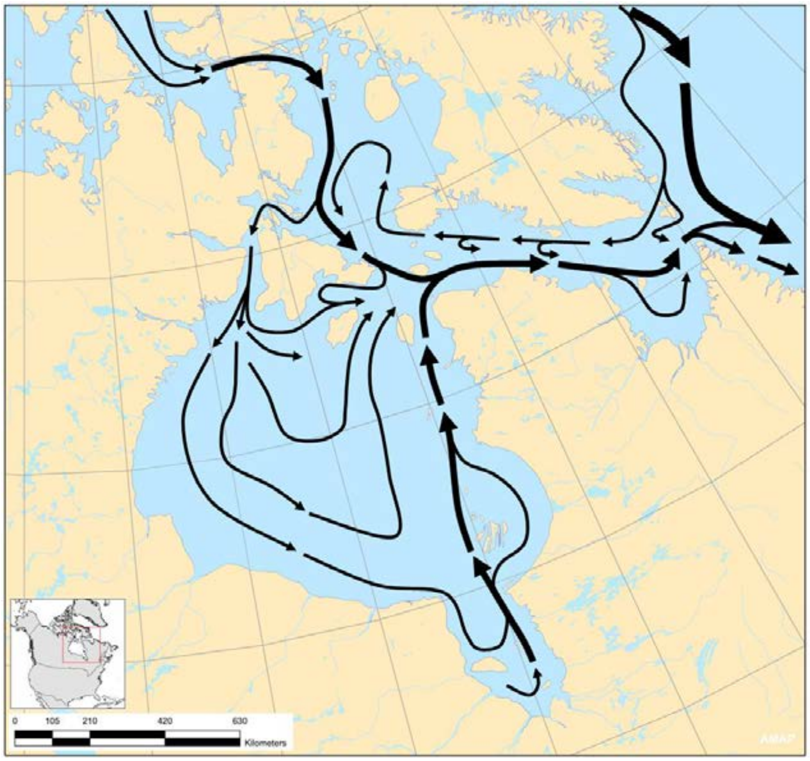

Figure 4. Surface water circulation patterns in the Foxe Basin-Hudson Bay region (adapted from Canada poster 8: Eastern Canadian Arctic) (Base map courtesy of the Arctic Monitoring and Assessment Programme).

Sea Ice

Sea ice is important because its upper and lower surfaces provide habitat to animals, it shapes climate and weather and serves as a platform for transportation and resource-harvesting activities. In northern Foxe Basin, sea ice predominates for most of the year (November to June) and is characterized as first year ice (Saucier et al. 2004; Laidler et al. 2009). Once the first year ice melts in summer, the area is frequented by old ice (second year and multi-year ice) from the Gulf of Boothia (Ford et al. 2009). Freeze-up, as defined by local Inuit (useable platform - 9/10 sea ice coverage), normally begins in mid- to late October (Laidler et al. 2009), which is similar to the average dates reported by the Canadian Ice Service (CIS) for the period of 1971-2000 (Figure 5). However, more recent data indicate that freeze-up dates have become delayed by nearly a month. At the same time there has been a significant increase in temperature of almost 0.2°C per year and shifts in prevailing winds and wind speeds during the months of October and November (Laidler et al. 2009).

Average break-up dates (i.e., when ice disappears or moves out of a given area) begin in July and August in northern Foxe Basin (Figure 5). Laidler et al. (2009) also noted a shift towards an earlier spring break-up based on information from local people and sea ice concentration data. These trends in freeze-up and break-up suggest an increase in the open water season which Laidler et al. (2009) identified as an increase of 1.19 days per year between 1982 and 2005.

Ice cover in Foxe Basin is distinguishable from all other Canadian Arctic ice by its dark colour and rough topography (Campbell and Colin 1958; Ingram and Prinsenberg 1998). This colouration is due to autumn storms and large tides that cause bottom sediments to be stirred into the water column and subsequently frozen in the ice (Ingram and Prinsenberg 1998). Tides and storms can also cause ice rafting by continuous breaking of ice (Ingram and Prinsenberg 1998). Generally more ice is produced per unit area, by as much as 90% more, in places where severe ice rafting occurs compared with areas of smooth, level ice (Prinsenberg 1988; Ingram and Prinsenberg 1998). Mechanical ridging is at a maximum in eastern Foxe Basin and ice thickness growth is likely more so due to ridging as opposed to local thermodynamic growth (Saucier et al. 2004). Prinsenberg (1988) estimated ridge frequency in Foxe Basin to be greater than in Hudson Strait where 6-14 ridges·km^{-1} were observed. Ridging and rubble fields have a major impact on freshwater budget estimates in Foxe Basin, potentially increasing the estimated freshwater contribution by as much as 30% (Prinsenberg 1988).

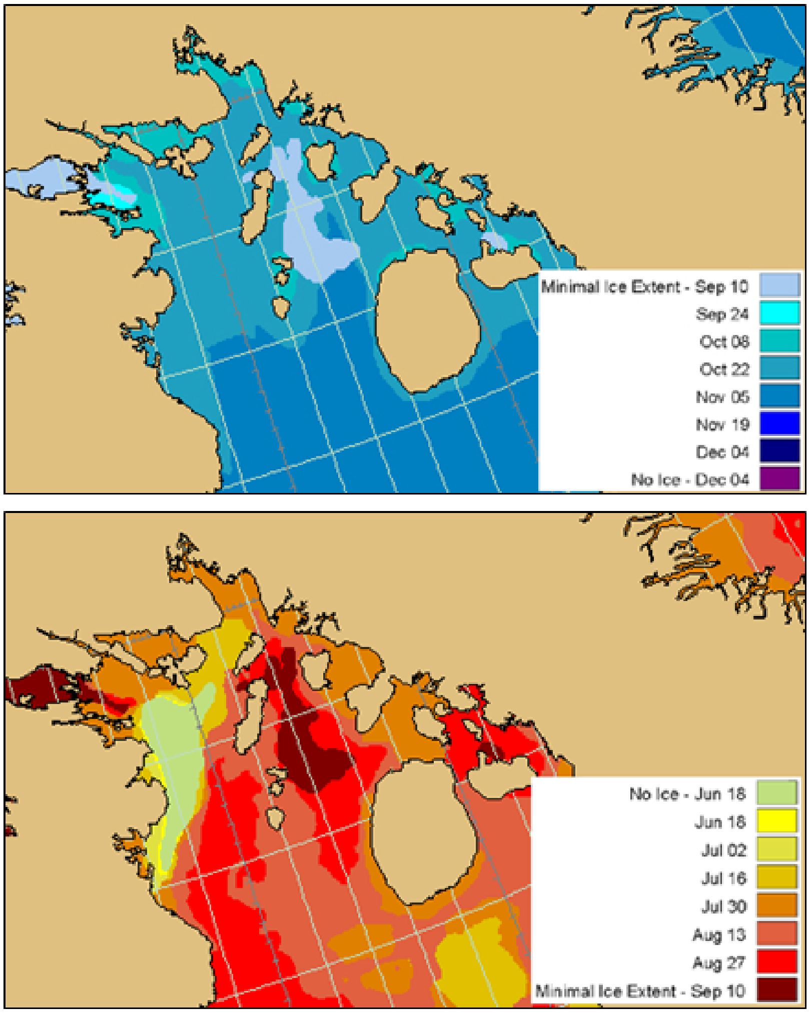

Figure 5. Average ice freeze-up and ice break-up dates (top and bottom panels, respectively) in Foxe Basin over a 21 year period from 1971 to 2000 (adapted from Canadian Ice Service).

Maximum ice thickness in northern Foxe Basin ranges between 175–200 cm when the ice is level and not ridged, however, these values can have large interannual variations (Prinsenberg 1988). Igloolik Inuit report thinning trends in sea ice thickness, particularly at the floe edge and around the perimeter of polynyas where subsistence hunting takes place (Laidler et al. 2009). This trend is consistent with pan-Arctic data for which an overall decrease in ice thickness has been reported (Rothrock et al. 1999).

Polynyas

Openings in the sea ice, in the form of cracks, leads and polynyas, typically begin to form in northern Foxe Basin in winter (Smith and Rigby 1981). Polynyas are persistent areas of open water and/or thin ice that occur within regions of consolidated ice. They are known to be recurrent and occur at predictable locations (Barber and Massom 2007) although the timing, duration and size of a polynya can be highly variable among years (Williams et al. 2007). In northern Foxe Basin, three large polynyas have been identified; one located around Igloolik Island (southeast of the eastern end of Fury and Hecla Strait), one north and northwest of Prince Charles Island and another south of Hall Beach (Figure 6). In addition to these three polynyas, Igloolik community members have also identified another well-known polynya that occurs at the mouth of Murray Maxwell Bay (not mapped; Laidler et al. 2009).

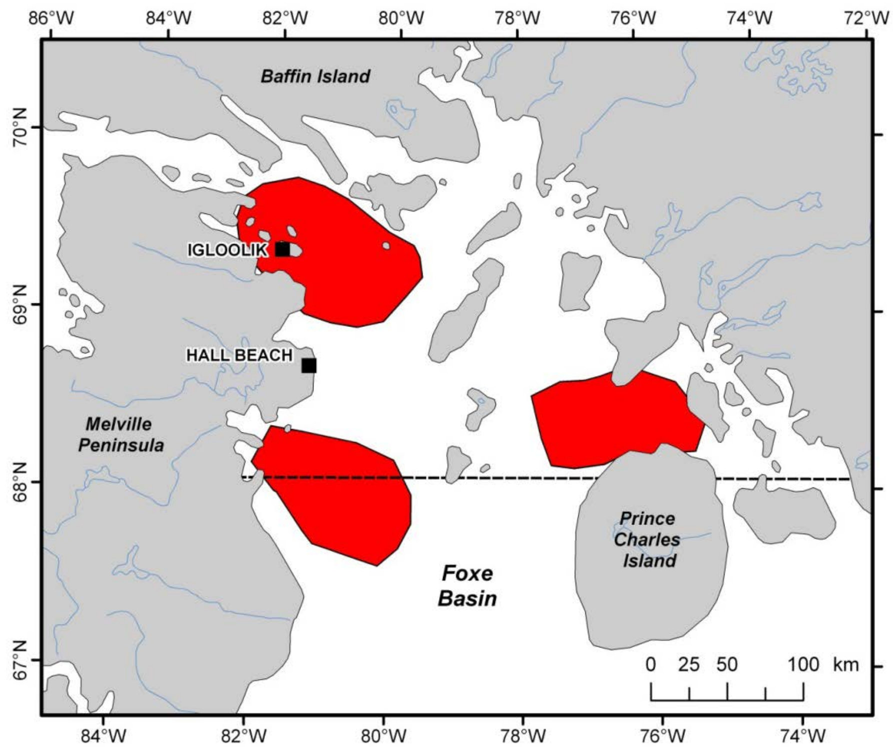

Figure 6. Three main polynyas identified in northern Foxe Basin with dashed line showing southern boundary of the study area (modified from Barber and Massom 2007).

The larger polynya located at the eastern mouth of Fury and Hecla Strait typically begins to appear around May (Laidler et al. 2009), however, CIS data suggest that open water begins to appear on average (1971–2000) in April (Figure 7) and the frequency of sea ice continually decreases until open waters in the surrounding areas appear by late summer (late August–early September). Evidence suggests that this polynya forms due to tidal events which bring warm water to the surface and currents that bring water eastward through Fury and Hecla Strait, thereby melting the ice (Laidler et al. 2009; Hannah et al. 2009). Since opening of the polynya is largely dependent on current speeds, volume and bottom topography the location of this polynya varies annually.

In recent years, the floe edge in this region has formed closer to the community of Igloolik than previously reported. This is likely due to an observed decrease in the presence of multi-year ice between Melville Peninsula and Baffin Island (Laidler et al. 2009). The reduction in sea ice may be due to

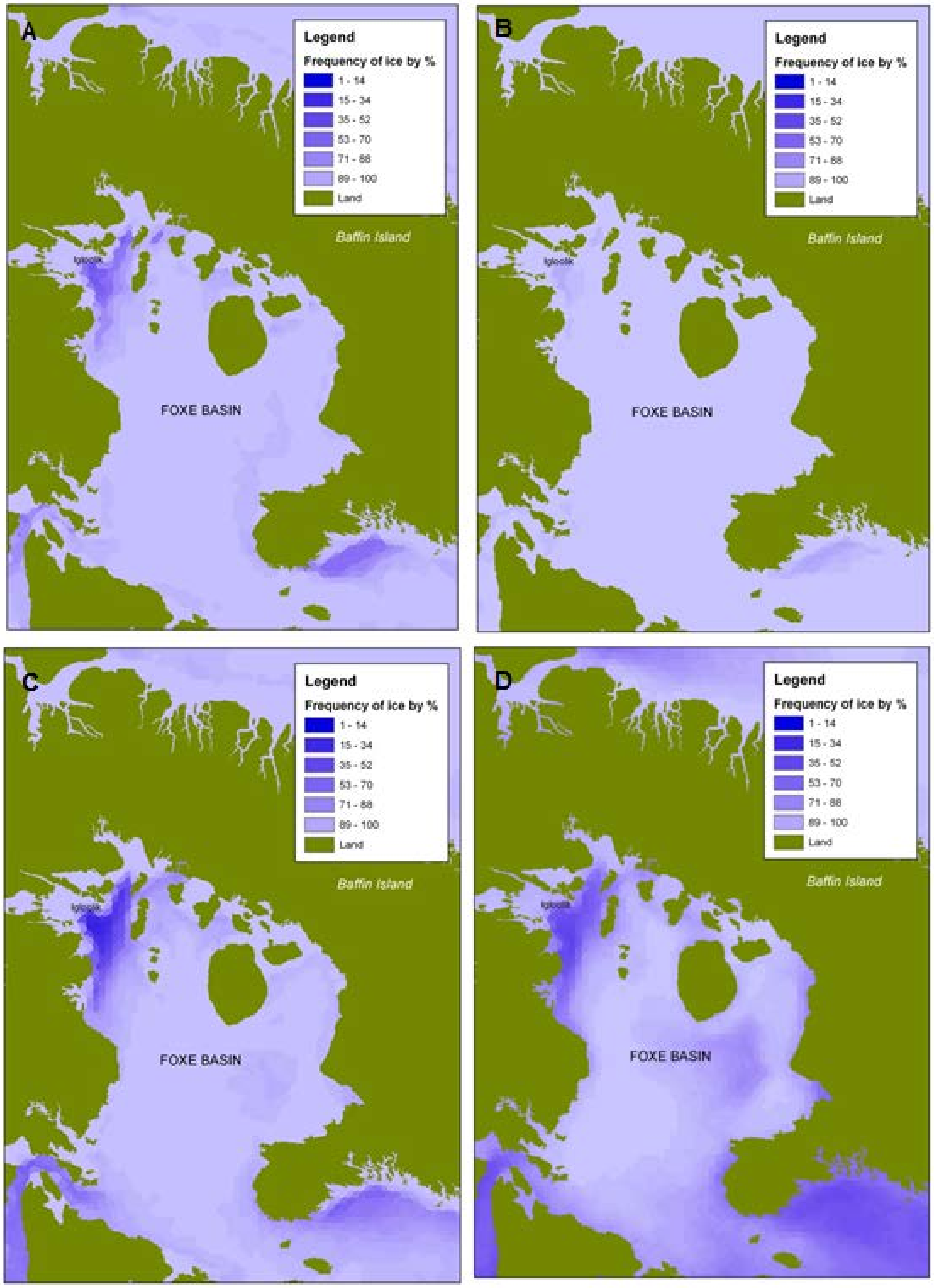

Figure 7. Average percent frequency of sea ice in Foxe Basin for (A) April, (B) May, (C) June and (D) July (CIS data, 1971-2000). Dark blue represents a greater percentage of ice-free water which also illustrates the location of polynyas in Foxe Basin.

a significant decrease in wind speeds and variability in the prevailing winds, resulting in less ice being pushed through the Labrador Narrows into eastern Fury and Hecla Strait (Laidler et al. 2009).

The other polynyas located in northern Foxe Basin typically form behind islands (Charles Hannah, pers. comm.). For example, strong winds eventually lead to opening of the Hall Beach polynya which can be considered continuously open during the winter (Defossez et al. 2010). These polynyas are kept open by the export of ice and are maintained by air temperature and winds (Defossez et al. 2010; Charles Hannah, pers. comm.).

PRIMARY AND SECONDARY PRODUCTION

There is very little information on the export of multi-year ice and ice melt rates, as well there has been very limited sampling of primary productivity conducted in the northern Foxe Basin study area to date, so it is difficult to speculate about areas of increased primary production (Christine Michel, pers. comm.). Smith and Nelson (1985) found that phytoplankton blooms in the Ross Sea (Antarctica) were restricted to waters with reduced salinity. Thomas (1999) found that salinity was typically lower at the ice-edge in Foxe Basin than in the open water areas, likely due to the melting of landfast ice, which suggests the ice edge is an important area for increased primary production.

Very little information on zooplankton has been obtained from northern Foxe Basin to date. Based on samples collected from a single station near Igloolik during a one-year study, Grainger (1959) found that zooplankton concentrations were at a maximum during July, August and early September with peak concentrations in September. Thomas (1999) also collected zooplankton samples in Foxe Basin while conducting research on Bowhead Whale distributions. Both found that *Pseudocalanus* copepods were the dominant species. This arctic copepod is known to be highly aggregated in the first few centimeters under landfast ice during spring and feeds opportunistically on ice algae near the ice-water interface that is either attached (epontic) or eroding from the ice (Conover et al. 1986). Oceanographic features and currents are often important in determining zooplankton distributions and abundance. In the Igloolik area, the steady influx of ice and water via Fury and Hecla Strait, as well as bottom topography, may create areas of retention (Jim Reist, pers. comm.). Copepods are thought to be the major food source for Bowhead Whales in the western Arctic (Bradstreet et al. 1987*)* and in Isabella Bay in Davis Strait *(*Finley et al. 1994); their importance in northern Foxe Basin is unknown. The stomach contents of a subadult female harvested near Igloolik in mid-September 1994 was found to contain a variety of epibenthic and benthic organisms (Pomerleau et al. 2011).

BENTHIC INVERTEBRATES AND MARINE PLANTS

There is little quantitative information available on benthic invertebrates and marine plants for northern Foxe Basin. Invertebrates were sampled as part of the work conducted in 1947 to 1955 aboard the *Calanus* vessel (Dunbar 1956). Local people have identified areas where they have observed a variety of benthic invertebrates and kelp beds (Figures 8 and 9, respectively; Nunavut Coastal Resource Inventory (NCRI) 2008). Additionally, Walrus and Bearded Seal (*Erignathus barbatus*) feeding aggregation sites can serve as a proxy for identifying clam beds and other areas where sea cucumbers, sea urchins and nudibranchs are abundant.

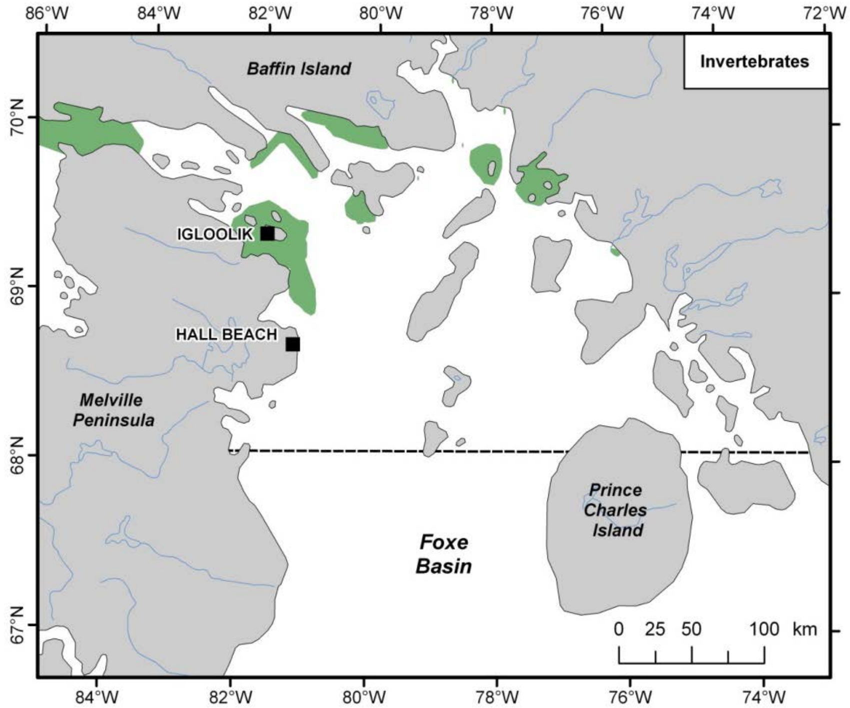

Figure 8. Areas of high abundance and occupation of invertebrates (clams, mussels, sea cucumbers and amphipods) (modified from NCRI 2008).The area around Igloolik and Jens Munk Island were high in abundance for all invertebrates, while clam beds were more common in Murray Maxwell Bay and along the eastern shores and amphipods in the western mouth of Fury and Hecla Strait (NCRI 2008).

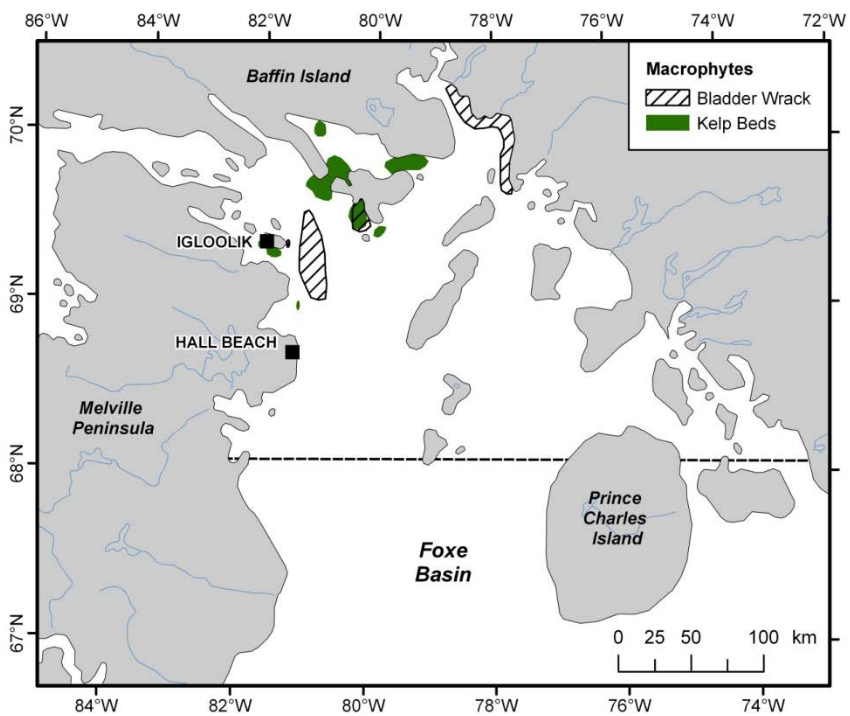

Figure 9. Areas of high abundances of Bladder Wrack (Fucus vesiculosus), a species of seaweed, and kelp beds (modified from NCRI 2008).

MARINE AND ANADROMOUS FISHES

Many fish species including Arctic Char have been recorded within (or near) the Foxe Basin area (Table 1). Several species of freshwater salmonids were found in marine waters and were included in the table below. Further scientific research is needed to determine distribution, abundance estimates and specific habitat use of each of these species in the region.

Table 1. Common and scientific names of fishes caught in marine waters in or near the Foxe Basin area (from Stewart and Bernier 1984, DFO unpubl. data). Species and common names following the American Fisheries Society convention (Page et al. 2013).

Family	Common Name	Scientific Name
Osmeridae	Capelin	*Mallotus villosus*
Salmonidae	Arctic Char	*Salvelinus alpinus*
Salmonidae	Lake Trout	*Salvelinus namaycush*
Salmonidae	Arctic Cisco	*Coregonus autumnalis*
Salmonidae	Cisco	*Coregonus artedi*
Salmonidae	Lake Whitefish	*Coregonus clupeaformis*
Salmonidae	Arctic Grayling	*Thymallus arcticus*
Gadidae	Arctic Cod	*Boreogadus saida*
Gadidae	Atlantic Cod	*Gadus morhua*
Gadidae	Polar Cod	*Arctogadus glacialis*
Gadidae	Greenland Cod	*Gadus ogac*
Gasterosteidae	Ninespine Stickleback	*Pungitius pungitius*
Gasterosteidae	Threespine Stickleback	*Gasterosteus aculeatus*
Cottidae	Arctic Staghorn Sculpin	*Gymnocanthus tricuspis*
Cottidae	Twohorn Sculpin	*Icelus bicornis*
Cottidae	Spatulate Sculpin	*Icelus spatula*
Cottidae	Fourhorn Sculpin	*Myoxocephalus quadricornis*
Cottidae	Arctic Sculpin	*Myoxocephalus scorpioides*
Cottidae	Shorthorn Sculpin	*Myoxocephalus scorpius*
Cottidae	Ribbed Sculpin	*Triglops pingelii*
Agonidae	Arctic Alligatorfish	*Ulcina olrikii*
Agonodiae	Atlantic Poacher	*Leptagonus decagonus*
Cyclopteridae	Atlantic Spiny Lumpsucker	*Eumicrotremus spinosus*
Cyclopteridae	Leatherfin Lumpsucker	*Eumicrotermus derjugini*
Cyclopteridae	Lumpfish	*Cyclopterus lumpus*
Liparidae	Gelatinous Seasnail	*Liparis fabricii*
Liparidae	Kelp Snailfish	*Liparis tunicatus*
Liparidae	Variegated Snailfish	*Liparis gibbus*
Zoarcidae	Fish Doctor	*Gymnelus viridis*
Zoarcidae	Saddled Eelpout	*Lycodes mucosus*
Zoarcidae	Checker Eelpout	*Lycodes vahlii*
Stichaeidae	Daubed Shanny	*Leptoclinus maculatus*
Stichaeidae	Fourline Snakeblenny	*Eumesogrammus praecisus*
Stichaeidae	Arctic Shanny	*Stichaeus punctatus*

Arctic Char

Arctic Char (*Salvelinus alpinus*) is a key component of northern aquatic ecosystems and is an important food resource for northerners. This species occurs in the rivers and lakes throughout Nunavut and is common in Foxe Basin (Figure 10). Anadromous Arctic Char are commonly found in waterbodies that connect to the sea and have suitable overwintering habitat.

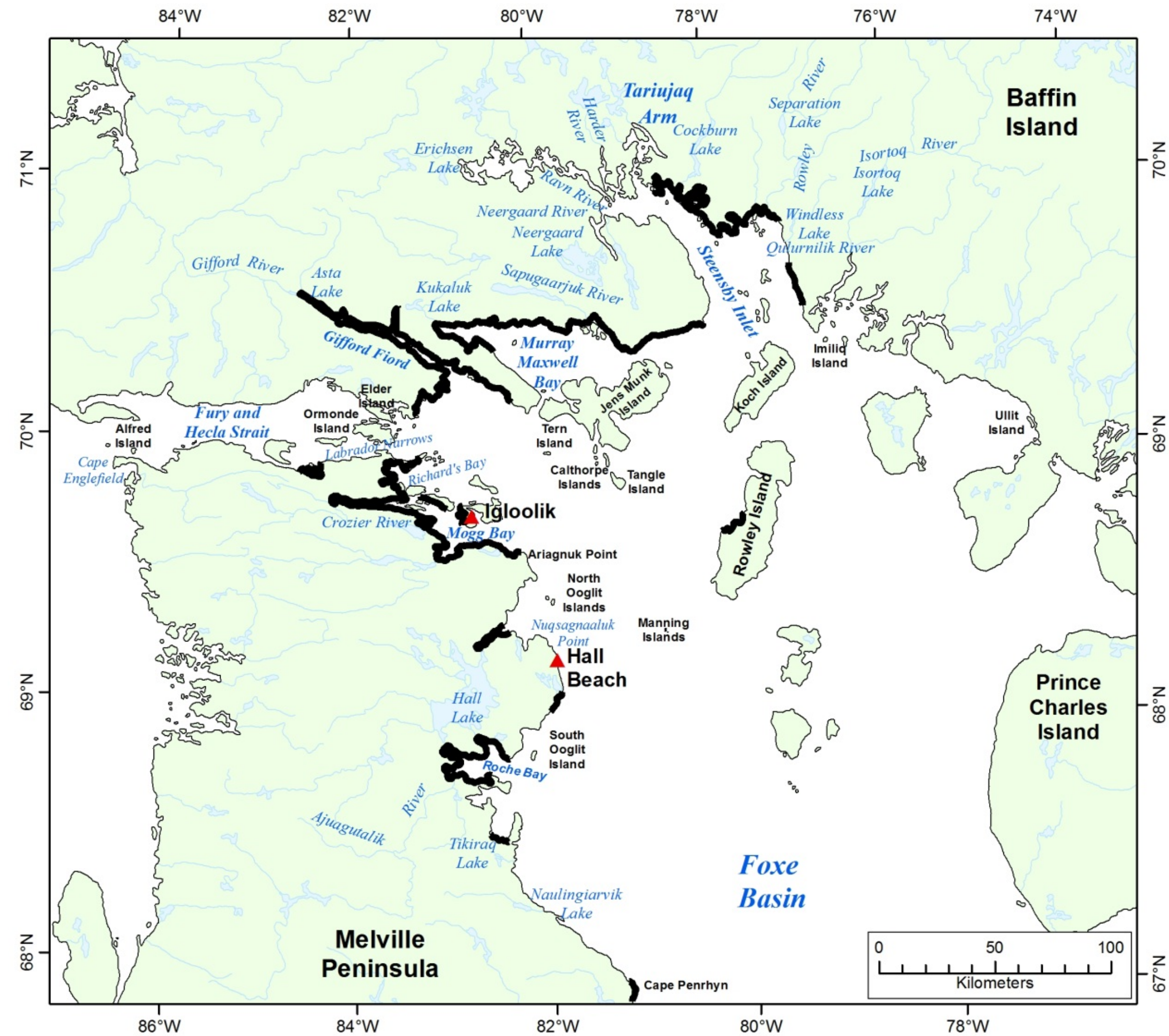

Figure 10. Rivers and lakes in northern Foxe Basin where Arctic Char are found (Kroeker 1985, Read 2000). Marine fishing areas where anadromous Arctic Char are caught between mid-July and mid-September are identified by thick black lines (modified from Stewart and Bernier 1984).

Anadromous Arctic Char migrate to the sea to feed and then move back into freshwater to overwinter and spawn. Stocks mix while feeding in coastal waters. Stewart and Bernier (1984) reported that harvesting by Igloolik fishers ranged throughout the northeastern half of Melville Peninsula, to Jens Munk and Rowley islands and across Fury and Hecla Strait to coastal river systems on the southwestern side of Baffin Island. The fished areas varied by season. Stewart and Bernier (1984) reported that Hall Beach residents concentrate their domestic fishing efforts on lakes, rivers, and coastal waters near the community. They also visit rivers along the southwestern coast of Baffin Island and the southeastern coast of Melville Peninsula.

Yaremchuk et al. (1989) reported historical Arctic Char commercial quotas and harvests for 26 waterbodies/areas in the Igloolik and Hall Beach region. From 1961 to 1987, commercial harvest ranged from about 300 kg to 34,000 kg annually (average about 5,000 kg). Test fisheries have also been conducted in a number of these waterbodies (Kroeker 1985, McGowan 1989). Read (2000) provided data on subsistence and commercial Arctic Char fishing in Igloolik and Hall Beach. Arctic Char were sampled from Kukaluk and Asta lakes near Igloolik, and Tikiraq and Naulingiavik rivers near Hall Beach (Read 2000). The study also included local knowledge surveys. Gifford River, Asta Lake, Kukaluk River, and Lailor Lakes were the fishing sites mentioned most often by Igloolik community members while Hall Lake (Tasiujak Lake) was mentioned most often by Hall Beach community members.

MARINE BIRDS

The Canadian Wildlife Service (CWS) has completed a number of surveys in the study area, including several shorebird studies conducted near Prince Charles Island and several seabird and shorebird surveys in the area near the community of Igloolik. The results are briefly summarised in Mallory and Fontaine (2004). On the basis of these studies, the CWS identified Foxe Basin as one of 33 key marine habitat sites for migratory birds in Nunavut (Mallory and Fontaine 2004). There were insufficient data to delineate specific marine sites or areas within the basin although aggregations of migratory bird species were associated with key oceanographic features, in particular open water leads and polynyas. Surveys conducted to date indicate that aggregations of shorebirds are present in the coastal areas near Prince Charles and nearby islands. These birds likely use the marine zone up to approximately 5 km offshore; however more surveys are needed to confirm this. Similar results are noted at the polynya near Roche Bay. Seabird aggregations have been reported in Fury and Hecla Strait and in or near the polynya in the northwestern portion of the study area. Northern Foxe Basin may be an important moulting location for King Eiders (*Somateria spectabilis*).

The Nunavut Atlas (Riewe 1992) and the Nunavut Coastal Resource Inventory (NCRI 2008) report that the waters of northern Foxe Basin and Fury and Hecla Strait are important feeding and staging areas for many marine birds. In winter, the recurring polynyas and open leads provide feeding sites for over-wintering birds, mainly Black Guillemots (*Cepphus grylle*). They are also important staging areas for eiders, Arctic Terns (*Sterna paradisaea*), gulls and loons waiting for the snow to melt inland to make their way to their nesting grounds. Several known nesting colonies of Arctic Tern, Black Guillemots and Common Eiders (*Somateria mollissima*) occur near the community of Igloolik, Hooper Inlet and the area east of Calthorpe Island (Figure 11). Several small colonies of breeding pairs and nesting gulls occur at both the east and west entrances to the narrow part of Fury and Hecla Strait at Alfred Island, Cape Englefield and the Elder and Ormonde Islands (Figure 11). Roche Bay and Manning Island are known to support several colonies of nesting Arctic Tern and Nugsanarsuk Point is considered an important nesting area for gulls, more specifically, Sabine’s Gull (*Xema sabini*) (Figure 11).

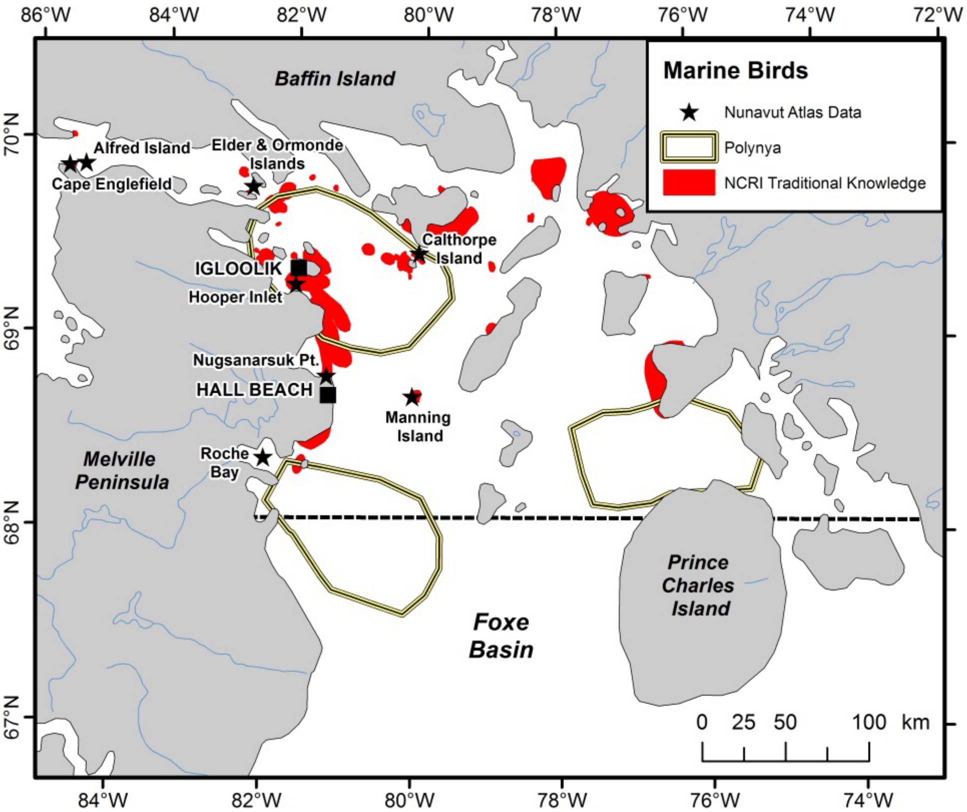

Figure 11. Important marine bird areas identified by local knowledge (Riewe 1992; NCRI 2008). Locations of the three main polynyas are also shown (modified from Barber and Massom 2007).

MARINE MAMMALS

Bowhead Whale

The Bowhead Whale is a migratory species with broad distributional ranges in the Canadian Arctic. The distribution and migrations of this species are closely linked to seasonal changes in sea ice (DFO 2008). The Eastern Canada-West Greenland Bowhead Whale population was reduced to low numbers by the end of commercial whaling but appears to have undergone a significant degree of recovery since then (Cosens et al. 2006). Published scientific and traditional knowledge studies document Bowhead Whale use of the northern Foxe Basin study area in spring, summer and fall (Figure 12) (NWMB 2000; Cosens et al. 1997; NCRI 2008; DFO 2009; DFO unpubl. data); winter occurrences of this species appear to be rare.

In spring and early summer, northwestern Foxe Basin is known to be a nursery area (Cosens and Blouw 2003). Shallow waters and ice cover provide conditions suitable for nursing newborns (DFO 2009), yet fewer sightings of Killer Whales (*Orcinus orca*) have been reported there than in western Hudson Bay at a time of year when calves would be highly vulnerable to predation. Higdon and Ferguson (2009) suggest this may be due to the ice conditions in Foxe Basin that create a refuge from predation. Northern Foxe Basin also serves as a migration corridor in spring and fall between wintering waters in Hudson and Davis straits and summering areas in the Canadian Arctic archipelago. Bowheads may use the coastal areas in northwestern Foxe Basin as far south as Cape Penrhyn during their spring and fall migrations (DFO, unpubl. data).

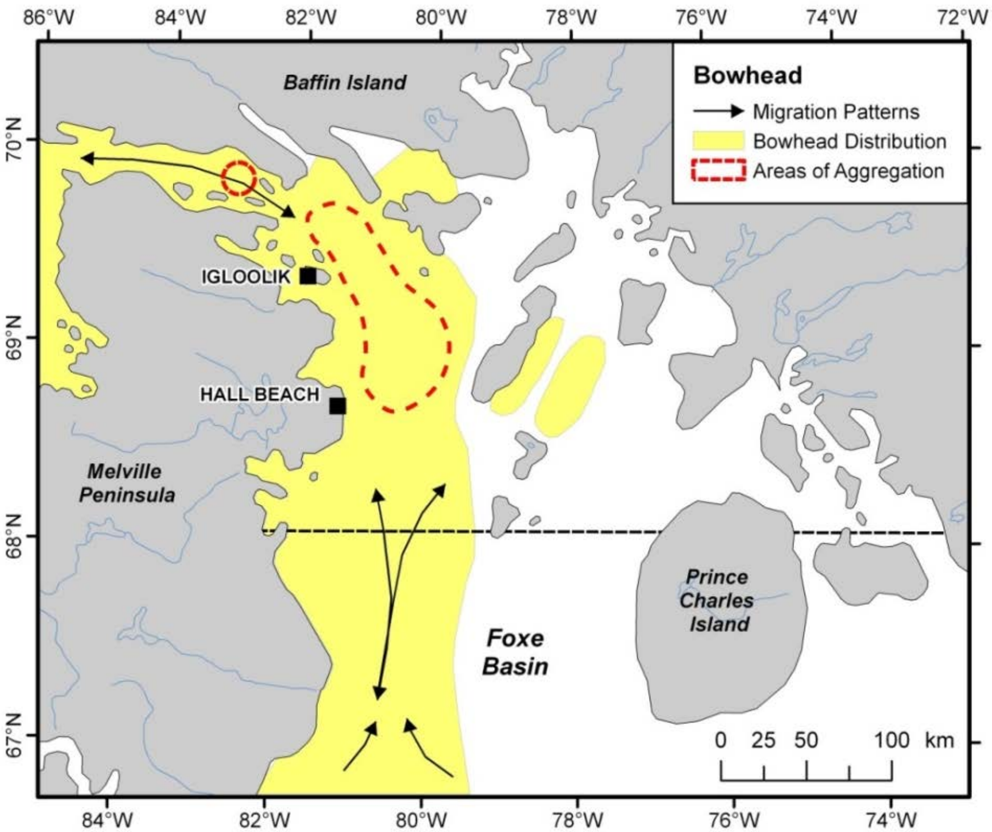

Figure 12. General Bowhead Whale distributions and migration patterns based on community knowledge (NWMB 2000; NCRI 2008) and satellite tagging data (Ferguson et al. 2010a). Areas of aggregation and increased residence time in northern Foxe Basin are also indicated (DFO 2009).

Killer Whale

Killer Whales were sighted infrequently in Foxe Basin in the past, including at least one ice entrapment in the 1950s (Higdon 2007), but in recent years this species is present in northern Foxe Basin every summer when ice conditions are favourable. The marked increase in Killer Whale sightings in Foxe Basin and Hudson Bay since the mid-1900s appears to be related to a decrease in summer sea ice in Hudson Strait (Ferguson et al. 2010b). In general, this species avoids shallow waters and sea ice. Hunters in Foxe Basin have reported a link between the increasing presence of Killer Whales in recent years and an increase in the Bowhead Whale population (Ferguson et al. 2012). Killer Whale sightings in northern Foxe Basin are more frequent in the west near the community of Igloolik (Figure 13). This area generally corresponds to the greatest residence time of Bowhead Whales. In addition, the migratory patterns of Killer Whales and Bowhead Whales are similar (Figures 12 and 13). At least 22 deaths of different Bowhead Whales resulting from Killer Whale attacks have been documented for Foxe Basin, eight of which occurred in 1999 (Ferguson et al. 2012).

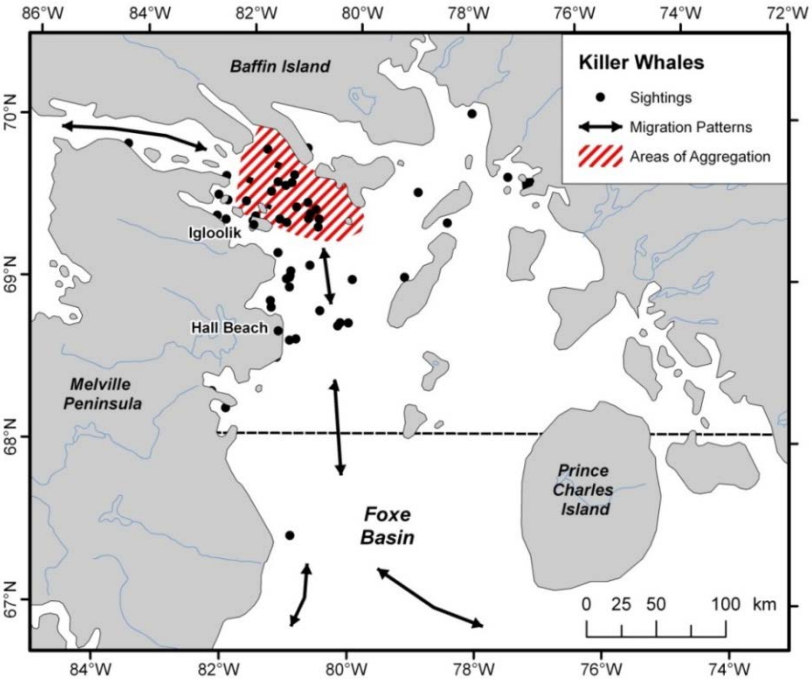

Figure 13. Killer whale sightings, migration patterns and aggregation areas in northern Foxe Basin (NCRI 2008; Ferguson et al. 2010b).

Beluga

Traditional/local knowledge studies indicate that Belugas (*Delphinapterus leucas*) are in north Foxe Basin in the summer and early fall before freeze-up (Stewart et al. 1995, NCRI 2008). During this period, hunters report seeing them searching for food and feeding, between Igloolik, Hall Beach, Rowley and Jens Munk islands, and off Steensby Inlet. In late October, a hunter sighted Belugas travelling in a southward direction past Hall Beach in search of open water (Stewart et al. 1995). Belugas are occasionally sighted in northern Foxe Basin between late November and mid-July when they become entrapped by ice and overwinter in polynyas. Non-systematic surveys conducted in portions of Foxe Basin in April, June, August, September and October 2008 revealed similar results (Baffinland Iron Mines Corporation (BIM) 2011). Belugas were observed at low densities during surveys in April, June and August and at higher densities in September and October, especially in northwest Foxe Basin and in Steensby Inlet. Results from the April and June surveys corroborate hunters' reports that Belugas may overwinter in open-water areas in northern Foxe Basin. Fury and Hecla Strait is an important migration corridor for Belugas.

Narwhal

Narwhals (*Monodon monoceros*) are known to occur in northern Foxe Basin but not in all years. This species occurs infrequently in northern Foxe Basin during winter or spring when animals become entrapped by ice and overwinter in polynyas (Stewart et al. 1995, DFO, unpubl. data). During a survey conducted in April 2008, in a portion of northern Foxe Basin, seven Narwhals were sighted northwest of Prince Charles Island, possibly having overwintered there (BIM 2011). Three Narwhals were sighted in northern Foxe Basin in the vicinity of Koch and Rowley islands during the June 2008 survey but none were seen during the August, September and October surveys. Local hunters report that in summer and early fall, they have observed Narwhals searching for food in the Igloolik area, including Richard's Bay, and moving through Fury and Hecla Strait (Stewart et al. 1995; NCRI 2008). Fury and Hecla Strait is an important migration corridor for Narwhals.

Walrus

Walruses are widely distributed throughout northern Foxe Basin (Figure 14; Foxe Basin Walrus Working Group), particularly in areas where shallow depths and the presence of ice during most of the year offer optimal feeding conditions (NCRI 2008). During the open-water season, from late July-early August to early or mid-October (Ford et al. 2009), Walruses typically rest on floating ice or terrestrial haulout sites. Stewart et al. (2013) identified eight former, current and potential Walrus haulout sites within the northern Foxe Basin study area: South Ooglit Island, North Ooglit Islands, Manning Islands, Ullit Island, Imiliq Island, Bushnan Rock (southwest tip of Koch Island), Tern Island and northwestern Jens Munk Island (see Figure 1 for location names). Aerial surveys of the haulout sites and most of the coastline and islands conducted in August-September 2010 and 2011 revealed that at least 3,900 and 6,000 Walruses were present in 2010 and 2011, respectively, not including animals in the water (Stewart et al. 2013).

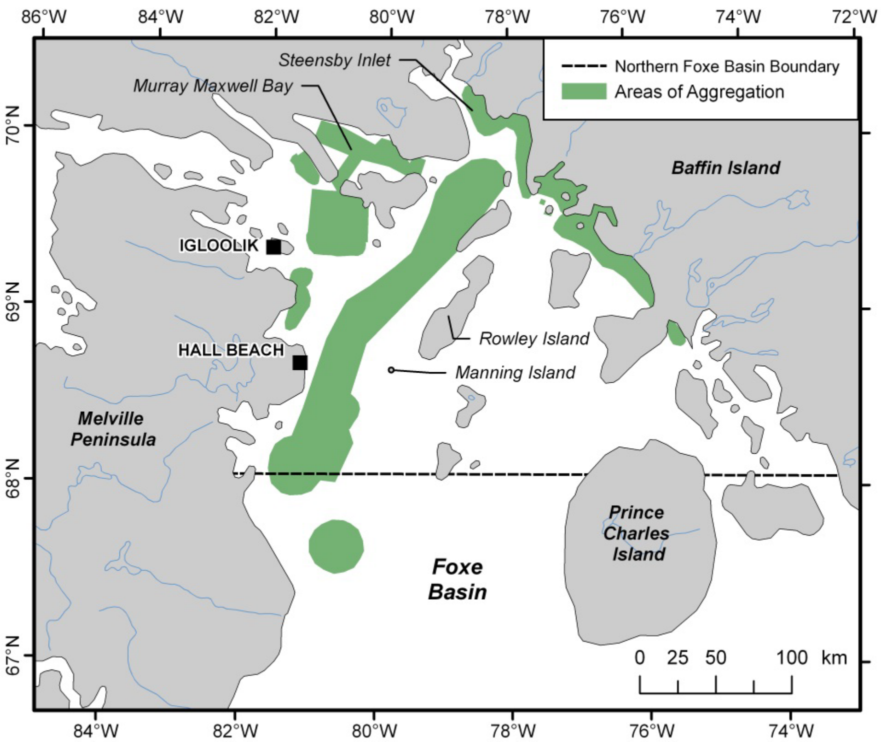

Figure 14. Areas identified as being important to Walrus in northern Foxe Basin (NCRI 2008; Foxe Basin Walrus Working Group, unpubl. data).

Bearded Seal

Although only limited information is available, relatively high densities of Bearded Seals are thought to be present in northern Foxe Basin year-round in areas where clam beds and benthic communities exist (Figure 15; NCRI 2008; Rob Stewart, pers. comm.). Local hunters report that in February, prior to pupping, Bearded Seals travel north along the west side of the basin between Hall Beach and Igloolik (Foxe Basin Walrus Working Group, unpubl. data). As the ice begins to retreat in spring they tend to move inshore to pup and to areas where anadromous fish are moving from freshwater to marine areas and where there is greater availability of molluscs (NCRI 2008). This species has also been observed following fish into Gifford Fjord (NCRI 2008). As ice freeze-up occurs in fall they move farther offshore to open water. Juveniles likely use polynyas and open water throughout the year to the extent possible (Steve Ferguson, pers. comm.).

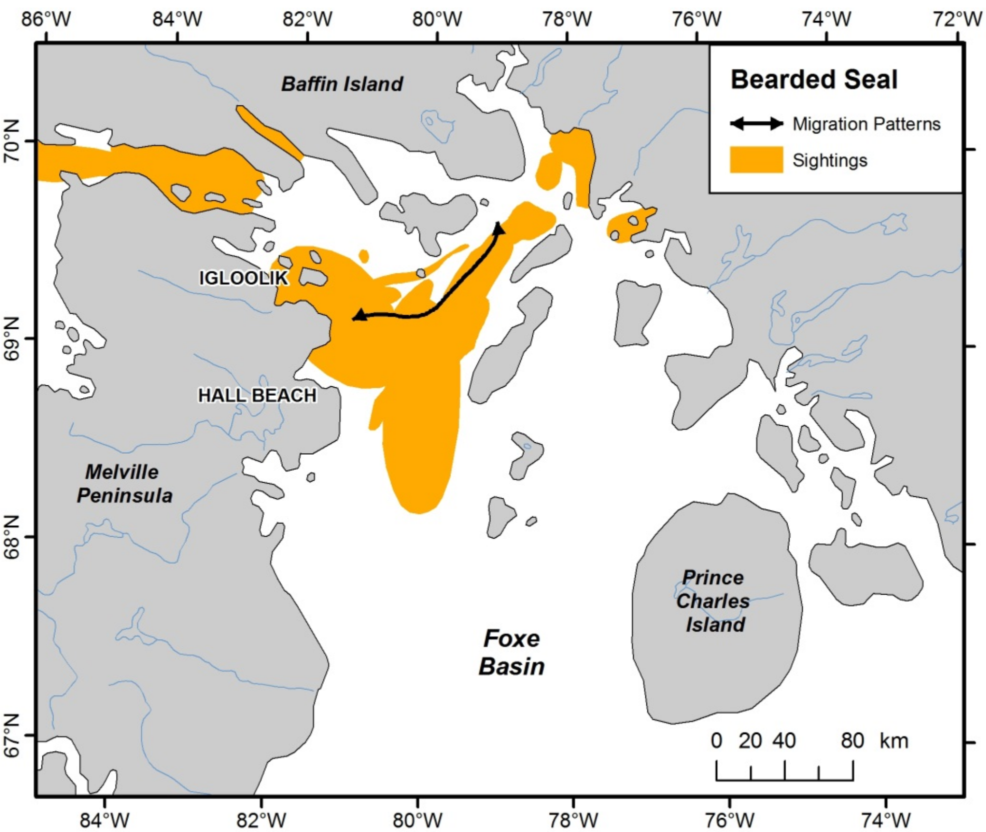

Figure 15. Areas identified as being important to Bearded Seal in northern Foxe Basin (NCRI 2008).

Ringed Seal

In northern Foxe Basin, Ringed Seals (*Phoca hispida*) are reported to be most common along the northwestern coastline, and in Gifford Fjord and Fury and Hecla Strait (NCRI 2008). These areas offer Arctic Cod for feeding and ice conditions in spring that support breeding and pupping (NCRI 2008). Juveniles likely use polynyas and open water throughout the year to the extent possible (Steve Ferguson, pers. comm.). This species typically prefers deeper waters which may account for the relatively lower densities in northern Foxe Basin than in other areas of the Arctic for which there are data.

Harp Seal

Harp Seals (*Phoca groenlandica*) follow the receding pack ice from the east coast of Canada into the archipelago in spring and make the return migration in fall. Some animals migrate through Hudson Strait into Foxe Basin where they are seen most often in summer and fall, primarily between Igloolik and Melville Peninsula (NCRI 2008).

OTHER SPECIES

Polar Bear

Polar Bears (*Ursus maritimus*) are widely distributed in northern Foxe Basin (NCRI 2008), aggregating along the coast during late summer and denning in Murray Maxwell Bay and in Fury and Hecla Strait (Figure 16; Hillary Robison, pers. comm.). The size of the Foxe Basin Polar Bear population, which includes northern Hudson Bay, was estimated to be about 2,100 bears in the mid-1990s (Stirling and Parkinson 2006) and about 2,600 bears in late summer 2009-2010. During the latter study, high numbers of bears were observed on islands in northern Foxe Basin.

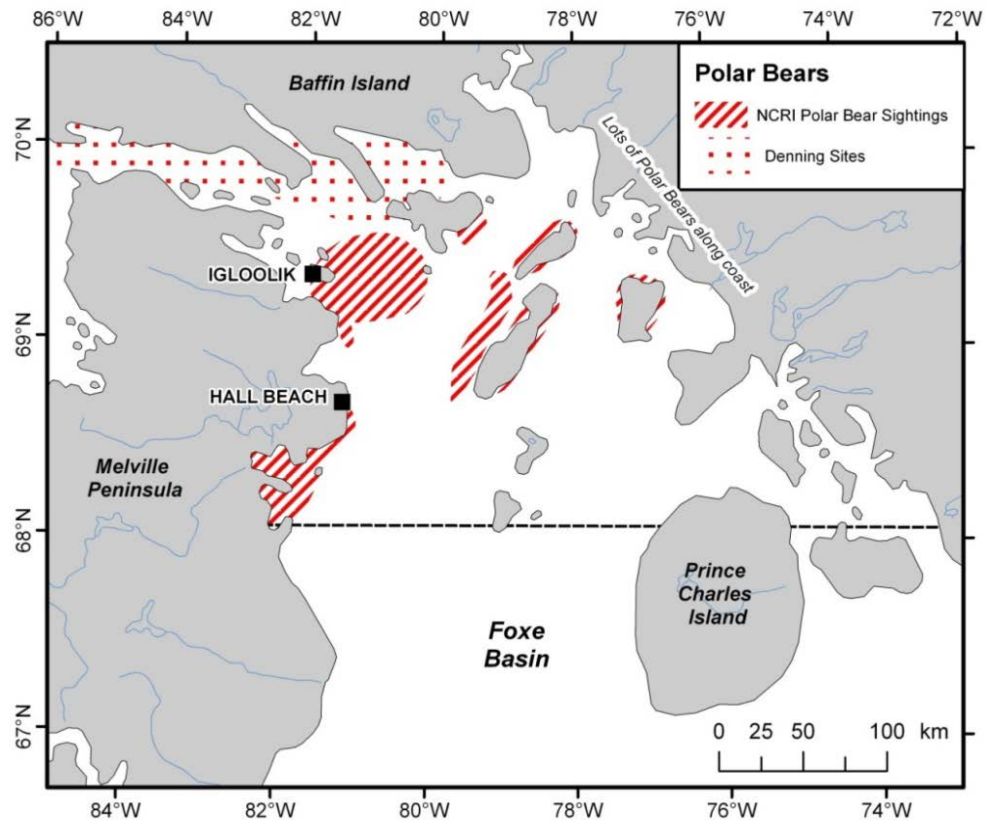

Figure 16. Polar Bear sightings and denning sites in northern Foxe Basin (sighting data from NCRI 2008; denning data provided by H. Robison, Government of Nunavut).

CONCLUSIONS AND SOURCES OF UNCERTAINTY

Three EBSAs were identified and delineated in the Northern Foxe Basin study area based on the best available biological and ecological information (Figure 17). They were named according to a relevant geographical feature or place name: Rowley Island, Igloolik Island and Fury and Hecla Strait. The Rowley Island EBSA comprises most of Steensby Inlet and the area southwest of there, between Jens Munk, Tangle, Koch, and Rowley islands, to the eastern coast of Melville Peninsula from Arlagnuk Point to Cape Penrhyn (Figure 17) covering an area of about 17,700 km^2. The Igloolik Island EBSA comprises an area that is bounded by Arlagnuk Point on the eastern coast of Melville Peninsula, the southern tip of Jens Munk Island and just east of Ormande and Elder islands at the eastern end of Fury and Hecla Strait (Figure 17), covering an area of about 4,750 km^2. The Fury and Hecla Strait EBSA extends from Cape Englefield at the western entrance of the Strait to just east of Ormonde and Elder islands near the eastern entrance of the Strait (Figure 17), covering an area of about 3,100 km^2.

Ratings for the three ecological criteria (i.e., uniqueness, aggregation and fitness consequences) and the two qualifiers (i.e., resilience and naturalness) for the features present in each EBSA are outlined in Tables 2-4.

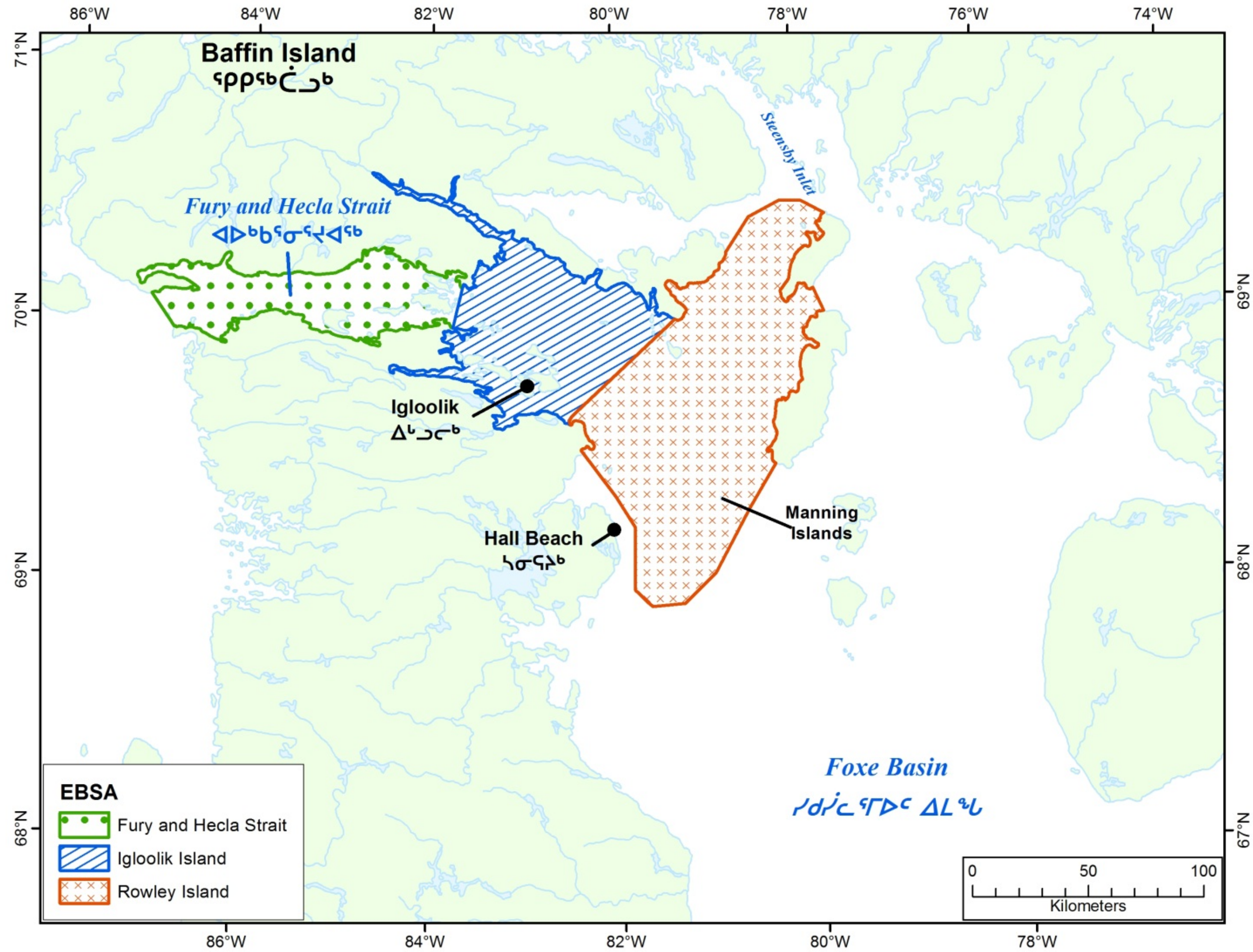

Figure 17. The three EBSAs identified and delineated within the northern Foxe Basin study area.

Table 2. Ratings of the three ecological criteria (dimensions) of uniqueness, aggregation and fitness consequences and the two qualifiers of resilience and naturalness, along with the level of confidence in the data supporting each EBSA, for the features present in the Rowley Island EBSA.

Feature	Level of Confidence	Uniqueness	Aggregation	Fitness Consequences	Resilience	Naturalness
Sea ice	HIGH	Benthic and water column productivity and dynamics are important to many species. The ice edge is used as a platform by several marine mammal species, as well as lower trophic levels.	Marine mammals, benthic invertebrates, under-ice algae, zooplankton and fishes (likely Arctic Cod) are known to aggregate on and below the sea ice and at the ice edge.	Sea ice provides important habitat for multiple life history stages for a number of species. This EBSA is considered to be seasonal refugium for many species.		Ice edge and sea ice is formed by local oceanography and climate.
	MEDIUM				Assuming climate change trends continue to affect parameters that create sea ice, this feature will likely vary in timing or appearance, duration, extent, thickness and age over time.	
Primary production	UNKNOWN	This area is subject to recurrent wind-induced upwelling and the influence of currents from western Fury and Hecla Strait. A large portion of the EBSA is open water during spring due to a large polynya. Increased primary productivity likely occurs at the sea ice edge, particularly in spring, The degree of diversity in species composition and the values in biomass or abundance are unknown.				

Feature	Level of Confidence	Uniqueness	Aggregation	Fitness Consequences	Resilience	Naturalness
Zooplankton	UNKNOWN	Similar to results for primary production, the oceanography of this region suggests that zooplankton are abundant at the sea ice edge and in open waters during summer when Bowhead Whales are feeding (retention zones). The degree of diversity in species composition and the values in biomass or abundance are unknown.				
Benthic invertebrates	UNKNOWN	Insufficient scientific data exist to evaluate these criteria. However, local people report that clam beds occur just northeast of the EBSA.				
Marine plants	UNKNOWN	Insufficient scientific data exist to evaluate these criteria. However, local people report that Bladder Wrack occurs in the region. This may be important habitat for other species in the area.				

Feature	Level of Confidence	Uniqueness	Aggregation	Fitness Consequences	Resilience	Naturalness
Arctic Char	**MEDIUM**	Arctic Char use coastal areas in Foxe Basin during the open-water period as they do in many other coastal areas in Nunavut.	Anadromous Arctic Char feed in the coastal waters of this EBSA.	Coastal waters provide important feeding habitat and migration corridors for this species. Timing of break-up and freeze-up determines the length of time that Arctic Char can feed which effects condition and spawning potential.	Arctic Char is a highly adaptable and resilient species. It inhabits environmental extremes, and responds to interspecific interactions and environmental variation with shifting trophic roles, niche use and life-history changes indicating ecological resilience and phenotypic plasticity (Hammar 2011). The species reacts to high levels of exploitation, and possibly variable climatic conditions, with changes in size, growth and age configurations (Dempson et al. 2008). After exploitation is reduced and environmental conditions ameliorated, the species also shows a return to pre-exposure population characteristics (Dempson et al. 2008).	Although some fishing occurs, most is for subsistence purposes and the impacts are focussed near communities. The coastal areas used by Arctic Char in this EBSA currently remain largely unimpacted by human activities.

Feature	Level of Confidence	Uniqueness	Aggregation	Fitness Consequences	Resilience	Naturalness
Marine fishes	**UNKNOWN**	Point distribution maps are the only information available for this region thus there are insufficient data available to evaluate these criteria.				
Marine birds	**MEDIUM**		Feeding and/or staging area(s) for marine birds.	Nesting Arctic Terns feed and/or stage close to colonies on Manning Island.		
Marine mammals	**HIGH**	Important Walrus habitat Important Bowhead Whale habitat	There are at least three known terrestrial Walrus haulout sites in this EBSA. Bowhead Whale nursery area. Important migratory route for Bowhead Whales, Belugas and Narwhals.	Walruses use sea ice and terrestrial haulouts for birthing, nursing, resting, moulting and access to nearby feeding areas. Female Bowhead Whales with calves and juveniles aggregate in summer to feed and rest; sea ice provides seasonal refugia. Killer Whales prey on Bowhead Whales. Migratory route for marine mammals provides access to feeding areas.	Walrus are highly sensitive to disturbance.	

Feature	Level of Confidence	Uniqueness	Aggregation	Fitness Consequences	Resilience	Naturalness
Polar Bears	HIGH		Polar Bears aggregate at terrestrial Walrus haulout sites.	Polar Bears prey on Walruses at terrestrial haulout sites where Walruses are more vulnerable to predation.		

Table 3. Ratings of the three ecological criteria of uniqueness, aggregation and fitness consequences and the two qualifiers of resilience and naturalness for the features present in the Igloolik Island EBSA.

Feature	Level of Confidence	Uniqueness	Aggregation	Fitness Consequences	Resilience	Naturalness
Polynya	HIGH	Heat exchange and circulation create a polynya which supports biological productivity and diversity.	Planktonic organisms aggregate at the ice edge of polynyas which supports increased productivity at the higher trophic levels. Migratory mammals use this open-water area to move into the eastern entrance of Fury and Hecla Strait.	In the absence of this polynya, several species would not have access to important nursery and feeding grounds. Availability of prey leads to local and variable fitness consequence issues.		This polynya is created by tidal events and currents.

Feature	Level of Confidence	Uniqueness	Aggregation	Fitness Consequences	Resilience	Naturalness
	MEDIUM				Assuming climate change trends continue to affect parameters that create polynyas their persistence and variability will vary (timing or appearance, duration and size).	
Sea ice	HIGH	Benthic and water column productivity and dynamics important to many species. The ice edge is used as a platform by several marine mammal species, as well as lower trophic levels.	Marine mammals, benthic invertebrates, under-ice algae, zooplankton and fishes (likely Arctic Cod) are known to aggregate on and below the sea ice and at the ice edge.	Sea ice provides important habitat for multiple life history stages for a number of species.		Ice edge and sea ice is formed from local oceanography and climate.
	MEDIUM				Assuming climate change trends continue to affect parameters that create sea ice, this feature will likely vary in timing or appearance, duration, extent, thickness and age over time.	

Feature	Level of Confidence	Uniqueness	Aggregation	Fitness Consequences	Resilience	Naturalness
Tidal mixing	HIGH					Tidal mixing occurs in response to local oceanography, topography, freshwater input and climate.
	UNKNOWN	Tidal mixing zones are often associated with increased productivity and dynamics that are important for many species; however it is unknown to what extent this occurs here.				
Upwelling zones	HIGH		This feature likely generates areas of retention for planktonic organisms and nutrients.	Retention zones are highly productive areas that provide food for a number of species that are reliant on these areas as their main summer feeding areas.	Dynamic both spatially and temporally therefore location, duration and timing are unpredictable.	Driven primarily by water currents and sea floor topography.
Primary production	UNKNOWN	This area is subject to recurrent wind-induced upwelling and the influence of currents from western Fury and Hecla Strait. A large portion of the EBSA is open water during spring due to a large polynya. Increased primary productivity likely occurs at the sea ice edge, particularly in spring. The degree of diversity in species composition and the values in biomass or abundance are unknown.				

Feature	Level of Confidence	Uniqueness	Aggregation	Fitness Consequences	Resilience	Naturalness
Zooplankton	**UNKNOWN**	Similar to results for primary production, the oceanography of the region suggests that zooplankton are abundant at the sea ice edge and in open waters during summer when Bowhead Whales are feeding (retention zones). Species composition and the values in biomass and abundance are available but only for a limited number of sampling stations.				
Benthic invertebrates	**UNKNOWN**	Insufficient scientific data exist to evaluate these criteria. However, local people report that clam and mussel beds occur in the EBSA. As well, aggregations of Walruses and Bearded Seals feeding in the EBSA suggest that the productivity at the sea floor is high compared to other areas in northern Foxe Basin.				
Marine plants	**UNKNOWN**	Insufficient scientific data exist to evaluate these criteria. However, local people identified areas where Bladder Wrack occurs in the region which may be important habitat for other species in the area.				

Feature	Level of Confidence	Uniqueness	Aggregation	Fitness Consequences	Resilience	Naturalness
Arctic Char	**MEDIUM**	Arctic Char use coastal areas in Foxe Basin during the open-water period as they do in many other coastal areas in Nunavut.	Anadromous Arctic Char feed in the coastal waters of this EBSA.	Coastal waters provide important feeding habitat and migration corridors for this species. Timing of break-up and freeze-up determines the length of time that Arctic Char can feed which effects condition and spawning potential.	Arctic Char is a highly adaptable and resilient species. It inhabits environmental extremes, and responds to interspecific interactions and environmental variation with shifting trophic roles, niche use and life-history changes indicating ecological resilience and phenotypic plasticity (Hammar 2011). The species reacts to high levels of exploitation, and possibly variable climatic conditions, with changes in size, growth and age configurations (Dempson et al. 2008). After exploitation is reduced and environmental conditions ameliorated, the species also shows a return to pre-exposure population characteristics (Dempson et al. 2008).	Although some fishing occurs, most is for subsistence purposes and the impacts are focussed near communities. The coastal areas used by Arctic Char in this EBSA currently remain largely unimpacted by human activities.

Feature	Level of Confidence	Uniqueness	Aggregation	Fitness Consequences	Resilience	Naturalness
Marine fishes	**UNKNOWN**	Point distribution maps are the only information available for this region thus there are insufficient data available to evaluate these criteria.				
Marine birds	**MEDIUM**		Feeding and/or staging area(s) for marine birds.	Over-wintering Black Guillemots use polynyas and leads to feed. Arctic Terns, Black Guillemots, Common Eiders and loons stage in this EBSA prior to nesting.		

Feature	Level of Confidence	Uniqueness	Aggregation	Fitness Consequences	Resilience	Naturalness
Marine mammals	HIGH	Important Bowhead Whale habitat	Bowhead Whale nursery area. There are two unconfirmed Walrus haulout sites in this EBSA. Important migratory route for Bowhead Whales, Belugas and Narwhals. Belugas and Narwhals feed opportunistically in this EBSA.	Female Bowhead Whales with calves and juveniles aggregate in summer to feed and rest; sea ice provides seasonal refugia. Walruses use sea ice and terrestrial haulouts for birthing, nursing, resting, moulting and access to nearby feeding areas. Killer Whales prey on Bowhead Whales in this EBSA. Migratory route for marine mammals provides access to feeding areas.		
Polar Bears	HIGH	Important Polar Bear denning habitat	Polar Bear denning area along the northern coast.	Polar Bear maternal denning sites reduce vulnerability of the cubs and nursing females to hunters and intraspecific predation.	Female Polar Bears with cubs are highly vulnerable during the birthing/ denning period (about late October through to March or April).	

Table 4. Ratings of the three ecological criteria of uniqueness, aggregation and fitness consequences and the two qualifiers of resilience and naturalness for the features present in the Fury and Hecla Strait EBSA.

Feature	Level of Confidence	Uniqueness	Aggregation	Fitness Consequences	Resilience	Naturalness
Water currents	HIGH	Typically strong water currents flow through western Fury and Hecla Strait and through the Labrador Narrows. These waters are vertically homogenous Arctic marine waters.	The currents export multi-year ice into northern Foxe Basin.	The currents are a factor in creating the polynya at the eastern entrance to Fury and Hecla Strait southeast of Igloolik.		These currents are likely created by general Arctic circulation patterns, topography, geography and prevailing winds.
Sea ice	HIGH	The ice is used as a platform by several marine mammal species, as well as lower trophic levels.	Marine mammals, benthic invertebrates, under-ice algae, zooplankton and fishes (likely Arctic Cod) are known to aggregate on and below the sea ice and at the ice edge.	Used as critical habitat for several life history stages for a number of species.		Ice edge and sea ice is formed from local oceanography and climate.
	MEDIUM				Assuming climate change trends continue to affect parameters that create sea ice will likely vary in timing or appearance, duration, extent, thickness and age.	

Feature	Level of Confidence	Uniqueness	Aggregation	Fitness Consequences	Resilience	Naturalness
Tidal mixing	HIGH					Tidal mixing occurs in response to local oceanography, topography, freshwater input and climate.
	UNKNOWN	Tidal mixing zones are often associated with increased productivity and dynamics that are important for many species; however it is unknown to what extent this occurs here.				
Primary production	UNKNOWN	Insufficient scientific data exist to evaluate these criteria. The degree of diversity in species composition and the values in biomass or abundance are unknown.				
Zooplankton	UNKNOWN	Insufficient scientific data exist to evaluate these criteria. The degree of diversity in species composition and the values in biomass or abundance are unknown.				
Benthic invertebrates	UNKNOWN	Insufficient scientific data exist to evaluate these criteria. However, local people report that high abundance of amphipods occurs in the western part of the EBSA.				

Feature	Level of Confidence	Uniqueness	Aggregation	Fitness Consequences	Resilience	Naturalness
Arctic Char	LOW	Arctic Char use coastal areas in Fury and Hecla Strait during the open-water period as they do in many other coastal areas in Nunavut.	Anadromous Arctic Char feed in the coastal waters of this EBSA.	Coastal waters provide important feeding habitat and migration corridors for this species. Timing of break-up and freeze-up determines the length of time that Arctic Char can feed which effects condition and spawning potential.	Arctic Char is a highly adaptable and resilient species. It inhabits environmental extremes, and responds to interspecific interactions and environmental variation with shifting trophic roles, niche use and life-history changes indicating ecological resilience and phenotypic plasticity (Hammar 2011). The species reacts to high levels of exploitation, and possibly variable climatic conditions, with changes in size, growth and age configurations (Dempson et al. 2008). After exploitation is reduced and environmental conditions ameliorated, the species also shows a return to pre-exposure population characteristics (Dempson et al. 2008).	Limited fishing occurs in this EBSA. The coastal areas used by Arctic Char in this EBSA remain largely unimpacted by human activities.
Marine fishes	UNKNOWN	Point distribution maps are the only information available for this region thus there are insufficient data available to evaluate these criteria.				

Feature	Level of Confidence	Uniqueness	Aggregation	Fitness Consequences	Resilience	Naturalness
Marine birds	MEDIUM		Feeding and/or staging area(s) for marine birds.	Nesting gulls feed and/or stage close to colonies located near the east and west ends of Fury and Hecla Strait.		
Marine mammals	HIGH	Important migratory route	Important migratory route for Bowhead Whales, Belugas and Narwhals.	Migratory route for marine mammals provides access to feeding areas.		
Polar bears	HIGH	Important Polar Bear denning habitat	Polar Bear denning area along the northern coast.	Polar Bear maternal denning sites reduce vulnerability of the cubs and nursing females to hunters and intraspecific predation.	Female Polar Bears with cubs are highly vulnerable during the birthing/ denning period (about late October through to March or April).	

While some species and processes that occur within the three EBSAs are relatively well known or understood, others are not, therefore the boundaries of these EBSAs are imprecise both spatially and temporally. This is particularly true for the Rowley Island and Igloolik Island EBSAs whose spatial limits are based on the seasonal and complex nature of ice melt and the formation of polynyas and ice edges. Thus the outlines of the EBSAs, as presented in this document, should be considered an approximation and the precautionary approach should be used in the absence of any existing data.

Limitations in the availability of data and information may have curtailed the identification of additional ecologically important areas in northern Foxe Basin. Locations of the communities (i.e., Igloolik and Hall Beach) may have biased the availability of information in favour of areas located closer to the communities which have a higher likelihood of being better studied. However, this may not be valid concern because communities are more likely to be located in or near areas that support greater wildlife abundance and/or diversity and good hunting opportunities. Changes associated with ongoing climate change (e.g., earlier ice break-up and later freeze-up) and their effects on the ecosystem in northern Foxe Basin may influence where and when ecologically and biologically significant areas occur.

The three EBSAs combined represent almost 47% coverage (25,550 km^2 of 54,810 km^2) within the study area. Although the exercise was focussed on the Northern Foxe Basin study area, the Rowley Island EBSA was extended beyond the study area into adjacent waters to capture more of the polynya south of Hall Beach, thought to be continuously open during winter, and the ecological importance of that area as identified by local knowledge. As new information comes available and/or effects of human activities like climate change or resource development occur, the boundaries of the three EBSAs and the potential for additional EBSAs in the study area should be re-evaluated.

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