ENVIRONMENTAL OIL SPILL SENSITIVITY ATLAS FOR THE NORTHERN WEST GREENLAND (72°-75° N) COASTAL ZONE

NERI Technical Report no. 828 2011

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Abstract: This oil spill sensitivity atlas covers the shoreline and the offshore areas of West Greenland between 72º N and 75º N. The coastal zone is divided into 118 shoreline segments and the offshore zone into 3 areas. A sensitivity index value is calculated for each segment/area, and each segment/area is subsequently ranked according to four degrees of sensitivity. Besides this general ranking a number of smaller areas are especially selected as they are of particular significance, they are especially vulnerable to oil spills and they have a size making oil spill response possible. The shoreline sensitivity ranking are shown on 13 maps (in scale 1:250,000), which also show the different elements included and the selected areas. Coast types, logistics and proposed response methods along the coasts are shown on another 13 maps. The sensitivities of the offshore zones are depicted on 4 maps, one for each season. Based on all the information, appropriate oil spill response methods have been assessed for each area.

Keywords:	West Greenland, oil spill sensitivity mapping, shoreline oil spill sensitivity, offshore oil spill sensitivity, coastal zone environmental mapping, meteorology, oceanography, ice conditions, coastal morphology, human use, archaeology, local knowledge, marine mammals, seabirds, fish, logistics, oil spill response.
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2 Preface

This Atlas was produced as a part of the preparations for exploratory oil/gas drilling offshore Greenland. It is a continuation of the atlases covering the regions 58º N to 62º N, 62º N to 68º N and 68º N to 72º N, produced in respectively 2004, 2000 and 2004.

This atlas was produced using the available information. Draft maps with environmental information were presented to local communities for quality assurance and gathering of supplemental information on natural resources and resource use. Further a draft of the complete Atlas was sent to relevant Greenlandic and Danish institutions for comments. However, the available information was by no means complete and as further information becomes available, it will be relevant to update the atlas.

A draft version of the report was send to representatives of the local hunters organsation (KNAPP), to the council of the settlements within the covered region, to the relevant ministries of the Greenland Government (APNN and NNPAN), to Greenland Command and to the Qaasuitsup Kommunia (municipality).

The atlas was produced in a dynamic GIS (Geographical Information System) where new map sheets can be produced easily, when new data is becomes available.

It is our hope that this atlas with all its integrated information and suggestions will be a valuable tool for Greenlandic authorities, oil companies and others.

The study team

The National Environmental Research Institute, Department of Arctic Environment (NERI-AE) headed and performed the main part of the study.

NERI has prepared the coastal morphology interpretation, provided and processed the biological information in the Atlas and prepared the shoreline and offshore sensitivity maps. NERI also developed versions on CD and to the internet.

SL Ross Environmental Research Ltd. developed the sections on countermeasures, access and safe havens on the Physical Environment and Logistics maps.

The Greenland National Museum and Archives (GNMA) compiled and reviewed the archaeological information.

The Greenland Institute of Natural Resources (GINR) contributed with information regarding living resources (fish, marine mammals) and their use. As a part of the project, a study of local knowledge was carried out by GINR (Appendix C).

The software application used to generate shoreline and offshore sensitivity scores was originally developed for the first atlas (Mosbech et al. 2000) in co-operation with AXYS Environmental Consulting Ltd. The map layout applied was originally developed in collaboration with The Geological Survey of Denmark and Greenland (GEUS)

Contributions from the Greenland Institute of Natural Resources were delivered by Josephine Nymand, Sofie Ruth Jeremiassen and Helle Siegstad.

Archaeological information from the region was delivered by Mikkel Myrup from the Greenland National Museum and Archives.

Frants von Platen (GEUS) provided valuable input for the kick-off of this extension of coverage.

The present project has been funded by the Bureau of Minerals and Petroleum, Government of Greenland. The authors are solely responsible for all results and conclusions presented in the report, and it does not necessary reflect the position of the Bureau of Minerals and Petroleum.

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Photos of shore types Fig. 7.1-12 by NERI-AM.

3 Summary

Environmental oil spill sensitivity atlas for the northern West Greenland (72º-75º N) coastal zone

This atlas is produced as a part of the preparations for exploratory drilling offshore Greenland. The objective is to produce a tool for oil spill responders by providing an overview of resources vulnerable to oil spills, for example biological resources (fish, birds etc.). The atlas covers the region between 72° N and 75° N in northern West Greenland including the offshore waters to the Canadian border.

The following elements are included in the project:

- coast types,
- oceanography, ice and climate,
- biological resources (fish, birds etc.),
- fishing and hunting,
- protected areas,
- archaeological sites,
- logistics and oil spill response methods.

As the oil spill sensitive resources are very different in character (e.g. seabird breeding colonies, important fishing areas and archaeological sites), it has been common practice to calculate an index value of the sensitivity of a specific area, in order to compare areas with different characteristics. The index calculations are based on a Canadian system, which has been used in Lancaster Sound. An overview of the methods used in the atlas is given in Chapter 6.

The coastline is divided into segments (coastlines and groups of islands) approx. 50 km long. Each segment has been ranked in one of four degrees of sensitivity based on the index calculation that includes abundance and sensitivity of a number of environmental or community elements (e.g. different birds and marine mammals, hunting areas and archaeological sites).

Besides the general classification of coastal sensitivity, the maps of the atlas also show smaller selected areas. They have been selected as being of particular significance, particular vulnerable to oil spills and as being of a size where an effective oil spill response can be performed.

As a part of the project, classification of the coastline morphology has been conducted from satellite imagery and geological maps, e.g. the occurrence of rocky shores and beaches. An index value of the self-cleaning ability of the coast after an oil spill has been calculated, based on this classification in combination with shoreline exposure to waves and ice. For example, oil on a rocky coast exposed to wave action will be cleaned faster than oil on a beach in a protected lagoon.

Based on all the information, appropriate methods to respond to oil spills in the different areas have been assessed.

Chapter 8 in the atlas contains offshore and overview information, primarily in 1:3.5 million scale maps, and Chapter 9 contains detailed coastal information in 1:250,000 scale maps. Chapter 7 is a users guide common to Chapter 8 and 9.

Chapter 8 contains maps showing the sensitivity of the offshore areas and with each of the elements used in the classification (fishing areas, fish, birds and marine mammals). A number of

maps provide an overview of the most economical important biological resource (Greenland halibut) and an overview of breeding colonies of 12 bird species.

Chapter 9 contains 13 maps in the scale 1:250,000 showing the coastal segments and their index values for coastal sensitivity and the symbols for the elements of the classification (hunting and fishing areas, fish, birds, marine mammals and archaeological sites). The maps also show the selected areas. Each map is accompanied by a description of biological resources and human use of each coastal segment.

Chapter 9 also contains 13 maps showing coast types, logistics and proposed methods to oil spill response in the covered area.

A community consultation phase was carried out during the project and the results are incorporated in the human use setting of each coastal segment, and presented in Appendix C.

The Bureau of Minerals and Petroleum (Greenland Government) financed the preparation of the atlas.

The project was carried out by the National Environmental Research Institute, the Greenland Institute of Natural Resources, the Greenland National Museum and Archives and SL Ross Environmental Research Ltd.

4 Eqikkaaneq

Kitaata avannaani (72º-75º N) sinerissanut uuliaarluernermit sunnertianerusunut takussutissiaq

2010-mi aasaanerani Disko West-imi neqerooruteqarfiusumi uuliasiorluni qillerinerit aallartinneqarput. Taamatut misiligutaasumik qillerinerit tamakkua avatangiisinut ajornerpaamik sunniutigisinnaasaat tassaavoq uuliamik qilleriffimmiit tiffuttumik aqunneqanngitsumik immamut siaruaattumik aniasoqalersinnaanera. Annertuumilli uuliaamik aniasoortoqarnissaanut aarlerinartua annikitsuinnaavoq.

Siusinnerusukkut Kitaani uuliaarluernermit sunnertianerusunut pingasunut, 72° N tikillugu, takussutissanik saqqummersitsisoqareernikuuvoq. Takussutissat taakkua siunertaraat isumalluutit uuliaarluernermit sunnertiasut ataatsimut takussutissiornissaat. Taakkua ilaatigut tassaapput isumalluutit tamaaniittut (aalisakkat, timmissat il.il.) aammalu aalisarnikkut piniarnikkullu soqutigisat. Taamatut ilisimasanik tamakkuninnga nalunaarsuinikkut ingerlatsiviit oqartussaasullu pilersaarusiornermi siumut nalileereernissamut periarfissaqalerput sumiiffit misikkarinneruner-sut sumiinneri ilisimariissallugit aammalu uuliaarluertoqassagaluarpat qanoq iliortoqarnissaanut.

Massakkut nalunaarsugaqarfik annertusineqarpoq Nunavik/Siggummiit (72° N) Upernaviup avannarpasinnerusuanut (75° N) immamullu tamatuma avatangiisaanut.

Takussutissami makkua ilaapput:

- sinerissat assigiinngitsut nassuiarneqarnerat,
- immamut, sikunut silallu pissusiinut tunngasut
- uumasut isumalluutit (timmissat, aalisakkat il.il.),
- aalisarneq piniarnerlu,
- sumiiffiit immikkut illersorneqartut (assersuutigalugu timmissat ineqarfii),
- qangarsuarnitsat eriagisassat,
- angalanermut tunngasut uuliaarluernermilu akiueriaatsit.

Tamakka tamarmik assigiinngitsorujussuummata (assersuutigalugu timmissat ineqarfii, aalisarfiit pingaarutillit qangarsuarnitsallu eriagisassat) sumiiffiup qanoq sunnertiatiginera kisitsisinngortinneqartarpoq sanilliussuunneqarsinnanngorlugu tulleriijaarneqarsinnaanngorlugulu. Tamanna siunertaralugu periaatsit assigiinngitsut arlallit pilersinneqarnikuupput. Uani canadamiut periaasiat, ilaatigut Lancaster Sound-imi, Canadap issittortaata avannaani kangianiittumi atorneqartoq aallaavigineqassaaq.

Sineriak segmentinut (immikkoortunut) 50 km missiliorlugu isorartutigisunut agguataarneqartarpoq misikkarissutsinut sisamanut aggorlugu (misikkarluttoq, akunnaattoq, misikkarissoq, misikkarilluinnartoq). Taamatut agguataarineq pisrpoq naatsorsuineq, index-beregning, atorllugu (timmissat assigiinngitsut miluumasullu imarmioqatigiikkuutaat, piniartarfiit, aalisartarfiit, qangarsuarnitsat eriagisassat il.il.) Tamakkua naatsorsornerisigut immikkoortut tamarmik immikkut uuliaarluernermut misikkarissusiat kisinngortinneqartarpoq, pineqartut amerlassusiat/pingaarutaat apeqqutaatillugu. Uumasut uuliaarluernermut misikkarissusiat uumasup taassuma uuliaarluerneqartillugu uuliaarluernermut kalluunissaata qanoq ilimanartiginera aammalu uumasup taassuma uuliamut qanoq misikkaritsiginera aallaavigalugu naatsorsorneqartarpoq. Uumasut ilanngunneqartartut taakkualu qanoq iluaqutigineqarnerat immikkoortut misikkarissusiannik naatsorsuinermi pingaarnerpaatinneqartarpoq.

Nalinginnaasumik immikkoortiterinerup saniatigut sinerissap tamarmiusup ilai minnerusut nunap assingani toqqarneqartarput (”selected areas”). Taakkua toqqarneqarput immikkut naleqassusiat, uuliaarluernermut misikkarippallaarnerat aammalu angissusiat uuliaarluernermik pitsaasumik akuiniarmfiusinnaammat.

Pilersaarutip ilaatut nunap sananeqaataasa nunap assingortinneri satellitikkullu assilisat tunngavigalugit sineriak ilusaa suuneralu tunngavigalugu agguataarneqartarpoq (qanoq sunillu sananeqaateqarnerat, assersuutigalugu qaarsortaanerunersoq sioraanersorluunniit). Ilisimasaq taanna tunngavigalugu aammalu qanoq avataaneersunut, soorlu malinnut sikumut, qanoq sammitiginersoq aallaavigalugu uuttuut (index) uuliaarluerneqartillutik qanoq imminnut nalissinnaatiginerat naatsorsorneqarsimavoq. Assersuutigalugu sineriaq ujaraannaasoq malinnut sammilluartoq mingutitsineqartillugu sukkanerusumik imminut ”uliaarluerniiarsinnaavoq” tasinngortamut oqquartamiittumut naleqqiulluni.

Paasissutissat katersukkat tunngavigalugit sumiiffinni assigiinngitsuni uuliaarluernermut sorsuutissat naleqqunnerpaat nalilersorneqarsimapput.

Atlas takussutissaq immikkoortortaqarpoq sinerissap avataani ujarlerfinnut tunngatillugu takussutissanik nunap assilianillu (kapitel 8) pingaartumik angissutsinut uuttuutit 1:1,25 million aamma 1:3, million atorlugit. Immikkoortup allaap imarai sinerissap qanittuanut tunngatillugu paasissutissat (kapitel 9) nunap assingi angissutsinut uuttuut 1:250.000 atorlugu. Kapitel 7-ip nunap assingisa kapitel 8 aamma 9-miittut atornissaannut ilitsersuutit imarai.

Kapitel 8 nunap assinginik avataasiorluni ujarlerfiit misikkarissusiannut pineqartunut ilisarnaatit qanoq inissisimanerinut takussutissanik imaqarpoq (aalisarfiit, aalisakkat, timmissat miluumasullu imarmiut).

Kapitel 9 nunap assinginik 13-inik angissutsinut uuttuut 1:250.000 atorlugu sanaanik imaqarpoq. Tassani sinerissat misikkarisssiisa index-værdi-vi aammalu ilisarnaatit atorlugit misikkarissutsinut agguataarineq takutinneqarput (piniarfiit, aalisarfaiit, aalisakkat, timmissat aamma miluumasutk imarmiut aammalu qangarsuarnitsat eriagisariaqartut). Nunap assingisa aamma takutippaat sinerissap ilai immikkoortitat (”selected areas”). Nunap assinginut ataasiakkaanut tamanut suliarineqarsimavoq tamatuma atorneqarneranut sunillu uumasoqarneranut tunngatillugu nassuiaat.

Tamatuma saniatigut kapitel 9 aamma nunap assinginik 13-inik sinerissap qanoq ittuuneranut, angallannermut aammalu imikkoortuni tamani uuliaarluernerup qanoq sorsunneqarsinnaaneranut tunngatillugu paasissutissanik imaqarpoq.

Suliap inernivia naqitanngorlugu qarasaasiakkoortumillu (CD-ngorlugu internetimilu) pineqarsinnaajumaarpoq.

Pilersaarut Namminersorlutik Oqartussat Aatsitassarsiornermut Pisortaqarfianit aningaasalerneqarpoq. Suliaq Danmarks Miljøundersøgelser (DMU)-mit ingerlanneqarpoq Pinngortitalerifffimmnit Kalaallit Nunaatalu Katertsugaasivianit Allagaasivianillu aammalu canadamiut konsulentfirmaanit SL Ross Environmental Research Ltd.-imit ikiupissaarneqarluni.

5 Sammenfatning

Atlas over kystområder der er særligt følsomme for oliespild i det nordlige Vestgrønland (72º-75º N)

I sommeren 2010 blev prøveboringerne efter olie i Disko West udbudsområdet indledt. De alvorligste miljømæssige påvirkninger fra disse prøveboringer vil være et stort oliespild som følge af et uheld, dvs. en udblæsning ("blow out") med efterfølgende ukontrolleret spredning af olie i havet. Sandsynligheden for et stort oliespild er dog lille.

Der er tidligere udgivet tre atlasser over oliespildsfølsomme områder i Vestgrønland og de dækker hele området op til 72° N. Hensigten med disse atlasser var at få et samlet overblik over de ressourcer, der er følsomme over for et oliespild. Det drejer sig bl.a. om de biologiske ressourcer (forekomst af fisk, fugle m.v.) og om fiskeri- og fangstinteresser. Med en kortlægning af denne viden fik såvel selskaber som myndigheder mulighed for på forhånd at vurdere, hvor de særligt følsomme områder findes, med henblik på planlægning og prioritering af en indsats i tilfælde af et oliespild.

Nu udvides det dækkede område med regionen fra Nunavik/Svartenhuk halvøen (72° N) til det nordlige Upernavik (75° N) og hele havområdet ud herfor.

I atlasset indgår følgende elementer:

- kysttypebeskrivelser,
- oceanografi, isforhold og klima
- biologiske ressourcer (fugle, fisk osv.),
- fiskeri og jagt,
- særligt beskyttede områder (f.eks. fuglefjelde),
- fortidsminder,
- logistiske forhold og metoder til at bekæmpe oliespild.

Da disse elementer har meget forskellig karakter (f.eks. fuglekolonier, vigtige fiskeriområder og fortidsminder), udregnes index-værdier som udtryk for et områdes følsomhed, så forskellige områder kan sammenlignes og prioriteres. Der er udviklet en række forskellige systemer til dette formål. Her tages udgangspunkt i et canadisk system, der bl.a. er brugt i Lancaster Sound i det nordøstlige, arktiske Canada.

Kysten inddeles i segmenter (områder) af ca. 50 km's længde, der klassificeres i fire grader af følsomhed (lav, moderat, høj og ekstrem). Klassifikationen er sket ved hjælp af en index-beregning, hvor ovenstående miljø- og samfundselementer indgår (forskellige fugle og havpattedyrgrupper, jagtområder, fiskeriområder, fortidsminder m.v.). Disse elementer er givet dels en værdi for følsomhed overfor oliespild, dels en værdi for, hvor talrig/vigtig forekomsten er i hvert segment. De biologiske elementers følsomhed overfor oliespild beregnes ud fra, hvor sandsynligt det er, at den pågældende art kommer i kontakt med olie under et oliespild, samt hvor følsom arten er overfor olie. De biologiske elementer og deres udnyttelse indgår med den største vægt ved beregningen af segmenternes samlede følsomhed.

Udover den generelle klassificering af hele kystens følsomhed er der på kortene udpeget en række mindre områder ("selected areas"). Disse er udvalgt fordi de er særligt værdifulde, særligt følsomme overfor oliespild samt fordi de har en størrelse, der generelt gør det praktisk muligt at gennemføre en effektiv oliespildsbekæmpelse.

Som en del af projektet er der ud fra geologiske kort og satellitbilleder foretaget en morfologisk klassifikation af kysterne (deres opbygning og materialesammensætning, f.eks. om de består af klippeflader eller sand). Ud fra denne viden og hvor udsatte de er overfor påvirkning fra bølger og is, er der udregnet et mål (index) for deres selvrensende evne efter en eventuel olieforurening. For eksempel vil en klippekyst, der er meget udsat for bølgeslag, hurtigere blive "vasket ren" for olie end en strand i en beskyttet lagune.

På baggrund af det samlede materiale er der lavet en vurdering af egnede metoder til bekæmpelse af oliespild i de forskellige områder.

Atlasset indeholder en sektion med oversigtsinformation og kortlægning af udenskærsområderne (kapitel 8), der hovedsageligt er angivet på kort i målestoksforholdene 1:1,25 million og 1:3,5 million. En anden sektion indeholder detaljeret information om de kystnære områder (kapitel 9) på kortblade i målestoksforholdet 1:250.000. Kapitel 7 indeholder en fælles brugervejledning til kortene i kapitel 8 og 9.

Kapitel 8 indeholder kort, der viser udenskærsområdernes følsomhed, med symboler for elementerne i klassifikationen (fiskeriområder, fisk, fugle og havpattedyr).

Kapitel 9 indeholder 13 kortblade i målestoksforholdet 1:250.000. Her vises kystsegmenternes index-værdier for følsomhed og symboler for elementerne i klassifikationen (jagt- og fiskeriområder, fisk, fugle og havpattedyr samt fortidsminder). Kortene viser også de særligt udvalgte områder ("selected areas"). Til hvert kortblad er der udarbejdet en beskrivelse med oplysninger om områdets udnyttelse og biologiske forekomster.

Derudover indeholder kapitel 9 yderligere 13 kortblade med angivelse af kysttyper og logistiske forhold samt forslag til metoder til bekæmpelse af oliespild for hvert område.

Den endelige version bliver tilgængelig både i en trykt og i en digital udgave (på CD og på internettet).

Projektet er finansieret af Råstofdirektoratet (Grønlands Selvstyre). Det er udført af Danmarks Miljøundersøgelser (DMU) med bidrag fra Grønlands Naturinstitut og Grønlands Nationalmuseum og Arkiv samt det canadiske konsulentfirma SL Ross Environmental Research Ltd.

6 Introduction

6.1 Objectives

This Environmental Oil Spill Sensitivity Atlas has been prepared to provide oil spill response planners and responders with tools to identify resources at risk, establish protection priorities and identify appropriate response and clean-up strategies.

The atlas is designed for planning and implementing year-round oil spill countermeasures in both coastal and offshore areas in West Greenland between 72° N and 75° N latitude. The key component of the atlas is a sensitivity ranking system, which is used to calculate an index value describing the relative sensitivity of coastal areas. The sensitivity index value is calculated based on information on natural resource use (human use), biological occurrences and physical environment. The sensitivity ranking system is based on a Canadian system used in Lancaster Sound (Dickins et al. 1990) and modified to meet the specific requirements of the Greenland study area (see Chapter 6.3). As a supplement to the Canadian ranking system, a number of smaller areas have been selected for priority in case of an oil spill (see Chapter 6.4). The selection of these areas is based on expert opinion on the available information.

West Greenland between 72º and 75º N is the former Upernavik municipality and marks the northern limit of the West Greenland. The area is sparsely populated with 1 town (Upernavik – 1200 inhabitants) and 10 small settlements ranging from 7 to 450 inhabitants totalling approx. 1700. Hunting and fishing are the main ways of living in the region. The region is also ecologically highly important for a number of seabird and marine mammal species. It is therefore essential that all possible measures are taken to minimise the environmental risk of oil activities in the area. The objective of this atlas is to contribute to that effort.

This atlas is an extension of a three similar atlas's prepared for West Greenland between 62° N and 68° N in 2000 (Mosbech et al. 2000), between 60° N and 62° N (Mosbech et. al 2004a) and between 68° N and 72° (Mosbech et. al 2004b). With the present atlas, the entire West Greenland coast from the southern tip of Greenland – Cape Farewell at 60° N – north to 75° N is now mapped.

6.2 Contents and organisation

The study area covers the northern part of the west coast of Greenland, between 72° N and 75° N including the offshore areas to the Canadian border.

This atlas is produced as a pdf-document provided by download from NERI web-site and on CD. Additional to the report the shoreline sensitivity map and physical environment and logistics maps are also available in a GIS application, which makes it possible to produce seamless maps at various scales.

The information in the atlas is organised by map scale moving from summary information (Chapter 8) in a scale of approx. 1:1,25 million (shoreline) and 1: 3.5 million (offshore) to operational information (Chapter 9) in a scale of 1: 250,000 (G/250 Vector copyright Danish Survey & Cadastre 1998).

Chapter 7 contains a user guide to the maps, which supplements the map legends.

Chapter 8 contains the offshore and summary maps, which include:
- bathymetry,
- overall distribution of important species,
- overview of extreme and high sensitive areas and special status areas,
- offshore sensitivity (winter, spring, summer and autumn),

Chapter 9 contains the coastline operational maps, which include Shoreline Sensitivity Maps with:
- shoreline species,
- resource use (human use),
- archaeological sites,
- sensitivity rankings,
- selected areas,

and Physical Environment and Logistics Maps with:
- shoreline geomorphology,
- anchorage's and safe havens,
- access by boat or aircraft,
- descriptions of potential countermeasures.

Detailed accounts of methodology and data documentation and limitations are given in chapter 12.

6.3 Sensitivity index system

An environmental sensitivity ranking system is used in the atlas to determine and illustrate the relative sensitivity of shoreline and offshore areas of northern West Greenland (72º-75º N) to the effects of an oil spill. This pre-spill ranking allows spill responders and on-scene planners to do a quick evaluation of which areas and environmental components that are most susceptible to an oil spill, and thus provides information regarding protection priorities during a spill event.

Through the use of the sensitivity ranking system each shoreline and offshore area receive a single numeric value, which represents the relative sensitivity of that area to a marine oil spill. This numeric value is ranked as extreme, high, moderate or low and is illustrated on the summary, regional and operational maps by a colour code.

This ranking is based on a system used for the Canadian atlases (e.g. Lancaster Sound, Dickens et al. 1990) with some modifications to account for the different biological and physical features of the region. The sensitivity ranking system incorporates the biophysical and social elements of the region that are important from an oil spill perspective. These elements are assigned to and ranked on a relative scale within three major categories: (1) resource (human) use; (2) species occurrence; and (3) oil residence. The latter category considers the oil residence periods associated with various coastal types, and the differences in ice and open water zones between the shoreline and offshore areas of West Greenland, respectively. Each of the categories are assigned a weighting factor, which is based on their relative importance within the region. The elements within each of the categories are ranked based on their relative sensitivity to potential effects of oil spills. These assigned values are then multiplied by the weighting factor to produce a single numeric value the PI (priority index). It is the sum of the priority indices that determines the overall sensitivity of a specific shoreline or offshore area.

PI = AV x WF

and

S = sum of PI

where:

AV	=	assigned value of the element
WF	=	weighting factor of the category
PI	=	priority index
S	=	relative sensitivity of an area: the sensitivity value

Criteria for ranking the relative sensitivity of the human use elements are based on their importance to local residents from a cultural/historic and economic perspective, and the re-placeability of the resource.

Biological elements (species or species group) selected for the sensitivity index are listed in Table 6.1. They are selected based on their sensitivity to oil spills, their ecological importance and their importance to biodiversity and the local human population.

The following formula is used to calculate the AV (assigned value) for each biological element (species or species group):

AV = (RS x RA x TM x ORI) / C

Where:

RS	=	relative sensitivity of the species
RA	=	relative abundance of the species
TM	=	temporal modifier
ORI	=	oil residence index
C	=	constant used to reduce the maximum possible score

The relative sensitivity (RS) for the species rely on available information regarding the vulnerability, recovery potential and the potential for lethal and sublethal effects which are summarised in Table 6.1. The relative sensitivity for the selected species ranges from 7 to 25. The relative abundance and timing of occurrence of the selected species (biological elements) is extracted from available knowledge and encoded for each shoreline and offshore area.

Table 6.1. The relative sensitivity (RS) and characteristics of the selected species or species groups in relation to oil spills.

Species/group name	Vulnerability	Mortality potential	Sublethal potential	Recovery period	Relative sensitivity
Fish and shellfish					
Scallop	High	Low	High	Long	18
Snow crab	Very low	Low	Moderate	Short	9
Deep sea shrimp	Very low	Very low	Low	Short	7
Greenland halibut	Very low	Very low	Low	Short	7
Lumpsucker	Moderate	Moderate	High	Short	15
Arctic char	Moderate	Low/Short	Moderate	Moderate	14
Capelin	Very high	High	High	Moderate	21
Birds					
Alcids	Very high	Very high	Very high	Very long	25
Cormorants	High	High	High	Moderate	19
Gulls	Moderate	High	Very high	Short	17
Seaducks	Very high	High	Very high	Long	23
Seaducks breeding	Very high	High	Very high	Long	23
Tubenoses offshore	Moderate	High	High	Moderate	17
Tubenoses shoreline	Moderate	High	High	Long	18
Marine mammals					
Baleen whales	Low	Very low	Very low	Moderate	9
Narwhal	Low	Low	Low	No recovery	13
White whale	Low	Low	Low	No recovery	13
Seals	Low	Very low	Low	Short	9
Walrus	High	Moderate	Low	No recovery	18
Polar bear	High	High	High	Moderate	19

The biological resource constant, "C", refers to a value which is used to limit the maximum possible biological resource score, and thus to balance the importance of the biological components with the other components.

The oil residence index (ORI) provides a relative estimate of the potential residence period of oil stranded within the shore zone under normal conditions. The index is only an approximation, because many aspects of a spill are unknown until the time of the spill incident (e.g. the volume of spill, oil type, speed of weathering). The oil residence is ranked from 1 to 5 mainly based on the shoreline exposure class and the shoreline substrate. Table 6.2 shows the basic relation.

See also appendix A (p. 11-1), where the RS, RA, TM, AV, PI and S values are listed for each segment.

Table 6.2. Basic Oil Residence Index (ORI) ranking based on a combination of shoreline substrate and exposure class.

Substrate / Exposure class	Protected	Semi-protected	Semi-exposed	Exposed
Coarse sediment	4	3	1	1
Fine sediment	4	3	1	1
Ice	1	1	1	1
Not classified	4	3	2	1
Rock	4	3	1	1
Rock and coarse sediment	5	4	2	1
Rock and fine sediment	5	4	2	1

6.4 Selected areas

In particular, a total of 12 areas along the coast and within fjords have been selected for priority in an oil spill situation. These areas are identified by a red polygon border and a number with the prefix, 'S'. The basis for their selection is that they are, relative to the shoreline in general: i) of high value either environmentally or for resource use; ii) sensitive to oil spills; and iii) of a size and form that may allow effective protection in an oil spill situation with a manageable amount of manpower and equipment. A summary of the selected areas is given in Appendix B (12.6).

6.5 Countermeasure overview

Oil spill countermeasure considerations will in the final version be described for each of the 13 operational maps in Chapter 9. The following is an overview of their content.

The low level of industrial and marine activity in the waters of West Greenland has until now given rise to a limited risk of marine oil spills. The main sources are related to fuel supply to the communities and to fuel carried by fishing vessels and other ships. A new, small but finite, risk is added with the exploration drillings for crude oil initiated in the Disko West license block in 2010.

If a significant spill occurs, response possibilities are limited, particularly during the critical initial stages of the incident. The remoteness of the region, the distance to existing response bases and , the low level of marine activity reduce the possibility of an effective initial marine-based response, unless dedicated response plans and equipment are available. This is however, the case during the offshore exploration drillings planned for the Disko West blocks.

The main countermeasure activities that could be carried out are described in general terms below, with specific local notes where applicable on each of the operational maps. These countermeasures could include surveillance and tracking, *in situ* burning of spills, dispersant-use in offshore areas and the protection and clean-up of important coastal entities, such as the "selected areas", site specific resources (such as sea bird breeding colonies) and extremely sensitive shore lines (see Chapter 6.4).

Surveillance and tracking activities will be critical in determining the location and extent of spilled oil. This will be particularly important in establishing clean-up priorities and adjusting strategies when a long-term and geographically widespread response is required. Aircraft-based remote sensing and surveillance overflights could be deployed from airports at Kangerlussuaq, Aasiaat, Ilulissat, Qaarsut and Upernavik. A program to track oiled ice would be required for spills that occur among pack ice or for open water spills that reach the pack ice edge or persist through freeze-up in protected inshore waters.

Conventional containment and recovery techniques will be severely limited by the lack of vessels with which to deploy and operate equipment, unless vessels and equipment are available on standby as part of a response plan. Spills that are not contained within the first few days of a response will likely be too thin and widespread to allow effective recovery.

In situ burning can be an effective initial response measure for spills both in waters with or without ice, however the use of this method requires approval from the Greenland authorities, and there are areas where this method cannot be applied. Pack ice concentration of 6 tenths or greater will limit the spread of an oil spill and may allow the opportunity for burning until some time after an incident. For inshore areas and fjords that freeze over winter, oil that persists through the freezing season may be available for burning the following melt season when released into leads and melt pools. This would require a tracking and monitoring program through the winter to delineate oiled areas and to prepare for the likely release period.

Dispersing an oil spill by applying dispersants is another effective way of removing oil from the surface in the early phases of an oil spill. This method and the chemicals used require approval from the Greenland authorities (which includes an Net Environmental Benefit Analysis NEB A). The method is not allowed in shallow areas (see below), but is should be considered in offshore areas to prevent or reduce surface oil from contaminating more sensitive inshore areas. Dispersants should receive particular consideration in situations where containment and recovery countermeasures may not be fully effective due to the size of the spill, the limited logistical support for a large-scale clean-up, the prevailing weather and sea conditions, or a combination of the three. The use of dispersants is not allowed within a zone ranging from the coast line and to 10 km off the Greenland baseline and in some particularly sensitive and relatively shallow offshore areas (Store Hellefiskebanke).

Shoreline protection countermeasures will also be limited by a lack of logistical support. In case of an oil spill threat, countermeasure priority should be given to the selected areas, the site specific resources and the extremely sensitive shore lines, considering the time of the year (e.g. no birds are present at breeding colonies in the winter). Particular priority should be given to the selected areas, which are vulnerable to oiling, can generally be protected with a relatively modest effort and, in some cases, could be difficult to clean if heavily oiled.

In many cases, deflection rather than containment booming will be preferred because the tidal currents may exceed 1 knot. While deflection booming may not offer complete protection of the "selected area" it will be valuable in limiting the extent and degree of contamination and lead to faster and more complete post-spill recovery. Deflection booming strategies will require monitoring and perhaps repositioning periodically to account for changes in current strength and direction.

A more significant limitation for shoreline protection countermeasures will be that dictated by the water currents and topography. Little water current information is available for the area; the few data available indicates that tidal currents are strong in most areas - as high as 4 knots. This coupled with steep, rocky shorelines and bottom contours may preclude effective booming. As noted above, for areas that can be boomed, the most effective strategy may be to use deflection booming to limit the extent of shoreline oiling and thereby hasten recovery.

It should be noted that there are many areas, including some of the "selected areas", for which effective containment operations are not likely to be possible. In many areas, offshore countermeasures present the only realistic option for effective protection. For spills that may affect such areas, consideration should be given to dispersant-use and *in situ* burning.

Much of the coastline in the region covered by this atlas consists of a high-relief rocky shoreline that is moderately or highly exposed to prevailing weather and sea conditions as well as ice action. In many areas, fjords, bays and other inshore areas may also be somewhat protected from

extensive contamination by the flushing action of tidal currents and by the natural outflow of streams and rivers. As a result, much of the shoreline may not require a widespread active cleaning effort unless it is heavily contaminated. Where active shoreline clean-up is required, priorities for restoration can be established based on both the environmental sensitivity and oil persistence factors. Preference should be given to *in situ* cleaning techniques such as in-place washing of rocky shores, use of shoreline cleaning agents, *in situ* burning and bio-remediation. Use of these techniques will minimise the amount of oily material collected and subsequent hauling requirements. Disposal site selection was beyond the scope of this study and would require extensive study involving technical, logistical, environmental, and political factors. An alternative to land disposal within the region would be the trans-shipment of collected oily materials from temporary stockpiles to disposal sites and/or incineration elsewhere.

Marine access for shoreline clean-up may be limited in some areas by shoaling and off lying rocks and islets. In some areas, locally forming ice and the encroachment of seasonal pack ice may also limit access. The steep shorelines in many areas will rule out the use of remote staging areas and may necessitate ship- or barge-based clean-up operations.

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7 Users Guide

The region covered by this atlas is the northern part of West Greenland between 72º N and 75º N. It corresponds almost to the former municipality of Upernavik. The entire region is generally referred to as 'the study region/area', 'the region covered by this atlas' or 'the sensitivity mapping region'.

The previous atlas covering the West Greenland coasts between 68º N and 72 º N included the fiords Sullua and Ukkusissat Fjord, which also appear on map 7202. These fjords are therefore not classified in the present atlas.

The map sheets are aligned with the axes of the UTM zone 21 projection. The map sheets 7201 and 7202 thus have a slightly different coverage compared to the sheets in the previous atlasses, which are aligned with the UTM zone 22 projection.

Detailed shoreline information is given in Chapter 9. The entire study area is covered by a total of 13 separate maps with a scale of 1: 250,000 (A4 size). The number of each map reflects the northern latitude (degrees N) of the area covered, and the position of the area from west to east, where numbering starts from west to east. For example, the western-most map (map number 1) that covers the area from 72° N and northwards, is map 7201, and the next to the east is map 7202. Note that there are two rows for each latitudinal degree, thus the map to the north of map 7201 is at 72.5° N and is map 7251.

In Chapter 9 there are two series of detailed maps: **Shoreline Sensitivity Maps** and **Physical Environment and Logistics Maps**. The Shoreline Sensitivity Maps are on the left-hand side, and Physical Environment and Logistics Maps are on the right. Descriptive text appears on the pages between these maps.

7.1 Shoreline and Offshore Sensitivity Maps

7.1.1 Sensitivity index and icons (animal and other symbols)

The shoreline zone in the study area has been divided into 118 shoreline segments. They consist of approximately 50 km of shoreline or of archipelagos (group of islands and skerries) which roughly have a shoreline totalling 50 km. The 118 shoreline segments are numbered from south to north and the numbers are given on the map with the nearest latitudinal degree south of it given as prefix, e.g. 74_98.

The offshore zone in the study area has been divided into 3 offshore areas. The boundaries of the offshore areas are based on oceanographic, bathymetric and climatic features.

An oil spill sensitivity index value has been calculated for each of the 118 shoreline and 3 offshore areas based on:

i) abundance and sensitivity of selected species (or species groups),
ii) resource use (human use), mainly fishing and hunting,
iii) potential oil residency on the shoreline (Oil Residency Index) based mainly on wave exposure and substrate,
iv) presence of towns, settlements and archaeological sites (for shorelines).

The sensitivity index value for each of the 118 shoreline segments is given on the opposite page to the corresponding map. All segments are ranked as having an extreme, high, moderate or low sensitivity to oil spills and a corresponding colour code has been applied to these four ranks. Detailed index value calculations for each shoreline segment are given in Appendix A. (p 11-1).

The importance of resource use and the abundance of a number of biological occurrences in each of the 118 shoreline segments has been rated on a scale from 0 to 5 (see map legend or Chapter 6.3 for a list of species and species groups included in the index). If resource use and abundance of a particular species in a segment is significant (rated 5, 4 or 3) it is indicated on the map with a black icon (and a letter code) after the shoreline segment number. However, all resource use and species are shown on the offshore maps.

Blue icons (animal symbols) indicate a site-specific significant habitat. These are mainly important seabird breeding colonies.

7.1.2 Selected areas

To supplement the rather general mapping of shoreline sensitivity using the 50 km long shoreline segments, a number of small sensitive localities have been selected. A total of 13 areas along the coast and within fjords have been selected as priority areas in the case of an oil spill situation. These areas are identified by a red polygon border and a number with the prefix, 's' for selected. Their selection is based, compared to the coastline in general, on that they are:

i) of high value either environmentally or for resource use,
ii) sensitive to oil spill, and
iii) of a size and form that may allow effective protection in an oil spill situation with a manageable amount of manpower and equipment.

7.1.3 Season information

Offshore sensitivity is presented on seasonal maps reflecting the changes in sensitivity during winter (January-March), spring (April-May), summer (June-August) and autumn (September-December).

The temporal occurrence of species in the 3 offshore areas is presented in Figure 8.6.

Temporal occurrence of shoreline species is presented next to the shoreline legend in the beginning of chapter 9.

7.1.4 Resource use data

Data on resource use was extracted from GINR's interview surveys regarding fishery for capelin, lumpsucker and Arctic char (Olsvig & Mosbech 2003, Nymand 2010). The interview report including detailed maps is included as Appendix C (p13-1).

The information previously compiled based on interviews with local hunters and fishermens by Petersen (1993) has only been used to a limited degree, as climatic and especially ice conditions have changed significantly since then due to climate change. Additional information on resource use (Greenland halibut fisheries) and hunting were supplied by GINR.

7.1.5 Species distribution and abundance data

Information on species distribution and abundance is mainly derived from a number of NERI reports reviewing data on biological resources in the area. See the strategic environmental impact assessment of oil activities in the Baffin Bay compiled by NERI in 2009 (Boertmann et al. 2009).

7.1.6 Archaeological and historical sites included

All known prehistoric and historic sites are included in the background database to the present atlas. However, only sites likely to be threatened by a marine oil spill are shown on the maps (as purple squares). In order to protect the sites from illegal excavation, only the most basic information is given.

Further information on the archaeological sites are available from the Greenland National Museum and Archives if needed e.g. in an oil spill situation.

All man made relics more than 100 years old are protected according to *"Landstingslov nr. 5/1980 af 16. oktober 1980 om fredning af jordfaste fortidsminder og bygninger"* (The Conservation Act). The Greenland National Museum & Archives manages the legislation and is responsible for recording the sites concerned.

7.2 Physical environment and logistics maps

7.2.1 Coastal types description

The shores in the study area are classified into seven different shore types on the Operational Maps of Physical Environment and Logistics. Shore type definitions are given in Table 7.1 and photos of shore types in Figures 7.1-7.15. See also Appendix B section 12.3.

7.2.2 Access

For each operational map access information is provided to cover the following issues:

- **Marine access**: navigational information, prevailing currents, tides, local ice conditions, shoal hazards, identified anchorages, beach landing sites.
- **Air access**: airstrips within the area. Details of size, surface and seasonality of airstrips can be found at http://www.glv.gl/.

Marine information is taken from the nautical charts for the area and from the corresponding descriptions in the Arctic Pilot, Volume III published by the British Admiralty.

Table 7.1. Classification of shore types in northern West Greenland between 72° N and 75° N.

Shore type	Characteristics
Shores developed in solid rock	
Rocky coast	- Coast developed in bedrock of varying morphology, elevation and gradient. - Narrow beach with coarse sediment consisting of boulders, cobbles and pebbles might occur. - The occurrence of abraded inter-tidal platforms is indicated by the gradient.
Archipelago	- Several smaller islands, normally developed in solid rock. - Rocky coasts and pocket beaches might occur, but have only been classified individually if the perimeter of the island exceeds 6 kilometres.
Glacier coast	- Occurrence of a glacier in the intertidal zone.
Shores developed in sediments of glacial, alluvial or colluvial origin	
Moraine	- Shore developed in unconsolidated glacial sediments. - Narrow beach with coarse sediment consisting of boulders, cobbles and pebbles might occur. - The occurrence of abraded intertidal platforms are indicated by the gradient.
Alluvial fan	- Shore developed in alluvial fan. - Narrow beach with sediment consisting of boulders, cobbles, pebbles, gravel and sand might occur. - The occurrence of intertidal platforms is indicated by the gradient.
Talus	- Shore developed in talus (colluvial fan) of varying gradient. - Narrow beach with coarse sediment consisting of boulders, cobbles and pebbles might occur.
Shores developed in marine sediments	
Beach	- Long, linear depositional beaches of well-sorted sand, gravel, pebbles, cobbles or boulders. - Beach ridge plains often occur landwards the beach.
Barrier beach	- Coastal environment consisting of coastal barriers and lagoons with beaches, dunes, salt marsh and tidal flats. - Spits often occur near tidal inlets. - Washover fans might occur on barriers. - Beaches consisting of well-sorted sand, gravel, pebbles or cobbles.
Salt marsh and/or tidal flat	- Wide salt marshes with or without salt marsh cliff and/or wide intertidal flats. - Consisting of relatively fine sediments (mud, sand, silt and clay).
Pocket beach	- Beach developed in the inner part of an embayment in solid rock. - No larger rivers run into the embayment. - Beaches normally consist of well-sorted sediments consisting of sand, gravel, pebble or cobbles.
Shores developed in deltaic sediments	
Delta	- Low gradient intertidal platform developed by fluvial sediments in front of a river valley. - Braided river channels often occur within the inter-tidal zone. - Sediment normally fine grained ranging from clay to fine sand.
Others	
Not classified	- The shore has not been classified due to lack of air photo information (cloud cover, shadow, etc.)

Figure 7.1. Example of rocky coast in basalt with steep coastal cliffs.

Figure 7.2. Rocky coast with tall steep cliffs.

Figure 7.3. An archipelago with rocky coasts.

Figure 7.4. An archipelago with low eroded coasts.

Figure 7.5. Glacier coast.

Figure 7.6. Moraine coast.

Figure 7.7. Alluvial fan.

Figure 7.8. Talus with low beach in front.

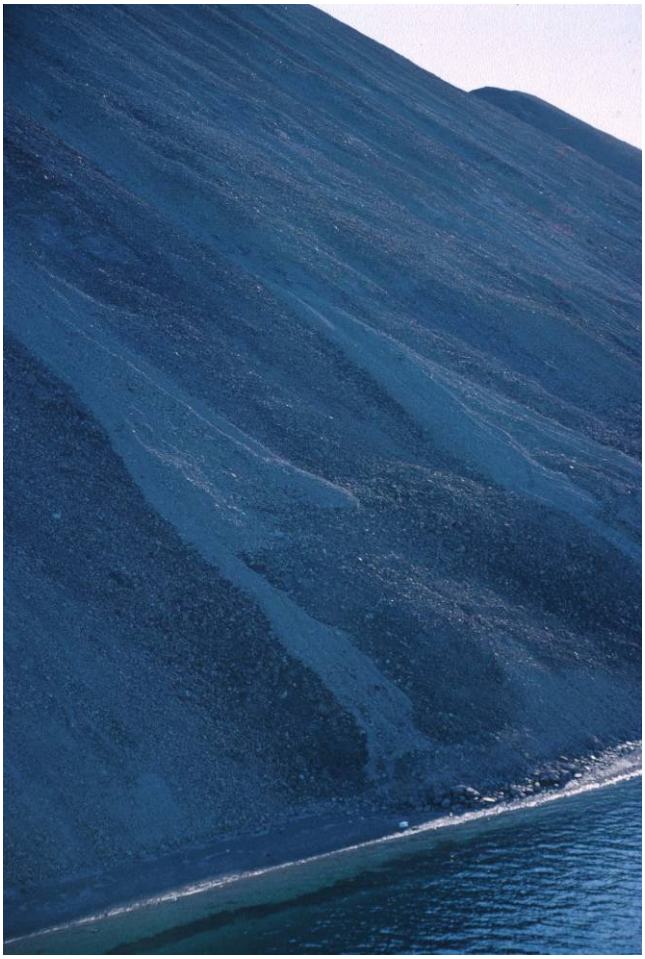

Figure 7.9. Talus in combination with steep cliffs.

Figure 7.10. Pocket beach surrounded by rocky coast.

Figure 7.11. Beach with well-sorted sand and gravel.

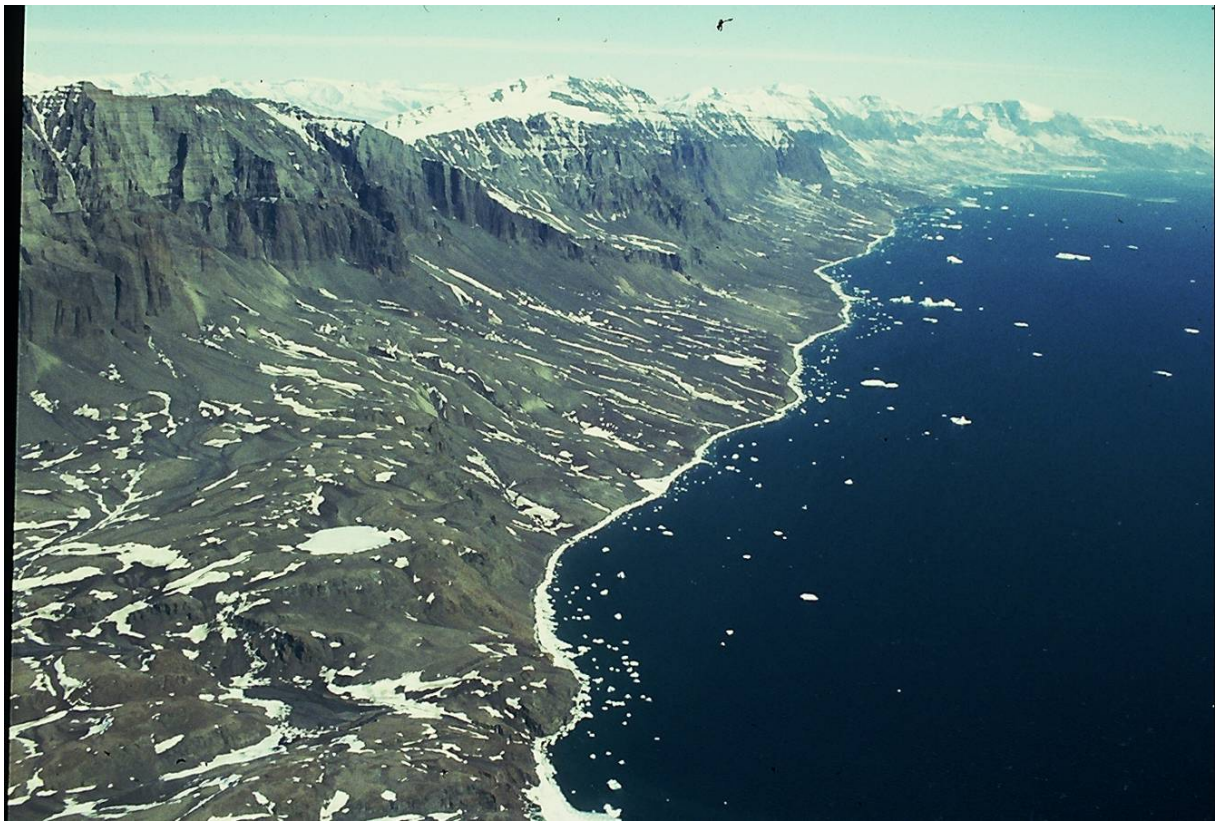

Figure 7.12. A mixture of rocky coasts, moraine coasts and beaches. Note that sea ice still is attached to the coast (the ice foot) in mid-May.

7.2.3 Potential safe havens

A safe haven is a site where unloading and/or stabilisation operations can be carried out on a stricken vessel with limited impact on the environment. Small bays and inlets which can be exclusion boomed and which are situated in areas with low sensitive coasts qualify for such sites. A few potential safe havens which generally qualify and where the navigation information apparently is good are indicated on the map sheets. However, the general knowledge on the navigability and water depth on other potential safe haven sites within the mapped region is very limited, and such sites should be investigated for their suitability. Therefore in the text we have also included a number of sites which possibly might be used as safe havens after a reconnaissance or by involving local knowledge. It will be more feasible, at the time of an incident, to investigate the use of such a nearby potential safe haven, rather than searching for safe havens within the entire region. If only those areas that unreservedly can be recommended for use as a safe haven were to be identified, very few would be left.

7.2.4 Countermeasures

Countermeasure information will in final version be given for each map. Potential sites for booming and inshore containment lengths will be indicated on the maps.

7.2.5 Topographic maps and nautical charts

The study region is covered by 3 topographic maps at a scale of 1:250.000. The maps are named 72 V.1 Upernavik; 73 V.1 Tasiussaq and 74 V.1 Kraulshavn. The region is also covered by nautical charts No. 1600 and No. 1700 in 1: 400.000 and charts of main harbours (No. 1650 and No. 1710). The maps are available from Weilbach (http://www.weilbach.dk).

7.2.6 Climate, oceanography and ice conditions

Information regarding the climate, oceanography and ice conditions in the region covered by this atlas can be found in the recent strategic environmental impact assessment of oil activities in the Baffin Bay region (Boertmann et al. 2009).

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8 Offshore and summary information

8.1 Study area introduction

8.1.1 The offshore area

The offshore part of the study region (72-75º N) is the eastern part of the Baffin Bay. The shelf is the shallow (less than 200 m) waters between the coast and the usually steep break to the deep sea. This shelf is in this region confined to a narrow and broken (by deeps to the west of some of the fjords) strip (max. 80 km wide) along the coast and some shoals or banks (Figure 8.1). To the west of the shelf depth reaches more than 2,300 m.

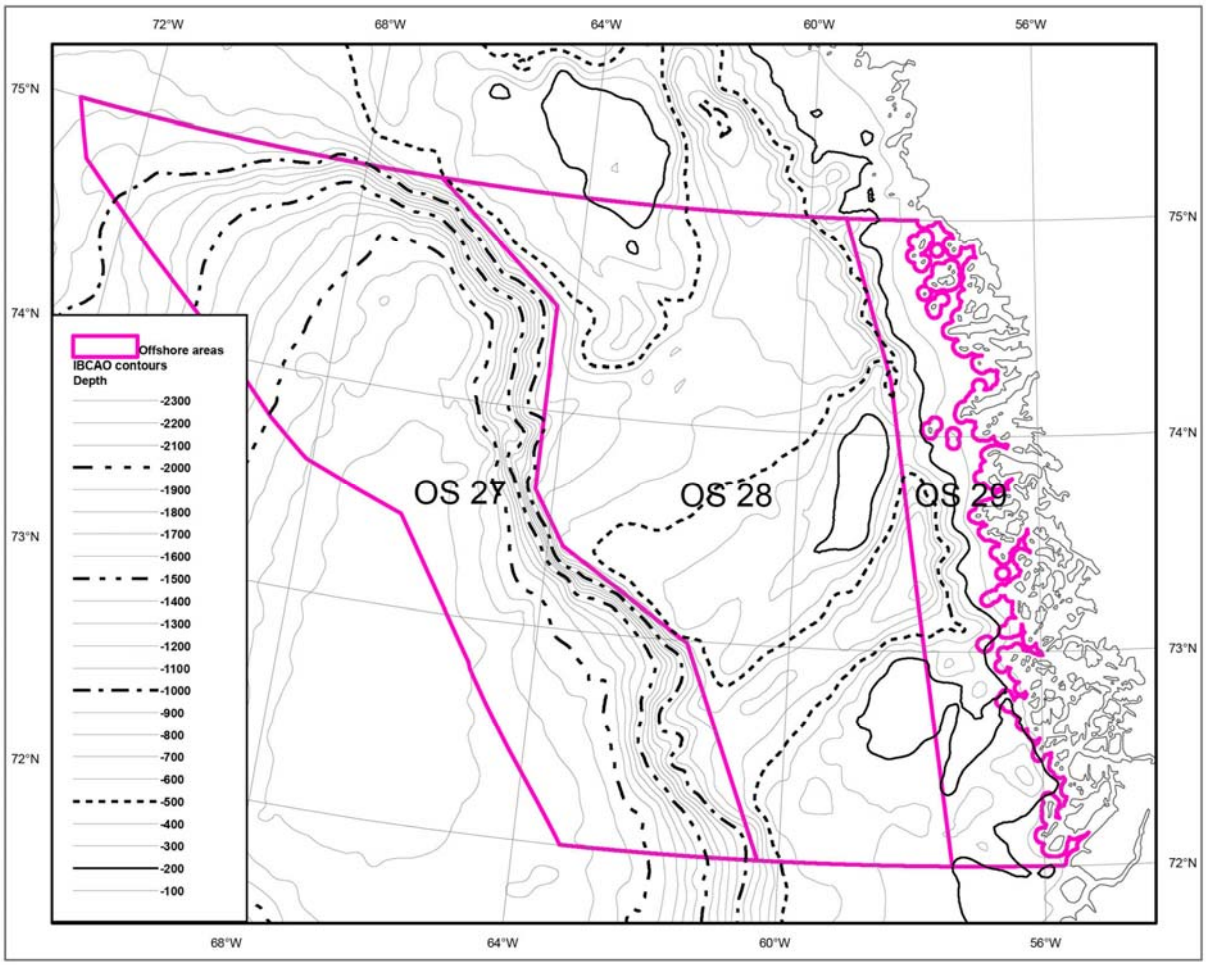


Figure 8.1. Bathymetry of the northern West Greenland (72º-75º N) offshore waters.

In winter the waters normally are covered with ice: Fast ice occur near the shore and in fjords and bays while in the offshore areas highly dynamic drift ice occur. Off the fast ice edge there is a shear zone (flaw zone), where a varying amount of open water occurs throughout the winter. The open water increase gradually in spring. The ice edge is an important hunting area for the inhabitants of the region in winter and spring. The primary production in the area is generally lower than in the waters of the Davis Strait, but in the shear zone, production may start very early due to the open water.

8.1.2 Currents

Along West Greenland flows the West Greenland current with two principal components. Closest to the shore the East Greenland Current component brings water of polar origin northward along the West Greenland coast. On its way, this water is diluted by run-off water from the various fjord systems. The East Greenland Current component looses its momentum on the way northward and at the latitude of Fylla Bank (64º N) it turns westward towards Canada where it joins the Labrador Current. West for and below the Polar water of the East Greenland Current, another component with Atlantic water is found. This originates from the Irminger Sea and the North Atlantic Current. This relatively warm and salty water can be traced all the way along West Greenland from Cape Farewell to Thule (Qaanaaq). See Figure 8.2.

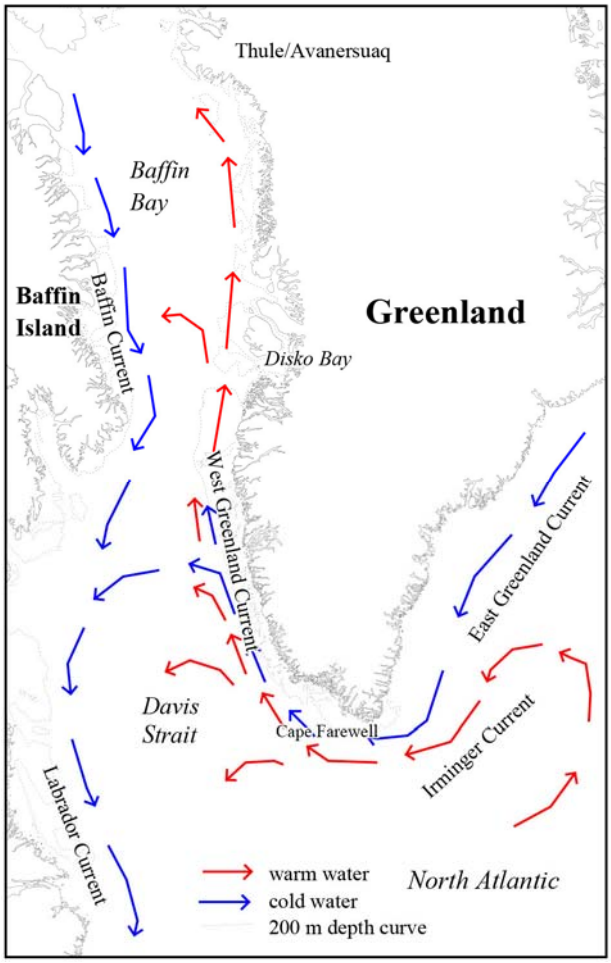


Figure 8.2. Surface current patterns in the waters off West Greenland.

The Polar Water inflow is strongest during spring and early summer (May - July). The inflow of Atlantic water masses is strongest during autumn and winter explaining why the waters between 62º and 67º N normally are ice free during wintertime.

A fifty year long time-series of temperature and salinity measurements from West Greenland oceanographic observation points reveal strong inter-annual variability in the oceanographic conditions off West Greenland. Moreover are some distinct climatic events obvious, of which three cold periods within the recent thirty years are the most dominant. The inter-annual variability is caused by changes in the atmospheric circulation or by variation in the strength of the ocean currents transporting water to the West Greenland area, and both seem to be related to the North Atlantic Oscillation Index (NAO-index) reflecting the difference in mean sea level air pressure between the Icelandic Low and the Azores High.

8.1.3 Ice and weather

Sea ice is normally present throughout the region from December to June. Inside fjords fast ice may form from October, and generally the ice cover peak in March.

Icebergs originating from glaciers occur in the entire region. The density is high in and off some of the fjords with productive glaciers. However, the drift and distribution of glacial ice at sea have never been investigated systematically and is therefore only known roughly.

The meteorological conditions in the area are influenced by the North American continent and the North Atlantic Ocean, but also the Greenland Inland Ice and the steep coasts of Greenland have a significant impact on the local climate. Many Atlantic depressions develop and pass near the southern tip of Greenland and cause frequently very strong winds off West Greenland. Also small-scale phenomena such as fog or polar lows are common features near the West Greenland shores. The probability of strong winds increases close to the Greenland coast and towards the Atlantic Ocean.

8.1.4 Coastal zone geomorphology

The coastal zone of the region is dominated by rocky shorelines with many skerries and archipelagos. In the southern part the coasts are dominated by basaltic, but elsewhere the brocky coasts are bedrock. Small bays with sand or gravel are found between the rocks in sheltered areas, and here and there are low sediment coasts with sand, gravel or pebbles. The tidal amplitude is approx 2.3 m and a rich subtidal flora and fauna exists on the bedrock shorelines.

The geomorphology of the northern part of the West Greenland coast has been classified according to shore type, and exposure. The classification covers the coastline from northern Sigguup Nunaa (Svartenhuk) to the north of Tuttulikassaak (Lillle Renland) about 40 km north of Kullorsuag . The total shoreline length is c. 5,895 km.

The division of the shoreline into shore type segments is based on the geomorphology of the coast. As the classification has been performed on the basis of topographical and geological maps and satellite imagery, some shore types with short extent (< 2 km) might be underrepresented in the classification. Short segments have been included where a clear indication of type could be found. The input data have not allowed for the identification of pocket beaches.

The total number of segments identified is 1868. Of these 177 segments (1,561 km) are on the mainland coast, 219 segments (3,133 km) are on bigger islands (perimeter > 6 km) and 1,461 segments (1,190 km) are on smaller islands (perimeter < 6 km).

The distribution of segments on shore type and exposure categories respectively is given in Tables 8.1-8.2. In terms of shoreline length, the 'Rocky coast' is the dominant shore type (63.9 %) and 'Semi-protected' is the dominant exposure type (52.1 %). The majority of the coasts within the 'Archipelago' shore type are rocky coasts. Together the 'Archipelago' and 'Rocky coast' shore types by length constitute 92.1 % of the total investigated shoreline.

Table 8.1. Shore type statistics.

Shore type	No. of stretches	Km	%
Rocky coast	763	3770	63.9
Archipelago	981	1668	28.3
Glacier coast	35	154	2.6
Moraine	46	93	1.6
Alluvial fan	3	5	0.1
Talus	35	189	3.2
Beach	5	17	0.3
Total	**1868**	**5895**	**100.0**

Table 8.2. Exposure statistics.

Exposure type	Km	%
1 Protected	1436	24,4
2 Semi-protected	3069	52,1
3 Semi-exposed	930	15,8
4 Exposed	458	7,6
Total	**5893**	

8.1.5 Marine fish and invertebrates

Table 8.3. Important fish and large invertebrate species in the area (72°-75° N).

Species	Main habitat	Spawning area	Spawning period	Exploitation
Blue mussel	Subtidal, rocky coast			s
Scallop	Inshore and on the banks, in area with high current velocity, 20-60 m depth		July-August	s
Northern shrimp	Mainly offshore, 100-600 m depth	Larvae released at relatively shallow depth (100-200 m), larvae in middle water-column	(July -September) larvae released March to May	
Snow crab	Coastal and fjords, 180-400 m depth		Larvae released April-May	s
Polar cod	In- and offshore	Pelagic eggs and larvae in upper water column	Winter and early spring	Used for bait
Wolffish	Inshore and offshore	Hard bottom, demersal eggs	Peaks in September	s
Arctic char	Coastal waters, fjords	Freshwater	-	s
Capelin	Coastal waters	Beaches, demersal eggs	April-June	s, important prey item
Greenland halibut	Offshore and inshore, deep water	Do not spawn in region	Winter	Important c & s
Lumpsucker	Pelagic coastal, demersal eggs	Shallow water near coast	May-June	None

Exploitation of the species are categorised in c: commercial and s: subsistence fishery.

Bottom fish dominates the offshore fish assemblage in the area. The most important fish and invertebrate species in the study area are listed in Table 8.3. The inshore fishery for Greenland halibut (Figure 8.3) is the most important fishery in the area. It takes mainly place in inshore waters, in the deep fjords. For further details see also the strategic environmental impact assessment of oil activities in the Baffin Bay produced by NERI in 2009 (Boertmann et al. 2009) with later updates.

Lumpsucker and capelin are coastal spawners, which in other parts of Greenland are used on subsistence basis and in case of lumpsucker also on commercial basis. However both have their northern distribution limit within the covered region, and they have only insignificant importance. Arctic char spend the winter in fresh water and is caught in coastal waters when the return to the winter habitat after the marine summer. Arctic char is a popular fish for the subsistence use.

Northern shrimp is the most important natural resource in Greenland. Within the region covered by this atlas, it is fished on the bank slopes in the southern part. For further details see also the strategic environmental impact assessment of oil activities in the Baffin Bay produced by NERI in 2009 (Boertmann et al. 2009) with later updates.

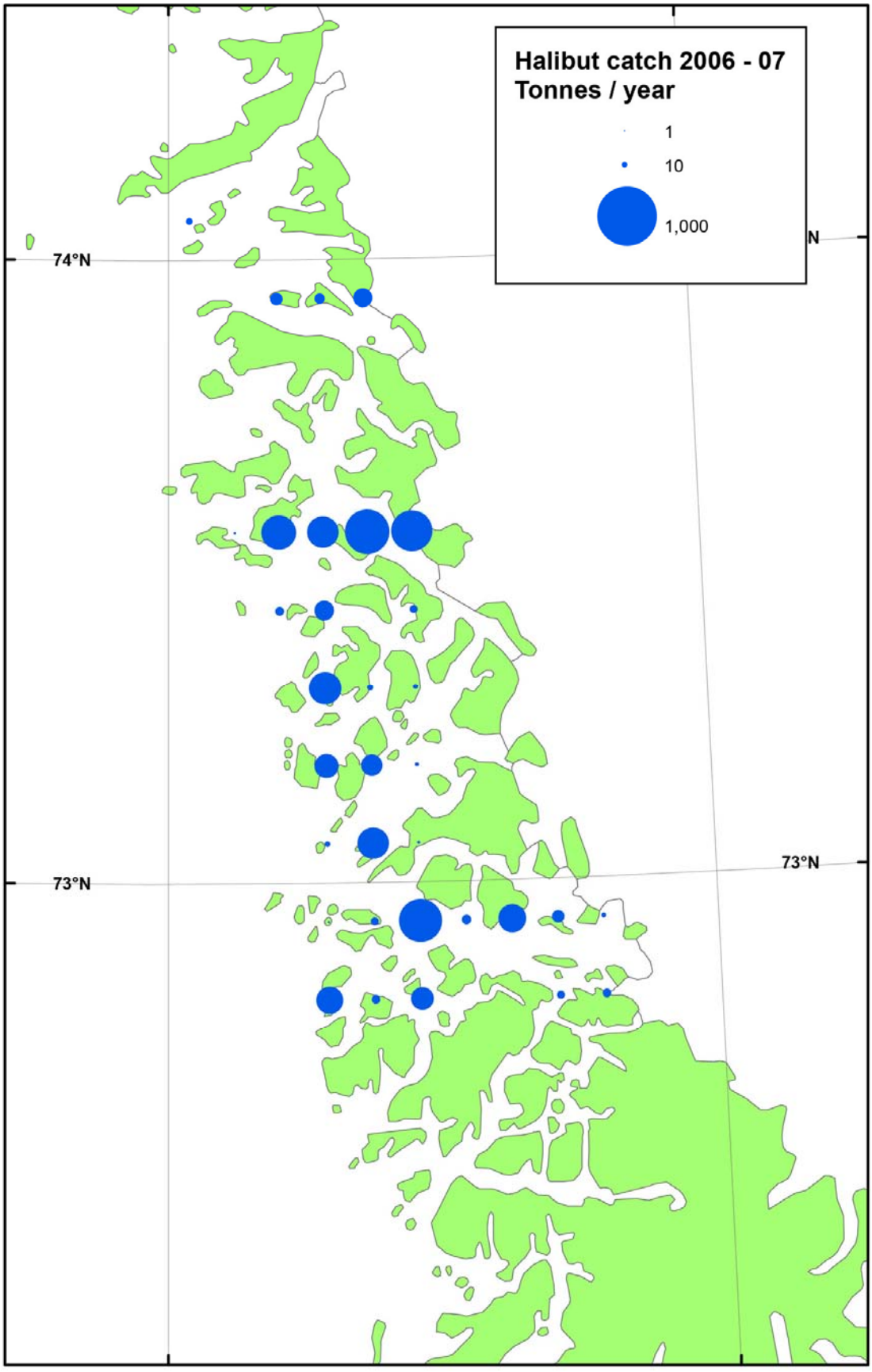


Figure 8.3. Distribution of inshore catches of Greenland halibut (mean values of catches in 2006-07 . Based on data from GINR.

8.1.6 Seabirds

The study area is very important to seabirds with a high diversity and large numbers.

Some of the species feed predominately on fish taken during dives below the surface. Examples are thick-billed murres and cormorants. Other species are surface plankton feeders such as the kittiwake and some dive to the bottom to feed on crustaceans and mollusks; e.g eiders (hard bottom) and king eiders (soft bottom). The largest seabird populations are present in the area during summer, as the winter ice forces the bird populations southwards to open waters.

Spring

From April through to June, when the ice starts to break up, large numbers of birds which winter in the open water area further south, move into and through the study area. King eiders head for breeding areas mainly in the western Canadian Arctic, common eiders to breeding areas along the Canadian and Greenland coasts, little auks to the huge colonies in Thule (Qaanaaq) and thick-billed murre to the large colonies in the study region and Qaanaaq.

Large numbers of kittiwakes and fulmars, which winter south of Greenland, also move into or pass through the region on their way to breeding grounds in the region or further north.

Summer

There are 14 species of colony breeding seabirds in the study area (Figure 8.4). They have their colonies on small islands or steep cliffs. The most important breeding colonies are those of the thick-billed murre, which are found dispersed throughout the region. Most of these are declining in numbers, due to excessive hunt, but two placed in the region between Tasiusaq and Kraulshavn are apparently stable. One of these, on Kap Schackleton, is the larges seabird breeding colony in West Greenland with more than 100,000 pairs of murres.

There are numerous colonies of common eider, great cormorant, gulls, Arctic terns and kittiwakes scattered along the coasts, both exposed to the open sea and in the fjordlands.

In July/August, post-breeders of some duck species gather in the coastal zone for moulting and feeding. Moulting birds loose the ability to fly for 3-4 weeks and are particular sensitive to disturbance and oil spills. The post breeding ducks are common eider (mainly scattered along the coasts and archipelagos for example at Fladøerne, and - as the most significant - the king eider (they arrive in high number from Canadian breeding areas from late July, and moult in remote fjords and bays).

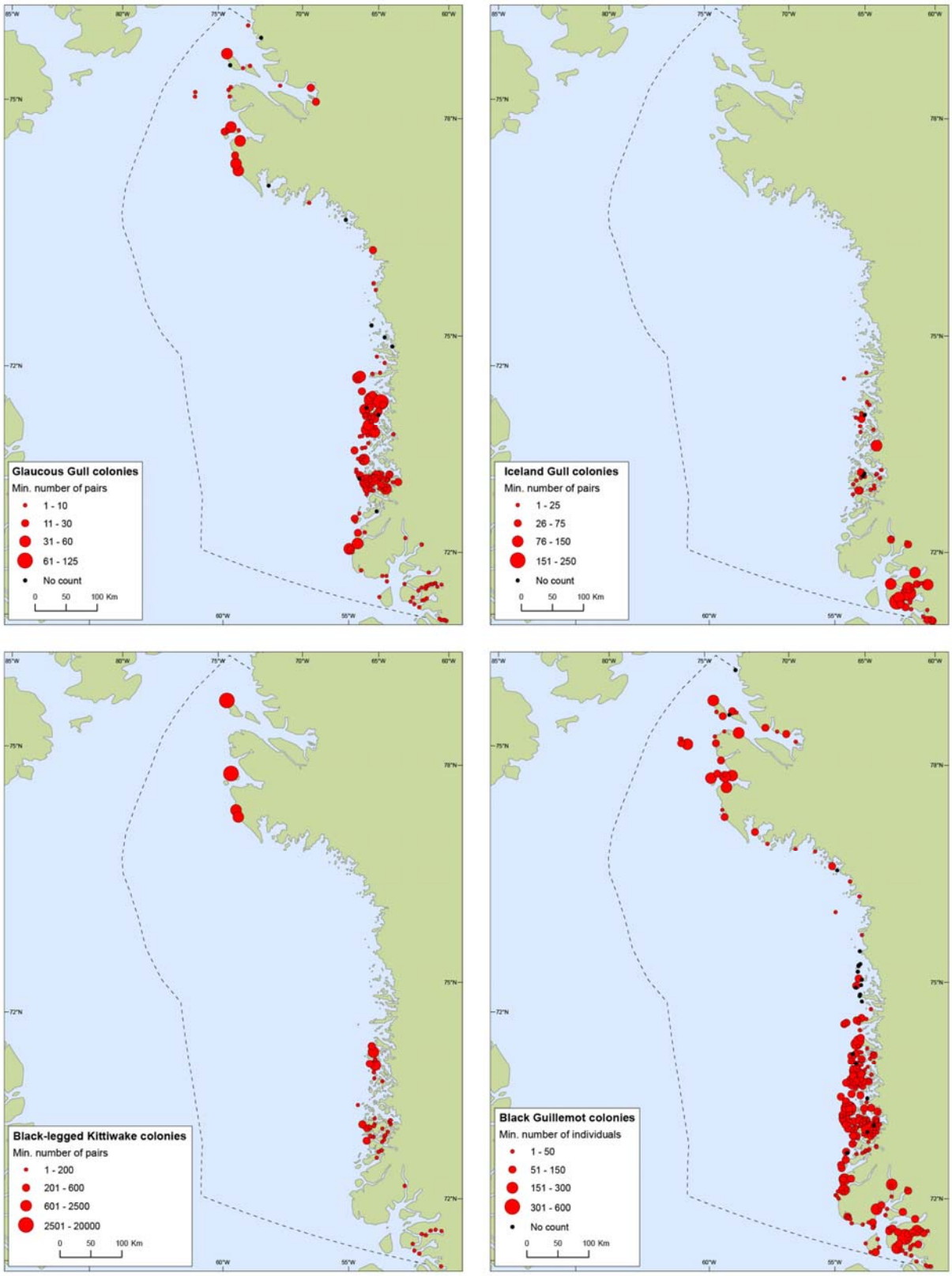


Figure 8.4 a. Distribution and size of seabird breeding colonies in the region covered by this atlas. The hatched line indicates the areas where a strategic environmental impact assessment has been carried out.

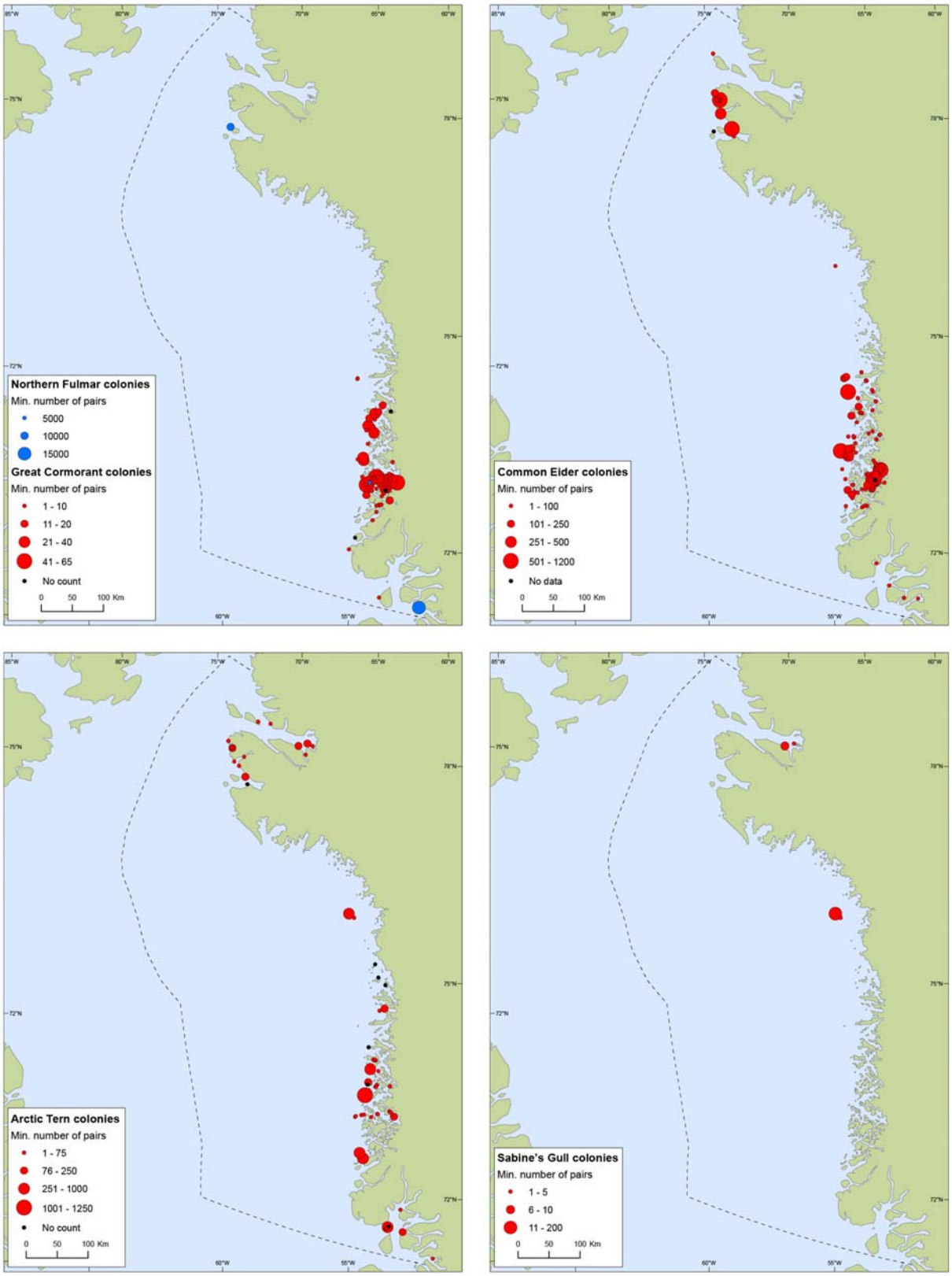


Figure 8.4 b. Distribution and size of seabird breeding colonies in the region covered by this atlas. The hatched line indicates the areas where a strategic environmental impact assessment has been carried out.

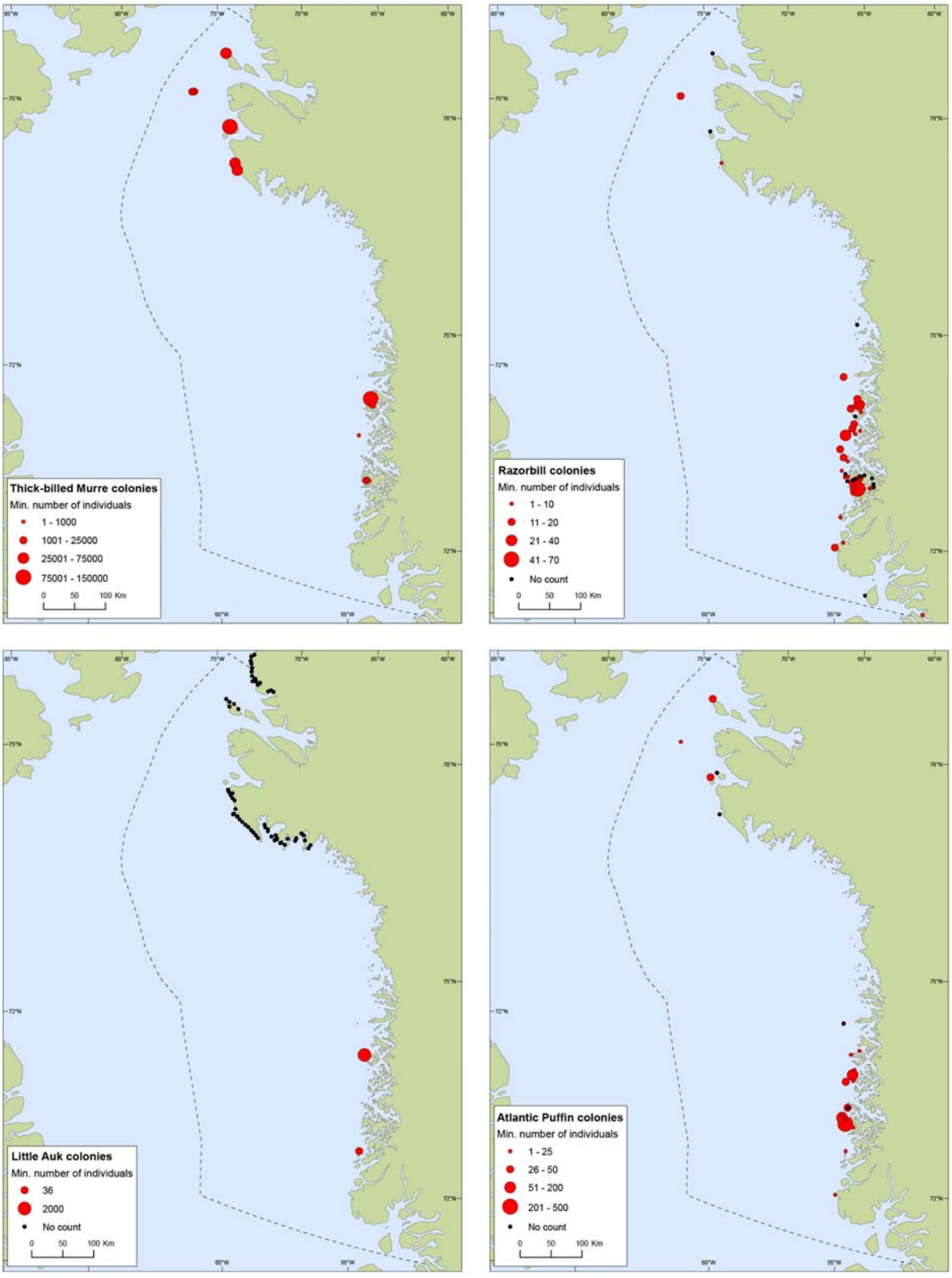


Figure 8.4 c. Distribution and size of seabird breeding colonies in the region covered by this atlas. The hatched line indicates the areas where a strategic environmental impact assessment has been carried out. Note that the size of the huge colonies of little auk in Qaanaaq municipality is unknown. However, the total numbers breeding here has been estimated to more than 30 million pairs.

During summer the offshore density of seabirds generally is low compared to the autumn and spring period. The most common and widespread specie in summer is the northern fulmar, and most of them are probably non-breeding immature birds. Breeding birds from the coastal colonies of gulls, fulmars and alcids may also occur, although they usually stay closer to the coast

Autumn and winter

During autumn seabirds of different populations move through the study area. These comprise mainly thick-billed murres from the colonies further north and little auks from the huge colonies in Thule (Qaanaaq).

Table 8.4. Seabird occurrence and activity in the coastal zone and offshore areas between 72° and 75° N.

Specie		Occurrence	Distribution	National red list status
Fulmar	b/s	April-October	c & o	Least concern (LC)
Great cormorant	b	May-October	c	Least concern (LC)
Common eider	b/s/m	April-October	c	Vulnerable (VU)
King eider	m	July -September	c	Least concern (LC)
Long-tailed duck	b/m	May-October	c	Least concern (LC)
Kittiwake	b/s	May-October	c & o foraging	Vulnerable (VU)
Glaucous gull	b/s	April-December	c & o	Least concern (LC)
Iceland gull	b/s	April-December	c & o	Least concern (LC)
Great black-backed gull	b/s	April-December	c & o	Least concern (LC)
Arctic tern	b	May-September	c	Near threatened (NT)
Thick-billed murre	b/s/mv	May-September	c & o	Vulnerable (VU)
Razorbill	b	May-September	c & o	Least concern (LC)
Puffin	b	May-September	c & o	Near threatened (NT)
Black guillemot	b	May -September	c	Least concern (LC)
Little auk	b/mv	May-October	c & o	Least concern (LC)

Categories of occurrence: b: breeding, s: summering, m: moulting, mv: migrant visitor, w: wintering.
Categories of distribution: c: coastal, o: offshore.

Increasing ice cover in December force the remaining seabirds southward to wintering sites further south along the West Greenland coast and Newfoundland.

For further details on the seabird occurrence in the study region see also the strategic environmental impact assessment of oil activities in the Baffin Bay produced by NERI in 2009 (Boertmann et al. 2009).

8.1.7 Marine mammals

The study area is important to many marine mammal species. Table 8.5 gives an overview of the species. Bowhead whales, narwhals, white whales and walrusses are migrant visitors occurring in and along the drift ice in the Baffin Bay. In May-June minke, humpback, fin and blue whales arrive to the area from the south. Ringed seals and bearded seals occur throughout the year and are usually associated with ice. Harp and hooded seals start their migration along the West Greenland coasts in May-June and stay until November/December. These patterns are summarised in Table 8.5.

Table 8.5. Overview of marine mammals present in the study area.

Specie	Period	Main habitat	Stock size in the area/ occurrence	Protection / exploitation	National red list status
Bowhead whale	May-June	Drift ice/ice edge	c. 1200	Annuals quota of two	Near threatened (NT)
Minke whale	April-November	whole area	Rather common	Hunting regulated	Least concern (LC)
Humpback whale	July-November	Banks and coastal waters	Rather common	Hunting regulated	Least concern (LC)
Fin whale	June-October	Banks and coastal waters	Few	Hunting regulated	Least concern (LC)
Blue whale	June-October	Banks and coastal waters	Few	Protected (1966)	Data deficient (DD)
Narwhal	December-April	Pack ice/deep water	Thousands	Annual quota	Critical endangered (CR)
White whale	November-May	Drift ice on banks	Some thousands	Annual quata	Critical endangered (CR)
Killer whale	Whole year	Whole area	Rare	Hunting unregulated	Not applicable (NA)
Harp seal	May-November	Whole area	Common	Hunting unregulated	Least concern (LC)
Hooded seal	March-October	Whole area	Rather common	Hunting unregulated	Least concern (LC)
Ringed seal	Whole year	Whole area, mainly fjords with ice	Common	Hunting unregulated	Least concern (LC)
Bearded seal	Mainly winter	Drift ice	Common	Hunting unregulated	Least concern (LC)
Walrus	Spring, summer, autumn	Drift ice on banks	Only in low numbers	Annual quota	Endangered (EN)
Polar bear	December-June	Drift ice	Widespread in low numbers	Annual quota	Vulnerable (VU)

Some of the marine mammals, such as walrus and bearded seal feed on the bottom fauna. Ringed seal, harp seal and harbour seal feed on a broad range of pelagic prey items, whereas hooded seal mainly feed close to the bottom at great depths. Baleen whale feed on krill and smaller schooling fish species.

For further details on the occurrence of marine mammals in the study region see also the strategic environmental impact assessment of oil activities in the Baffin Bay produced by NERI in 2009 (Boertmann et al. 2009).

8.1.8 Archaeological and historic sites

Based on our present knowledge, Greenland seems to have been inhabited almost continuously since 4500 BP. Evidence of the various prehistoric cultures and settlements and use of resources are found almost everywhere along the Greenland coasts. Between 72º and 75º N there are for example some 112 archaeological sites registered in the central database of the Greenland National Museum & Archives (NKA), and they are therefore subject to the terms of the Conservation Act (see chapter 12.5). The main part of the 112 sites is coastal and included in this atlas.

The sensitivity of the items of archaeological interest is expressed on an ascending scale from 1 to 3:

1) Sites considered not likely to be impacted by marine oil spill.

2) Sites considered likely to be directly impacted by marine oil spill.

3) Sites of special importance, which require special considerations in the event of an oil spill or other activities in connection with raw material exploration and extraction.

8.2 Areas of extreme and high sensitivity

Figure 8.5 shows an overview of the shoreline areas of extreme (red) and high (yellow) sensitivity to marine oil spill as designated by this atlas. In total there are 27 areas of extreme sensitivity and 32 of high sensitivity.

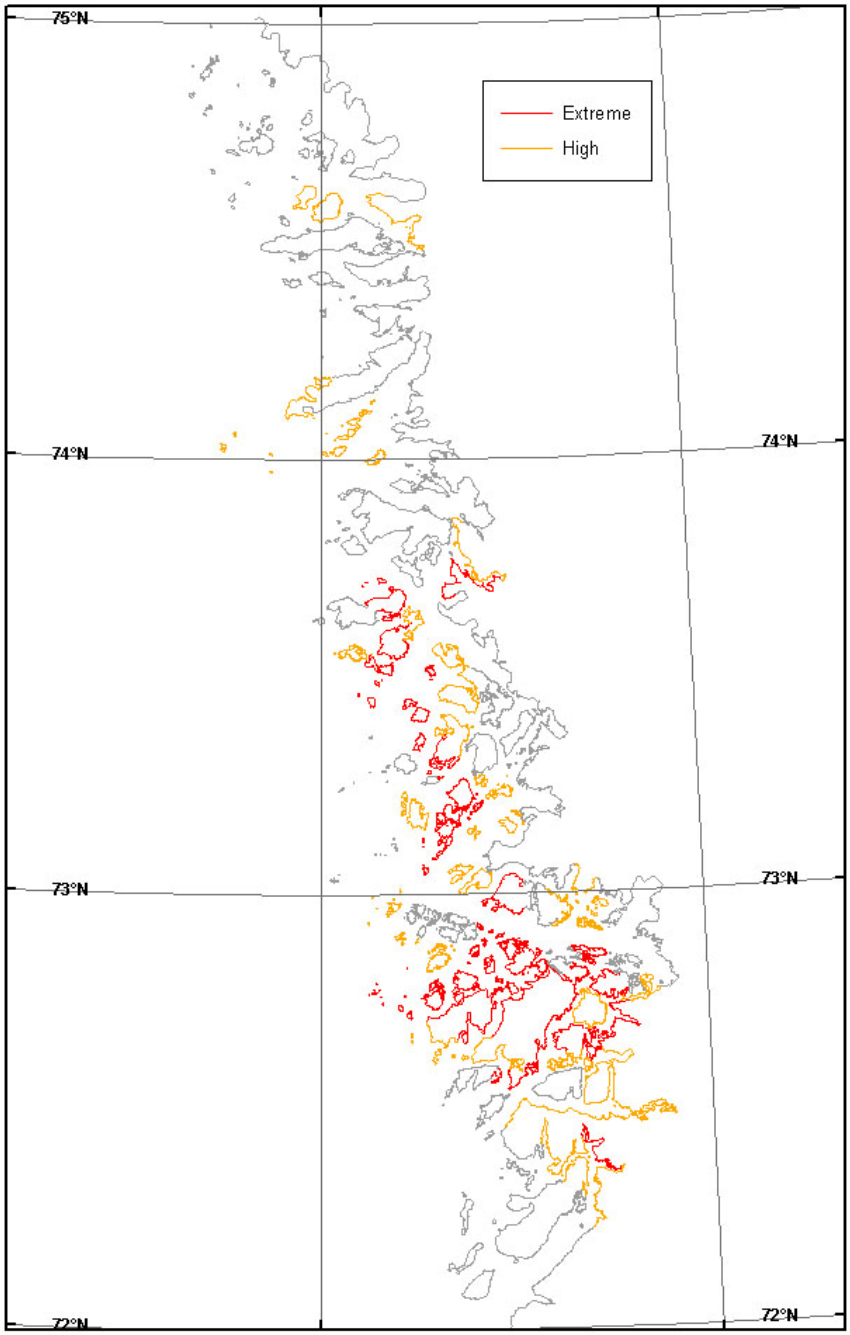


Figure 8.5. Areas of extreme and high sensitivity.

8.3 Offshore sensitivity

This chapter presents the four maps showing the sensitivity of the offshore areas between 72° and 75° N for each of the seasons, winter, spring, summer and autumn.

See Chapter 7 Users Guide for further information on map interpretation.

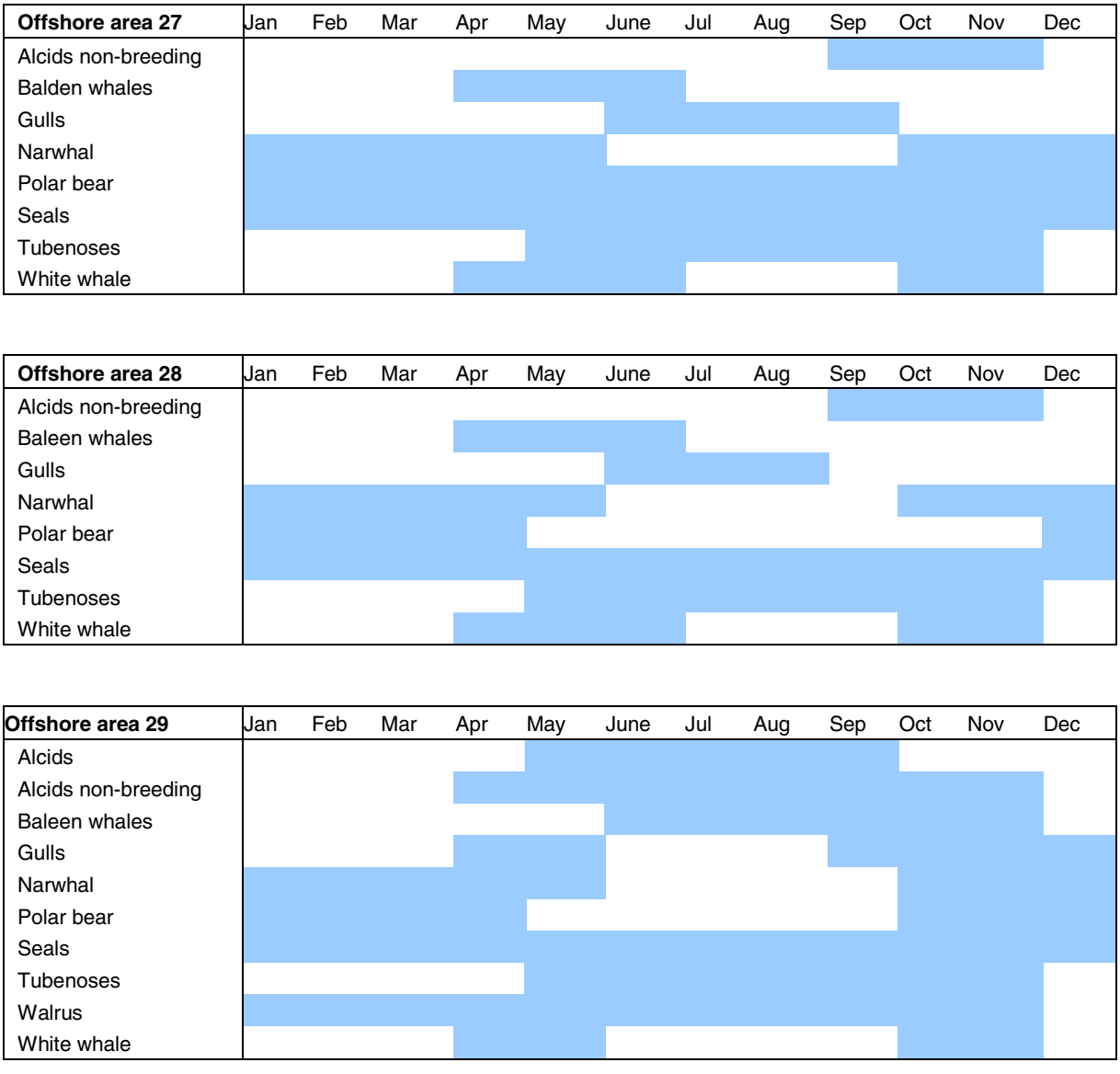
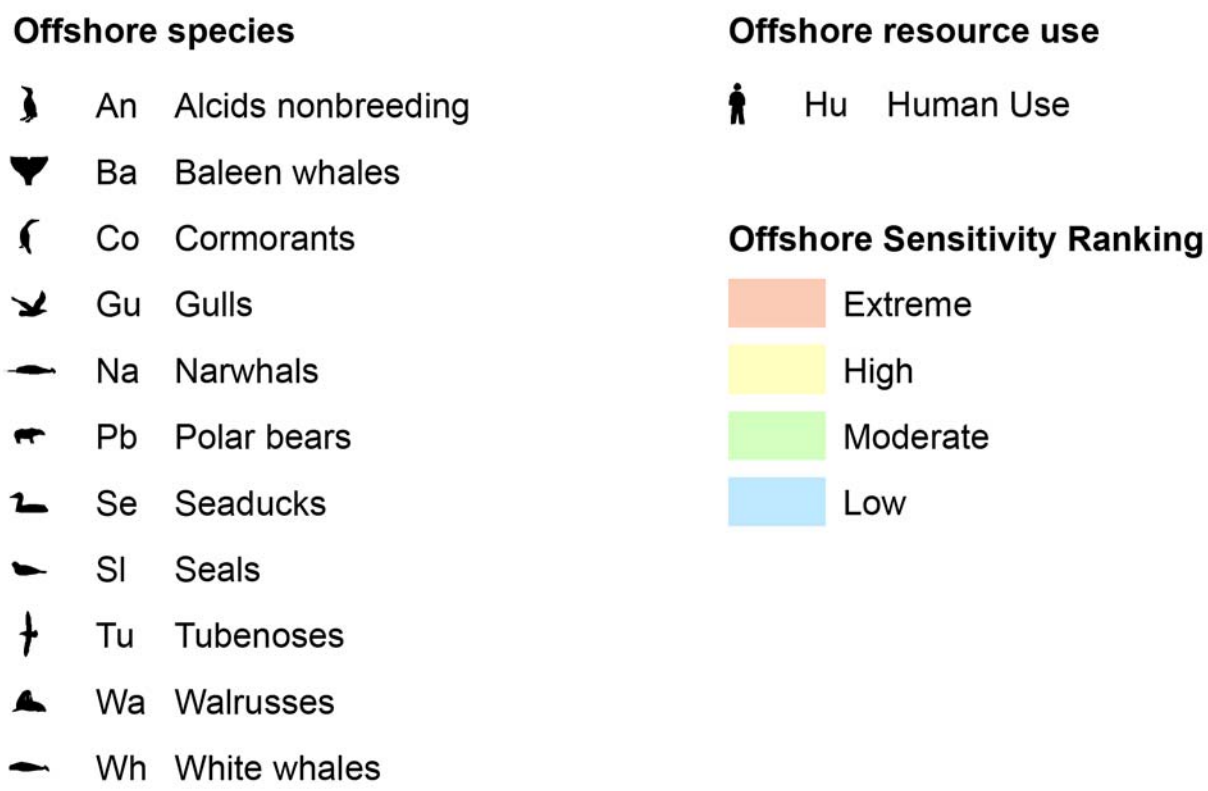


Figure 8.6. Temporal species occurrence in the three offshore areas.

Legend to the offshore maps (Figures 8.7-8.10):



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Offshore sensitivity Winter (January-March)

Environmental description (Figure 8.7)

Offshore area 27 (OS 27): *Resource use* (R OS 27): No fishery or hunting takes place in winter. *Species occurrence*: Important winter habitat for narwhal, ringed seal and polar bear.

Offshore area 28 (OS 28): *Resource use* (R OS 27): No fishery takes place in winter. Polar bears are occasionally caught in late winter. *Species occurrence*: Important winter habitat for narwhal, ringed seal and polar bear.

Offshore area 29 (OS 29): *Resource use* (R OS 29): Important hunting area for the subsistence hunters of the former municipality of Upernavik, where ringed seals are the main quarry, supplemented with polar bears. *Species occurrence*: Important winter habitat for ringed seals and polar bear.

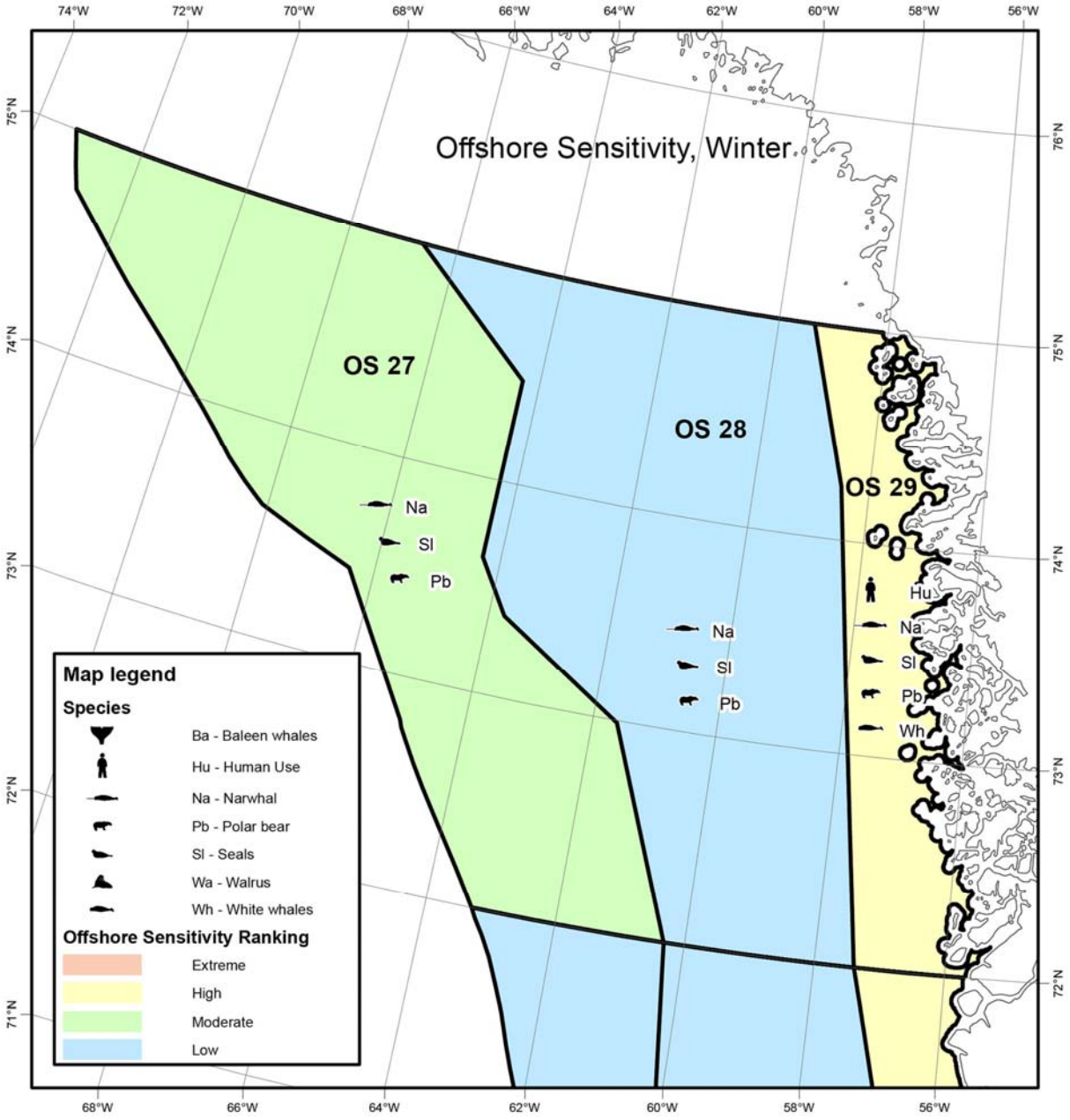


Figure 8.7. Offshore sensitivity in winter.

Offshore sensitivity — Spring (April-May)

Environmental description (Figure 8.8)

Offshore area 27 (OS 27): *Resource use* (R OS 27): No fishery takes place in spring. Hunting for polar bears and ringed seals occur. *Species occurrence*: Important habitat for narwhals, white whales and bowhead whales migrating northwards, ringed seals and polar bears are frequent.

Offshore area 28 (OS 28): *Resource use* (R OS 28): No fishery takes place in spring. Hunting for polar bears and ringed seals occur. *Species occurrence*: Important habitat for narwhals, white whales and bowhead whales migrating northwards, ringed seals and polar bears are frequent. Seabirds such as thick-billed murre, little auk and northern fulmar migrate through the area.

Offshore area 29 (OS 29): *Resource use* (R OS 29): No fishery takes place in spring. Hunting especially at ice edges for polar bear, walrus, ringed seal, whales and seabirds is important. *Species occurrence*: Important habitat for white whales, seals (ringed and bearded), polar bears and seabirds (including thick-billed murre, northern fulmar, common eider, great cormorant and black-legged kittiwakes).

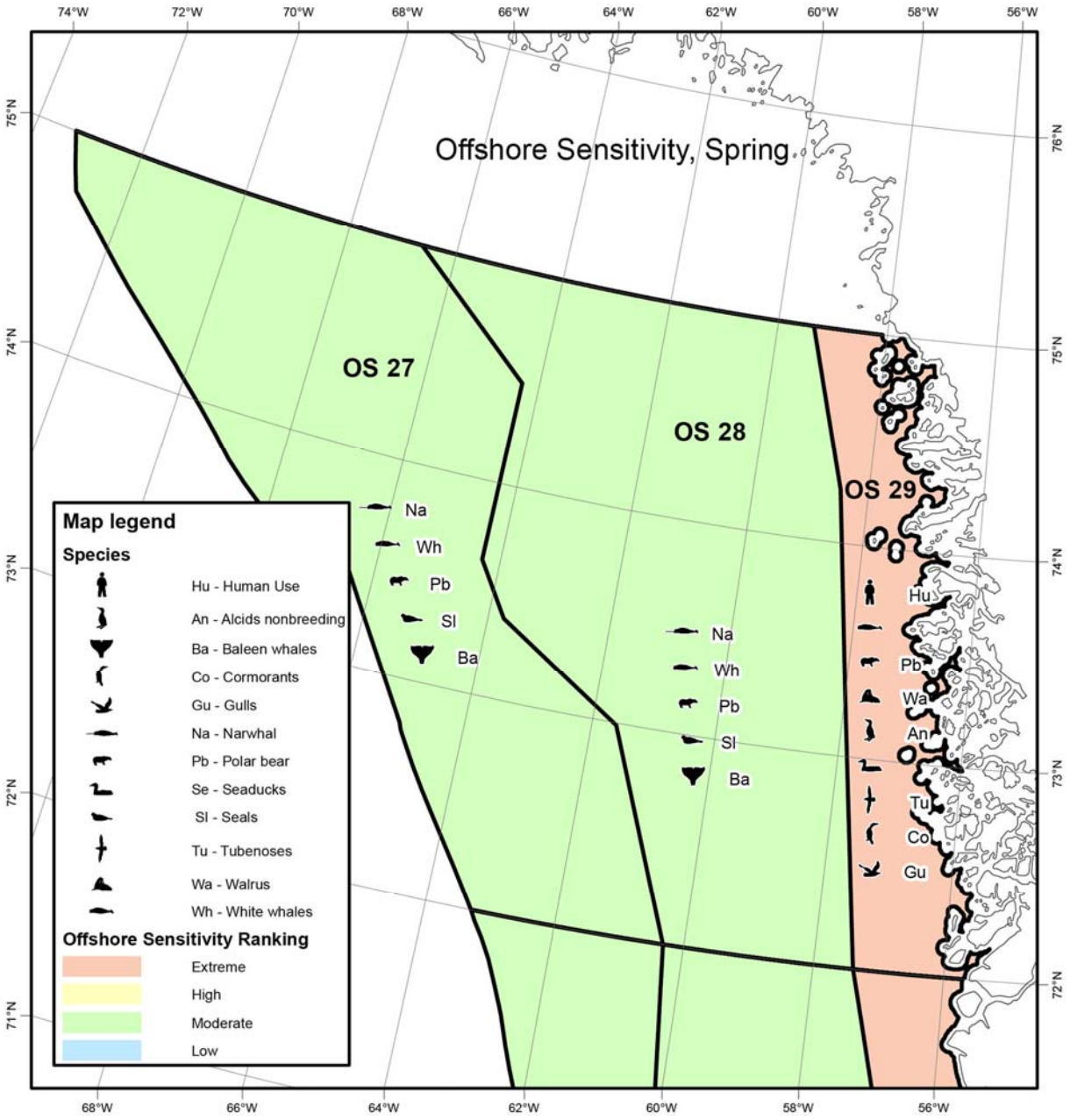


Figure 8.8. Offshore sensitivity in spring.

Offshore sensitivity Summer (June-August)

Environmental description (Figure 8.9)

Offshore area 27 (OS 27): *Resource use* (R OS 27): Trawling for Greenland halibut takes place along the shelf break in waters between 1000 and 2000 m deep. No hunting takes place in summer. *Species occurrence*: Most whales have left the area in summer, but fin whales and other species may occur in low numbers. Seabirds are few in summer, the most frequent are northern fulmar, black-legged kittiwake and thick-billed murre.

Offshore area 28 (OS 28): *Resource use* (R OS 28): Occasional hunting for marine mammals takes place. *Species occurrence*: Most whales have left the area in summer, but fin whales and other species may occur in low numbers. Seabirds are generally few in summer, the most frequent are northern fulmar, black-legged kittiwake and thick-billed murre. However, in the parts closes to the shore, foraging seabirds from the large breeding colonies on the coast may occur in higher densities.

Offshore area 29 (OS 29): *Resource use* (R OS 29): Subsistence fishery for Greenland halibut, wolffish, etc. takes place and subsistence hunting primarily for seals, occasionally minke whales and walrus is very important. *Species occurrence*: Many marine mammals occur: seals (harp, hooded, ringed), whales (minke, fin, humpback). Seabirds are numerous, mainly foraging birds from the large breeding colonies on the adjacent coasts: thick-billed murres, Atlantic puffins, black-legged kittiwakes, great cormorants, northern fulmars etc.

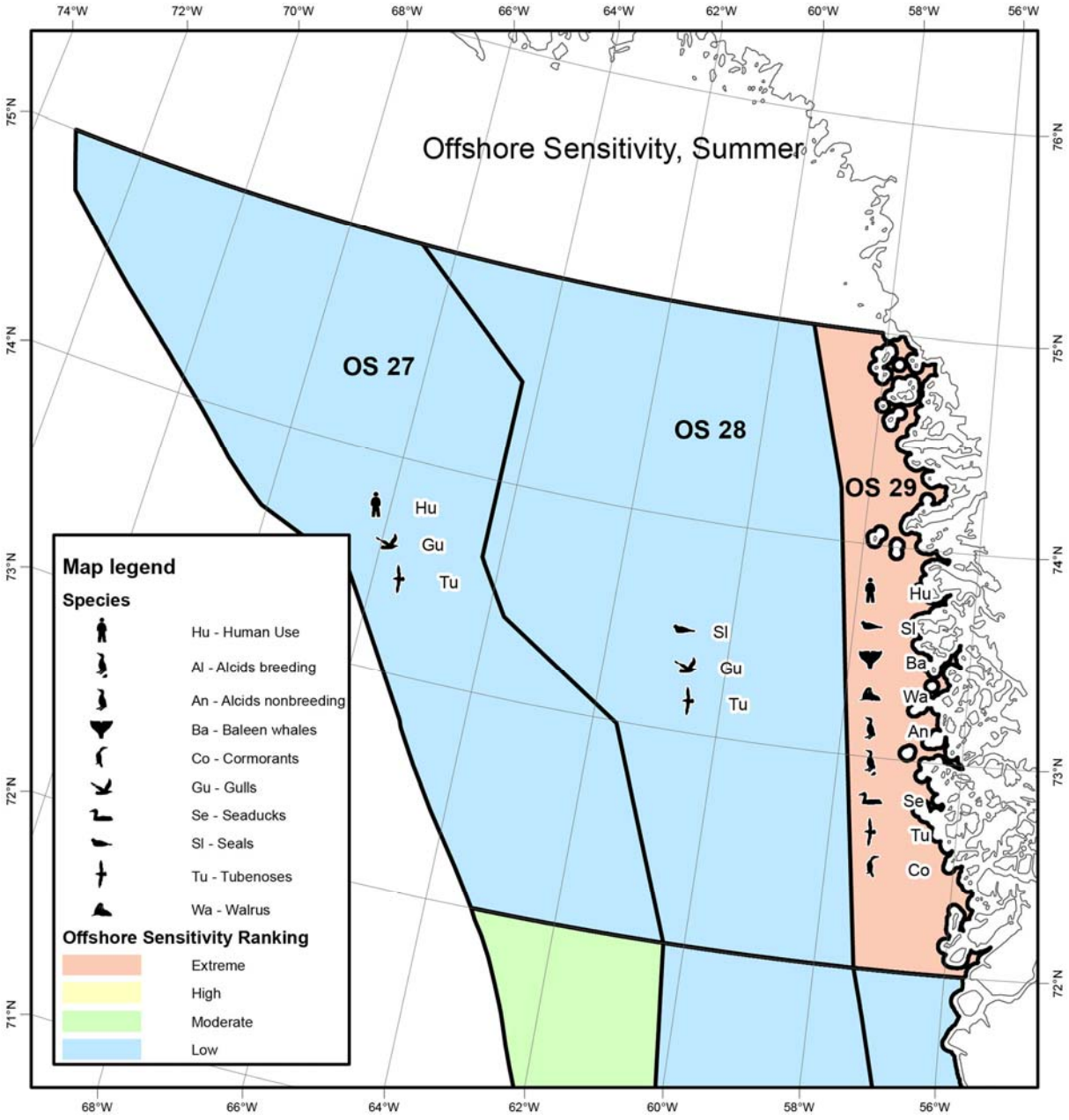


Figure 8.9. Offshore sensitivity in summer.

Offshore sensitivity Autumn (September-December)

Environmental description (Figure 8.10)

Offshore area 27 (OS 27): *Resource use* (R OS 27): Trawling for Greenland halibut takes place along the shelf break in waters between 1000 and 2000 m deep. No hunting takes place in autumn. *Species occurrence*: Important area for narwhals returning from summer grounds further north. Seabirds in large numbers move through the area on their autumn migrations: Thick-billed murres, little auks, northern fulmars and several species of gulls.

Offshore area 28 (OS 28): *Resource use* (R OS 28): Only occasional hunting takes place. *Species occurrence*: Important area for narwhals and white whales returning from summer grounds further north. Seabirds in large numbers move through the area on their autumn migrations: Thick-billed murres, little auks, northern fulmars and several species of gulls.

Offshore area 29 (OS 29): *Resource use* (R OS 29): Subsistence fishery for Greenland halibut, wolffish, etc. takes place and subsistence hunting for seals, white whales, narwhals and occasionally minke whales and walrus is very important. Seabirds such as common eider and thick-billed murre are also importnat hunting quarry. *Species occurrence*: Many marine mammals occur: seals (harp, hooded, ringed, bearded), whales (minke, fin, humpback, narwhal, white whale). Seabirds are numerous as large numbers migrate along the coast, mainly thick-billed murres, black-legged kittiwakes, common eiders great cormorants, northern fulmars etc.

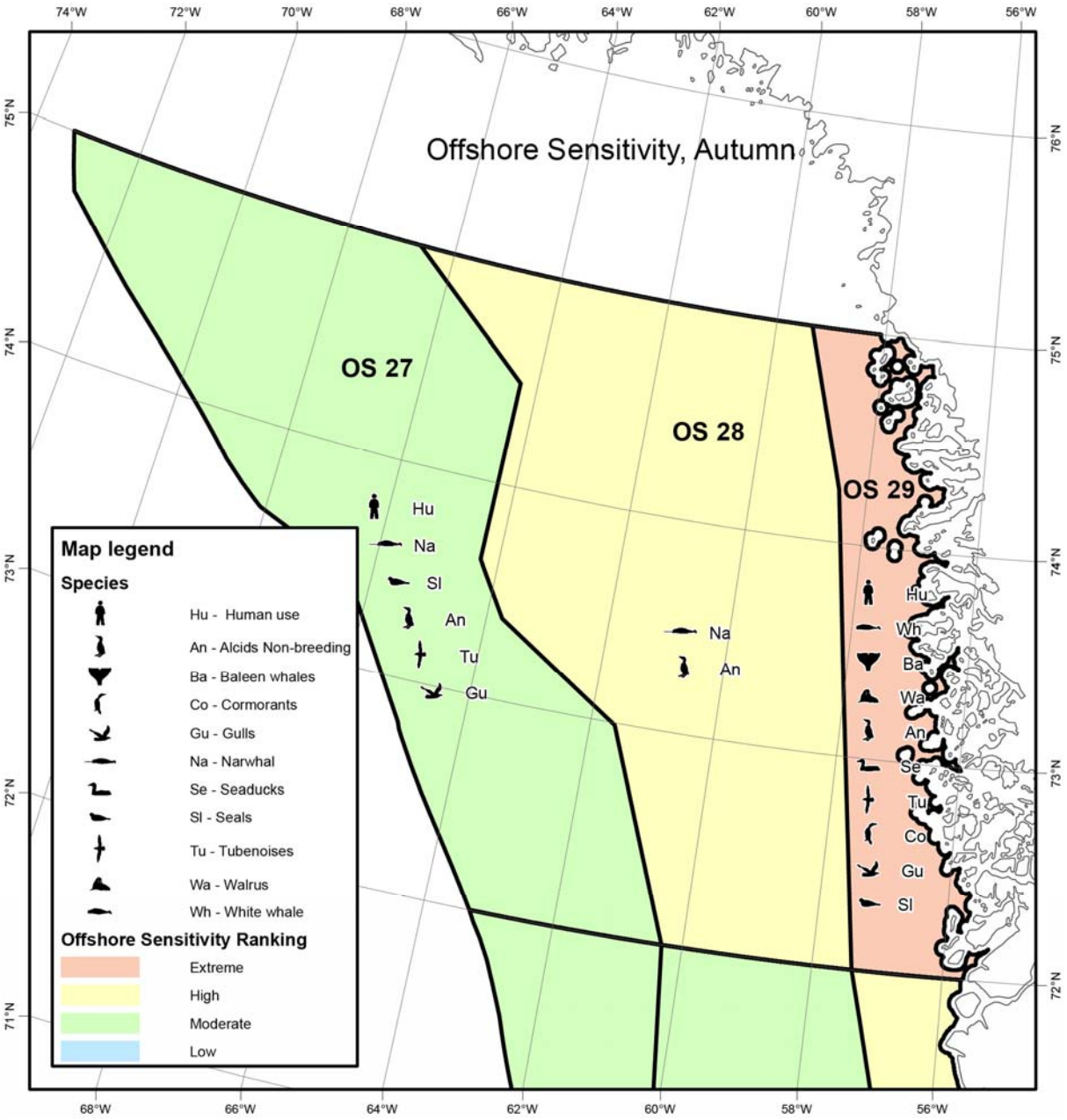
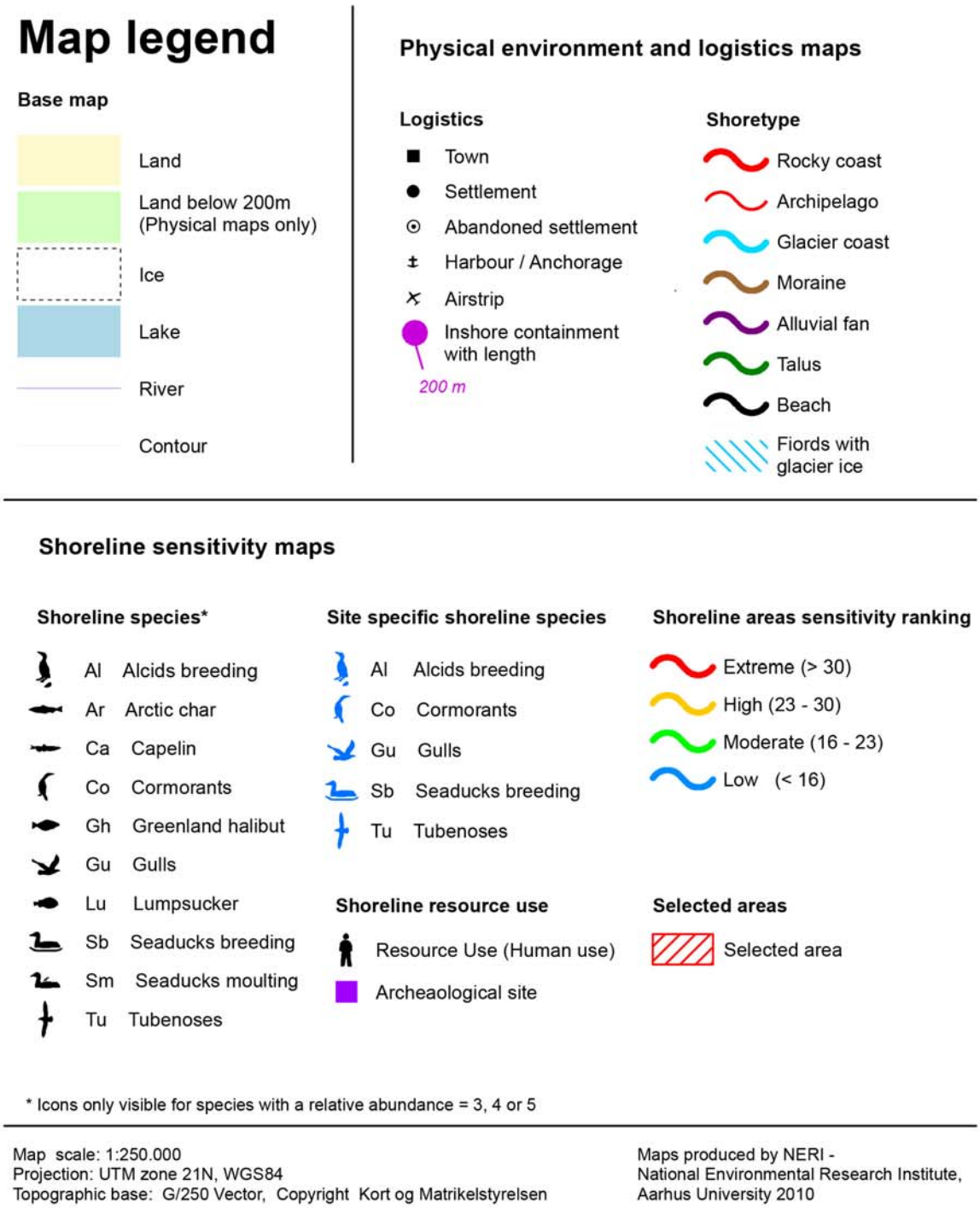


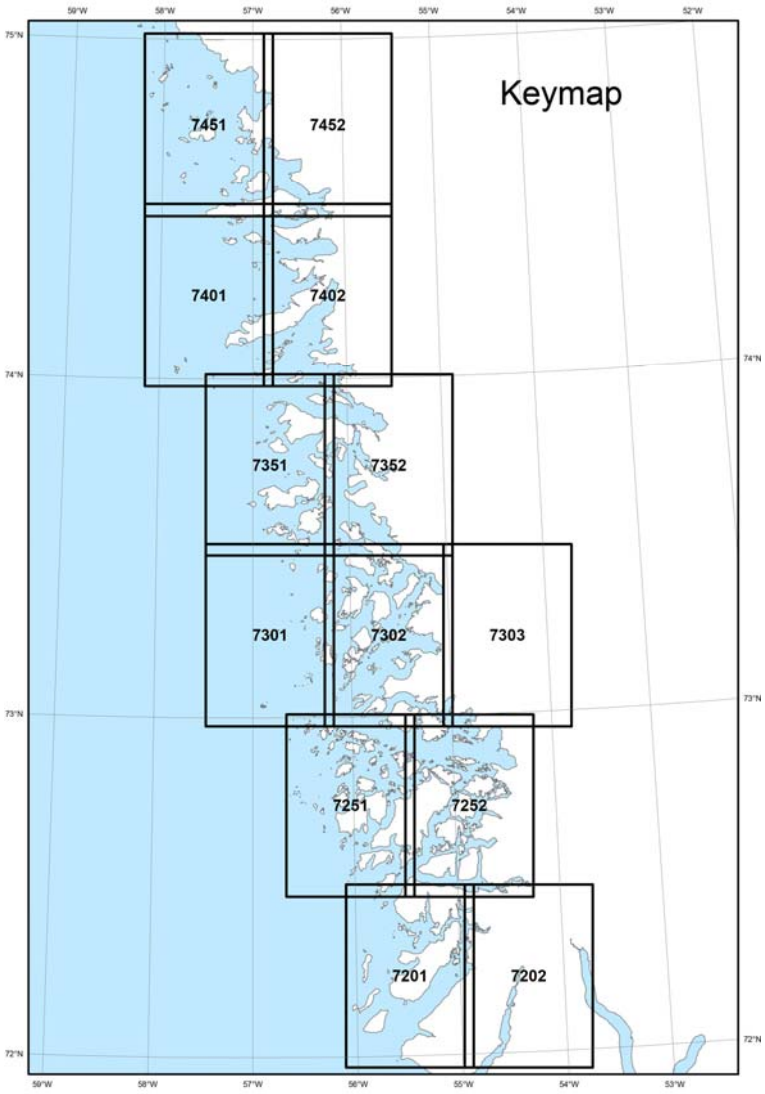
Figure 8.10. Offshore sensitivity in autumn.

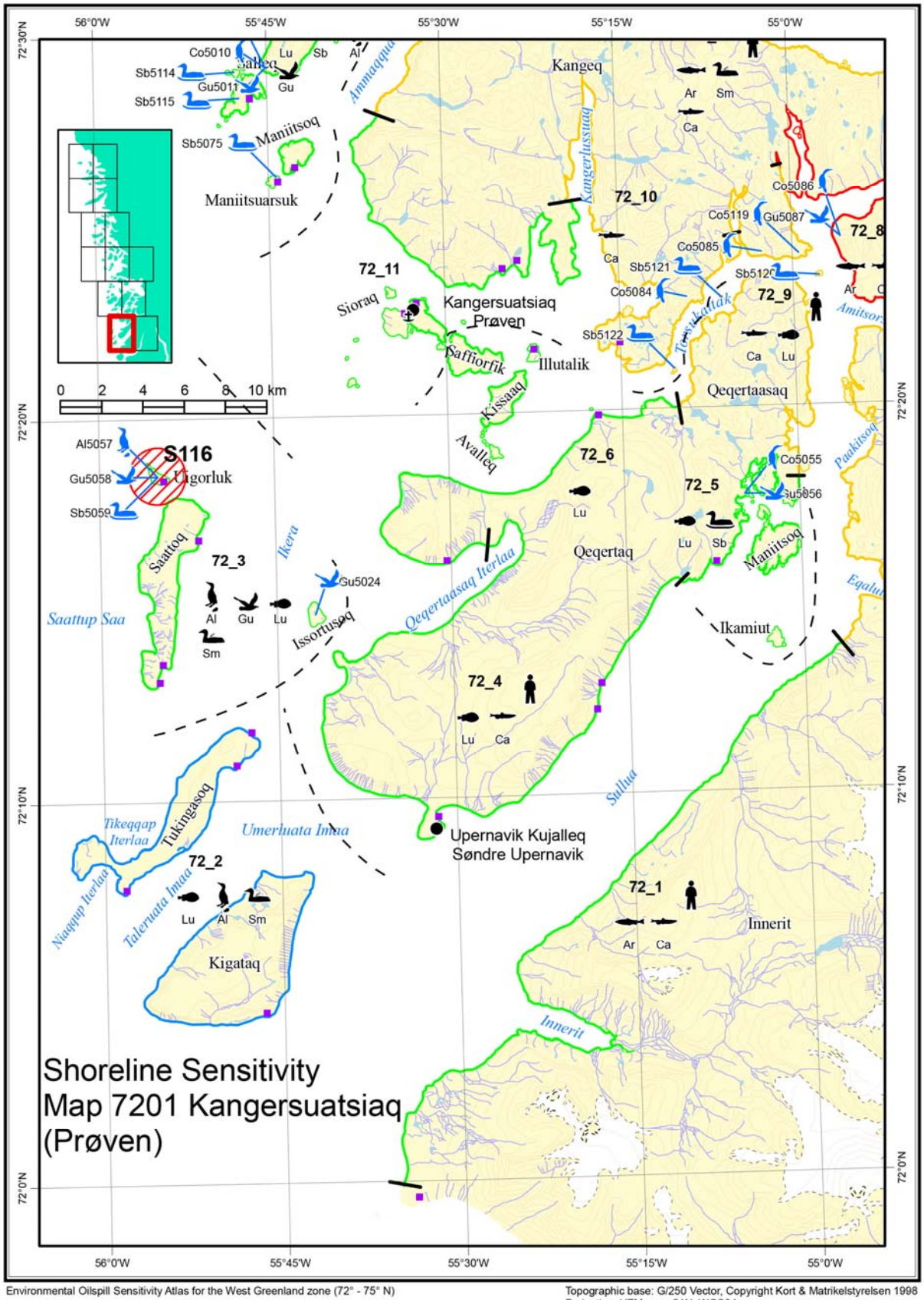

Map legend
Base map
Land
Land below 200m
(Physical maps only)
Ice
Lake
River
Contour
Physical environment and logistics maps
Logistics
Town
Settlement
Abandoned settlement
Harbour / Anchorage
Airstrip
Inshore containment
with length
200 m
Shoretype
Rocky coast
Archipelago
Glacier coast
Moraine
Alluvial fan
Talus
Beach
Fiords with
glacier ice
Shoreline sensitivity maps
Shoreline species*
Al Alcids breeding
Ar Arctic char
Ca Capelin
Co Cormorants
Gh Greenland halibut
Gu Gulls
Lu Lumpsucker
Sb Seaducks breeding
Sm Seaducks moulting
Tu Tubenoses
Site specific shoreline species
Al Alcids breeding
Co Cormorants
Gu Gulls
Sb Seaducks breeding
Tu Tubenoses
Shoreline areas sensitivity ranking
Extreme (> 30)
High (23 - 30)
Moderate (16 - 23)
Low (< 16)
Shoreline resource use
Resource Use (Human use)
Archeaological site
Selected areas
Selected area
* Icons only visible for species with a relative abundance = 3, 4 or 5
Map scale: 1:250.000
Projection: UTM zone 21N, WGS84
Topographic base: G/250 Vector, Copyright Kort og Matrikelstyrelsen
Maps produced by NERI -
National Environmental Research Institute,
Aarhus University 2010

9 Operational shoreline information

This chapter contains two series of 13 detailed maps covering the area (see key map this page; map 7203 is not included): **Shoreline sensitivity maps** and **Physical environment and logistics maps**. The Shoreline sensitivity maps are on left-hand side, and Physical environment and logistics maps are on the right. Descriptive text appears on the pages in between. There is a common legend to the maps to be unfolded on the page facing this. Please refer to the official topographical maps and nautical charts for any site names missing on the maps and to the Greenland Pilot (Grønlands Lods) and the nautical charts for detailed information on anchorages and sailing routes.

See Chapter 7, Users guide, for further information on map interpretation.





Environmental Oilspill Sensitivity Atlas for the West Greenland zone (72° - 75° N)

Topographic base: G/250 Vector, Copyright Kort & Matrikelstyrelsen 1998
Projection: UTM zone 21N, WGS84

Shoreline sensitivity — Map 7201 - Kangersuatsiaq (Prøven)

Environmental description

Resource use

R 72_1	Fishery for capelin, Greenland halibut and arctic char at river outlet. Important hunting area for inhabitants of Søndre Upernavik.
R 72_2	Important hunting area for inhabitants of Søndre Upernavik.
R 72_3	Hunting area for inhabitants of Søndre Upernavik.
R 72_4	Fishery for capelin and Greenland halibut. Important hunting area for inhabitants of Søndre Upernavik.
R 72_6	Important hunting area for inhabitants of Søndre Upernavik and Kangersuatsiaq.
R 72_7	Fishery for capelin, Greenland halibut and arctic char at river outlet.
R 72_8	Fishery for arctic char at river outlet.
R 72_9	Fishery for capelin and Greenland halibut.
R 72_10	Important hunting area for inhabitants of Kangersuatsiaq.
R 72_11	Important hunting area for inhabitants of Kangersuatsiaq.

Species occurrence

Al72002	4 colonies with breeding black guillemots and razorbills.
Al72003	3 colonies with breeding little auk, black guillemots and puffins.
Ar72001	Important area for arctic char in the inlet Innerit.
Ar72007, Ar72008	Important area for arctic char in the inlet Eqaluit and the inner part of the inlet Amitsorsuaq.
Ca72001	Important spawning area for capelin along the whole coastline of Sullua.
Ca72004	Important spawning area for capelin along the southern and western coastline of Qeqertaq.
Ca72007	Important spawning area for capelin along the whole coastline of Sullua.
Ca72008, Ca72009	Important spawning area for capelin along the northern coastline.
Ca72010	Important spawning area for capelin along Kangerlussuaq and coastlines east of Kangersuatsiaq (Prøven).
Gu72003	2 colonies with breeding Arctic terns.
Gu72008	1 colony with breeding kittiwakes and Iceland gulls.
Lu72002 - Lu72006, Lu72009	Spawning area for lumpsucker.
Sb72005	Breeding common eiders on islets.
Sm72002, Sm72003	Moulting area for king eiders.

Site specific species occurrence (seabird breeding colonies); blue icons

Al5057	Breeding puffins, razorbills and black guillemots.
Co5055, Co5084, Co5085,	Breeding great cormorants.
Co5086, Co5119	Breeding great cormorants.
Gu5024, Gu5058	Breeding Arctic terns.
Gu5056	Breeding kittiwakes and glaucous gulls.
Gu5087	Breeding kittiwakes and Iceland gulls.
Sb5059, Sb5120, Sb5121	Breeding common eiders.
Sb5122	Breeding common eiders.

Shoreline sensitivity summary

SEG_ID	Sensitivity	Ranking
72_1	20	Moderate
72_2	15	Low
72_3	18	Moderate
72_4	22	Moderate
72_5	21	Moderate
72_6	17	Moderate
72_7	25	High
72_8	30	Extreme
72_9	25	High
72_10	24	High
72_11	22	Moderate

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Physical environment and logistics Map 7201 - Kangersuatsiaq (Prøven)

Access

The nearshore waters in this area are uncharted and caution should be exercised. In general, the waters offshore, nearshore, and within the islands and fjords appear to be deep, however, uncharted dangers may exist. Local knowledge is essential for navigation.

This area is ice-bound in the average year from December to June. Breakup begins with a lead that opens up between the fast ice along the coast and the pack ice in Baffin Bay. The lead widens through the summer months and the coast is generally ice-free by July. First-year ice forms in fjords and sheltered waters, generally starting in early December; however, tidal streams and stormy weather often break up the ice or prevent its formation except at the inner ends of fjords.

Vessels are advised to give the western extremity of Tukingassoq a berth of at least 5 km due to the presence of a reef. Small islets, below-water rocks, and foul ground are reported in the Prøven chain of islands, particularly in the vicinity of Nitserfik, Sioraq/Sandøen, and Kissaaq.

The prevailing West Greenland Current is 0.5 knots, setting to the north and generally parallel to the coast.

At Upernavik Kujalleq and at Kangersuatsiaq/Prøven, the tide attains a maximum height of 2.0 m. The tidal stream is weak. There is no other information on tides or currents within this area.

Anchorage, with good protection from the north, is available at Kangarssuk, an abandoned settlement close NE of the western extremity of Innerit Peninsula.

Anchorage is available off the NW extremity of Uigorluk/Lille Fladø, which has shoal water extending about 1 km from shore.

Anchorage can be found at the settlement of Upernavik Kujalleq, with depths of 19 to 22 m and good holding. It is open to the south and east, and subject to squalls, but icebergs seldom enter. The anchorage and approaches are free of dangers.

At the village of Kangersuatsiaq/Prøven, a mooring berth for vessels up to 40 m length and 3.5 m draft is available off the entrance to the cove. There is a concrete wharf, 4.5 m long with depths alongside of 3.0 m, and a height of 1.0 above mean water. Two groups of below-water rocks are situated at the entrance. Ringbolts are available around the cove for securing lines. The cove offers good protection from the north, but SW winds produce a swell in the harbour. Icebergs rarely enter the cove.

Shorelines within this area are predominantly rock and talus allowing little opportunity for marine access.

There are no airports on this or adjoining maps. The closest airport (STOL, 800 m asphalt runway) is at Upernavik (map 7251).

Countermeasures

In ice concentrations down to six tenths, in situ burning of oil in conjunction with tracking oiled ice is recommended. In open water conditions in offshore and nearshore areas, containment for recovery or burning is recommended. Dispersant application should be considered in offshore areas to remove oil from the water surface, to protect waterfowl and to prevent oil from entering inshore areas. Dispersant-use is cautioned against in inter-island channels and shallow nearshore waters, which may exist within the fjords on this map. The waters appear to be deep, but as they are uncharted, soundings should be taken to confirm their depth prior to using dispersants.

Offshore countermeasures represent the only practical method of protecting most shoreline areas.

There are several opportunities for nearshore booming along the shorelines described on this map. Exclusion booming could be used in the channel Torsukattak where the inlet width is 900 m. Exclusion booming could also be used to protect the fjord Kangerlussuaq (600 m), and the two unnamed fjords north of the tip of Qeqertaq (200 and 300 m). Diversion booming could be attempted in the channels on each side of the north end of Qeqertaq to reduce contamination of more sensitive inshore areas, but this will be complicated by the excessive length of boom required and the difficulty in anchoring in the deep nearshore waters. Depths are unknown and would require reconnaissance at the time of a spill.

Shorelines shown on this map are predominantly rock and talus, much of which is exposed, which may not require active cleaning efforts unless heavily contaminated with heavy oils. Consideration should be given to flushing operations in more protected waters within the embayments, fjords, and inter-island channels. Access and trafficability of these areas are unknown, but it is probable that any cleanup operations would be marine-based given the nature of the shoreline.

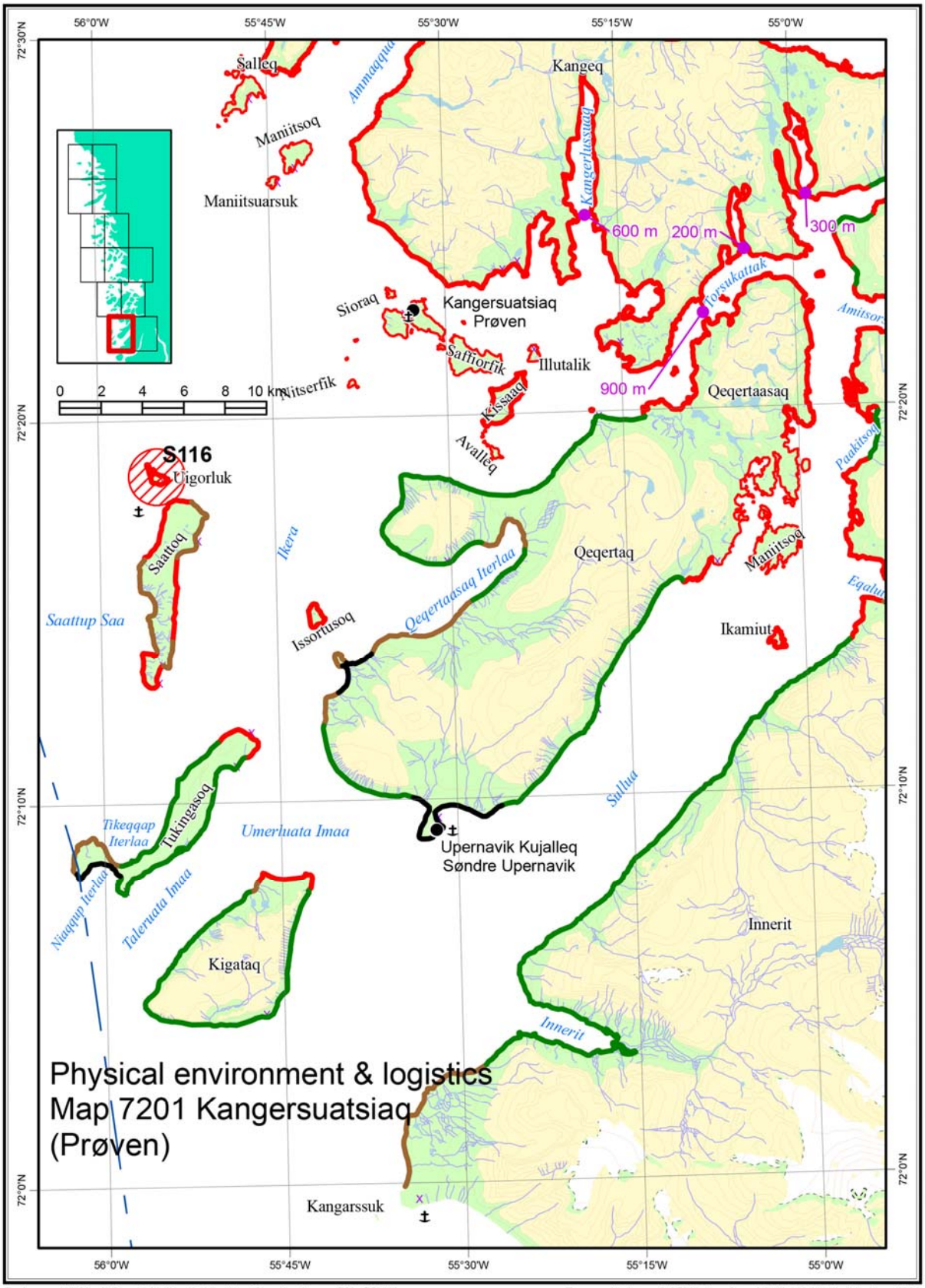
Two sections of the shoreline on Qeqertaq are designated as beach and have semi-protected coastal exposure; if oiled, this area may require cleaning using sediment removal techniques, along with the temporary stockpiling and subsequent removal for disposal of collected materials. Marine access and beach trafficability are unknown, necessitating site surveys at the time of the cleanup: it is probable that any cleanup operations would be marine-based given the nature of the shoreline.

Safe Havens

The anchorages at Upernavik Kujalleq and Kangersuatsiaq/Prøven could be considered as a potential safe havens but exclusion booming would be impractical. The fjord Kangerlussuaq has the potential for booming, and should also be considered, but has a moderate sensitivity rating. It has not been sounded, but the waters appear to be deep.

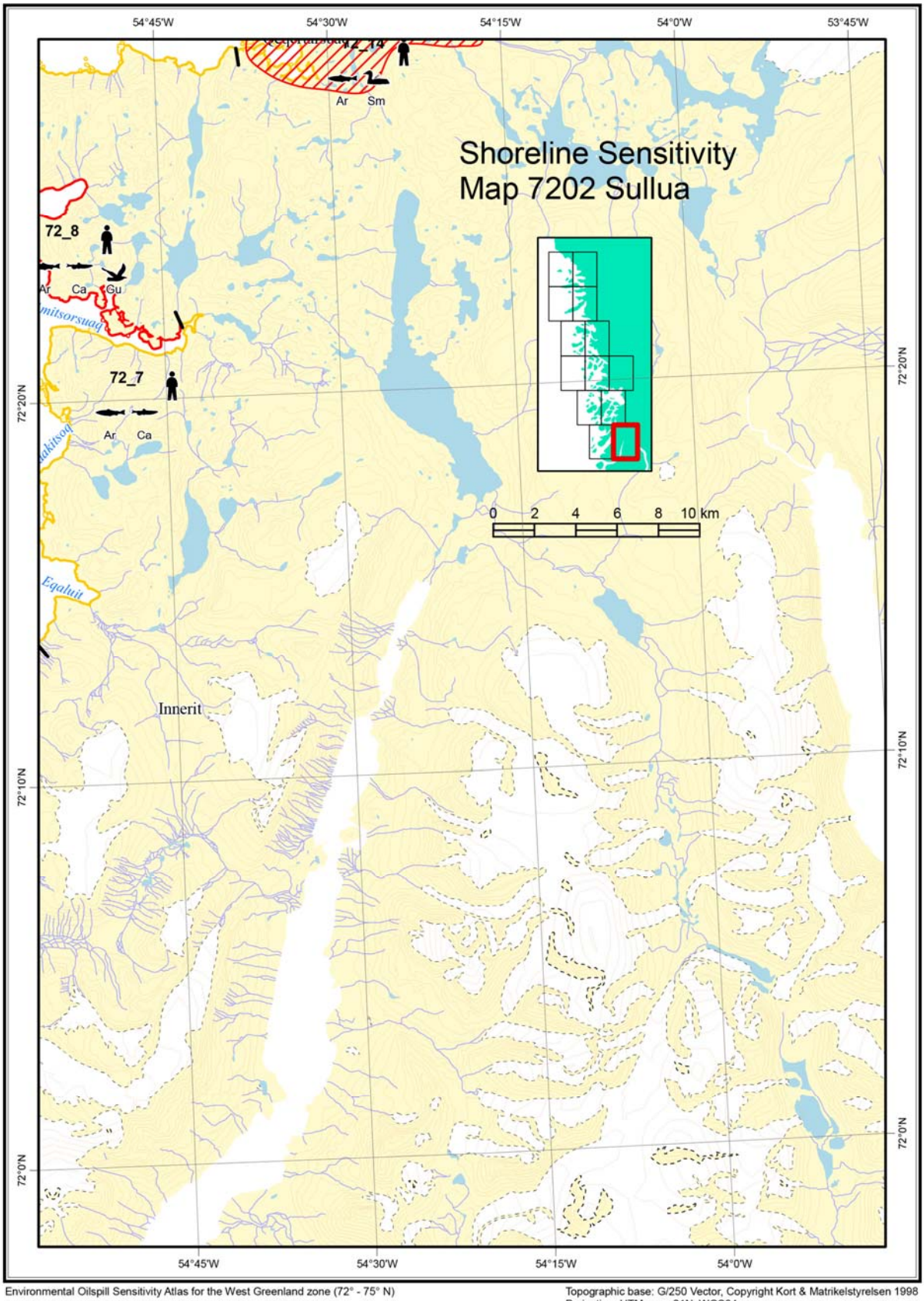
Maps

Danish Survey & Cadastre (KMS) topographical map: 72 V.1. Nautical charts: 1600, 1650, 1700, 1710.



Environmental Oilspill Sensitivity Atlas for the West Greenland zone (72° - 75° N)

Topographic base: G/250 Vector, Copyright Kort & Matrikelstyrelsen 1998
Projection: UTM zone 21N, WGS84


Shoreline Sensitivity
Map 7202 Sullua
54°45'W
54°30'W
54°15'W
54°0'W
53°45'W
72°20'N
72°10'N
72°0'N
72_8
72_7
Ar
Ca
Gu
Sm
Innerit
Eqaluit
0 2 4 6 8 10 km
Environmental Oilspill Sensitivity Atlas for the West Greenland zone (72° - 75° N)
Topographic base: G/250 Vector, Copyright Kort & Matrikelstyrelsen 1998
Projection: UTM zone 21N, WGS84

Shoreline sensitivity — Map 7202 - Sullua

Environmental description

Resource use
No resources selected.

Species occurence
No species selected.

Site specific species occurrence (seabird breeding colonies); blue icons
No sites selected.

Shoreline sensitivity summary

SEG_ID	Sensitivity	Ranking
72_07	25	High
72_08	30	Extreme

Physical environment and logistics Map 7202 - Sullua

Access

The nearshore waters in this area are uncharted and caution should be exercised. In general, the waters within these fjords appear to be deep, however, uncharted dangers may exist. Local knowledge is essential for navigation.

This area is ice-bound in the average year from December to June. Breakup begins with a lead that opens up between the fast ice along the coast and the pack ice in Baffin Bay. The lead widens through the summer months and the coast is generally ice-free by July. First-year ice forms in fjords and sheltered waters, generally starting in early December, however, tidal streams and stormy weather often break up the ice or prevent its formation except at the inner ends of fjords.

No anchorages are reported for this map area.

Shorelines in this area are predominantly rock and talus allowing little opportunity for marine access. Landings may be possible near the beach and alluvial shorelines within the fjords but would require reconnaissance to confirm.

There are no airports on this or adjoining maps. The nearest airport is at Qaarsut (map 7052, 900 meter gravel runway) and there is an airport at Upernavik town (map 7251, 800 m asphalt runway).

Countermeasures

(Note: The description do only apply to the coasts with indication of shore type. For the remaining coasts see the Environmental Oils Spill Sensitivity Atlas for the West Greenland (68°-72° N) Coastal Zone.

In situ burning of oil in conjunction with tracking oiled ice is recommended in ice concentrations down to six tenths. In open water conditions in offshore and nearshore areas, containment for recovery or burning is recommended. Dispersant application is cautioned against in the nearshore waters, fjords, and inter-island channels of this map area.

Offshore countermeasures represent the only practical method of protecting most shoreline areas, including the selected area shown on the map. Diversion booming could be considered to reduce inshore contamination in the fjord Amitsorsuaq, with an inlet width of 400 m.

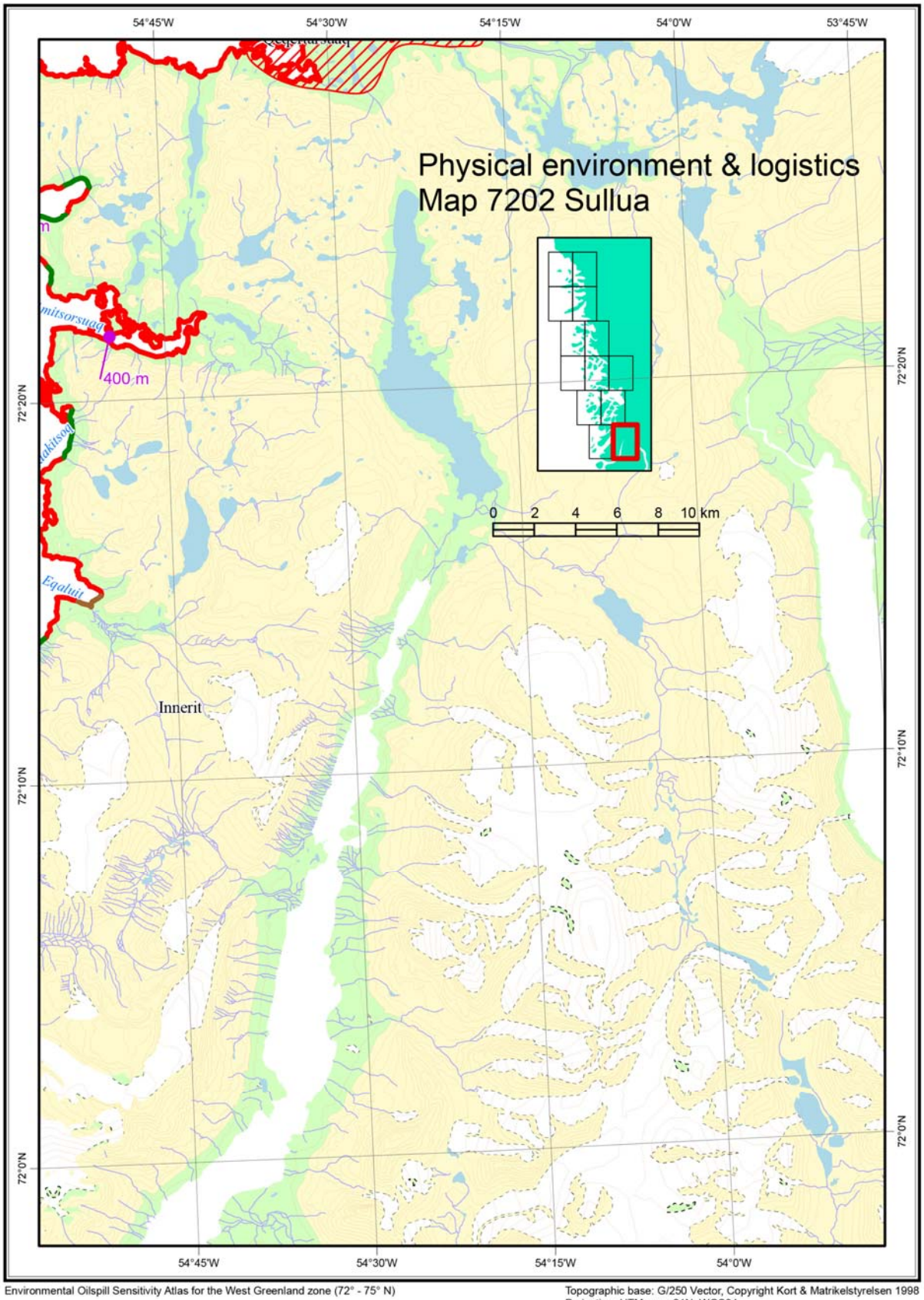
Shorelines shown on this map are predominantly rock and talus, much of which is exposed, which may not require active cleaning efforts unless heavily contaminated with heavy oils. Consideration should be given to flushing operations in more protected waters within the embayments, fjords, and inter-island channels. Access and trafficability of these areas are unknown, but it is probable that any cleanup operations would be marine-based given the nature of the shoreline.

Safe havens

There are no potential safe havens identified on this map.

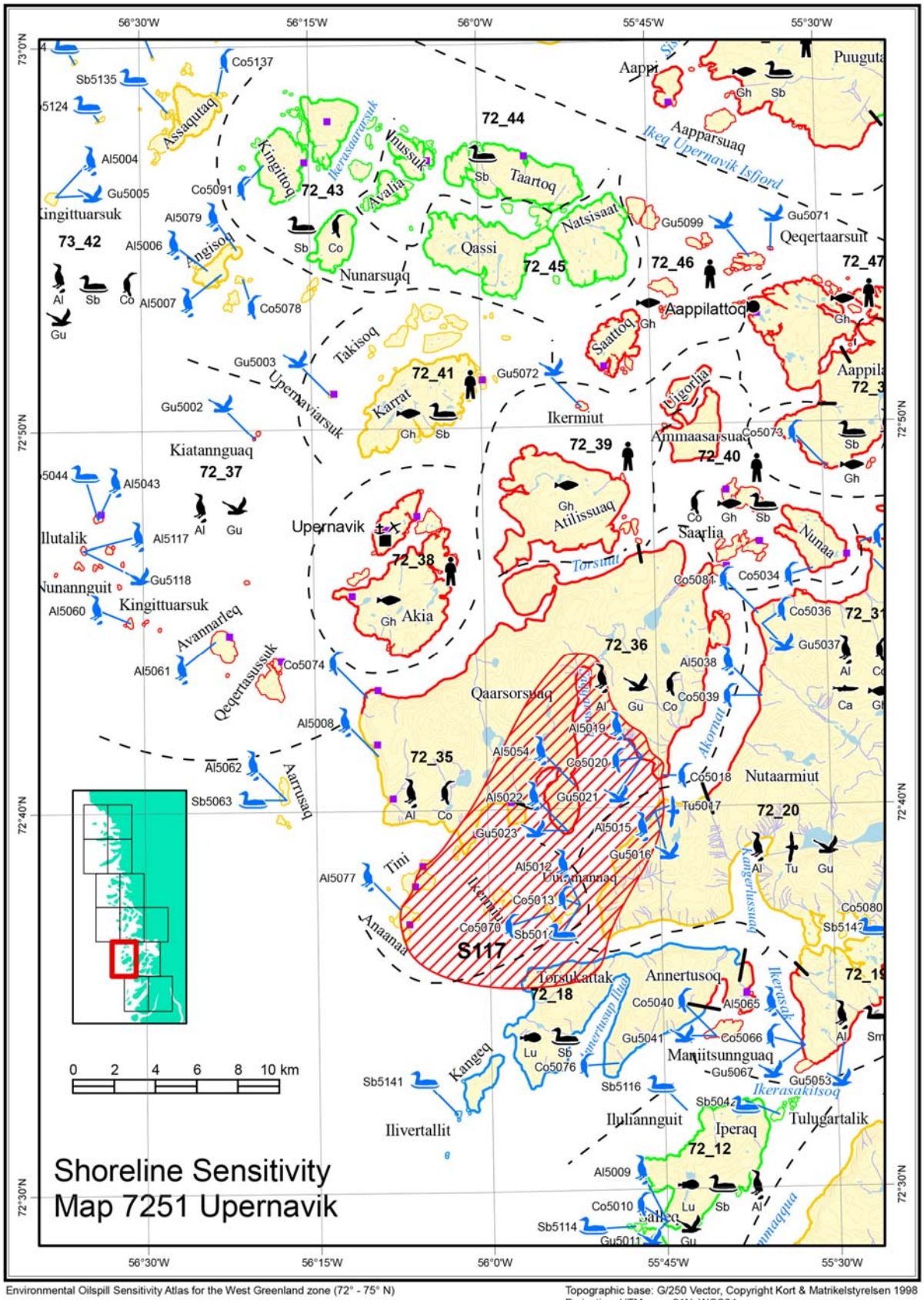
Maps

Danish Survey & Cadastre (KMS) topographical maps: 72 V.1 Nautical charts: 1700



Environmental Oilspill Sensitivity Atlas for the West Greenland zone (72° - 75° N)

Topographic base: G/250 Vector, Copyright Kort & Matrikelstyrelsen 1998
Projection: UTM zone 21N, WGS84


Shoreline Sensitivity
Map 7251 Upernavik
Environmental Oilspill Sensitivity Atlas for the West Greenland zone (72° - 75° N)
Topographic base: G/250 Vector, Copyright Kort & Matrikelstyrelsen 1998
Projection: UTM zone 21N, WGS84
56°30'W
56°15'W
56°0'W
55°45'W
55°30'W
73°0'N
72°50'N
72°40'N
72°30'N
0 2 4 6 8 10 km
Upernavik
Kiatannguaq
Nunarsuaq
Qaarsorsuaq
Saarlia
Aappilattoq
Ammaasarsuaq
Ikermiut
Akia
Atilissuaq
Nutaarmiut
Annertusoq
Maniitsunnguaq
Iluliannguit
Iperaq
Tulugartalik
Ilivertallit
Kingittuarsuk
Qeqertaarsuit
Aappi
Puuguta
Taartoq
Qassi
Natsisaat
Karrat
Takisoq
Upernaviarsuk
Aappartsuaq
Ikeq Upernavik Isfjord
Assaqutaq
Kingittoq
Avalia
Angisoq
Saattoq
Pigorlia
Nunaa
Torsuut
Akornat
Tini
Anaanaa
Aarrutsaq
Qeqertasussuk
Avannarleq
Kangeq
Ikerasaakitsoq
S117
72_35
72_36
72_37
72_38
72_39
72_40
72_41
72_43
72_44
72_45
72_46
72_47
72_18
72_20
72_12

Shoreline sensitivity — Map 7251 - Upernavik

Environmental description

Resource use

R 72_34	Hunting area for inhabitants of Aappilattoq.
R 72_35	Hunting area for inhabitants of Upernavik.
R 72_36	Hunting area for inhabitants of Upernavik.
R 72_37	Important hunting area for inhabitants of Upernavik.
R 72_38	Fishery for Greenland halibut and polar cod. Important hunting area for inhabitants of Upernavik and Aappilattoq.
R 72_39	Fishery for Greenland halibut. Important hunting area for inhabitants of Upernavik and Aappilattoq.
R 72_40	Hunting area for inhabitants of Aappilattoq. Fishery for Greenland halibut.
R 72_41	Fishery for Greenland halibut.
R 72_44	Hunting area for inhabitants of Upernavik and Aappilattoq.
R 72_45	Hunting area for inhabitants of Upernavik and Aappilattoq.
R 72_46	Fishery for Greenland halibut. Important hunting area for inhabitants of Aappilattoq.
R 72_47	Fishery for Greenland halibut and capelin. Important hunting area for inhabitants of Aappilattoq.
R 72_54	Fishery for Greenland halibut. Hunting area for inhabitants of Aappilattoq.

Species occurrence

Al72012	3 colonies with breeding black guillemots and razorbills.
Al72019	2 colonies with breeding black guillemots and razorbills.
Al72020	1 colony with breeding thick-billed murres, black guillemots and razorbills.
Al72035	5 colonies with breeding puffins, black guillemots and razorbills.
Al72036	4 colonies with breeding thick-billed murres, black guillemots, razorbills and puffins.
Al72037	10 colonies with breeding black guillemots, puffins and razorbills.
Al73042	9 colonies with breeding black guillemots, razorbills and puffins.
Co72035, Co72036, Co73042	2 colonies with breeding great cormorants.
Co72040, Co72043	1 colony with breeding great cormorants.
Gh72038, Gh72039, Gh72040	Important area for Greenland halibut.
Gh72041, Gh72046, Gh72047	Important area for Greenland halibut.
Gh72054	Important area for Greenland halibut.
Gu72012	3 colonies with breeding kittiwakes, Iceland gulls and glaucous gulls.
Gu72020	1 colony with breeding kittiwakes and glaucous gulls.
Gu72036	4 colonies with breeding kittiwakes, glaucous gulls and Iceland gulls.
Gu72037	8 colonies with breeding Arctic terns and glaucous gulls.
Gu73042	9 colonies with breeding kittiwakes and glaucous gulls.
Lu72012, Lu72018	Spawning area for lumpsucker.
Sb72012	5 colonies with breeding common eiders.
Sb72018, Sb72043	1 colony with breeding common eiders.
Sb72040, Sb72041, Sb72044	Breeding common eiders on islets.
Sb72054	Breeding common eiders on islets.
Sb73042	4 colonies with breeding common eiders.
Sm72019	Moulting area for king eiders.
Tu72020	Colony with breeding northern fulmar.

(Continued on page 9-12)

(continued from page 9-11)

Site specific species occurrence (seabird breeding colonies); blue icons

Al5004, Al5006, Al5007	Breeding black guillemots, razorbills and puffins.
Al5008, Al5065, Al5019	Breeding black guillemots and razorbills.
Al5015, Al5054	Breeding thick-billed murres, razorbills and black guillemots.
Al5022	Breeding thick-billed murres, razorbills, puffins and black guillemots.
Al5043, Al5061	Breeding puffins and black guillemots.
Al5060, Al5062, Al5077	Breeding puffins, razorbills and black guillemots.
Al5079	Breeding black guillemots.
Al5117	Breeding puffins.
Co5010, Co5013, Co5018	Breeding great cormorants.
Co5020, Co5034, Co5040	Breeding great cormorants.
Co5066, Co5070, Co5074	Breeding great cormorants.
Co5076, Co5078, Co5080	Breeding great cormorants.
Co5091, Co5137	Breeding great cormorants.
Gu5002, Gu5003, Gu5071	Breeding Arctic terns.
Gu5072, Gu5099, Gu5118	Breeding Arctic terns.
Gu5011, Gu5021, Gu5041	Breeding kittiwakes, Iceland gulls and glaucous gulls.
Gu5053	Breeding kittiwakes, Iceland gulls and glaucous gulls.
Gu5005, Gu5016, Gu5023	Breeding kittiwakes and glaucous gulls.
Gu5067	Breeding kittiwakes and glaucous gulls.
Sb5014, Sb5042, Sb5044	Breeding common eiders.
Sb5063, Sb5075, Sb5114	Breeding common eiders.
Sb5115, Sb5116, Sb5124	Breeding common eiders.
Sb5134, Sb5135, Sb5136	Breeding common eiders.
Sb5141, Sb5142	Breeding common eiders.
Tu5017	Breeding northern fulmar.

Shoreline sensitivity summary

SEG_ID	Sensitivity	Ranking
72_12	23	Moderate
72_18	14	Low
72_19	32	Extreme
72_20	28	High
72_35	29	High
72_36	30	Extreme
72_37	34	Extreme
72_38	32	Extreme
72_39	30	Extreme
72_40	42	Extreme
72_41	29	High
73_42	25	High
72_43	21	Moderate
72_44	17	Moderate
72_45	18	Moderate
72_46	35	Extreme
72_47	31	Extreme
72_54	31	Extreme

Physical environment and logistics Map 7251 - Upernavik

Access

The nearshore waters in this area are uncharted and caution should be exercised. In general, the waters around the islands in this map area are deep, however the channels between many of them are reported to be obstructed by below-water reefs and there are numerous rocks awash. Local knowledge is essential for navigation.

This area is ice-bound in the average year from December to June. Breakup begins with a lead that opens up between the fast ice along the coast and the pack ice in Baffin Bay. The lead widens through the summer months and the coast is generally ice-free by July. First-year ice forms in fjords and sheltered waters, generally starting in early December, however, tidal streams and stormy weather often break up the ice or prevent its formation except at the inner ends of fjords.

The prevailing West Greenland Current is 0.5 knots, setting to the north and generally parallel to the coast.

Anchorage with good holding in sand has been found off Qaersoq, in the bay close north of the south extremity of Qaarsorsuaq.

A harbour is located at Upernavik, with mooring for vessels to 75 m length and 5 m draft. The approaches to the harbour are encumbered with numerous islets and below-water rocks. The harbour freezes over from November or December until May, with ice drifting in the vicinity for a month after breakup. Glacier ice and icebergs easily enter the harbour.

Anchorage for vessels of medium size lies at the southwest end of Ikerssuaq, between Griseøen and the south end of Upernavik Ø, in depths of 30 to 40 m. Tidal streams are reported to be weak.

Anchorage can be found off the south end of the settlement of Aappilattoq in 25 m. Tidal streams through Upernavik Isfjord are reported to be strong, and ice from Upernavik Isfjord frequently hinders navigation.

Shorelines in this area are predominantly rock allowing little opportunity for marine access.

There is a STOL airport at Upernavik town (800 m asphalt runway).

Countermeasures

In ice concentrations down to six tenths, in situ burning of oil in conjunction with tracking oiled ice is recommended. In open water conditions in offshore and nearshore areas, containment for recovery or burning is recommended. Dispersant application should be considered in offshore areas to remove oil from the water surface, to protect waterfowl and to prevent oil from entering inshore areas. Dispersant-use is cautioned against in inter-island channels and shallow nearshore waters, which may exist within the fjords on this map. The waters appear to be deep, but as they are uncharted, soundings should be taken to confirm their depth prior to using dispersants.

Offshore countermeasures represent the only practical method of protecting most shoreline areas. There are no opportunities for nearshore booming along the shorelines described on this map due to the width of the inlets and the deep nearshore waters. Diversion booming could be considered to protect the selected area on Qaarsorsuaq, but this will be complicated due to the highly exposed nature of the coast, by the excessive length of boom required, and by the difficulty in anchoring in the deep nearshore waters.

Shorelines shown on this map are exclusively rock, much of which is exposed, which may not require active cleaning efforts unless heavily contaminated with heavy oils. Consideration should be given to flushing operations in more protected waters within the embayments, fjords, and inter-island channels. Access and trafficability of these areas are unknown, but it is probable that any cleanup operations would be marine-based given the nature of the shoreline.

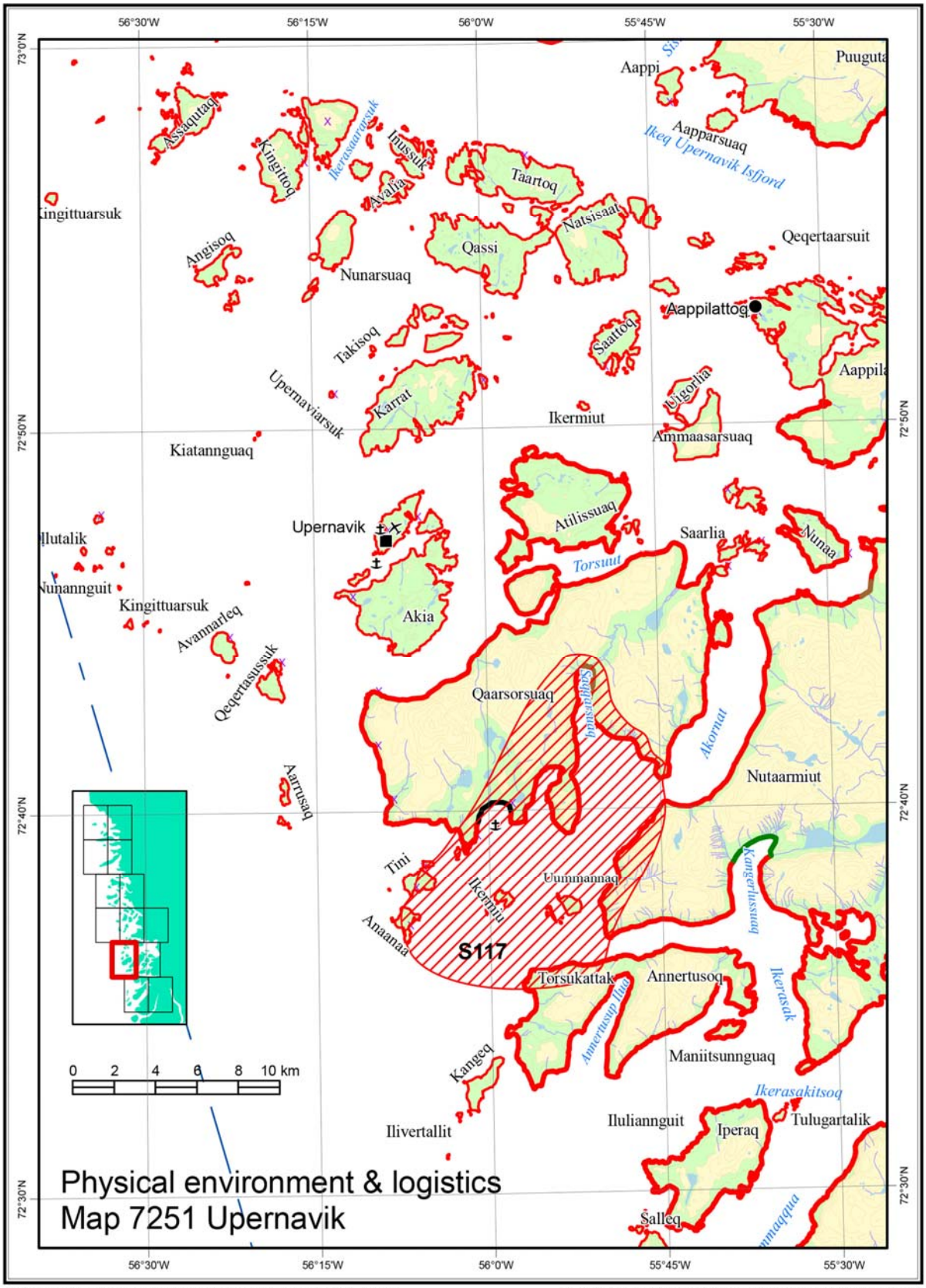
Safe Havens

The anchorages at Upernavik and Qaersoq could be considered as potential safe havens, but both have an extreme sensitivity rating.

Various inter-island channels could be considered as potential safe havens; in particular, the channel between Taartoq and Qassi has a low sensitivity rating and appears to offer protection. Exclusion booming would be impractical due to the width of the channel; however the shape of the channel may afford natural containment depending on wind direction and tidal streams.

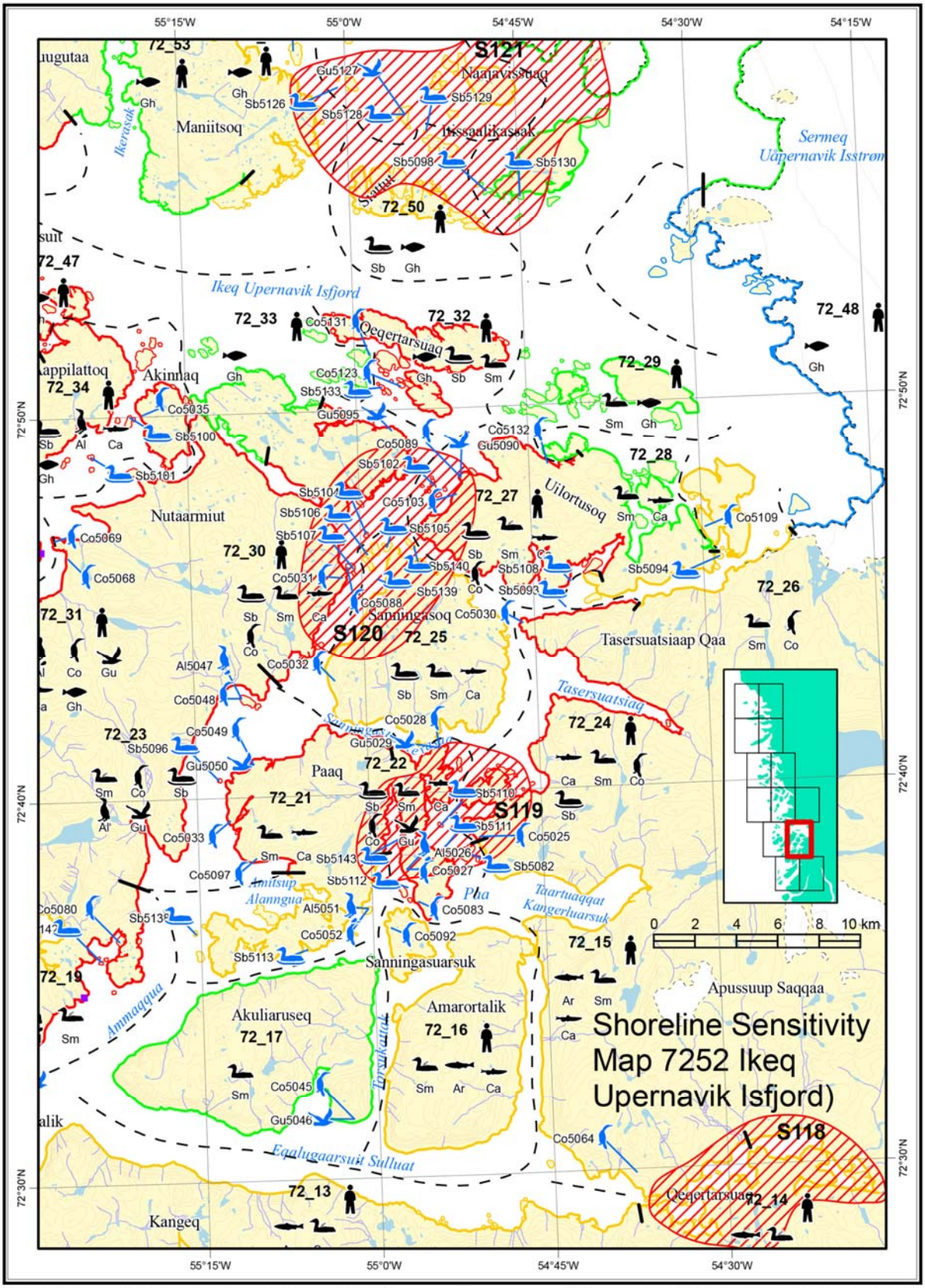
Maps

Danish Survey & Cadastre (KMS) topographical map: 72 V.1. Nautical charts: 1650, 1700, 1710



Environmental Oilspill Sensitivity Atlas for the West Greenland zone (72° - 75° N)

Topographic base: G/250 Vector, Copyright Kort & Matrikelstyrelsen 1998
Projection: UTM zone 21N, WGS84


Shoreline Sensitivity Map 7252 Ikeq Upernavik Isfjord)
Environmental Oilspill Sensitivity Atlas for the West Greenland zone (72° - 75° N)
Topographic base: G/250 Vector, Copyright Kort & Matrikelstyrelsen 1998
Projection: UTM zone 21N, WGS84
S121
S120
S119
S118
Maniitsoq
Akinnaq
Nutaarmiut
Sanningasoq
Paaq
Akuliaruseq
Amarortalik
Kangeq
Sanningasuarsuk
Apussuup Saqqaa
Tasersuatsiaap Qaa
Ikeq Upernavik Isfjord
Sermeq Uupernavik Isstrøm
Uilortusoq
Tasersuatsiaq
Ammaqqua
Eqalugaarsuit Sulluat
Taartuaqqat Kangerluarsuk
0 2 4 6 8 10 km
55°15'W
55°0'W
54°45'W
54°30'W
54°15'W
72°50'N
72°40'N
72°30'N

Shoreline sensitivity — Map 7252 - Ikeq (Upernavik Isfjord)

Environmental description

Resource use

R 72_13	Fishing for capelin, arctic char and Greenland halibut.
R 72_14, R 72_15	Fishing for arctic char and capelin.
R 72_16	Fishing for arctic char and capelin.
R 72_24	Fishing for capelin.
R 72_27, R 72_29	Fishing for Greenland halibut and capelin.
R 72_30, R 72_31	Fishing for Greenland halibut and capelin.
R 72_32	Fishery for Greenland halibut and capelin.
R 72_34	Fishery for Greenland halibut and capelin. Hunting area for the inhabitants of Aappilattoq.
R 72_37	Hunting area for the inhabitants of Aappilattoq.
R 72_48,	Fishery for Greenland halibut.
R 73_49, R 72_50, R 72_52	Fishery for Greenland halibut and capelin.
R 72_53	Hunting area for the inhabitants of Aappilattoq.

Species occurrence

Al72023	2 colonies with breeding black guillemots.
Al72031	4 colonies with breeding black guillemots and razorbills
Al72034	4 colonies with breeding black guillemots.
Ar72013, Ar72014, Ar72016	Important area for arctic char along all coasts of Eqalugaarsuit Sulluat.
Ar72015	Important area for arctic char along all coasts of Eqalugaarsuit Sulluat and inner part of Kangerluarsuq.
Ca72013, Ca72015	Important spawning area for capelin along whole coastline segment.
Ca72016	Important spawning area for capelin along the coast of Amarortalik from souteastern corner to the nortwestern corner.
Ca72021	Important spawning area for capelin along the majority of the coastline segment (northern end).
Ca72022, Ca72024, Ca72028	Important spawning area for capelin along all parts of the coastline segment.
Ca72025	Important spawning area for capelin along all parts of the coastline segment.
Ca72027, Ca72030, Ca72031	Important spawning area for capelin along the majority of the coastline segment (protected parts).
Ca72034	Important spawning area for capelin along all parts of the coastline segment.
Co72022, Co72027	3 colonies with breeding great cormorants.
Co72023	4 colonies with breeding great cormorants.
Co72024, Co72030	2 colonies with breeding great cormorants.
Co72026	1 colony with breeding great cormorants.
Co72031	5 colonies with breeding great cormorants.
Gh72029, Gh72031, Gh72032	Important area for Greenland halibut.
Gh72033, Gh72034, Gh72048	Important area for Greenland halibut.
Gh72050, Gh72052, Gh72053	Important area for Greenland halibut.
Gh73049	Important area for Greenland halibut.
Gu72022	7 colonies with breeding kittiwakes, glaucous gulls and Iceland gulls.
Gu72023	5 colonies with breeding kittiwakes, Iceland gulls and glaucous gulls.
Gu72031	4 colonies with breeding kittiwakes, glaucous gulls and Iceland gulls.
Sb72022	5 colonies with breeding common eiders.
Sb72023, Sb72027, Sb72030	2 colonies with breeding common eiders.
Sb73049	2 colonies with breeding common eiders.
Sb72024, Sb72032, Sb72050	1 colony with breeding common eiders.
Sb72025	4 colonies with breeding common eiders.
Sb72034	3 colonies with breeding common eiders.
Sm72013, Sm72014, Sm72015	Moulting area for king eiders.
Sm72016, Sm72017, Sm72021	Moulting area for king eiders.
Sm72022, Sm72023, Sm72024	Moulting area for king eiders.
Sm72025, Sm72026, Sm72027	Moulting area for king eiders.
Sm72028, Sm72029, Sm72030	Moulting area for king eiders.
Sm72032	Moulting area for king eiders.

(Continued from page 9-17)

Site specific species occurrence (seabird breeding colonies); blue icons

Al5026, Al5038, Al5051	Breeding black guillemots and razorbills.
Al5047	Breeding black guillemots.
Co5025, Co5027, Co5028	Breeding great cormorants.
Co5030, Co5031, Co5032	Breeding great cormorants.
Co5033, Co5035, Co5036	Breeding great cormorants.
Co5039, Co5045, Co5048	Breeding great cormorants.
Co5049, Co5052, Co5064	Breeding great cormorants.
Co5068, Co5069, Co5073	Breeding great cormorants.
Co5081, Co5083, Co5088	Breeding great cormorants.
Co5089, Co5092, Co5097	Breeding great cormorants.
Co5103, Co5109, Co5123	Breeding great cormorants.
Co5131, Co5132	Breeding great cormorants.
Gu5029	Breeding kittiwakes, Iceland gulls and glaucous gulls.
Gu5037, Gu5050	Breeding kittiwakes and Iceland gulls.
Gu5046, Gu5090, Gu5095	Breeding kittiwakes and glaucous gulls.
Sb5082, Sb5093, Sb5094	Breeding common eiders.
Sb5096, Sb5098, Sb5100	Breeding common eiders.
Sb5101, Sb5102, Sb5104	Breeding common eiders.
Sb5105, Sb5106, Sb5107	Breeding common eiders.
Sb5108, Sb5110, Sb5111	Breeding common eiders.
Sb5112, Sb5113, Sb5125	Breeding common eiders.
Sb5129, Sb5130, Sb5133	Breeding common eiders.
Sb5138, Sb5139, Sb5140	Breeding common eiders.
Sb5143	Breeding common eiders.

Shoreline sensitivity summary

SEG_ID	Sensitivity	Ranking
68_26	51	Extreme
72_13	26	High
72_14	25	High
72_15	28	High
72_16	23	High
72_17	20	Moderate
72_21	28	High
72_22	35	Extreme
72_23	31	Extreme
72_24	30	Extreme
72_25	29	High
72_26	25	High
72_27	40	Extreme
72_28	18	Moderate
72_29	21	Moderate
72_30	40	Extreme
72_31	39	Extreme
72_32	33	Extreme
72_33	17	Moderate
72_34	42	Extreme
72_48	15	Low
73_49	22	Moderate
72_50	28	High
72_52	24	High

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Physical environment and logistics Map 7252 - Ikeq (Upernavik Isfjord)

Access

The nearshore waters in this area are uncharted and caution should be exercised. In general, the waters around the islands in this map area are deep, however the channels between many of them are reported to be obstructed by below-water reefs and there are numerous rocks awash. Local knowledge is essential for navigation.

This area is ice-bound in the average year from December to June. Breakup begins with a lead that opens up between the fast ice along the coast and the pack ice in Baffin Bay. The lead widens through the summer months and the coast is generally ice-free by July. First-year ice forms in fjords and sheltered waters, generally starting in early December, however, tidal streams and stormy weather often break up the ice or prevent its formation except at the inner ends of fjords.

Tidal streams through Upernavik Isfjord are reported to be strong. Frequent icebergs can be expected from the glacier at the head of the fjord.

No anchorages have been identified in this area.

Shorelines in this area are predominantly rock and glacier allowing little opportunity for marine access.

The closest air base is the STOL airport at Upernavik (map 7251, 800 m asphalt runway).

Countermeasures

In situ burning of oil in conjunction with tracking oiled ice is recommended in ice concentrations down to six tenths. In open water conditions in offshore and nearshore areas, containment for recovery or burning is recommended. Dispersant application is cautioned against in the nearshore waters, fjords, and inter-island channels of this map area.

There are no opportunities for exclusion booming for most of the area shown on this map due to the width of the inlets and the deep nearshore waters. Offshore countermeasures represent the only practical method of protecting most shoreline areas.

Exclusion booming to reduce the extent of inshore contamination should be considered within the fjord at the east end of Eqalugaarsuit Sulluat, where the inlet narrows to 300 m. Depths are unknown and would require reconnaissance at the time of a spill.

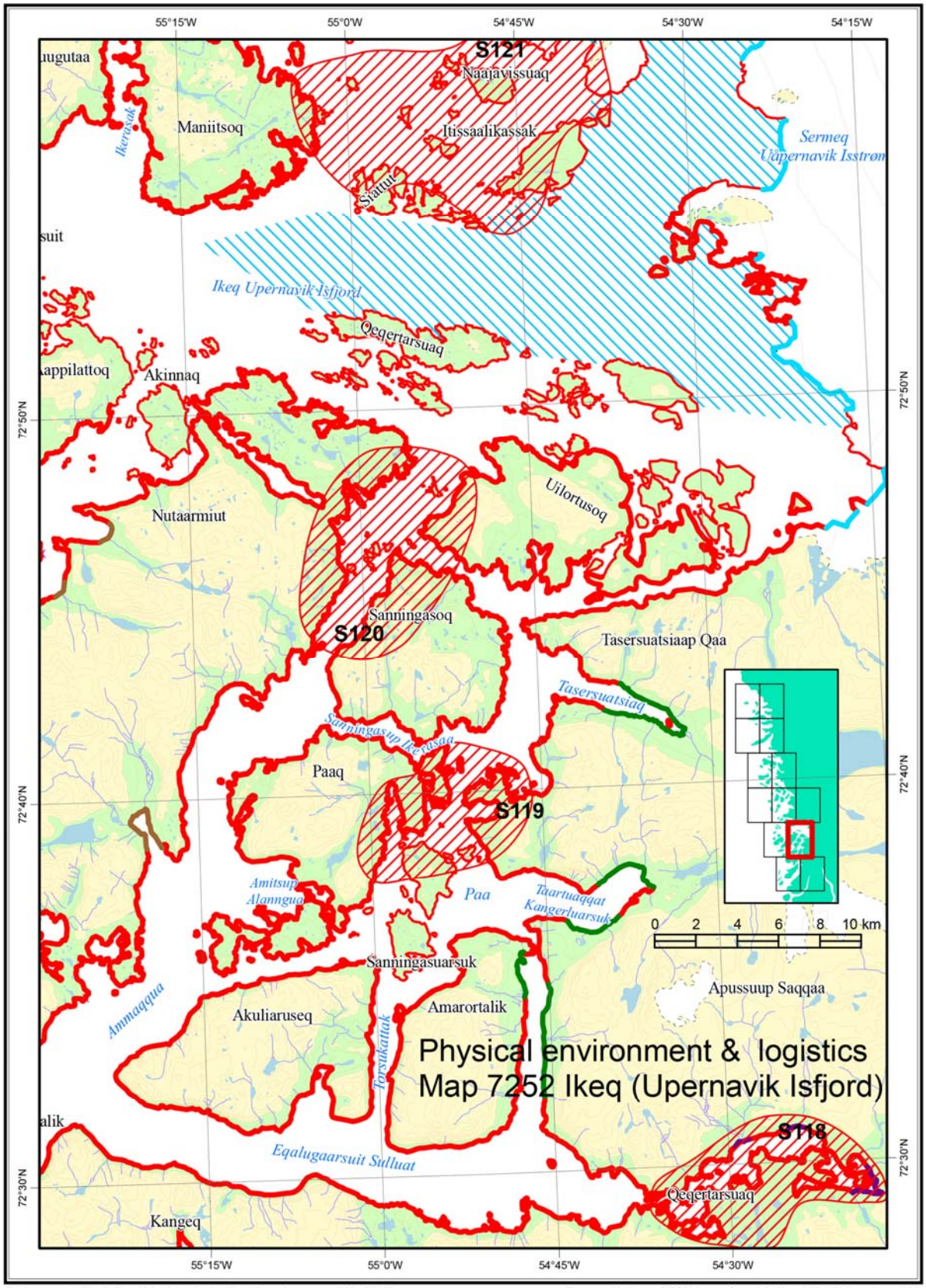
Shorelines shown on this map are predominantly exposed rock, with glacier at the head of Upernavik Isfjord and some talus in smaller fjords, which may not require active cleaning efforts unless heavily contaminated with heavy oils. Consideration should be given to flushing operations in more protected waters within the embayments, fjords, and inter-island channels. Access and trafficability of these areas are unknown, but it is probable that any cleanup operations would be marine-based given the nature of the shoreline.

Safe Havens

There are no potential safe havens identified on this map.

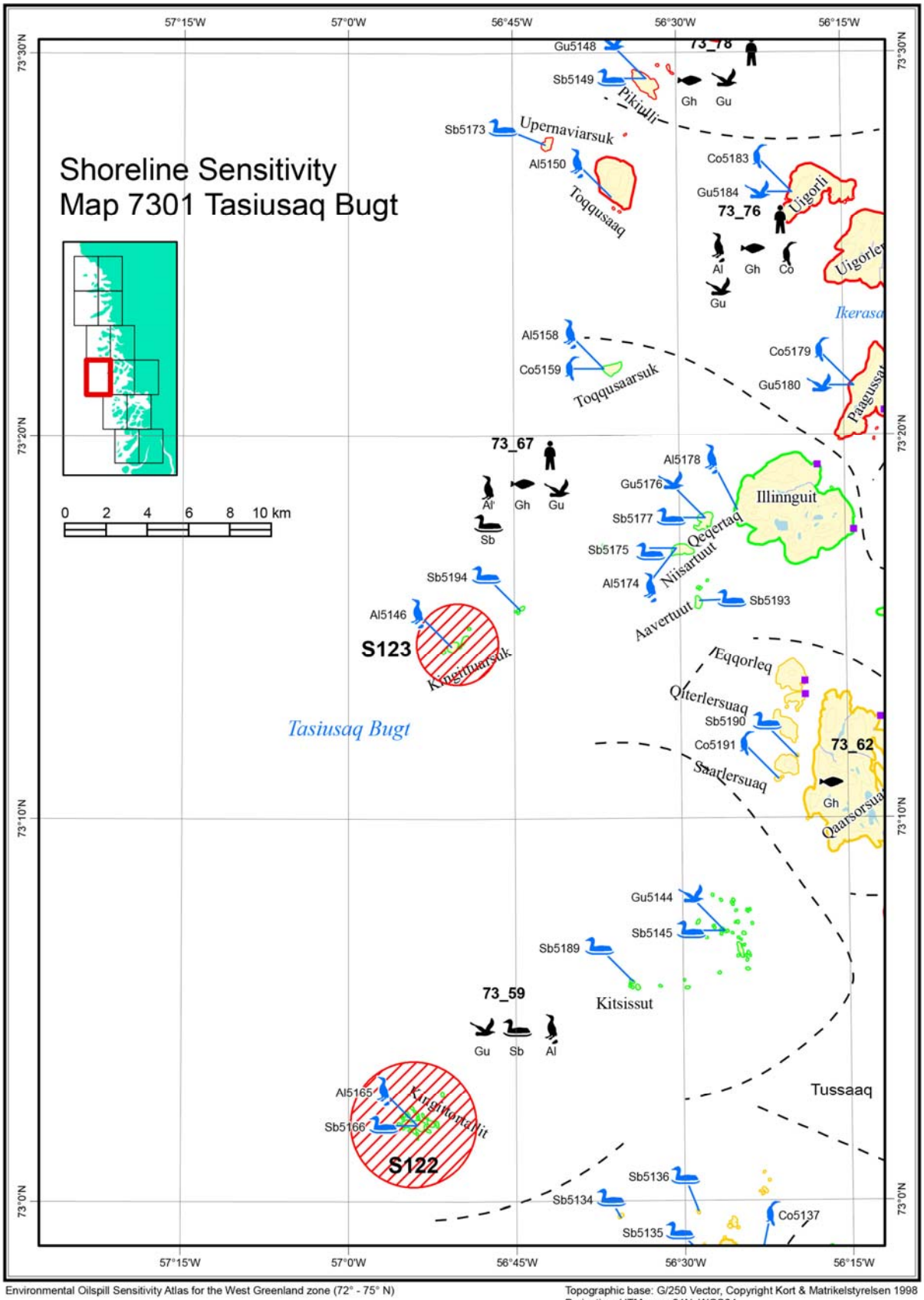
Maps

Danish Survey & Cadastre (KMS) topographical map: 72 V.1. Nautical charts: 1700.



Environmental Oilspill Sensitivity Atlas for the West Greenland zone (72° - 75° N)

Topographic base: G/250 Vector, Copyright Kort & Matrikelstyrelsen 1998
Projection: UTM zone 21N, WGS84



Environmental Oilspill Sensitivity Atlas for the West Greenland zone (72° - 75° N)

Topographic base: G/250 Vector, Copyright Kort & Matrikelstyrelsen 1998
Projection: UTM zone 21N, WGS84

Shoreline sensitivity — Map 7301 - Tasiusaq Bugt

Environmental description

Resource use

R 73_62	Fishery for Greenland halibut. Important hunting area for the inhabitants of Naajaat and Tasiusaq.
R 73_67	Hunting area for the inhabitants of Tasiusaq.
R 73_76	Fishery for Greenland halibut polar cod. Important hunting area for inhabitants of Tasiusaq Nutaarmiut and Ikerasaarsuk.

Species occurrence

Al73059	2 colonies with breeding black guillemots and razorbills.
Al73067	8 colonies with breeding black guillemots, puffins and razorbills.
Al73076	6 colonies with breeding black guillemots, razorbills and puffins.
Co73076	2 colonies with breeding great cormorants.
Gh73062, Gh73067, Gh73076	Important area for Greenland halibut.
Gu73059	3 colonies with breeding Arctic terns and glaucous gulls.
Gu73067	7 colonies with breeding Arctic terns and glaucous gulls.
Gu73076	6 colonies with breeding kittiwakes, glaucous gulls and Iceland gulls.
Sb73059	3 colonies with breeding common eiders.
Sb73067	4 colonies with breeding common eiders.

Site specific species occurrence (seabird breeding colonies); blue icons

Al5146, Al5150, Al5158	Breeding puffins, razorbills and black guillemots.
Al5165, Al5178	Breeding black guillemots and razorbills.
Al5174	Breeding black guillemots and puffins.
Co5159, C5179, Co5183	Breeding great cormorants.
Co5191	Breeding great cormorants.
Gu5144	Breeding Arctic terns and glaucous gulls.
Gu5176	Breeding colony of Arctic terns.
Gu5180	Breeding kittiwakes, Iceland gulls and glaucous gulls.
Gu5184	Breeding colony of kittiwakes and Iceland gulls.
Sb5145, Sb5166, Sb5173	Breeding common eiders.
Sb5175, Sb5177, Sb5189	Breeding common eiders.
Sb5190, Sb5193, Sb5194	Breeding common eiders.

Shoreline sensitivity summary

SEG_ID	Sensitivity	Ranking
73_59	17	Moderate
73_62	29	High
73_67	23	Moderate
73_76	43	Extreme

Physical environment and logistics — Map 7301 - Tasiusaq Bugt

Access

The nearshore waters in this area are uncharted and caution should be exercised. In general, the waters around the islands in this map area are deep, however there are numerous islets and rocks awash in the general area. Local knowledge is essential for navigation.

This area is ice-bound in the average year from December to June. Breakup begins with a lead that opens up between the fast ice along the coast and the pack ice in Baffin Bay. The lead widens through the summer months and the coast is generally ice-free by July. First-year ice forms in fjords and sheltered waters, generally starting in early December, however, tidal streams and stormy weather often break up the ice or prevent its formation except at the inner ends of fjords.

The prevailing West Greenland Current is 0.5 knots, setting to the north and generally parallel to the coast.

There is no information on tides or currents for this area.

No anchorages have been identified in this area.

Shorelines in this area are predominantly rock allowing little opportunity for marine access.

The closest air base is the STOL airport at Upernavik (map 7251, 800 m asphalt runway).

Countermeasures

In ice concentrations down to six tenths, in situ burning of oil in conjunction with tracking oiled ice is recommended. In open water conditions in offshore and nearshore areas, containment for recovery or burning is recommended. Dispersant application should be considered in offshore areas to remove oil from the water surface, to protect waterfowl and to prevent oil from entering inshore areas. Dispersant-use is cautioned against in inter-island channels and shallow nearshore waters, which may exist within the fjords on this map. The waters appear to be deep, but as they are uncharted, soundings should be taken to confirm their depth prior to using dispersants.

There are no opportunities for nearshore booming for the shoreline described on this map. Offshore countermeasures represent the only practical method of protecting shoreline areas and the two selected areas shown in this map.

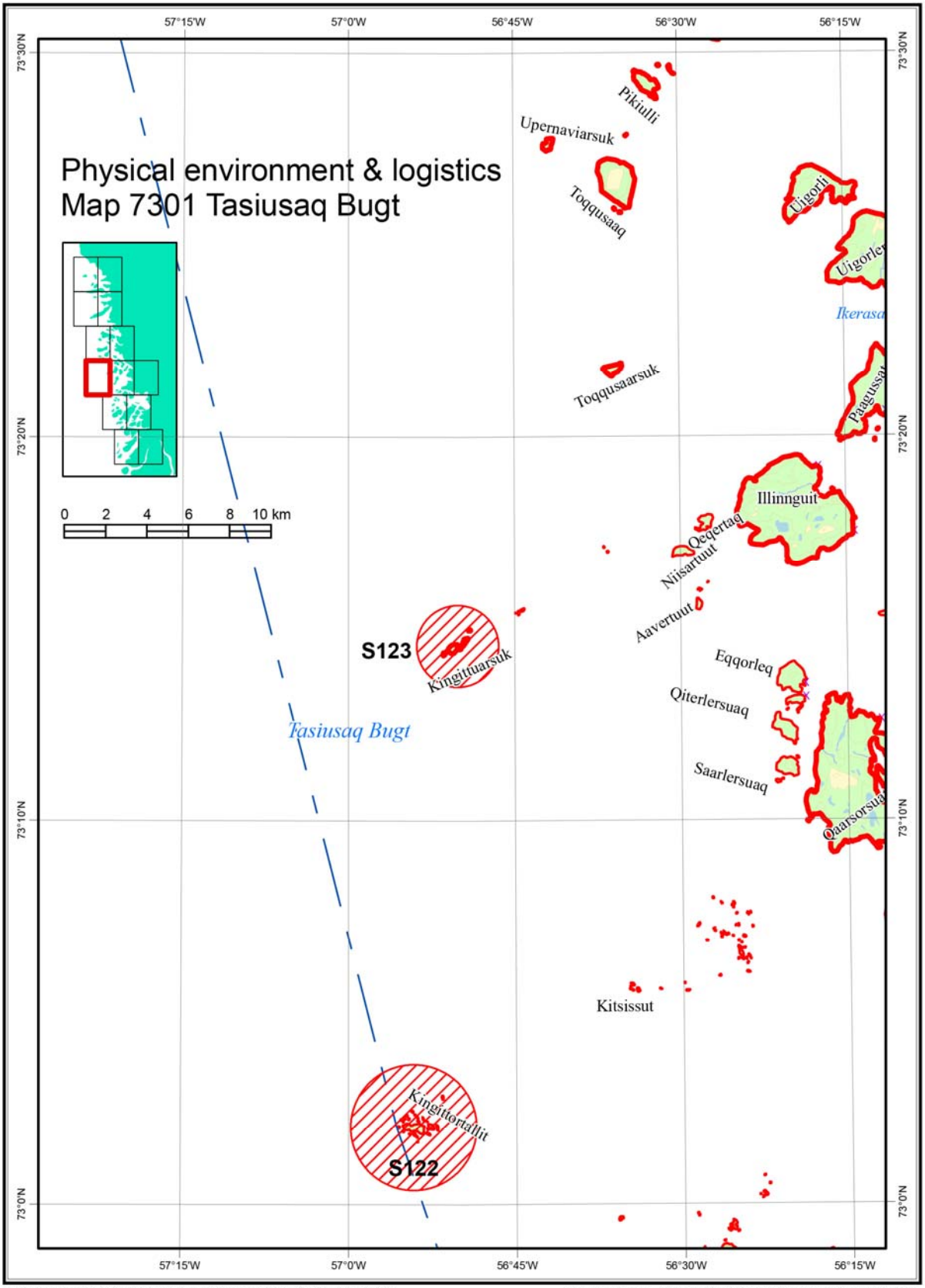
Shorelines shown on this map are predominantly exposed rock, which may not require active cleaning efforts unless heavily contaminated with heavy oils. Consideration should be given to flushing operations in more protected waters within the embayments, fjords, and inter-island channels. Access and trafficability of these areas are unknown, but it is probable that any cleanup operations would be marine-based given the nature of the shoreline.

Safe Havens

There are no potential safe havens identified on this map.

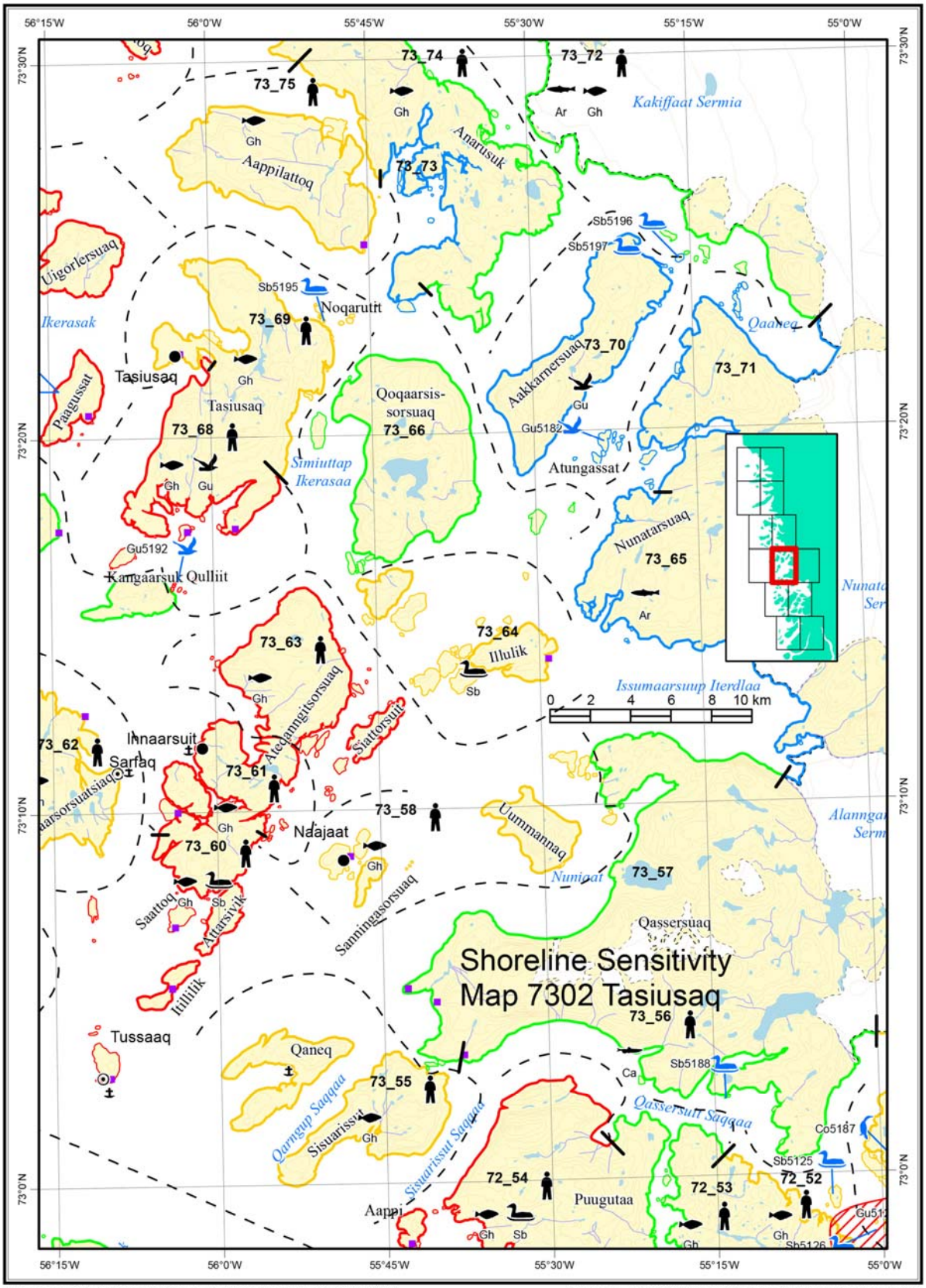
Maps

Danish Survey & Cadastre (KMS) topographical map: 73 V.1. Nautical charts: 1700



Environmental Oilspill Sensitivity Atlas for the West Greenland zone (72° - 75° N)

Topographic base: G/250 Vector, Copyright Kort & Matrikelstyrelsen 1998
Projection: UTM zone 21N, WGS84



Environmental Oilspill Sensitivity Atlas for the West Greenland zone (72° - 75° N)

Topographic base: G/250 Vector, Copyright Kort & Matrikelstyrelsen 1998
Projection: UTM zone 21N, WGS84

Shoreline sensitivity — Map 7302 - Tasiusaq

Environmental description

Resource use

R 73_53	Hunting area for the inhabitants of Naajaat and Aappilattoq
R 73_55	Fishery for Greenland halibut. Hunting area for the inhabitants of Tusaaq.
R 73_56	Fishery for capelin.
R 73_57	Hunting area for the inhabitants of Naajaat.
R 73_58	Fishery for Greenland halibut. Important hunting area for the inhabitants of Tasiusaq, Innaarsuit and Naajaat.
R 73_60	Fishery for Greenland halibut. Important hunting area for the inhabitants of Tasiusaq, Innaarsuit and Naajaat.
R 73_61	Fishery for Greenland halibut and capelin. Important hunting area for the inhabitants of Tasiusaq and Innaarsuit.
R 73_62	Important hunting area for the inhabitants of Tasiusaq, Innaarsuit and Naajaat.
R 73_63,	Fishery for Greenland halibut. Important hunting area for the inhabitants of Tasiusaq and Innaarsuit.
R 73_68, R 73_69	Fishery for Greenland halibut. Important hunting area for the inhabitants of Tasiusaq.
R 73_64	Important hunting area for the inhabitants of Tasiusaq.
R 73_66	Hunting area for the inhabitants of Tasiusaq.
R 73_72	Fishery for Greenland halibut.
R 73_73	Hunting area for the inhabitants of Tasiusaq.
R 73_74	Fishery for Greenland halibut.
R 73_75	Fishery for Greenland halibut. Hunting area for the inhabitants of Tasiusaq, Nutaarmiut and Ikerasaarsuk.
R 73_76	Important hunting area for the inhabitants of Tasiusaq, Nutaarmiut and Ikerasaarsuk.

Species occurrence

Ar73065	Important area for arctic char on south coast of Nunatakassak.
Ar73072	Important area for arctic char in narrow inlet south of Qeqertarsuup Sermia.
Ca73056	Important spawning area for capelin along the whole coastline segment.
Gh73055, Gh73058, Gh73060	Important area for Greenland halibut.
Gh73061, Gh73063, Gh73068	Important area for Greenland halibut.
Gh73069, Gh73072, Gh73074	Important area for Greenland halibut.
Gh73075	Important area for Greenland halibut.
Gu73055, Gu73075	1 colony with breeding Iceland gulls.
Gu73068	3 colonies with breeding Arctic terns, Iceland gulls and glaucous gulls.
Gu73070	3 colonies with breeding Arctic terns, Iceland gulls and glaucous gulls.
Sb73060, Sb73064	Breeding common eiders on islets.

Site specific species occurrence (seabird breeding colonies); blue icons

Gu5182	Breeding Arctic terns and glaucous gulls.
Sb5188, Sb5195, Sb5196	Breeding common eiders.
Sb5197	Breeding common eiders.

Shoreline sensitivity summary

SEG_ID	Sensitivity	Ranking
73_55	24	High
73_56	22	Moderate
73_57	19	Moderate
73_58	28	High
73_60	36	Extreme
73_61	40	Extreme
73_63	39	Extreme
73_64	26	High
73_65	14	Low
73_66	21	Moderate
73_68	38	Extreme
73_69	29	High
73_70	11	Low
73_71	9	Low
73_72	20	Moderate
73_73	15	Low
73_74	18	Moderate
73_75	26	High

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Physical environment and logistics — Map 7302 - Tasiusaq

Access

The nearshore waters in this area are uncharted and caution should be exercised. In general, the waters around the islands in this map area are deep, the channels between many of them are reported to be obstructed by below-water reefs and there are numerous rocks awash. Local knowledge is essential for navigation.

This area is ice-bound in the average year from December to June. Breakup begins with a lead that opens up between the fast ice along the coast and the pack ice in Baffin Bay. The lead widens through the summer months and the coast is generally ice-free by July. First-year ice forms in fjords and sheltered waters, generally starting in early December, however, tidal streams and stormy weather often break up the ice or prevent its formation except at the inner ends of fjords.

There is no information on tides or currents for this area.

Anchorage is available at the settlement of Tussaaq. Caution is advised: sheltered areas are often made dangerous when calving icebergs send waves through narrow entrance channels.

Anchorage with good protection is also available off Qaneq.

Anchorage with good protection has been found in a bay on the east side of Qaersorssuatsiaq, and across the channel at Innaarsuit in 25 m.

Shorelines in this area are predominantly rock allowing little opportunity for marine access.

The closest air base is the STOL airport at Upernavik (map 7251, 800 m asphalt runway).

Countermeasures

In situ burning of oil in conjunction with tracking oiled ice is recommended in ice concentrations down to six tenths. In open water conditions in offshore and nearshore areas, containment for recovery or burning is recommended. Dispersant application is cautioned against in the nearshore waters, fjords, and inter-island channels of this map area.

There are several opportunities for nearshore booming to reduce the extent of inshore contamination: such inlets are marked on the map with widths ranging from 100 to 700 m. Of particular priority would be those within the zones of extreme sensitivity on Tasiusaq and near Innaarsuit.

Alternatively, diversion booming could be attempted within Qassersuit Saqqaa to protect the selected area to the southeast (maps 7303, 7252), but this will be complicated by the excessive length of boom required and the difficulty in anchoring in the deep nearshore waters.

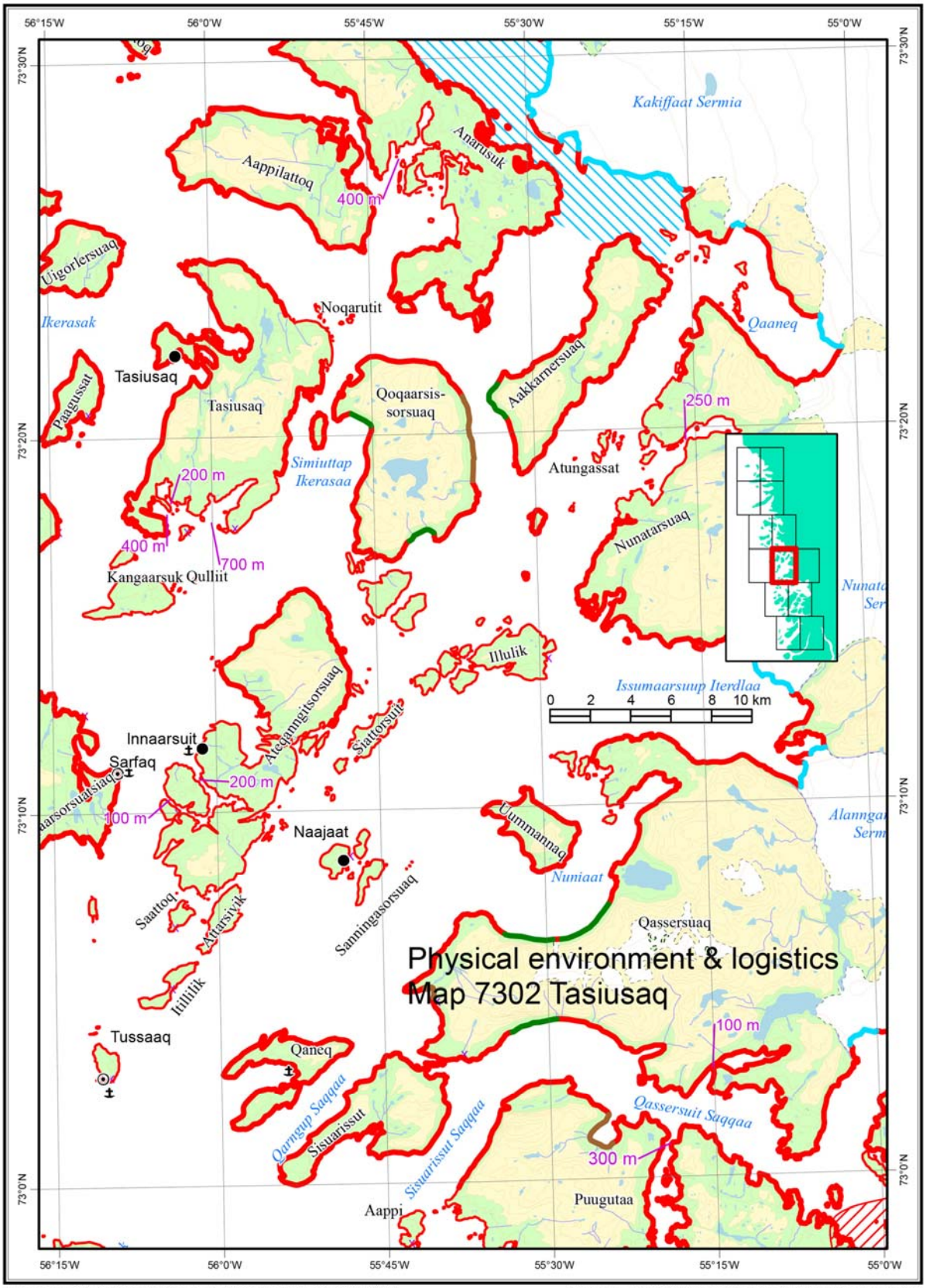
Shorelines shown on this map are almost exclusively rock, with some talus and glacier, much of which is exposed, and none of which may require active cleaning efforts unless heavily contaminated with heavy oils. Consideration should be given to flushing operations in more protected waters within the embayments, fjords, and inter-island channels. Access and trafficability of these areas are unknown, but it is probable that any cleanup operations would be marine-based given the nature of the shoreline.

Safe Havens

The anchorage at Innaarsuit could be considered as a potential safe haven but the inlet has an extreme sensitivity rating. Likewise, the anchorage at Qaneq offers good protection but has a high sensitivity rating.

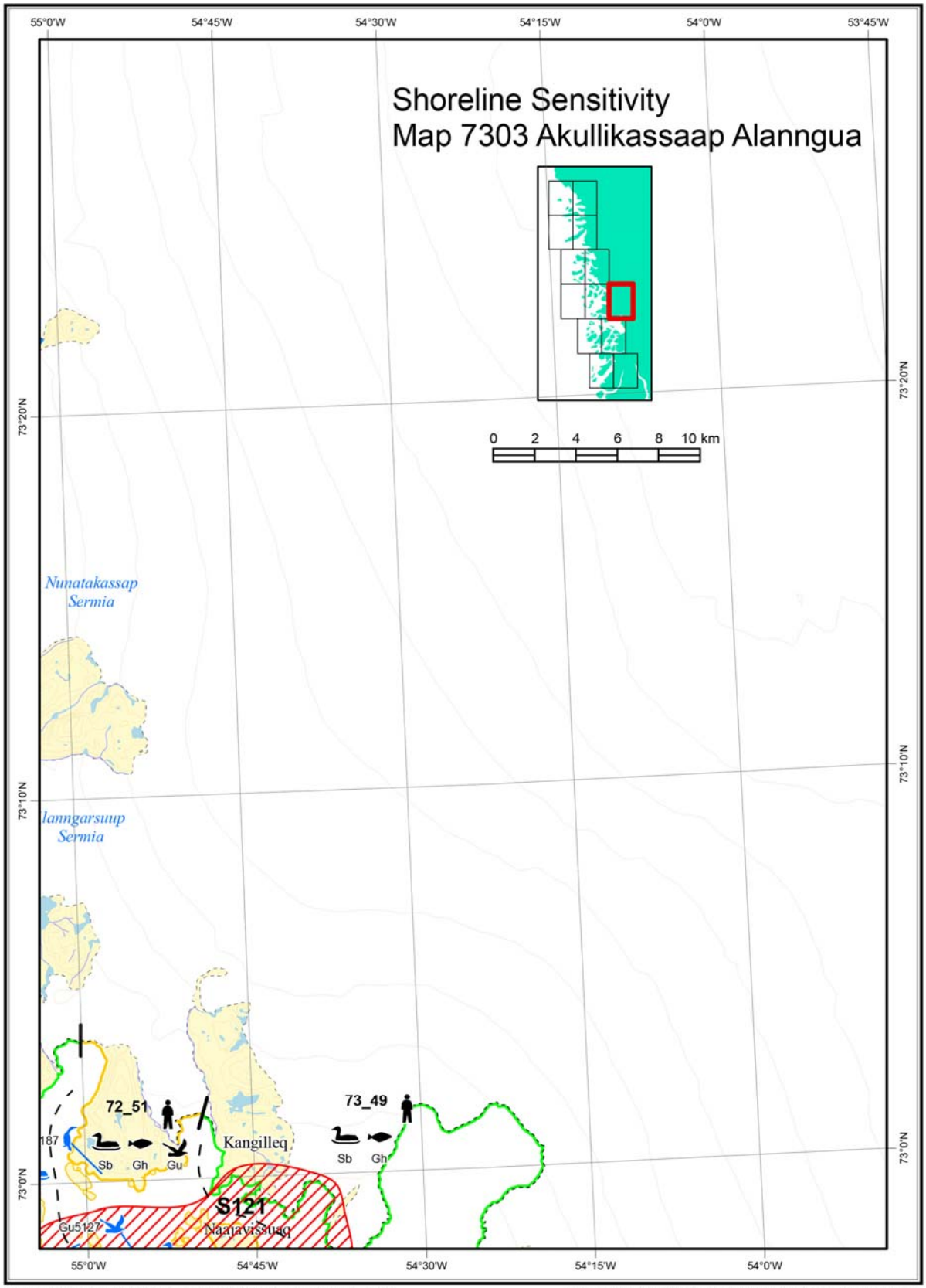
Maps

Danish Survey & Cadastre (KMS) topographical map: 73 V.1 Nautical charts: 1700.



Environmental Oilspill Sensitivity Atlas for the West Greenland zone (72° - 75° N)

Topographic base: G/250 Vector, Copyright Kort & Matrikelstyrelsen 1998
Projection: UTM zone 21N, WGS84



Environmental Oilspill Sensitivity Atlas for the West Greenland zone (72° - 75° N)

Topographic base: G/250 Vector, Copyright Kort & Matrikelstyrelsen 1998
Projection: UTM zone 21N, WGS84

Shoreline sensitivity — Map 7303 - Akullikassaap Alanngua

Environmental description

Resource use

R 72_51	Fishery for Greenland halibut and capelin.

Species occurrence

Gh72051	Important area for Greenland halibut.
Gu72051	3 colonies with breeding Arctic terns and Iceland gulls.
Sb72051	3 colonies with breeding common eiders

Site specific species occurrence (seabird breeding colonies); blue icons

Co5187	Breeding great cormorants.
Gu5127	Breeding colony of Arctic terns.
Sb5126, Sb5128	Breeding common eiders.

Shoreline sensitivity summary

SEG_ID	Sensitivity	Ranking
72_51	29	High
73_49	22	Moderate

Physical environment and logistics Map 7303 - Akullikassaap Alanngua

Access

The nearshore waters in this area are uncharted and caution should be exercised. In general, the waters around the islands in this map area are deep, the channels between many of them are reported to be obstructed by below-water reefs and there are numerous rocks awash. Local knowledge is essential for navigation.

This area is ice-bound in the average year from December to June. Breakup begins with a lead that opens up between the fast ice along the coast and the pack ice in Baffin Bay. The lead widens through the summer months and the coast is generally ice-free by July. First-year ice forms in fjords and sheltered waters, generally starting in early December, however, tidal streams and stormy weather often break up the ice or prevent its formation except at the inner ends of fjords.

There is no information on tides or currents within this area.

No anchorages are noted in this map area.

Shorelines in this area are predominantly rock and glacier allowing little opportunity for marine access.

The closest air base is the STOL airport at Upernavik (map 7251, 800 m asphalt runway).

Countermeasures

In situ burning of oil in conjunction with tracking oiled ice is recommended in ice concentrations down to six tenths. In open water conditions in offshore and nearshore areas, containment for recovery or burning is recommended. Dispersant application is cautioned against in the nearshore waters, fjords, and inter-island channels of this map area.

There are no opportunities for nearshore booming along the short section of shoreline described on this map. Offshore countermeasures represent the only practical method of protecting most shoreline areas.

Diversion booming could be attempted within Qassersuit Saqqaa (map 7302) to protect the selected area on this map, but this will be complicated by the excessive length of boom required and the difficulty in anchoring in the deep nearshore waters.

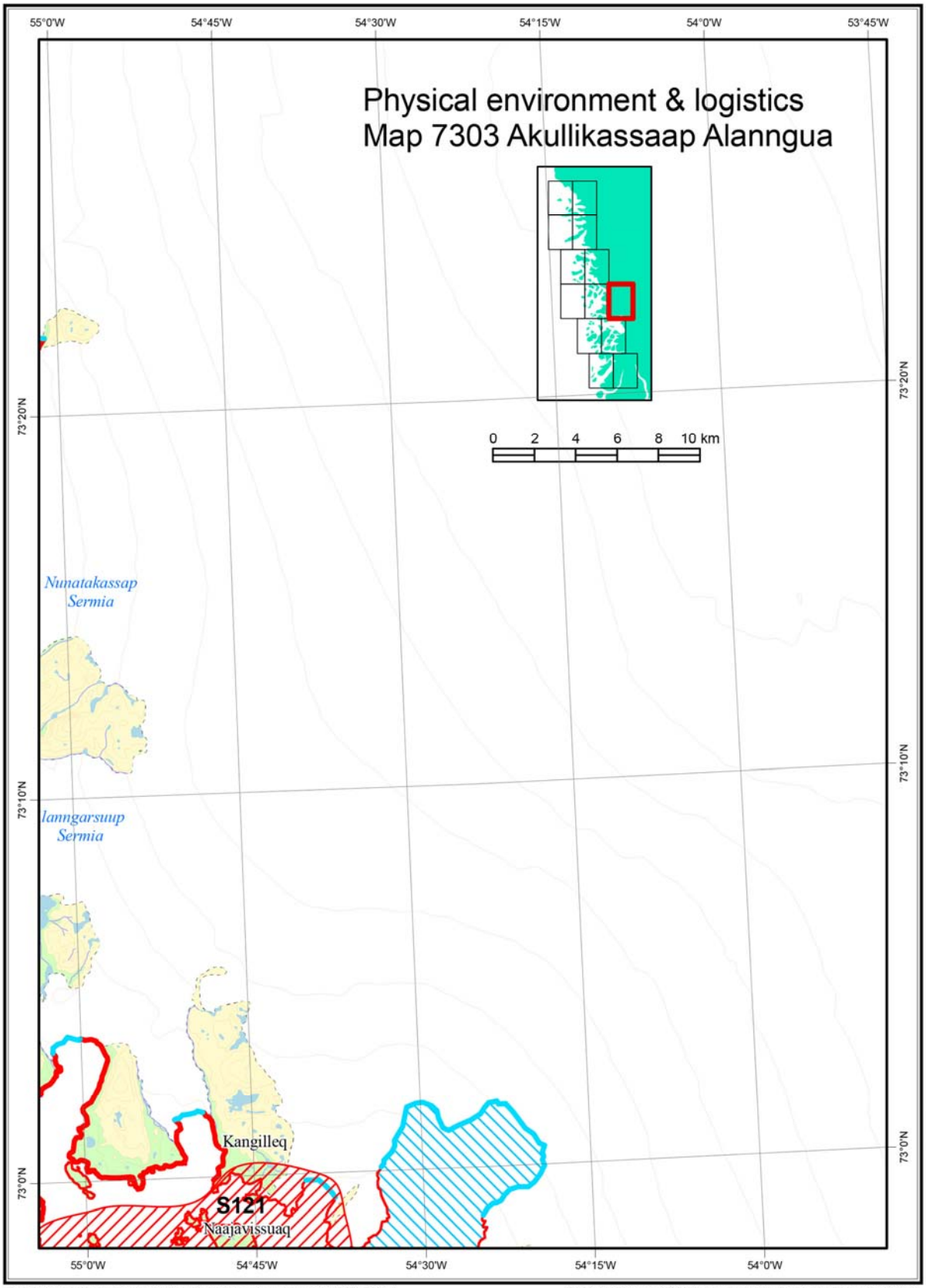
Shorelines shown on this map are predominantly rock and glacier, much of which is exposed, which may not require active cleaning efforts unless heavily contaminated with heavy oils. Consideration should be given to flushing operations in more protected waters within the embayments, fjords, and inter-island channels. Access and trafficability of these areas are unknown, but it is probable that any cleanup operations would be marine-based given the nature of the shoreline.

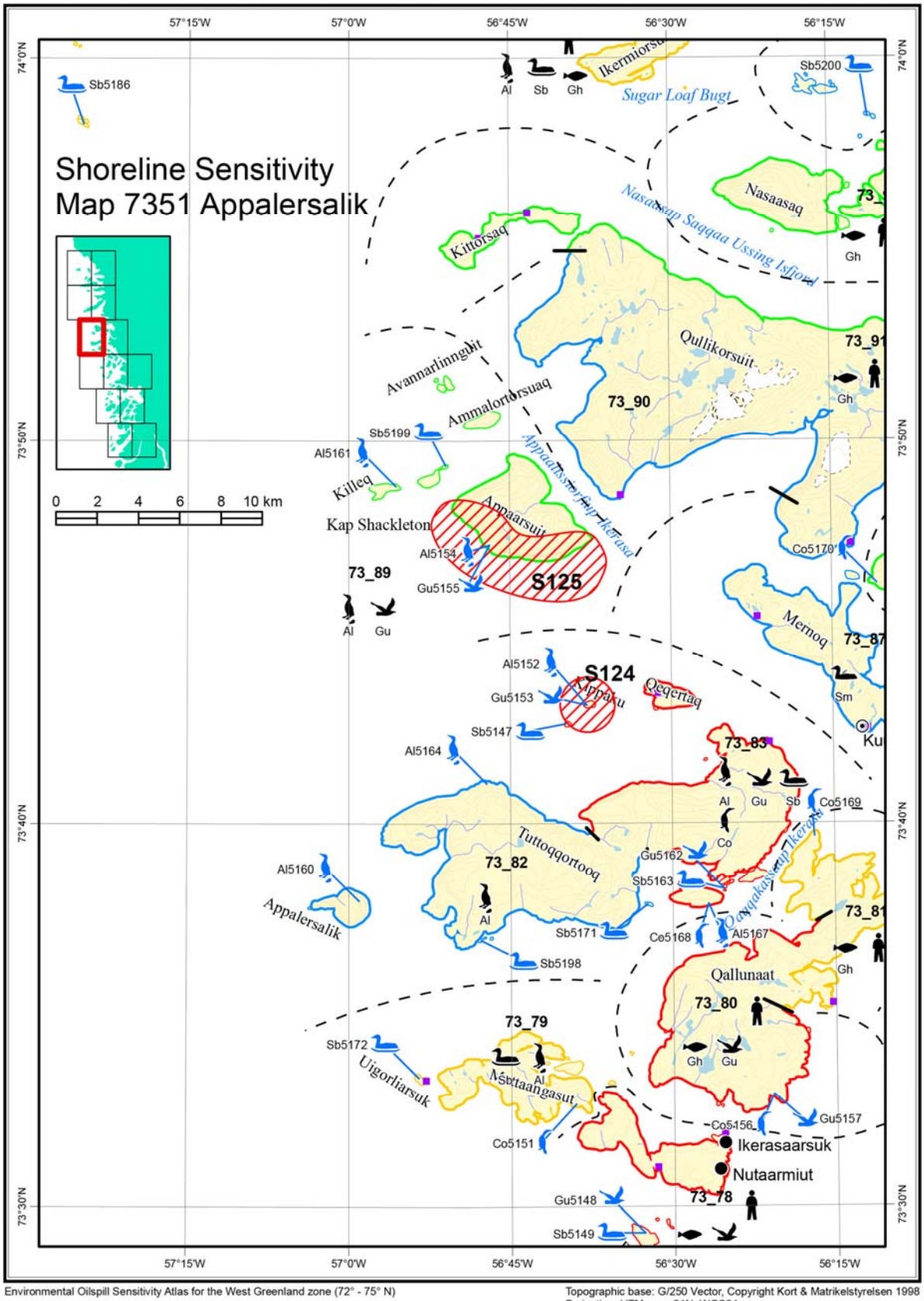
Safe havens

There are no potential safe havens identified on this map.

Maps

Danish Survey & Cadastre (KMS) topographical map: 73 V.1. Nautical charts: 1700.


55°0'W
54°45'W
54°30'W
54°15'W
54°0'W
53°45'W
Physical environment & logistics
Map 7303 Akullikassaap Alanngua
0 2 4 6 8 10 km
73°20'N
73°10'N
73°0'N
Nunatakassap
Sermia
Ianngarsuup
Sermia
Kangilleq
S121
Naajavissuaq
Environmental Oilspill Sensitivity Atlas for the West Greenland zone (72° - 75° N)
Topographic base: G/250 Vector, Copyright Kort & Matrikelstyrelsen 1998
Projection: UTM zone 21N, WGS84


Shoreline Sensitivity
Map 7351 Appalersalik
0 2 4 6 8 10 km
57°15'W
57°0'W
56°45'W
56°30'W
56°15'W
74°0'N
73°50'N
73°40'N
73°30'N
Sugar Loaf Bugt
Nasaasaq
Kittorsaq
Qullikorsuit
Avannarlinngit
Ammalortorsuaq
Killeq
Kap Shackleton
Appaarsuit
Mernoq
Qeqertaq
Tuttoqqortooq
Appalersalik
Qallunaat
Uigorliarsuk
Ikerasaarsuk
Nutaarmiut
73_89
73_90
73_91
73_87
73_83
73_82
73_81
73_80
73_79
73_78
S125
S124
Sb5186
Sb5200
Sb5199
Al5161
Al5154
Gu5155
Al5152
Gu5153
Sb5147
Al5164
Al5160
Gu5162
Sb5163
Sb5171
Sb5198
Co5168
Al5167
Co5169
Co5170
Sb5172
Co5151
Co5156
Gu5157
Gu5148
Sb5149
Environmental Oilspill Sensitivity Atlas for the West Greenland zone (72° - 75° N)
Topographic base: G/250 Vector, Copyright Kort & Matrikelstyrelsen 1998
Projection: UTM zone 21N, WGS84

Shoreline sensitivity — Map 7351 – Appalersalik

Environmental description

Resource use

R	73_78	Fishery for Greenland halibut. Important hunting area for the inhabitants of Nutaarmiut and Ikerasaarsuk.
R	73_79	Hunting area for the inhabitants of Nutaarmiut and Ikerasaarsuk.
R	73_80	Important hunting area for the inhabitants of Nutaarmiut and Ikerasaarsuk. Fishery for Greenland halibut.
R	73_81	Hunting area for the inhabitants of Nutaarmiut and Ikerasaarsuk. Fishery for Greenland halibut.
R	73_83	Hunting area for the inhabitants of Nutaarmiut and Ikerasaarsuk.
R	73_91	Fishery for Greenland halibut.

Species occurrence

Al73079	4 colonies with breeding black guillemots and razorbills.
Al73082	4 colonies with breeding little auk, black guillemots, razorbills and puffins.
Al73083	3 colonies with breeding thick-billed murres, black guillemots, razorbills and puffins.
Al73089	3 colonies with breeding thick-billed murres, black guillemots and razorbills.
Co73083	1 colony with breeding great cormorants.
Gh73078, Gh73080, Gh73081	Important area for Greenland halibut.
Gh73091	Important area for Greenland halibut.
Gu73078	4 colonies with breeding Arctic terns and glaucous gulls.
Gu73080	3 colonies with breeding kittiwakes, Iceland gulls and glaucous gulls.
Gu73083	4 colonies with breeding kittiwakes, Arctic terns, glaucous gulls and Iceland gulls.
Gu73089	3 colonies with breeding kittiwakes and glaucous gulls.
Gu73091	1 colony with breeding Iceland gulls.
Sb73079	2 colonies with breeding common eiders.
Sb73083	3 colonies with breeding common eiders.
Sm73087	Moulting area for king eiders.

Site specific species occurrence (seabird breeding colonies); blue icons

Al5152	Breeding thick-billed murres, puffins, razorbills and black guillemots.
Al5154	Breeding thick-billed murres, razorbills and black guillemots.
Al5160	Breeding little auks, puffins, black guillemots and razorbills.
Al5161	Breeding black guillemots.
Al5164, Al5167	Breeding colonies of black guillemots and razorbills.
Co5151, Co5156, Co5168	Breeding great cormorants.
Co5169	Breeding great cormorants.
Gu5148	Breeding Arctic terns and glaucous gulls.
Gu5153, Gu5155	Breeding colony of kittiwakes and glaucous gulls.
Gu5157	Breeding kittiwakes and Iceland gulls.
Gu5162	Breeding Arctic terns and glaucous gulls.
Sb5147, Sb5149, Sb5163	Breeding common eiders.
Sb5171, Sb5172, Sb5198	Breeding common eiders.
Sb5199	Breeding common eiders.

Shoreline sensitivity summary

SEG_ID	Sensitivity	Ranking
73_78	33	Extreme
73_79	27	High
73_80	32	Extreme
73_81	29	High
73_82	13	Low
73_83	37	Extreme
73_87	15	Low
73_89	18	Moderate
73_90	9	Low
73_91	18	Moderate

Physical environment and logistics — Map 7351 - Appalersalik

Access

The nearshore waters in this area are uncharted and caution should be exercised. In general, the waters around the islands in this map area are deep, the channels between many of them are reported to be obstructed by below-water reefs and there are numerous rocks awash. Local knowledge is essential for navigation.

This area is ice-bound in the average year from December to June. Breakup begins with a lead that opens up between the fast ice along the coast and the pack ice in Baffin Bay. The lead widens through the summer months and the coast is generally ice-free by July. First-year ice forms in fjords and sheltered waters, generally starting in early December, however, tidal streams and stormy weather often break up the ice or prevent its formation except at the inner ends of fjords.

A reef is reported to extend for some distance off Kap Shackleton.

The prevailing West Greenland Current is 0.5 knots, setting to the north and generally parallel to the coast.

Tidal streams in the area are reported to be strong.

An anchorage with good protection is available off the west coast of Nutarmiut. The tidal stream is strong and there are some rocks.

Anchorage is also available in the two bays on Qullikorsuit, with good shelter from all directions. Rocks are reported in the easterly of these bays, where icebergs frequently ground.

Shorelines in this area are exclusively rock allowing little opportunity for marine access.

The closest air base is the STOL airport at Upernavik (map 7251, 800 m asphalt runway).

Countermeasures

In ice concentrations down to six tenths, in situ burning of oil in conjunction with tracking oiled ice is recommended. In open water conditions in offshore and nearshore areas, containment for recovery or burning is recommended. Dispersant application should be considered in offshore areas to remove oil from the water surface, to protect waterfowl and to prevent oil from entering inshore areas. Dispersant-use is cautioned against in inter-island channels and shallow nearshore waters, which may exist within the fjords on this map. The waters appear to be deep, but as they are uncharted, soundings should be taken to confirm their depth prior to using dispersants.

Offshore countermeasures represent the only practical method of protecting the selected areas noted on this map.

One inlet, with a width of 1000 m, is noted as an opportunity for exclusion booming to limit the extent of contamination, however booming will be complicated by the difficulty in anchoring in the deep nearshore waters. Currents are not well known but are likely to be high.

Shorelines shown on this map are exclusively rock, much of which is exposed, which may not require active cleaning efforts unless heavily contaminated with heavy oils. Consideration should be given to flushing operations in more protected waters within the embayments, fjords, and inter-island channels. Access and trafficability of these areas are unknown, but it is probable that any cleanup operations would be marine-based given the nature of the shoreline.

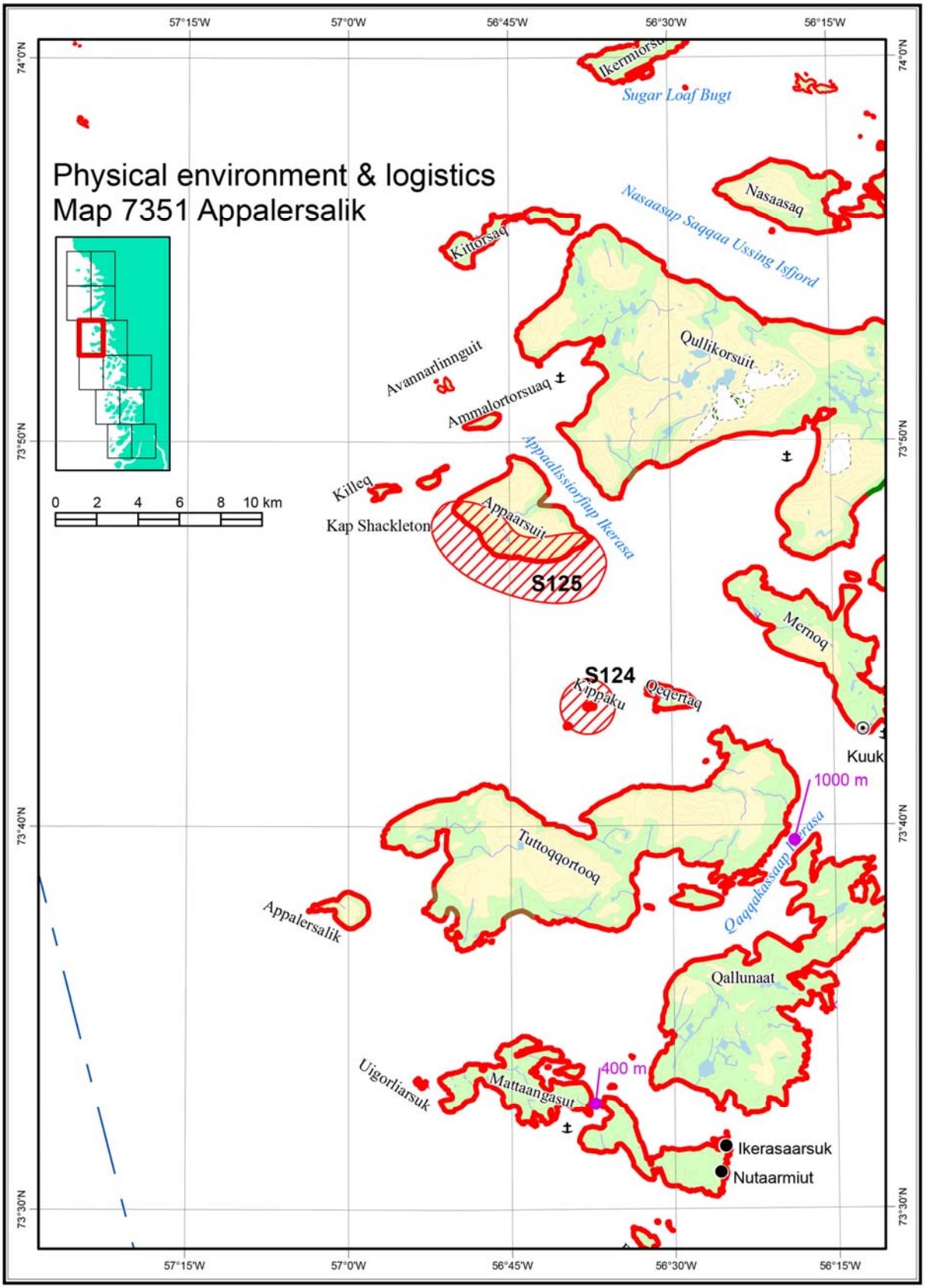
Safe havens

The anchorages within the two bays on Qullikorsuit could be considered as a potential safe haven given their low sensitivity rating; the anchorage offers some shelter but exclusion booming would be impractical.

The anchorage off the west coast of Nutarmiut could be considered as a potential safe haven but the inlet has an extreme sensitivity rating.

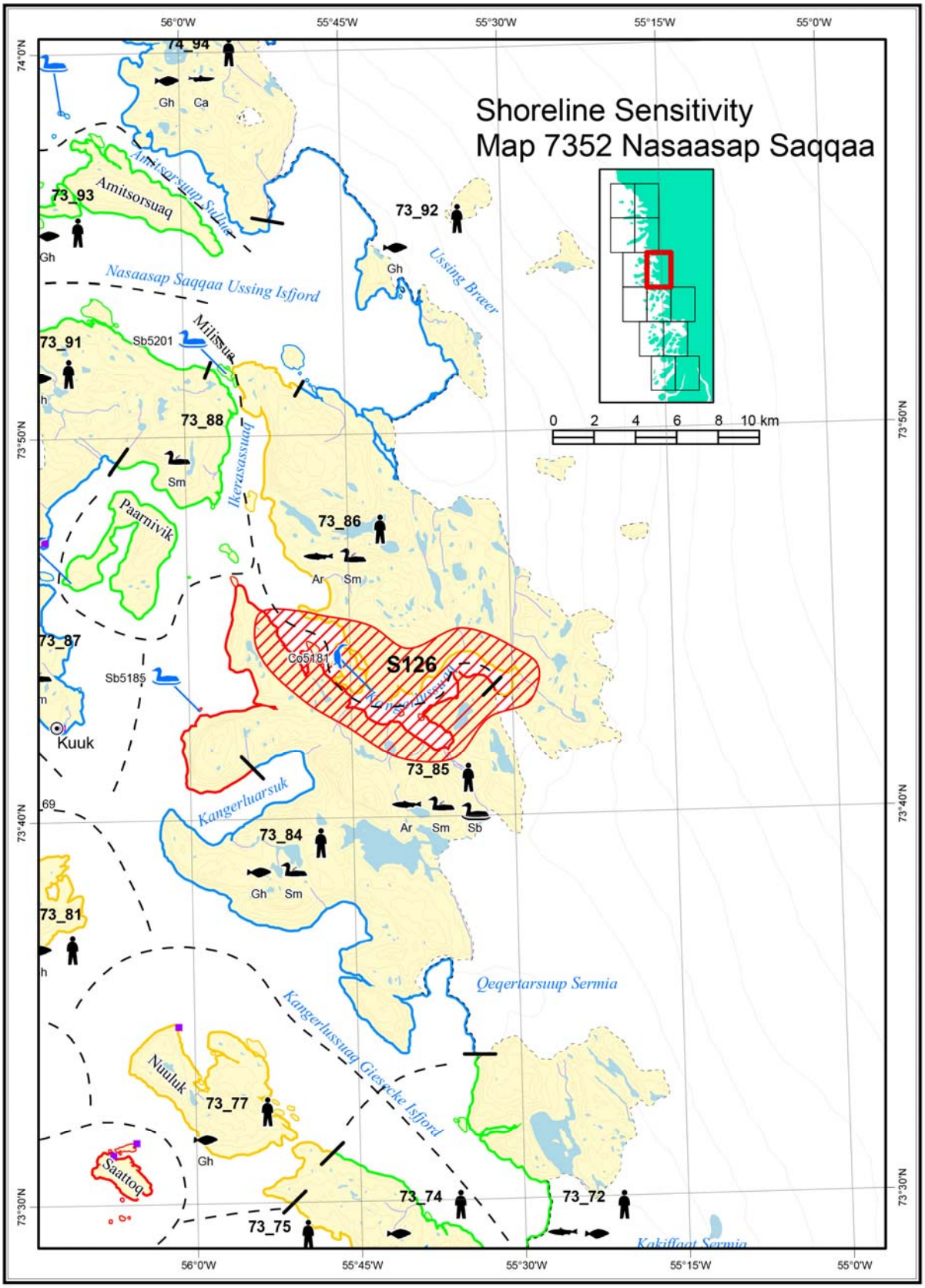
Maps

Danish Survey & Cadastre (KMS) topographical map: 73 V.1. Nautical charts: 1700.



Environmental Oilspill Sensitivity Atlas for the West Greenland zone (72° - 75° N)

Topographic base: G/250 Vector, Copyright Kort & Matrikelstyrelsen 1998
Projection: UTM zone 21N, WGS84


Shoreline Sensitivity
Map 7352 Nasaasap Saqqaa
56°0'W
55°45'W
55°30'W
55°15'W
55°0'W
74°0'N
73°50'N
73°40'N
73°30'N
0 2 4 6 8 10 km
74_94
Gh Ca
73_93
Amitsorsuaq
Amitsorsuup Sullua
Gh
73_92
Gh
Ussing Bræer
Nasaasap Saqqaa Ussing Isfjord
Milissuk
Sb5201
73_91
73_88
Sm
Ikerasassuaq
Paarnivik
73_86
Ar Sm
73_87
Co5181
S126
Sb5185
Kuuk
73_85
Ar Sm Sb
Kangerluarsuk
73_84
Gh Sm
73_81
Qeqertarsuup Sermia
Kangerlussuaq Giesecke Isfjord
Niuluk
73_77
Gh
Saattoq
73_74
73_72
73_75
Kakiffaat Sermia
Environmental Oilspill Sensitivity Atlas for the West Greenland zone (72° - 75° N)
Topographic base: G/250 Vector, Copyright Kort & Matrikelstyrelsen 1998
Projection: UTM zone 21N, WGS84

Shoreline sensitivity — Map 7352 - Nasaasap Saqqaa

Environmental description

Resource use

R 73_77	Fishery for Greenland halibut. Hunting area for the inhabitants of Nutaarmiut and Ikerasaarsuk.
R 73_78	Important hunting area for the inhabitants of Nutaarmiut and Ikerasaarsuk.
R 73_85	Fishery for arctic char, Greenland halibut.
R 73_86	Fishery for Greenland halibut. capelin.
R 73_92	Fishery for Greenland halibut.
R 73_93	Fishery for Greenland halibut and capelin.

Species occurrence

Ar73085	Important area for arctic char along most of the coastline.
Ar73086	Important area for arctic char along the coastline near Maqigiaq.
Gh73077, Gh73084, Gh73092	Important area for Greenland halibut.
Gh73093	Important area for Greenland halibut.
Sb73085	1 colony with breeding common eiders.
Sm73084, Sm73085	Moulting area for king eiders.
Sm73086, Sm73088	Moulting area for king eiders.

Site specific species occurrence (seabird breeding colonies); blue icons

Co5170, Co5181	Breeding great cormorants.
Sb5185, Sb5201	Breeding common eiders.

Shoreline sensitivity summary

SEG_ID	Sensitivity	Ranking
73_77	23	High
73_84	14	Low
73_85	31	Extreme
73_86	23	High
73_88	23	Moderate
73_92	16	Low
73_93	20	Moderate

Physical environment and logistics Map 7352 - Nasaasap Saqqaa

Access

The nearshore waters in this area are uncharted and caution should be exercised. In general, the waters around the islands in this map area are deep, the channels between many of them are reported to be obstructed by below-water reefs and there are numerous rocks awash. Local knowledge is essential for navigation.

This area is ice-bound in the average year from December to June. Breakup begins with a lead that opens up between the fast ice along the coast and the pack ice in Baffin Bay. The lead widens through the summer months and the coast is generally ice-free by July. First-year ice forms in fjords and sheltered waters, generally starting in early December, however, tidal streams and stormy weather often break up the ice or prevent its formation except at the inner ends of fjords.

Tidal streams are reported to be strong through Giesecke Isfjord.

Anchorage with good protection for small vessels is available in a cove off the small abandoned settlement of Kuuk, in 25 m.

Anchorage is available in the bay on the north side of Nuuluk, the site of an abandoned settlement.

Shorelines in this area are exclusively rock and glacier allowing little opportunity for marine access.

The closest air base is the STOL airport at Upernavik (map 7251, 800 m asphalt runway).

Countermeasures

In situ burning of oil in conjunction with tracking oiled ice is recommended in ice concentrations down to six tenths. In open water conditions in offshore and nearshore areas, containment for recovery or burning is recommended. Dispersant application is cautioned against in the nearshore waters, fjords, and inter-island channels of this map area.

Offshore countermeasures represent the only practical method of protecting most shoreline areas and the selected area.

Approaches to the selected area at Kangerlussuaq are too wide to allow effective exclusion booming. Exclusion booming could be considered within Kangerlussuaq where on each side of the island that blocks the inlet (200 and 200 m). Alternatively, diversion booming could be attempted at the entrance to the selected area, but this will be complicated by the excessive length of boom required and the difficulty in anchoring in the deep nearshore waters. Tidal currents are not reported but are expected to be high.

Shorelines shown on this map are exclusively rock and glacier, much of which is exposed, which may not require active cleaning efforts unless heavily contaminated with heavy oils. Consideration should be given to flushing operations in more protected waters within the embayments, fjords, and inter-island channels. Access and trafficability of these areas are unknown, but it is probable that any cleanup operations would be marine-based given the nature of the shoreline.

Access and trafficability of these areas are unknown, but it is probable that any cleanup operations would be marine-based given the nature of the shoreline.

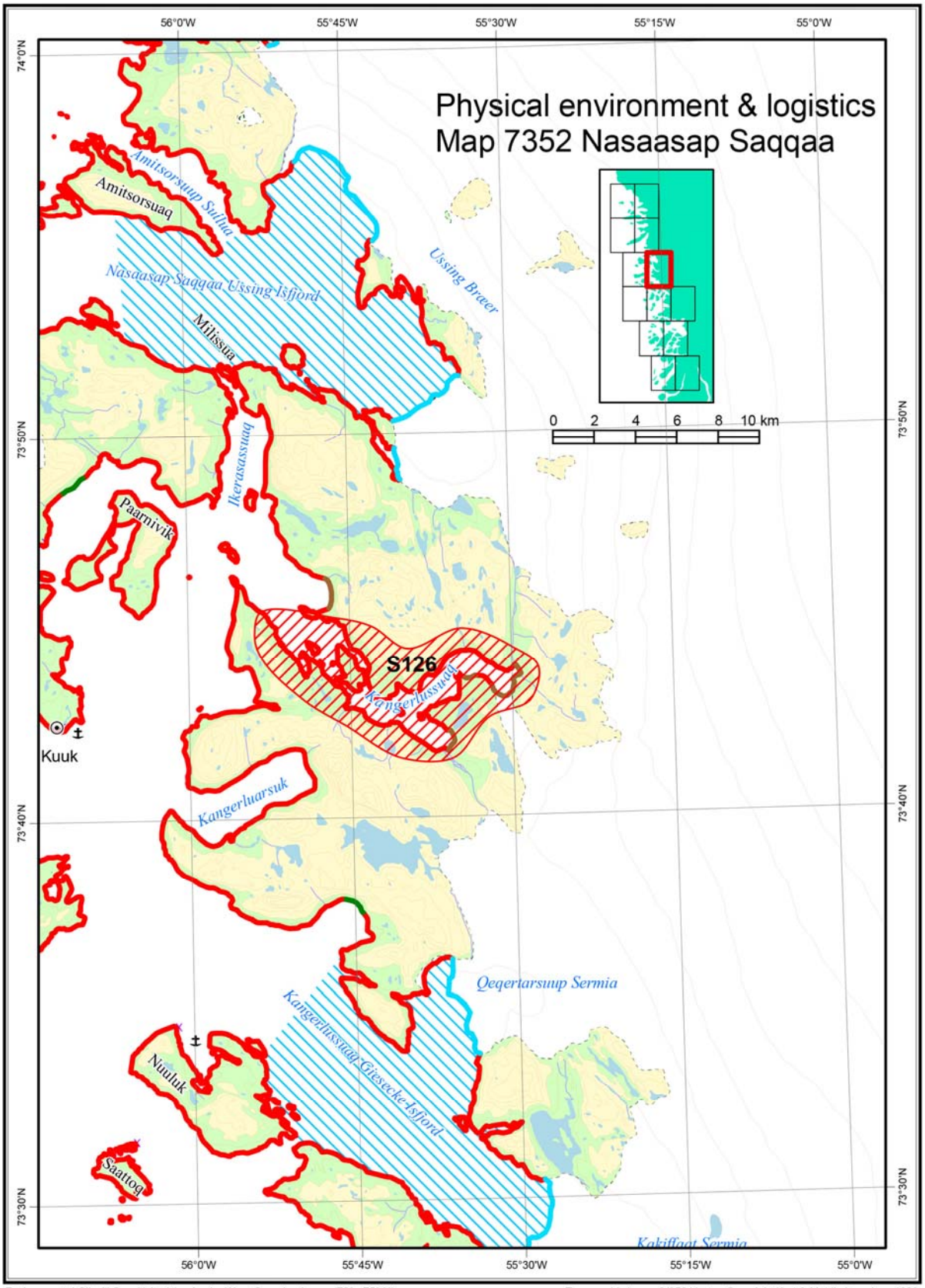
Safe havens

The anchorages noted at Nuuluk could be considered as a potential safe haven; it offers good protection but has a high sensitivity rating. Exclusion booming would be impractical due to the width of the channel; however the shape of the channel may afford natural containment depending on wind direction and tidal streams.

Other natural embayments such as Kangerluarsuk and the on the south side of Paarnivik have lower sensitivity ratings and could also be considered, but depths and navigational hazards are unknown.

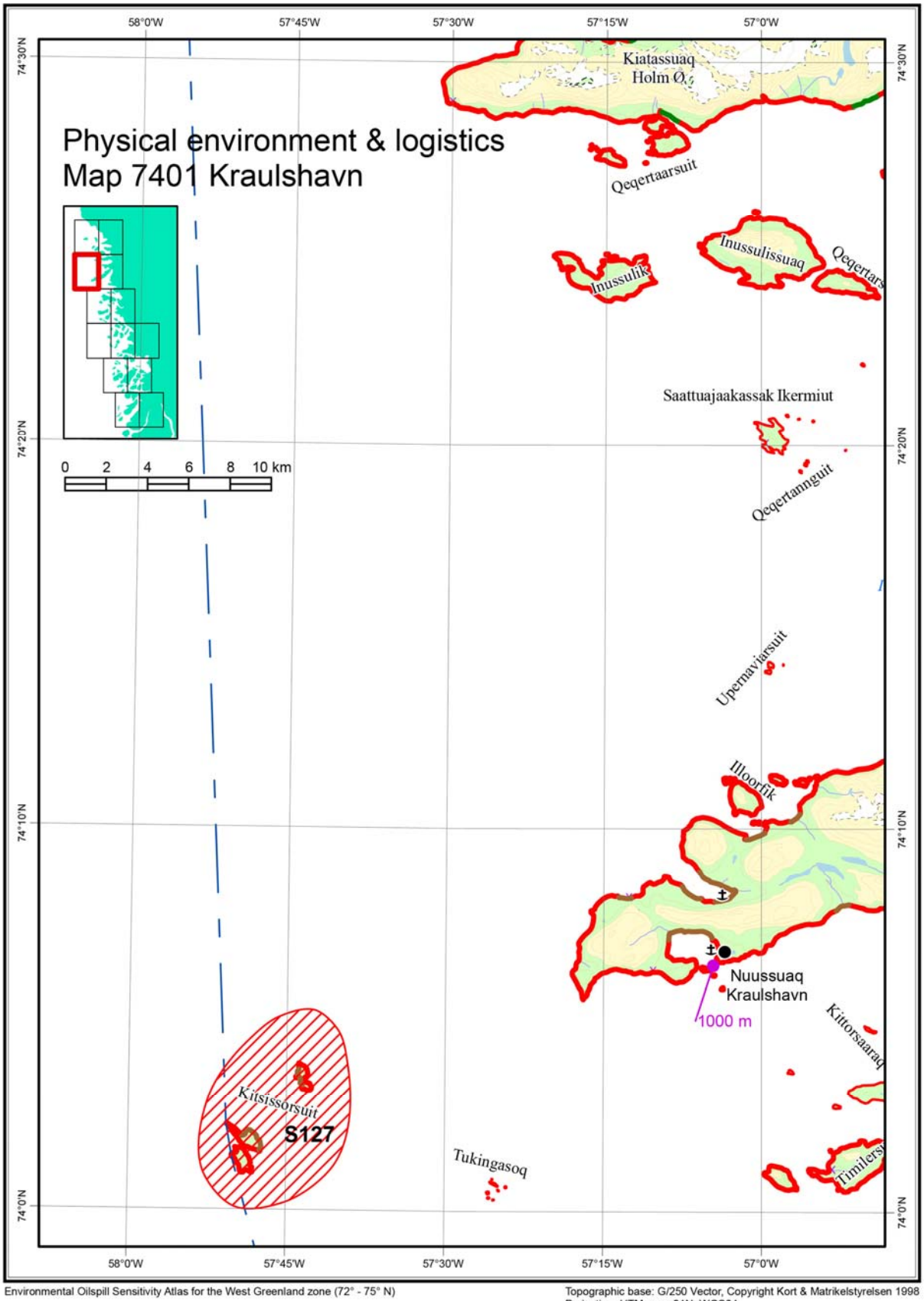
Maps

Danish Survey & Cadastre (KMS) topographical map: 73 V.1. Nautical charts: 1700.



Environmental Oilspill Sensitivity Atlas for the West Greenland zone (72° - 75° N)

Topographic base: G/250 Vector, Copyright Kort & Matrikelstyrelsen 1998
Projection: UTM zone 21N, WGS84



Environmental Oilspill Sensitivity Atlas for the West Greenland zone (72° - 75° N)

Topographic base: G/250 Vector, Copyright Kort & Matrikelstyrelsen 1998
Projection: UTM zone 21N, WGS84

Shoreline sensitivity — Map 7401 - Kraulshavn

Environmental description

Resource use

R 74_95	Fishery for Greenland halibut. Hunting area for the inhabitants of Nuussuaq.
R 74_96	Hunting area for the inhabitants of Nutaarmiut and Ikerasaarsuk.
R 74_99	Hunting area for the inhabitants of Nuussuaq.
R 74_100	Fishery for Greenland halibut and polar cod. Important hunting area for the inhabitants of Nuussuaq.
R 74_108	Hunting area for the inhabitants of Kullorsuaq.

Species occurrence

Al74095	4 colonies with breeding black guillemots, puffins and razorbills.
Al74100	4 colonies with breeding black guillemots.
Gh74095	Important area for Greenland halibut.
Gu74104	3 colonies with breeding Arctic terns and glaucous gulls.
Lu74108	Spawning area for lumpsucker.
Sb74095	4 colonies with breeding common eiders.
Sb74104	1 colony with breeding common eiders.
Sm74100	Moulting area for king eiders.

Site specific species occurrence (seabird breeding colonies); blue icons

Al5202	Breeding colonies of black guillemots and puffins.
Al5205	Breeding puffins, razorbills and black guillemots.
Co5203, Co5206	Breeding great cormorants.
Gu5210, Gu5211	Breeding Arctic terns.
Sb5186, Sb5204, Sb5207	Breeding common eiders.
Sb5208, Sb5209	Breeding common eiders.

Shoreline sensitivity summary

SEG_ID	Sensitivity	Ranking
74_95	25	High
74_100	25	High
74_104	13	Low
74_108	14	Low

Physical Environment and logistics — Map 7401 - Kraulshavn

Access

The nearshore waters in this area are uncharted and caution should be exercised. In general, the waters around the islands in this map area are deep, the channels between many of them are reported to be obstructed by below-water reefs and there are numerous rocks awash. Local knowledge is essential for navigation.

This area is ice-bound in the average year from December to June. Breakup begins with a lead that opens up between the fast ice along the coast and the pack ice in Baffin Bay. The lead widens through the summer months and the coast is generally ice-free by July. First-year ice forms in fjords and sheltered waters, generally starting in early December, however, tidal streams and stormy weather often break up the ice or prevent its formation except at the inner ends of fjords.

After breakup, ice drifts through the area throughout the navigation season.

The prevailing West Greenland Current is 0.5 knots, setting to the north and generally parallel to the coast.

The tidal range is 1.3 to 2.3 m. Tidal streams are reported to be strong in the area.

A large, deep harbour is available at the settlement of Nuussuaq/Kraulshavn, and has been used by vessels of 50 m length and 4 m draft. Weak tidal streams are reported. The channel has a least depth of 30 m, but shoals, islets, and rocks are in the vicinity.

Anchorage for shallow draft vessels is also available north of Nuussuaq/Kraulshavn, in an inlet on the north coast of the peninsula.

The closest air base is the STOL airport at Upernavik (map 7251, 800 m asphalt runway).

Countermeasures

In ice concentrations down to six tenths, in situ burning of oil in conjunction with tracking oiled ice is recommended. In open water conditions in offshore and nearshore areas, containment for recovery or burning is recommended. Dispersant application should be considered in offshore areas to remove oil from the water surface, to protect waterfowl and to prevent oil from entering inshore areas. Dispersant-use is cautioned against in inter-island channels and shallow nearshore waters, which may exist within the fjords on this map. The waters appear to be deep, but as they are uncharted, soundings should be taken to confirm their depth prior to using dispersants.

Offshore countermeasures represent the only practical method of protecting most shoreline areas and the selected area noted on this map.

Exclusion booming could be used to prevent oil from entering the harbour at Nuussuaq/Kraulshavn, where the inlet width is 1000 m and the tidal stream is reported to be weak. Depths are unknown and would require reconnaissance at the time of a spill.

There are no other opportunities for exclusion booming in the area shown on this map due to the width of the inlets and the deep nearshore waters.

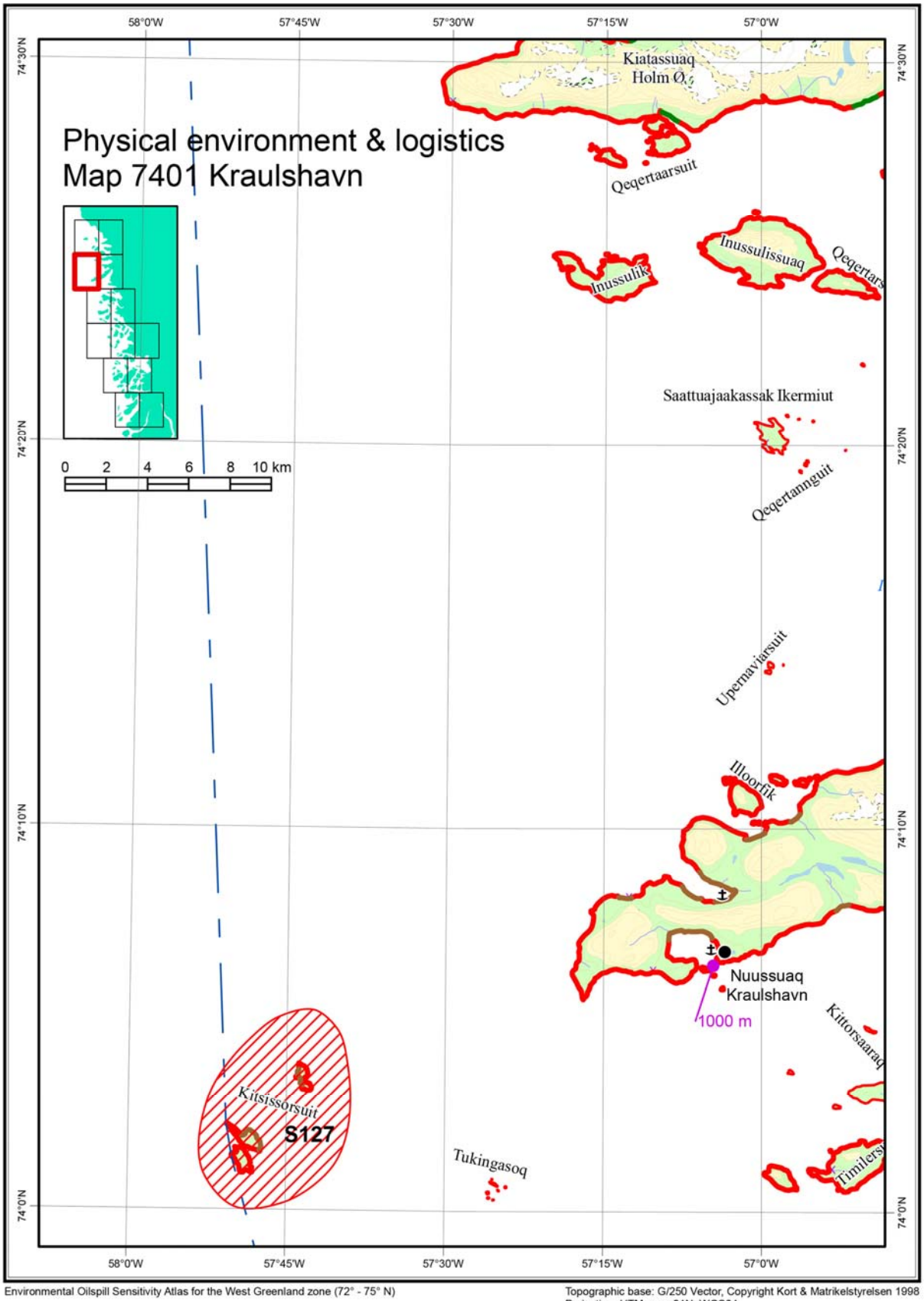
Shorelines shown on this map are exclusively rock, much of which is exposed, which may not require active cleaning efforts unless heavily contaminated with heavy oils. Consideration should be given to flushing operations in more protected waters within the embayments, fjords, and inter-island channels. Access and trafficability of these areas are unknown, but it is probable that any cleanup operations would be marine-based given the nature of the shoreline.

Safe havens

The anchorage within Nuussuaq/Kraulshavn could be considered as a potential safe haven: it has a low sensitivity rating, offers good shelter, and its entrance width of 500 m should allow the use of exclusion booming to contain any further release of oil. It is however very close to the settlement.

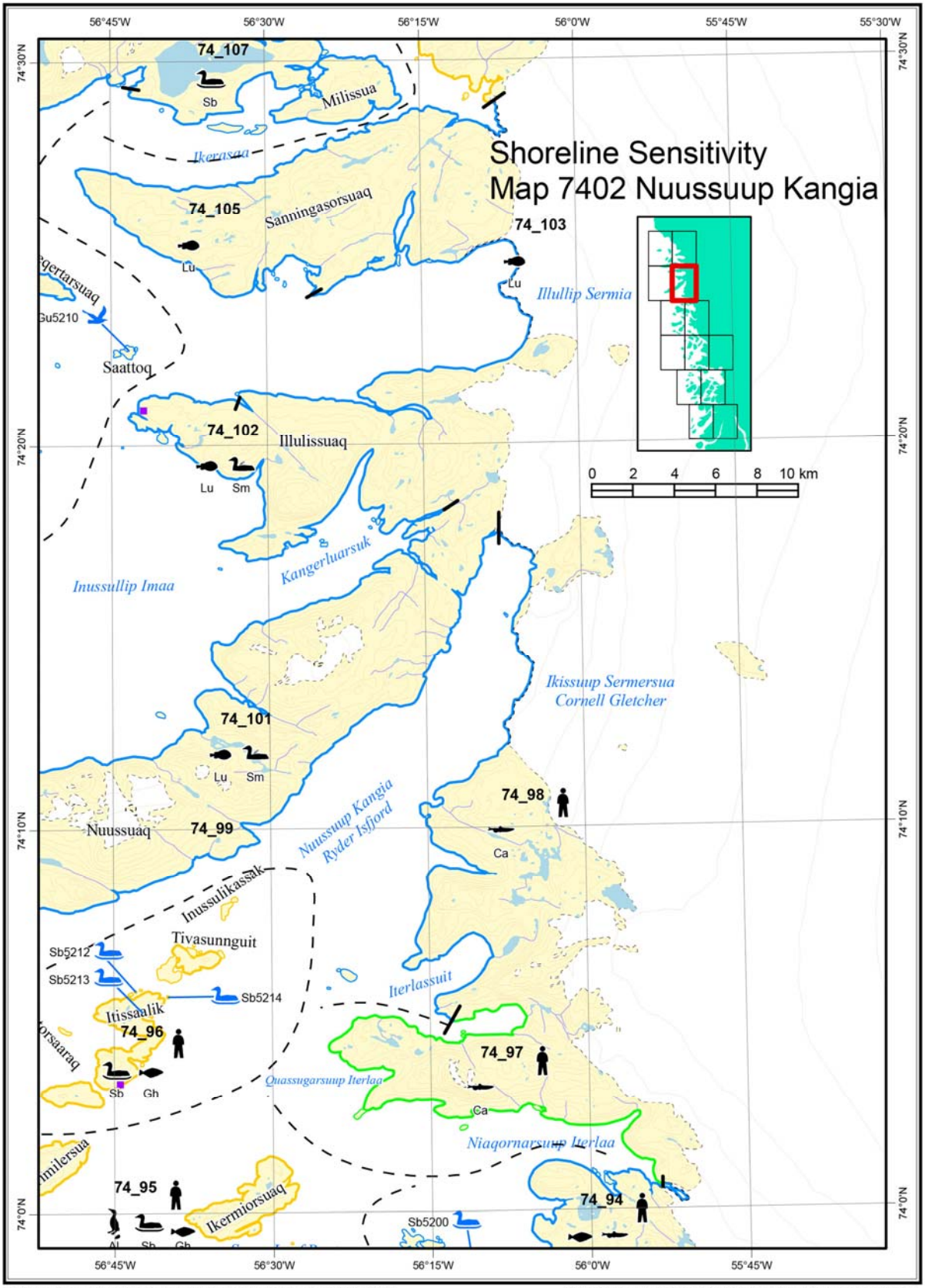
Maps

Danish Survey & Cadastre (KMS) topographical map: 74 V.1. Nautical charts: 1650, 1700.



Environmental Oilspill Sensitivity Atlas for the West Greenland zone (72° - 75° N)

Topographic base: G/250 Vector, Copyright Kort & Matrikelstyrelsen 1998
Projection: UTM zone 21N, WGS84



Environmental Oilspill Sensitivity Atlas for the West Greenland zone (72° - 75° N)

Topographic base: G/250 Vector, Copyright Kort & Matrikelstyrelsen 1998
Projection: UTM zone 21N, WGS84

Shoreline sensitivity — Map 7402 - Nuussuup Kangia

Environmental description

Resource use

R 74_95	Hunting area for the inhabitants of Nuussuaq.
R 74_96	Fishery for Greenland halibut. Important hunting area for the inhabitants of Nuussuaq.
R 74_97	Fishery for capelin 3 Greenland halibut.
R 74_98	Fishery for Greenland halibut 2 capelin.
R 74_99	Hunting area for the inhabitants of Nuussuaq.
R 74_108	Hunting area for the inhabitants of Kullorsuaq.

Species occurrence

Ca74094	Important spawning area for capelin along most of dominant part of the coastline segment around Amitsorsuup Sullua and northwards.
Ca74097	Important spawning area for capelin throughout the coastline segment.
Ca74098	Important spawning area for capelin along the southern part of the coastline segment.
Gh74094, Gh74096	Important area for Greenland halibut
Lu74101, Lu74102, Lu74103	Spawning area for lumpsucker
Lu74105	Spawning area for lumpsucker
Sb74096	3 colonies with breeding common eiders
Sb74107	Breeding common eiders on islets
Sm74101, Sm74102	Moulting area for king eiders

Site specific species occurrence (seabird breeding colonies); blue icons

Sb5200, Sb5212, Sb5213	Breeding common eiders

Shoreline sensitivity summary

SEG_ID	Sensitivity	Ranking
74_94	14	Low
74_96	24	High
74_97	20	Moderate
74_98	16	Low
74_99	15	Low
74_101	14	Low
74_102	15	Low
74_103	7	Low
74_105	10	Low
74_107	15	Low

Physical environment and logistics Map 7402 - Nuussuup Kangia

Access

The nearshore waters in this area are uncharted and caution should be exercised. In general, the waters around the islands in this map area are deep, the channels between many of them are reported to be obstructed by below-water reefs and there are numerous islets and rocks awash. Local knowledge is essential for navigation.

This area is ice-bound in the average year from December to June. Breakup begins with a lead that opens up between the fast ice along the coast and the pack ice in Baffin Bay. The lead widens through the summer months and the coast is generally ice-free by July. First-year ice forms in fjords and sheltered waters, generally starting in early December, however, tidal streams and stormy weather often break up the ice or prevent its formation except at the inner ends of fjords.

There is no information on tides or currents for this area.

No anchorages have been identified in this area.

Shorelines in this area are predominantly rock allowing little opportunity for marine access.

The closest air base is the STOL airport at Upernavik (map 7251, 800 m asphalt runway).

Countermeasures

In situ burning of oil in conjunction with tracking oiled ice is recommended in ice concentrations down to six tenths. In open water conditions in offshore and nearshore areas, containment for recovery or burning is recommended. Dispersant application is cautioned against in the nearshore waters, fjords, and inter-island channels of this map area.

Offshore countermeasures represent the only practical method of protecting most shoreline areas. Two channels are identified, with widths of 500 and 600 m, where exclusion booming could be considered to reduce the extent of inshore contamination. Tidal currents are unknown, as are depths: reconnaissance would be required at the time of a spill.

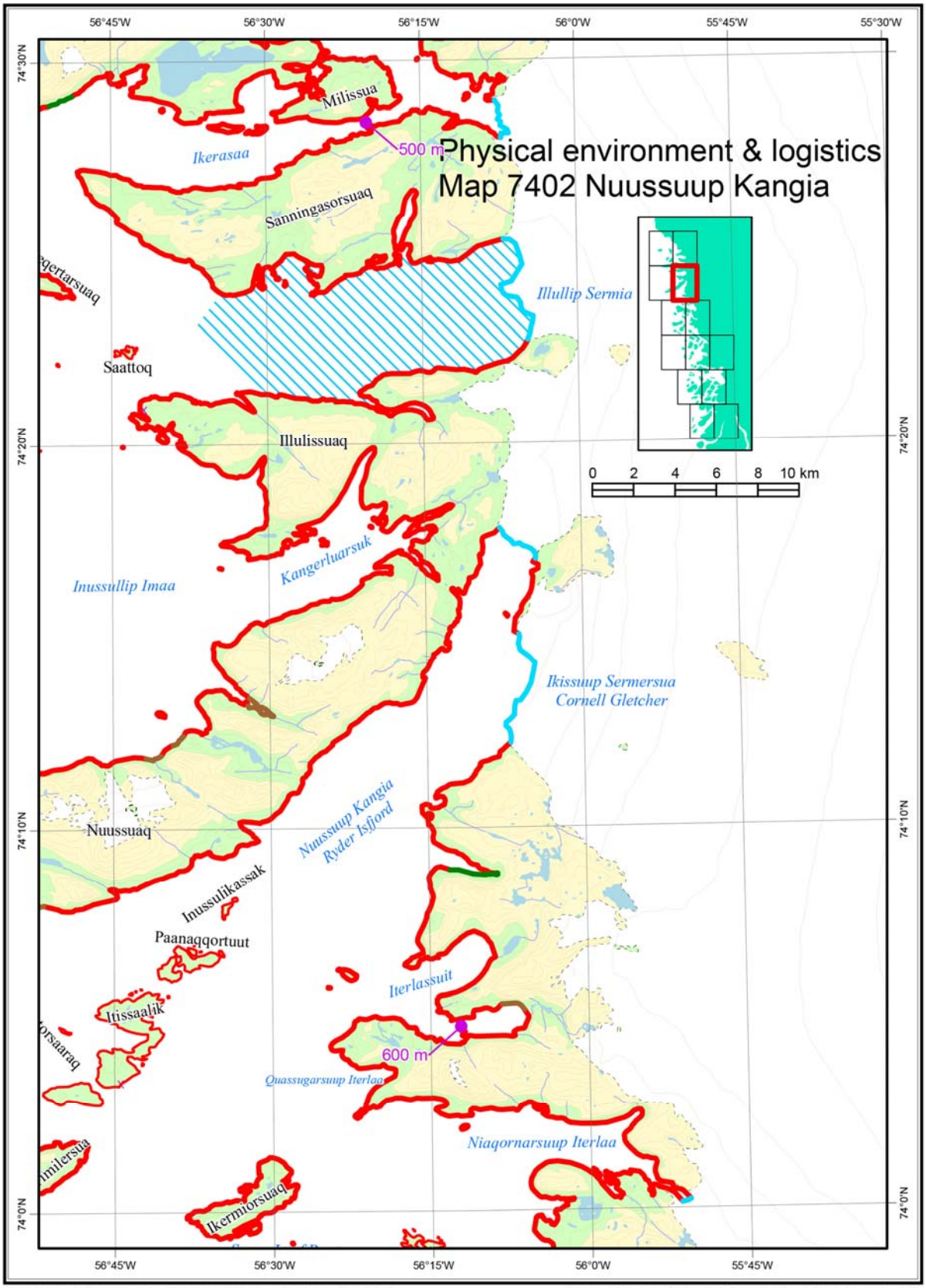
Shorelines shown on this map are rock and glacier, much of which is exposed, which may not require active cleaning efforts unless heavily contaminated with heavy oils. Consideration should be given to flushing operations in more protected waters within the embayments, fjords, and inter-island channels. Access and trafficability of these areas are unknown, but it is probable that any cleanup operations would be marine-based given the nature of the shoreline.

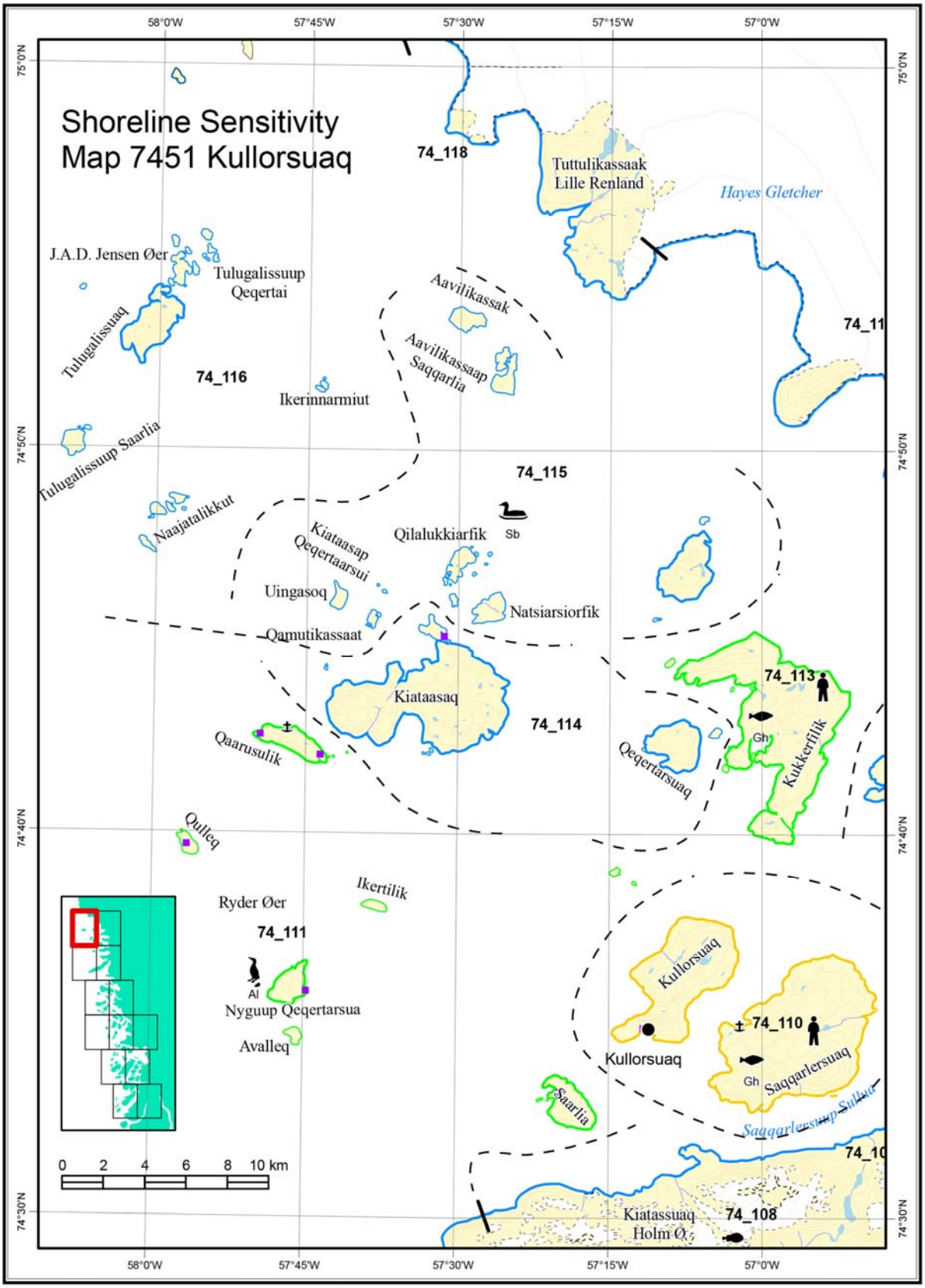
Safe havens

There are no potential safe havens identified on this map. The unmarked bay due east of Tivasunnguit could be considered as a potential safe haven given its moderate sensitivity rating. The bay offers very good shelter and may afford natural containment depending on wind direction and tidal streams, and exclusion booming may be practical. However, depths and navigational hazards are unknown: reconnaissance would be required at the time of a spill.

Maps

Danish Survey & Cadastre (KMS) topographical map: 74 V.1. Nautical charts: 1700.


Physical environment & logistics
Map 7402 Nuussuup Kangia
56°45'W
56°30'W
56°15'W
56°0'W
55°45'W
55°30'W
74°30'N
74°20'N
74°10'N
74°0'N
Milissua
500 m
Ikerasaa
Sanningasorsuaq
Illullip Sermia
Saattoq
Illulissuaq
Kangerluarsuk
Inussullip Imaa
Ikissuup Sermersua
Cornell Gletcher
Nuussuaq
Nuussuup Kangia
Ryder Isfjord
Inussulikassak
Paanaqqortuut
Iterlassuit
Itissaalik
600 m
Quassugarsuup Iterlaa
Niaqornarsuup Iterlaa
Ikermiorsuaq
0 2 4 6 8 10 km
Environmental Oilspill Sensitivity Atlas for the West Greenland zone (72° - 75° N)
Topographic base: G/250 Vector, Copyright Kort & Matrikelstyrelsen 1998
Projection: UTM zone 21N, WGS84



Environmental Oilspill Sensitivity Atlas for the West Greenland zone (72° - 75° N)

Topographic base: G/250 Vector, Copyright Kort & Matrikelstyrelsen 1998
Projection: UTM zone 21N, WGS84

Shoreline sensitivity — Map 7451 - Kullorsuaq

Environmental description

Resource use

R 74_109	Hunting area for the inhabitants of Kullorsuaq.
R 74_110	Fishery for Greenland halibut and capelin. Important hunting area for the inhabitants of Kullorsuaq.
R 74_111	Hunting area for the inhabitants of Kullorsuaq.
R 74_113	Fishery for Greenland halibut. Hunting area for the inhabitants of Kullorsuaq.

Species occurrence

Al74111	4 colonies with breeding black guillemots.
Gh74110, Gh74113	Important area for Greenland halibut.

Site specific species occurrence (seabird breeding colonies); blue icons

Sb74115	Breeding common eiders on islets.

Shoreline sensitivity summary

SEG_ID	Sensitivity	Ranking
74_109	12	Low
74_110	27	High
74_111	18	Moderate
74_113	18	Moderate
74_114	13	Low
74_115	14	Low
74_116	15	Low
74_118	3	Low

Physical environment and logistics — Map 7451 - Kullorsuaq

Access

The nearshore waters in this area are uncharted and caution should be exercised. In general, the waters around the islands in this map area are deep, the channels between many of them are reported to be obstructed by below-water reefs and there are numerous rocks awash. Local knowledge is essential for navigation.

This area is ice-bound in the average year from December to June. Breakup begins with a lead that opens up between the fast ice along the coast and the pack ice in Baffin Bay. The lead widens through the summer months and the coast is generally ice-free by July. First-year ice forms in fjords and sheltered waters, generally starting in early December, however, tidal streams and stormy weather often break up the ice or prevent its formation except at the inner ends of fjords.

Foul ground is reported in the vicinity of the four islands comprising the group, Ryder Øer.

The prevailing West Greenland Current is 0.5 knots, setting to the north and generally parallel to the coast.

There is no information on tides or currents within this area.

Anchorage is identified in a bay on the north side of Qaarusulik, and off Kiataasaq, with no details on depths or holding.

Anchorage with good holding is reported on the northwest side of Saqqarlersuaq in depths of 35 m. The area has not been surveyed.

Shorelines in this area are exclusively rock and glacier allowing little opportunity for marine access.

The closest air base is the STOL airport at Upernavik (map 7251, 800 m asphalt runway).

Countermeasures

In ice concentrations down to six tenths, in situ burning of oil in conjunction with tracking oiled ice is recommended. In open water conditions in offshore and nearshore areas, containment for recovery or burning is recommended. Dispersant application should be considered in offshore areas to remove oil from the water surface, to protect waterfowl and to prevent oil from entering inshore areas. Dispersant-use is cautioned against in inter-island channels and shallow nearshore waters, which may exist within the fjords on this map. The waters appear to be deep, but as they are uncharted, soundings should be taken to confirm their depth prior to using dispersants.

There are no opportunities for nearshore booming along the shoreline described on this map. Offshore countermeasures represent the only practical method of protecting most shoreline areas.

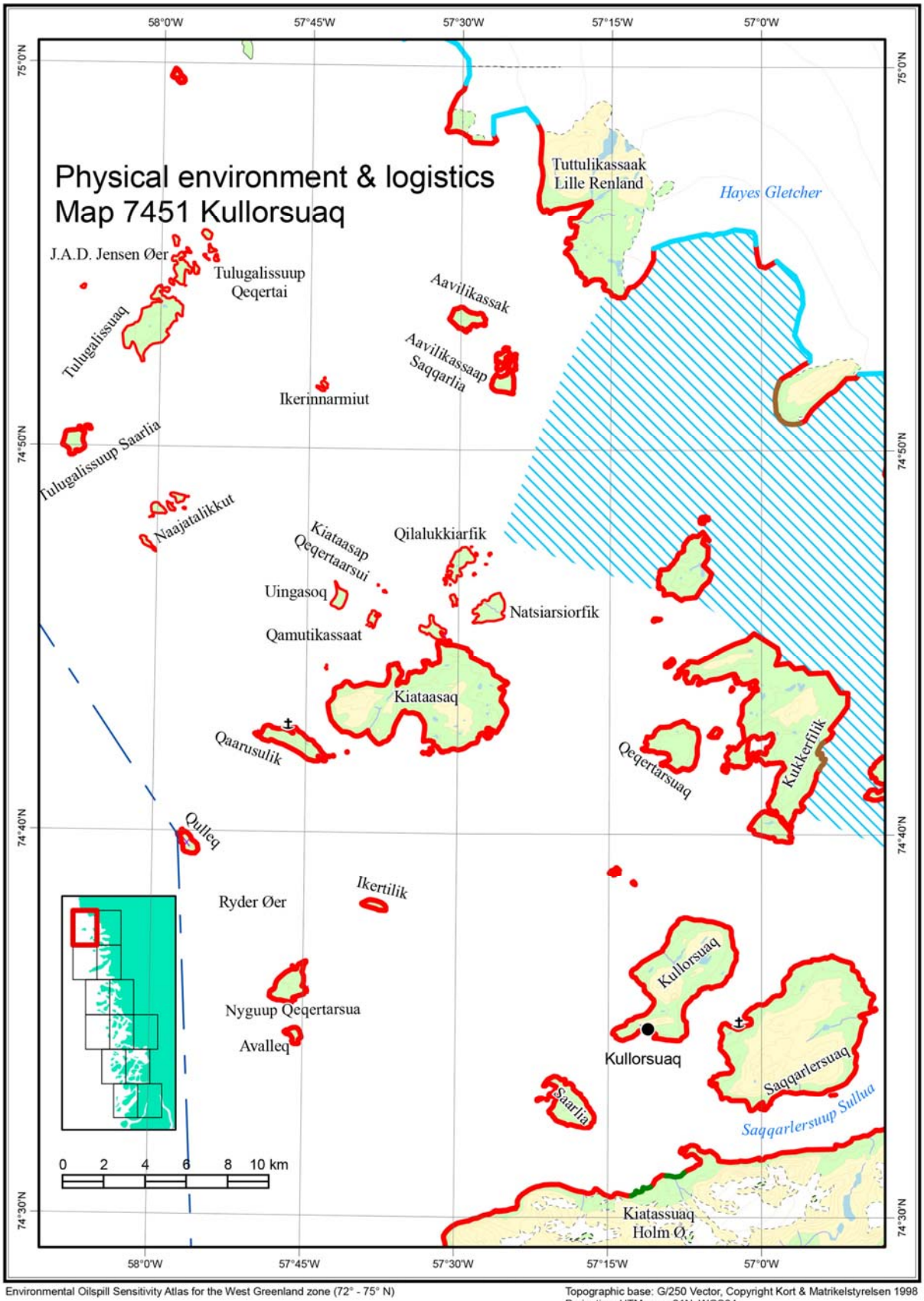
Shorelines shown on this map are predominantly rock and glacier, much of which is exposed, which may not require active cleaning efforts unless heavily contaminated with heavy oils. Consideration should be given to flushing operations in more protected waters within the embayments, fjords, and inter-island channels. Access and trafficability of these areas are unknown, but it is probable that any cleanup operations would be marine-based given the nature of the shoreline.

Safe havens

There are no potential safe havens identified on this map. The anchorage noted on Saqqarlersuaq could be considered as a potential safe haven but the area has a high sensitivity rating. The anchorage offers some shelter but exclusion booming would be impractical.

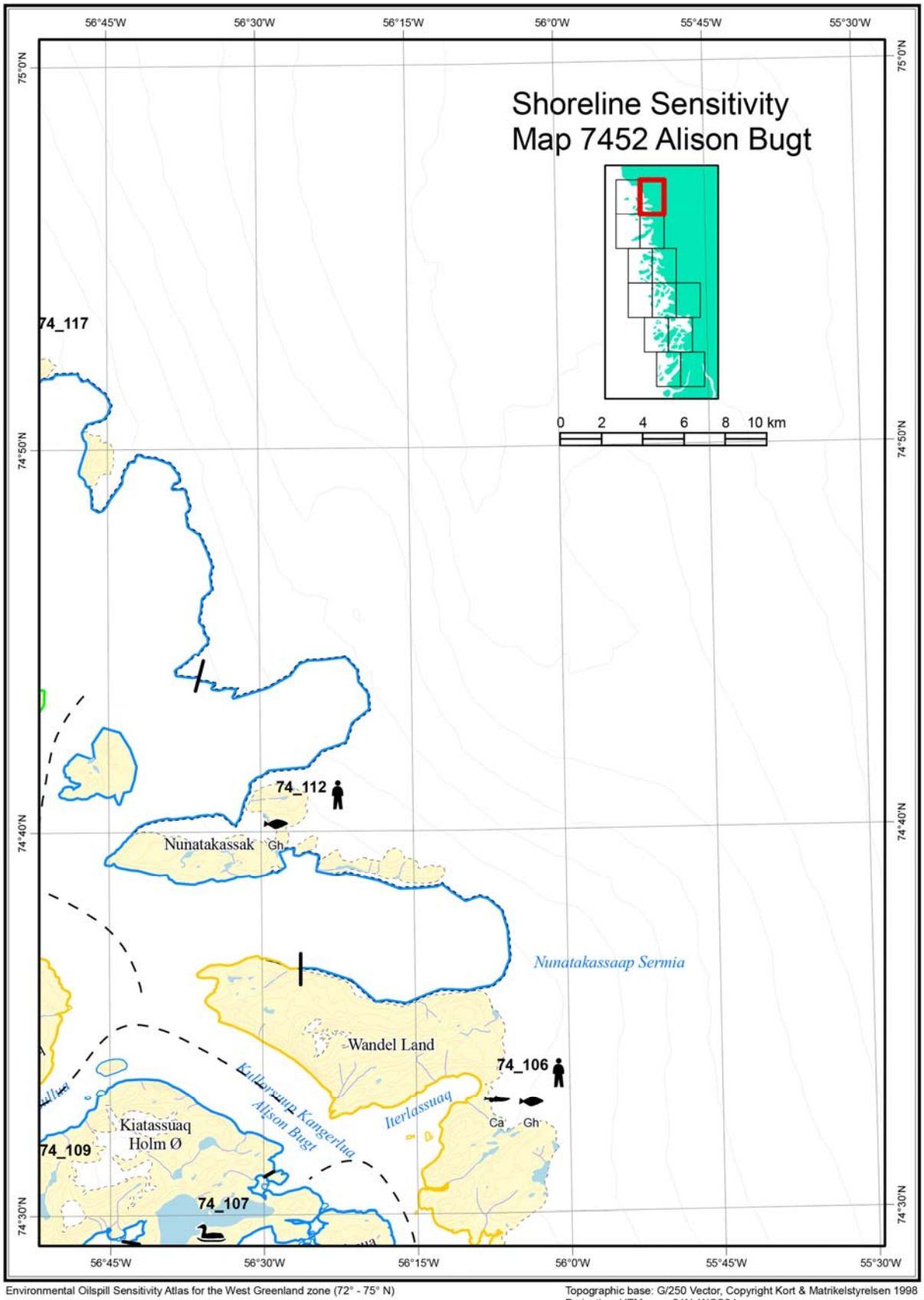
Maps

Danish Survey & Cadastre (KMS) topographical map: 74 V.1. Nautical charts: 1700.



Environmental Oilspill Sensitivity Atlas for the West Greenland zone (72° - 75° N)

Topographic base: G/250 Vector, Copyright Kort & Matrikelstyrelsen 1998
Projection: UTM zone 21N, WGS84



Environmental Oilspill Sensitivity Atlas for the West Greenland zone (72° - 75° N)

Topographic base: G/250 Vector, Copyright Kort & Matrikelstyrelsen 1998
Projection: UTM zone 21N, WGS84

Shoreline sensitivity — Map 7452 - Alison Bugt

Environmental description

Resource use

R 74_106	Fishery for Greenland halibut and capelin.
R 74_109	Hunting area for the inhabitants of Kullorsuaq.
R 74_112	Fishery for Greenland halibut.

Species occurrence

Ca74106	Important spawning area for capelin along Iterlassuaq and south towards Ikerasaa.
Ca74106	Spawning area for capelin.
Gh74106, Gh74112	Important area for Greenland halibut.

Site specific species occurrence (seabird breeding colonies); blue icons

None selected.

Shoreline sensitivity summary

SEG_ID	Sensitivity	Ranking
74_106	23	High
74_112	14	Low
74_117	3	Low

Physical environment and logistics — Map 7452 - Alison Bugt

Access

The nearshore waters in this area are uncharted and caution should be exercised. In general, the waters around the islands in this map area are deep, the channels between many of them are reported to be obstructed by below-water reefs and there are numerous rocks awash. Local knowledge is essential for navigation.

This area is ice-bound in the average year from December to June. Breakup begins with a lead that opens up between the fast ice along the coast and the pack ice in Baffin Bay. The lead widens through the summer months and the coast is generally ice-free by July. First-year ice forms in fjords and sheltered waters, generally starting in early December, however, tidal streams and stormy weather often break up the ice or prevent its formation except at the inner ends of fjords.

There is no information on tides or currents for this area.

No anchorages are reported for this map area.

Shorelines in this area are exclusively rock and glacier allowing little opportunity for marine access.

The closest air base is the STOL airport at Upernavik (map 7251, 800 m asphalt runway).

Countermeasures

In situ burning of oil in conjunction with tracking oiled ice is recommended in ice concentrations down to six tenths. In open water conditions in offshore and nearshore areas, containment for recovery or burning is recommended. Dispersant application is cautioned against in the nearshore waters, fjords, and inter-island channels of this map area.

There are no opportunities for nearshore booming along the shoreline described on this map. Offshore countermeasures represent the only practical method of protecting most shoreline areas.

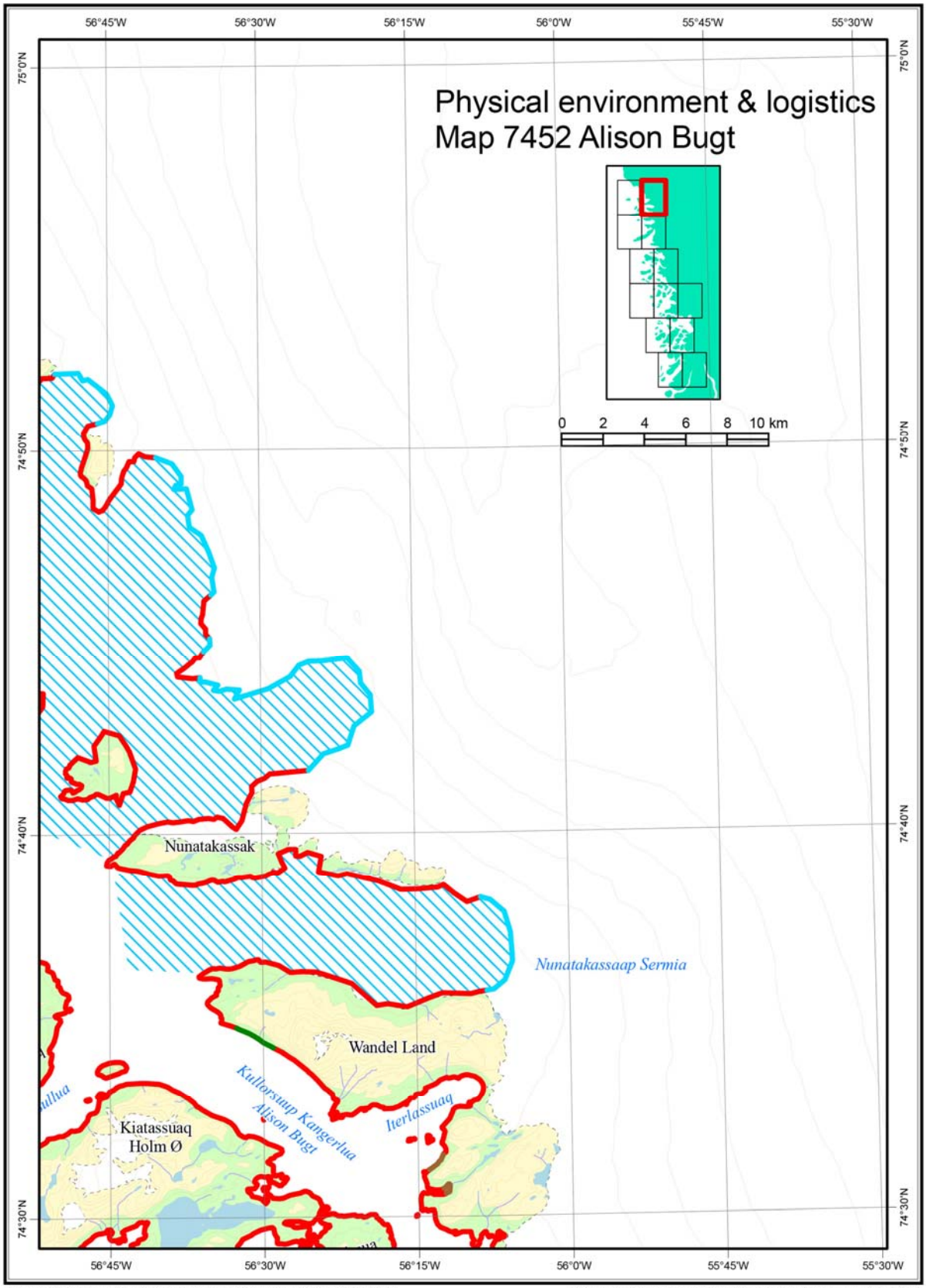
Shorelines shown on this map are exclusively rock and glacier, much of which is exposed, which may not require active cleaning efforts unless heavily contaminated with heavy oils. Consideration should be given to flushing operations in more protected waters within the embayments, fjords, and inter-island channels. Access and trafficability of these areas are unknown, but it is probable that any cleanup operations would be marine-based given the nature of the shoreline.

Safe havens

There are no potential safe havens identified on this map.

Maps

Danish Survey & Cadastre (KMS) topographical map: 74 V.1. Nautical charts: 1700



Environmental Oilspill Sensitivity Atlas for the West Greenland zone (72° - 75° N)

Topographic base: G/250 Vector, Copyright Kort & Matrikelstyrelsen 1998
Projection: UTM zone 21N, WGS84

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11 Appendix A

Shoreline sensitivity ranking

Explanation to calculations used in the table

Assigned value x Weighting factor = Priority index
Sensitivity value = sum of Priority Indices

For biological elements:

(**Relative sensitivity** x **Relative abundance** x **Temporal modifier** x Oil residence index)/ Constant = **Assigned value**

Formula for calculation of the sensitivity value of shoreline areas. Bold abbreviations indicate factors which appear in the column headlines for the Shoreline Sensitivity ranking table. The Oil Residence Value (ORI) is a row heading. For further explanation see Chapter 6.3 and Chapter 12.

Area	Map no.	Element	Relative sensitivity	Relative abundance	Temporal modifier	Assigned value	Priority index	Sensitivity value	Final ranking
72_1	7201	Human Use				5.00	10.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				2.04	4.08		
		Oil Residency Index				2.22	3.33		
		Arctic char	14	5	0.25	0.62	1.09		
		Capelin	21	4	0.25	0.75	1.31		
		Greenland halibut	7	1	1	0.25	0.44		
								20	Moderate
72_2	7201	Human Use				1.00	2.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				1.88	3.77		
		Oil Residency Index				1.75	2.63		
		Alcids	25	4	0.5	1.40	2.45		
		Greenland halibut	7	1	1	0.20	0.34		
		Gulls	17	1	0.5	0.24	0.42		
		Lumpsucker	15	5	0.25	0.53	0.92		
		Seaducks Moulting	23	3	0.25	0.48	0.85		
								15	Low
72_3	7201	Human Use				1.00	2.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				0.60	1.20		
		Oil Residency Index				2.09	3.13		
		Alcids	25	5	0.5	2.09	3.65		
		Greenland halibut	7	1	1	0.23	0.41		
		Gulls	17	5	0.5	1.42	2.48		
		Lumpsucker	15	5	0.25	0.63	1.10		
		Seaducks Breeding	23	1	0.5	0.38	0.67		
		Seaducks Moulting	23	3	0.25	0.58	1.01		
								18	Moderate
72_4	7201	Human Use				3.00	6.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				3.52	7.04		
		Oil Residency Index				2.41	3.61		
		Capelin	21	4	0.25	0.81	1.41		
		Greenland halibut	7	1	1	0.27	0.47		
		Lumpsucker	15	5	0.25	0.72	1.26		
								22	Moderate

Area	Map no.	Element	Relative sensitivity	Relative abundance	Temporal modifier	Assigned value	Priority index	Sensitivity value	Final ranking
72_5	7201	Human Use				1.00	2.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				4.05	6.07		
		Cormorants	19	1	0.5	0.61	1.08		
		Greenland halibut	7	1	1	0.45	0.79		
		Gulls	17	2	0.5	1.10	1.93		
		Lumpsucker	15	5	0.25	1.21	2.12		
		Seaducks Breeding	23	4	0.5	2.98	5.21		
								21	Moderate
72_6	7201	Human Use				1.00	2.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				3.51	7.02		
		Oil Residency Index				2.56	3.83		
		Alcids	25	1	0.5	0.51	0.89		
		Capelin	21	2	0.25	0.43	0.75		
		Lumpsucker	15	3	0.25	0.46	0.80		
								17	Moderate
72_7	7201	Human Use				5.00	10.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				4.30	6.45		
		Arctic char	14	5	0.25	1.20	2.11		
		Capelin	21	5	0.25	1.81	3.16		
		Greenland halibut	7	1	1	0.48	0.84		
		Lumpsucker	15	1	0.25	0.26	0.45		
								25	High
72_8	7201	Human Use				5.00	10.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				4.79	7.18		
		Alcids	25	1	0.5	0.96	1.67		
		Arctic char	14	5	0.25	1.34	2.34		
		Capelin	21	5	0.25	2.01	3.52		
		Cormorants	19	1	0.5	0.73	1.27		
		Greenland halibut	7	1	1	0.54	0.94		
		Gulls	17	3	0.5	1.95	3.42		
								30	Extreme

Area	Map no.	Element	Relative sensitivity	Relative abundance	Temporal modifier	Assigned value	Priority index	Sensitivity value	Final ranking
72_9	7201	Human Use				3.00	6.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.32	0.64		
		Oil Residency Index				4.77	7.16		
		Alcids	25	1	0.5	0.95	1.67		
		Capelin	21	3	0.25	1.20	2.10		
		Cormorants	19	2	0.5	1.45	2.54		
		Greenland halibut	7	1	1	0.53	0.94		
		Gulls	17	1	0.5	0.65	1.14		
		Lumpsucker	15	3	0.25	0.86	1.50		
		Seaducks Breeding	23	1	0.5	0.88	1.54		
								25	High
72_10	7201	Human Use				2.00	4.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				2.22	4.45		
		Oil Residency Index				4.43	6.64		
		Alcids	25	1	0.5	0.89	1.55		
		Capelin	21	4	0.25	1.49	2.60		
		Cormorants	19	1	0.5	0.67	1.18		
		Seaducks Breeding	23	1	0.5	0.81	1.43		
								24	High
72_11	7201	Human Use				2.00	4.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				4.00	8.00		
		Oil Residency Index				3.21	4.82		
		Alcids	25	1	0.5	0.64	1.13		
		Capelin	21	2	0.25	0.54	0.95		
		Greenland halibut	7	1	1	0.36	0.63		
								22	Moderate
72_12	7251	Human Use				1.00	2.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				1.55	3.10		
		Oil Residency Index				2.74	4.10		
		Alcids	25	3	0.5	1.64	2.87		
		Cormorants	19	2	0.5	0.83	1.46		
		Greenland halibut	7	1	1	0.31	0.54		
		Gulls	17	3	0.5	1.12	1.95		
		Lumpsucker	15	5	0.25	0.82	1.44		
		Seaducks Breeding	23	4	0.5	2.01	3.52		
								23	Moderate

Area	Map no.	Element	Relative sensitivity	Relative abundance	Temporal modifier	Assigned value	Priority index	Sensitivity value	Final ranking
72_13	7252	Human Use				5.00	10.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.33	0.65		
		Oil Residency Index				4.08	6.12		
		Arctic char	14	5	0.25	1.14	2.00		
		Capelin	21	3	0.25	1.03	1.80		
		Greenland halibut	7	1	1	0.46	0.80		
		Gulls	17	1	0.5	0.55	0.97		
		Seaducks Moulting	23	5	0.25	1.88	3.28		
								26	High
72_14	7252	Human Use				5.00	10.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				4.89	7.34		
		Arctic char	14	5	0.25	1.37	2.40		
		Capelin	21	2	0.25	0.82	1.44		
		Seaducks Moulting	23	5	0.25	2.25	3.94		
								25	High
72_15	7252	Human Use				4.00	8.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				4.34	6.51		
		Alcids	25	1	0.5	0.87	1.52		
		Arctic char	14	5	0.25	1.22	2.13		
		Capelin	21	4	0.25	1.46	2.55		
		Cormorants	19	2	0.5	1.32	2.31		
		Gulls	17	1	0.5	0.59	1.03		
		Seaducks Moulting	23	5	0.25	2.00	3.49		
								28	High
72_16	7252	Human Use				3.00	6.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				4.49	6.73		
		Arctic char	14	4	0.25	1.01	1.76		
		Capelin	21	3	0.25	1.13	1.98		
		Cormorants	19	1	0.5	0.68	1.19		
		Gulls	17	2	0.5	1.22	2.14		
		Seaducks Moulting	23	5	0.25	2.06	3.61		
								23	High

Area	Map no.	Element	Relative sensitivity	Relative abundance	Temporal modifier	Assigned value	Priority index	Sensitivity value	Final ranking
72_17	7252	Human Use				2.00	4.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				4.10	6.15		
		Alcids	25	1	0.5	0.82	1.44		
		Capelin	21	2	0.25	0.69	1.21		
		Cormorants	19	1	0.5	0.62	1.09		
		Greenland halibut	7	1	1	0.46	0.80		
		Gulls	17	2	0.5	1.12	1.95		
		Seaducks Moulting	23	5	0.25	1.89	3.30		
								20	Moderate
72_18	7251	Human Use				1.00	2.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				2.64	3.96		
		Alcids	25	1	0.5	0.53	0.93		
		Cormorants	19	1	0.5	0.40	0.70		
		Greenland halibut	7	1	1	0.30	0.52		
		Gulls	17	1	0.5	0.36	0.63		
		Lumpsucker	15	5	0.25	0.79	1.39		
		Seaducks Breeding	23	4	0.5	1.95	3.40		
								14	Low
72_19	7251	Human Use				2.00	4.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				4.07	6.10		
		Alcids	25	5	0.5	4.07	7.12		
		Capelin	21	2	0.25	0.68	1.20		
		Cormorants	19	2	0.5	1.24	2.16		
		Greenland halibut	7	1	1	0.46	0.80		
		Gulls	17	2	0.5	1.11	1.94		
		Lumpsucker	15	1	0.25	0.24	0.43		
		Seaducks Breeding	23	2	0.5	1.50	2.62		
		Seaducks Moulting	23	5	0.25	1.87	3.27		
								32	Extreme
72_20	7251	Human Use				2.00	4.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				4.44	6.66		
		Alcids	25	5	0.5	4.44	7.77		
		Capelin	21	1	0.25	0.37	0.65		
		Greenland halibut	7	1	1	0.50	0.87		
		Gulls	17	3	0.5	1.81	3.17		
		Tubenoses Shoreline	18	4	0.5	2.56	4.48		
								28	High

Area	Map no.	Element	Relative sensitivity	Relative abundance	Temporal modifier	Assigned value	Priority index	Sensitivity value	Final ranking
72_21	7252	Human Use				2.00	4.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				4.48	6.73		
		Alcids	25	2	0.5	1.79	3.14		
		Capelin	21	4	0.25	1.51	2.64		
		Cormorants	19	2	0.5	1.36	2.39		
		Gulls	17	2	0.5	1.22	2.13		
		Seaducks Breeding	23	2	0.5	1.65	2.89		
		Seaducks Moulting	23	5	0.25	2.06	3.61	28	High
72_22	7252	Human Use				2.00	4.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				4.70	7.05		
		Alcids	25	2	0.5	1.88	3.29		
		Capelin	21	3	0.25	1.18	2.07		
		Cormorants	19	3	0.5	2.14	3.75		
		Gulls	17	3	0.5	1.92	3.36		
		Seaducks Breeding	23	5	0.5	4.32	7.57		
		Seaducks Moulting	23	5	0.25	2.16	3.78		
								35	Extreme
72_23	7252	Human Use				1.00	2.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				4.27	6.41		
		Alcids	25	3	0.5	2.56	4.48		
		Capelin	21	2	0.25	0.72	1.26		
		Cormorants	19	4	0.5	2.60	4.54		
		Gulls	17	3	0.5	1.74	3.05		
		Seaducks Breeding	23	4	0.5	3.14	5.50		
		Seaducks Moulting	23	5	0.25	1.96	3.44		
								31	Extreme
72_24	7252	Human Use				3.00	6.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				4.46	6.69		
		Alcids	25	1	0.5	0.89	1.56		
		Capelin	21	5	0.25	1.87	3.28		
		Cormorants	19	3	0.5	2.03	3.56		
		Gulls	17	1	0.5	0.61	1.06		
		Seaducks Breeding	23	3	0.5	2.46	4.31		
		Seaducks Moulting	23	5	0.25	2.05	3.59		
								30	Extreme

Area	Map no.	Element	Relative sensitivity	Relative abundance	Temporal modifier	Assigned value	Priority index	Sensitivity value	Final ranking
72_25	7252	Human Use				2.00	4.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				4.67	7.01		
		Alcids	25	1	0.5	0.93	1.63		
		Capelin	21	4	0.25	1.57	2.75		
		Cormorants	19	1	0.5	0.71	1.24		
		Gulls	17	1	0.5	0.64	1.11		
		Seaducks Breeding	23	5	0.5	4.30	7.52		
		Seaducks Moulting	23	5	0.25	2.15	3.76		
								29	High
72_26	7252	Human Use				2.00	4.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				4.75	7.12		
		Capelin	21	2	0.25	0.80	1.40		
		Cormorants	19	3	0.5	2.16	3.79		
		Greenland halibut	7	1	1	0.53	0.93		
		Gulls	17	1	0.5	0.65	1.13		
		Seaducks Breeding	23	2	0.5	1.75	3.06		
		Seaducks Moulting	23	5	0.25	2.18	3.82		
								25	High
72_27	7252	Human Use				4.00	8.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				4.78	7.18		
		Alcids	25	2	0.5	1.91	3.35		
		Capelin	21	3	0.25	1.21	2.11		
		Cormorants	19	3	0.5	2.18	3.82		
		Greenland halibut	7	2	1	1.07	1.88		
		Gulls	17	2	0.5	1.30	2.28		
		Seaducks Breeding	23	5	0.5	4.40	7.70		
		Seaducks Moulting	23	5	0.25	2.20	3.85		
								40	Extreme
72_28	7252	Human Use				2.00	4.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				4.67	7.00		
		Capelin	21	3	0.25	1.18	2.06		
		Seaducks Breeding	23	1	0.5	0.86	1.50		
		Seaducks Moulting	23	5	0.25	2.15	3.76		
								18	Moderate

Area	Map no.	Element	Relative sensitivity	Relative abundance	Temporal modifier	Assigned value	Priority index	Sensitivity value	Final ranking
72_29	7252	Human Use				4.00	8.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				4.33	6.49		
		Capelin	21	1	0.25	0.36	0.64		
		Greenland halibut	7	3	1	1.45	2.54		
		Seaducks Moulting	23	5	0.25	1.99	3.48		
								21	Moderate
72_30	7252	Human Use				4.00	8.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				4.46	6.69		
		Alcids	25	2	0.5	1.78	3.12		
		Capelin	21	3	0.25	1.12	1.97		
		Cormorants	19	3	0.5	2.03	3.56		
		Greenland halibut	7	2	1	1.00	1.75		
		Gulls	17	2	0.5	1.21	2.12		
		Seaducks Breeding	23	5	0.5	4.10	7.18		
		Seaducks Moulting	23	5	0.25	2.05	3.59		
								40	Extreme
72_31	7252	Human Use				5.00	10.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				1.19	2.39		
		Oil Residency Index				4.48	6.72		
		Alcids	25	4	0.5	3.58	6.27		
		Capelin	21	3	0.25	1.13	1.98		
		Cormorants	19	4	0.5	2.72	4.77		
		Greenland halibut	7	3	1	1.50	2.63		
		Gulls	17	4	0.5	2.44	4.26		
								39	Extreme
72_32	7252	Human Use				5.00	10.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				4.32	6.48		
		Alcids	25	1	0.5	0.86	1.51		
		Capelin	21	2	0.25	0.73	1.27		
		Cormorants	19	1	0.5	0.66	1.15		
		Greenland halibut	7	4	1	1.93	3.39		
		Gulls	17	2	0.5	1.17	2.06		
		Seaducks Breeding	23	4	0.5	3.18	5.56		
		Seaducks Moulting	23	3	0.25	1.19	2.09		
								33	Extreme

Area	Map no.	Element	Relative sensitivity	Relative abundance	Temporal modifier	Assigned value	Priority index	Sensitivity value	Final ranking
72_337252		Human Use				0.00	0.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.68	1.37		
		Oil Residency Index				4.32	6.48		
		Alcids	25	1	0.5	0.86	1.51		
		Capelin	21	2	0.25	0.73	1.27		
		Cormorants	19	1	0.5	0.66	1.15		
		Greenland halibut	7	5	1	2.42	4.24		
		Gulls	17	1	0.5	0.59	1.03		
								17	Moderate
72_347252		Human Use				5.00	10.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				3.22	6.43		
		Oil Residency Index				4.34	6.51		
		Alcids	25	3	0.5	2.60	4.56		
		Capelin	21	3	0.25	1.09	1.91		
		Cormorants	19	1	0.5	0.66	1.15		
		Greenland halibut	7	3	1	1.46	2.55		
		Gulls	17	1	0.5	0.59	1.03		
		Seaducks Breeding	23	4	0.5	3.19	5.59		
								42	Extreme
72_357251		Human Use				1.00	2.00		
		Archaeological Sites				3.00	6.00		
		Special Status Areas				5.00	7.50		
		Communities				0.91	1.81		
		Oil Residency Index				2.28	3.41		
		Alcids	25	5	0.5	2.28	3.98		
		Cormorants	19	4	0.5	1.38	2.42		
		Greenland halibut	7	1	1	0.25	0.45		
		Gulls	17	1	0.5	0.31	0.54		
		Lumpsucker	15	2	0.25	0.27	0.48		
		Seaducks Breeding	23	1	0.5	0.42	0.73		
								29	High
72_367251		Human Use				2.00	4.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				1.29	2.57		
		Oil Residency Index				4.13	6.19		
		Alcids	25	5	0.5	4.13	7.22		
		Cormorants	19	3	0.5	1.88	3.29		
		Greenland halibut	7	2	1	0.92	1.62		
		Gulls	17	4	0.5	2.25	3.93		
		Seaducks Breeding	23	1	0.5	0.76	1.33		
								30	Extreme

Area	Map no.	Element	Relative sensitivity	Relative abundance	Temporal modifier	Assigned value	Priority index	Sensitivity value	Final ranking
72_37	7251	Human Use				2.00	4.00		
		Archaeological Sites				3.00	6.00		
		Special Status Areas				0.00	0.00		
		Communities				3.54	7.08		
		Oil Residency Index				3.19	4.79		
		Alcids	25	5	0.5	3.19	5.59		
		Cormorants	19	1	0.5	0.49	0.85		
		Greenland halibut	7	2	1	0.72	1.25		
		Gulls	17	4	0.5	1.74	3.04		
		Seaducks Breeding	23	1	0.5	0.59	1.03		
								34	Extreme
72_38	7251	Human Use				5.00	10.00		
		Archaeological Sites				3.00	6.00		
		Special Status Areas				0.00	0.00		
		Communities				4.00	8.00		
		Oil Residency Index				3.48	5.21		
		Greenland halibut	7	4	1	1.56	2.73		
								32	Extreme
72_39	7251	Human Use				4.00	8.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				4.61	9.23		
		Oil Residency Index				4.13	6.20		
		Alcids	25	1	0.5	0.83	1.45		
		Greenland halibut	7	4	1	1.85	3.24		
		Gulls	17	2	0.5	1.12	1.97		
								30	Extreme
72_40	7251	Human Use				4.00	8.00		
		Archaeological Sites				3.00	6.00		
		Special Status Areas				0.00	0.00		
		Communities				3.03	6.07		
		Oil Residency Index				4.22	6.33		
		Alcids	25	2	0.5	1.69	2.95		
		Cormorants	19	4	0.5	2.57	4.49		
		Greenland halibut	7	4	1	1.89	3.31		
		Gulls	17	1	0.5	0.57	1.00		
		Seaducks Breeding	23	3	0.5	2.33	4.08		
								42	Extreme
72_41	7251	Human Use				3.00	6.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				3.99	7.99		
		Oil Residency Index				3.32	4.98		
		Alcids	25	1	0.5	0.66	1.16		
		Greenland halibut	7	3	1	1.12	1.95		
		Gulls	17	2	0.5	0.90	1.58		
		Seaducks Breeding	23	3	0.5	1.83	3.21		
								29	High

Area	Map no.	Element	Relative sensitivity	Relative abundance	Temporal modifier	Assigned value	Priority index	Sensitivity value	Final ranking
73_427251		Human Use				1.00	2.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				5.00	7.50		
		Communities				0.41	0.83		
		Oil Residency Index				2.29	3.43		
		Alcids	25	5	0.5	2.29	4.00		
		Cormorants	19	3	0.5	1.04	1.83		
		Greenland halibut	7	1	1	0.26	0.45		
		Gulls	17	3	0.5	0.93	1.63		
		Seaducks Breeding	23	5	0.5	2.10	3.68		
								25	High
72_437251		Human Use				2.00	4.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				0.24	0.47		
		Oil Residency Index				3.00	4.49		
		Alcids	25	2	0.5	1.20	2.10		
		Cormorants	19	3	0.5	1.37	2.39		
		Greenland halibut	7	2	1	0.67	1.17		
		Gulls	17	1	0.5	0.41	0.71		
		Seaducks Breeding	23	4	0.5	2.20	3.86		
								21	Moderate
72_447251		Human Use				2.00	4.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				0.64	1.28		
		Oil Residency Index				3.56	5.34		
		Greenland halibut	7	2	1	0.80	1.39		
		Seaducks Breeding	23	3	0.5	1.96	3.44		
								17	Moderate
72_457251		Human Use				2.00	4.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				2.90	5.79		
		Oil Residency Index				4.07	6.11		
		Greenland halibut	7	2	1	0.91	1.60		
								18	Moderate
72_467251		Human Use				5.00	10.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				4.50	8.99		
		Oil Residency Index				3.74	5.61		
		Alcids	25	1	0.5	0.75	1.31		
		Greenland halibut	7	5	1	2.09	3.66		
		Gulls	17	2	0.5	1.02	1.78		
		Seaducks Breeding	23	1	0.5	0.69	1.20		
								35	Extreme

Area	Map no.	Element	Relative sensitivity	Relative abundance	Temporal modifier	Assigned value	Priority index	Sensitivity value	Final ranking
72_47	7251	Human Use				5.00	10.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				4.00	8.00		
		Oil Residency Index				4.34	6.51		
		Capelin	21	1	0.25	0.36	0.64		
		Greenland halibut	7	4	1	1.94	3.40		
								31	Extreme
72_48	7252	Human Use				3.00	6.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				3.12	4.67		
		Greenland halibut	7	3	1	1.05	1.83		
		Seaducks Breeding	23	2	0.5	1.15	2.01		
								15	Low
73_49	7252	Human Use				4.00	8.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				3.23	4.85		
		Capelin	21	2	0.25	0.54	0.95		
		Greenland halibut	7	3	1	1.09	1.90		
		Gulls	17	1	0.5	0.44	0.77		
		Seaducks Breeding	23	5	0.5	2.97	5.20		
								22	Moderate
72_50	7252	Human Use				5.00	10.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				3.83	5.74		
		Capelin	21	2	0.25	0.64	1.12		
		Greenland halibut	7	4	1	1.71	3.00		
		Gulls	17	2	0.5	1.04	1.82		
		Seaducks Breeding	23	5	0.5	3.52	6.16		
								28	High
72_51	7303	Human Use				4.00	8.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				4.17	6.26		
		Alcids	25	1	0.5	0.83	1.46		
		Capelin	21	2	0.25	0.70	1.23		
		Cormorants	19	1	0.5	0.63	1.11		
		Greenland halibut	7	3	1	1.40	2.45		
		Gulls	17	3	0.5	1.70	2.98		
		Seaducks Breeding	23	4	0.5	3.07	5.38		
								29	High

Area	Map no.	Element	Relative sensitivity	Relative abundance	Temporal modifier	Assigned value	Priority index	Sensitivity value	Final ranking
72_52	7252	Human Use				5.00	10.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.12	0.25		
		Oil Residency Index				4.30	6.45		
		Capelin	21	2	0.25	0.72	1.26		
		Greenland halibut	7	4	1	1.93	3.37		
		Gulls	17	1	0.5	0.58	1.02		
		Seaducks Breeding	23	1	0.5	0.79	1.38		
								24	High
72_53	7252	Human Use				3.00	6.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				1.25	2.50		
		Oil Residency Index				4.46	6.69		
		Alcids	25	1	0.5	0.89	1.56		
		Greenland halibut	7	3	1	1.50	2.62		
		Gulls	17	1	0.5	0.61	1.06		
								20	Moderate
72_54	7251	Human Use				5.00	10.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				2.25	4.51		
		Oil Residency Index				3.92	5.88		
		Alcids	25	1	0.5	0.78	1.37		
		Greenland halibut	7	5	1	2.19	3.84		
		Seaducks Breeding	23	3	0.5	2.16	3.79		
								31	Extreme
73_55	7302	Human Use				5.00	10.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				2.32	4.64		
		Oil Residency Index				3.63	5.44		
		Greenland halibut	7	5	1	2.03	3.55		
								24	High
73_56	7302	Human Use				3.00	6.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				0.29	0.57		
		Oil Residency Index				4.30	6.44		
		Alcids	25	1	0.5	0.86	1.50		
		Capelin	21	5	0.25	1.80	3.16		
		Gulls	17	1	0.5	0.58	1.02		
		Seaducks Breeding	23	1	0.5	0.79	1.38		
								22	Moderate

Area	Map no.	Element	Relative sensitivity	Relative abundance	Temporal modifier	Assigned value	Priority index	Sensitivity value	Final ranking
73_57	7302	Human Use				2.00	4.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				1.97	3.94		
		Oil Residency Index				3.99	5.99		
		Alcids	25	1	0.5	0.80	1.40		
		Greenland halibut	7	2	1	0.89	1.57		
								19	Moderate
73_58	7302	Human Use				4.00	8.00		
		Archaeological Sites	1.00	2.00					
		Special Status Areas	0.00	0.00					
		Communities	4.67	9.34					
		Oil Residency Index	3.91	5.86					
		Greenland halibut	7	4	1	1.75	3.06		
								28	High
73_59	7301	Human Use				2.00	4.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.13	0.26		
		Oil Residency Index				2.00	3.00		
		Alcids	25	4	0.5	1.60	2.80		
		Greenland halibut	7	2	1	0.45	0.78		
		Gulls	17	5	0.5	1.36	2.38		
		Lumpsucker	15	2	0.25	0.24	0.42		
		Seaducks Breeding	23	5	0.5	1.84	3.22		
								17	Moderate
73_60	7302	Human Use				5.00	10.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				6.05	12.11		
		Oil Residency Index				2.78	4.18		
		Alcids	25	2	0.5	1.11	1.95		
		Greenland halibut	7	5	1	1.56	2.73		
		Seaducks Breeding	23	3	0.5	1.54	2.69		
								36	Extreme
73_61	7302	Human Use				5.00	10.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				8.00	16.00		
		Oil Residency Index				4.30	6.44		
		Capelin	21	2	0.25	0.72	1.26		
		Greenland halibut	7	4	1	1.92	3.37		
		Lumpsucker	15	2	0.25	0.52	0.90		
								40	Extreme

Area	Map no.	Element	Relative sensitivity	Relative abundance	Temporal modifier	Assigned value	Priority index	Sensitivity value	Final ranking
73_62	7301	Human Use				4.00	8.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				4.25	8.49		
		Oil Residency Index				2.84	4.27		
		Alcids	25	1	0.5	0.57	1.00		
		Cormorants	19	1	0.5	0.43	0.76		
		Greenland halibut	7	4	1	1.27	2.23		
		Gulls	17	1	0.5	0.39	0.68		
		Lumpsucker	15	1	0.25	0.17	0.30		
		Seaducks Breeding	23	1	0.5	0.52	0.92		
								29	High
73_63	7302	Human Use				5.00	10.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				7.71	15.41		
		Oil Residency Index				3.94	5.91		
		Greenland halibut	7	5	1	2.21	3.86		
		Gulls	17	1	0.5	0.54	0.94		
		Seaducks Breeding	23	2	0.5	1.45	2.54		
								39	Extreme
73_64	7302	Human Use				2.00	4.00		
		Archaeological Sites	1.00	2.00					
		Special Status Areas	0.00	0.00					
		Communities	3.54	7.09					
		Oil Residency Index	4.06	6.08					
		Greenland halibut	7	2	1	0.91	1.59		
		Seaducks Breeding	23	4	0.5	2.98	5.22		
								26	High
73_65	7302	Human Use				2.00	4.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				3.77	5.65		
		Arctic char	14	5	0.25	1.05	1.84		
		Greenland halibut	7	2	1	0.84	1.48		
		Gulls	17	1	0.5	0.51	0.90		
								14	Low
73_66	7302	Human Use				2.00	4.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				2.69	5.37		
		Oil Residency Index				3.89	5.83		
		Alcids	25	2	0.5	1.56	2.72		
		Greenland halibut	7	2	1	0.87	1.52		
		Gulls	17	2	0.5	1.06	1.85		
								21	Moderate

Area	Map no.	Element	Relative sensitivity	Relative abundance	Temporal modifier	Assigned value	Priority index	Sensitivity value	Final ranking
73_67	7301	Human Use				0.00	0.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				2.86	5.73		
		Oil Residency Index				2.22	3.33		
		Alcids	25	5	0.5	2.22	3.89		
		Cormorants	19	1	0.5	0.34	0.59		
		Greenland halibut	7	5	1	1.24	2.18		
		Gulls	17	4	0.5	1.21	2.11		
		Seaducks Breeding	23	4	0.5	1.63	2.86		
								23	Moderate
73_68	7302	Human Use				5.00	10.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				5.62	11.23		
		Oil Residency Index				3.79	5.69		
		Alcids	25	2	0.5	1.52	2.66		
		Greenland halibut	7	5	1	2.13	3.72		
		Gulls	17	3	0.5	1.55	2.71		
								38	Extreme
73_69	7302	Human Use				4.00	8.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				4.04	8.09		
		Oil Residency Index				4.13	6.19		
		Greenland halibut	7	4	1	1.85	3.24		
		Lumpsucker	15	1	0.25	0.25	0.43		
		Seaducks Breeding	23	1	0.5	0.76	1.33		
								29	High
73_70	7302	Human Use				0.00	0.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				3.98	5.97		
		Gulls	17	3	0.5	1.62	2.84		
		Seaducks Breeding	23	2	0.5	1.46	2.56		
								11	Low
73_71	7302	Human Use				1.00	2.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				4.36	6.54		
		Capelin	21	1	0.25	0.37	0.64		
								9	Low

Area	Map no.	Element	Relative sensitivity	Relative abundance	Temporal modifier	Assigned value	Priority index	Sensitivity value	Final ranking
73_72	7302	Human Use				5.00	10.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				3.42	5.13		
		Arctic char	14	5	0.25	0.96	1.68		
		Greenland halibut	7	5	1	1.92	3.35		
								20	Moderate
73_73	7302	Human Use				1.00	2.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.83	1.66		
		Oil Residency Index				4.73	7.09		
		Capelin	21	2	0.25	0.79	1.39		
		Gulls	17	1	0.5	0.64	1.13		
		Seaducks Breeding	23	1	0.5	0.87	1.52		
								15	Low
73_74	7302	Human Use				4.00	8.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.23	0.46		
		Oil Residency Index				4.13	6.20		
		Greenland halibut	7	4	1	1.85	3.24		
								18	Moderate
73_75	7302	Human Use				4.00	8.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				2.53	5.06		
		Oil Residency Index				4.06	6.08		
		Alcids	25	1	0.5	0.81	1.42		
		Greenland halibut	7	4	1	1.82	3.18		
								26	High
73_76	7301	Human Use				5.00	10.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				5.00	7.50		
		Communities				4.64	9.27		
		Oil Residency Index				2.44	3.67		
		Alcids	25	5	0.5	2.44	4.28		
		Cormorants	19	3	0.5	1.11	1.95		
		Greenland halibut	7	4	1	1.10	1.92		
		Gulls	17	3	0.5	1.00	1.75		
		Seaducks Breeding	23	1	0.5	0.45	0.79		
								43	Extreme

Area	Map no.	Element	Relative sensitivity	Relative abundance	Temporal modifier	Assigned value	Priority index	Sensitivity value	Final ranking
73_77	7352	Human Use				5.00	10.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				0.65	1.31		
		Oil Residency Index				3.85	5.77		
		Capelin	21	1	0.25	0.32	0.57		
		Greenland halibut	7	5	1	2.15	3.77		
								23	High
73_78	7351	Human Use				5.00	10.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				3.73	7.46		
		Oil Residency Index				2.98	4.47		
		Alcids	25	2	0.5	1.19	2.09		
		Greenland halibut	7	5	1	1.67	2.92		
		Gulls	17	4	0.5	1.62	2.84		
		Seaducks Breeding	23	1	0.5	0.55	0.96		
								33	Extreme
73_79	7351	Human Use				2.00	4.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				2.83	5.66		
		Oil Residency Index				2.92	4.38		
		Alcids	25	3	0.5	1.75	3.07		
		Cormorants	19	2	0.5	0.89	1.55		
		Greenland halibut	7	2	1	0.65	1.14		
		Gulls	17	2	0.5	0.79	1.39		
		Seaducks Breeding	23	4	0.5	2.15	3.76		
								27	High
73_80	7351	Human Use				5.00	10.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				3.39	6.78		
		Oil Residency Index				3.84	5.77		
		Alcids	25	1	0.5	0.77	1.35		
		Cormorants	19	1	0.5	0.58	1.02		
		Greenland halibut	7	5	1	2.15	3.77		
		Gulls	17	4	0.5	2.09	3.66		
								32	Extreme

Area	Map no.	Element	Relative sensitivity	Relative abundance	Temporal modifier	Assigned value	Priority index	Sensitivity value	Final ranking
73_81	7351	Human Use				5.00	10.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				1.58	3.17		
		Oil Residency Index				4.26	6.39		
		Cormorants	19	2	0.5	1.30	2.27		
		Greenland halibut	7	5	1	2.39	4.18		
		Gulls	17	1	0.5	0.58	1.01		
								29	High
73_82	7351	Human Use				2.00	4.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.33	0.65		
		Oil Residency Index				2.04	3.06		
		Alcids	25	5	0.5	2.04	3.57		
		Greenland halibut	7	2	1	0.46	0.80		
		Gulls	17	1	0.5	0.28	0.49		
		Seaducks Breeding	23	1	0.5	0.38	0.66		
								13	Low
73_83	7351	Human Use				1.00	2.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				5.00	7.50		
		Communities				0.67	1.35		
		Oil Residency Index				3.59	5.38		
		Alcids	25	5	0.5	3.59	6.28		
		Cormorants	19	3	0.5	1.64	2.86		
		Greenland halibut	7	1	1	0.40	0.70		
		Gulls	17	5	0.5	2.44	4.27		
		Seaducks Breeding	23	4	0.5	2.64	4.62		
								37	Extreme
73_84	7352	Human Use				0.00	0.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index	3.80	5.71					
		Alcids	25	1	0.5	0.76	1.33		
		Capelin	21	1	0.25	0.32	0.56		
		Greenland halibut	7	5	1	2.13	3.73		
		Gulls	17	1	0.5	0.52	0.91		
		Seaducks Moulting	23	3	0.25	1.05	1.84		
								14	Low

Area	Map no.	Element	Relative sensitivity	Relative abundance	Temporal modifier	Assigned value	Priority index	Sensitivity value	Final ranking
73_85	7352	Human Use				5.00	10.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				4.48	6.72		
		Alcids	25	1	0.5	0.90	1.57		
		Arctic char	14	5	0.25	1.25	2.20		
		Greenland halibut	7	2	1	1.00	1.76		
		Gulls	17	1	0.5	0.61	1.07		
		Seaducks Breeding	23	3	0.5	2.47	4.33		
		Seaducks Moulting	23	5	0.25	2.06	3.61		
								31	Extreme
73_86	7352	Human Use				3.00	6.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				4.50	6.76		
		Arctic char	14	5	0.25	1.26	2.21		
		Capelin	21	1	0.25	0.38	0.66		
		Cormorants	19	1	0.5	0.68	1.20		
		Greenland halibut	7	2	1	1.01	1.77		
		Gulls	17	1	0.5	0.61	1.07		
		Seaducks Moulting	23	5	0.25	2.07	3.63		
								23	High
73_87	7351	Human Use				1.00	2.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				3.69	5.54		
		Alcids	25	1	0.5	0.74	1.29		
		Greenland halibut	7	1	1	0.41	0.72		
		Gulls	17	2	0.5	1.00	1.76		
		Seaducks Moulting	23	3	0.25	1.02	1.78		
								15	Low
73_88	7352	Human Use				2.00	4.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				4.33	6.49		
		Cormorants	19	2	0.5	1.32	2.30		
		Greenland halibut	7	2	1	0.97	1.70		
		Gulls	17	2	0.5	1.18	2.06		
		Seaducks Breeding	23	2	0.5	1.59	2.79		
		Seaducks Moulting	23	5	0.25	1.99	3.48		
								23	Moderate

Area	Map no.	Element	Relative sensitivity	Relative abundance	Temporal modifier	Assigned value	Priority index	Sensitivity value	Final ranking
73_89	7351	Human Use				1.00	2.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				5.00	7.50		
		Communities				0.00	0.00		
		Oil Residency Index				1.90	2.85		
		Alcids	25	5	0.5	1.90	3.32		
		Greenland halibut	7	1	1	0.21	0.37		
		Gulls	17	3	0.5	0.77	1.36		
		Seaducks Breeding	23	1	0.5	0.35	0.61		
								18	Moderate
73_90	7351	Human Use				1.00	2.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				2.77	4.15		
		Greenland halibut	7	1	1	0.31	0.54		
		Gulls	17	1	0.5	0.38	0.66		
								9	Low
73_91	7351	Human Use				3.00	6.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				3.26	4.88		
		Alcids	25	1	0.5	0.65	1.14		
		Greenland halibut	7	3	1	1.09	1.91		
		Seaducks Breeding	23	2	0.5	1.20	2.10		
								18	Moderate
73_92	7352	Human Use				4.00	8.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				3.34	5.02		
		Greenland halibut	7	4	1	1.50	2.62		
								16	Low
73_93	7352	Human Use				5.00	10.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				3.78	5.66		
		Capelin	21	1	0.25	0.32	0.56		
		Greenland halibut	7	4	1	1.69	2.96		
		Gulls	17	1	0.5	0.51	0.90		
								20	Moderate

Area	Map no.	Element	Relative sensitivity	Relative abundance	Temporal modifier	Assigned value	Priority index	Sensitivity value	Final ranking
74_94	7402	Human Use				0.00	0.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				4.11	6.17		
		Capelin	21	3	0.25	1.04	1.81		
		Greenland halibut	7	4	1	1.84	3.23		
		Seaducks Breeding	23	2	0.5	1.51	2.65		
								14	Low
74_95	7401	Human Use				3.00	6.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				0.59	1.17		
		Oil Residency Index				2.49	3.73		
		Alcids	25	5	0.5	2.49	4.36		
		Cormorants	19	2	0.5	0.76	1.32		
		Greenland halibut	7	3	1	0.84	1.46		
		Gulls	17	2	0.5	0.68	1.19		
		Seaducks Breeding	23	5	0.5	2.29	4.01		
								25	High
74_96	7402	Human Use				3.00	6.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				2.30	4.59		
		Oil Residency Index				3.49	5.24		
		Greenland halibut	7	3	1	1.17	2.05		
		Seaducks Breeding	23	4	0.5	2.57	4.50		
								24	High
74_97	7402	Human Use				5.00	10.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				3.77	5.66		
		Capelin	21	5	0.25	1.58	2.77		
		Greenland halibut	7	2	1	0.85	1.48		
								20	Moderate
74_98	7402	Human Use				4.00	8.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				3.29	4.93		
		Capelin	21	3	0.25	0.83	1.45		
		Greenland halibut	7	2	1	0.74	1.29		
								16	Low

Area	Map no.	Element	Relative sensitivity	Relative abundance	Temporal modifier	Assigned value	Priority index	Sensitivity value	Final ranking
74_99	7402	Human Use				2.00	4.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				1.60	3.20		
		Oil Residency Index				3.29	4.93		
		Greenland halibut	7	2	1	0.74	1.29		
								15	Low
74_100	7401	Human Use				3.00	6.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				4.00	8.00		
		Oil Residency Index				2.06	3.08		
		Alcids	25	3	0.5	1.23	2.16		
		Greenland halibut	7	2	1	0.46	0.81		
		Gulls	17	1	0.5	0.28	0.49		
		Lumpsucker	15	2	0.25	0.25	0.43		
		Seaducks Breeding	23	1	0.5	0.38	0.66		
		Seaducks Moulting	23	3	0.25	0.57	0.99		
								25	High
74_101	7402	Human Use				1.00	2.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.43	0.85		
		Oil Residency Index	2.71	4.06					
		Alcids	25	1	0.5	0.54	0.95		
		Greenland halibut	7	1	1	0.30	0.53		
		Gulls	17	1	0.5	0.37	0.64		
		Lumpsucker	15	5	0.25	0.81	1.42		
		Seaducks Breeding	23	2	0.5	1.00	1.74		
		Seaducks Moulting	23	4	0.25	1.00	1.74		
								14	Low
74_102	7402	Human Use				1.00	2.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				3.35	5.03		
		Alcids	25	1	0.5	0.67	1.17		
		Greenland halibut	7	1	1	0.38	0.66		
		Gulls	17	1	0.5	0.46	0.80		
		Lumpsucker	15	5	0.25	1.01	1.76		
		Seaducks Moulting	23	3	0.25	0.93	1.62		
								15	Low

Area	Map no.	Element	Relative sensitivity	Relative abundance	Temporal modifier	Assigned value	Priority index	Sensitivity value	Final ranking
74_103	7402	Human Use				0.00	0.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				3.55	5.33		
		Lumpsucker	15	5	0.25	1.07	1.86		
								7	Low
74_104	7401	Human Use				1.00	2.00		
		Archaeological Sites	1.00	2.00					
		Special Status Areas	0.00	0.00					
		Communities	0.00	0.00					
		Oil Residency Index	2.29	3.43					
		Alcids	25	1	0.5	0.46	0.80		
		Greenland halibut	7	1	1	0.26	0.45		
		Gulls	17	4	0.5	1.24	2.18		
		Seaducks Breeding	23	3	0.5	1.26	2.21		
								13	Low
74_105	7402	Human Use				1.00	2.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				3.67	5.51		
		Capelin	21	2	0.25	0.62	1.08		
		Lumpsucker	15	3	0.25	0.66	1.16		
								10	Low
74_106	7452	Human Use				5.00	10.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				4.11	6.16		
		Capelin	21	3	0.25	1.03	1.81		
		Greenland halibut	7	3	1	1.38	2.41		
		Gulls	17	1	0.5	0.56	0.98		
								23	High
74_107	7402	Human Use				1.00	2.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				4.56	6.83		
		Capelin	21	2	0.25	0.77	1.34		
		Lumpsucker	15	1	0.25	0.27	0.48		
		Seaducks Breeding	23	3	0.5	2.52	4.40		
								15	Low

Area	Map no.	Element	Relative sensitivity	Relative abundance	Temporal modifier	Assigned value	Priority index	Sensitivity value	Final ranking
74_108	7401	Human Use				1.00	2.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				1.63	3.27		
		Oil Residency Index				2.96	4.43		
		Alcids	25	1	0.5	0.59	1.03		
		Greenland halibut	7	1	1	0.33	0.58		
		Lumpsucker	15	3	0.25	0.53	0.93		
								14	Low
74_109	7451	Human Use				1.00	2.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				2.30	4.60		
		Oil Residency Index				3.19	4.78		
		Greenland halibut	7	1	1	0.36	0.63		
								12	Low
74_110	7451	Human Use				5.00	10.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				3.69	7.38		
		Oil Residency Index				3.47	5.21		
		Greenland halibut	7	4	1	1.56	2.72		
								27	High
74_111	7451	Human Use				2.00	4.00		
		Archaeological Sites				3.00	6.00		
		Special Status Areas				0.00	0.00		
		Communities				1.46	2.91		
		Oil Residency Index				1.58	2.37		
		Alcids	25	3	0.5	0.95	1.66		
		Greenland halibut	7	2	1	0.35	0.62		
								18	Moderate
74_112	7452	Human Use				4.00	8.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				2.76	4.14		
		Greenland halibut	7	4	1	1.24	2.16		
								14	Low
74_113	7451	Human Use				4.00	8.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.88	1.76		
		Oil Residency Index				3.33	5.00		
		Greenland halibut	7	4	1	1.49	2.61		
		Gulls	17	1	0.5	0.45	0.79		
								18	Moderate

Area	Map no.	Element	Relative sensitivity	Relative abundance	Temporal modifier	Assigned value	Priority index	Sensitivity value	Final ranking
74_114	7451	Human Use				2.00	4.00		
		Archaeological Sites				1.00	2.00		
		Special Status Areas				0.00	0.00		
		Communities				0.45	0.90		
		Oil Residency Index				2.62	3.93		
		Alcids	25	1	0.5	0.52	0.92		
		Greenland halibut	7	2	1	0.59	1.03		
		Gulls	17	1	0.5	0.36	0.62		
								13	Low
74_115	7451	Human Use				2.00	4.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				2.95	4.43		
		Greenland halibut	7	2	1	0.66	1.16		
		Gulls	17	1	0.5	0.40	0.70		
		Seaducks Breeding	23	4	0.5	2.17	3.80		
								14	Low
74_116	7451	Human Use				0.00	0.00		
		Archaeological Sites				5.00	10.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				2.32	3.49		
		Alcids	25	1	0.5	0.46	0.81		
		Gulls	17	1	0.5	0.32	0.55		
								15	Low
74_117	7452	Human Use				0.00	0.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				1.97	2.96		
								3	Low
74_118	7451	Human Use				0.00	0.00		
		Archaeological Sites				0.00	0.00		
		Special Status Areas				0.00	0.00		
		Communities				0.00	0.00		
		Oil Residency Index				1.89	2.83		
								3	Low

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12 Appendix B, methods and documentation

12.1 Introduction

In the Chapters 6, 7 and 8 the methods and data used in the present atlas project have been described. However, some technical details and data documentation was not included in these chapters and is presented here. Appendix B should thus be seen as supplementary to the descriptions in Chapters 6, 7 and 8.

This chapter contains the detailed settings used for calculating the sensitivity index values with the Greenland oil spill sensitivity application (Chapter 12.2):

- a description of the data and methods used in the geomorphologic coast classification (Chapter 12.3),
- a description of the data and methods used to assess abundance values for the biological occurrences for each area (Chapter 12.4),
- a description of the data and method used to assess assigned values for the archaeological sites for each shoreline area (Chapter 12.5),
- an account of the selected areas (Chapter 12.6).

12.2 The parameters of the Greenland oil spill sensitivity application

Below is a list of the parameter settings in the Greenland oil spill sensitivity application for the index calculations in this atlas.

Assigned Values to shoreline and offshore areas:

Score per community	1-4*
Special status area score (Ramsar sites)	5
Resource (human) use, range**	0-5
Archaeological sites, range	0-5
Animal relative abundance, range	0-5

* Calculated in GIS using a 10 km and a 15 km buffer zone around each community. The initial weights being 2 in the 0 to 10 km zone and 1 in the zone from 10 to 15 km, and the index value is proportional to the length of shoreline segments included within this buffer zone.
** Range from 0 (no importance) to 5 (extreme importance).

Shoreline exposure class modifier for shoreline ice cover:
No modifiers for short open water periods have been applied.

Shoreline ORI modifiers
A single modifier to the basic classification of the ORI value (see Chapter 6) is made to account for the expected longer residence times in the geomorphologic shore type "Archipelagos". The maximum ORI value is limited to 5.

Weighing factors

Resource (human) use	2
Species occurrences	1.75
Special status areas (Ramsar sites)	1.5
Oil residence index	1.5

Application constants

Biological resource constant (shoreline)	62.5
Biological resource constant (offshore)	35
Maximum ORI value	5

The final classification onto the four shoreline sensitivity classes "low", "moderate", "high" and "extreme" was based on even distribution with the following threshold values:

Sensitivity class	PI value domain	No. Segments	Length (km)
Low	2.83 - 16	29	1464
Moderate	16 - 23	30	1493
High	23 - 30	32	1596
Extreme	30 – 44.12	27	1344

12.3 Geomorphologic information

The geomorphology of the West Greenland coast between c. 72º N and 75º N has been classified according to shore type, sediment type and exposure. The classification covers the coastline from the west coast of northern Sigguup Nunaa/Svartenhuk to 8 km north of Tuuttulikassaak./Lille Renland. The total shore-line length is c. 5,895 km.

12.3.1 Methods

The classification is based on a mixture of information from topographic maps (1:250.000), geological maps in 1: 100.000 and 1:500.000 and Landsat 7 imagery from 200X and 2009.

The area is composed of 3 main geological rock types: in the southern-western part the Svartenhuk basalt formations, in the central part a formation of Prøven charnokite (a granitic rock type) and in the northern part meta greywacke - a hard sandstone with gneissic aspect.

To allow the calculation of oil spill sensitivity indexes, the coastal classification is mainly based on the methods outlined in the proposal 'West Greenland Coastal Atlas for Environmental Protection. A Proposal to the Danish Energy Agency' produced by AXYS in July 1999 (Mosbech et al. 2000). For definition of shore types, the classification has been changed a bit to suit Greenland coasts better. The classification scheme has been simplified in comparison to the previous shoreline sensitivity atlases for the Greenland west coast to accommodate a faster production without aerial photography interpretation.

The overall process consisted of the following processes:

1. A revision of the coastline from the topographic maps for the changes in extent of the Greenland Icecap. This mapping also identified all shore of type "glacier coasts" Landsat 7 composite from August – September 2009 was used for this.

2. An identification and delineation of primarily the loose deposits as mapped in the geological maps. Secondary the bedrock type was identified.
3. The areas of "undifferentiated deposits" was interpreted into the sedimentary shore types using a topographic information and the satellite imagery where the geological maps and not already provided a classification.
4. The remaining hard rock areas was classified into "rocky coast", "archipelago" and "talus" according satellite imagery, the complexity of the coastline, presence of small islands composites and the interpretation of Landsat satellite imagery.

The division of the shoreline into shore type segments is based on the geomorphology of the coast. A shore type is a repeatable category of coastal geomorphology, which indirectly indicates the coastal sediment type. Seventeen different shore types have been used for the classification (Table 12.1). However, in the atlas the seventeen shore types have been reduced to twelve shore types for simplicity (Table 7.1). This has been done by lumping shore types with erosional cliffs together with the corresponding shore types without erosional cliffs.

Table 12.1. Classification of shore types in North Greenland between 72° and 75° N.

Shore type no.	Shore type	Segmenttype	Characteristics
Shores developed in soil rock			
1	Rocky coast	Line	• Coast developed in bedrock of varying morphology, elevation and gradient. • Narrow beach with coarse sediment consisting of boulders, cobbles and pebbles might occur.
3	Archipelago	Polygon	• Several smaller islands normally developed in solid rock. • Rocky coasts on larger islands are included if interpreted to be a part of same landscape of very uneven coastline as the islands.
4	Glacier coast	Line	• Occurrence of a glacier in the intertidal zone.
Shores developed in sediments of glacial alluvial or culluvial origin			
5	Moraine	Line	• Shore developed in unconsolidated glacial sediments. • Narrow beach with coarse sediment consisting of boulders, cobbles and pebbles might occur.
7	Alluvial fan	Line	• Shore developed in alluvial fan. • Narrow beach with sediment consisting of boulders, cobbles, pebbles, gravel and sand might occur.
9	Talus	Line	• Shore developed in talus (colluvial fan) of varying gradient. • Narrow beach with coarse sediment consisting of boulders, cobbles and pebbles might occur.
Shores developed in marine sediments			
11	Beach	Line	• Long, linear depositional beaches of well-sorted sand, gravel, pebbles, cobbles or boulders. • Beach ridge plains often occur landwards the beach.
Others			
17	Not classified	Line	• The shore has not been classified due to lack of air photo information (cloudcover, shadow, etc.).

No specific lower segment length was applied, but the sedimentary shore types have been included to the extent they have been mapped in the geological maps. In practical terms this has led to a lower segment limit of 500 meters. It should however be noted that the geology in the area between 72º N and 73º N is only mapped in the scale 1:500.000. Inside the hard rock areas

the often short formations of intrusive have not been delineated separately. In the end Prøven charnokite and metagreywacke has been classified as "Granite".

For each segment the shore type (Table 12.1) and the exposure (Table 12.4) were classified. The segments were marked and classified directly on a corresponding digital shoreline. The shore type "Talus" includes shorelines, which consist of rock-glaciers and larger landslide areas. This special shore type occurs mostly in the basalt dominated region to the south, Innerit and Qeqerteq.

Table 12.2. Sediment classification for West Greenland coasts between 72º and 75º N.

Substrate class	Substrate, general	Substrate, specific	Shore description
1	Ice	Ice	Glacial ice within the intertidal zone.
2	Rock	Rock	Bedrock within the intertidal zone.
3	Rock and sediment	Rock and coarse sediment	A combination of bedrock and coarse sediment including boulders, cobbles and pebbles, either as veneers over the bedrock or as small pocket beaches interspersed with bedrock.
4		Rock and fine sediment	A combination of bedrock and fine sediment including mud, sand or mixtures of sand and boulders, cobbles or pebbles. Sediments most likely to occur as small pocket beaches interspersed with bedrock.
5	Sediment	Coarse sediment	Boulders, cobbles and pebbles. Collectively referred to as 'gravel'. Includes 'shingle-type' beaches.
6		Fine sediment	Mud, sand and combinations of sand and gravel.

To accommodate the shoreline sensitivity calculation using the Axsys application, the shore types have been reclassified into coastal sediment types.

Tabel 12.3. Reclassification of shore types to sediment type.

Shore type	Sediment type / substrate
Moraine (5)	Fine sediment (6)
Alluvial fan (7)	Fine sediment (6)
Talus (9)	Coarse sediment (5)
Beach (11)	Fine sediment (6)
Archipelago (3)	Rock (2)
Rocky coast (1)	Rock and coarse sediment (3)
Glacier coast (4)	Ice (1)

Classification of exposure:

The classification of exposure has been performed as a grid analysis with a cell size of 250 meters and UTM zone 21 as the orthogonal coordinate system. The basis for the classification has been the distance to coast in the 8 main directions (N, NE, E, SE, S, SW, W and NW). The distance threshold has been set to 50 km.

Exposure classes have been defined as:

Class 4 (Exposed):

Distances min 50 km from at least 2 of the westerly directions (NW, W or SW)

Class 3 (Semi-exposed):
Distance of min. 50 km from one of the westerly directions (NW, W or SW)
OR
Mean distance of all westerly directions greater than 10 km.

Class 1 (Protected):
Maximum distance in any direction 4 km
AND
The mean distance of all directions less than 2 km

Class 2 (semi-protected):
Remaining shorelines.

Table 12.4. Exposure classification for West Greenland coasts between 72º and 75º N.

Exposure class	Exposure
1	Protected
2	Semi-protected
3	Semi-exposed
4	Exposed

Oil Residence Index classification:

Tabel 12.5. Basic Oil Residence Index (ORI) ranking based on a combination of shore type and exposure for the Upernavik area.

Shore type / Exposure class	Protected	Semi-protected	Semi-exposed	Exposed
Moraine (5)	4	3	1	1
Alluvial fan (7)	4	3	1	1
Talus (9)	5	4	1	1
Beach (11)	4	3	1	1
Archipelago (3)	5	4	2	2
Rocky coast (1)	5	4	2	1
Glacier coast (4)	1	1	1	1

The ORI index entering the calculations is a length proportional average value of the individual segments.

12.3.2 Statistics

The total length of the coastline is 5895 km of which 1191 km is the length of the coastlines of the 1460 smaller islands (perimeter < 6 km), 3144 km the coastline length of the 121 larger islands and 1561 km is the length of mainland coast.

The distributions of segments on shore type and exposure categories respectively are given in Tables 12.6-12.7. In terms of shoreline length, the 'Rocky coast' is the dominant shore type (63.9 %) and 'Semi-protected' is the dominant exposure type (52.1 %). The majority of the coasts within the 'Archipelago' shore type are rocky coasts. Together the Archipelago' and 'Rocky coast' shore types by length constitute 92.2 % of the total investigated shoreline.

Table 12.6. Shore type statistics.

Shore type	No. of stretches	Km	%
1	331	3770	63.9
3	182	1668	28.3
4	33	154	2.6
5	56	93	1.6
7	3	5	0.1
9	51	189	3.2
11	9	17	0.3
Total	665	5895	100.0

Table 12.7. Exposure statistics.

Exposure type	Km	%
1 - Protected	1436	24,4
2 - Semi-protected	3069	52,1
3 – Semi-exposed	930	15,8
4 - Exposed	458	7,6
Total	5893	

12.4 Biological and resource use information

12.4.1 Introduction

This section describes the different species/species groups included in the biological part of the atlas, and it gives an overview of the different sources to the biological information. Moreover, a description of the rationale behind the selection of seabird breeding colonies and behind the calculation of the relative abundance of seabirds in each shoreline area is given. Many more species of birds, marine mammals and fish/shellfish occur in the region. These are however of insignificant importance as hunting/fishing objects, they occur widespread without any concentration areas or they are not particularly exposed to oil in case of a spill in the region. Following acronyms are used: NERI-AE = National Environmental Research Institute, Denmark department of Arctic Environment, GINR = Greenland Institute of Natural Resources.

12.4.2 Marine mammals

Seals

The true seals are represented by four species: Bearded seals are widespread but in low numbers in the region, especially during winter as they are associated with the ice. Ringed seals are numerous throughout the region and especially frequent in ice covered waters, both in fjords with fast ice and in the drift ice. They occur years round and whelp in liars on the ice. Harp seals are numerous visitors in the open water season, both in the fjords and offshore. Hooded seals occur also in the open water season, but much lower numbers than the harp seals. For details see the Strategic Environmental Impact Assessment of the Baffin Bay East area (Boertmann et al. 2009).

Walrus

Walruses are scarce visitors in the area and may occur throughout the year with a peak in the spring. The presented information is retrieved from the Strategic Environmental Impact Assessment of the Baffin Bay East area (Boertmann et al. 2009).

Baleen whales

This group comprise three species: fin whale, minke whale and bowhead whale. Fin whale and minke whale are both summer visitors to the area, and both hunted under regulation by the International Whaling Commission. The presented data on these two species are from the Strategic Environmental Impact Assessment of the Baffin Bay East area (Boertmann et al. 2009) and from the Greenland catch statistics (Witting 2000). The third species is the bowhead whale, which is a winter and spring visitor to the area. The presented information is retrieved from the Strategical Environmental Impact Assessment of the Baffin Bay East area (Boertmann et al. 2009). A few more species occur in the area: Humpback whale, which is an increasingly more common summer visitor and blue whale, which is a rare summer visitor.

White whale (Beluga)

The white whale is a migrant visitor to the region both in spring (April and May) and autumn (late October and November). The information is summarised in the Strategic Environmental Impact Assessment of the Baffin Bay East area (Boertmann et al. 2009).

Narwhal

This whale is also a migrant visitor. In autumn, October –November they occur along the coasts and in offshore areas, in spring (April-May) along the ice edge and the the drift ice offshore. See also the the Strategic Environmental Impact Assessment of the Baffin Bay East area (Boertmann et al. 2009).

12.4.3 Seabirds

The seabird species have been assembled in some seabird groups:

- Alcids, comprising breeding thick-billed murre, razorbill, black guillemot, Atlantic puffin and little auk (dovekie).
- Seaducks breeding, comprising breeding common eider.
- Seaducks spring, comprising spring concentrations of common eider, king eider and long-tailed duck.
- Seaducks moulting, comprising autumn (and late summer) concentrations of usually moulting common eider, king eider, long-tailed duck and red-breasted merganser.
- Gulls, comprising Iceland gull, glaucous gull, great black-backed gull, kittiwake and Arctic tern.
- Cormorants, comprising only great cormorant.
- Tubenoses comprising only northern fulmar.

Breeding seabirds at shorelines

The selection of seabird breeding colonies included in this atlas derives from a database of seabird breeding colonies covering entire Greenland (see Boertmann et al. 1996). The selection is based upon the geographical range between 72° N and 75° N and on the best available surveys, as many colonies have been surveyed several times. However, the most recent surveys are not necessarily the best, as for example aircraft based surveys are inferior to boat based surveys.

All numbers of birds are expressed in individuals, as many species can only be monitored as such. Numbers expressed in pairs or nests are transformed to individuals (No. of pairs/nests x 2).

Species criteria for selection

The criteria for inclusion of colonies are listed in Table 12.8.

Table. 12.8. Criteria for inclusion of seabird colonies.

Species	Criteria	No of colonies	
		No. of colonies meeting the criterion	Included because other species meet their criterion (mixed colonies)
Northern fulmar	all colonies	1	-
Great cormorant	all colonies	61	-
Common eider:	colonies with ≥ 5 indvs.	76	7
Iceland gull	colonies with ≥ 500 indvs.	13	10
Glaucous gull	colonies with≥ 500 indvs.	19	66
Unsp. glaucous/Iceland gull	colonies with ≥ 500 indvs.	3	17
Black-legged kittiwake	colonies with ≥ 50 indvs.	26	3
Arctic tern	colonies with ≥ 30 indvs.	17	4
Thick-billed murre	all colonies	5	-
Razorbill	colonies with ≥ 5 indvs.	29	7
Black guillemot	colonies with ≥ 250 indvs.	30	68
Little auk (dovekie)	all colonies	2	-
Atlantic puffin	all colonies	19	-

Taking into account that most colonies have a mixed species assemblage, the total number of colonies (with different geographical position) selected is 167 out of 278 known colonies with observations.

Comments to the criteria

The criteria take into account the sensitivity to oil spill of the bird species both on individual level and on population level. These sensitivities are dependent on the behaviour and ecology of the birds but also the distance to neighbouring colonies, which is a measure of the ability to recolonise a colony. Moreover they take into account the status of the breeding population within the region, whether they are decreasing, increasing or stable, and finally their international conservation status.

Northern fulmar is only found breeding in one site, where more than 10,000 pairs nest.

Great cormorant colonies are found both within the fjords and on exposed coasts. The Greenland cormorant population is small and most likely isolated from other populations in the North Atlantic. The breeding population is widely dispersed, and presently it seems to increase and disperse northwards.

The breeding population of common eider in West Greenland decreased seriously until approx. 2000. In 2001 new hunting regulations introduced a closed season in spring and the eider breeding population responded immediately with increase in the following. The common eider has a strong preference for smaller (< 1.5 km^2) islands and islets for their colonies (F. Merkel pers. comm.). On several of the smaller islands around Ikeq (Upernavik Isfjord) the colonies may actu-

ally have reached the limits for additional nests. As a part of the interview survey (Nymand 2010) the local hunters indicated areas with high numbers of eiders. This information has been integrated with the colony survey data by counting the numbers of islands smaller than 1.5 km^2 in the segment – and converting the number of islands into relative abundance values:

Number of islands < 1.5 km^2 in coastal segment	Relative abundance value
1 – 2	1
3 – 5	2
6 – 10	3
11 – 20	4
> 20	5

Red-breasted mergansers are included where they occur in moulting concentrations. Within the study region such are located deep inside some of the fjords.

Iceland gull, glaucous gull (incl. unsp. Iceland/glaucous gull) are widespread breeders in West Greenland (68º-72º N). As gulls are only moderately sensitive to oil spill only the largest colonies are included.

Black-legged kittiwakes breed exclusively in colonies usually on the lower part of steep cliff faces, and the species is widespread in entire West Greenland. Colony size range from very few to tens of thousands. Colonies less than 50 pairs are excluded, as they tend to be less stable over time.

Arctic terns breed usually in dense colonies on low islands. The population in West Greenland is generally decreasing. A characteristic feature is that colonies in large areas are in certain years (with adverse weather in spring) abandoned. Small colonies less than 30 pairs are excluded. Terns are moderately sensitive to oil spill, but colonies situated on low islands are very sensitive to disturbance e.g. from oil spill response activities.

All members of the family auks (alcids), that is thick-billed murres, razorbill, black guillemot, little auk and Atlantic puffin, are very sensitive to oil spills. This is caused by their behaviour and also by their very low population turnover. Protection of their breeding sites therefore have high priority. Moreover is the breeding population of thick-billed murres seriously decreasing in West Greenland as a whole, probably due to disturbance and hunting.

Razorbill breeds in small colonies (rarely more than a 100 pairs) scattered throughout the region (and entire West Greenland). The colonies are difficult to monitor, because the nests are concealed, and the presence of a few birds at a site may sometimes only be prospecting birds, not breeding there. Sites with less than 5 birds are therefore excluded.

The black guillemot is the most widespread and numerous alcid within the region, where colony size range from a few pairs to some hundred. The colonies are often very loose and difficult to delimit, and only large colonies with more than 250 pairs are included.

There are only a few sites with breeding little auks within the atlas region and all are included.

The population of Atlantic puffin is small in West Greenland, the largest colonies holding a few hundred pairs. The population was moreover decreasing until hunting and egging was prohibited in 1960. All colonies are included.

In each shoreline segment the numbers of breeding seabirds for each of the species groups are added to calculate the input (relative abundance) to the sensitivity calculation:

Alcids

Black guillemot	1-100	1
	101-200	2
	201-500	3
	501-1,000	4
	> 1,001	5
Razorbill	1-20	1
	21-50	2
	51-100	3
	101-200	4
	> 201	5
Puffin	1-5	1
	6-10	2
	11-20	3
	21-50	4
	> 51	5
Thick-billed murre	1-10	1
	11-50	2
	51-100	3
	101-200	4
	> 201	5
Little auk	1-10	1
	11-50	2
	51-100	3
	101-200	4
	>201	5

A colony/shoreline area which otherwise only will reach a relative abundance of 3 or less, is added one point if three or more alcid species are present.

Seaducks			
	Common eider	1-50	1
		51-100	2
		101-200	3
		201-500	4
		> 501	5
Gulls			
	Iceland Gull	1-200	1
	Glaucous Gull	201-400	2
	Great black-backed	401-1,000	3
		1,001-2,000	4
		> 2,001	5
	Kittiwake	1-100	1
		101-1,000	2
		1,001-2,000	3
		2,001-10,000	4
		> 10,001	5
	Arctic tern	1-50	1
		51-200	2
		201-1,000	3
		1,001-2,000	4
		> 2,001	5
Tubenoses			
	Northern fulmar	1-200	1
		201-1,000	2
		1,001-2,000	3
		2,001-10,000	4
		> 10,001	5
Commorants			
	Great cormorant	1-20	1
		21-50	2
		51-100	3
		101-200	4
		> 201	5

Non-breeding coastal seabirds

Included are seaducks (separated in spring and autumn occurrence). Alcids are only related to offshore areas, as they are feeding in the water column (pelagic) and not dependent on shallow coastal sea bottom feeding areas as sea ducks are.

Seaducks	Common eider	1-200	1
		201-500	2
		501-2,000	3
		2,001-5,000	4
		>5,000	5

Offshore seabirds

The information regarding offshore occurrence of seabirds have been retrieved from the many surveys carried out by NERI and GINR, both by ship and aircraft.

12.4.4 Fish and fisheries

Greenland halibut

Greenland halibut is the most important fish species in the region. It is commercially landed and also used as dog food in all settlements. The information on Greenland halibut in the area is sparse. Greenland halibut is caught on longlines in waters more than 500 meters deep. The annual catch is mainly determined by the assigned quotas and the possibility to ship the catch out of the area. There is no survey data to assess the fish stocks in the area.

Two types of data are available for determining the values of Greenland halibut in the Upernavik area:

- Commercial fishing vessels are obliged to register the location of catch at the level of grid cells of 15´ by 7.5´ degrees. Data from 2006 and 2007 are available. The data are merged to average variations between years, see Figure 8.4.
- During the interview survey in January 2010, local fishermen were asked to delineate the areas where Greenland halibut are caught.

Relative abundance and human resource value:

The value of Greenland halibut as a fishing resource is determined by merging the catch register data with the location of halibut interest areas. The catch figures are distributed proportional to the area of the overlap between halibut interest areas and shoreline segment regions.

Where catch figures are available outside halibut interest areas the catch values are distributed proportional to the waters areas of the shoreline segment regions in the 57 grid cell.

A total of 97 shoreline segments out of 126 possible segments have in this way been assigned a "Greenland halibut" value. The value is used both as the relative species abundance value and the human resource value.

The resulting catch values are aggregated to shoreline segments and assigned score values between 1 and 5:

Assigned value	Criteria	No of segments
1	Greenland halibut interest areas without catch figures	27
2	Mean annual catch of 0 – 10 tonnes	24
3	Mean annual catch 10 – 50 tonnes	12
4	Mean annual catch 50 – 250 tonnes	20
5	Mean annual catch > 250 tonnes (maximum 1741 T / y)	14

12.4.5 Other fish species

The information on capelin, lumpsucker, polar cod and Arctic char derive from an interview survey in the region (72º-75º N) carried out in January -February 2010 (Nymand 2010). The data mainly reflect areas where the resources are utilised, however the data is also used as an indicator of the presence of the species. The interview report including detailed maps is included as Appendix C (p13-1).

The four species of fish are relevant both by their presence (species abundance) and as resources for subsistence use, as they are not caught for commercial reasons. The human resource value of these fish species is calculated as:

$RU = L_f * WF_{species}$, where L_f is the proportion of coastline in interest to the total segment length. $WF_{species}$ is a species specific human use weight factor.

Polar cod

Polar cod is present throughout the region and is typically caught at low depth. Polar cod is exclusively used as fishing bait for Greenland halibut and is as such very important. Both large and small polar cod are caught. The Polar cod is not assigned a species abundance value.

The human use weight factor for cod is 3.

Arctic char

Rivers with Arctic char are found primarily in the southern part of the region; a finding in accordance with a survey in 2003. It is not commercially landed and is primarily of recreational importance. All arctic char localities are given species abundances of 4 and above and are thus mapped on the Shoreline Sensitivity map (black icons). The Arctic char is for human use assigned a species weight factor of 5.

Capelin

Capelin spawn in the subtidal zone in early summer. At this time capelin are easy to catch and the species is utilised on subsistence basis, for consumption bait and dog food. The importance of capelin decreases from south to north, but following an increase in the area since 2003, the capelin has gained in importance. However, people are apparently not fully accustomed to drying and using capelin in the household.

The maps show local knowledge of spawning and fishing areas (people do not distinguish between the two).

Capelin is assigned a species abundance weight factor of 5 and a human use weight factor of 3. In 17 out of 54 coastal segments is the capelin abundance value 3 or above and thus mapped on the Shoreline Sensitivity map (black icons).

Lumpsucker

Lumpsucker also spawn in shallow coastal waters in spring. In other parts of Greenland lumpsucker is caught for landing the roe, but this is presently not possible in the region covered by this atlas. Lumpsucker may be caught as by-catch, and then mostly discarded.

Lumpsucker is also assigned a species abundance weight factor of 5 and no human use weight factor. In 11 out of 28 coastal segments is the lumpsucker abundance value 3 or above and lumpsucker thus mapped on the Shoreline Sensitivity map (black icons).

Snow crab

Snow crab is caught only as by-catch and is not landed commercially, although it does have some importance for local consumption. Snow crab has not been included in the sensitivity calculations.

Hunting

Hunting is a very important activity in the region covered by this atlas, and it forms the basis for the income of many families. It is however difficult to map areas important for the hunting, as this takes place throughout the region and the hunting sites vary in location with season, weather and ice conditions. It is worth to note that the figures for seal hunting in the region are among the largest in Greenland. The average annual catch per settlement is around 6000 seals.

Hunting for ringed seals in spring takes place on fjords with stable ice or along the ice edge in the shear zone. In winter, seals are often taken in nets in small open water areas.

White whales are taken in autumn when they migrate southwards along the outer coast and walrus are often taken along the ice edge in spring.

Seabirds are mainly hunted in the autumn in the archipelagos and fjord areas.

Resource use

The resource use index value is calculated as the sum of the fishery values described in chapter 6.3

The value of hunting has not been specifically evaluated as no data were available.

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12.5 Issues of cultural and/or historical interest

12.5.1 Introduction

Settlement in Greenland

Greenland has been populated for two long periods which together span c. 4,400 years. The oldest period is c. 2400 BC - 200 AD; the later period is c. 1000 AD until the present day.

The settlement strategy of the various cultures, the visibility of the features, and the utilization of the resources of the country have left their mark on the landscape. The area in question covers the west coast from 68°N to 75°N.

As the crow flies this is almost 900 km, but in reality the distance is much greater because of fjords, islands and sounds. In this area there are for example some 830 archaeological sites, that is man-made remains which are registered in the central database of the Greenland National Museum & Archives (NKA), and which are therefore subject to the terms of the Conservation Act (see below). Of the c. 830 known sites the vast majority are positioned immediately by the coast.

The natural conditions within the mapped coastal stretch vary greatly from north to south and from the outer coast to the inner fjords. Climatically, the region is in the Low Arctic zone. Islands, peninsulas and narrow strips of land between the inland ice sheet and the sea consists of alpine, sterile rock with good vegetation areas in the more low-lying parts. Such areas, with subsistence potential for caribou, have also attracted Inuit through the ages.

In the summer the open water is typified by drifting ice floes and icebergs. In the winter the sea is frozen over. These conditions provide very different possibilities for settlement, for transport and for access to resources depending on the traditions and cultural preconditions that form the starting-point.

All Eskimo immigrations to northern West Greenland came through the Avanersuaq (Thule) region.

Around the year 1000 AD Icelandic farmers ("the Norse Greenlanders") settled in South Greenland, and with Hans Egede's establishment of the mission station "Håbets Koloni" ("Hope Colony") in 1721, the foundation was laid for the Colonial Period and the later development of modern Greenland.

In North West Greenland the oldest part of the Palaeo Eskimo period in Greenland comprised the cultural periods Saqqaq and Early Dorset, i.e. c. 2400 BC - 200 AD. Settlements and finds from these periods are known in large numbers from islands and the mainland coast in Disko Bay. At some of these settlement sites the finds also include implements of organic material, something otherwise extremely rare in the Palaeo Eskimo context.

In Uummannaq and Upernavik Municipalities there are very few reports of Palaeo Eskimo settlement sites. This must be due to among other things:

- lack of awareness in former times of the Palaeo Eskimo period
- inadequate reconnaissance in more recent times

- land subsidence/the rising of the sea level, which have left older low-lying sites under water or eroded them down to the beach level.

In the areas there are no settlement sites from the Late Dorset period (c. 1000 - 1200 AD). At the Norse farms in South West Greenland the presence of a few Late Dorset implements suggests that the Norsemen met these people and exchanged tools and/or raw materials with them. This presumably happened during the Norsemen's journeys north to the Avanersuaq area. Although the Norsemen sailed around in Disko Bay, which they called "Nordsæteren", there are no safely identified Norse ruins. There are many Norse objects in the ruins of the Thule culture, but often these are from the period after the disappearance of the Norse Greenlanders. From the Norse period (985 - 1450 AD) comes a small stone with an unusually long narrative runic inscription from the island of Kingittorsuaq just north of Upernavik.

In the course of the thirteenth century, the last great Inuit wave came from Alaska. Via Canada the people of the Thule culture came over Smith Sound to the Avanersuaq area. From there they quickly spread all over the country. The Thule people were whalers and sealers. The umiaq ('women's boat'), kayak and dog-sledges gave them great mobility and the potential for incorporating whaling in their hunting.

Around 1500 AD the Norse Greenlanders had gone, and the Thule people had settled along the entirety of the Greenland coasts. In the following centuries there were great migrations of people along the coasts and an incipient concentration of the population in particular regions and large settlements. Sermermiut near Ilulissat was for example in the view of the population one of the biggest settlements at the beginning of the eighteenth century.

The Palaeo Eskimo period is richly represented, with many settlement sites and fine finds in Disko Bay, but it is very poorly represented further north - despite the fact that this was the immigration route. The very scanty evidence of Palaeo Eskimo presence in the northern part of the area in question, therefore, in a risk assessment context, will induce an elevated value designation.

Which items of archaeological and historical interest are included?

All known coastal archaeological and historical find-spots (minus colonial trading posts, villages and the like) are included in this atlas, but with a view to the protection of the antiquities only the basic site information is included.

If, in connection with an acute situation or for other reasons, it emerges that there is a need to establish a higher state of preparedness, detailed information about the individual sites can be obtained from the Greenland National Museum & Archives, Box 145, DK-3900 Nuuk, which can be contacted by telephone at (+299) 32 26 11 or e-mail: nka@natmus.gl

The Conservation Act

If a man-made feature is older than hundred years, it is protected by the terms of "*Landstingslov nr. 18 af 19. november 2007 om fredning af kulturminder*" ("The Conservation Act"). The Greenland National Museum & Archives administers this act and is responsible for the registration of antiquities.

12.5.2 Description of the data

History

For more than 200 years, information has been gathered about archaeological sites in Greenland. The oldest reports are from the beginning of the eighteenth century, when Denmark began the colonization of Greenland, and the Christian mission was established. The first missionaries were preoccupied with the fate of the Norse Greenlanders and visited the ruins of their settlements. Thus throughout the 1800s a large body of material was submitted to shed light on the history of Norse settlement; but it was only after 1900 that serious interest in the indigenous population of the country arose. It was not before the beginning of the 1930s that an actual archaeological investigation of the prehistory of the Eskimos began.

In the 1950s the first systematic archaeological investigations were conducted at Sermermiut near Ilulissat. There, for the first time, stratigraphic deposits were found from the three great Eskimo periods: the *Saqqaq* culture, the *Dorset* culture and the *Thule* culture. Today Sermermiut is part of an area designated as a World Heritage area under the auspices of UNESCO.

With the transfer of the conservation and museum acts to the Greenland Home Rule Government in 1981, the collected knowledge of antiquities in Greenland was systematized in the form of card indices, overview maps, conservation numbers etc. This knowledge has been regularly developed and updated by surveys and other ways of gathering information about the antiquities. Most recently, all this material has been entered in a database, which is subject to ongoing expansion and quality assurance.

The data

Information about the individual sites is a mixture of experts' inspections in older and more recent times and various items of information from past and present. It is a mixture of good site information and less good and poor information. The latter categories may also include information that has not yet been verified by specialists. Information that sounds credible and which can be localized has been used in this atlas. The settlement type has typically been inferred from the feature types. Place-names have been used to shed light on the activities in the area in question. An attempt has been made to update the information up to and including the summer of 2009

Data quality

Much of the information comes from secondary sources, and in the present context the information is usually inadequate. We may lack information on which and how many features are covered by the registration; on how old they are believed to be; how close to the present sea level they are; their state of preservation etc. Information which is today important for the assessment of their sensitivity in the event of an oil spill. The systematic maps of the past two decades in parts of Disko Bay and a few areas in Uummannaq Municipality as a rule cover the relevant information.

For most of the coastal sites we have no information on their position in terms of metres above sea level. In some cases this has been estimated on the basis of other available information and/or personal experience. All coastal sites with no information on altitude above sea level are treated in this atlas as being in the risk zone for oil spills that is in Group 2, until proved otherwise.

The more recent surveys in the area have given rise to two typical comments in the database:

a. the site could no longer be found
b. the site no longer exists.

The first of these indicates that the site is not at the position indicated, but that it may exist somewhere else nearby, or that it may have been eroded away. Sites with such information have been retained as fully valid items in this atlas, since the littoral zone may have unverified remains, or there may be features/remains close by which have not yet been registered.

The second comment means that we have positive knowledge that there was once a feature or features at the place but that they have now disappeared. This may have happened for example as a result of coastal erosion or construction activities. Sites listed with such information have been retained as fully valid items in this atlas, since the beach zone may still have remains or traces of the features originally observed.

In a number of cases there is uncertainty about the precise geographical position of the site. On the original maps of the antiquities each 'antiquity circle' covers an area with a diameter of 500 metres. The transfer of 'points' from paper maps to a digital map has only increased the precision if more recent GPS coordinates have been obtained.

In the section "Sensitivity assessment" there is an account of the principles underlying the assessment of the individual sites.

12.5.3 Geographical coverage

Besides the geographical conditions - and thus the presence of available resources - there are many factors which must be considered when one is assessing the representativity of the registered coastal sites. In 2009 a municipality administrational structure reform was implemented reducing the eighteen municipal administrations to four administrational units.

Upernavik saw a certain amount of archaeological reconnaissance in the twentieth century. In 2004 the NKA conducted a survey of the southern part of the Municipality. There is very little up-to-date information about the coasts north of *c.* 72° – mainly scattered information about individual sites, and hardly any details. We lack systematic archaeological mapping. The municipality has a wealth of islands. Experience suggests that there is considerable potential for archaeological "gains" on these.

The municipality is not fully covered by archaeological surveys, and it must be expected that new sites will appear.

12.5.4 Explanations of the classification and terms used in the table

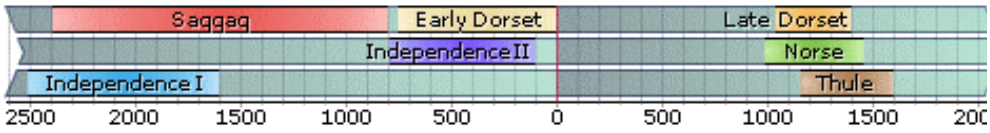
Identification

Fmnr. — Each archaeological site entered in the Greenland Archive of Antiquities (GFA) has a *fredningsnummer* ('conservation number'). All man-made remains from before 1900 are subject to the Conservation Act. When a report on a new find is received, the site is assigned a conservation number and entered in the GFA.

Datings

Periods of cultural history — For each site in GFA there is an account of when or in what periods the individual features were used – that is, which periods of cultural history are represented. Distinctions are made between Inuit, Norse and European origin. If we only know that there are ruins at the place with no dating we use the overall category "Unknown".

Inuit — The table shows the Inuit cultural periods that are known in Greenland and their chronological placing. If no accurate dating has been possible, one must refer to the next level above. The Independence cultures belong in Northwest Greenland.



The Palaeo-eskimo period is considered as lasting until the end of "Late Dorset". With "Thule" begins the Neo-eskimo period, which lasts until 1900 AD.

Norse — The period from the *landnam* (pioneering settlement) of Eric the Red until the collapse of the Norse society, i.e. *c.* 985-1450 AD.

Whaling — European cultural traces dated within the period *c.* 1450-1721 AD, the latter being the year when Denmark's colonisation of Greenland began.

Colonial — The period from 1721 until 1900 AD.

Recent — All cultural traces that are more recent than 1900 AD. If there are recent features at an archaeological site, this is noted in GFA, even if they are not subject to the protection of the Conservation Act. No distinction is made here between Inuit and European features.

Site type — The general terms for site types given below are used in GFA. More detailed information on the feature types and other traces of activity at the individual sites have been entered in the database if they are available.

Settlement,

- summer
- winter
- other season
- assembling camp

Camp for capelin-fishery
Sea-hunting camp
Musk ox hunting camp
Base camp
Overnight camp
Caribou hunting camp
Camp for catching arctic char
Gravesite or graveyard
Hunting system
Cache
Mineral utilization

- pit or exposed mineral
- mine

Cairn

Town
Village
Expedition base camp
Hunting station
Fishery station
Sheep farm
Trading post
Churchyard
Missionary station
Wintering camp
Fox farm
Recent camp site
Train-oil production

Norse farm
Isolated norse building
Isolated norse structure

Other
Indeterminable structure

12.5.5 Sensitivity assessment

General assessment

Most of the coastal Eskimo settlements were established close to the sea and just above the present-day high-water line. Most of the Norse structures lie inland, but there are also many along the coast, where they have been subject to the same erosive forces as many of the Eskimo remains.

Because of the sinking of the land and/or the rising of the sea, many sites may today lie very close to – or even below - the current high-water line. These will therefore be particularly sensitive in the event of an oil spill:

- directly, because contamination will in several ways mean a deterioration of the scientific documentation value of the cultural deposits:
    - the preservation conditions for organic material will become considerably poorer
    - the possibility of conducting analyses and scientific datings will be destroyed
- indirectly, because emergency measures or land-based action would be difficult to implement without causing substantial physical damage to the coastal ruins and culture layers.

Many of the registered cultural remains are very difficult to recognize in the terrain, even for the trained eye. The sensitivity assessment of the archaeological sites must therefore only be regarded as providing guidelines. It is assumed that in the event of a spill, archaeological expertise will be involved in the planning of the emergency measures and in the practical implementation of the plan.

The assessment of sensitivity is based both on factual knowledge of the relevant local cultural history of the region and on qualified opinion.

Since the atlas covers all the known coastal sites, in principle they are all without exception at risk in the event of coastal land-based activities in connection with an oil spill.

Criteria for the assessment

The criteria applied are in principle the same as were used for the sensitivity assessment of the archaeological sites between 62º N and 68º N in the *Environmental Oil Spill Sensitivity Atlas for the West Greenland Coastal Zone* (2000). The differences lie on the one hand in a more rigorous linguistic approach to the criteria and on the other in the transfer of all "coastal sites on which there at present is no more detailed information" from Group 1 to Group 2. This until we have proof that a site should be in one of the other groups. The sensitivity of the items of archaeological interest is expressed on an ascending scale from 1 to 3:

1. Sites considered not likely to be impacted by marine oil spill.
2. Sites considered likely to be directly impacted by marine oil spill.
3. Sites of special importance, which requires special status in the event of an oil spill or other activities in connection with raw material exploration and extraction.

Group 1 comprises sites situated more than 20 metres above sea level or traces of features considered to be of very little importance as historical documentation, because they are very poorly preserved.

In principle the features in this group could be threatened by land-based activities, for example in connection with oil spill.

Group 2 comprises a) all coastal archaeological sites deemed to represent historical source value, b) sites considered to have recreational value or sightseeing value, and c) sites which can be localised, but about which there at present is no further information.

In principle the features in this group could be threatened by land-based activities, for example in connection with oil spill.

Group 3 meets the criteria for Group 2 items a and b, but these sites are further considered to have quite special importance, especially in scientific respects. The basis of this evaluation may be the result of archaeological investigations, historical source material or the like.

The sightseeing value or the local population's use of the locality in question may also be included as criteria.

In principle the features in this group could be threatened by land-based activities, for example in connection with oil spill.

12.6 Selected areas

12.6.1 Brief description of the selected areas

This is a short description to the selected areas referred to in Chapter 6.4.

S116. Uigorluk / Lille Fladø. (Map 7201) A small rocky island with a high diversity of breeding seabirds, especially Arctic tern. little auk and black guillemot.

S117. The waters south of Kingittooq. (Map 7251) Several seabird colonies on the coasts and islands, including species such as thick-billed murres, black-legged kittiwakes, great cormorants and northern fulmars.

S118. Eqalugaarsuit Sulluat / Prøvens Laksefjord. (Map 7252) The inner part of this fjord is an important site for fishery of Arctic char, and it is also moulting and breeding habitat for seaducks; red-breasted merganser and harlequin duck.

S119. The straits around the island Paaq. (Map 7252) Many small islands and skerries with high numbers of breeding common eiders.

S120. The straits east of Nutaarmiut. (Map 725) Many small islands and skerries with high numbers of breeding common eiders.

S121. The waters north of Siagtut. (Map 7252) Many small islands and skerries with high numbers of breeding common eiders.

S122. Kingittortallit. (Map 7301) Small archipelago with many breeding common eiders.

S123. Kingituarssuk. (Map 7301) Small archipelago with many breeding common eiders, puffins and previously also thick-billed murres. Bird protection area.

S124. Kippako. (Map 7351)Small island with a very important seabird colony. Breeding species include thick-billed murre, razorbill, puffin and black-legged kittiwake. Bird protection area.

S125. Appparsuit / Kap Schackleton. (Map 7351) The largest bridcliff in West Greenland. Breeding species include thick-billed murre and black-legged kittiwake. Bird protection area.

S126. Kangerlussuaq. (Map 7352) Small and shallow fjord with a narrow entrance. Moulting site for seaducks, mainly red-breasted merganser.

S127. Kitsissorsuit / Ederfugleøer. (Map 7401) A group of three islands and some skerries. Important breeding site for seabirds, and with a high diversity. Species include common eider, razorbill, puffin and great cormorant.

13 Appendix C

Interview study report

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Introduction

In January/February 2010 Pinngortitaleriffik conducted a series of interview meetings in the Upernavik region in order to map coastal areas sensitive to oil spills. This survey is was the continuation of a survey conducted by NERI, Department of Arctic Environment in 2003, which was part of the project: Environmental Oil Spill Sensitivity Atlas for the West Greenland (68°-72° N) Coastal Zone.

Since 2003 the area of oil exploration has been extended and it was decided to extend the mapping of coastal areas sensitive to oil spills to include all of the former Kommuneqarfik Upernavik (up to 75°N); for example, there is a planned drilling in summer 2010 in the Baffin Bay Basin offshore Disko West by Cairn Energy and even though small, there is a risk of incidents which can lead to oil spill.

Areas sensitive to oil spills include for example spawning areas in shallow waters, target areas of fishery for coastal fish species (i.e. capelin, lumpsucker, and arctic char) and bird concentration areas.

Method

When we learned that the survey had to be undertaken we phoned the local KNAPK chairmen and informed them about the substance of the survey and the time frame.

As soon as we knew the time schedule for visits to specific towns and settlements we again phoned the local chairmen and arranged the meetings between us and the locals. KNAPK has an efficient and extended network that former surveys have made use of as well. In this case, the local KNAPK chairman contacted all members of the community, and timed and placed the meetings according to their convenience within a time frame given by our schedule.

At the meetings we presented detailed maps showing the region and asked participants to mark coastal areas that are used for fishing for the species mentioned above as well as other important species. From the beginning we had decided to use maps without any specific hunting and fishing information.

We also presented a questionnaire similar to the one used by Olsvig & Mosbech (2003) and asked specific for participants to join in on a discussion on issues on for example how the catch was caught and how it was used.

All discussion took place in both Greenlandic and Danish; Sofia Ruth Jeremiassen speaks both languages, while Josephine Nymand speaks Danish.

Results

The following town and settlements were visited and interview meetings held on the following dates:

Upernavik, 22 January and 26 January
Aappilattoq, 23 January
Upernavik Kujallaq, 24 January
Kangersuatsiaq, 25 January
Innaarsuit, 31 January
Tasiusaq, 1 February
Nuussuaq, 2 February.

Upernavik Kujallaq, Kangersuatsiaq and Upernavik were also visited in the 2002 and 2003 study (Olsvig & Mosbech 2003).

In general people would only talk about the species they themselves caught and the corresponding fishing areas. They were reluctant to talk about other areas if we were to visit those areas later on.

Only in Nuussuaq were participants willing to tell about Kullorsuaq area, because we told them that we would be unable to visit that area.

In Upernavik the Greenland halibut is of utmost economic importance because it is the only species that is commercially landed in sufficient amounts to sustain a family. Sealskin is in some settlements also commercially landed (e.g. Tasiusaq, Nuussuaq).

Greenland halibut, ringed seal, harp seal, capelin, and polar cod are important for dog food and bait. Greenland halibut, seal and Arctic char is used for human consumption as well. In more southern areas capelin is consumed too and is increasingly becoming important in the northern areas as well.

Capelin

Figures 1 to 9.

The importance of capelin for consumption and for use as bait decreases from south to north – as shown in a former survey – but following an increase in the area of distribution since 2003, the capelin has gained in importance. However, people are apparently not fully accustomed to drying and using capelin in the household.

The maps show local knowledge of spawning and fishing areas (people do not distinguish between the two). Where capelin spawns on steep slopes it is caught in limited amounts.

Lumpsucker

Figures 10 to 17.

The lumpsucker cannot be commercially landed in the region and is therefore of no importance. It may be caught as by-catch, though, but is mostly discarded.

The maps show a larger area of distribution, compared to the 2003 distribution. We were told that spawning lumpsuckers have been observed in the same areas as spawning capelin, but it does not show on the maps because the participants were uncertain on the exact distribution.

Arctic char

Figures 18 to 22.

Rivers with migrating Arctic char (anadromous) are found primarily in the southern part of the region; this has not changed since the 2003 survey. Arctic char is only caught – by gillnet and fishing rod – in the southern part. It is not commercially landed and is primarily of recreational importance. Especially in festive seasons arctic char is very important.

Greenland halibut

Figures 23 to 33.

Greenland halibut is the most important fish species in the region. It is commercially landed and also used as dog food in all settlements visited.

As the maps of local fishing areas shows, fishing of Greenland halibut is widely distributed in the region.

Polar cod

Figures 34 to 43.

Polar cod is exclusively used for bait in the Greenland halibut fishery and is as such very important. Both large and small polar cod are caught and used.

The map shows coastal areas that are important fishing areas and areas that are believed to comprise spawning grounds. Fishery for polar cod takes place primarily in the central parts of the region.

Snow crab

Figures 44 to 46.

Snow crab is caught only as by-catch and is not landed commercially, although it does have some importance for local consumption.

Other species

Common eider

Figures 47 to 57.

The population of eider has increased in the last couple of years – probably as a consequence of hunting regulations which has introduced a reduced open season. King eiders are also said to be more numerous now than a few years ago.

The maps show areas where common eider are supposed to breed.

Conclusion

As seen on the maps areas of importance to fishery and spawning are more numerous in the southern part of the region.

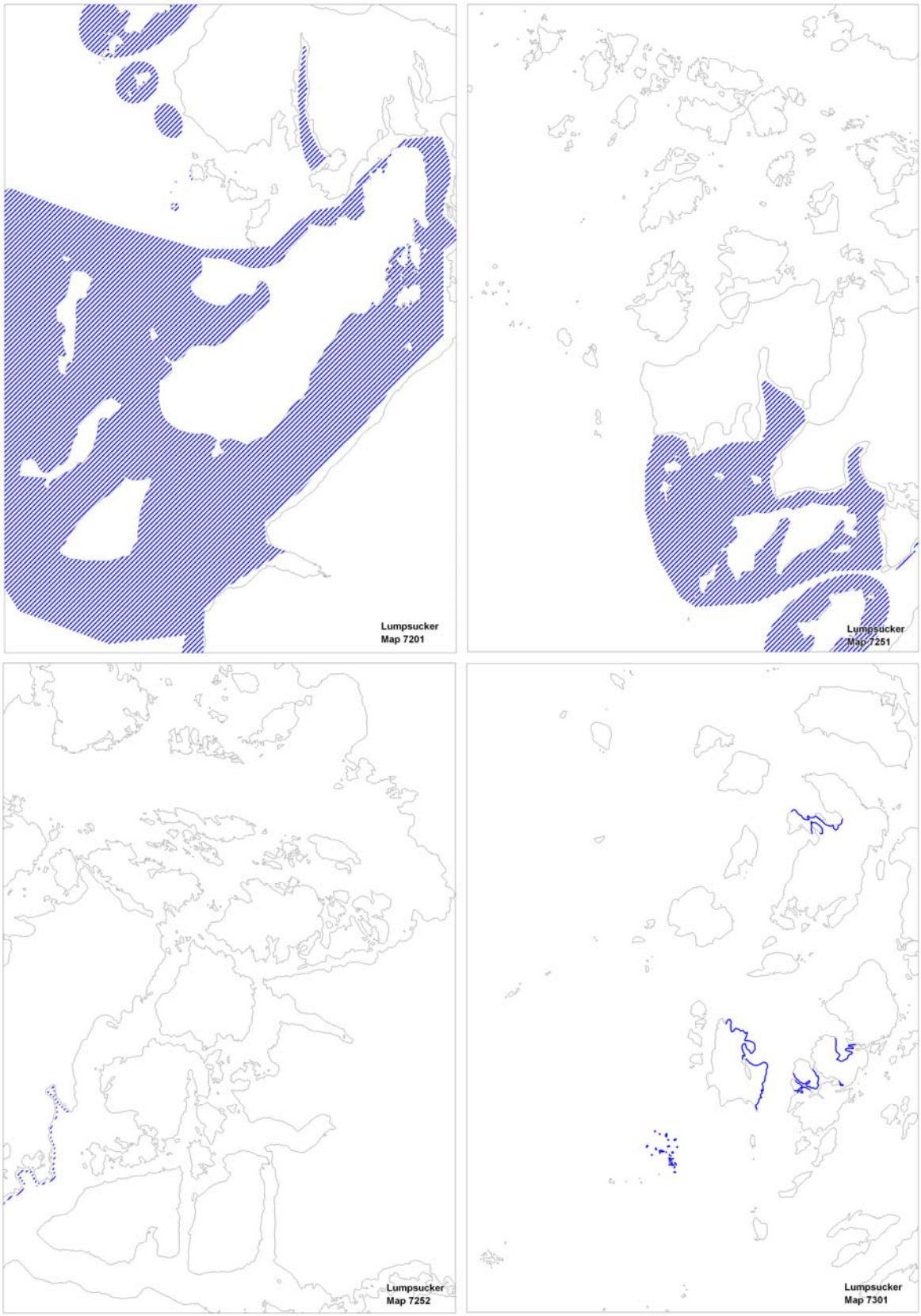
Fishing for Greenland halibut is by far the most important resource.

Narwhal and seal hunting is also is important, and especially in the northern settlements.

Figures 1 - 4. Shorelines with capeline spawning and fishing areas, shown with organge signature, in Map 7201, Map 7251, Map7252 and Map 7301 respectively.

Figures 5 - 8. Shorelines with capeline spawning and fishing areas, shown with organge signature, in Map 7302, Map 7351, Map7352 and Map 7402 respectively.

Figure 9. Shorelines with capelin spawning and fishing areas, shown with orange signature, in Map 7452.



Figures 10 – 13. Areas with occurrence (blue hatching) of lumpsucker in Map 7201, Map 7251, Map 7252 and (blue coastline) Map 7301 respectively.

Figures 14 – 17. Areas with occurrence (blue hatching and blue coastline) of lumpsucker in Map 7401, Map 7402, Map 7451 and Map 7452 respectively

Figures 18 – 21. Coastlines and areas (red) where Arctic char is caught in Map 7201, and rivers with anadromous stocks (yellow) in Map 7202, Map 7252 and Map7302 respectively.

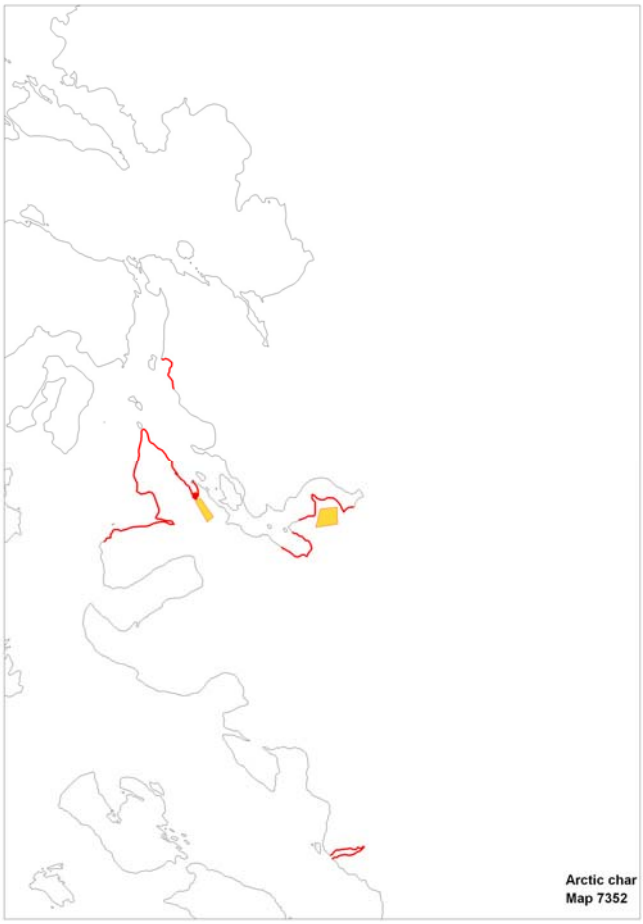
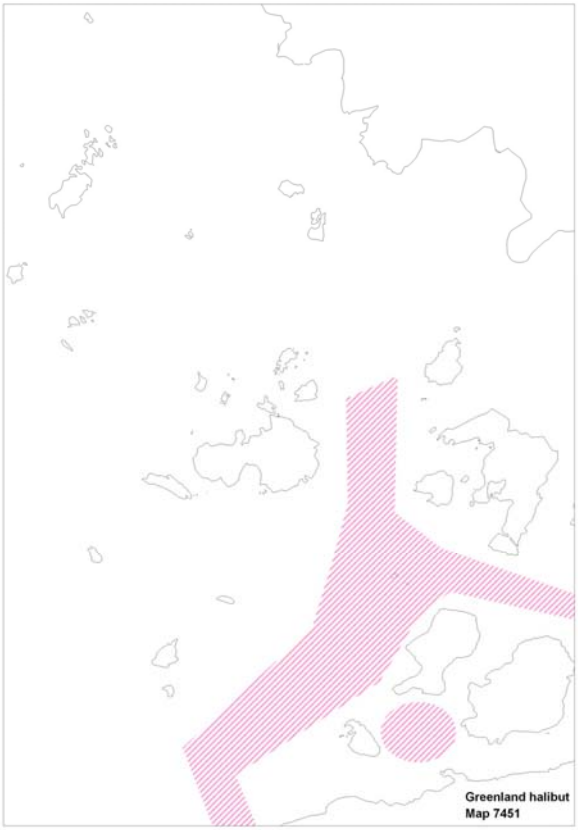


Figure 22. Coastlines and areas (red) where Arctic char is caught and rivers with anadromous stocks (yellow) in Map 7352.

Figures 23 - 26. Fishing areas (purple hatching) for Greenland halibut in Map 7201, Map 7251, Map 7252 and Map 7301 respectively.

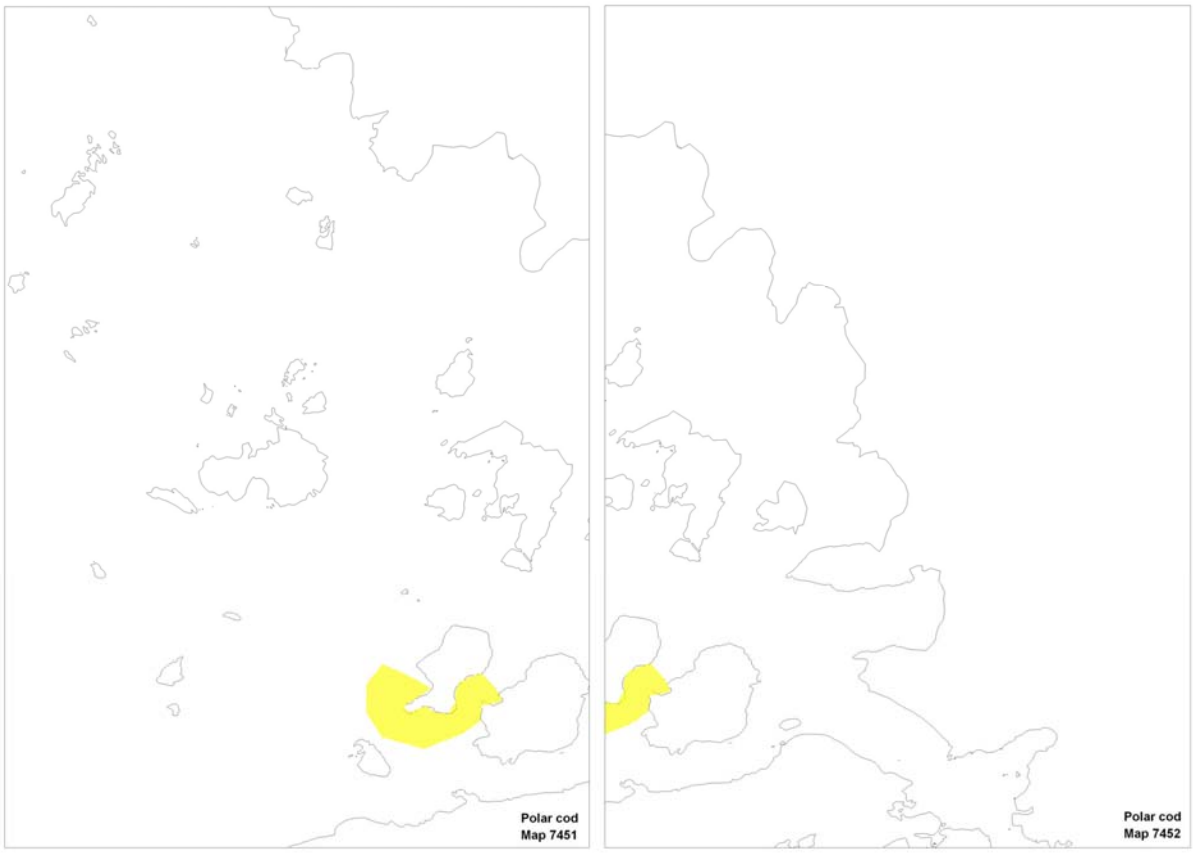
Figures 27 - 30. Fishing areas (purple hatching) for Greenland halibut in Map 7302, Map 7351, Map 7352 and Map 7401 respectively.



Figures 31 - 33. Fishing areas (purple hatching) for Greenland halibut in Map 7402, Map 7451 and Map 7452 respectively.

Figures 34 - 37. Fishing areas (yellow signature) for polar cod in Map 7251, Map 7252, Map 7301 and Map 7302 respectively.

Figures 38 - 41. Fishing areas (yellow signature) for polar cod in Map 7351, Map 7352, Map 7401 and Map 7402 respectively.



Figures 42 - 43. Fishing areas (yellow signature) for polar cod in Map 7451 and Map 7452 respectively.

Figures 44 - 46. Areas (green hatching) where snow crab are occasionally caught in Map 7251, Map 7252 and Map 7301 respectively.

Figures 47 - 50. Areas (purple hatching) where common eiders are supposed to breed in area covered by Map 7201, Map 7252 and Map 7301 respectively, and the central part of the area covered by Map 7251.

Figures 51 - 54. Areas (purple hatching) where common eiders are supposed to breed in area covered by Map 7302, Map 7351, Map 7352 and Map 7401 respectively.

Figures 55 - 57. Areas (purple hatching) where common eiders are supposed to breed in area covered by Map 7402, Map 7451 and Map 7452 respectively.

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14 Appendix D, place names

This is an index to all the place names used on the maps in Chapter 8 and 9. Some place names also have a name in Danish, which are listed too. Some place names only have a name in Danish and are listed at the end of the index. The positions listed are the positions of the names on the maps. If the place name occurs in several positions, it is listed once for each position.

Greenlandic	Danish	Map sheet(s)	Latitude	Longitude
Aakkarnersuaq		7302	73° 21' N	55° 28' W
Aapparsuaq		7251	72° 57' N	55° 39' W
Aappi		7251, 7302	72° 59' N	55° 45' W
Aappilattoq		7251, 7252	72° 51' N	55° 25' W
Aappilattoq		7251	72° 52' N	55° 39' W
Aappilattoq		7302	73° 27' N	55° 53' W
Aarrusaq		7251	72° 40' N	56° 16' W
Aavertuut		7301	73° 15' N	56° 31' W
Aavilikassaap Saqqarlia		7451	74° 52' N	57° 31' W
Aavilikassak		7451	74° 54' N	57° 29' W
Akia		7251	72° 45' N	56° 5' W
Akinnaq		7252	72° 51' N	55° 16' W
Akornat		7251	72° 41' N	55° 40' W
Akuliaruseq		7252	72° 34' N	55° 9' W
Akullikassak		7451	74° 46' N	57° 26' W
Alanngarsuup Sermia		7302, 7303	73° 9' N	54° 59' W
Amarortalik		7252	72° 34' N	54° 52' W
Amitsorsuaq		7201, 7201	72° 22' N	54° 53' W
Amitsorsuaq		7351, 7352	73° 56' N	56° 4' W
Amitsorsuup Sullua		7352	73° 56' N	55° 59' W
Amitsup Alanngua		7252	72° 37' N	55° 8' W
Ammaasarsuaq		7251	72° 49' N	55° 40' W
Ammalortorsuaq		7351	73° 51' N	56° 45' W
Ammaqqua		7252	72° 34' N	55° 20' W
Ammaqqua		7201, 7251	72° 29' N	55° 35' W
Anaanaa		7251	72° 36' N	56° 9' W
Anarusuk		7302, 7352	73° 27' N	55° 34' W
Angisoq		7251	72° 54' N	56° 23' W
Anguniartarfik		7451	74° 46' N	57° 27' W
Annertusoq		7251	72° 35' N	55° 43' W
Annertusup Ilua		7251	72° 34' N	55° 50' W
Appaalissiorfiup Ikerasa		7351	73° 48' N	56° 38' W
Appaarsuit		7351	73° 48' N	56° 44' W
Appalersalik		7351	73° 37' N	57° 4' W
Apussuup Saqqaa		7252	72° 34' N	54° 26' W
Assaqutaq		7251, 7301	72° 58' N	56° 25' W
Ateqanngitsorsuaq		7302	73° 12' N	55° 51' W
Atilissuaq		7251	72° 47' N	55° 51' W
Attarsivik		7302	73° 7' N	55° 59' W

Greenlandic	Danish	Map sheet(s)	Latitude	Longitude
Atungassat		7302	73° 19' N	55° 25' W
Avalia		7251	72° 56' N	56° 8' W
Avalleq		7201	72° 18' N	55° 27' W
Avalleq		7451	74° 34' N	57° 48' W
Avannarleq		7251	72° 44' N	56° 24' W
Avannarlinnguit		7351	73° 51' N	56° 52' W
Eqalugaarsuit Sulluat		7252	72° 30' N	55° 3' W
Eqaluit		7201, 7202	72° 15' N	54° 54' W
Eqqorleq		7301	73° 14' N	56° 24' W
Ikamiut		7201	72° 14' N	55° 5' W
Ikeq	Upernavik Isfjord	7251	72° 56' N	55° 39' W
Ikeq	Upernavik Isfjord	7252	72° 53' N	55° 5' W
Ikera		7201	72° 16' N	55° 43' W
Ikerasaa		7402	74° 27' N	56° 34' W
Ikerasaararsuk		7251, 7302	72° 57' N	56° 10' W
Ikerasaarsuk		7351	73° 31' N	56° 19' W
Ikerasak		7252, 7302	72° 57' N	55° 19' W
Ikerasak		7251	72° 35' N	55° 34' W
Ikerasak		7301, 7302	73° 23' N	56° 13' W
Ikerasakassak		7402	74° 6' N	56° 35' W
Ikerasakitsoq		7251, 7252	72° 32' N	55° 33' W
Ikerasassuaq		7352	73° 49' N	55° 54' W
Ikerinnarmiut		7451	74° 51' N	57° 43' W
Ikermiorsuaq		7351, 7402	74° 0' N	56° 32' W
Ikermiu		7251	72° 37' N	56° 0' W
Ikermiut		7251	72° 50' N	55° 51' W
Ikermiut		7401, 7402	74° 21' N	56° 55' W
Ikertilik		7451	74° 38' N	57° 37' W
Ikissuup Sermersua	Cornell Gletcher	7402	74° 13' N	55° 57' W
Ilivertallit		7251	72° 31' N	56° 6' W
Illinnguit		7301	73° 18' N	56° 20' W
Illoorfik		7401	74° 11' N	57° 0' W
Illulik		7302	73° 14' N	55° 32' W
Illulissuaq		7402	74° 20' N	56° 25' W
Illullip Sermia		7402	74° 23' N	55° 59' W
Illutalik		7201	72° 21' N	55° 19' W
Illutalik		7251	72° 47' N	56° 37' W
Iluliannguit		7251	72° 31' N	55° 46' W
Innaarsuit		7302	73° 12' N	56° 5' W
Innerit		7202	72° 11' N	54° 44' W
Innerit		7201	72° 3' N	55° 21' W
Innerit		7201	72° 6' N	55° 3' W
Inussuk		7251	72° 57' N	56° 6' W
Inussulik		7401	74° 24' N	57° 13' W
Inussulikassak		7402	74° 8' N	56° 34' W
Inussulissuaq		7401	74° 25' N	56° 59' W
Inussullip Imaa		7401, 7402	74° 16' N	56° 43' W
Iperaq		7251	72° 31' N	55° 38' W
Issortusoq		7201	72° 14' N	55° 41' W

Greenlandic	Danish	Map sheet(s)	Latitude	Longitude
Issumaarsuup Iterdlaa		7302	73° 13' N	55° 16' W
Iterlassuaq		7452	74° 32' N	56° 14' W
Iterlassuit		7402	74° 5' N	56° 15' W
Itillilik		7302	73° 5' N	56° 2' W
Itissaalik		7402	74° 5' N	56° 42' W
Itissaalikassak		7252	72° 57' N	54° 47' W
Kakiffaat Sermia		7302, 7352	73° 28' N	55° 14' W
Kangaarsuk		7302	73° 16' N	56° 6' W
Kangarssuk		7201	71° 59' N	55° 40' W
Kangeq		7201, 7252	72° 29' N	55° 18' W
Kangeq		7251	72° 33' N	56° 1' W
Kangerluarsuk		7352	73° 40' N	55° 55' W
Kangerluarsuk		7402	74° 16' N	56° 24' W
Kangerlussuaq		7201, 7252	72° 26' N	55° 17' W
Kangerlussuaq		7251	72° 37' N	55° 37' W
Kangerlussuaq		7352	73° 43' N	55° 39' W
Kangerlussuaq	Giesecke Isfjord	7352	73° 33' N	55° 44' W
Kangersuatsiaq	Prøven	7201	72° 22' N	55° 25' W
Kangilleq		7303	73° 0' N	54° 44' W
Kap Shackleton		7351	73° 47' N	56° 57' W
Karrat		7251	72° 50' N	56° 7' W
Kiataasap Qeqertaarsui		7451	74° 47' N	57° 42' W
Kiataasaq		7451	74° 43' N	57° 33' W
Kiatannguaq		7251	72° 49' N	56° 23' W
Kiatassuaq	Holm Ø	7452	74° 32' N	56° 40' W
Kiatassuaq	Holm Ø	7401, 7451, 7452	74° 30' N	57° 9' W
Kigataq		7201	72° 5' N	55° 49' W
Killeq		7351	73° 48' N	56° 59' W
Kingittoq		7251	72° 56' N	56° 17' W
Kingittorsuaq		7251, 7301, 7302	72° 58' N	56° 9' W
Kingittortallit		7301	73° 2' N	56° 51' W
Kingittuarsuk		7251	72° 45' N	56° 28' W
Kingittuarsuk		7251	72° 55' N	56° 35' W
Kingittuarsuk		7301	73° 13' N	56° 49' W
Kippaku		7351	73° 43' N	56° 36' W
Kissaaq		7201	72° 20' N	55° 25' W
Kitsissorsuit		7401	74° 2' N	57° 45' W
Kitsissut		7301	73° 5' N	56° 35' W
Kittorsaaraq		7401, 7402	74° 4' N	56° 51' W
Kittorsaaraq		7402	74° 4' N	56° 51' W
Kittorsaq		7351	73° 55' N	56° 47' W
Kukkerfilik		7451, 7452	74° 42' N	56° 55' W
Kullorsuaq		7451	74° 34' N	57° 11' W
Kullorsuaq		7451	74° 36' N	57° 7' W
Kullorsuup Kangerlua	Alison Bugt	7402, 7452	74° 32' N	56° 27' W
Kuuk		7351, 7352	73° 41' N	56° 12' W
Maniitsoq		7252	72° 57' N	55° 12' W
Maniitsoq		7201	72° 16' N	55° 2' W
Maniitsoq		7201	72° 27' N	55° 43' W

Greenlandic	Danish	Map sheet(s)	Latitude	Longitude
Maniitsuarsuk		7201	72° 25' N	55° 46' W
Maniitsunnguaq		7251	72° 33' N	55° 40' W
Mattaangasut		7351	73° 33' N	56° 43' W
Mernoq		7351, 7352	73° 45' N	56° 17' W
Milissua		7352	73° 52' N	55° 57' W
Milissua		7402, 7452	74° 29' N	56° 21' W
Naajaat		7302	73° 9' N	55° 50' W
Naajatalikkut		7451	74° 48' N	57° 56' W
Naajavissuaq		7252, 7303	72° 58' N	54° 45' W
Nanortalikassak		7451	74° 47' N	57° 22' W
Nasaasap Saqqaa	Ussing Isfjord	7351, 7352	73° 55' N	56° 10' W
Nasaasaq		7351	73° 56' N	56° 19' W
Natsiarsiorfik		7451	74° 45' N	57° 20' W
Natsisaat		7251	72° 55' N	55° 50' W
Niaqornarsuup Iterlaa		7402	74° 1' N	56° 4' W
Niaqqup Iterlaa		7201	72° 7' N	56° 2' W
Niisartuut		7301	73° 16' N	56° 29' W
Nitserfik		7201	72° 20' N	55° 41' W
Noqarutit		7302	73° 23' N	55° 46' W
Nunaa		7251, 7252	72° 46' N	55° 30' W
Nunannguit		7251	72° 45' N	56° 36' W
Nunarsuaq		7251	72° 54' N	56° 9' W
Nunatakassaap Sermia		7452	74° 36' N	55° 55' W
Nunatakassak		7452	74° 39' N	56° 35' W
Nunatakassap Sermia		7302, 7303	73° 15' N	54° 57' W
Nunatarsuaq		7302	73° 17' N	55° 19' W
Nuniaat		7302	73° 8' N	55° 27' W
Nutaarmiut		7252	72° 47' N	55° 15' W
Nutaarmiut		7251	72° 40' N	55° 34' W
Nutaarmiut		7301, 7351	73° 30' N	56° 21' W
Nuuluk		7352	73° 33' N	56° 2' W
Nuussuaq		7401, 7402	74° 10' N	56° 44' W
Nuussuaq	Kraulshavn	7401	74° 5' N	56° 59' W
Nuussuup Kangia	Ryder Isfjord	7402	74° 10' N	56° 22' W
Nyguup Qeqertarsua		7451	74° 35' N	57° 45' W
Paa		7252	72° 37' N	54° 50' W
Paagussat		7301, 7302	73° 21' N	56° 12' W
Paakitsoq		7201, 7202	72° 18' N	54° 55' W
Paanaqqortuut		7402	74° 7' N	56° 36' W
Paaq		7252	72° 40' N	55° 3' W
Paarnivik		7352	73° 47' N	56° 3' W
Pikiulli		7301, 7351	73° 28' N	56° 33' W
Puugutaa		7251, 7251, 7302	72° 59' N	55° 25' W
Qaaneq		7302	73° 22' N	55° 7' W
Qaarsorsuaq		7251	72° 43' N	55° 57' W
Qaarsorsuatsiaq		7301, 7302	73° 10' N	56° 13' W
Qaarusulik		7451	74° 42' N	57° 50' W
Qallunaat		7351	73° 36' N	56° 23' W
Qamutikassaat		7451	74° 45' N	57° 44' W

Greenlandic	Danish	Map sheet(s)	Latitude	Longitude
Qaneq		7302	73° 3' N	55° 51' W
Qaqqakassaap Ikerasa		7351	73° 38' N	56° 20' W
Qarngup Saqqaa		7251, 7302	73° 1' N	55° 52' W
Qassersuaq		7302	73° 6' N	55° 18' W
Qassersuit Saqqaa		7302	73° 1' N	55° 17' W
Qassi		7251	72° 54' N	55° 59' W
Qeqertaarsuit		7251, 7252	72° 54' N	55° 29' W
Qeqertaarsuit		7401	74° 27' N	57° 10' W
Qeqertaasaq		7201	72° 20' N	55° 4' W
Qeqertaasaq Iterlaa		7201	72° 15' N	55° 29' W
Qeqertannguit		7401, 7402	74° 18' N	56° 56' W
Qeqertaq		7201	72° 16' N	55° 16' W
Qeqertaq		7301	73° 17' N	56° 26' W
Qeqertaq		7351	73° 43' N	56° 29' W
Qeqertarsuaq		7202, 7252	72° 29' N	54° 31' W
Qeqertarsuaq		7252	72° 51' N	54° 55' W
Qeqertarsuaq		7401, 7402	74° 24' N	56° 49' W
Qeqertarsuaq		7451	74° 41' N	57° 10' W
Qeqertarsuup Sermia		7352	73° 35' N	55° 27' W
Qeqertasussuk		7251	72° 43' N	56° 21' W
Qilalukkiarfik		7451	74° 47' N	57° 31' W
Qiterlersuaq		7301	73° 13' N	56° 27' W
Qoqaarsissorsuaq		7302	73° 20' N	55° 41' W
Quassugarsuup Iterlaa		7402	74° 3' N	56° 25' W
Qulleq		7451	74° 40' N	57° 55' W
Qulliit		7302	73° 16' N	56° 0' W
Qullikorsuit		7351	73° 52' N	56° 25' W
Qullugiartuukassaap Avannarlia		7252, 7303	72° 58' N	54° 41' W
Saarlersuaq		7301	73° 11' N	56° 25' W
Saarlia		7251	72° 47' N	55° 40' W
Saarlia		7451	74° 32' N	57° 18' W
Saattoq		7251	72° 52' N	55° 48' W
Saattoq		7201	72° 16' N	55° 54' W
Saattoq		7402	74° 22' N	56° 43' W
Saattoq		7302	73° 7' N	56° 5' W
Saattoq		7302, 7352	73° 30' N	56° 6' W
Saattuajaakassak		7401	74° 21' N	57° 4' W
Saattup Saa		7201	72° 14' N	56° 1' W
Saffiorfik		7201	72° 21' N	55° 27' W
Salleq		7201, 7251	72° 29' N	55° 45' W
Sanningasoq		7252	72° 44' N	54° 55' W
Sanningasorsuaq		7302	73° 7' N	55° 45' W
Sanningasorsuaq		7402	74° 26' N	56° 24' W
Sanningasuarsuk		7252	72° 35' N	54° 56' W
Sanningasup Ikerasaa		7252	72° 41' N	54° 58' W
Saqqarlersuaq		7451, 7452	74° 33' N	56° 55' W
Saqqarlersuup Sullua		7451, 7452	74° 32' N	56° 55' W
Saqqarsuaq		7251	72° 42' N	55° 51' W
Sarfaq		7302	73° 11' N	56° 7' W

Greenlandic	Danish	Map sheet(s)	Latitude	Longitude
Sermeq	Upernavik Isstrøm	7252	72° 56' N	54° 17' W
Siattorsuit		7302	73° 12' N	55° 45' W
Siattut		7252	72° 55' N	54° 57' W
Simiuttap Ikerasaa		7302	73° 19' N	55° 49' W
Sioraq		7201	72° 22' N	55° 37' W
Sisuarissut		7302	73° 1' N	55° 49' W
Sisuarissut Saqqaa		7251, 7302	73° 0' N	55° 39' W
Sullua		7201	72° 10' N	55° 15' W
Taartoq		7251	72° 56' N	55° 55' W
Taartuaqqat Kangerluarsuk		7252	72° 36' N	54° 43' W
Takisoq		7251	72° 52' N	56° 10' W
Taleruata Imaa		7201	72° 7' N	55° 55' W
Tasersuatsiaap Qaa		7252	72° 43' N	54° 33' W
Tasersuatsiaq		7252	72° 42' N	54° 39' W
Tasiusaq		7302	73° 20' N	55° 57' W
Tasiusaq Bugt		7301	73° 12' N	56° 59' W
Tassiussaq		7302	73° 21' N	56° 5' W
Tikeqqap Iterlaa		7201	72° 9' N	55° 57' W
Timilersua		7351, 7401, 7402	74° 1' N	56° 50' W
Tini		7251	72° 38' N	56° 7' W
Toqqusaaq		7301	73° 25' N	56° 37' W
Toqqusaarsuk		7301	73° 21' N	56° 35' W
Torsukattak		7252	72° 33' N	54° 59' W
Torsukattak		7201	72° 23' N	55° 5' W
Torsukattak		7251	72° 35' N	55° 52' W
Torsuut		7251	72° 46' N	55° 50' W
Tukingasoq		7201	72° 9' N	55° 53' W
Tukingasoq		7351, 7401	74° 1' N	57° 25' W
Tulugalissuaq		7451	74° 52' N	58° 6' W
Tulugalissuup Qeqertai		7451	74° 54' N	57° 50' W
Tulugalissuup Saarlia		7451	74° 49' N	58° 5' W
Tulugartalik		7251, 7252	72° 31' N	55° 30' W
Tulugartallip Sanilikassaa		7251, 7252	72° 32' N	55° 27' W
Tussaaq		7302	73° 4' N	56° 7' W
Tuttoqqortooq		7351	73° 39' N	56° 40' W
Tuttulikassaak	Lille Renland	7451	74° 57' N	57° 16' W
Uigorlersuaq		7301, 7302	73° 24' N	56° 11' W
Uigorli		7301, 7302	73° 26' N	56° 17' W
Uigorlia		7251	72° 50' N	55° 41' W
Uigorliarsuk		7351	73° 33' N	56° 55' W
Uigorluk		7201	72° 18' N	55° 51' W
Uilortusoq		7252	72° 47' N	54° 41' W
Uingasoq		7451	74° 46' N	57° 46' W
Umerluata Imaa		7201	72° 9' N	55° 43' W
Upernaviarsuit		7401	74° 14' N	57° 0' W
Upernaviarsuk		7251	72° 50' N	56° 15' W
Upernaviarsuk		7301	73° 27' N	56° 39' W
Upernaviarsuk		7251	72° 57' N	56° 6' W
Upernavik		7251	72° 47' N	56° 13' W

Greenlandic	Danish	Map sheet(s)	Latitude	Longitude
Upernavik Kujalleq	Søndre Upernavik	7201	72° 8' N	55° 25' W
Uummannaq		7302	73° 9' N	55° 31' W
Uummannaq		7251	72° 38' N	55° 52' W
	Hayes Gletcher	7451	74° 56' N	56° 59' W
	J.A.D. Jensen Øer	7451	74° 54' N	58° 5' W
	Ryder Øer	7451	74° 38' N	57° 50' W
	Sugar Loaf Bugt	7351, 7402	73° 59' N	56° 29' W
	Ussing Bræer	7352	73° 53' N	55° 33' W
	Wandel Land	7452	74° 34' N	56° 17' W

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15 Appendix E, names of animals in English, Danish and Greenlandic

English and *scientific* name **Engelsk og *videnskabeligt* navn** **Tuluttut ilisimatuussutsik kullu taaguutaat**	**Danish name** **Dansk navn** **Qallunaatut taaguutaat**	**Greenlandic name** **Grønlandsk navn** **Kalaallisut taaguutaat**
Fish and shellfish Fisk og skaldyr Aalisakkat il. il.		
American plaice *Hippoglossoides platessoides*	Håising	Oquutaq
Arctic char *Salvelinus alpinus*	Fjeldørred	Eqaluk
Arctic cod *Arctogadus glacialis*	Istorsk	
Atlantic cod *Gadus morhua*	Torsk	Saarullik
Atlantic halibut *Hippoglossus hippoglossus*	Helleflynder	Nataarnaq
Atlantic salmon *Salmo salar*	Laks	Kapisilik
Atlantic wolffish *Anarichas lupus*	Havkat	Qeeraaraq
Beaked redfish *Sebastes mentella*	Dybhavsrødfisk	Suluppaagaq itisoormiu
Blue mussel *Mytilus edulis*	Blåmusling	Uiloq
Butterfish *Pholis gunnellus*	Tangspræl	Pilaatalik
Capelin *Mallotus villosus*	Lodde	Ammassak
Cutthroat trout *Salmo clarki*	Cutthroat ørred	-
Deep sea shrimp *Pandalus borealis*	Dybvandsreje	Kinguppak
Golden redfish *Sebastes marinus*	Stor rødfisk	Suluppaagaq
Greenland cod *Gadus ogac*	Uvak	Uugaq
Greenland halibut *Reinhardtius hippoglossoides*	Hellefisk	Qaleralik
Long rough dab *Hippoglossoides platessiodes*	Håsing	Oquutaq
Lumpsucker *Cyclopterus lumpus*	Stenbider	Nipisa

Fish and shellfish cont. **Fisk m.m.** **Aalisakkat il. il.**		
Polar cod *Boreogadus saida*	Polartorsk	Eqalugaq
Redfish *Sebastes spp.*	Rødfisk	Suluppaagaq
Sand eel *Ammodytes sp.*	Tobis	-
Scallop *Chlamys islandica*	Kammusling	Uiluiq
Shorthorn sculpin *Myoxocephalus scorpius*	Almindelig ulk	Kanajoq
Spottet wolffish *Anarhicas minor*	Plettet havkat	Qeeraq milattooq
Snow crab *Chionoecetes opilio*	Krabbe	Saattuaq
Starry skate *Raja radiata*	Tærbe	Allernaq
Three-spined stickleback *Gasterosteus aculeatus*	Trepigget hundestejle	Kakilisak pingasunik kap-inartulik
Wolffish *Anarhicas sp.*	Havkat	

Birds **Fugle** **Timmisat**		
Arctic skua *Stercorarius parasiticus*	Almindelig kjove	Isunngaq
Arctic tern *Sterna paradisaea*	Havterne	Imeqqutaalaq
Atlantic puffin *Fratercula arctica*	Lunde	Qilanngaq
Black guillemot *Cepphus grylle*	Tejst	Serfaq
Black-legged kittiwake *Rissa tridactyla*	Ride	Taateraaq
Common eider *Somateria mollissima*	Ederfugl	Miteq siorartooq
Common guillemot (common murre) *Uria aalge*	Almindelig lomvie	Appa sigguttooq
Cormorant *Phalacrocorax sp.*	Skarv	Oqaatsoq
Glaucous gull *Larus hyperboreus*	Gråmåge	Naajarujussuaq
Great black-backed gull *Larus marinus*	Svartbag	Naajarluk
Great cormorant *Phalacrocorax carbo*	Storskarv	Oqaatsoq
Great northern diver *Gavia immer*	Islom	Tuullik
Great shearwater *Puffinus gravis*	Storskråpe	Qaqullunnaq
Great skua *Stercorarius skua*	Storkjove	-
Grey phalarope *Phalaropus fulicarius*	Thorshane	Kajuaraq
Harlequin duck *Histrionicus histrionicus*	Strømand	Toornarviarsuk
Iceland gull *Larus glaucoides*	Hvidvinget måge	Naajarnaq
Ivory gull *Pagophila eburnea*	Ismåge	Naajavaarsuk
King eider *Somateria spectabilis*	Kongeederfugl	Miteq siorakitsoq
Little auk (dovekie) *Alle alle*	Søkonge	Appaliarsuk
Long-tailed duck *Clangula hyemalis*	Havlit	Alleq

Birds cont. **Fugle** **Timmisat**		
Longtailed skua *Stercorarius longicaudus*	Lille kjove	Papikkaaq
Mallard *Anas platyrhynchos*	Gråand	Qeerlutooq
Northern fulmar *Fulmarus glacialis*	Mallemuk	Qaqulluk
Pomarine skua *Stercocarius pomarinus*	Mellemkjove	Isunngarsuaq
Purple sandpiper *Calidris maritima*	Sortgrå ryle	Saarfaarsuk
Raven *Corvus corax*	Ravn	Tulugaq
Razorbill *Alca torda*	Alk	Apparluk
Red-breasted merganser *Mergus merganser*	Toppet skallesluger	Paaq
Red-necked phalarope *Phalaropus lobatus*	Odinshane	Naluumasortoq
Red-throated diver *Gavia stellata*	Rødstrubet lom	Qarsaaq
Sabine's gull *Larus sabini*	Sabinemåge	Taateraarnaq
Brünnich's guillemot (Thick-billed murre) *Uria lomvia*	Polarlomvie	Appa
White-tailed eagle *Haliaeetus albicilla*	Havørn	Nattoralik

Mammals **Pattedyr** **Uumasut miluumasut**		
Bearded seal *Erignathus barbatus*	Remmesæl	Ussuk
Bedlamer *Phoca groenlandica*	Grønlandssæl (blåside)	Allattooq
Blue whale *Balaenoptera musculus*	Blåhval	Tunnulik
Bottlenose whale *Hyperoodon ampullatus*	Døgling	Anarnak
Bowhead whale *Balaena mysticetus*	Grønlandshval	Arfivik
Fin whale *Balaenoptera physalis*	Finhval	Tikaagulliusaaq
Harbour porpoise *Phocoena phocoena*	Marsvin	Niisa
Harbour seal *Phoca vitulina*	Spættet (spraglet) sæl	Qasigiaq
Harp seal *Phoca groenlandica*	Grønlandssæl (sortside)	Aataaq
Hooded seal *Cystophora cristata*	Klapmyds	Natsersuaq
Humpback whale *Megaptera novaeangliae*	Pukkelhval	Qipoqqaq
Killer whale *Orcinus orca*	Spækhugger	Aarluk
Minke whale *Balaenoptera acutorostrata*	Vågehval (sildepisker)	Tikaagullik
Narwhal *Monodon monoceros*	Narhval	Qilalugaq qernertaq
Polar bear *Ursus maritimus*	Isbjørn	Nanoq
Ringed seal *Phoca hispida*	Ringsæl (netside)	Natseq
Sei whale *Balaenoptera borealis*	Sejhval	Tunnullit ilaat
Sperm whale *Physeter macrocephalus*	Kaskelot	Kigutilissuaq
Walrus *Odobenus rosmarus*	Hvalros	Aaveq
White whale (Beluga) *Delphinapterus leucas*	Hvidhval (hvidfisk)	Qilalugaq qaqortaq

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ENVIRONMENTAL OIL SPILL SENSITIVITY ATLAS FOR THE NORTHERN WEST GREENLAND (72°-75° N) COASTAL ZONE

This oil spill sensitivity atlas covers the shoreline and the offshore areas of West Greenland between 72° N and 75° N. The coastal zone is divided into 118 shoreline segments and the offshore zone into 3 areas. A sensitivity index value is calculated for each segment/area, and each segment/area is subsequently ranked according to four degrees of sensitivity. Besides this general ranking a number of smaller areas are especially selected as they are of particular significance, they are especially vulnerable to oil spills and they have a size making oil spill response possible. The shoreline sensitivity ranking are shown on 13 maps (in scale 1:250,000), which also show the different elements included and the selected areas. Coast types, logistics and proposed response methods along the coasts are shown on another 13 maps. The sensitivities of the offshore zones are depicted on 4 maps, one for each season. Based on all the information, appropriate oil spill response methods have been assessed for each area.

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