



Fisheries and Oceans
Canada

Pêches et Océans
Canada

Fisheries
Management

Gestion
des pêches

Integrated Fishery Management Plan

Greenland Halibut *(Reinhardtius hippoglossoides)*

Northwest Atlantic Fisheries Organization Subarea 0

Effective 2014



Canada

Produced by:

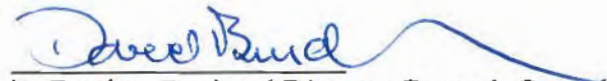
Fisheries and Oceans Canada
Central and Arctic Region
Resource Management and Aboriginal Affairs
501 University Crescent
Winnipeg, MB
R3T 2N6

FORWARD

The purpose of this Integrated Fishery Management Plan (IFMP) is to identify the main objectives and requirements for the Greenland Halibut fishery in Northwest Atlantic Fisheries Organization Subarea 0, as well as the management measures that will be used to achieve these objectives. This document also serves to communicate the basic information on the fishery and its management to Fisheries and Oceans Canada (DFO) staff, legislated co-management boards and other stakeholders. This IFMP provides a common understanding of the basic “rules” for the sustainable management of the fisheries resource.

This IFMP is not a legally binding instrument which can form the basis of a legal challenge. The IFMP can be modified at any time and does not fetter the Minister’s discretionary powers set out in the *Fisheries Act*. The Minister can, for reasons of conservation or for any other valid reasons, modify any provision of the IFMP in accordance with the powers granted pursuant to the *Fisheries Act*.

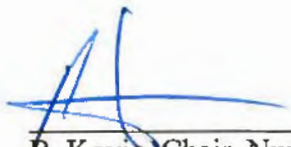
Where DFO is responsible for implementing obligations under land claims agreements, the IFMP will be implemented in a manner consistent with these obligations. In the event that an IFMP is inconsistent with obligations under land claims agreements, the provisions of the land claims agreements will prevail to the extent of the inconsistency.



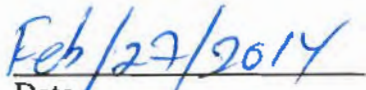
D. Burden, Regional Director General, Central and Arctic Region, Fisheries and Oceans Canada



Date



B. Kovio, Chair, Nunavut Wildlife Management Board



Date

Table of Contents

List of Tables	vi
List of Figures	vi
List of Appendices	vi
Acronyms	vii
1. Overview of the Fishery.....	9
1.1. Location of the Fishery	9
1.2. Type of Fishery	9
1.3. Historical Development of the Fishery	9
1.3.1. Division OB	9
1.3.2. Division OA	10
1.4. Participants	11
1.4.1. Division OA	11
1.4.2. Division OB	11
1.5. Fishery Characteristics	11
1.5.1. Division OA	11
1.5.2. Division OB	12
1.6. Governance	13
1.7. Approval Process	14
2. Stock Assessment, Science, and Traditional Knowledge	14
2.1. Biological Synopsis	14
2.2. Ecosystem Interactions	16
2.3. Traditional Ecological Knowledge	17
2.4. Stock Assessment	17
2.5. Stock Scenarios	18
2.6. Precautionary Approach	18
2.7. Research	18
3. Economic, Social and Cultural Importance of the Fishery	19
4. Management Issues	20
4.1. Fisheries Issues	20
4.2. Depleted Species Concerns	22
4.3. Oceans and Habitat Considerations	23
4.4. Gear Impacts	24
4.5. International Issues	26
5. Objectives.....	26
6. Access and Allocation	28

7. Management Measures.....	29
8. Shared Stewardship Arrangements	32
9. Compliance Plan	33
9.1. Conservation and Protection Program Description	33
9.2. Regional Compliance Program Delivery	33
9.3. Consultation	34
9.4. Compliance Performance.....	34
9.5. Compliance Issues and Strategies	34
10. Performance Review	34
 References	 35
 Glossary.....	 39
 Appendices.....	 42

List of Tables

Table 1. Ten most common species caught in science surveys conducted in NAFO Division 0A (1999) and Division 0B (2000).	17
Table 2. Long and short term objectives for the Subarea 0 Greenland Halibut fishery.....	26

List of Figures

Figure 1. Coral locations by group (a) and sponge locations (b) found in the Canadian eastern Arctic (DFO 2010b).	24
Figure 2. Narwhal Overwintering and Coldwater Coral Zone in Division 0A closed to Greenland Halibut fishing.	31

List of Appendices

Appendix 1. Key provisions of the Nunavut Land Claims Agreement related to the Greenland Halibut fishery.....	42
Appendix 2a. Stock assessment for Greenland Halibut in Northwest Atlantic Fisheries Organization Subarea 0+1A (offshore) and 1B-F	46
Appendix 2b. Bycatch summary.....	59
Appendix 3. Depleted species concerns.....	60
Appendix 4. Overview of current management measures in the Subarea 0 Greenland Halibut fishery.....	63
Appendix 5. Fishery and economic conditions.....	66
Appendix 6. Maps	71
Appendix 7. Safety at sea.....	72

Acronyms

C&A	Central and Arctic Region, Fisheries and Oceans Canada
C&P	Conservation and Protection, Fisheries and Oceans Canada
CAD	Canadian dollar
CCG	Canadian Coast Guard
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CTD	Conductivity, temperature, depth
DFO	Fisheries and Oceans Canada
DSC	Digital Selective Calling
EBSA	Ecologically and Biologically Significant Area
EPIRB	Emergency Position Indicating Radio Beacon
GINR	Greenland Institute of Natural Resources
ICES	International Council for the Exploration of the Sea
IFMP	Integrated Fishery Management Plan
LOA	Length Over All
MCTS	Marine Communications and Traffic Services
Minister	Minister of Fisheries and Oceans Canada
N&L	Newfoundland and Labrador Region, Fisheries and Oceans Canada
NAFO	Northwest Atlantic Fisheries Organization
NLCA	Nunavut Land Claims Agreement
NSA	Nunavut Settlement Area
NWMB	Nunavut Wildlife Management Board
RV	Research Vessel
SARA	<i>Species At Risk Act</i>
TAC	Total Allowable Catch
TC	Transport Canada
TEK	Traditional Ecological Knowledge
USD	United States dollar
VHF	Very High Frequency

VMS Vessel Monitoring System

1. Overview of the Fishery

Greenland Halibut (*Reinhardtius hippoglossoides*) are a deep water fish commonly referred to as Turbot in Canada. Based on available evidence, Greenland Halibut comprise a single population throughout the Northwest Atlantic, although some data suggest Greenland Halibut found in the Gulf of St. Lawrence are a separate population. However, for management purposes this large Greenland Halibut population is divided into smaller stock assessment units, one of which is the Northwest Atlantic Fisheries Organization (NAFO) Subarea 0 and Division 1A (offshore) and Divisions 1B-F unit shared between Canada and Greenland. The Canadian portion of this stock assessment unit is Subarea 0 (Appendix 6).

1.1. Location of the Fishery

The Greenland Halibut fishery addressed by this Integrated Fishery Management Plan (IFMP) occurs in Subarea 0. Subarea 0 is divided into a northern region, Division 0A (Baffin Bay) which extends from 78°10'N to 66°15'N, and a southern region, Division 0B (Davis Strait) which extends from 66°15'N to 60°12'N. The area covered in this IFMP excludes the inner portion of Cumberland Sound, for which a separate IFMP is being developed. The boundary between Division 0A and Division 0B coincides with a natural oceanographic boundary between marine ecoregions (Powles et al. 2004) consisting of a colder High Arctic water mass to the north and a warmer North Atlantic water mass to the south. Many marine fauna (mammals, fish, and seabirds) show regime shifts at this same approximate divide. Fishing primarily occurs along the Baffin Island and Greenland shelf slopes in waters 800-1,300m deep.

1.2. Type of Fishery

The Subarea 0 fishery is a commercial fishery with the exception of that portion of Division 0A which falls within the Nunavut Settlement Area (NSA). In this area there is an exploratory fishery with a quota for Nunavut inshore fisheries development. This quota is not transferable to the offshore.

1.3. Historical Development of the Fishery

1.3.1. Division 0B

Fishing began in the mid 1960's in what is now called Division 0B by foreign fleets. Since the ratification of the "Third Convention of the Law of the Sea" in 1977, Canada has exercised its 200 nautical mile fisheries jurisdiction. The Canadian Greenland Halibut commercial fishery began in Division 0B in 1981. At this time most of the Canadian quota was allocated to foreign countries (i.e. Union of Soviet Socialist Republics, German Democratic Republic, Faroe Islands, Norway, and Japan). These foreign allocations were steadily reduced until they were eliminated in 1992. In 1988, the Inuit of what is now Nunavut received an inshore allocation of 100 tonnes (t). During the 1990s, with the collapse of most major groundfish resources in the Northwest Atlantic, Greenland Halibut became the most significant groundfish fishery in the region (Bowering 1999). Meanwhile, the Greenland Halibut stock began to decline in biomass and shift in age structure (Bowering et al. 1995, in Morgan and Bowering 1997). In 1994, based on the

first detailed assessment of the Subarea 0 and Division 1A (offshore) and Divisions 1B-F Greenland Halibut stock (Atkinson et al. 1994, cited in Bowering 1999), the NAFO Scientific Council recommended the Total Allowable Catch (TAC) be reduced significantly from 25,000t to 11,000t. Canada's TAC for Subarea 0 (which consisted only of Division 0B at that time) dropped from 12,500t to 5,500t and was assigned to Division 0B in 2001 following the expansion of the fishery into Divisions 0A and 1A and the establishment of a separate quota for the northern area (see below). The Division 0B quota remained at this level until 2010, when it was increased to 7,000t based on results of scientific surveys.

Beginning in 1986, a winter, through-ice longline fishery was developed in the innermost portion of Cumberland Sound. Catches in this fishery peaked in 1992 at 430t. Declining catches throughout the 1990s were due mainly to deteriorating ice conditions that limited safe access. Over the years catches have varied from less than 100t to over 400t, depending on ice conditions and effort. In 2004, the NAFO Scientific Council recommended a separate stock management area be established for the traditional winter fishing grounds for Greenland Halibut in the inner portion of Cumberland Sound. In February 2005, the Nunavut Wildlife Management Board (NWMB) and Minister of Fisheries and Oceans Canada (Minister) established a Total Allowable Harvest of 500t for Greenland Halibut which could be fished at any time of the year in the new Cumberland Sound Turbot Management Area. This 500t is separate from the existing Division 0B quota. This fishery was converted from exploratory to commercial in 2008. This IFMP excludes the Cumberland Sound Turbot Management Area, for which a separate IFMP is being developed.

There was very limited fishing conducted in the 1990s in the inshore. As well, a small inshore summer fishery was conducted in the Division 0B portion of Cumberland Sound between 2009 and 2011.

Recent quotas and catches of Greenland Halibut in Division 0B are provided in Appendix 5, Table 1.

1.3.2. Division 0A

Before 1996 there was no Greenland Halibut commercial fishery in Division 0A. From 1996 to 2000 an effort based exploratory fishery was granted to Nunavut interests in Division 0A. These harvests were not counted against the Canadian Subarea 0 TAC of 5,500t. In 2000 the NAFO Scientific Council recommended an additional TAC for Division 0A and the offshore area of Division 1A and, as a result, in 2001 Canada established an exploratory fishery quota of 3,500t in Division 0A. Since 2001, the quota for Division 0A has increased several times based on data from surveys initiated by Canada and Greenland in both Divisions 0A and 1AB and subsequent favorable stock assessments. From 2001 to 2004 the use of foreign vessels by Nunavut fishing interests was approved to assist in the development of the Division 0A fishery. By 2004, foreign vessels were no longer in use. In 2006, a quota increase of 2,500t was established for Division 0A and reserved entirely for Nunavut interests. The NWMB recommended 100t of the Division 0A quota increase be designated for fisheries development within the NSA. The exploratory fishery of Division 0A was converted to commercial status in 2007 with the exception of the

portion of Division 0A which falls within the NSA. Since 2008, the quota for the offshore has remained at 6,400t and the quota for inside the NSA has remained at 100t.

Harvestable quantities of Greenland Halibut in the inshore may exist in deep water channels connected to offshore waters. Hunters and Trappers Organizations adjacent to these deep water areas have conducted exploratory fisheries over the years in Eclipse Sound, Scott Inlet and Sam Ford Fjord, Kingnelling Fjord, Makiak, Coronation and Kangert Fjords.

Recent quotas and catches of Greenland Halibut in Division 0A are provided in Appendix 5, Table 1.

1.4. Participants

1.4.1. Division 0A

In Division 0A, the quota is reserved exclusively for Nunavut interests. The NWMB has established an *Allocation Policy for Commercial Marine Fisheries* to assist it in making individual allocation recommendations for Nunavut enterprises to the Minister for consideration. Successful Nunavut allocation recipients are provided access to the fishery. Nunavut owned vessels are used to exploit this quota however vessel charters and harvest arrangements with southern based Canadian fishing companies are commonly used. Appendix 5, Table 2 details allocations in Division 0A.

1.4.2. Division 0B

At its inception in 1981, most of the Greenland Halibut Division 0B quota was allocated to foreign countries. Over the years, foreign allocations were reduced steadily and eliminated by 1992. By 1998 the use of foreign vessels was eliminated, all vessels in the Division 0B fishery were Canadian owned, and stabilized enterprise allocations were formed. In 2000, the competitive quotas for groundfish licence holders (900t for fixed gear and 600t for mobile gear) were limited to historical participants from Nova Scotia and Newfoundland. In 2008, the mobile gear competitive quota was converted to Enterprise Allocations at share levels agreed to amongst fleet members. In 2009, Nunavut interests acquired access to the Division 0B fixed gear competitive fishery. The quota is currently shared between Special Allocations, Enterprise Allocations and a competitive allocation. Participants include interests from Nunavut, Nunavik, Labrador, Newfoundland and Nova Scotia. Appendix 5, Table 3 details allocations in Division 0B. As in Division 0A, the Special Allocation for Nunavut is sub-allocated to Nunavut interests as described above.

1.5. Fishery Characteristics

1.5.1. Division 0A

The Division 0A fishery operates on the calendar year as an enterprise allocation type fishery among Nunavut interests as approved by the Minister. There are no gear specific fleets in this fishery. Both mobile and fixed gear vessels are used and vessels are typically greater than 28m

(92') in length due to the harsh environment and location of this fishery. All vessels used in the offshore are outfitted with factory freezer capabilities.

The Division 0A fishing season is dictated by the presence of sea ice but typically begins in June and ends in November. There is an overall fishing pattern based on season and gear type. The larger trawl vessels usually start in the north as the ice begins to clear. They approach this area by travelling along the ice free Greenland coast and move across northern Baffin Bay into Canadian waters. These vessels then retreat southwards down the Baffin coast in the fall as new sea ice begins to form. The smaller fixed gear vessels tend to concentrate in the southern portion of Division 0A however fishing has occurred by both mobile and fixed gear vessels as high as 72°N latitude.

Catches are taken using either bottom otter trawl (single and twin trawl configurations) or fixed gear (longline or gillnet). Specifically for fixed gear in the offshore, to date longlines have been used in only two years (2002 and 2003) with bottom set gillnets used exclusively since 2004. The average number of vessels operating in Division 0A between 2005 and 2011 was 10. During these years, the number of vessels using mobile gear varied between 2 and 4, while the number of vessels using fixed gear varied between 5 and 9 (Appendix 5, Figure 1). In 2011 approximately half of the Division 0A quota was taken by mobile gear and half by fixed gear. Lack of infrastructure (i.e. port facilities and processing plants) in the North presents landing constraints. As a result, catches are offloaded predominately in Greenland ports.

In some years a limited amount of fishing has occurred under the 100t exploratory inshore quota.

1.5.2. Division 0B

The Division 0B fishery operates on the calendar year. There is a mix of different fleets and allocations in the Division 0B fishery however, the majority of the 7,000t quota is managed via Enterprise Allocations (2480t) and Special Allocations (3620t) which are permitted to use specified vessel sizes and gears. In the offshore, both mobile (single and twin bottom otter trawl configurations) and fixed (longline or gillnet) gear vessels are used and all have factory freezer capabilities. The following fleets currently participate: Vessels 19.8m to 30.48 m Length Over All (LOA) Using Fixed Gear; Vessels Greater than 30.48 m LOA Using Fixed Gear or Mobile Gear; and, Scandinavian Longline Vessels Using Fixed Gear. The fishing season is dependent on ice conditions and usually starts in May and finishes at the end of November.

A 900t competitive quota is accessible to three fixed gear fleets: Vessels Less than 19.8m LOA Using Fixed Gear; Vessels 19.8m to 30.48 m LOA Using Fixed Gear; and Scandinavian Longline Vessels Using Fixed Gear. Vessels use bottom set longlines or gillnets and all have factory freezer capabilities. Historically the fishery has opened within the first or second week of June and ends when the quota is reached.

On average between 2005 and 2011, there were 16 vessels fishing in Division 0B each year. During these years, the number of mobile gear vessels ranged between 7 and 12, while the number of fixed gear vessels ranged between 5 and 9 (Appendix 5, Figure 2). In 2011 ~60% of the Division 0B quota was taken by mobile gear and ~40% by fixed gear. Lack of infrastructure

(i.e. port facilities and processing plants) in the North presents landing constraints. As a result catches are offloaded predominately in Greenland and Newfoundland and Labrador ports.

Interest exists in further development of an inshore summer fishery in the Division 0B portion of Cumberland Sound.

1.6. Governance

Canada and Denmark (on behalf of Greenland) request the NAFO Scientific Council to conduct the stock assessment for the Subarea 0 and Division 1A (offshore) and Divisions 1B-F stock area, including recommendations on TACs for Division 0A and 1A (offshore) and 1B in the north and Divisions 0B and 1C-F in the south. Canada retains management authority for stocks in Subarea 0, while Greenland retains management authority in Subarea 1.

Canada's *Fisheries Act*, and the *Fishery (General) Regulations* and the *Atlantic Fishery Regulations, 1985* made thereunder, as well as the *Oceans Act* and the *Species at Risk Act (SARA)* are the main pieces of federal legislation under which the Subarea 0 Greenland Halibut fishery is managed. The powers granted pursuant to these Acts and Regulations permit the Minister to specify licence conditions related to vessel type, gear, species and catch limits, incidental catch, fishing restrictions, information reporting, vessel monitoring system, *SARA* listed species etc. The *Fisheries Act* provides the Minister ultimate responsibility for the management of marine fisheries. The *Fish Inspection Act* and *Fish Inspection Regulations* govern processing operations aboard vessels.

The Subarea 0 Greenland Halibut fishery is managed consistent with the *Nunavut Land Claims Agreement (NLCA)* and the *Nunavik Inuit Land Claims Agreement*. These Agreements are treaties within the meaning of section 35 of the *Constitution Act, 1982* and set out a co-management system for wildlife/resource management. While Government retains ultimate responsibility for wildlife management within and outside respective settlement areas, the Agreements, among other things, set out the harvesting rights of the beneficiaries to the respective Agreements, provide for the establishment of wildlife management structures, set out the role of those structures and cooperative management processes, and contain provisions related to defined waters outside of the settlement areas. The *NLCA* sets out procedural and substantive requirements on the Minister related to the management of the Subarea 0 fishery, and sets out the role of the NWMB. Specific roles and responsibilities of the NWMB and key provisions of the *NLCA* related to the management of this fishery are provided in Appendix 1. The *Nunavik Inuit Land Claims Agreement* also imposes requirements on the Minister related to commercial harvesting in the Southern Davis Strait Zone (which in general terms refers to NAFO Division 0B).

Fisheries and Oceans Canada (DFO) has developed a National Sustainable Fisheries Framework (<http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/fish-ren-peche/sff-cpd/overview-cadre-eng.htm>), with the following primary goal:

“to ensure that Canada's fisheries are environmentally sustainable, while supporting economic prosperity. This means maintaining a balance between healthy fish stocks and marine environments, while allowing for prosperous fisheries; a balance known as ‘sustainable development’.”

Policies contained within the National Sustainable Fisheries Framework promote an ecosystem-based approach to fisheries management, and include *A Fishery Decision-making Framework Incorporating the Precautionary Approach* and *Managing Impacts of Fishing on Benthic Habitat, Communities and Species*. This policy framework applies to the Subarea 0 Greenland Halibut fishery.

1.7. Approval Process

This IFMP applies to the Subarea 0 Greenland Halibut fishery in waters both inside and outside the NSA. The *NLCA* sets out a co-management system for decisions related to the management of this fishery. The NWMB, in exercising its roles and responsibilities as set out in the *NLCA*, provides fisheries management decisions (inside the NSA) and recommendations (outside the NSA) to the Minister for decision, following processes set out in the *NLCA*.

In addition to working with co-management organizations, the management of the Subarea 0 Greenland Halibut fishery is done in collaboration with fishery participants and other stakeholders. Fishery review meetings with co-management organizations and stakeholders are held to review current management measures, discuss management issues, and provide management recommendations. In accordance with the terms of the *NLCA* as noted above, applicable management recommendations are provided for NWMB decision and/or advice. Stakeholder and NWMB decision/recommendations, as approved by the Minister, are incorporated into the IFMP for final approval by the Minister (or designate).

2. Stock Assessment, Science, and Traditional Knowledge

2.1. Biological Synopsis

Greenland Halibut belong to the order Pleuronectiformes, a group of flat, bilaterally asymmetrical fish. They live in the cold northern waters of the Pacific and Atlantic Oceans.

Greenland Halibut of the Northwest Atlantic are highly migratory; fish tagged and released in Davis Strait, Baffin Bay, and the fjords of southwestern and eastern Greenland have moved south to the northern slopes of the Grand Bank of Newfoundland and as far east as Denmark Strait (between Greenland and Iceland) (Boje 2002a). This movement ensures genetic mixing and prevents genetic separation into distinct populations (Arthur and Albert 1993; Vis et al. 1997; Roy 2012). The Northwest Atlantic population extends south from Baffin Bay to the waters off the continental slope of Labrador and outer Grand Banks east of Newfoundland, east into Greenland waters and Denmark Strait (Boje 2002a), and possibly to Icelandic and Norwegian waters (Vis et al. 1997). Divisions 0A and 0B Greenland Halibut are part of this much larger population.

Greenland Halibut in the fjords of northwestern Greenland appear to be resident in these fjords, and once they have migrated from offshore nursery areas to the fjords, they do not intermingle with fish in the offshore or more southerly fjords (Boje 2002a). Evidence from a smaller tagging study conducted in Cumberland Sound suggested that a similar resident stock may exist there (Treble 2003). In 2004 NAFO Scientific Council reviewed the information available and

concluded that Greenland Halibut in the Cumberland Sound traditional winter fishing grounds do not move beyond these grounds. They recommended the establishment of a separate management unit for Greenland Halibut in the inner portion of Cumberland Sound.

The Baffin Bay-Davis Strait Greenland Halibut stock is thought to originate primarily in the deep-water (800-2000m) spawning grounds in Davis Strait near the submarine ridge between Baffin Island and Greenland (Boje 2002a, Bowering 1999), from about 67° N to south of Flemish Pass off Newfoundland (Boje 2002b). Greenland Halibut spawning does not show a clear seasonality, and peak spawning does not coincide year after year (Boje 2002b). Females produce relatively few, heavily yolked eggs (6,100-188,400 eggs/female) that result in large larvae with high survival rates.

The proportion of females found in spawning condition in catches or in surveys is greater in Davis Strait than in Baffin Bay (Harris et al. 2009, Simonsen and Gundersen 2005). Several theories as to why this occurs have been suggested: 1) Greenland Halibut conduct spawning migrations from Baffin Bay to Davis Strait; 2) there is local spawning in Baffin Bay with an extended adolescent phase and/or multi-year maturation cycle that might explain the large proportion of fish classed as immature; and 3) a majority of fish in Baffin Bay never enter a spawning phase due to a lack of energy surplus caused by harsh environmental conditions (Simonsen and Gundersen 2005).

Once spawning occurs, eggs and then larvae drift for up to four months before they metamorphose into the bottom-dwelling life stage (Boje 2002b). Eggs and larvae originating in the Davis Strait spawning grounds are thought to drift with the currents along the coast of West Greenland and then westwards, until larvae settle on the Greenland and Baffin Island shelves (Templeman 1973, in Boje 2002b). These relatively shallow waters (<400m) in Baffin Bay and Davis Strait are considered nursery areas where fish are thought to spend the first few years of their lives. Larger fish are found at greater depths and it is believed that the fish migrate off the banks into deeper waters, i.e. eastward into the fjords of Northwest Greenland and south and westward into Baffin Bay and Davis Strait (Jørgensen 1997).

Greenland Halibut size at maturity varies widely over space and time (Morgan and Bowering 1997). Length of females at 50% maturity was measured at 69cm for fish caught in the 1993 Division 0B deep-water gillnet fishery (Morgan and Bowering 1997). Data from research surveys in Division 0B showed that the length at 50% maturity for females was 62cm in 2000 and 67cm in 2001 (Morgan and Treble 2006). Surveys in Division 0A showed a significant decline in 50% maturity from 80cm or greater in 1999 and 2004 to 67cm in 2006 and 73cm in 2008 (Harris et al. 2009). As with previous maturity studies in Division 0A, Harris et al. (2009) confirm that very few of the fish collected in Division 0A surveys are mature.

Ages have not been used in assessments for Subarea 0 and Division 1A(offshore) and Divisions 1B-F for several years since an accurate and precise age determination method for Greenland Halibut does not currently exist. Research to determine one is continuing. Several age reading methods for Greenland Halibut were described and evaluated together with validation results at an International Council for the Exploration of the Sea (ICES) workshop in 2011. The different methods could be classified into two groups: A) Those that produce age-length relationships that

are similar to the traditional methods described by the joint NAFO-ICES workshop in 1996, which typically indicate ages around 10-12 years for 70cm fish; and B) Several recently developed techniques that produce much higher estimates of longevity and approximately half the growth rate from 40-50cm onwards compared to the traditional method. Group B methods typically produce age estimates around 20 years or more for 70cm fish. Validation results from studies conducted on samples from Subarea 0 support the new Group B methods.

2.2. Ecosystem Interactions

Greenland Halibut feed on a variety of species during their lives. Orr and Bowering (1997) found that individual size was the most important variable related to species composition in the diet, followed by depth and latitude. Small fish (<20cm) feed on small pelagic crustaceans, while intermediate-sized fish (about 20-60cm) feed mainly on a variety of small fish, squid and northern shrimp (*Pandalidae*) wherever these are abundant. Larger Greenland Halibut (>60cm) feed mostly on other fish, preferring larger species such as redfish (*Sebastes* spp.) and grenadiers (*Macrouridae*) (Orr and Bowering 1997, Dwyer et al. 2010).

Cod (*Gadus morhua*) and other species eat Greenland Halibut larvae, while cod and larger Greenland Halibut eat young Greenland Halibut. The Greenland Shark (*Somniosus microcephalus*) and Narwhal (*Monodon monoceros*) are considered to be the main predators of adult Greenland Halibut in Baffin Bay and Davis Strait (Lairdre et al. 2004). Hooded Seals (*Cystophors cristata*), Ringed Seals (*Phoca hispida*), and Beluga Whales (*Delphinapterus leucas*) are also important predators of adult Greenland Halibut (Crawford 1992). Scientists working in Greenlandic waters have noticed the periodic disappearance of Greenland Halibut often coincides with increased sightings of Beluga Whales, and the occasional appearance of whales into the fjords is often followed by reduced catches of Greenland Halibut. Values of natural mortality used in stock assessment calculations for North American stocks of Greenland Halibut have varied between 0.10 (Ernst and Bormann 1987, in Crawford 1992) and 0.20 (Darby et al. 2004). This equates to 10-20% of the population per year.

Environmental conditions are warmer on the west coast of Greenland compared to the east coast of Baffin Island. Moreover, bottom temperatures in Division 0A are normally at or near 0°C, which is three to four degrees cooler than bottom temperatures at similar depths in Division 0B (Treble 2002 and Treble 2011). The relationship between environmental conditions and Greenland Halibut growth and reproduction is not fully understood, but the greater densities of Greenland Halibut on the shelf and in fjords of Northwest Greenland suggests oceanographic conditions may be favourable there.

Distinct groups of fish species have been described for Baffin Bay and Davis Strait based on data of species abundance and distribution collected during bottom trawl surveys (Jørgensen et al. 2005, 2011). Greenland Halibut are common throughout Subarea 0 but the fish assemblages found in Division 0A and Division 0B are different from each other (Table 1). These differences may be partially attributable to environmental conditions.

Table 1. Ten most common marine fish species caught in science surveys conducted in NAFO Division 0A (1999) and Division 0B (2000). Four species present in both areas are marked with an asterix.

0A	Occurrence (no. sets/65)	Total Abundance (all sets)	0B	Occurrence (no. sets/66)	Total Abundance (all sets)
Greenland halibut*	65	11935	Greenland halibut*	66	5545
Snailfish	62	432	Roughhead grenadier	51	718
Threebeard rockling*	54	527	Deepwater redfish*	46	4276
Glacier lanternfish*	47	630	Threebeard rockling*	40	176
Arctic cod	32	10516	Giotre black smelt	36	821
Eelpout	31	105	Blue hake	34	491
Arctic skate	28	169	Glacier lanternfish*	32	397
Deepwater redfish*	24	976	Longnose eel	31	199
Hookear sculpin	17	100	Lantern fish	29	672
Mailed sculpin	14	230	Roundnose grenadier	28	540

The nature and impact of climate change on the marine ecosystem in this area is unknown. There are scientific experts who hypothesize that significant regime shifts will occur, or are already occurring in the oceans of the world. Such large scale oceanographic regime shifts in the Baffin Bay/Davis Strait ecoregion would have to be considered in the management of Greenland Halibut.

2.3. Traditional Ecological Knowledge

Inuit and fisher Traditional Ecological Knowledge (TEK) is an important component of fisheries management and is used with scientific knowledge for effective fisheries decision-making. DFO routinely consults resource users on a wide range of topics (e.g. management issues, stock assessment studies, quotas, management measures) and incorporates their views and traditional knowledge in the development of scientific research and fishery management plans. While Inuit did not traditionally fish Greenland Halibut, Inuit fishers as well as other users have knowledge of the resource. For example, Inuit have experience in the Cumberland Sound inshore fishery which can contribute to our understanding in areas such as climate change, sea ice patterns, and fish movements. TEK can contribute to an understanding of long-term changes in environments that ultimately affect the management of Greenland Halibut in Subarea 0.

2.4. Stock Assessment

The current stock assessment for Greenland Halibut in NAFO Subarea 0 and Division 1A (offshore) and Divisions 1B-F is detailed in Appendix 2a. Biomass and abundance indices, length frequency distribution and catch-per-unit-effort (CPUE) are currently the key metrics used in stock assessments and subsequent recommendations from the NAFO Scientific Council on TACs. Issues surrounding accurate ageing of Greenland Halibut preclude age related information from being used in stock assessment.

2.5. Stock Scenarios

NAFO Scientific Council recommended TACs are set on the basis of stock biomass and abundance indices, catch size structure from both the fishery and science surveys and fishery catch-per-unit effort indices. Attempts to model the stock using either age based or production models has not been successful. Large Greenland Halibut are able to avoid the survey gear and therefore it is difficult to determine spawning stock biomass or mortality estimates. In general, the lack of an assessment model and precise estimates of Greenland Halibut age and growth makes predicting the impact of fishing effort on future stock recruitment difficult (Morgan and Bowering 1997).

2.6. Precautionary Approach

The *Fishery Decision-Making Framework Incorporating the Precautionary Approach* applies to fish stocks that are the targets of a commercial, recreational, or subsistence fishery. It may be applied more broadly to other stocks, if necessary or as circumstances warrant.

The *Framework* requires that a harvest strategy be incorporated into respective fishery management plans to keep the removal rate moderate when the stock status is healthy, promote rebuilding when stock status is low, and ensure a low risk of serious or irreversible harm to the stock. It also requires a rebuilding plan when a stock reaches low levels. In general, the precautionary approach in fisheries management is about being cautious when scientific knowledge is uncertain, and not using the absence of adequate scientific information as a reason to postpone action or failure to take action to avoid serious harm to fish stocks or their ecosystem. This approach is widely accepted as an essential part of sustainable fisheries management (DFO 2006a).

A precautionary approach to the management of the Subarea 0 Greenland Halibut fishery, consistent with the basic tenants set out in the *Framework*, is applied. Priority is given to monitoring the stock and establishing a data time series to support management decisions. Biomass, abundance and recruitment indices are used to indicate stock status. Scientific uncertainty is quantified by including standard errors for these indices. This approach is based on biological criteria established by Science and peer reviewed through the NAFO Scientific Council process. Scientific uncertainty and uncertainty related to the implementation of management measures are explicitly considered when evaluating stock status and making management decisions. The application of a precautionary approach to this fishery is done in concert with fishers, co-management organizations and other stakeholders through the Integrated Fishery Management Plan process.

2.7. Research

Research is critical to provide information needed for the sustainable management of Greenland Halibut. Fishery independent multi-species surveys are an important part of this research and provide the data required to establish biomass and abundance indices, size/age structure and recruitment of Greenland Halibut, as well as other species caught during the survey. The

expense of conducting large offshore fishery research necessitates collaborative approaches. Since the surveys began in Division 0A in 1999, DFO has received support from NWMB, Nunavut fishing enterprises, the Government of Nunavut, Nunavut Tunngavik Inc., Makivik Inc. and the Greenland Institute of Natural Resources (GINR). Greenland Halibut, other commercial and non-commercial species are sampled for abundance, weight and other biological parameters. Temperature, depth, salinity, conductivity (CTD) data have also been collected at each fishing station since 2007. In addition, three oceanographic transects have been established in Division 0A since 2004, and fluorescence is also measured at these stations along with CTD data. Sampling of oceanographic parameters allow the differentiation of cold arctic polar water and warmer Atlantic water by strata, and can be useful in understanding the distribution, growth and reproduction of Greenland Halibut.

Science gaps will be addressed on a priority basis in order to achieve full ecosystem-based management of the Greenland Halibut fishery.

3. Economic, Social and Cultural Importance of the Fishery

The Canadian Subarea 0 Greenland Halibut commercial fishery began in 1981 in Division 0B. The fishery was established in Division 0A in 1996. Over the years, as more information has become available on the stock, the Canadian TAC has increased to the current 13,500t (Division 0A quota=6,500t, Division 0B quota=7,000t).

In Division 0A, during 2005–2011, average Greenland Halibut landings were 5,864t generating an average landed value of \$26 million. In Division 0B, during 2005–2011, average Greenland Halibut landings were 5,951t generating an average landed value of \$25 million. Of the average landings of 5,951t, Central & Arctic Region (C&A) accounted for 34%, Newfoundland & Labrador Region (N&L) for 63% and Maritimes Region for 3%. Table 4 in Appendix 5 provides annual landings and landed value for this time period.

In the absence of fishery specific information to properly assess the economic viability of the Greenland Halibut fishery, several useful indicators are worth tracking to focus on the trends in recent years. These include, but are not restricted to, landings and landed values, external variables affecting income from the fishery (e.g. exchange rate), cost of operations (e.g. price of crude oil), Gross Domestic Products of importing countries, and changing market environments. Trends in these variables explain in part the current economic viability of the Greenland Halibut fishery.

The role played by exchange rates is highly significant for the Canadian economy because international trade is a sizeable part of Canada's total output. Over the past couple of decades, the value of the Canadian dollar (CAD) has fluctuated widely against most major currencies. Moreover, as most Canadian trade occurs in the US dollar (USD), the value of the Canadian dollar against the US dollar is especially crucial. Based on a Bank of Canada dataset, since 2005, its value has been as low as 1.26 CAD/USD in the second quarter of 2005 and first quarter of 2009 and as high as 0.95 CAD/USD in the third quarter of 2011 (Appendix 5, Figure 3). During the period 2005–2011, the Canadian dollar appreciated by over 18% against the US dollar. Such

an unprecedented level of appreciation of the Canadian dollar against the US dollar has substantial implications on revenues from Greenland Halibut fishing activities.

The surge in the Canadian dollar has not only been experienced with the US dollar but also with other major trading partners (e.g. United Kingdom, European Union, China, and Russia). For instance, the value of the Euro fell by 9.0% against the Canadian dollar between 2005 and 2011. During the same period, while the value of Chinese currency rose marginally, the values of United Kingdom and Russian currencies fell against the Canadian dollar by 28% and 21%, respectively.

Another major concern for harvesters is the ever increasing costs of production. The prices of all inputs (e.g. fuel, labour, gear) have gone up significantly in Canada in the last decade. For example, the price of fuel has risen substantially over that time and is the biggest operating cost for harvesters. The price of crude oil per barrel mostly fluctuated in the early 2000s but has maintained an upward trend since then. Based on data retrieved from the World Bank, during 2005-2011, the price of crude oil rose by 59% (from CAD64 to CAD102) or an average of 8% per year (Appendix 5, Figure 4).

Therefore, even though the Greenland Halibut fishery holds potential to contribute to the participating regions' economic growth, the rise in fuel costs coupled with the appreciation of the CAD against the USD has significantly squeezed the profit margin of harvesters in the Greenland Halibut fishery in recent years.

Income of major trading partners, which is widely measured as Gross Domestic Product, is a major determinant of the volume and prices of Canadian exports of fish and fish products. International Monetary Funds projected economic growth to be much higher in China and developing Asia as compared to European Union and Japan.¹ Since income is a major determinant of product demand, the projected higher growth in major importing countries is beneficial and may be considered to be a sign of stable and/or higher demand for Greenland Halibut in upcoming years.

Finally, eco-certification of a fishery from one of the international certification bodies, which is being driven by retailers and the food service sector, has gained significant momentum and become much more mainstream (The United Nations Environment Program, 2009). Meeting these increasing buyer preferences imposes additional costs on harvesters.

4. Management Issues

4.1. Fisheries Issues

The following issues have been raised by stakeholders or identified by DFO and will be addressed through the IFMP process:

¹ Although stronger than expected growth in Europe is projected, significant risks remain due to sovereign debt and banking concerns. These factors increase Canada's domestic economic risk for the fishing industry.

Scientific Knowledge - The multi-species surveys are the main basis for Greenland Halibut stock assessment and TAC recommendations. Given their multi-species nature, these surveys also provide data on other bottom dwelling animals, benthic habitat and oceanographic conditions, as well as a means for obtaining samples for future study (e.g. genetic and biodiversity research and monitoring). Specific studies on Greenland Halibut are required to delineate stocks and understand reproduction, age determination, recruitment and migration. As well, ecosystem research is necessary to better predict stock trends and understand the impacts of fishing on sensitive benthic areas, other species, and the ecosystem in general. Surveys and research need to continue to support management decisions and resource conservation.

Implementation of a precautionary approach – There are a number of scientific data limitations which preclude the use of standard biomass and harvest metrics to determine reference points and stock status for the Subarea 0 Greenland Halibut stock. As outlined in the *Fishery Decision-Making Framework Incorporating the Precautionary Approach*, in cases where insufficient stock-specific information is available, different approaches may be used to provide guidance for management and assessment of stock sustainability. Biomass, abundance and recruitment indices are used to indicate the condition of this stock. Work is planned to explore the use of proxies for calculating reference points and defining harvest decision rules.

Size distribution of catch - Fish size composition of catches in Subarea 0 varies depending on gear type and Division (Appendix 2a, Figure 9). The fishery has primarily been a trawl based fishery since it began in the mid-1960s, and currently there is a mix of both fixed gear and mobile gear types used to prosecute the fishery. Trawls catch primarily small, immature fish, whereas gillnets catch larger fish with a mix of immature and mature status. Science assessments continue to show the stock is healthy with stable or increasing trends in recruitment, biomass and abundance indices. These trends suggest the level of exploitation and harvesting approach have been effective to date.

Recently, some stakeholders have identified a desire to monitor the harvest of large mature roe bearing fish and reduce catches of small immature fish. Under DFO's *Procedures for Monitoring and Control of Small Fish Catches and Incidental Catches in Atlantic Groundfish Fisheries* (<http://www.glf.dfo-mpo.gc.ca/Gulf/FAM/Groundfish-Information/Small-Fish-Protocol>), designated areas may be closed when the number of undersized fish reaches or exceeds 15% of the catch. DFO will continue to closely monitor biological indices and the size distribution of the catch, and will take action as needed to ensure sustainability of the resource.

Bycatch management – Improvements are needed in bycatch management, including reporting on both retained and released bycatch species as well as clear and consistent information in all Subarea 0 Greenland Halibut fishery management documents. Effective solutions to specific bycatch issues will need to be developed in collaboration with harvesters.

Reporting – Issues exist with the accuracy of information reported to DFO including discard amounts, bycatch amounts, product form, and landings. Timeliness of reporting is also an issue in some cases. This information is used to monitor quotas and effectiveness of management measures. It is also essential for demonstrating sustainable harvesting and fish harvested are legal, reported and regulated. Concerted efforts are required by all licence holders to provide timely, accurate and complete information as outlined in licence conditions. DFO will continue

to work with industry and, where applicable, international counterparts to improve reporting in the Greenland Halibut fishery.

Fishery monitoring - Fishery monitoring means observing and understanding the fishery and its dynamics. Monitoring is carried out by harvesters, third party At-sea Observers designated by DFO, and DFO staff. Both the level and pattern (e.g. random, targeted) of monitoring, as well as affordability and practicality of implementation, need to be considered when designing a monitoring program so results can be extrapolated legitimately to the operation of the entire fishery. A variety of tools and best practices are used to meet fishery monitoring requirements. New approaches and technologies need to be considered and tested. In collaboration with fishery participants, DFO will assess the risks and management requirements of the Subarea 0 Greenland Halibut fishery, review the efficiency of the current fishery monitoring and reporting program, and make changes as required to support sustainable harvesting practices.

Fishery modernization – DFO is implementing a number of changes aimed at modernizing fisheries management to ensure Canada's fisheries are more sustainable, prosperous and competitive for years to come. These changes will be phased in over time in the Subarea 0 Greenland Halibut fishery, beginning in 2013, and will make better use of common modern technology, ensure services are consistent nationally, and bring greater stability to the fishing industry. In addition, the establishment of fixed shares for the Division 0B competitive fishery will increase stability and predictability in resource allocations among harvesters and encourage strategic business planning and longer-term considerations of the health of the resource. These transitions will require cooperation by all parties.

Compliance – There are a number of ongoing compliance issues in this fishery as outlined in Chapter 9 of this Plan. Conservation & Protection (C&P) continue to work with industry representatives as well as vessel captains to address compliance issues. Enforcement action is taken when warranted.

Performance review – Given the broad range of stakeholders involved in this fishery, great distances to be traveled, and high costs for many, it requires significant commitment and effort from all parties to attend face-to-face meetings. More frequent discussions amongst all stakeholders would build relationships and lead to more timely identification and resolution of issues. Frequency, timing and format of future meetings need to be discussed with stakeholders and alternatives to in person meetings explored. As well, indicators and targets to measure progress on achieving objectives need to be developed.

4.2. Depleted Species Concerns

Subarea 0 contains several depleted species which have either been listed under *SARA* (<http://www.sararegistry.gc.ca>), assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (<http://www.cosewic.gc.ca>) and awaiting *SARA* listing, or are under a DFO moratorium. These species are of conservation concern for a number of reasons such as historical over-harvesting, climate change effects, industrial activity, vessel traffic, incidental capture, or habitat disturbance. For species that are listed as Threatened or Endangered under *SARA* Schedule

1, automatic prohibitions apply and *SARA* recovery strategies and action plans must be developed within a set time. Also to be noted is the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) of which Canada is a member. CITES is an international agreement that ensures international trade in specimens of wild animals and plants does not threaten their survival (<http://www.cites.ec.gc.ca>). Appendix 3 lists species known to interact with the Greenland Halibut fishery and for which concerns exist. Their status (i.e. *SARA* status, COSEWIC designation, CITES listing and applicable moratoria) along with the threats and management measures relevant to the Greenland Halibut fishery are also included.

There are also species which do not fall under any of the above formal listing processes but for which concerns exist. For example, sharks and skates typically grow slowly, mature late, and produce few offspring making them susceptible to overexploitation. Depletion in stocks can occur rapidly and recovery times can be long. Given their life history characteristics, in addition to the limitations in scientific and stock status information, the precautionary approach to management and conservation of these species is warranted. DFO has developed a *National Plan of Action for the Conservation and Management of Sharks* (<http://www.dfo-mpo.gc.ca/npoa-pan/npoa-pan/npoa-sharks-eng.htm>) which covers all elasmobranchs, including sharks and skates. This *Plan* states objectives and actions, including ones related to increased reporting of elasmobranch bycatch and reduction in elasmobranch bycatch.

4.3. Oceans and Habitat Considerations

DFO has developed criteria for the identification of Ecologically and Biologically Significant Areas (EBSAs) in Canada's oceans (DFO CSAS report 2004/006). All habitats are important ecologically. However, certain ones are particularly significant to the functioning of the ecosystem or to specific stages of the life history of a species. EBSAs do not have legal status, but rather are to be considered as areas requiring risk averse management during planning and decision making processes.

The identification of EBSAs is a key component for the following initiatives:

- Development of ecosystem-based management in the marine environment;
- Compilation of a knowledge base for the development of the Arctic component of Canada's network of Marine Protected Areas, which is called for in the *Oceans Act*; and
- Implementation of DFO's Sustainable Fisheries Framework.

A science advisory meeting was held in 2011 and six areas were broadly identified within Subarea 0 (Hatton Basin-Labrador Sea-Davis Strait, Cumberland Sound, Baffin Island Coastline, Baffin Bay Shelf Break, Southern Baffin Bay, and Northern Baffin Bay) (DFO 2011). Given current limitations in data and changes that are expected to occur in Arctic ecosystems (e.g. climate change), it was recognized further work will be needed to refine these boundaries and potentially identify more specific areas within each of these broadly identified EBSAs.

Sensitive cold-water corals, including *Paragorgia arborea*, *Acanella arbuscula*, *Flabellum* spp. and *Keratoisis ornata* have been identified in the deep waters (>500 m) of Subarea 0 (Figure 1a). The current Greenland Halibut fishing closure in Division 0A (see description of Narwhal Overwintering and Coldwater Coral Zone in Section 7, Management Measures) helps protect

these corals. Sponges (identified as species within the Geodidae family and similar to the species complex identified in the NAFO Regulatory Area on the slope of the Grand Banks) are also important habitat-forming species that have been found in Subarea 0 (Figure 1b). A *Coral and Sponge Conservation Strategy for Eastern Canada* is currently under development and will have a similar format to the *Pacific Region Cold-Water Coral and Sponge Conservation Strategy* <http://www.pac.dfo-mpo.gc.ca/oceans/protection/docs/cscs-pcce-eng.pdf>.

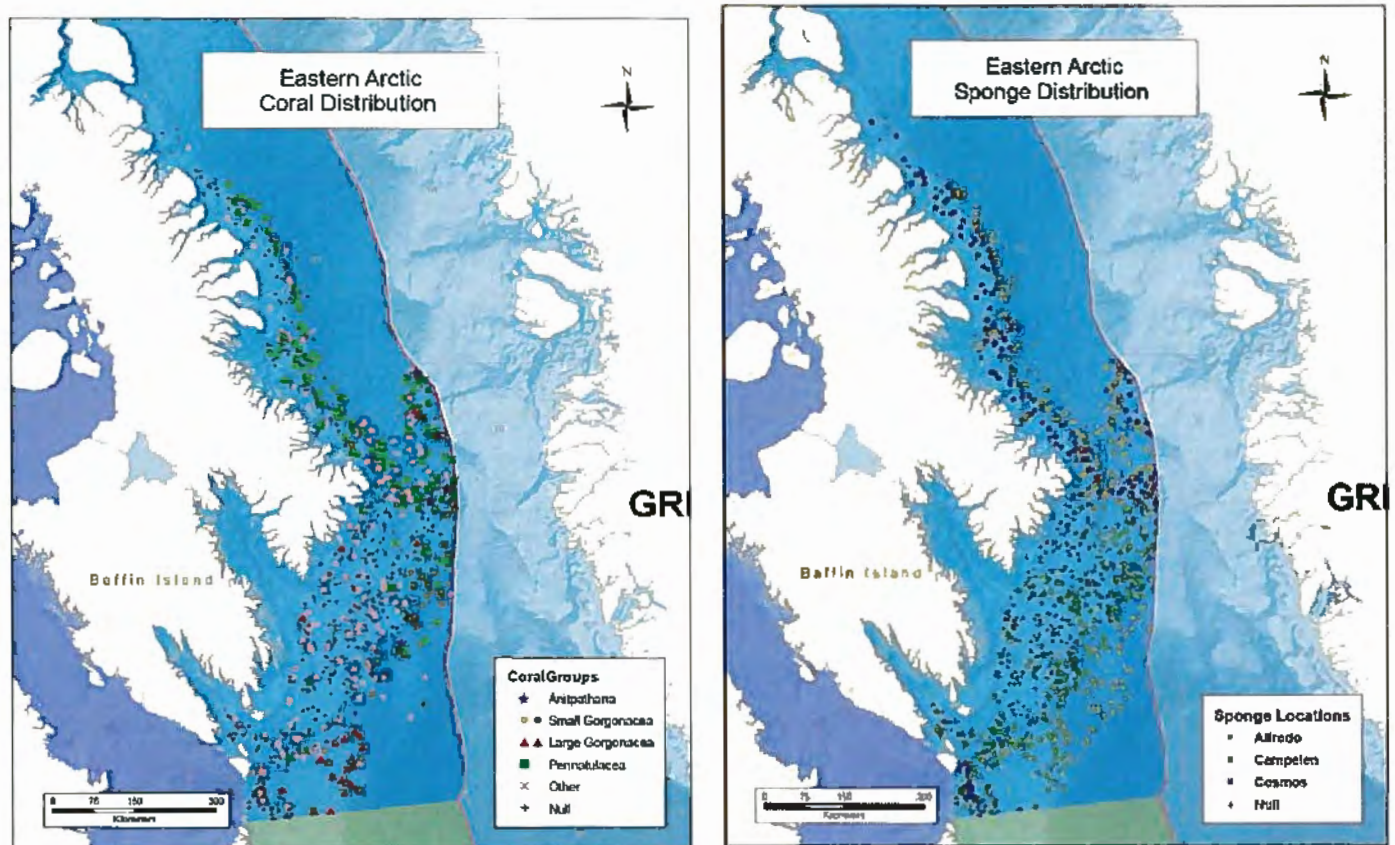


Figure 1. Coral locations by group (a) and sponge locations (b) found in the Canadian eastern Arctic (DFO 2010b).

4.4. Gear Impacts

Size and age composition of Greenland Halibut catches in Subareas 0 and 1 can vary depending on gear type (Jørgensen 2002). Specifically, trawls catch primarily small fish (approx. range 35-65 cm) that are immature, whereas gillnets catch larger fish (approx. range 50-85 cm) with a mix of immature and mature status. Length of females at 50% maturity ranges from ~67-80cm in Division 0A and ~62-67cm in Division 0B (Harris et al. 2009).

Different gear types can have different bycatch rates. Tables 1 and 2 in Appendix 2b contain a summary based on At-sea Observer records from the 2009 and 2010 fisheries. In the Division 0A fishery, 81 species or families were recorded as bycatch during 11 trips in the trawl fishery and 61 species were recorded during 17 trips in the gillnet fishery. Greenland Shark, Thorny

Skate, Arctic Skate and Roughhead Grenadier were the most commonly caught bycatch species by both gear types. In the Division 0B trawl fishery, 120 species or families were recorded over 13 trips. The most commonly caught species were Greenland Shark, Thorny Skate, several grenadiers, redfish, Northern Wolffish and sponge. Thirty eight species were recorded during two observed trips in the Division 0B gillnet fishery and the most common bycatch recorded was Roughhead Grenadier.

The Northern Wolffish and Spotted Wolffish have been designated as threatened species under the *SARA*. Measures established in recovery plans require the release of wolffish and where alive in a manner that causes the least harm, or the retention of wolffish only for the purpose of scientific study. Records of wolffish encounters from At-sea Observer data and logbook information by region are being kept to assist monitoring efforts.

There are Beluga, Narwhal, Bowhead, Sperm and Bottlenose whale populations in Subarea 0, and the potential for net entanglement is a concern. Areas of particular concern include the following:

- Cumberland Sound, which Beluga, Narwhal and Bowhead frequent during the open water season;
- the deeper waters (500-1500m) of Baffin Bay, where Sperm and Bottlenose whales are found in summer months and where narwhal overwinter; and
- Davis Strait, where Bowhead wintering grounds are located.

In offshore areas Bottlenose Whales and diving sea birds can become entangled in fishing gear.

In 2007, DFO developed a *National Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries* (<http://www.dfo-mpo.gc.ca/npoa-pan/npoa-pan/npoa-seabirds-eng.htm>).

Overall, fishing effort with longlines in the Canadian Arctic is very low compared to other areas. Longline vessels do not currently operate in the offshore Greenland Halibut fishery in Division 0A and there are usually 1 or 2 longline vessels operating in Division 0B in any given year.

Different gear types also have different benthic habitat impacts. DFO Science reviewed information available on the impacts of trawling on ocean-bottom habitat in 2006 (DFO 2006b) and other gear types on ocean-bottom habitat in 2010 (DFO 2010a). The information issued from these meetings represents the scientific basis on which Canadian policy regarding the management of fishing gears has been developed in the *Policy for Managing the Impacts of Fishing on Sensitive Benthic Areas* (<http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/fish-ren-peche/sff-cpd/benthi-eng.htm>).

Longline gear is the only gear authorized for use in Cumberland Sound and it is the gear recommended for use in other inshore areas of Baffin Island (DFO 2008, Treble and Stewart 2010). Gillnets used to capture Greenland Halibut are very different from nets used to catch Arctic Char in coastal areas. Greenland Halibut gillnets are typically made up of many (20 or more) individual nets of approximately 91m in length strung together to create net gangs. They have large mesh (153–229mm) and are set on the bottom in very deep water (>500m). Impacts and risks associated with Greenland Halibut gillnet fisheries in inshore areas of Baffin Island include: entanglement of marine mammals and Greenland Shark in nets that are actively fishing; entanglement of marine mammals, Greenland Shark, Greenland Halibut and other fish species in

nets that become lost; selective removal of large Greenland Halibut females that could affect future spawners and recruitment; and, quality of the fish is affected as fish are usually dead or damaged by the twine or Greenland Sharks (Treble and Stewart 2010).

Timely, accurate and complete information from both harvesters and third party At-sea Observers is important to monitor and address gear impact related issues.

4.5. International Issues

Canada has various international commitments, agreements and obligations regarding commercial marine fisheries and has developed domestic policies and tools (e.g. Sustainable Fisheries Framework) to support them. These will be implemented in the Subarea 0 Greenland Halibut fishery in a phased and progressive manner over a number of years based on priorities established by DFO in consultation with fishery groups and other fishery interests.

In particular, Canada is a signatory to the United Nations Fish Stocks Agreement (1995) which provides for the coordinated management of highly migratory fish stocks occurring in zones of national jurisdiction and on the high seas. International cooperation through regional fisheries management organizations, such as NAFO, is key to its implementation. The Subarea 0 fishery falls under this agreement because the Greenland Halibut Subareas 0 and 1 stock is highly migratory moving between Canada and Greenland as well as south into international waters managed by NAFO. Canada and Denmark (on behalf of Greenland) ask the NAFO Scientific Council to conduct the stock assessment and provide TAC recommendations for this stock however a cooperative management mechanism is not in place.

Also to be noted, a substantial portion of Greenland Halibut caught in this fishery is offloaded in foreign ports (e.g. Greenland, Iceland). No bilateral arrangements currently exist with these countries to monitor landing activity.

5. Objectives

Objectives for the Greenland Halibut fishery are a key component of the IFMP. Long term objectives guide the management of the fishery and may be categorized as stock conservation, ecosystem, shared stewardship, compliance, and social, cultural and economic objectives. Each long term objective is supported by one or more short term objectives to address existing management issues in the fishery. The objectives listed in Table 4 were developed in consultation with industry, co-management and Inuit organizations, and other stakeholders.

Table 2. Long and short term objectives for the Subarea 0 Greenland Halibut fishery.

Long-term Objective	Short-term Objective
<i>Stock Conservation</i>	
Conserve the Greenland Halibut stock through sustainable use and effective fishery management.	<ul style="list-style-type: none"> • Improve knowledge of Greenland Halibut biology through the continuation of ageing, maturity, genetics and migration studies.

Long-term Objective	Short-term Objective
	<ul style="list-style-type: none"> • Secure funding for annual multi-species surveys to monitor Greenland Halibut abundance and biomass. • Improve the timeliness and accuracy of reporting in the fishery. • Promote fishing practices that maximize quality of the catch thereby minimizing discards. • Review the current fishery monitoring program once a national catch monitoring and reporting framework is in place. • Explore the use of proxies for determining reference points.
Take a precautionary approach to fishery decisions for the Subarea 0 Greenland Halibut stock.	<ul style="list-style-type: none"> • Given uncertainties related to the Subarea 0 Greenland Halibut stock, take a precautionary approach to setting TACs.
Ecosystem	
Conserve sensitive benthic areas through effective fishery management.	<ul style="list-style-type: none"> • Promote fishing practices that avoid or mitigate impacts on sensitive benthic habitats.
Conserve bycatch species through effective fishery management.	<ul style="list-style-type: none"> • Promote fishing practices that avoid or mitigate impact on bycatch species. • Improve bycatch reporting in order to account for total catch. • Improve reporting of marine mammal encounters.
Shared Stewardship	
Promote collaboration, participatory decision making, and shared responsibility with resource users, co-management organizations and other interested parties.	<ul style="list-style-type: none"> • Conduct Greenland Halibut fishery meetings with stakeholders on a more frequent basis. • Transition shared responsibility, accountability and decision making to licence holders within the constraints of the <i>Fisheries Act</i> and land claims agreements.
Promote collaborative science and management initiatives with Greenland.	
Social, Cultural and Economic	
Promote a competitive and prosperous fishing industry that is able to maximize value from fisheries resources and generate economic growth, while ensuring stocks remain healthy and abundant for future generations.	<ul style="list-style-type: none"> • Establish shares for the Division 0B competitive fixed gear fishery for stability in allocation and effective management. • Support increased market access initiatives such as eco-certification.

Long-term Objective	Short-term Objective
	<ul style="list-style-type: none"> Continue to take into account relevant land claim agreements and Government of Canada strategies and policies when making access and allocation decisions.
Compliance	
Support effective fisheries management through a comprehensive compliance program.	<ul style="list-style-type: none"> Conduct a risk assessment of compliance issues. Implement a variety of compliance activities and tools to address identified risks.

6. Access and Allocation

There are two elements that frame the sharing of adjacent marine resources: access (i.e. licences for participating in the fishery) and allocation (i.e. distribution of quota). The Minister can, for reasons of conservation or for any other valid reasons, modify access, allocations and sharing arrangements as outlined in this IFMP in accordance with the powers granted pursuant to the *Fisheries Act*. See Tables 2 and 3 in Appendix 5 for current allocations for the fishery.

When making decisions regarding access to fisheries resources, primary consideration is given to conservation. Other important considerations taken into account include relevant land claims agreements, the principle of adjacency, historical dependence and economic viability. In a similar vein, the allocation of any increase in Canadian TAC is determined based on relevant land claims agreements, adjacency, historical participation, economic viability and other considerations. This approach also applies to future decisions.

With respect to the Greenland Halibut Subarea 0 fishery, relevant provisions of the *NLCA* and *Nunavik Inuit Land Claims Agreement* apply. These agreements set out specific requirements regarding the management and allocation of fisheries resources.

Inside the NSA, the NWMB is the main instrument of wildlife management and the main regulator of access to wildlife in the NSA. Article 5 of the *NLCA* sets out a detailed process under which the Minister may accept, reject or vary decisions of the NWMB (s. 5.3.3, s. 5.3.4 and s. 5.3.16 to s. 5.3.23). The major roles and responsibilities of the NWMB are set out in s. 5.2.33, s. 5.2.34, s. 5.2.37 and s. 5.2.38 of the *NLCA*. Appendix 1 lists the key provisions of the *NLCA* related to the Greenland Halibut Subarea 0 fishery.

The majority of the fishery in Divisions 0A and 0B takes place in waters adjacent to the NSA. In the *NLCA*, Canadian waters of Baffin Bay and Davis Strait (Divisions 0A and 0B) outside the NSA waters are referred to as Zone I. Regarding fisheries in waters adjacent to the NSA, section 15.3.4 of the *NLCA* sets out the circumstances under which the advice of the NWMB must be sought and considered; s. 15.3.4 “Government shall seek the advice of the NWMB with respect to any wildlife management decisions in Zones I and II which would affect the substance and value of Inuit harvesting rights and opportunities within the marine areas of the Nunavut

Settlement Area. The NWMB shall provide relevant information to Government that would assist in wildlife management beyond the marine areas of the Nunavut Settlement Area."

Section 15.3.7 of the *NLCA* sets out two requirements of the Minister: 1) The Minister must give special consideration to the principles of adjacency (as defined in the provision) and economic dependence of communities in the NSA on marine resources when allocating commercial fishing licences within Zones I and II. In section 15.3.7, adjacency means adjacent to or within a reasonable geographic distance of the zone in question; and 2) the Minister must apply the principles in such a way as to promote a fair distribution of licences (and quota) between residents of the NSA and other residents of Canada and in a manner consistent with Canada's interjurisdictional obligations.

Key provisions of the Nunavik Inuit Land Claims Agreement with respect to Greenland Halibut are s.5.4.7 which sets out that commercial harvesting benefits for Nunavut Inuit must exceed those provided to Nunavik Inuit and s.5.4.8 which sets out minimum percentages of the quota of Greenland Halibut in Division 0B for Nunavik Inuit based on different quota levels.

s.5.4.8: The portion in any calendar year will be determined for that year as follows:
(a) 2.54% of that part of the total allowable catch established by the Minister for NAFO Division 0B equal to or less than 5,500 metric tonnes; and
(b) 10% of that part of the total allowable catch established by the Minister for NAFO Division 0B in excess of 5,500 metric tonnes; but, for greater certainty, nothing in paragraphs (a) and (b) prevents the Minister from providing to a Makivik Designated Organization, or a Makivik Designated Organization from acquiring, outside of this Agreement, any additional allocation of Greenland Halibut in the Southern Davis Strait Zone.

With respect to access, there has been no increase in the number of licences issued by the Minister for participation in the fishery. No new access is being considered under the current management plan.

Access to Nunavut's share of the resource in Divisions 0A and 0B is determined in cooperation with the NWMB who provides recommendations to the Minister for decision with respect to allocations to Nunavut interests. To make these recommendations, the NWMB follows its *Allocation Policy for Commercial Marine Fisheries* (http://www.nwmb.com/index.php?option=com_content&view=article&id=80&Itemid=71&lang=en). Under the NWMB's policy, allocations would be provided for 5 year terms, subject to the NWMB's annual review to confirm evidence of satisfactory performance.

7. Management Measures

Management measures outline the controls or rules adopted for the fishery, including stock conservation and ecosystem management measures. These measures are based on the *Fisheries Act* and *SARA* and the regulations made under these acts. In addition, non-quota limitations may be established under the *NLCA* on harvesting activities in the NSA. For the Subarea 0 Greenland Halibut fishery, Canadian TACs are updated annually on the DFO Fisheries Management Decision website. Annual Variation Orders outline fishing season and areas. In

addition to the provisions set out in the *Fishery (General) Regulations* and *Atlantic Fishery Regulations, 1985*, specific management measures are outlined in annual licences. Conservation Harvest Plans for each fleet reiterate key management measures found in licences and the IFMP, as well as any industry proposed Codes of Conduct for responsible fishing. *SARA* requirements are included in licences, and licence conditions list species and specific mitigation measures. Habitat protection measures (including closures or partial closures) are also listed in licences. Appendix 4 provides an overview of management measures currently in place in the NAFO Subarea 0 Greenland Halibut fishery.

In 1998, DFO created an area where fishing effort for Greenland Halibut was restricted to minimize impacts on the winter food source and overwintering habitat for Narwhal. The boundaries for this area were defined based on the best information available (Figure 2). Coldwater coral concentrations, including gorgonian and antipatharian species, were first located along the steep shelf break in this same area during research surveys conducted in 1999 and 2001. In 2006, given the known negative impacts to corals by bottom contact fishing gear, DFO proposed a full closure to Greenland Halibut fishing in the restricted area. The full closure was incorporated into the 2006-2008 NAFO Subarea 0 Greenland Halibut Fishery Management Plan and implemented for the 2008 season (i.e. Narwhal Overwintering and Coldwater Coral Zone) (DFO 2007).

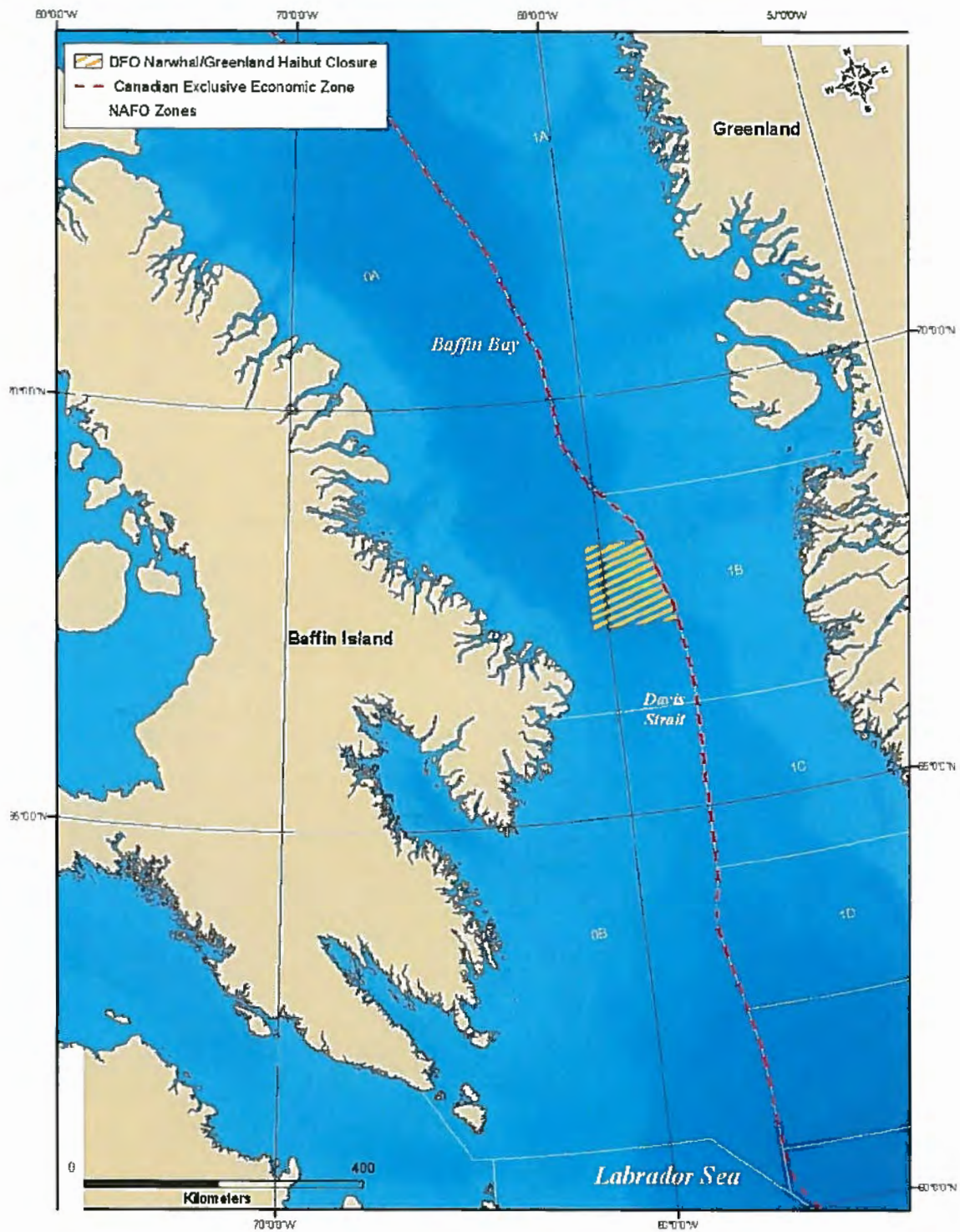


Figure 2. Narwhal Overwintering and Coldwater Coral Zone in Division OA closed to Greenland Halibut fishing.

As noted in Appendix 4, gillnets require a valid tag securely attached to the head rope of each net. If gillnets are lost, then their associated tag number is to be recorded in the fishing logbook as well as reported in the daily hail and every reasonable effort is to be made to retrieve them. Division 0A is closed to gillnets in November of each year to minimize gillnet loss from rapidly encroaching sea ice. There is no fishing with gillnets in Cumberland Sound.

Quota reconciliation is applied to the Subarea 0 Greenland Halibut fishery. Quota reconciliation provides that any overharvest of a quota in one year will be accounted for in advance of the following fishing season. The accounting will result in a quantity of fish equal to the quantity of the overrun being taken off the top of the allocation (i.e. not allocated) of the respective licence holder or fleet before the next fishing season starts. Quota reconciliation will facilitate the management of all fisheries and encourage harvest limits to be respected. Quota reconciliation will help to achieve conservation objectives for the resource, ensure that overruns by one fleet/harvester do not affect another, and provides industry with an increased responsibility in meeting conservation objectives. Quota Reconciliation Guidelines can be found at this link <http://www.glf.dfo-mpo.gc.ca/e0012110>.

8. Shared Stewardship Arrangements

The Greenland Halibut fishery has a long history of shared stewardship arrangements. Internationally, Canada and Denmark (on behalf of Greenland) ask the NAFO Scientific Council to conduct the Greenland Halibut stock assessment and provide TAC recommendations. As well DFO and the Greenland Department of Fisheries, Hunting and Agriculture are signatories to a Memorandum of Understanding on Issues Related to Satellite Based Vessel Monitoring System (VMS). DFO and the GINR also have a Memorandum of Understanding in support of collaborative research projects and the implementation of the multi-species survey. The offshore tagging project is one example of the collaborative projects undertaken by DFO and GINR researchers. Nationally, university and DFO researchers work together (e.g. benthic survey in Baffin Bay and Davis Strait) to understand ecosystem relationships in the Arctic marine environment. Regionally, co-management organizations, industry, and the Government of Nunavut have provided financial support to the multi-species survey program. Research undertaken in collaboration with the Government of Nunavut and its research vessel supports the development of inshore fisheries. In addition, the NWMB is continuing to work with DFO on verification reporting to support the NWMB's stewardship requirements under its *Allocation Policy for Commercial Marine Fisheries*. Conservation & Protection will continue to provide all pertinent information to the NWMB to assist in its evaluation process and understanding of the various compliance issues in the fishery, subject to privacy legislation.

Through a Memorandum of Understanding with Transport Canada (TC), DFO has committed to invite TC and CCG representatives to participate in the regional fishery management plan development process, including participation at regional fishery advisory committee meetings. DFO has also committed to ensuring safety considerations are outlined in every fishery management plan. Detailed safety-at-sea considerations and measures are presented in Appendix 7.

9. Compliance Plan

9.1. Conservation & Protection Program Description

The C&P program promotes compliance with legislation, regulations and management measures implemented to achieve the conservation and sustainable use of Canada's aquatic resources, and the protection of species at risk, fish habitat and oceans.

The program is delivered through a balanced regulatory management and enforcement approach including the following:

- Promotion of compliance through education and shared stewardship;
- Monitoring, control and surveillance activities; and
- Management of major cases / special investigations in relation to complex compliance issues.

9.2. Regional Compliance Program Delivery

Fishery Officers in the Central and Arctic Region (C&A) are responsible for compliance activities related to the Greenland Halibut fishery. These Officers are supported by Regional staff that provide oversight, *SARA* response and coordination, and also manage the air surveillance program. These Fishery Officers are designated under Section 5 of the *Fisheries Act* and have full enforcement powers and responsibilities outlined in the *Fisheries Act*, *Coastal Fisheries Protection Act*, *SARA*, *Criminal Code* and the *Constitution Act*. Fishery Officers can inspect and investigate groundfish vessels for compliance with Variation Orders, conditions of licences, as well as the *Fisheries Act* and related regulations.

Certified At-sea Observers are deployed to perform duties best described as "Observe, Record and Report." Duties are related to monitoring of fishing activities, examination and measurement of fishing gear, collection of biological samples, recording of scientific data, monitoring the landing of fish, and verification of the weight and species of fish caught and retained. Certified At-sea Observers are not enforcement personnel.

All vessels engaged in the NAFO Subarea 0 Greenland Halibut fishery are required to carry a DFO approved satellite tracking device. This VMS is used to monitor fleet activity particularly in and around closed areas and international boundaries as well as deploy surveillance resources.

With respect to monitoring capacities, both air surveillance and at-sea patrols are increasing with frequency in the NAFO Subarea 0 Greenland Halibut fishery. Patrol coverage using government or chartered aircraft with a Fishery Officer onboard is used to identify concentrations and distribution of fishing vessels. In particular, air patrols are necessary to monitor closed and/or conservation areas and the Canadian Greenland equidistant boundary for illegal foreign fishing. Flight reports, photographs and other data collected from the overflights are readily available to C&P managers and Fishery Officers.

Fishery Officers conduct joint patrols in the summer with Department of National Defense, monitoring for illegal foreign fishing activity and boarding domestic vessels to verify compliance

with licence conditions and other regulations. As well, Fishery Officers from both C&A and N&L work jointly to conduct at-sea boardings from Canadian Coast Guard (CCG) vessels in Davis Strait.

9.3. Consultation

C&P staff participates in fishery review meetings where compliance issues are presented and recommendations requested for resolution. As well, informal meetings continue on an ad hoc basis to resolve in-season matters. Fishery Officers present and discuss fisheries conservation during visits to local schools, trade shows and other events, plus interact with fishers and processors.

9.4. Compliance Performance

Post season analysis sessions are conducted with C&P and Resource Management staff to review issues encountered during the previous season and make recommendations on improving management measures.

9.5. Compliance Issues and Strategies

Compliance issues in this fishery include the following:

- failing to comply with reporting requirements;
- fishing in unlicensed areas;
- late submission of logbooks, daily hails and offload reports;
- lack of proper weighing of species and product type at offload; and
- unattended gear.

Fishery Officers conduct investigations in response to reported violations of fishing in the Narwhal Overwintering and Coldwater Coral fishing closure, other closed areas, licence conditions (e.g. logbook recording, VMS reporting), regulations (e.g. soak times), international boundary complaints and other elements of the fishery. Where warranted appropriate enforcement action is taken.

10. Performance Review

This IFMP was developed through a consultative process including resource users, co-management organizations, and other interested parties. DFO will continue to consult and liaise with these groups on an annual basis and as circumstances require, both through formal advisory processes as well as informal ad hoc or issue-related basis between advisory processes.

The stock will continue to be assessed annually through the NAFO Scientific Council and monitoring of the fishery will be accomplished using several tools including quota reports, daily hails, logbooks, VMS, Dockside Monitoring Programs, At-sea Observers, air surveillance and at-sea patrols.

References

- Arthur, J.R. and Albert E. 1993. Use of parasites for separating stocks of Greenland Halibut (*Reinhardtius hippoglossoides*) in the Canadian Northwest Atlantic. Canadian Journal of Fisheries and Aquatic Sciences 50: 2175-2181.
- Atkinson, D.B., Bowering, W.R., and W.B. Brodie. 1994. Analysis of data by At-sea Observers during the Greenland Halibut otter trawl fisheries in Subarea 0 during 1988-1993. NAFO SCR Doc. 94/47, Ser. No. N2417, 10 p
- Boje, Jesper. 2002a. Intermingling and seasonal migrations of Greenland Halibut (*Reinhardtius hippoglossoides*) populations determined from tagging studies. Fish. Bull. 100: 414-422.
- 2002b. (ed.) Greenland Halibut biology and population dynamics: state of the art and identification of research needs based on a Nordic workshop. TemaNord: Copenhagen. Authors: Albert, O.T., Bowering, W.R., Brodie, B., Gunderson, A., Hjörleifsson, E., Høines, Å., Junquera, S., Jørgensen, O.A., Reinert, J., Simonsen, C.S. and M. Treble. Part II.
- Bowering, W.R. 1999. Ecology, fisheries and management of Greenland Halibut (*Reinhardtius hippoglossoides* (Walbaum)) in the Canadian Northwest Atlantic. PhD. Thesis. Department of Fisheries and Marine Biology. University of Bergen, Bergen, Norway.
- Bowering, W.R., Brodie, W.B., Power, D., and M.J. Morgan. 1995. An assessment of the Greenland Halibut resource in NAFO Subarea 2 and Divisions 3KLMN. NAFO SCR Doc. 95/64 20pp.
- Crawford, R.E. 1992. Life history of the Davis Strait Greenland Halibut, with reference to the Cumberland Sound fishery. Canadian Manuscript Report of Fisheries and Aquatic Sciences 2130: iv + 19 p.
- Darby, C. B. Healey, J. Mahe, and W.R. Bowering. 2004. Greenland Halibut (*Reinhardtius hippoglossoides*) in Subarea 2 and Divisions 3KLMNO: An assessment of stock status based upon extended survivors analysis, ADAPT, and ASPIC analyses, with stochastic projections of potential stock dynamics. NAFO SCR Doc. 04/55. 53 p.
- DFO. 2004. Identification of Ecologically and Biologically Significant Areas. DFO Can. Sci. Advis. Sec. Ecosystem Status Rep. 2004/006.
- DFO. 2006a. A Harvest Strategy Compliant with the Precautionary Approach. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2006/023.
- 2006b. Impacts of Trawl Gears and Scallop Dredges on Benthic Habitats, Populations and Communities. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2006/025.

- DFO, 2007. Development of a Closed Area in NAFO 0A to protect Narwhal Over-Wintering Grounds, including Deep-sea Corals. DFO Can. Sci. Advis. Sec. Sci. Resp. 2007/002.
- DFO, 2008. Fixed gear recommendations for the Cumberland Sound Greenland Halibut fishery. DFO Can. Sci. Advis. Sec. Sci. Resp. 2008/011.
- DFO, 2010a. Potential impacts of fishing gears (excluding mobile bottom-contacting gears) on marine habitats and communities. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2010/003.
- 2010b. Occurrence, susceptibility to fishing, and ecological function of corals, sponges, and hydrothermal vents in Canadian waters. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2010/041.
- DFO, 2011. Identification of Ecologically and Biologically Significant Areas (EBSA) in the Canadian Arctic. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2011/055.
- Dwyer, K.S., A. Buren and M. Koen-Alonso. 2010. Greenland Halibut diet in the Northwest Atlantic from 1978 to 2003 as an indicator of ecosystem change. *Journal of Sea Research* 64: 436-445.
- Ernst, P. and H. Borrmann. 1987. On the natural mortality rate of Greenland Halibut stock (*Reinhardtius hippoglossoides* Walb.) off Canada and West Greenland. *Fisherei-Forschung*. 25(3): 11-12.
- Harris, L.N., Treble, M.A. and Morgan, M.J. 2009. An update of maturity in data for Greenland Halibut from trawl surveys of NAFO Subarea 0 with emphasis on Division 0A. NAFO SCR Doc. 09/025: 12 p.
- Jørgensen, O.A., 2002. Assessment of the Greenland Halibut Stock Component in NAFO Subarea 0 + Division 1A Offshore + Division 1B-1F. NAFO SCR. Doc 09/26. 16 p.
- Jørgensen, O.A., 1997. Movement Patterns of Greenland Halibut, *Reinhardtius hippoglossoides* (Walbaum), at West Greenland, as Inferred from Trawl Survey Distribution and Size Data. *J. Northw. Atl. Fish. Sci.*, Vol. 21: 23-37.
- Jørgensen, O.A., C. Hvingel, P. R. Møller and M. A. Treble 2005. Identification and mapping of bottom fish assemblages in Davis Strait and southern Baffin Bay. *Can. J. Fish. Aquat. Sci.* 62: 1833-1852.
- Jørgensen, O. A., C. Hvingel, and M. A. Treble. 2011. Identification and mapping of bottom fish assemblages in northern Baffin Bay. *J. Northw. Atl. Fish. Sci.*, 43: 65-79
doi:10.2960/J.v38.m666
- Jørgensen, O. A., and M. A. Treble. 2011. Assessment of the Greenland Halibut stock component in NAFO Subarea 0 + Division 1A Offshore + Divisions 1B-1F. NAFO SCR Doc. 12/31: 38 p.

- Laidre, K. L., M. P. Heide-Jørgensen, O. A. Jørgensen, and M. A. Treble. 2004. Deep-ocean predation by a high Arctic cetacean. *ICES J. Marine Science*, 61: 430-440.
- Morgan, M.J. and W.R. Bowering. 1997. Temporal and geographic variation in maturity at length and age of Greenland Halibut (*Reinhardtius hippoglossoides*) from the Canadian north-west Atlantic with implications for fisheries management. *ICES Journal of Marine Science* 54: 875-885.
- Morgan, M.J. and M. Treble. 2006. A first look at maturity data for Greenland Halibut from trawl surveys of NAFO Subarea 0. *NAFO SCR* 06/5: 12 p.
- Orr, D.C. and W.R. Bowering. 1997. A multivariate analysis of food and feeding trends among Greenland Halibut (*Reinhardtius hippoglossoides* (Walbaum)) sampled in Davis Strait during 1986. *ICES J. Mar. Sci.* 54: 819-829.
- Powles, H., V. Vendette, R. Siron and B. O'Boyle. 2004. Proceedings of the Canadian Marine Ecosystems Workshop, DFO Can. Sci. Advis. Sec. Proceed. Ser. 2004/016.
- Roy, D., D.C. Hardie, M.A. Treble, and D.E. Ruzzante. 2012. No evidence against panmixia in North Atlantic Greenland Halibut (*Reinhardtius hippoglossoides*) from neutral markers: Greenland Halibut population genetics report. Unpublished report prepared for Fisheries and Oceans Canada. 25 p.
- Simonsen, C.S. and S.C. Gundersen. 2005. Ovary development in Greenland Halibut *Reinhardtius hippoglossoides* in west Greenland waters. *J. Fish Biology* 67, 1299-1317.
- Templeman, W. 1973. Distribution and abundance of the Greenland Halibut, *Reinhardtius hippoglossoides* (Walbaum), in the Northwest Atlantic. *ICNAF Res. Bull.* 10:83-98.
- The United Nations Environment Program. 2009. Certification and Sustainable Fisheries. United Nations Environment Program, Division of Technology, Industry and Economics.
- Treble, M.A. 2002. Analysis of data from the 2001 trawl survey in NAFO Subarea 0. Northwest Atlantic Fisheries Organization SCR Doc 02/47: 28 p.
- Treble, M.A. 2003. Results of a Greenland Halibut (*Reinhardtius hippoglossoides*) tagging project in Cumberland Sound, NAFO Division 0B, 1997-2000. Northwest Atlantic Fisheries Organization SCR Doc 03/41: 7 p.
- Treble, M.A. 2011. Report on Greenland Halibut caught during the 2010 trawl survey in NAFO Division 0A. *NAFO SCR Doc.* 11/017. 32 p.
- Treble, M.A. and R.E.A. Stewart. 2010. Impacts and risks associated with a Greenland Halibut (*Reinhardtius hippoglossoides*) gillnet fishery in inshore areas of NAFO Subarea 0. *DFO Can. Sci. Advis. Sec. Res. Doc.* 2010/032. vi + 18 p.

Vis, M.L., Carr, S.M., Bowering, W.R., and W.S. Davidson. 1997. Greenland Halibut (*Reinhardtius hippoglosoides*) in the North Atlantic are genetically homogeneous. Canadian Journal of Fisheries and Aquatic Sciences 54: 1813-1821.

Glossary

Abundance: Number of individuals in a stock or a population.

Age Composition: Proportion of individuals of different ages in a stock or in the catches.

Biomass: Total weight of all individuals in a stock or a population.

Bycatch: The unintentional catch of one species when the target is another.

Catch-per-unit-effort (CPUE): The amount caught for a given fishing effort e.g. tonne of shrimp per tow, kilograms of fish per hundred longline hooks.

Conservation Harvesting Plan (CHP): A fishing plan, historically developed by all gear sectors, that outlines management measures in the fishery and any other industry proposed measures for responsible fishing.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC): Committee of experts that assess and designate the conservation status of species that may be at risk in Canada.

Discards: Portion of the directed species catch returned to the water after being caught in fishing gear.

Dockside Monitoring Program (DMP): A monitoring program that is conducted by a company that has been designated by DFO, which verifies the species composition, product form and landed weight of all fish landed from a commercial fishing vessel.

Ecologically and Biologically Significant Area (EBSA): An area that has high ecological or biological significance and which should receive a greater-than-usual degree of risk aversion in management of activities in order to protect overall ecosystem structure and function.

Ecosystem-based Management: Taking into account species interactions and the interdependencies between species and their habitats when making resource management decisions.

Elasmobranch: Any cartilaginous fish of the subclass Chondrichthyes e.g. sharks, skates, rays.

Fishing Effort: Quantity of effort using a given fishing gear over a given period of time.

Fishing Mortality: Death caused by fishing, often symbolized by the mathematical symbol F .

Fixed Gear: A type of fishing gear that is set in a stationary position. These include traps, weirs, gillnets, longlines and handlines.

Gillnet: A type of fishing gear composed of netting with weights on the bottom and floats at the top. Gillnets can be set at different depths and are anchored to the seabed.

Groundfish: Species of fish living near the bottom such as cod, haddock, halibut and flatfish.

Landings: Quantity of a species caught and landed.

Longline: A type of fishing gear composed of long lines with a series of baited hooks.

Maximum Sustainable Yield (MSY): Largest average catch that can continuously be taken from a stock.

Mesh Size: Size of the mesh of a net. Different fisheries have different minimum mesh size regulation.

Mobile Gear: A type of fishing gear that is drawn through the water by a vessel to entrap fish. These include otter trawls and Danish/Scottish seines.

Natural Mortality: Mortality due to natural causes, symbolized by the mathematical symbol M .

At-sea Observer Coverage: When a licence holder is required to carry an officially recognized At-sea Observer onboard his/her vessel for a specific period of time to verify fishing activities, such as the amount of fish caught, the area in which it was caught and the method by which it was caught.

Otolith: Structure of the inner ear of fish, made of calcium carbonate. Also called "ear bone" or "ear stone".

Pelagic: Of, relating to, or living or occurring in the open sea. A pelagic species lives in midwater or close to the surface (e.g. herring).

Population: Group of individuals of the same species, forming a breeding unit, and sharing a habitat.

Precautionary Approach: Set of agreed cost-effective measures and actions, including future courses of action, which ensures prudent foresight, reduces or avoids risk to the resource, the environment, and the people, to the extent possible, taking explicitly into account existing uncertainties and the potential consequences of being wrong.

Quota: Portion of the total allowable catch that a unit such as vessel class, enterprise, individual, etc. is permitted to take from a stock in a given period of time.

Recruitment: Amount of individuals becoming part of the exploitable stock i.e. that can be caught in a fishery.

Research Survey: Survey at sea, on a research vessel, allowing scientists to obtain information on the abundance and distribution of various species and/or collect oceanographic data (e.g. bottom trawl survey, plankton survey, hydroacoustic survey, etc.).

Species at Risk Act (SARA): A Canadian Act to prevent wildlife species from becoming extinct and secure the necessary actions for their recovery. It provides the legal protection of wildlife species and the conservation of their biological diversity.

Spawner: Sexually mature individual.

Spawning Stock: Sexually mature individuals in a stock.

Stock: Describes a population of individuals of one species found in a particular area, and is used as a unit for fisheries management [e.g. NAFO Subarea 0 and Division 1A (offshore) and Divisions 1B-F].

Stock Assessment: Scientific evaluation of the status of a species belonging to a same stock within a particular area in a given time period.

Total Allowable Catch (TAC): The amount of catch that may be taken from a stock.

Traditional Ecological Knowledge (TEK): A cumulative body of knowledge handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment.

Tonne (t): Metric tonne, which is 1,000kg or 2,204.6lbs.

Trawl: A type of fishing gear composed of a cone-shaped net towed in the water by a vessel called a "trawler". Bottom trawls are towed along the ocean floor to catch species such as groundfish. Mid-water trawls are towed within the water column.

Validation: The verification, by an independent certified At-sea Observer, of the weight of fish landed.

Vessel Size: Length overall.

Year-class: Individuals of a same stock born in a particular year. Also called "cohort".

Appendices

Appendix 1: Key provisions of the Nunavut Land Claims Agreement related to the Greenland Halibut fishery.

The *Nunavut Land Claims Agreement (NLCA)* in its entirety can be found at the following web link: <http://nlca.tunnngavik.com/>

The roles and responsibilities of the Nunavut Wildlife Management Board (NWMB) related to the Greenland Halibut fishery include but are not limited to the following:

- 5.2.33 Recognizing that Government retains ultimate responsibility for wildlife management, the NWMB shall be the main instrument of wildlife management in the Nunavut Settlement Area (NSA) and the main regulator of access to wildlife and have the primary responsibility in relation thereto in the manner described in the Agreement. Accordingly, the NWMB shall perform the following functions:
- (a) participating in research (Sections 5.2.37 to 5.2.38);
 - (d) establishing, modifying or removing levels of total allowable harvest (Sections 5.6.16 to 5.6.18);
 - (e) ascertaining the basic needs level (Sections 5.6.19 to 5.6.25);
 - (f) adjusting the basic needs level (Sections 5.6.26 to 5.6.30);
 - (g) allocating resources to other residents (Sections 5.6.32 to 5.6.37);
 - (h) allocating resources to existing operations (Section 5.6.38);
 - (i) dealing with priority applications (Section 5.6.39);
 - (j) making recommendations as to allocation of the remaining surplus (Section 5.6.40);
 - (k) establishing, modifying or removing non-quota limitations (Sections 5.6.48 to 5.6.51);
 - (m) any other function the NWMB is required to perform by the Agreement and not specifically referred to in this Section.
- 5.2.34 In addition to its primary functions outlined in Section 5.2.33, the NWMB shall in its discretion perform the following functions related to management and protection of wildlife and wildlife habitat;
- (c) approve plans for management and protection of particular wildlife habitats including areas within Conservation Areas, Territorial Parks and National Parks;
 - (d) (i) approve plans for management, classification, protection, restocking or propagation, cultivation or husbandry of particular wildlife, including endangered species.
 - (f) approve designation of rare, threatened and endangered species

Research

5.2.37 There is a need for an effective system of wildlife management, and to be effective, the system of management requires an efficient, co-ordinated research effort. The NWMB in fulfilling its management functions requires an informed and effective role in wildlife research and its direction. The ability and right of the Government of Canada and Territorial Government to continue their own research functions shall not be prejudiced by this Section. Accordingly the NWMB shall:

- (a) identify research requirements and deficiencies pertinent to wildlife management and the rational utilization of wildlife resources, and promote and encourage on an ongoing basis, research aimed at meeting requirements and overcoming deficiencies;
- (b) identify relevant persons and agencies to undertake wildlife research;
- (c) review research proposals and applications, and where appropriate recommend on the acceptance or rejection of such proposals to the appropriate government agency;
- (d) collect, classify, and disseminate wildlife statistics and information and maintain a data base adequate for such purposes; and
- (e) carry out all other research functions consistent with its responsibilities.

5.2.38 Further to its responsibilities in Section 5.2.37, the NWMB shall:

- (a) establish and maintain an open file system for all raw and interpreted data and information regardless of its source;
- (b) promote and encourage training for Inuit in the various fields of wildlife research and management;
- (c) promote and encourage the employment of Inuit and Inuit organizations in research and technical positions made available through government and private sector research contracts; and
- (d) prior to the carrying out of research, communicate, consult and cooperate with residents of the NSA and Designated Inuit Organizations (DIO) likely to be affected.

Criteria for Decisions by NWMB and Minister

Article 5 of the *NLCA* sets out a detailed process under which the Minister may accept, reject or vary decisions of the NWMB (s. 5.3.3 to s. 5.3.23)

5.3.3 Decisions of the NWMB or a Minister made in relation to Part 6 shall restrict or limit Inuit harvesting only to the extent necessary:

- (a) to effect a valid conservation purpose;
- (b) to give effect to the allocation system outlined in this Article, to other provisions of this Article and to Article 40; or
- (c) to provide for public health or public safety.

5.3.4 Certain populations of wildlife found in the NSA cross jurisdictional boundaries and are harvested outside the NSA by persons resident elsewhere. Accordingly, the NWMB and Minister in exercising their responsibilities in relation to Part 6 shall take account of

harvesting activities outside the NSA and the terms of domestic interjurisdictional agreements or international agreements pertaining to such wildlife.

- 5.3.6 In making decisions affecting Parks, sanctuaries and Conservation Areas, the NWMB and the Minister shall take into account the special purposes and policies relating to those areas.

Legal Effect of Decisions (Government of Canada Jurisdiction)

- 5.3.16 All decisions made by the NWMB in relation to Subsection 5.2.34(a), (c), (d) or (f) or any of Parts 4 to 6 or Article 40 and subject to government of Canada jurisdiction shall be made in the manner set out in Sections 5.3.17 to 5.3.23.
- 5.3.17 When the NWMB makes a decision, it shall forward that decision to the Minister. The NWMB shall not make that decision public.
- 5.3.18 After receiving a decision of the NWMB pursuant to Section 5.3.17 the Minister shall within 60 days or within such further period as may be agreed upon by the Minister and the NWMB:
- (a) accept the decision and notify the NWMB in writing; or
 - (b) give the NWMB reasons in writing for rejecting the decision.
- 5.3.19 The Minister shall be deemed to have accepted the decision of the NWMB when:
- (a) the Minister has so notified the NWMB in writing; or
 - (b) the Minister has not rejected the decision within the time period required pursuant to Section 5.3.18.
- 5.3.20 Where the Minister is deemed to have accepted a decision of the NWMB as provided in Section 5.3.19, the Minister shall proceed forthwith to do all things necessary to implement that decision.
- 5.3.21 Where the Minister rejects a decision of the NWMB pursuant to Section 5.3.18 the NWMB shall reconsider the decision in light of the written reasons provided by the Minister and make a final decision, which it shall forward to the Minister. The NWMB may make the final decision public.
- 5.3.22 After receiving a final decision of the NWMB made pursuant to Section 5.3.21, the Minister may:
- (a) accept the final decision;
 - (b) reject the final decision; or
 - (c) vary the final decision.
- 5.3.23 Where a final decision has been received by the Minister pursuant to Section 5.3.21 and the Minister decides to accept or vary the final decision, the Minister shall proceed forthwith to do all things necessary to implement the final decision or the final decision as varied.

There are also provisions in the *NLCA* covering wildlife management and harvesting beyond the marine areas of the NSA, such as the offshore fisheries in Baffin Bay and Davis Strait. They include the following:

- 15.3.4 Government shall seek the advice of the NWMB with respect to any wildlife management decisions in Zones I and II which would affect the substance and value of Inuit harvesting rights and opportunities within the marine areas of the NSA. The NWMB shall provide relevant information to Government that would assist in wildlife management beyond the marine areas of the NSA.
- 15.3.7 Government recognizes the importance of the principles of adjacency and economic dependence of communities in the Nunavut Settlement Area on marine resources, and shall give special consideration to these factors when allocating commercial fishing licences within Zones I and II. Adjacency means adjacent to or within a reasonable geographic distance of the zone in question. The principles will be applied in such a way as to promote a fair distribution of licences between the residents of the Nunavut Settlement Area and the other residents of Canada and in a manner consistent with Canada's inter-jurisdictional obligations.

Definitions

- 1.1.1 "Zone I" means those waters north of 61°E latitude subject to Canada's jurisdiction seaward of the Territorial Sea boundary as measured from lines drawn pursuant to the Territorial Sea Geographical Co-ordinates (Area 7) Order SOR/85-872 that are not part of the NSA or another land claim settlement area;
"Zone II" means those waters of James Bay, Hudson Bay and Hudson Strait that are not part of the NSA or another land claim settlement area.

Appendix 2a: Stock Assessment for Greenland Halibut in Northwest Atlantic Fisheries Organization Subarea 0 + Division 1A (offshore) + Divisions 1B-1F.

Information presented below can be found in Jørgensen and Treble 2012 and references therein.

Surveys:

Since the last management plan review meeting Fisheries and Oceans Canada (DFO) conducted three multi-species surveys in Northwest Atlantic Fisheries Organization (NAFO) Subarea 0; surveys in Division 0A (0A) in 2008 and 2010 covered both southern and northern areas (to 75°N), and a survey in 2011 covered Division 0B (0B). The Greenland Institute of Natural Resources (GINR) conducted 4 surveys in Division 1CD (1CD) during 2008-2011 and 1 survey in Division 1A (1A) in 2010. All surveys were conducted between 400 and 1500m in the fall (September to November) with the same research vessel (RV) and gear (i.e. RV Paamiut and Alfredo bottom trawl gear with 30mm liner in the cod end).

Division 0A-South (66°N to 72°N)

Six surveys in the 0A-south series were used to calculate biomass and abundance indices for this area. The biomass index increased from 68,700t in 1999 to 86,200t in 2004 and then declined to 74,272t in 2010 (Figure 1). The abundance index was fairly stable and was estimated at 110,000,000 fish in 2010, slightly below the 2008 estimate of 116,000,000 fish (Figure 1).

Density (mean biomass) was 1.67t/km² in 2008 and 1.53t/km² in 2010. These values were lower than estimates from 2001 and 2004 but were similar to 1999.

The overall length distribution ranged from 6cm to 99cm with a peak at 39cm; 70% of the fish were smaller than 45cm in both 2008 and 2010, which is similar to the patterns in 1999 and 2006 (Figure 2). The 2004 survey caught larger fish with 57% smaller than 45cm, which also happened to be the most abundant size class.

Division 0A-North (72°N to 75° 35'N)

Two surveys were conducted in the northern area, one in 2004 and one in 2010. The biomass index in 2010 (46,489t) was similar to the value in 2004 (45,877t). The abundance index increased to 67,400,000 fish in 2010 compared to 48,500,000 fish in 2004 (Figure 1). Overall density increased from 0.85t/km² in 2004 to 1.18t/km² in 2010, largely because of an increase in the fish caught at depths deeper than 1000m. Length ranged from 21 to 78cm, with a single mode at 39cm, in 2010 and there was a larger number of small fish (<45cm) compared to 2004 (Figure 3).

Division 1A (Offshore)

The survey in 2010 estimated biomass and abundance indices at 79,332t and 104,000,000 fish, respectively. The biomass index increased and the abundance index decreased in 2010 compared to a similar area that was surveyed in 2001 suggesting there were more small fish in 2001 compared to 2010. Biomass and abundance indices in the area covered in both 2004 and 2010 declined slightly between these two surveys. Length in 2010 ranged from 20cm to 105cm and was dominated by a peak at 45cm.

Division 0B

Three recent surveys were conducted in 0B using the RV Paamiut, in 2000, 2001 and 2011 (prior to this the RV Gadus Atlantica had surveyed 0B in 1986). The biomass index increased from 57,438t in 2000 to 83,043t in 2011 (Figure 1). The abundance index was variable but declined slightly from 85,900,000 fish in 2001 to 83,000,000 fish in 2011 (Figure 1). Biomass and abundance indices were reduced at depths of 1251-1500m and fewer fish <45cm were present at depths of 1001-1500m in 2011 compared to 2000 and 2001. In 2011 lengths ranged from 6 to 92cm with 30% <45cm, compared to 47% in 2001 and 57% in 2000. There was a single peak in the length distribution at 51cm compared to peaks at 45cm in 2001 and 42cm in 2000 (Figure 4).

Division 1CD

The survey series for 1CD extends back to 1997. In 2011 the biomass index was estimated at 86,591t, an increase compared to 75,522t in 2010 and the highest in the time series (Figure 5). The abundance index was estimated at 74,980,000 fish, an increase from 64,890,000 fish in 2010 and higher than the average for the time period (Figure 5).

In 2010 density was 1.44t/km² and in 2011 it had increased to 1.66t/km². The length distribution was dominated by a peak at 50cm, which was slightly larger than the 47-50cm peak that has typically been seen in previous years.

Recruitment Indices from the Greenland Shrimp Survey

The number of young Greenland Halibut (less than 3 years old) caught in the Greenland shrimp survey is used to assess potential recruitment. Recruitment of the 2007-2010 year-classes at age 1 in the offshore nursery area in 1A (to 70°N) and 1B were below average (<500 fish/hr in the survey tows) (Figure 6) but there had been several above average years during 1999 to 2006. When considering the entire shrimp survey area between 50°N and 72.5°N (Divisions 1A-1F) and including Disko Bay, the index of age 1 fish has been above average (>300 million fish) for most years since 1999, and 2000 and 2010 had the highest values in the time series (Figure 7).

Fishery Monitoring:

Logbooks and At-sea Observers are used to monitor data on catch and to collect biological data such as lengths and weights. In 0A, At-sea Observers have collected biological data from 100% of the fishery since it began in 1996. In 0B there has been fairly consistent sampling of the trawl fleet. However, fixed gear vessels have low coverage and in some years no data have been collected.

In 0A, the fishery is primarily concentrated along the 1000m depth contour within Baffin Bay and extends north to approximately 73°N. Prior to 2006 the 0A fishery was mainly a trawl fishery with a small portion of catch coming from longlines in 2002-2004. Gillnet vessels were introduced in 2004 and since 2006 they have been taking 35-50% of the catch. In 0B the fishery is located along the shelf slope at approximately 1000m between 61 and 64°N. Fixed gear (both longline and gillnet) catches have comprised 20-35% of the 0B catch in the last 5 years.

Catch and Total Allowable Catch (TAC) for the Overall Stock in Subarea 0 + Division 1A Offshore + Divisions 1B-1F

During the period 1965-1989, catches for this stock rose to approximately 20,000t in 1975 before declining to approximately 3,000t between 1986 and 1989 (Figure 8). Catches in Subarea 0 during this time were primarily harvested by non-Canadian vessels fishing in 0B. The fishery expanded in 1990 and by 1992 had peaked again at 18,457t, including 12,788t from 0B. Catches declined in 1993 and 1994 to approximately 11,000t. In 1994, the assessment of the 1A inshore stock was separated from the assessment of the offshore stock and in 1995 the TAC was reduced from 25,000t to 10,000t based on information from the Japan/Greenland survey. From 1995 to 2000 catches fluctuated between 8,250t and 11,750t (including Canadian Division 0B catches of approx. 1,800 to 5,400t). Catches began increasing again in 2001, following expansions of fishing in 0A and 1AB and increases in the TAC. Since 2010 catches have been approximately 27,000t (Figure 8) and have been split equally between Canada and Greenland.

Size of Fish in Division 0A and 0B Catches

Division 0A and 0B trawl fisheries have similar length distributions, with the most frequent length occurring around 50 cm (Fig. 9). The 0A gillnet fishery catches larger fish, with a peak at approximately 64 cm. The 0B gillnet fishery also has a peak at 64 cm, but a larger number of fish between 70 and 80 cm are caught compared to 0A gillnet catches. These length distributions have been relatively stable with little change in recent years.

Catch-Per-Unit-Effort

Mean catch-per-unit-effort (CPUE) was calculated using fishery logbook data for the trawl fishery in 0A from 1996 to 2011 (Figure 10) and for 0B from 1990 to 2011 (Figure 11).

In 0A, CPUE for single trawl gear fluctuated between 0.2 and 0.6t/hr during 1996 to 2001, increased to 0.8t/hr in 2002 and remained at this level until 2007. Since then, CPUE has varied between 0.6 and 1.2t/hr. The double trawl gear followed a similar pattern but with slightly higher rates (Figure 10). Gillnet catch rates increased from approximately 5t/100 nets in 2004 to 13t/100 nets in 2011 (Figure 12).

In 0B, CPUE for single trawl gear declined from 0.6 to 0.3t/hr during 1990 to 1994, then increased and was relatively stable at 0.8t/hr from 1995 to 2004 (Figure 11). CPUE increased to 1.1t/hr in 2005, declined to 0.5t/hr in 2007 and has since increased to approximately 1.4t/hr in 2011 (Figure 11). For double trawl gear between 2000 and 2007 catch rates ranged between 1.0 and 1.2t/hr, then rose to approximately 1.5t/hr in 2008 before declining back to 1.0 and 1.2t/hr in 2010 and 2011. Gillnet catch rates remained relatively stable at 3-4t/100 nets from 2003 to 2008, and then increased to approximately 5t/100 nets in 2010 and 2011 (Figure 12).

Standardized CPUE analysis takes into account vessel size and month of fishing. There has been little change in standardized CPUE in 0A or 1AB since 2002. In 0B and 1CD, standardized CPUE was relatively stable from 1990 to 2004, then increased and has been relatively stable since 2008 (Figure 13).

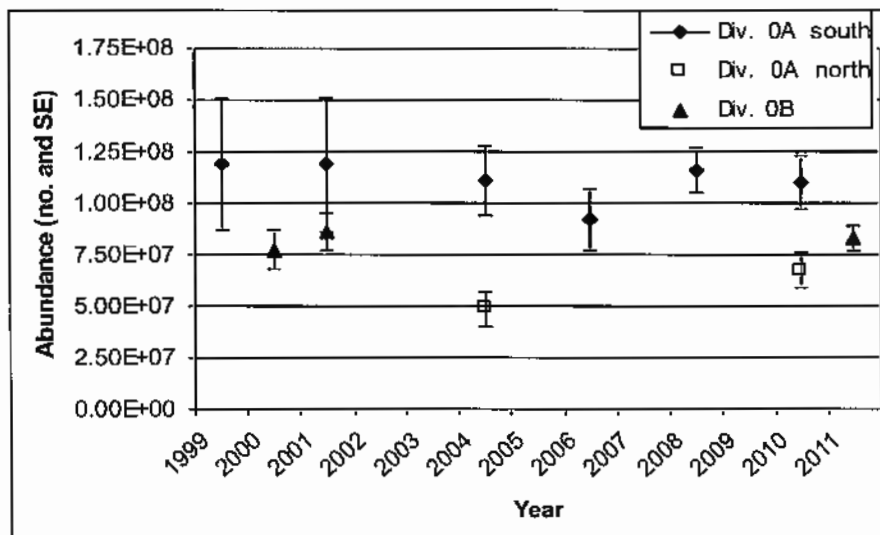
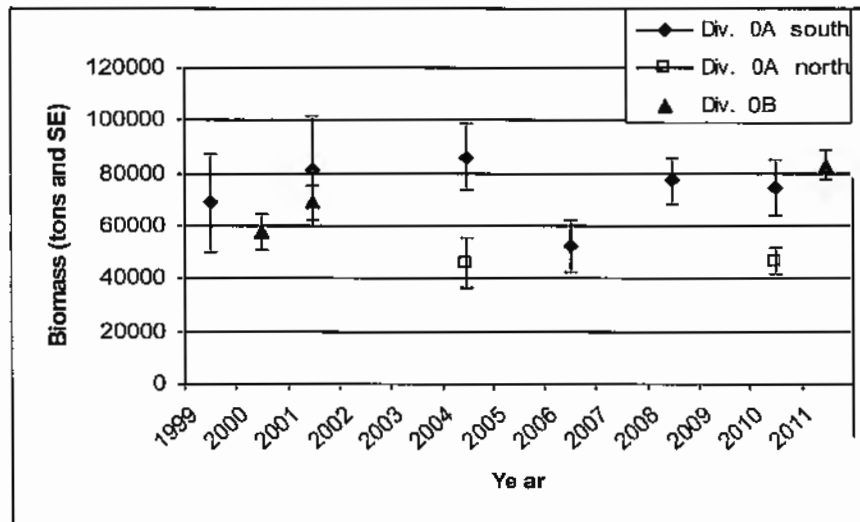


Figure 1. Biomass (top) and abundance (bottom) indices for Greenland Halibut in Subarea 0. Data are shown separately for Division 0A-south (filled diamonds), Division 0A-north (open squares) and Division 0B (filled triangles). Error bars indicate 1 standard error (SE).

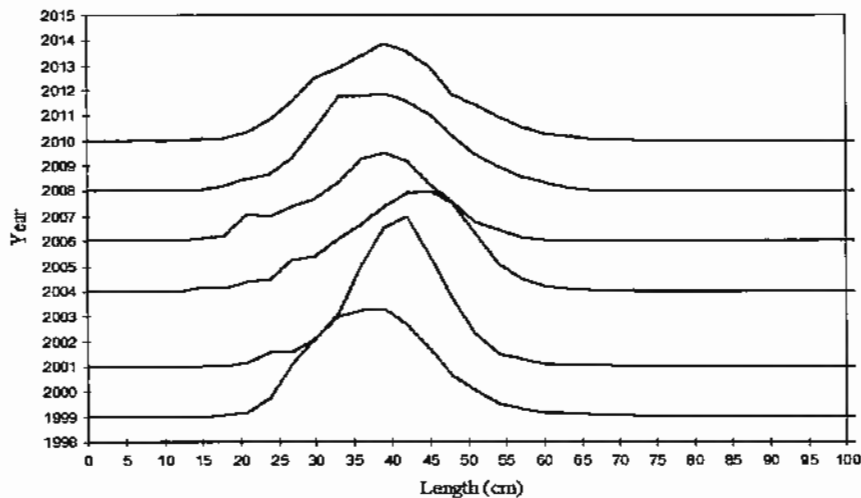


Figure 2. Length frequencies from research surveys in Division 0A-South conducted in 1999-2010 (number of fish/km² weighted by stratum area).

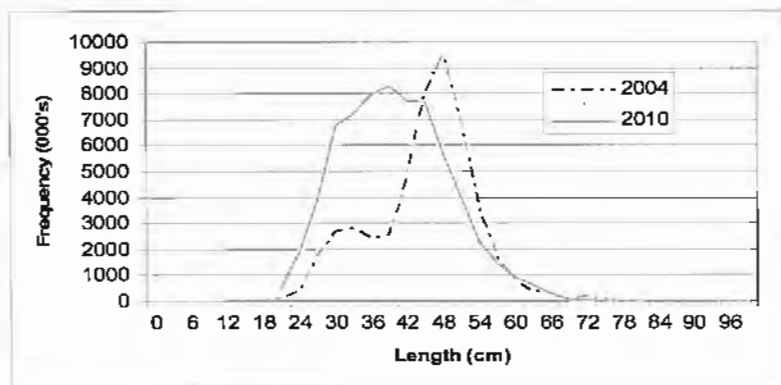


Figure 3. Length frequencies (number of fish weighted by stratum area) for Greenland Halibut from research surveys in Division 0A-north conducted in 2004 (dotted line) and 2010 (solid line).

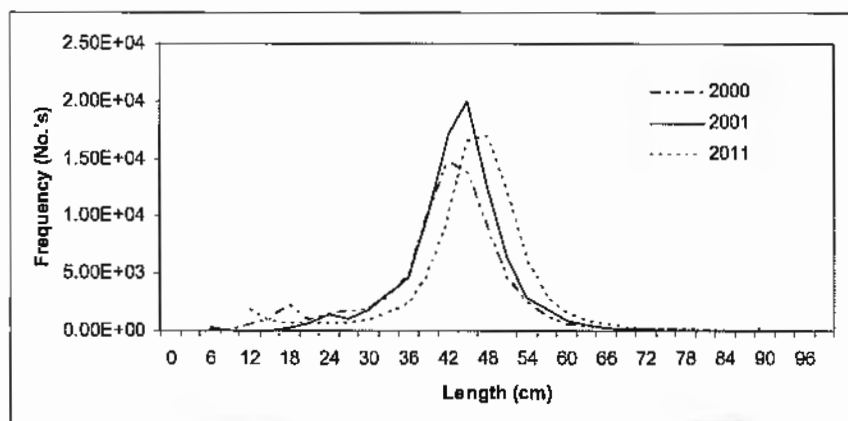


Figure 4. Length frequencies (number of fish) for Greenland Halibut from research surveys in Division 0B conducted in 2000 (dashed and dotted line), 2001 (solid line) and 2010 (dotted line).

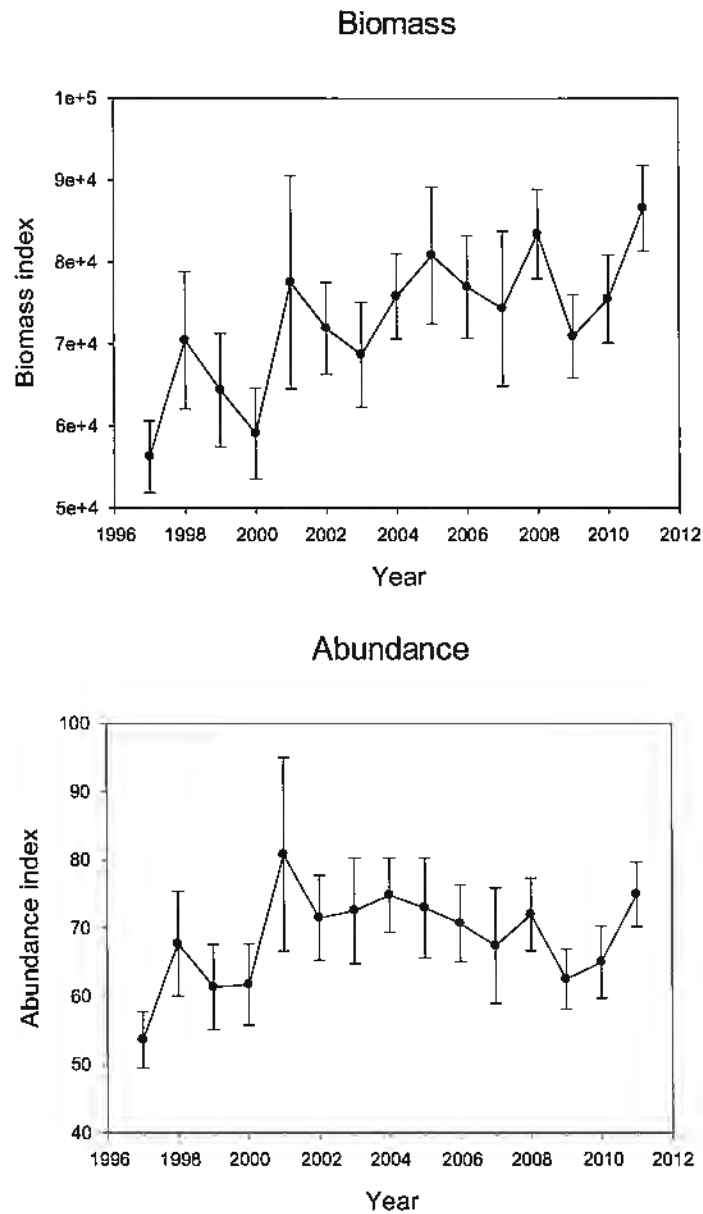


Figure 5. Biomass (top) and abundance (bottom) indices (with standard errors) from the Greenland deep sea survey in Division 1CD.

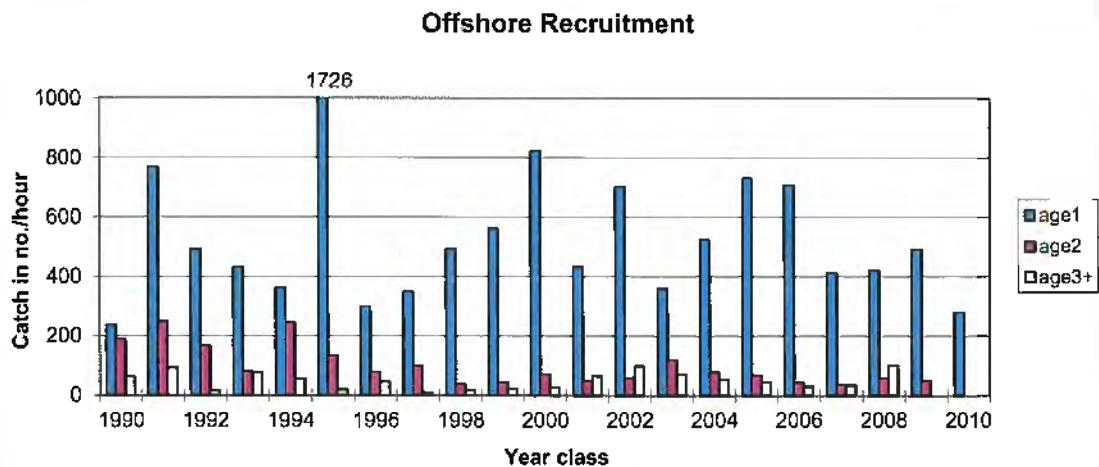


Figure 6. Year-class strength of ages 1-3+ (age 1, blue; age 2 red; age 3, yellow) Greenland Halibut (number per hour trawled) in the offshore nursery area (Division 1ASouth-1B, depths of 300-600m).

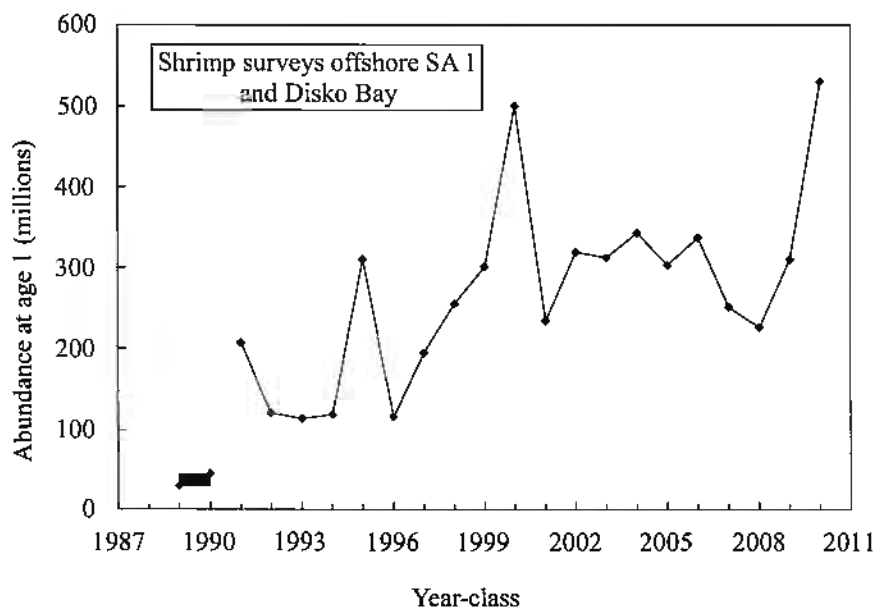


Figure 7. Abundance (millions of fish) of age-one Greenland Halibut in the entire area covered by the Greenland shrimp survey including inshore Disko Bay and Division 1ANorth (North of 70° 37.5'N).

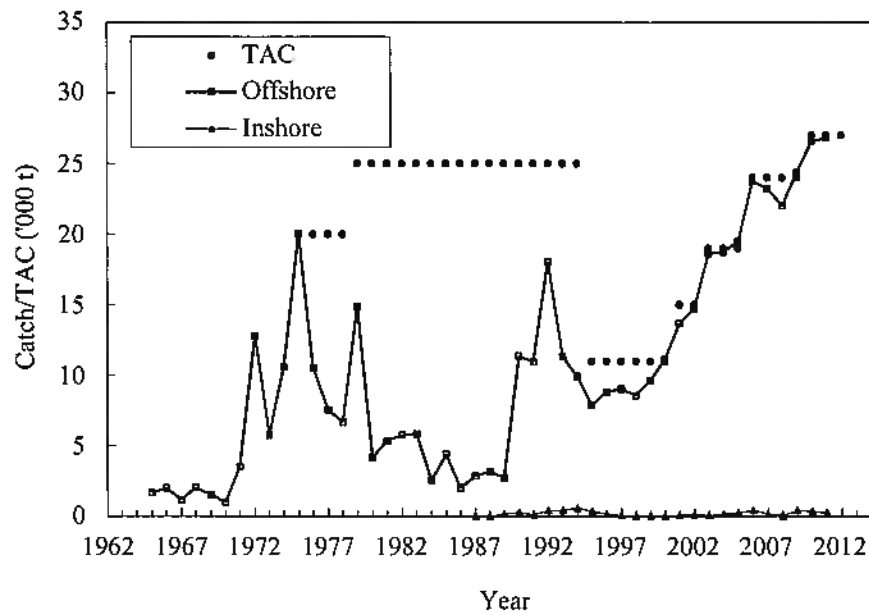


Figure 8. Catches in Subarea 0 and Division 1A offshore + Divisions 1B-1F (open squares) and Total Allowable Catch (TAC, filled circles) recommended by the Northwest Atlantic Fisheries Organization Scientific Council. Inshore catches come from Greenland, Divisions 1B-F (filled triangles).

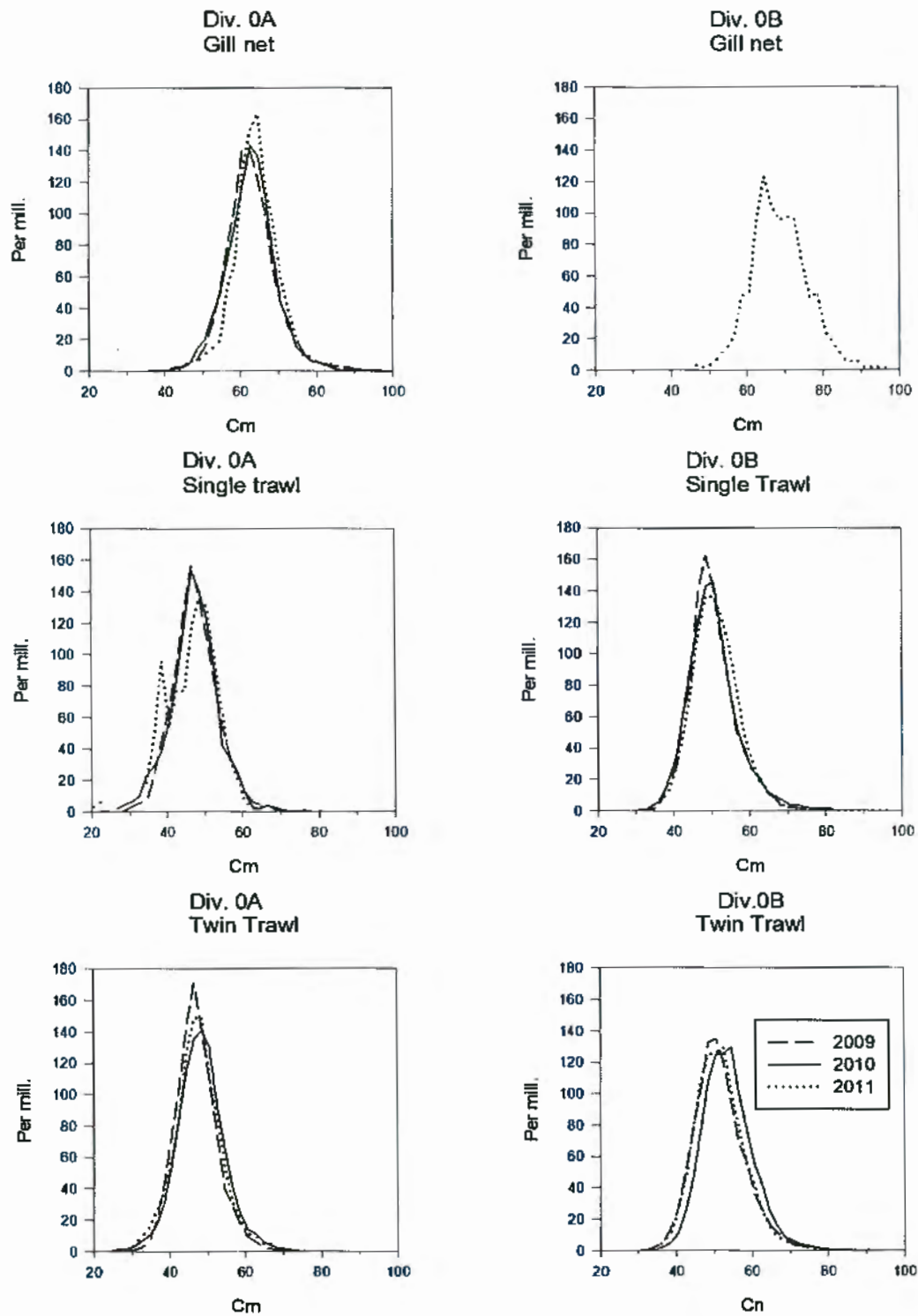


Figure 9. Length distribution from the fishery in Subarea 0 in 2009-2011 (number of fish (millions)) in 2cm length groups. Left panels, Division 0A; right panels, Division 0B; top row, gillnets; middle row, single trawls; bottom row, twin trawls.

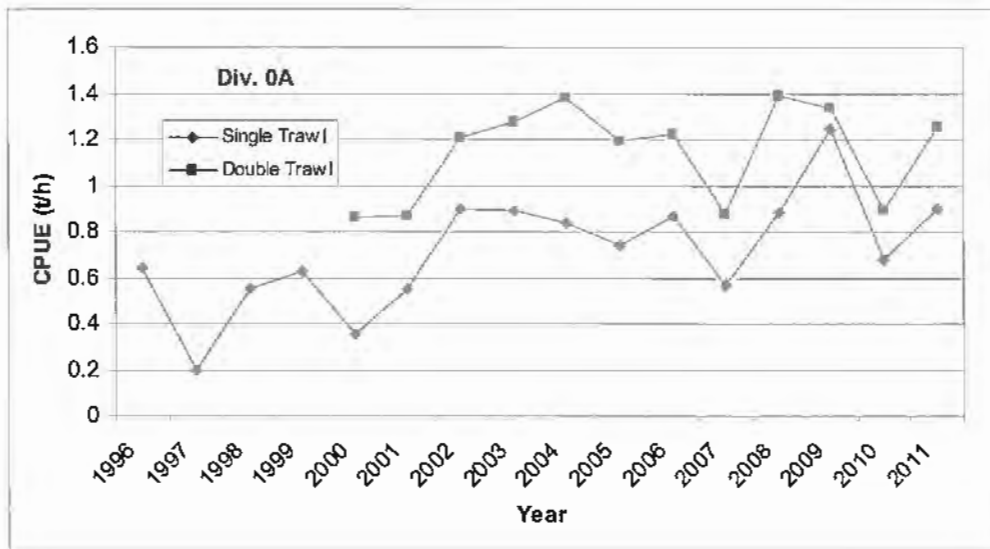


Figure 10. Un-standardized CPUE series for the Division 0A trawl fleet. Single trawl, diamonds; double trawl, squares.

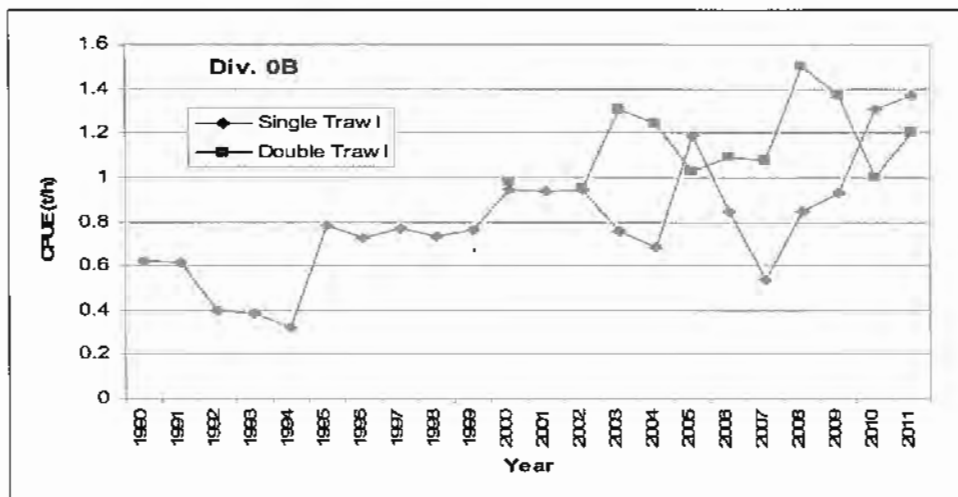


Figure 11. Un-standardized CPUE series for Division 0B trawl fleets. Single trawl, diamonds; double trawl, squares

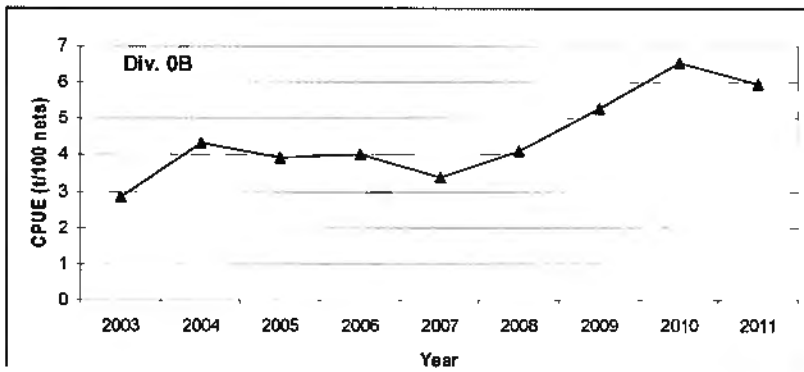
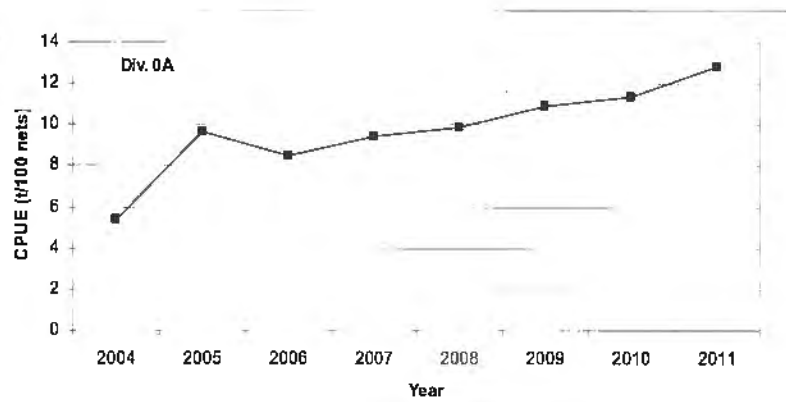


Figure 12. Un-standardized CPUE series for Division 0B and Division 0A gillnet fleets.

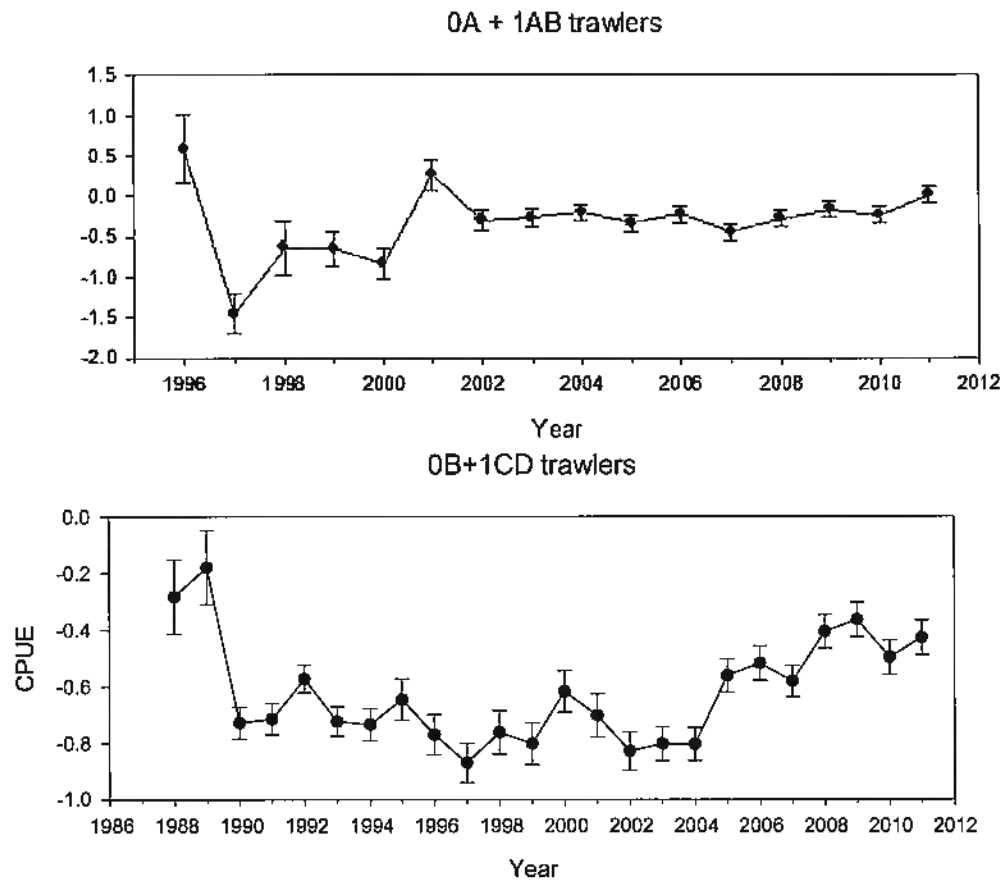


Figure 13. Standardized CPUE series (with standard errors) for trawlers in Divisions 0A+1AB combined (top) and Divisions 0B+1CD (bottom).

Appendix 2b: Bycatch summary.

Table 1. Catch (t) of select bycatch species (those with catches ≥ 1 t) from the 2009 and 2010 Division 0A Greenland Halibut fishery. Data are from At-sea Observers with 100% coverage in all fleets.

Species	2009			2010		
	Trawl	Gillnet	Total	Trawl	Gillnet	Total
Greenland Shark (<i>Somniosus microcephalus</i>)	50	11	61	22	5	27
Arctic Skate (<i>Amblyraja hyperborea</i>)		19	19		9	9
Thorny Skate (<i>Amblyraja radiata</i>)	6		6			
Roughhead Grenadier (<i>Macrurus berglax</i>)	3	10	13	1	10	11
Sponge	3		3			
Northern Wolffish (<i>Anarhichas denticulatus</i>)	1	3	4	2	2	4
Bottlenose Whale (<i>Hyperoodon ampullatus</i>)		6	6			

Table 2. Catch (t) of select bycatch species (those with catches ≥ 1 t) from the 2009 and 2010 Division 0B Greenland Halibut fishery. Data are from At-sea Observers with approximately 5% coverage in the gillnet fleet and 100% coverage in the trawl fleet.

Species	2009		2010	
	Trawl	Gillnet	Trawl	Gillnet
Greenland Shark (<i>S. microcephalus</i>)	5		12	1
Thorny Skate (<i>A. radiata</i>)	4			
Grenadier sp.	8		9	
Roughhead Grenadier (<i>M. berglax</i>)	6	1	6	3
Roundnose Grenadier (<i>Coryphaenoides rupestris</i>)	6		4	
Redfish (<i>Sebastes</i> sp.)	3	1	7	1
Sponge	8		11	
Spiny Crab (<i>Neolithodes grimaldii</i>)		1		2
Northern Wolffish (<i>A. denticulatus</i>)	5		15	1
Striped Wolffish (<i>Anarhichas lupus</i>)	5	1	2	
Spotted Wolffish (<i>Anarhichas Minor</i>)	3		1	

Appendix 3: Depleted species concerns.

Species known to interact with the Greenland Halibut fishery and for which concerns exist. For each species their status, known/potential threats, and relevant management measures are listed.

Species	Status	Known/Potential Threats Associated with the Greenland Halibut Fishery	Management Measures
<i>Fish</i>			
Northern Wolffish	<ul style="list-style-type: none"> • SARA Threatened • COSEWIC Threatened 	Bycatch. Disruption of habitat by bottom impact fishing gear.	SARA Recovery Plan in place and currently being updated. SARA Action Plan under development. Licence conditions related to authorization to kill, release, and reporting.
Spotted Wolffish	<ul style="list-style-type: none"> • SARA Threatened • COSEWIC Threatened 	Bycatch. Disruption of habitat by bottom impact fishing gear.	SARA Recovery Plan in place and currently being updated. SARA Action Plan under development. Licence conditions related to authorization to kill, release, and reporting.
Atlantic Wolffish	<ul style="list-style-type: none"> • SARA Special Concern • COSEWIC Special Concern 	Bycatch. Disruption of habitat by bottom impact fishing gear.	SARA Management Plan in place and currently being updated.
Roundnose Grenadier	<ul style="list-style-type: none"> • SARA under consideration • COSEWIC Endangered • MORATORIUM 	Bycatch. Disruption of habitat by bottom impact fishing gear.	Licence conditions related to retention and reporting.
Deep-water Redfish (northern population)	<ul style="list-style-type: none"> • SARA under consideration • COSEWIC Threatened 	Bycatch. Disruption of habitat by bottom impact fishing gear.	Licence conditions related to retention and reporting.
Acadian Redfish (Atlantic population)	<ul style="list-style-type: none"> • SARA under consideration • COSEWIC Threatened 	Bycatch. Disruption of habitat by bottom impact fishing gear.	Licence conditions related to retention and reporting.
Roughhead Grenadier	<ul style="list-style-type: none"> • SARA under consideration • COSEWIC Special Concern • MORATORIUM 	Bycatch. Disruption of habitat by bottom impact fishing gear.	Licence conditions related to retention and reporting.

Species	Status	Known/Potential Threats Associated with the Greenland Halibut Fishery	Management Measures
Thorny Skate	<ul style="list-style-type: none"> • <i>SARA</i> under consideration • COSEWIC Special Concern 	Bycatch. Disruption of habitat by bottom impact fishing gear.	DFO <i>National Plan of Action for the Conservation and Management of Sharks</i> . Licence conditions related to release and reporting.
American Plaice (northern population)	<ul style="list-style-type: none"> • COSEWIC Data Deficient 	Bycatch. Disruption of habitat by bottom impact fishing gear.	Licence conditions related to release/retention and reporting.
Greenland Shark	<ul style="list-style-type: none"> • COSEWIC not yet assessed, candidate wildlife species 	Bycatch. Entanglement in fishing gear. Competition for prey with fishery.	DFO <i>National Plan of Action for the Conservation and Management of Sharks</i> . Licence conditions related to release and reporting.
<i>Marine Mammals</i>			
Fin Whale	<ul style="list-style-type: none"> • <i>SARA</i> Special Concern • COSEWIC Special Concern 	Vessel noise and traffic. Entanglement in fishing gear.	<i>SARA</i> Management Plan in place. Licence conditions related to release and reporting.
Beluga Whale (Cumberland Sound population)	<ul style="list-style-type: none"> • <i>SARA</i> under consideration • COSEWIC Threatened • CITES Appendix II 	Vessel noise and traffic. Entanglement in fishing gear. Competition for prey with fishery.	Licence conditions related to release and reporting.
Bowhead Whale (Eastern Canada-West Greenland population)	<ul style="list-style-type: none"> • <i>SARA</i> under consideration • COSEWIC Special concern • CITES Appendix I 	Vessel noise and traffic. Entanglement in fishing gear.	Licence conditions related to release and reporting.
Northern Bottlenose Whale (Davis Strait-Baffin Bay-Labrador Sea population)	<ul style="list-style-type: none"> • <i>SARA</i> under consideration • COSEWIC Special Concern • CITES Appendix I 	Vessel noise and traffic. Entanglement in fishing gear.	Licence conditions related to release and reporting.
Beluga Whale (Eastern High Arctic-Baffin Bay population)	<ul style="list-style-type: none"> • <i>SARA</i> under consideration • COSEWIC Special Concern • CITES Appendix II 	Vessel noise and traffic. Entanglement in fishing gear. Competition for prey with fishery.	Licence conditions related to release and reporting.

Species	Status	Known/Potential Threats Associated with the Greenland Halibut Fishery	Management Measures
Narwhal	<ul style="list-style-type: none"> • <i>SARA</i> under consideration • COSEWIC Special Concern • CITES Appendix II 	Vessel noise and traffic. Entanglement in fishing gear. Competition for prey with fishery.	Narwhal Overwintering and Coldwater Coral fishing closure in Division 0A. Licence conditions related to release and reporting.
Atlantic Walrus (Arctic population)	<ul style="list-style-type: none"> • <i>SARA</i> under consideration • COSEWIC Special Concern • CITES Appendix III 	Vessel noise and traffic. Entanglement in fishing gear.	Licence conditions related to release and reporting.
Killer Whale	<ul style="list-style-type: none"> • <i>SARA</i> under consideration • COSEWIC Special Concern • CITES Appendix II 	Vessel noise and traffic.	Licence conditions related to reporting.
Sperm Whale	<ul style="list-style-type: none"> • COSEWIC not yet assessed • CITES Appendix I 	Entanglement in fishing gear.	Licence conditions related to release and reporting.

Appendix 4: Overview of current management measures in the Subarea 0 Greenland Halibut fishery.

Management Measure	Description
Total Allowable Catch (TAC)	<ul style="list-style-type: none"> The Minister determines the Canadian TAC for the Greenland Halibut stock.
Licences	<ul style="list-style-type: none"> Required when fishing Greenland Halibut.
Vessels	<ul style="list-style-type: none"> Specific vessels which may be used to fish are specified. Vessels operating in Cumberland Sound are to be $\leq 25.57\text{m}$ (83.89') in length.
Species, area and catch limitations	<ul style="list-style-type: none"> Species, quantity and area permitted to fish are specified. Conversion factors for various product forms are specified. Quota reconciliation is applied to all overruns.
Fishing Season	<ul style="list-style-type: none"> For Enterprise Allocation and Special Allocation holders, Jan. 1-Dec. 30 (subject to identified closure provisions). For Division 0B fixed gear competitive participants, to be determined annually.
Notification of closure	<ul style="list-style-type: none"> Via broadcasting, electronic means, or Fishery Officer.
Fishing gear	<ul style="list-style-type: none"> Type, construction, deployment and retrieval characteristics are specified Minimum gape opening of 15.4mm for longline hooks. No obstruction of mesh in either otter trawls or gillnets. Otter trawl with minimum mesh size in the cod-end of 145mm diamond or 155mm square. Only meshes $\geq 90\text{mm}$ to be used in the wings, body and belly. Minimum gillnet mesh size is 153mm in waters < 400 fathoms (730m) and 190mm in waters > 400 fathoms (730m). Individual gillnet is to be $< 91.5\text{m}$ and the maximum number of nets permitted to be used at any one time is 500. Gillnets require a valid tag securely attached to the headrope of each net Every reasonable effort made to retrieve lost nets. Fishing gear is not to be left unattended in water for more than 72 consecutive hours. Within the Nunavut Settlement Area (NSA), longline hooks are to be within the approved range of hook sizes.
Fishing restrictions	<ul style="list-style-type: none"> No fishing in the NSA or Nunavik Marine Region unless granted permission by respective wildlife board. No fishing with gillnets in Cumberland Sound. No fishing with otter trawls $> 19.8\text{m}$ in waters < 12 nautical miles from Atlantic seacoast. 100% At-sea Observer required in Division 0A for both mobile and fixed gears. 100% At-sea Observer required for mobile gear in Division 0B throughout the year and for fixed gear between Jan.1 and Apr. 30. For fixed gear between May 1 and Dec.31, 20% At-sea Observer coverage is required. No fishing in Division 0B with gillnets south of $63^{\circ}10'N$ from Oct. 1 to Dec. 31. No fishing with longline in Division 0B south of $63^{\circ}10'N$ from Oct. 1 to Dec.

Management Measure	Description
	<ul style="list-style-type: none"> 31 except where water depth is >1372m. Division 0A Narwhal Overwintering and Coldwater Coral Zone closed to all Greenland Halibut fishing. Division 0A closed to fixed gear as of Nov. 10 of each year. Close date may be extended depending on ice conditions.
Bycatch/incidental catch and discards	<ul style="list-style-type: none"> All groundfish are to be retained and are subject to catch limits assigned to the sector. Exceptions include Atlantic Halibut <81 cm, American Plaice <20cm, dogfish, lumpfish, sculpin and skate which are to be released and, where alive, in a manner causing the least harm. Any other fish other than groundfish are to be released and, where alive, in a manner causing the least harm. Catch of each bycatch species for each trip is not to exceed a specified percentage of the weight of Greenland Halibut caught. Procedures for Monitoring and Control of Small Fish Catches and Incidental Catches may be applied in this fishery.
Treatment of species listed under the <i>Species At Risk Act</i>	<ul style="list-style-type: none"> Northern Wolffish and Spotted Wolffish are to be released and, where alive, in a manner causing the least harm. Information on interactions with these species is to be recorded in logbook.
Reporting requirements	<ul style="list-style-type: none"> Pre-departure report (hail out) from an At-sea Observer company. Daily At-sea Reports (daily hails) required, which include catch and bycatch amounts. Accurately and completely record fishing activity and catch after each set and at least once a day in a logbook. Logbook is to be provided to DFO immediately at the end of each trip. All product is to be labeled such that species, product form and date of capture is identifiable. Required to provide a Trip Summary to a Dockside Monitoring Company at least 3 hours prior to landing. Lost gillnets and their associated tag number to be recorded in logbook and reported in daily hail. Reporting of all coral and sponge encounters in logbook. Marine mammal encounters reported in daily hail.
Vessel monitoring system (VMS)	<ul style="list-style-type: none"> Required to have an approved and operational VMS. VMS info collected by DFO on vessels sailing or fishing into Greenlandic waters will be provided to the Greenlandic Fisheries Authorities. DFO may provide and/or use VMS data for search and rescue and maritime safety purposes. Within the NSA, vessels are to have two VMS transponders onboard that operate on the iridium satellite system.
At-sea Observers	<ul style="list-style-type: none"> Where required, the operator is not to depart for fishing until At-sea Observer is onboard.
Fish landing procedures	<ul style="list-style-type: none"> Offloading may only occur in presence of a dockside At-sea Observer who will verify the weight, species and product form of all fish offloaded. Operator must ensure the dockside At-sea Observer is able to maintain visual

Management Measure	Description
	<p>continuity of the fish being removed from the vessel.</p> <ul style="list-style-type: none"> • All fish on board the vessel must be weighed. An accurate weight of fish offloaded must be supplied to the dockside At-sea Observer immediately after offloading. • When offloading in Greenland either an At-sea Observer or Lloyds of London agent can act as the dockside At-sea Observer.

Note: For complete information refer to the *Fisheries Act, Species at Risk Act, Fishery (General) Regulations* and *Atlantic Fishery Regulations, 1985*, as well as specific licences, Notices to Fishers, and Conservation Harvest Plans. Measures may vary based on fleet. In the event of discrepancies between the above Table and licence conditions, licence conditions prevail.

Appendix 5: Fishery and economic conditions.

Table 1. Recent quotas and catches of Greenland Halibut in NAFO Subarea 0 (2006-2011).

Year	Division 0A		Division 0B	
	Quota (t)	Catch (t)	Quota (t)	Catch (t)
2006	6500	6634	5500	5592
2007	6500	6173	5500	5334
2008	6500	4964	5500	5424
2009	6500	6496	5500	5547
2010	6500	6394	7000	6989
2011	6500	6262	7000	6985

Table 2. 2012 Allocations in Division 0A.

Allocation Holder	Sub-allocation Holder	Quota (t)
Nunavut	Baffin Fisheries Coalition	3800
	Cumberland Sound Fisheries Ltd/Pangnirtung Fisheries Ltd. Partnership	950
	Arctic Fisheries Alliance	950
	Qikiqtaaluk Corporation	700
	Qikiqtaaluk Wildlife Board for Inshore development*	100
Total		6500

* Exploratory and can only be fished in the NSA, cannot be transferred to offshore.

Table 3. 2012 Allocations in Division 0B.

Allocation Type	Allocation Holder	Sub-allocation Holder	Quota (t)
Enterprise Allocation	Ocean Choice International L.P.		84.00
Enterprise Allocation	Newfoundland Industrial Development Corp.		63.00
Enterprise Allocation	Mersey Seafoods Ltd.		52.02
Enterprise Allocation	Clearwater Seafoods Ltd.		1881.02
Enterprise Allocation	M.V. Osprey Ltd.		279.96
Enterprise Allocation	Harbour Grace Shrimp Company Ltd.		120.00
Special Allocation	Labrador Fishermen's Union Shrimp Co.		250.00
Special Allocation	Torngat Fish Producers Cooperative Society Ltd.		160.00
Special Allocation	Labrador Inuit Development Corporation		70.00
Special Allocation	Nunavik Inuit		290.00
Special Allocation	Nunavut	Arctic Fisheries Alliance	510.00
		Baffin Fisheries Coalition	800.00
		Cumberland Sound Fisheries Ltd/Pangnirtung Fisheries Ltd. Partnership	950.00
		Qikiqtaaluk Corporation	590.00
Fixed Gear Competitive			900.00
Total			7000.00

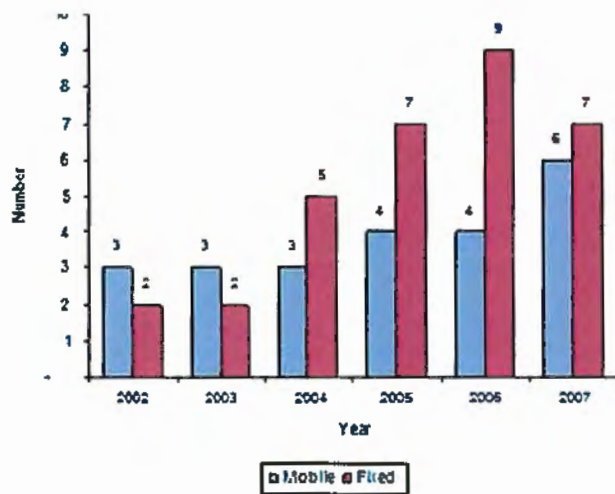


Figure 1. Vessel numbers and gear type used in the Greenland Halibut fishery in Division 0A.

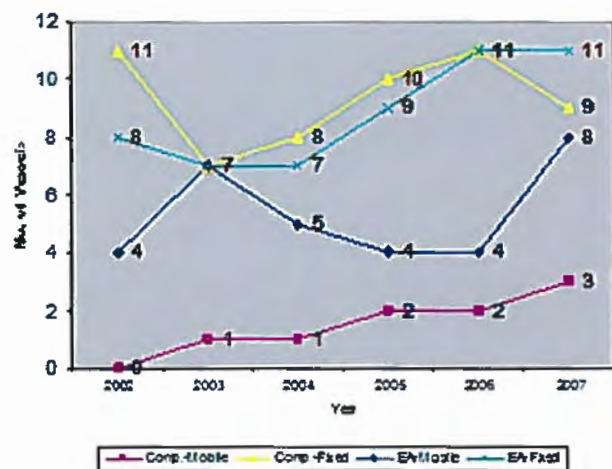


Figure 2. Vessel numbers and gear type used in the Greenland Halibut fishery in Division 0B.

Table 4. Landings and landed values for Greenland Halibut in Divisions 0A and 0B.

Variables	2005	2006	2007	2008	2009	2010	2011
Division 0A							
Landings (t)	4,125	6,634	6,173	4,964	6,496	6,394	6,262
Landed Values (\$000)	\$20,010	\$28,859	\$26,369	\$20,467	\$24,343	\$26,663	\$31,586
Division 0B							
Landings (t)	5,856	5,522	5,331	5,424	5,547	6,989	6,985
C&A	1,230	1,208	1,227	1,930	2,178	3,107	3,097
N&L	4,028	4,061	3,751	3,368	3,369	3,882	3,888
Maritimes	598	253	353	126	0	0	0
Landed Values (\$000)	\$21,259	\$19,794	\$17,718	\$15,869	\$24,541	\$36,691	\$41,146
C&A	\$6,356	\$5,570	\$5,551	\$8,413	\$8,585	\$13,706	\$15,622
N&L	\$12,769	\$13,381	\$11,408	\$7,272	\$15,956	\$22,986	\$25,524
Maritimes	\$2,134	\$842	\$759	\$184	--	--	--
Divisions 0A + 0B							
Landings (t)	9,981	12,156	11,504	10,388	12,043	13,383	13,247
Landed Values (\$000)	\$41,269	\$48,653	\$44,087	\$36,337	\$48,884	\$63,355	\$72,732

Source: Landings from Canadian Atlantic Quota Report and Landed Values from DFO staff calculations and data from DFO regional offices.

Note: Landed value in Division 0A until 2010 is the summation of landings offloaded at Pangnirtung plant (10%) with average landed price CAD2,000/tonne stated in 2006 Harvesting Summary and Historical Analysis, Baffin Fisheries Coalition, and the remaining landings offloaded elsewhere with export price for Greenland Halibut from DFO. Landed value in Division 0A for 2011 and landed value in Division 0B for Central & Arctic Region (C&A) is calculated using export price for Greenland Halibut from DFO. The landed values for Newfoundland & Labrador Region (N&L) and Maritimes Region were provided by respective regional offices.

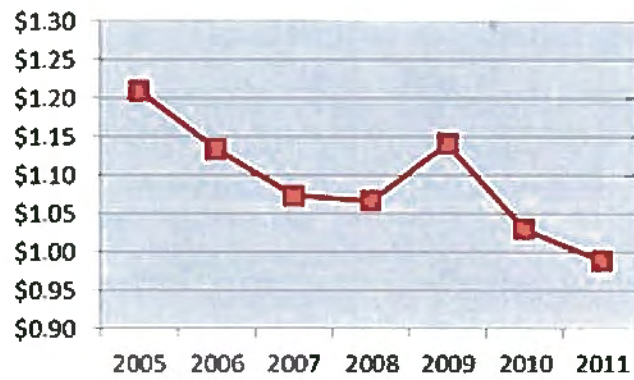


Figure 3. Exchange rate between the United States dollar (USD) and the Canadian dollar (CAD).

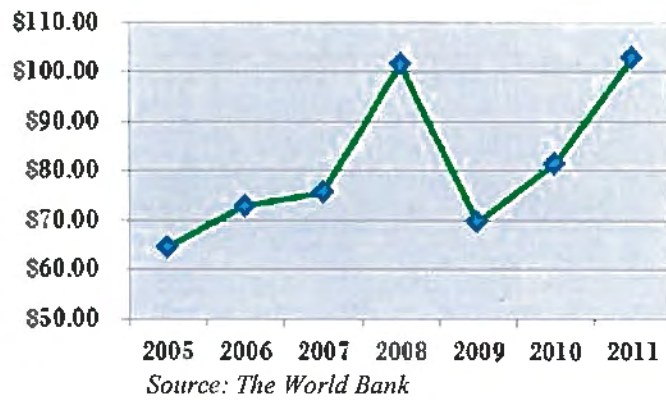


Figure 4. Price of crude oil.

Appendix 6: Maps.

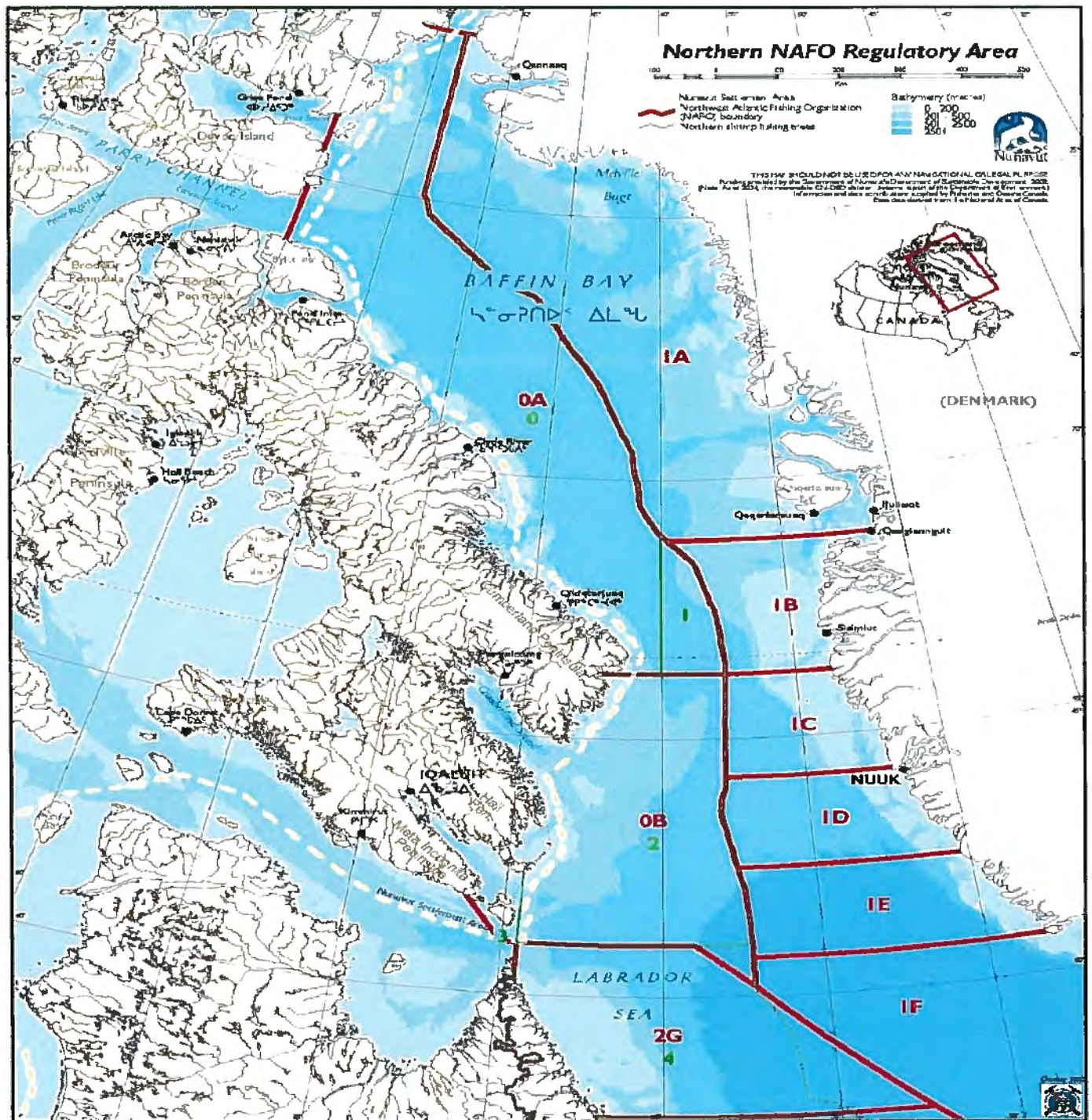


Figure 1. Northwest Atlantic Fisheries Organization Subareas and Divisions relevant to the Greenland Halibut fishery.

Appendix 7: Safety at sea.

Vessel owners and masters have a duty to ensure the safety of their crew and vessel. Adherence to safety regulations and good practices by owners, masters and crew of fishing vessels will help save lives, protect the vessel from damage and protect the environment. All fishing vessels must be in a seaworthy condition and maintained as required by Transport Canada (TC), and other applicable agencies. Vessels subject to inspection should ensure that the certificate of inspection is valid for the area of intended operation.

In the federal government, responsibility for shipping, navigation, and vessel safety regulations and inspections lies with TC; emergency response with the Canadian Coast Guard (CCG) and Fisheries and Oceans Canada (DFO) has responsibility for management of the fisheries resources. In Nunavut, the Workers Safety and Compensation Commission has jurisdiction over health and safety issues in the workplace. DFO and TC have a Memorandum of Understanding to formalize cooperation and to establish, maintain and promote a safety culture within the fishing industry.

Before leaving on a voyage the owner, master or operator must ensure that the fishing vessel is capable of safely making the passage. Critical factors for a safe voyage include the seaworthiness of the vessel, vessel stability, having the required safety equipment in good working order, crew training, and knowledge of current and forecasted weather conditions.

Useful publications include TC Publication TP 10038 '*Small Fishing Vessel Safety Manual*' which can be obtained from TC or printed from their website www.tc.gc.ca/MarineSafety/Tp/Tp10038/tp10038e.htm.

There are several issues that are important for fishing vessel safety, including three priority areas: vessel stability; emergency drills; and, cold water immersion.

Fishing Vessel Stability

Vessel stability is paramount for safety. Care must be given to the stowage and securing of all cargo, skiffs, equipment, fuel containers and supplies, and also to correct ballasting. Fishers must be familiar with their vessel's centre of gravity, the effect of liquid free surfaces on stability, loose water or fish on deck, loading and unloading operations and the vessel's freeboard. Know the limitations of your vessel; if you are unsure contact a reputable naval architect, marine surveyor or the local TC Marine Safety office.

Fishing vessel owners are required to develop detailed instructions addressing the limits of stability for each of their vessels. The instructions need to be based on a formal assessment of the vessel by a qualified naval architect and include detailed safe operation documentation kept on board the vessel. Examples of detailed documentation include engine room procedures, maintenance schedules to ensure watertight integrity, and instructions for regular practice of emergency drills.

Emergency Drill Requirements

The master must establish procedures and assign responsibilities to each crew member for emergencies such as crew member overboard, fire, flooding, abandoning ship and calling for help.

Since July 30, 2003 all crew with more than 6 months at sea are required to have taken minimum Marine Emergency Duties training or be registered for such training. This training provides a basic understanding of the hazards associated with the marine environment; the prevention of shipboard incidents (including fires); raising and reacting to alarms; fire and abandonment situations; and the skills necessary for survival and rescue.

Cold Water Immersion

Drowning is the number one cause of death in the fishing industry. Cold water is defined as water below 25°C, but the greatest effects occur below 15°C. Arctic waters are usually below 15°C. The effects of cold water on the body occur in four stages: cold shock; swimming failure; hypothermia; and, post-rescue collapse. Know what to do to prevent you or your crew from falling into the water and what to do if that occurs.

Other Issues

Weather

Vessel owners and masters are reminded of the importance of paying close attention to current weather trends and forecasts during the voyage. Marine weather information and forecasts can be obtained from Environment Canada website at www.weatheroffice.ec.gc.ca

Emergency Radio Procedures

Vessel owners and masters should ensure that all crew are able to activate the Search and Rescue system early rather than later by contacting the CCG. It is strongly recommended that all fishers carry a registered 406 MHz Emergency Position Indicating Radio Beacon (EPIRB). These beacons should be registered with the National Search and Rescue secretariat. When activated, an EPIRB transmits a distress call that is picked up or relayed by satellites and transmitted via land earth stations to the Joint Rescue Co-ordination Centre, which will task and co-ordinate rescue resources.

All crew should know how to make a distress call and should obtain their restricted operator certificate from Industry Canada. However, whenever possible, masters should contact the nearest CCG Marine Communications and Traffic Services (MCTS) station prior to a distress situation developing. Correct radio procedures are important for communications in an emergency. Incorrect or misunderstood communications may hinder a rescue response.

Since August 1, 2003 all commercial vessels greater than 20m in length are required to carry a Class D Very High Frequency (VHF) Digital Selective Calling (DSC) radio. A registered DSC VHF radio has the capability to alert other DSC equipped vessels in your immediate area and MCTS that your vessel is in distress. Masters should be aware that they should register their DSC radios with Industry Canada to obtain a Marine Mobile Services Identity number or the automatic distress calling feature of the radio may not work.

A DSC radio that is connected to a Global Positioning System unit will also automatically include your vessel's current position in the Distress message. More detailed information on MCTS and DSC can be obtained by contacting a local CCG MCTS center or from the Coast Guard website: www.ccg-gcc.gc.ca

Collision Regulations

Fishers must be knowledgeable of the *Collision Regulations* and the responsibilities between vessels where risk of collision exists. Navigation lights must be kept in good working order and must be displayed from sunset to sunrise and during all times of restricted visibility. To help reduce the potential for collision or close quarters situations which may also result in the loss of fishing gear, fishers are encouraged to monitor the appropriate local Vessel Traffic Services VHF channel, when traveling or fishing near shipping lanes or other areas frequented by large commercial vessels. Vessels required to participate in Vessel Traffic Services include the following:

- every ship 20m or more in length;
- every ship engaged in towing or pushing any vessel or object, other than fishing gear; where the combined length of the ship and any vessel or object towed or pushed by the ship is 45m or more in length; or
- where the length of the vessel or object being towed or pushed by the ship is 20m or more in length.

Exceptions to the above include the following:

- a ship towing or pushing inside a log booming ground;
- a pleasure yacht less than 30m in length; and
- a fishing vessel that is less than 24m in length and not more than 150 tonnes gross.

Buddy System

Fishers are encouraged to use the buddy system when transiting and fishing as this allows for the ability to provide mutual aid. An important trip consideration is the use of a sail plan which includes the particulars of the vessel, crew and voyage. The sail plan should be left with a responsible person on shore or filed with the local MCTS. After leaving port the fisher should contact the holder of the sail plan daily or as per another schedule. The sail plan should ensure notification to Joint Rescue Co-ordination Centre when communication is not maintained which might indicate your vessel is in distress. Be sure to cancel the sail plan upon completion of the voyage.