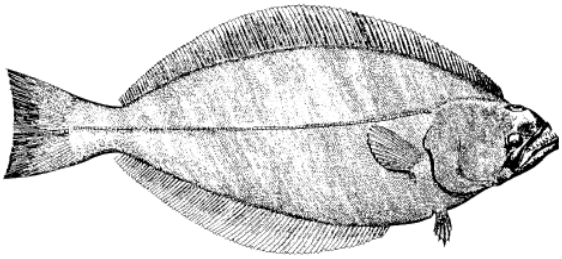

Gulf of St. Lawrence (4RST) Greenland Halibut in 2004

Background

This document presents an assessment of available data for this stock. It is a supplement to the 2004/14 Stock Status Report published in March 2004 following a full assessment of Greenland halibut in the Gulf of St. Lawrence.

The Greenland halibut (also known as black halibut, or turbot) population of the Gulf of St. Lawrence is considered to be a stock isolated from the main Northwest Atlantic population found to the east and north of Newfoundland's Grand Bank. Parasite studies conducted in the early 1990s showed that the Gulf population was distinct; all Greenland halibut in the Gulf, the Laurentian Channel and adjacent areas could be clearly distinguished from those of Labrador and the northern Grand Bank, suggesting that Greenland halibut complete their entire life cycle within the Gulf.

Greenland halibut are generally found in the channels of the Gulf of St. Lawrence at depths ranging between 130 and 500 m (70-280 fathoms). Spawning takes place primarily in winter, from January to March. Males reach sexual maturity at a smaller size than females, so their growth rate drops more sharply than that of the latter. This difference helps explain why females grow to be larger than males and make up the majority of commercial catches.

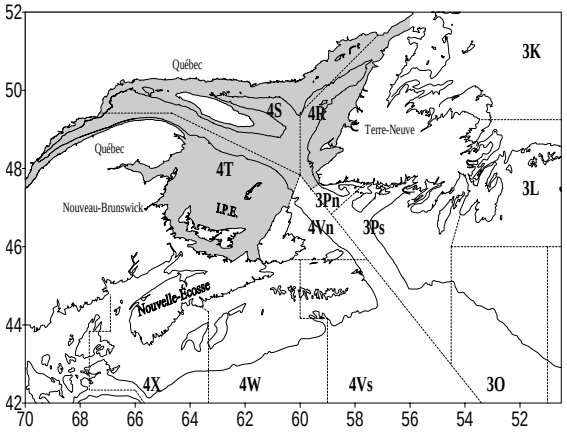

Figure 1. Map of the Gulf of St. Lawrence and adjacent areas showing NAFO 4RST divisions.

Summary

- Preliminary landings from Divisions 4RST rose from 3,565 to 3,895 t between 2003 and 2004. This increase resulted from the TAC increase, established at 4,500 t. For the last ten years, Quebec and Newfoundland fishermen have been using gillnets almost exclusively. Since 1998, this is the second consecutive year fishermen from both provinces have reached their allocations.
- Standardized catches per unit effort (CPUE) by traditional gillnetters using 6-inch mesh nets had been increasing since 2001, but dropped by 13% in 2004. Catches were mostly made up of females, reaching a proportion of 86%. The average size of the fish caught, which had been dropping since 1998, has increased in the last two years, reaching 47 cm. As a consequence, the number of Greenland halibut harvested per ton landed dropped by 10% between 2002 and 2004.
- Biomass indices obtained from the July sentinel survey and DFO survey show an upward trend between 1995 and 2003. In 2004, the sentinel survey index

continued this trend and reached the series' maximum value. The data from the 2004 DFO research survey conducted with the CCGS *Teleost* could not be used because of a calibration problem with the previously employed CCGS *Needler.*

- Information regarding sexual maturity showed that the size at which 50% of the fish are mature has dropped between 1998 and 2004. For males, it dropped from 40 to 35 cm, and for females from 51 to 44 cm.
- The 2005 fishery will likely be supported by the abundant 1999 year-class, and to a lesser extent by the 1997 and 1998 year-classes. However, the 1999 year-class seems to be less abundant than the one in 1997, which has been supporting the fishery for the last two years.
- The July sentinel survey showed an increase in population abundance in 2004, whereas the data from the commercial fishery indicates a decrease in standardized CPUE. The size of males and females at sexual maturity remained small in 2004. Nevertheless, the outlook for 2005 and beyond is positive in light of the presence of abundant year-classes already recruited in the fishery and the high levels of pre-recruits. Considering the uncertainty stemming from the missing abundance index from the DFO research survey, and because of the 2004 TAC increase, we recommend that the TAC remain at 4,500 t for 2005.

The fishery

Landings (thousands on tons)

Year	77-98 ay.	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005[1]
TAC	-	4.5[2]	4.5[3]	4.5[3]	3.5[3]	3.5[3]	4.5[3]
Fixed gear	3.1	3.4	2.0	1.2	1.6	3.5	3.8
Mobile gear	1.1	0.2	0.1	0.1	0.1	0.1	0.1
Total	4.2	3.6	2.1	1.3	1.7	3.6	3.9

[1] *Preliminary data*
[2] *TAC from January 1, 1999 to May 14, 2000*
[3] *TAC from May 15 of the current year to May 14 of the following year*

Conservation measures

Total allowable catches (TAC) have been set for Greenland halibut since 1982, to manage the fishery (Figure 2). In 1999, the TAC was set at 4,500 t and the fishing season ran from January 1, 1999 to May 14, 2000. In 2000-2001 and 2001-2002, the TAC remained unchanged but the season ran from May 15 of the current year to May 14 of the following year. In 2002-2003 and 2003-2004, the TAC was reduced to 3,500 t, and increased to 4,500 t in 2004-2005.

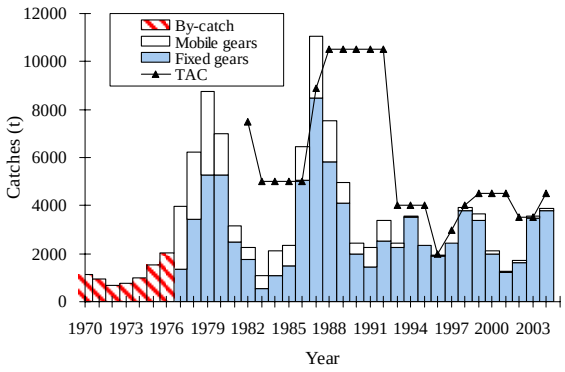

Figure 2. Annual Greenland halibut landings and total allowable catch (TAC). Data for 2004 are preliminary.

Following Fisheries Resource Conservation Council (FRCC) recommendations to reduce fishing effort and the number of immature fish caught, major conservation measures were implemented as of 1995:

- Increase in mesh size from 140 mm (5.5 inches) to 152 mm (6 inches);
- Adoption of a more selective fishing net configuration;
- Implementation of a minimum legal size (42 cm in 1996 and 44 cm since 1997) along with enforcement of a small-fish tolerance protocol for commercial catches;
- Establishment of a dockside monitoring program for commercial catches;
- Voluntary reduction in the number of nets used by Quebec fishermen (from 120 to 80 nets) between 1996 and 2000.

Landings

Until the mid-1970s, Greenland halibut landings in 4RST consisted mainly of by-catches from other fisheries (Figure 2). Subsequently, a directed gillnet fishery developed, and landings fluctuated substantially, exceeding 8,000 t on two occasions (1979 and 1987), due in part to additional catches from mobile gears. Beginning in 1989, catches stabilized between 2,000 t and 4,000 t. Since 1993, virtually no catches have been made using mobile gears because of the moratorium on directed cod fishing with this type of gear, and because shrimpers are required to use Nordmore grates. The fishery is now carried out by gillnetters with homeports in Quebec and the west coast of Newfoundland. An individual quota pilot project was launched in 1999 for Quebec traditional fishermen to extend their fishing season. This pilot project became permanent in 2002.

Landings decreased by 67% between 1999 and 2001. This significant drop reflects the disappointing results obtained for the fishery in 2000 and 2001, particularly for Quebec fishermen. Landings have increased since 2001, and have more than tripled between 2001 and 2004. Preliminary landings in Divisions 4RST have reached 3,895 t. Since 1998, this is the second consecutive year that fixed gear fishermen of both provinces catch their allocation. In 2002, only the Newfoundland fishermen caught their allocation.

Composition of catches

The mean size of the fish caught by commercial fishery, which was roughly 43 cm in 1995, shifted to 48 cm in 1996 after an increase in mesh size from 140 mm (5.5 inches) to 152 mm (6 inches) (Figure 3). The mean size of fish caught, which had been generally decreasing since 1998 (from 48 cm to 45 cm), has been increasing over the last two years, reaching 47 cm, and as a result, the number of Greenland halibut per tonne landed dropped by 10% between 2002 and 2004. Regardless of the increase in mean size of the fish from commercial catches, 28% of the fish landed are less than 44 cm in length, which is a source of concern.

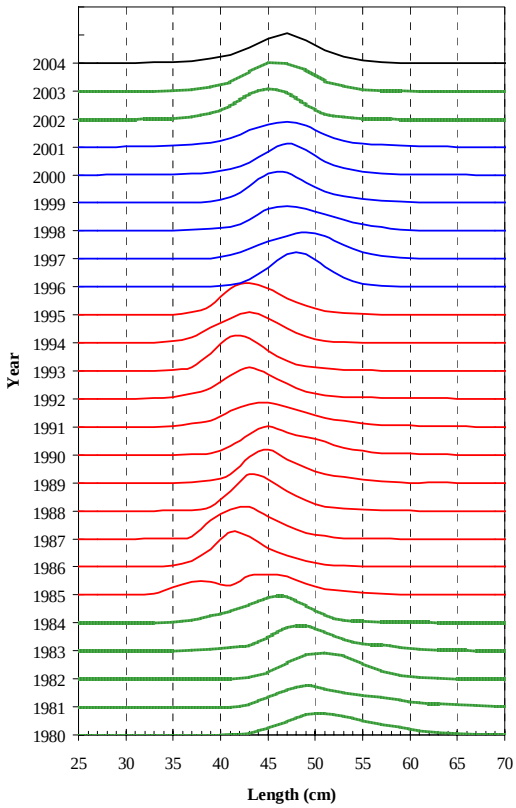

Figure 3. Size structure of Greenland halibut caught with gillnets, 1980–2004.

During the first half of the 1990s, the proportion of females in gillnet catches averaged 58%. Since 1998, there has been an increase in the percentage of females caught, reaching a value of 86% in 2004.

Fishery yields

Since 1996, the catches per unit effort (CPUE) of traditional gillnetters (6 in. mesh size) from Quebec and Newfoundland have been assessed using their logbooks.

Generally speaking, the CPUE per subdivision (or unit area) were decreasing for all areas between 1998 and 2000. In 2001 and 2002, while CPUE were increasing in 4Rb (Esquiman Channel), they remained low for the western areas of the Gulf. In 2003, the CPUE increased in every area, whereas in 2004, they were still increasing in the Esquiman Channel, but stabilized or decreasing in the western part of the Gulf.

Resource Assessment

For this assessment, the status of the resource is determined by studying indicators from the DFO's research survey, the July sentinel survey, and from the commercial fishery. The values of the indicators were compared with the 1996–2000 averages to assess recent stock status trends. Indicators from 2003 and 2004 were also compared with one another in order to assess the direction and significance of the changes between the two years (Table 1).

The indicators were rated according to the three following categories:

Positive: the indicator's value differs from the average in a way that positively affects resource status (e.g. above-average biomass).

Neutral: the indicator's value is similar to the average.

Negative: the indicator's value differs from the average in a way that adversely affects resource status.

The limits of the neutral category are delineated by the confidence intervals for the 1996–2000 average. Indicators differ from the average when their annual value is outside of the confidence interval.

Data used

Research surveys

The DFO's ground fish and shrimp research survey is going through a transition period. From now on, the survey will be conducted using the research vessel CCGS *Teleost,* equipped with a Campelen trawl, replacing the CCGS *Needler,* which was using a URI trawl. Because the selectivity of the two trawls is different, a calibration is required in order to link the two time series. Unfortunately, technical problems prevented gear calibration in 2004; it is now scheduled for 2005. Because of the missing DFO survey data, several indicators used to determine the resource status of Greenland halibut are lacking. These indicators include the main index for trawlable biomass, the main indicator for abundance of juveniles, an abundance indicator for pre-recruits and fish over 44 cm, a growth indicator (modal length at age 3), and the geographical distribution index.

The only mobile survey available this year was that from the July sentinel fisheries. This survey has been conducted in the northern Gulf since 1995 by nine otter trawlers according to a stratified random sampling design. It does not cover the St. Lawrence Estuary, where 20% of the Greenland halibut biomass is located and where a large concentration of 1 year-olds can be found.

This survey allows calculation of indices for minimum trawlable biomass, juvenile fish abundance (fish under 30 cm and 1 to 2-year old), pre-recruit (40-43 cm) abundance, and the abundance of fish above the minimum legal size (over 44 cm).

Table 1. Indicators used to assess short-term (2003 to 2004) and medium- term (1995-2004) stock status.

Indicators	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2003→2004
Stock biomass											
Alfred Needler (DFO)	−	=	=	=	=	+	+	=	+	na	na
Sentinel July	−	=	=	=	+	=	=	=	+	+	↑
Juvéniles (<30 cm)											
Alfred Needler (DFO)	−	−	=	=	=	+	=	=	+	na	na
Sentinel July	−	−	=	=	+	+	=	=	=	=	↓
Prerecruts (40-43 cm)											
Alfred Needler (DFO)	=	=	=	−	+	+	+	+	+	na	na
Sentinel July	−	−	=	=	+	=	=	+	+	+	↓
44 cm and more											
Alfred Needler (DFO)	−	+	+	−	=	=	=	−	+	na	na
Sentinel July	−	=	=	+	=	=	=	=	+	+	↑
Stock condition											
Distribution index	+	−	=	=	+	=	−	−	=	na	na
Condition index	=	=	=	+	=	−	=	=	=	=	±
Growth index	=	=	=	=	=	−	−	−	=	na	na
Males maturity		+	=	=	=	−	−	−	−	−	↓
Females maturity		=	=	+	=	−	−	−	−	−	±
Fishery											
Difference between fixed gear allocation and landings	+	+	+	+	=	−	−	−	+	+	±
CPUE		=	=	=	=	−	−	−	=	=	↓
Mean size	−	=	+	=	−	−	−	−	−	−	±

± no or little change (0 à 5 %) ; ↑ ↓ change of 5 % to 10 %; ↑↑ ↓↓ change of 10 % or more; na indicator not available

Data on the sexual maturity of males and females have been gathered since 1996 during DFO August survey, i.e. several months before spawning. Sexual maturity is assessed according to morphological criteria for all fish measured during this servey. The length at which 50% of fish are mature (L_{50}) is determined for both males and females and is used as a stock status indicator.

The Fulton condition index (fish weight / cubed length) was also calculated using the DFO survey data. This index provides information on fish physical condition.

Commercial fishery

The primary indicator of fishing success is the difference between fixed-gear allocations and related landings. The catch rate indicator was determined by standardizing (by sector, soak time and month) catch rates recorded in the logbooks of traditional gillnet fishermen using 6-inch mesh nets between 1996 and 2004. Lastly, the mean fish size of captures made with gillnets was calculated and used as the third indicator.

Resource status

Stock biomass

Recruitment

Since the late 1980s, two good years for juvenile production have been observed. A first group of juveniles (fish under 30 cm long and 1 and 2-year old) of average abundance was observed in DFO survey catches in the early 1990s (1989, 1990 and 1991 year-classes) (Figure 4 A). The next three year-classes (1992, 1993 and 1994) were low in abundance. The second good juvenile production period occurred during the second half of the 1990s. This period was characterized by alternating year-classes of high and average abundance. The 1997, 1999, 2001 and 2002 year-classes were of above-average abundance, while those of 1996, 1998 and 2000 appeared to be lower. The absence of a DFO survey in 2004 does not currently allow us to assess the strength of the 2003 year-class. The only available survey, the July sentinel survey, would however indicate that juvenile abundance was declining in 2004. However, the trawl that was used for this survey is not as selective for smaller size fish than the trawl used for the DFO survey (Figure 4).

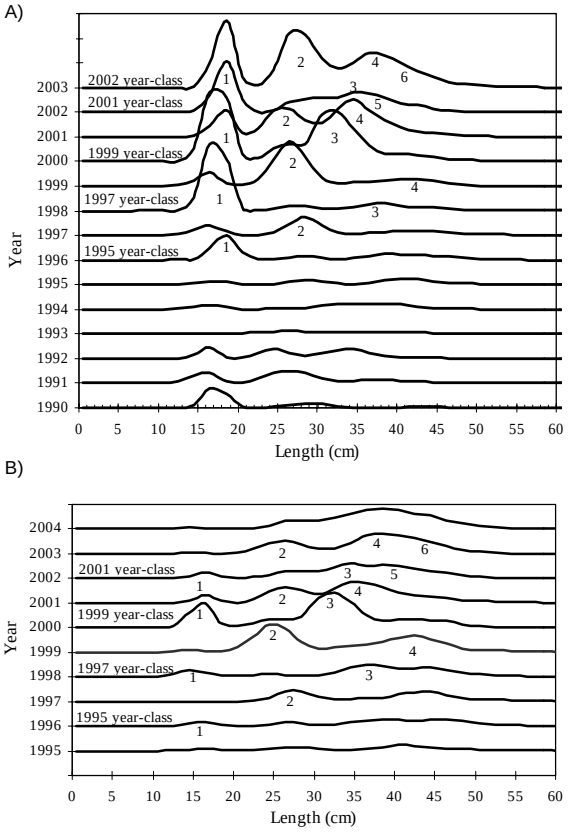

Figure 4. Size structure of Greenland halibut caught during DFO research surveys (A)(1990-2003) and (B) July sentinel survey (1995-2004). The five largest recent year-classes (1995, 1997, 1999, 2001 and 2002) are shown, as is the age of the fish each year.

Recent trends

The series of indicators that has been calculated since 1996 allows the assessment of stock trends over the recent years (Table 1). Stock biomass indices provided by the DFO survey and the July sentinel survey show similar patterns, with

an increasing trend between 1995 and 2003 (Figure 5). The sentinel survey index rose again in 2004 and reached a maximum value for that series. The increase between 2002 and 2003 was mostly due to a noticeable biomass increase in the western part of the Gulf, whereas the 2004 increase is mostly due to a rise in the Esquiman Channel.

Abundance indices expressed in numbers of pre-recruits (40-43 cm) and recruits to the fishery (over 44 cm) are also rising, with values that are higher in 2004 than the 1996-2000 series average.

The Fulton condition index began decreasing in 1999, and then improved from 2001 to 2004. However, the data regarding size at sexual maturity is still of concern. Data on sexual maturity show that the size at which 50% of the fish are mature (L_{50}) declined between 1998 and 2004 (Figure 6), decreasing from 40 to 35 cm for males and from 51 to 44 cm for females. The L_{50} for males is considerably lower than the minimum size of 44 cm established for the small fish protocol. Because growth rate drops after reaching sexual maturity, there exists a size dimorphism between males and females that advantages females in the gender ratio of commercial catches. In 2004, 86% of commercial catches were females.

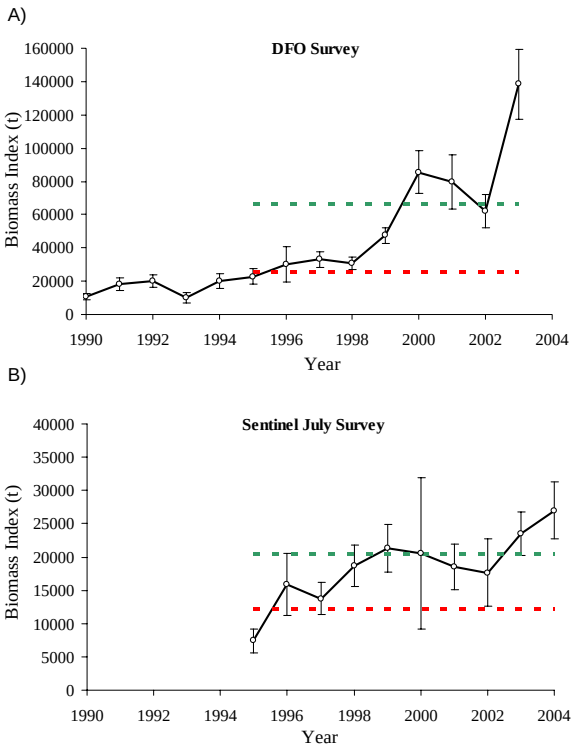

Figure 5. Minimum trawlable biomass indices for Greenland halibut in Divisions 4RST estimated from DFO and July sentinel survey data. The dotted lines represent the upper and lower limits for confidence intervals for the 1996–2000 mean.

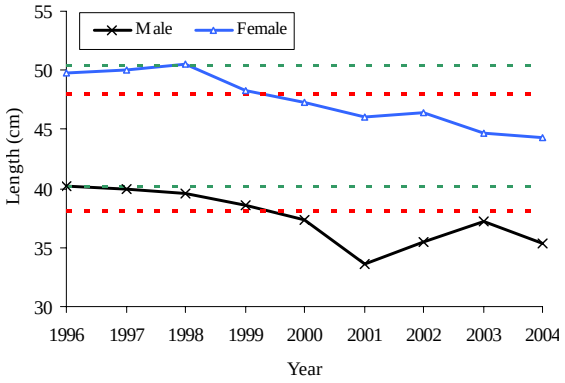

Figure 6. Length at 50% maturity for fish caught in DFO research surveys between 1996 and 2004. The dotted lines represent the upper and lower limits for confidence intervals for the 1996–2000 mean.

Two of the three fishery indicators (i.e. the difference between allocation and landings and the CPUE) improved in 2003 and 2004, yet they were all negative between 2000 and 2002. Thus, the difference between the allocation of fixed-gear fishermen and landings was positive and stable in 2003 and 2004, indicating that these fishermen reached their allocation. This observation is consistent with CPUE increases recorded between 2001 and 2003. In 2004 however, they decreased by 13%, but remain at the 1996-2000 series' average. Even though the mean size of fish in the fishery has been increasing over the last two years, it remains lower than series average. This situation is a consequence of the females' smaller size at sexual maturity.

Outlook

Forecasts for 2005 are positive given the presence of abundant year-classes already recruited to the fishery and the high level of pre-recruits. However, the indicators of the exploitable stock size differ in 2004, even though they have been increasing since 2001 (Figure 7). The biomass of 44+ cm fish is still increasing according to the sentinel survey, while the commercial fishery standardized CPUE are decreasing. The 2005 fishery will likely be supported by the abundant 1999 year-class and, to a lesser degree, the 1997 and 1998 year-classes. The 1999 year-class appears to be less abundant than the 1997 year-class, which supported the fishery over the last two years.

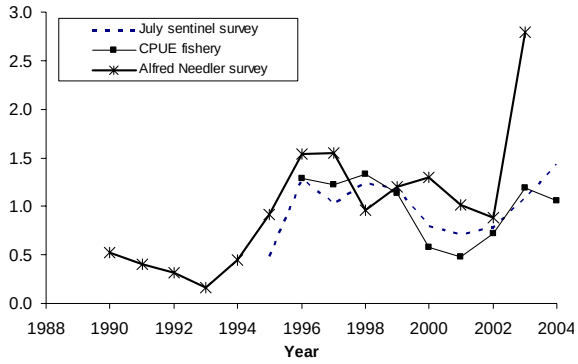

Figure 7. Standardized indices for fishable stock biomass (44 cm and over) for Greenland halibut and CPUE values for the fishery.

Uncertainty

As no calibration has been made between the 2004 CCGS *Teleost* survey and the CCGS *Needler* survey, the main stock abundance index was missing. The comparative survey scheduled for 2005 will link the two series.

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