

APPENDIX 3

The biological importance of the North East Water polynya, NE Greenland, 2010

Introduction

The North East Water (NEW) is a polynya off the North-east coast of Greenland (Figure 1). A polynya is an area of open water surrounded by sea ice that occurs seasonally at the same time and place each year. The NEW typically begins to open in April and closes in September. However, even during winter cracks and leads of open water are present.

The extent of the NEW varies considerably from year to year. In spring it typically extends from the Nordostrundingen at app. 81° N, 11° W and southwards to the Henrik Krøyer Holme which is three small islands situated at 80° 38' N; 13° 43' W (Figure 2). Later during the summer the borders are less well defined as a large area of open water typically develops off the North-east coast of Greenland (Figure 3).

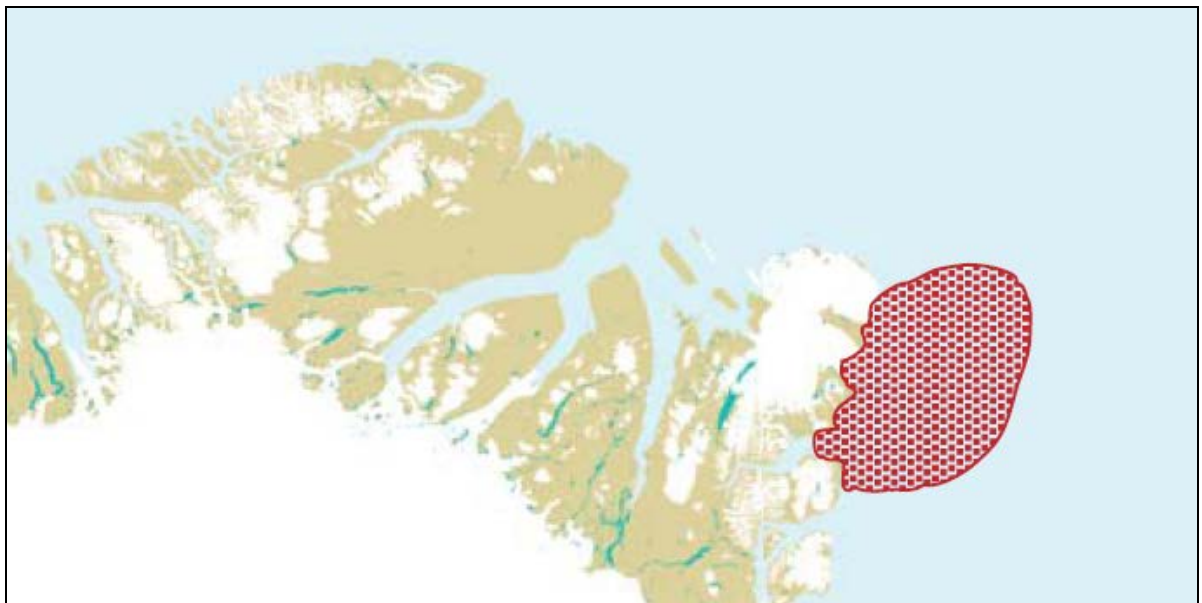


Figure 1. The location of the NEW. The area of open water varies considerably during the years but also between years (from Aastrup & Boertmann 2009).

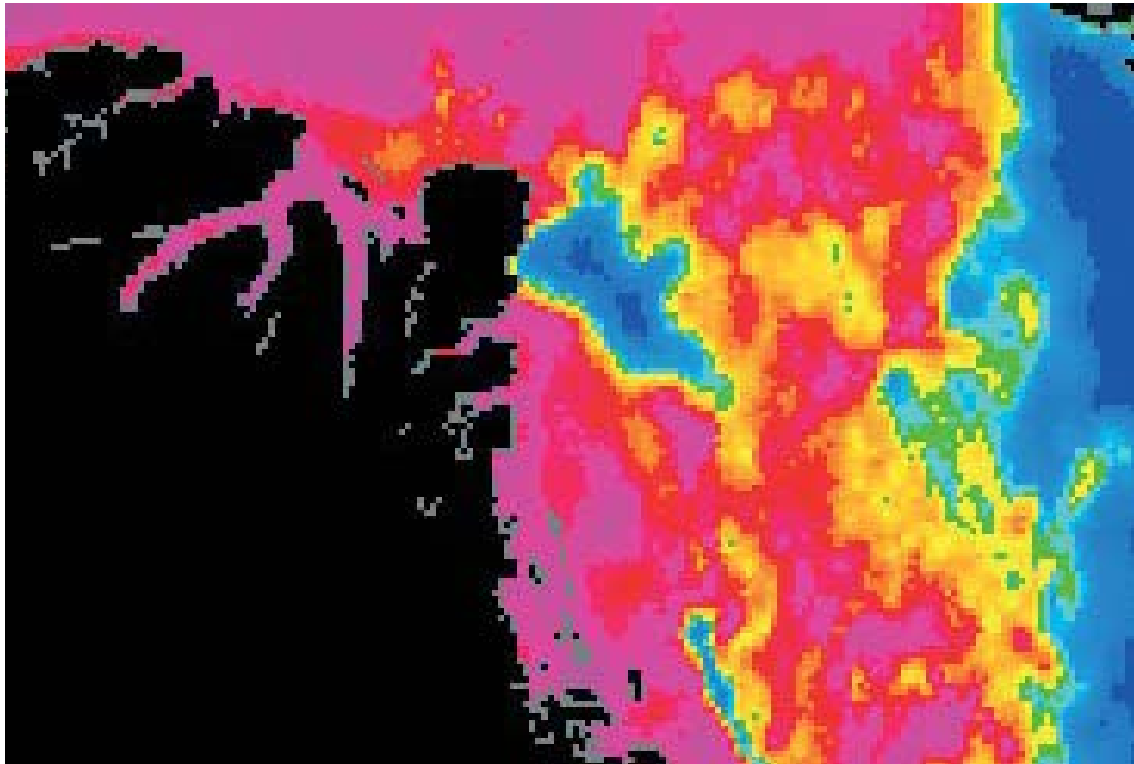


Figure 2. The ice situation off North-east Greenland on May 26, 2008. The NEW is the blue area in the centre. Purple and red indicate high ice concentrations, yellow and green low concentrations and blue no ice (from Boertmann & Nielsen 2010).

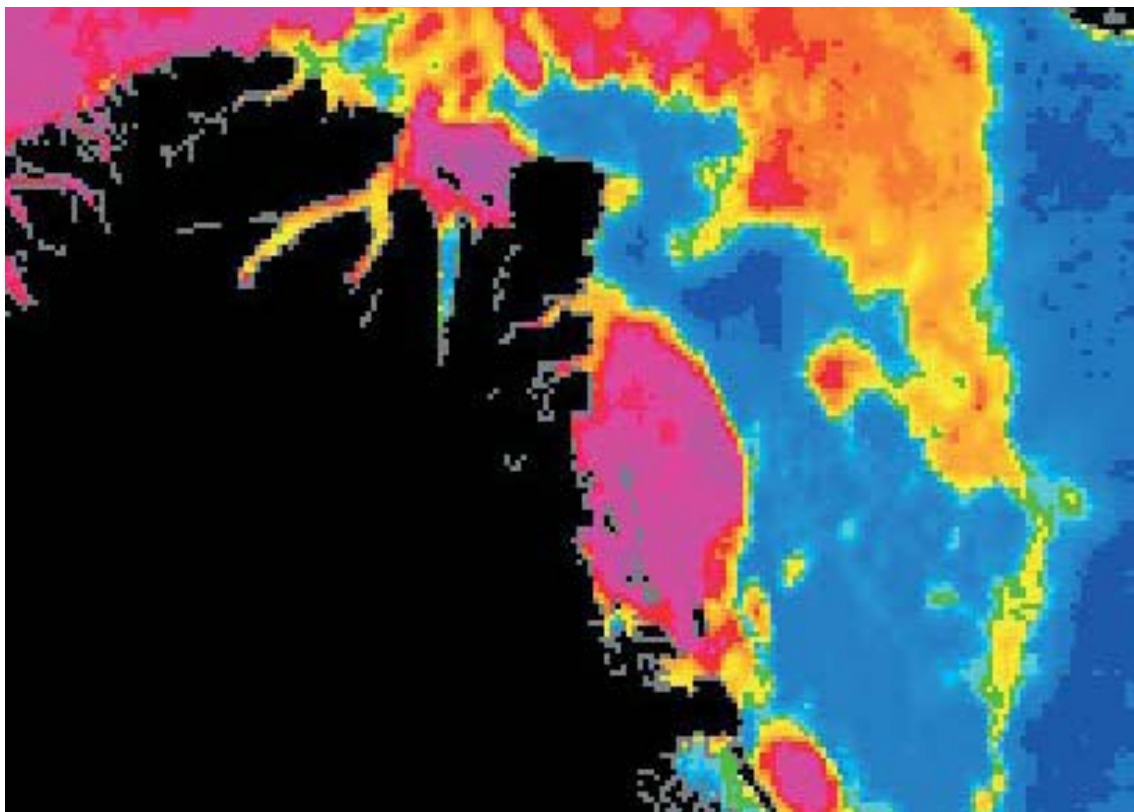


Figure 3. The ice situation off North-east Greenland on July 26, 2008 (from Boertmann & Nielsen 2010).

Why is the NEW important to seabirds and marine mammals?

The predictability of polynyas makes them important to biological life. In terms of the NEW, only sea birds and marine mammals have been studied in any detail. This has shown that the NEW makes it possible for seabirds that forage solely in the marine environment and therefore need ice free water to gain access to their prey, to begin breeding on the cliffs along the shore in June when most of the sea off NE Greenland is still covered in ice. The open water in cracks and leads in winter even permits walrus to stay in the NEW throughout the year. And as soon as larger areas of open water are present in May-June more marine mammals including Narwhals migrate into the NEW. At present it is largely unknown whether or not it is just the open water that makes the NEW biological important, or if it is more biologically productive as well.

The marine mammals of the NEW

Walrus, Polar bear and Ringed seal occur throughout the year in the NEW. In spring several other marine mammals migrate into the area. In the following brief, accounts are given on the status of the marine mammals the NEW is particularly important for.

Polar bear *Ursus maritimus*

The NEW is an important feeding and breeding area for Polar bears (Aastrup & Boertmann 2009). Many breeding dens are found along the coast and the bears feed on seals on the sea ice, mainly relatively close to the shore (Figure 4). When the NEW opens the bears are mainly found along the edges and in July-August few seem associated with the NEW (Boertmann *et al.* 2009, Boertmann & Nielsen 2010).



Figure 4. Core area for Polar bear near the NEW. The area indicates where female bears with small pups have often been recorded (from Aastrup & Boertmann 2009).

Walrus *Odonenus rosmarus*

The NEW probably has the largest population of walrus along the east coast of Greenland. On the 3-4 June 2008 104 walruses were observed including many females with calves (Boertmann *et al.* 2009). The population was estimated to 470 animals but this figure is based on few observations and is therefore imprecise (Aastrup & Boertmann 2009). The walruses were mostly observed close to the shores where they were resting on the scattered ice floes and on the ice edge (Figure 5). Very few were seen in late July 2008 and late July 2009 (Boertmann *et al.* 2009, Boertmann & Nielsen 2010), which perhaps suggest that the walruses are more scattered along the coast during the height of summer when more open water is found. Satellite tracking of a male walrus showed that during a four year period it wintered in the NEW but spent the summer further to the south along the coast at Dove Bay (ca. 76° to 77° N) (Born *et al.* 2005). Satellite tracking has confirmed that the walruses overwinter in the NEW (Born & Knutsen 1992).



Figure 5. Core area for Walrus in North-east Greenland. The blue squares show important haul-outs. The hatched area marks a shallow area which is particularly important for foraging females with young (from Aastrup & Boertmann 2009).

Bearded seal *Erignathus barbatus*

This seal appears to be widespread and relatively common in the NEW. It is unknown if Bearded seals stay in the NEW all year.

In connection with aerial counts in early June 2008 small numbers of Bearded seals were observed on the edge of the NEW (Boertmann *et al.* 2009) while in late July 2008 and late July 2009 only very few were recorded from the NEW (Boertmann *et al.* 2009, Boertmann & Nielsen 2010). This is in contrast with another study which has found the Bearded seal to be common in the NEW (Kristensen & Kristensen 1993).

Ringed seal *Phoca hispida*

This is believed to be the most common and widespread marine mammal in the NEW. The Ringed seal occurs in the area throughout the year.

Narwhal *Monodon monoceros*

Little is known about the status and behaviour of Narwhals in the NEW. The data that exists suggest that they are quite common in May-August in large parts of the NEW (Figure 6). During aerial counts in early June 2008 17 pods with a minimum 32 whales were observed along the NEW's southern ice edge (Boertmann *et al.* 2009) while in late July 2008 and late July 2009 low numbers were recorded throughout the polynya (Boertmann *et al.* 2009, Boertmann & Nielsen 2010). However, this was in contrast with observation made in connection with another study, when almost 200 Narwhals in 64 pods were observed in the NEW in mid-August 2009 (Boertmann & Nielsen 2010).

Studies of other populations in west Greenland and north Canada have revealed that these Narwhals are highly migratory and follow a cyclical rhythm related to seasonal changes in Arctic ice coverage and marine production (Laidre & Heide-Jørgensen 2005). During winter months these Narwhals prefer deep-water offshore areas but move to inshore areas during the open-water season from July to September (Dietz *et al.* 2008). The reason these Narwhals move inshore during summer is unknown. West Greenland Narwhals feed very little during the summer season (Laidre and Heide-Jørgensen 2005), and summering grounds do not appear to be related to calving needs given calves are born in the spring (Laidre *et al.* 2006). It has been hypothesized that their summer distribution in West Greenland and North Canada may be related to potential predation by Killer whales but this lacks conclusive evidence (Laidre *et al.* 2006). It is unknown if the Narwhals that occur in the NEW also move between offshore wintering grounds and inshore summer areas and feed very little during summer, but given the overall similarity of the areas the populations occupy it seems likely.



Figure 6. Core area for Narwhals during May-August (from Aastrup & Boertmann 2009).

Bowhead whale *Balaena mysticetus*

Bowhead whales are believed to be generally a rare/uncommon spring and summer visitor to the east Greenland coast. This is based on very few observations although the number of sightings of this critically endangered species has increased since the mid-1980s (Gilg & Born 2005, Wiig *et al.* 2008). In recent years the number of observations has increased significantly suggesting that either the population is larger than previously thought or it has increased. For example 14 Bowhead whales were observed in the NEW in mid-August 2009 (Boertmann pers. com) and in June 2008 a female Bowhead whale with a small calf was observed at the ice edge at 78° 41' N, 16° 26' W just south of the NEW (Boertmann & Nielsen 2010). This was only the second observation of reproduction in recent decades of Bowhead whales off Greenland (Boertmann & Nielsen 2010).

Sea birds associated with the NEW

A number of seabird species occur regularly at the NEW. These include (1) sea ducks that spring-stage along the coastal parts of the NEW in May-June before dispersing to breeding sites along the coast and inland and (2) seabirds that breed on the cliffs along the shore of the NEW and on Henrik Krøyer Holme and feed on fish and zooplankton in the polynya. In the following brief accounts are given of the status of the sea birds the NEW is particularly important for.

Fulmar *Fulmarus glacialis*

The Fulmar breeds in six colonies on cliffs along the edge of the NEW (Falk *et al.* 1997). In the early 1990ies the breeding population was estimated to about 1,500 pairs (Falk & Møller 1995). In addition to the breeding population a number of non-breeding Fulmars were also associated with the colonies. The total number of Fulmars in the NEW during summer was therefore estimated to 5,100 birds (Falk *et al.* 1997). Fulmars arrive to the colonies in April-May and leave the NEW shortly before it freezes over again in September (Falk *et al.* 1997). In the NEW (in 1993) the foraging conditions for the Fulmars seemed somewhat constrained with the pairs having long incubation shifts and chicks were left unguarded sooner than in other colonies despite a clear predation risk (Falk & Møller 1997). Also the lack of a diurnal attendance pattern, possibly to allow long foraging trips, suggests a moderate food supply in the NEW (Falk & Møller 1997). During the breeding period Fulmars were recorded in low densities all over the polynya (Falk *et al.* 1997). Aerial surveys for birds and mammals in 2008 and 2009 also recorded low densities of Fulmars in the NEW (Boertmann *et al.* 2009, Boertmann & Nielsen 2010).

Common eider *Somateria mollissima*

This sea duck arrives to the NEW in late April-early May. The birds first gather in flocks along coasts with shallow water (Figure 7). In 2008 about 4,600 eiders were observed along the coast in May-June (Boertmann *et al.* 2009). In June the ducks disperse and start breeding scattered along the coast. In July flocks of up to 100 males have been recorded off the coast (Falk *et al.* 1997). During July and August most eiders observed in connection with aerial counts in 2008 and 2009 were mainly females with young, non- (?) or failed breeders and males (Boertmann *et al.* 2009, Boertmann & Nielsen 2010). Later in August-September the Common eiders leave the NEW and migrate south. The Common eiders are almost exclusively observed close to the coast.

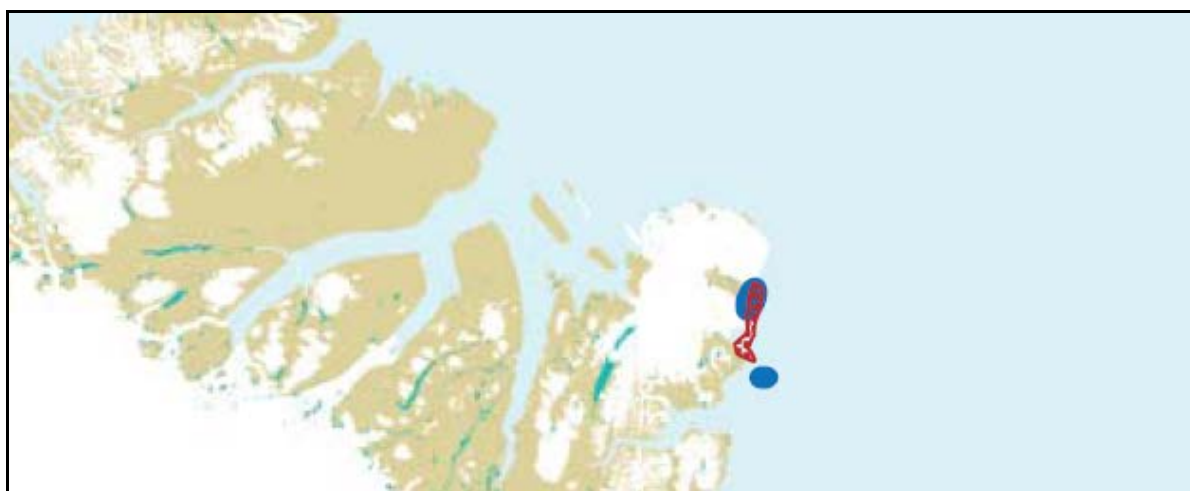


Figure 7. The hatched area marks the important spring staging areas for Common eider in the NEW. The blue spots show important breeding areas (from Aastrup & Boertmann 2009).

King eider *Somateria spectabilis*

The King eider arrives to the NEW from late April into May. Initially the arriving ducks form large flocks along the coast of the NEW (Figure 8), often mixing with Common eider. For example, in May-June 2008 over 1,500 spring staging King eiders were recorded along the coast of the NEW (Boertmann *et al.* 2009). In June-July the ducks disperse to inland breeding sites. Post-breeding congregations seem rare with only a few small flocks recorded in 1993 (Falk *et al.* 1997) and during aerial counts in 2008 and 2009 (Boertmann *et al.* 2009, Boertmann & Nielsen 2010).



Figure 8. The extent of the spring staging area of King eider in the NEW (from Aastrup & Boertmann 2009).

Ivory gull *Pagophila eburnea*

Greenland's largest colony of this high arctic gull is located on Henrik Krøyer Holme (Boertmann *et al.* 2009) where 100-300 pairs breed (Aastrup & Boertmann 2009). In 2009 about 135 breeding pairs were recorded along the shore of the NEW but this year no pairs were breeding on Henrik Krøyer Holme (Boertmann & Nielsen 2010). Outside the breeding colonies, a few Ivory gulls were observed along the ice edges of the Northeast Water connection with aerial counts in July 2008 and 2009 (Boertmann *et al.* 2009, Boertmann & Nielsen 2010). The breeding period seems to be spread out from mid-June to early July (Falk *et al.* 1997). Preliminary results from satellite tracking of breeding Ivory gulls suggest that while breeding, the adults regularly leave the nest for a few days and fly as far as 400 km from the colonies to forage (Gilg *et al.* 2008). In August, some of the gulls start to disperse away from Greenland towards the north of Svalbard (Gilg *et al.* 2008).

Ross's gull *Rhodostethia rosea*

Breeding Ross's gulls have been found on a few occasions on the coasts of the NEW and on Henrik Krøyer Holme (Egevang & Boertmann 2008). In addition non-breeding Ross's gulls occur in relatively high numbers in the NEW in spring and summer (Egevang & Boertmann 2008).

Sabine's gull *Larus sabini*

This gull breeds on Henrik Krøyer Holme and along the shore but considerable numbers of non-breeding birds also occur at the NEW in the summer months.

The size of the breeding colonies at Henrik Krøyer Holme seem to vary considerably from year to year. In 1985 the number was estimated to 50 pairs while the number was estimated to at least 100 pairs in 1992 (Falk *et al.* 1997). Several hundred were observed along the coast of the NEW in early June 2008; in late 2008, 1,200 Sabine's gull were recorded foraging along the glacier in the Antarctica bay in Amdrup Land in the southern part of the NEW (Boertmann *et al.* 2009) and 360 were recorded in the same place on the 28 July 2009 (Boertmann & Nielsen 2010). In total 770 Sabine's gulls were recorded from the coast of the NEW in late July 2009 (Boertmann & Nielsen 2010). The species seems to be a short-range coastal forager during the breeding season (Falk *et al.* 1997).

Black-legged kittiwake *Rissa tridactyla*

A small colony of kittiwake at the NEW is situated at the Mallemukfjeld. In 1993 the number of nests was estimated to 733 (Falk & Møller 1995). Including non-breeding adults it was estimated that about 2,000 kittiwakes were utilizing the NEW in summer (Falk & Møller 1995). Breeding kittiwakes usually forage relatively close to their breeding sites and many gather along the fast-ice edge and near leads close to the colony (Falk *et al.* 1997). In 1993 Kittiwakes were observed in most parts of the NEW, but in small numbers. Small numbers of kittiwake were also observed throughout the NEW in connection with aerial counts in May-August 2008 (Boertmann *et al.* 2009) but none were observed along the coast of the NEW in late July 2009 (Boertmann & Nielsen 2010).

Arctic tern *Sterna paradisaea*

This tern breeds on Henrik Krøyer Holme and in a few places along the coast of the NEW. The size of the breeding population is unknown, but is probably not exceeding 1,000 birds (Falk *et al.* 1997). The Arctic tern arrives to the NEW in early June (three observed on 3 June 2008 (Boertmann *et al.* 2009)) and starts breeding in early July (Falk *et al.* 1997). In late July 2009 270 terns were recorded during an aerial count along the coast of the NEW (Boertmann & Nielsen 2010). The terns mainly feed on small fish typically within a distance of 20 km from the nest (Egevang & Boertmann 2003). The terns leave the North-east Greenland in August-September (Egevang & Boertmann 2003).

Protection status of the NEW

The NEW is included in Flora and Fauna Protection Area number 12 (Område 12) of the National Park of North and East Greenland (Figure 9). This Flora and Fauna Protection Area includes core areas for a number of marine and terrestrial animals and plants – see Figure 10.

In addition to the 15 Flora and Fauna Protection Area of the national park the extreme importance to marine mammals of the ice edge between Germania Land (Île de France) and the NEW has recently been pointed out by Boertmann & Nielsen (2010). The ice edge is usually persistent throughout the summer in this area, and in 2009 concentrations of Narwhals and even more importantly a Bowhead whale accompanied by a calf (approx. 3 months old) were observed – see Figure 11 (Boertmann & Nielsen 2010).

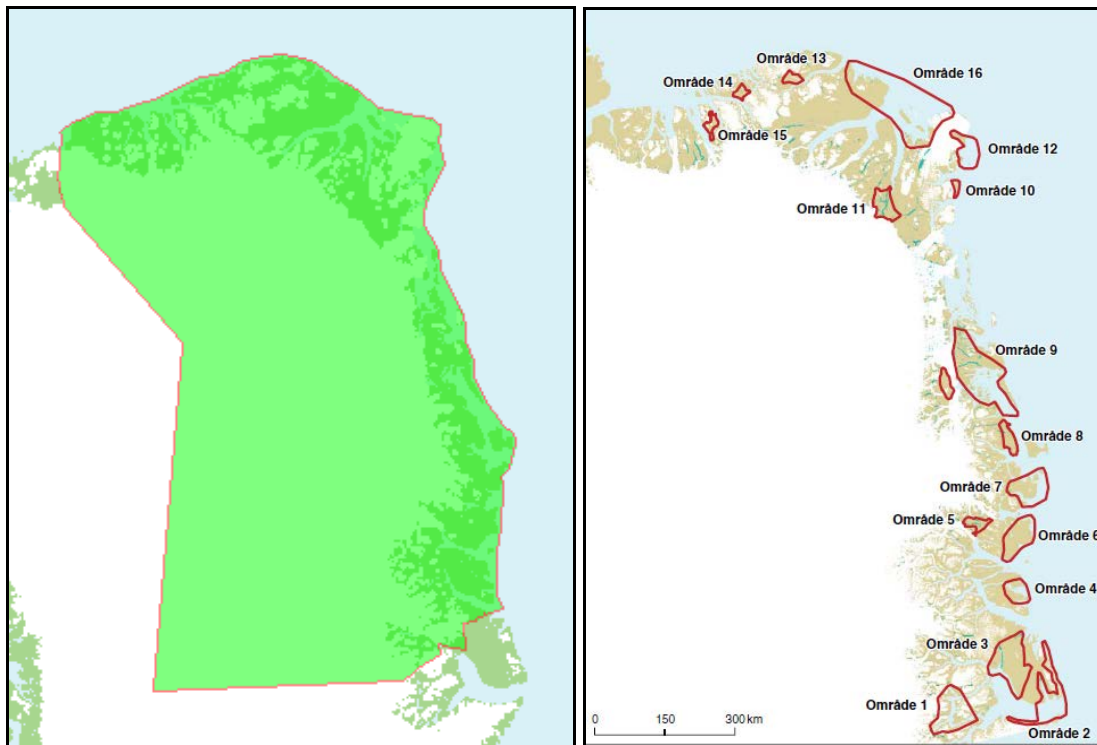


Figure 9. The National Park in North and East Greenland (left) and the 15 Flora and Fauna Protection Area of the national park (right). “Område 12” (Area 12) includes the NEW and some terrestrial areas (from Aastrup & Boertmann 2009).

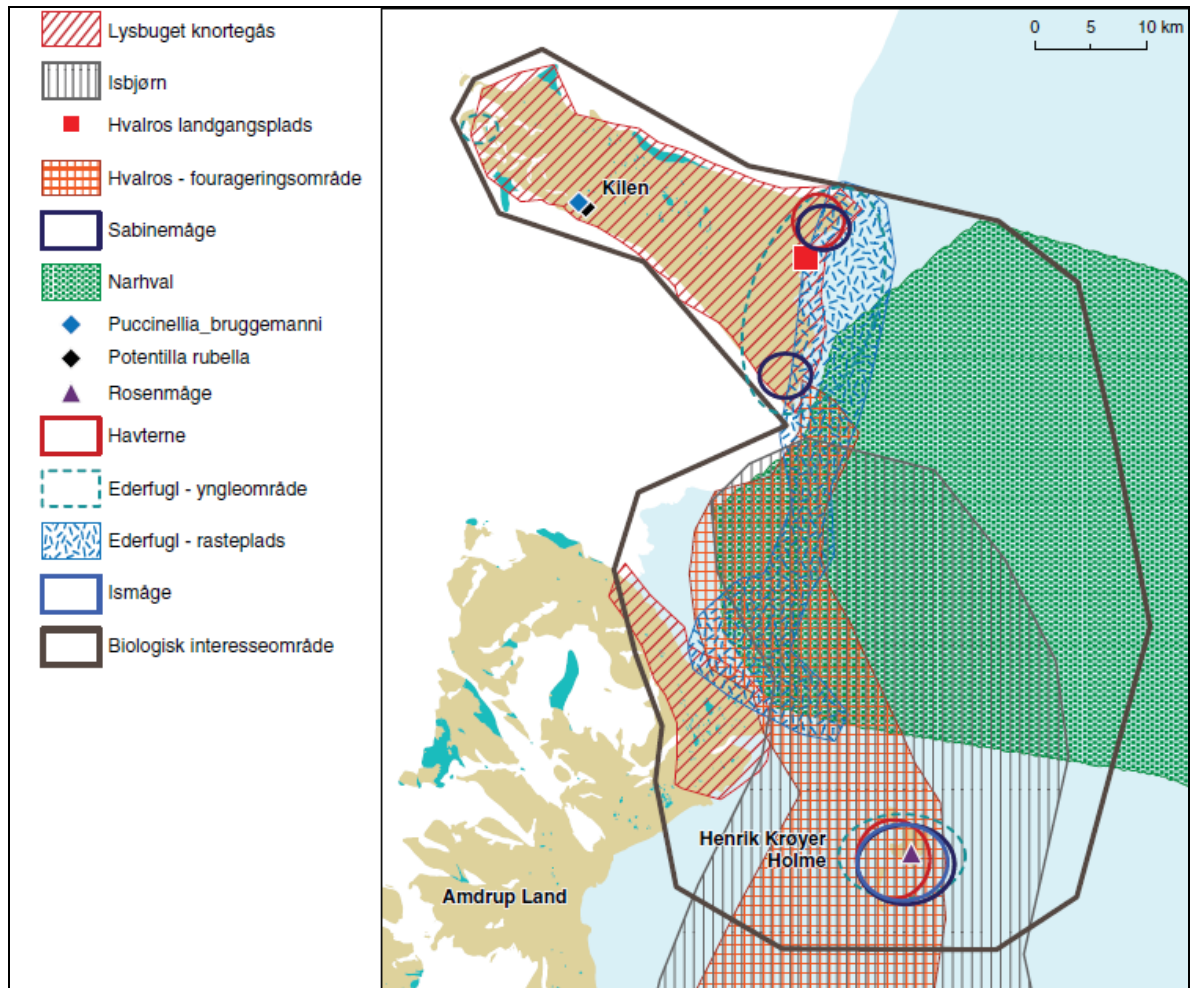


Figure 10. The Flora and Fauna Protection Area (Biologisk interesseområde) number 12 of the national park with Species Specific Core Areas. Marine core areas have been designated for the following species: **Polar bear** (Isbjørn), **Walrus** (Hvalros), **Sabine's gull** (Sabinemåge), **Narwhale** (Narhval), **Arctic tern** (Havterne), **Common eider** – staging area (Ederfugl – rasteplass) and **Ivory gull** (Ismåge) (from Aastrup & Boertmann 2009).

NERI has recently published guidelines for companies preparing environmental impact assessments of seismic activities in ice free Greenland waters (Boertmann *et al.* 2010). In the report a number of protection zones for sensitive marine mammals are designated. One of these includes the Northeast water and a large area south of the NEW (Figure 10). This protection zone is designated for Narwhale, Bowhead whale and walrus. NERI recommends that seismic activities in this area is avoided or of limited extend all year in the (northern) part designated for Walrus and from 1 July to 30 September in the area designated for Narwhale and Bowhead whale. Although these restriction apply specifically to seismic activities, other types of shipping in this protection zone should also be avoided or of a limited extend (NERI pers. com).

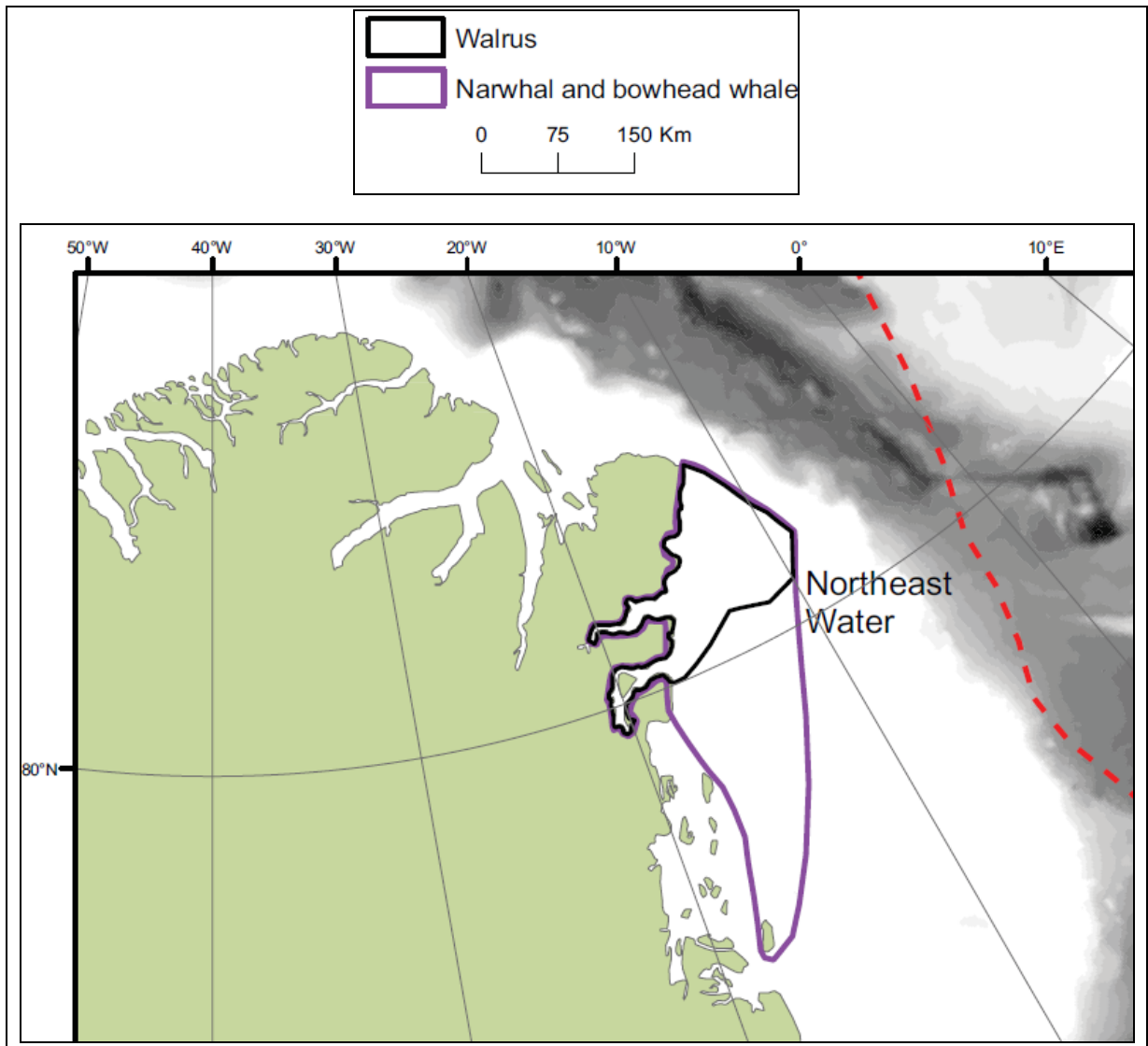


Figure 11. The protection zones for Narwhale, Bowhead whale and Walrus in the northern part of East Greenland (from Boertmann *et al.* 2010).

Red listed species recorded from the NEW

A number of the marine mammals and sea birds that have been observed in Flora and Fauna Protection Area number 12 are listed on the (2007) Greenland red list of threatened species (Boertman, 2008):

Critical threatened: Bowhead whale

Vulnerable: Polar bear

Ross's gull

Ivory Gull

Near threatened.	Walrus
	Sabine's gull
	Arctic tern
Data Deficient	Narwhal
	Bearded seal

The red list is prepared according to the regional guidelines issued by the International Union for the Conservation of Nature (2001, 2003).

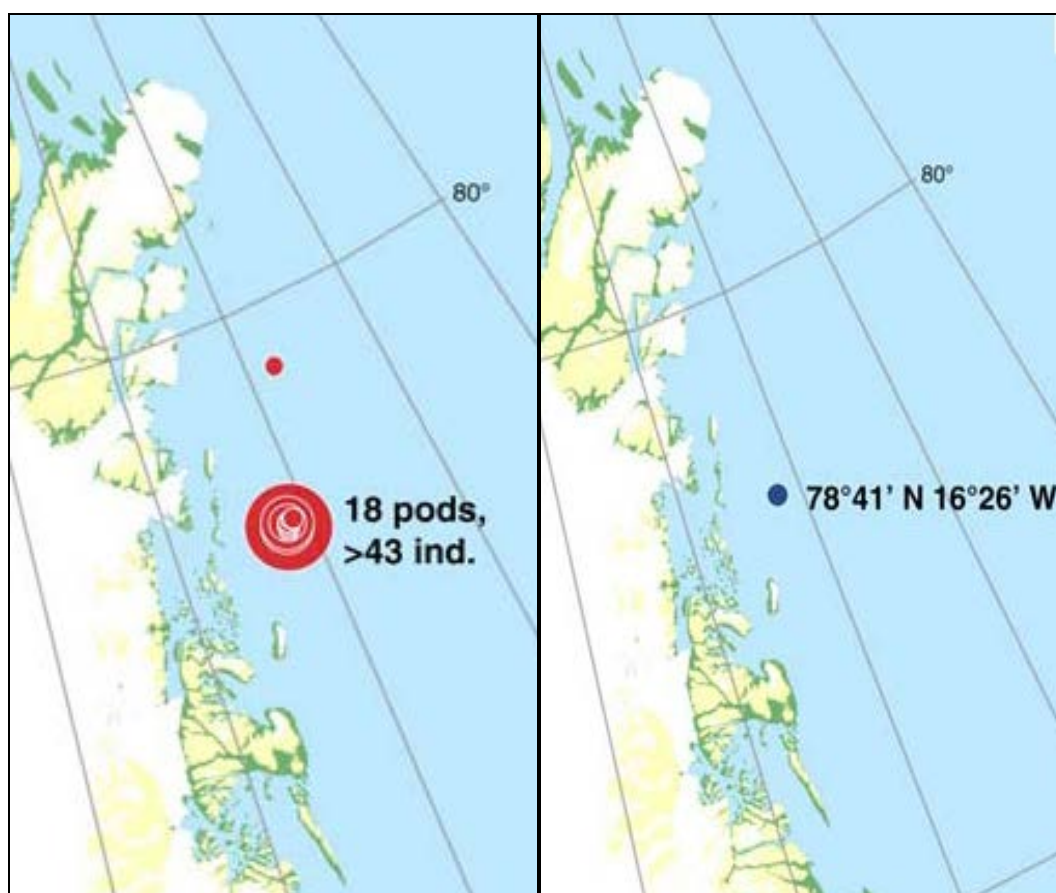


Figure 11. Position of large concentration of Narwhals (left) and Bowhead whale with calf (right) observed in late July 2009 between Germania Land (Île de France) and the NEW (from Boertmann and Nielsen 2010).

Marine mammals and seabirds associated with the off-shore part of the NEW in July-August

Marine mammals

Few marine mammals were recorded away from the coast of the NEW in connection with aerial transect counts in July-August 2008 and 2009 (Reference - (Boertmann *et al.* 2009). Other studies, however, have found that Bearded seals and Narwhals are common and widespread throughout the NEW in August (Reference). Also fairly large numbers of Bowhead whales have been recorded from the NEW and the sea just of the polynya in recent years. Ringed seals are probably also common along the outer ice edge and Polar bears might occur in small numbers at the edge of the polynya.

Seabirds

The majority of seabirds recorded from the NEW have been observed close to the coast or to Henrik Krøyer Holme. This includes the majority of birds that breed in the area and the flocks of sea duck that congregate in spring before dispersal to the breeding grounds.

Birds that have regularly been observed throughout the open parts of the NEW in summer (July-August) are mainly breeding and non-breeding Fulmars.

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