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Science Response 2020/005

Quebec Region

## UPDATE OF STOCK STATUS INDICATORS FOR GREENLAND HALIBUT IN THE GULF OF ST. LAWRENCE (4RST) IN 2019

### Context

The Gulf of St. Lawrence (NAFO Divisions 4RST) Greenland halibut (*Reinhardtius hippoglossoides*) stock is assessed and managed on a two-year cycle. In the interim years, Quebec Region Science prepares an update of the resource's key indicators to determine if there has been a significant change in stock status that could justify a full stock assessment before the expected date and a possible revision of the advice. The next full assessment of this stock is scheduled for the winter of 2021.

This Science Response is a result of the Science Response Process of December 4<sup>th</sup> 2019 on the Update of Stock Status Indicators for Greenland Halibut in the Gulf of St. Lawrence (4RST) in 2019.

Additional publications from this meeting will be posted on the [DFO Science Advisory Schedule](#) as they become available.

### Overview of oceanographic conditions and the ecosystem

The Gulf of St. Lawrence (GSL) ecosystem has undergone significant changes in recent decades. Deep waters have been warming and dissolved oxygen levels have decreased. These changes appear to be detrimental to cold water species such as northern shrimp (*Pandalus borealis*) and Greenland halibut. In 2019, preliminary analysis of water temperature data shows a warming that reaches new records at 250 and 300 m.

Dissolved oxygen saturation levels remain low in the deep waters of the GSL. The lowest levels are found in the Lower Estuary, which is the main nursery for Greenland halibut. In 2019, the observed values were less than 18%. A saturation of 30% is generally the limit below which water is considered hypoxic and could limit the survival of some species. The critical threshold for juvenile Greenland halibut is 15% oxygen saturation.

The massive arrival of redfish in the GSL ecosystem could cause and/or contribute to increased direct (for food resources) or indirect (for habitat) interspecific competitive interactions with Greenland halibut. The combined biomass of the two redfish species (*Sebastes mentella* and *S. fasciatus*) is still increasing in 2019 and reaches a level never observed in the GSL. As these are long-lived species, they will share the ecosystem with Greenland halibut for many years to come.

### Analysis and Response

The indicators selected to monitor the status of the stock in the interim years are landings from the commercial fishery and indices of biomass and abundance from the bottom trawl survey conducted by Fisheries and Oceans Canada (DFO) in the northern Gulf of St. Lawrence (nGSL).

## The fishery

Since the closure of the mobile gear fishery in 1993, part of their total allowable catch (TAC) has been transferred to fixed gear fleets, while the other part is no longer fished. In this document, the terminology "fishing allocation (F-ALL)" is used to indicate the portion of the TAC that can be caught annually by fixed gear fishers.

A TAC of 3,375 t is in place for the 2019-2020 fishing season which takes place from May 15, 2019 to May 14, 2020. The F-ALL, after quota review, is 2,813 t and is divided between the Quebec (83 %) and Newfoundland (17%) fleets. As of November 25, 2019, landings totalled 1,757 t or 63% of the F-ALL (Figure 1). The fixed gear fleets under 65 feet from Quebec and Newfoundland had landed respectively 54% and 101% of their allocation. These landing data are preliminary, but are not expected to increase significantly with the continuation of the fishery next spring.

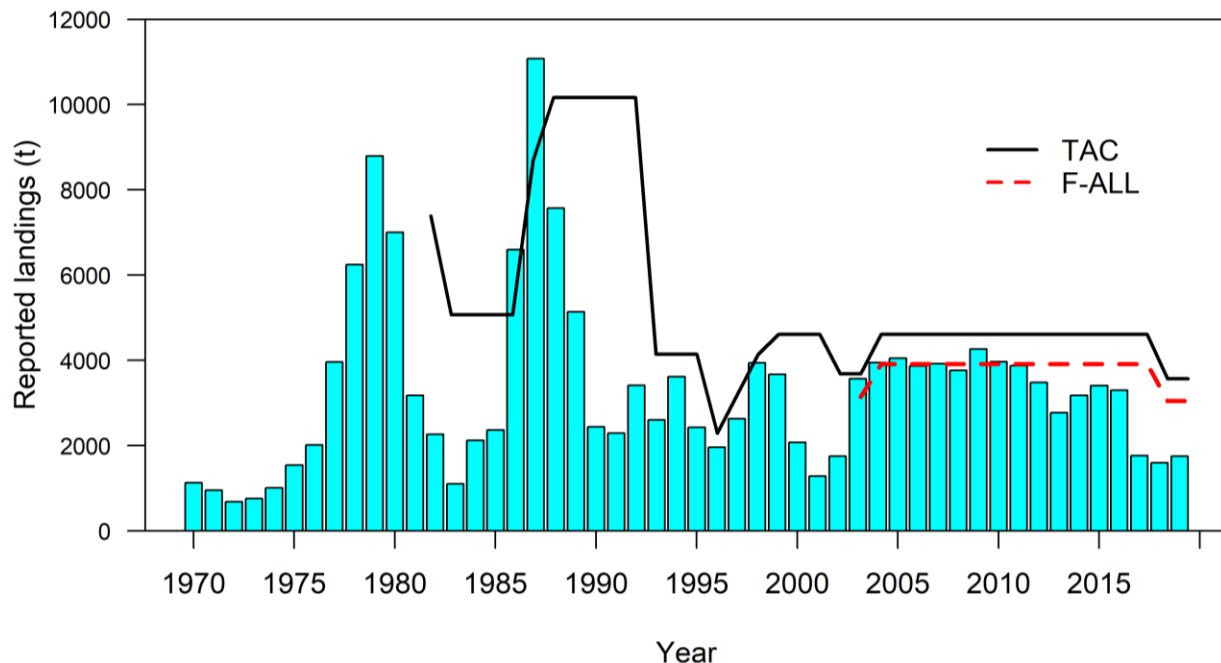


Figure 1. Reported landings of Gulf of St. Lawrence Greenland halibut, total allowable catch (TAC) and fishing allocation (F-ALL) available to fixed gear fleets. Data for 2018 and 2019 are preliminary.

Fishing allocations have not been reached since the 2012-2013 fishing season indicating that TACs have not been restrictive for the past eight years.

## Indicators of the stock status

The abundance index (mean number per tow) of DFO's nGSL survey for Greenland halibut shows a slight increase in 2019 compared to 2018 and is at the level of the 1990-2018 time series average (Figure 2). The biomass index (mean weight per tow) has shown a general downward trend for more than 15 years and has been below the long-term series average for the last 3 years. The 2019 value is slightly lower than that of 2018.

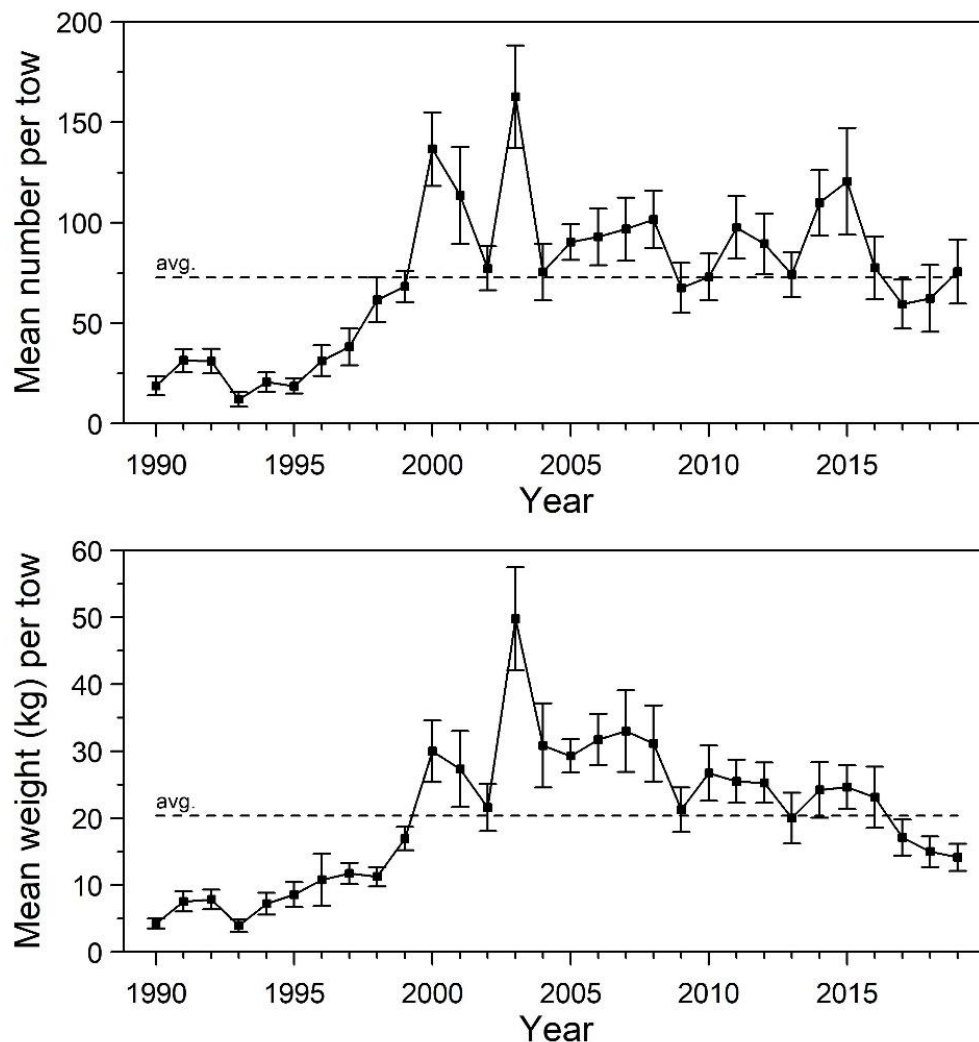


Figure 2. Mean number and weight per tow of Greenland halibut observed during DFO nGSL (1990-2019) surveys. The dotted lines indicate the long-term average of each series (1990-2018). The error bars indicate the 95% confidence interval.

Trends in abundance indices (mean number per tow) of Greenland halibut vary by size class (Figure 3). The size classes of 0-20 and 20-30 cm increased significantly in the late 1990s and then fluctuated around the long-term average. There is an alternation of strong and weak cohorts and a very good correlation between the abundance of 0-20 cm (1 year) and 20-30 cm (2 years) fish the following year. In 2019, the abundance of the 0-20 cm size class is high, indicating the arrival of a good cohort in 2018. For several years, the abundance of these large cohorts of juveniles has not led to subsequent increases in abundance indices for larger fish. For the latter, abundance indices increased until the beginning (fish 30-40 cm) or until the middle (fish > 40 cm) of the 2000s and these indices have shown a downward trend since then. In 2019, only the abundance index of fish in the 0-20 cm size class is above the long-term average (Figure 3).

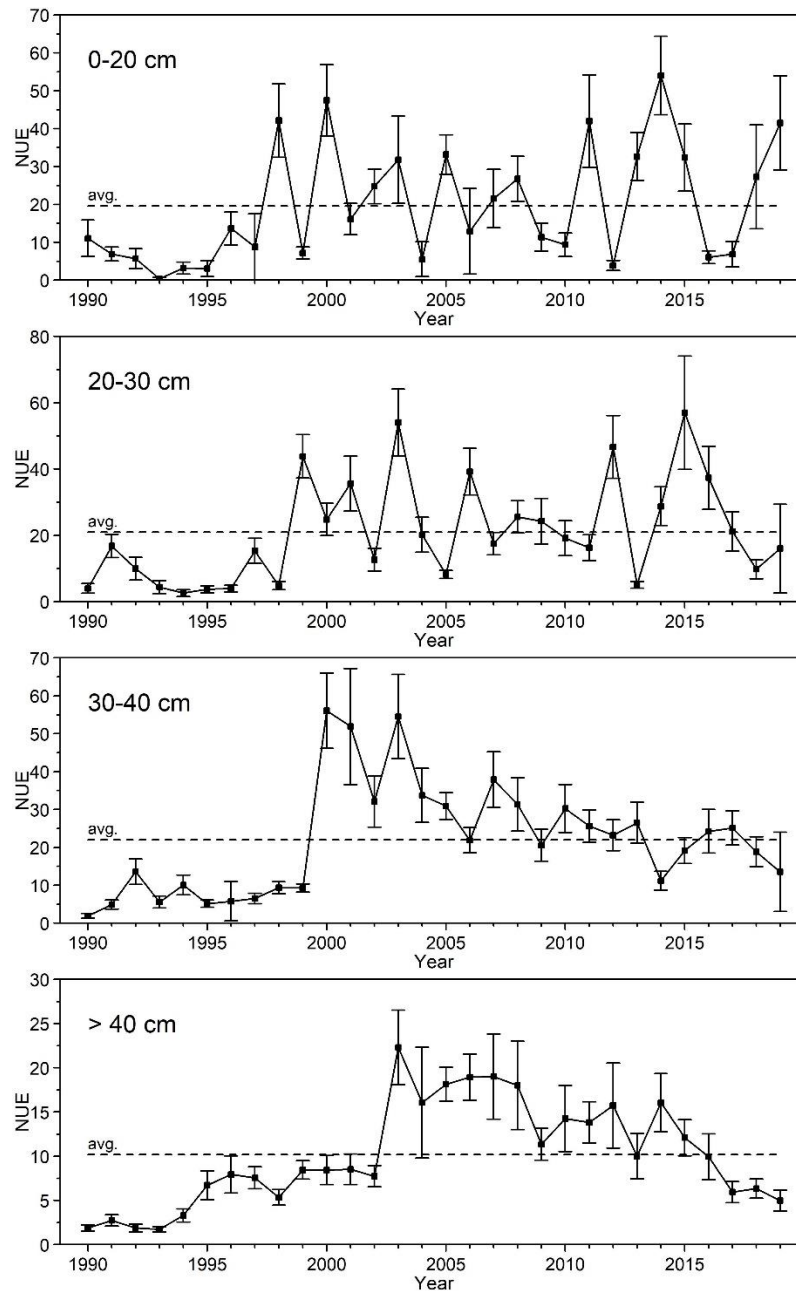


Figure 3. Abundance indices (mean number per tow, NUE) for different size classes of Greenland halibut observed during DFO's nGSL surveys. The dotted lines represent the long-term average (1990-2018) of each series. The error bars indicate the 95 % confidence interval.

### Relative exploitation rate

An annual indicator of the relative exploitation rate is obtained by dividing the weight of the commercial catch by the biomass of fish greater than 40 cm estimated by the DFO nGSL research survey. This biomass represents an approximation of the exploitable biomass. The method does not allow an absolute exploitation rate to be estimated, nor does it allow it to be related to target exploitation rates. However, it allows to track relative changes over time. For the Gulf of St. Lawrence, the average exploitation rate is 6.5% for the period 1996-2018 (Figure

4). The period from 2001 to 2008, when the exploitation rate (4.8%) was below average, corresponds to the time when the biomass of fish over 40 cm began to increase and then stabilized at a high level (Figure 5). The period from 2009 to 2018, characterized by a near-average exploitation rate, corresponds to a more or less constant period of decline in the biomass of fish over 40 cm. These data could suggest that the exploitation rate in recent years has been too high. In 2019, the biomass of fish over 40 cm continued to decline and removals increased compared to 2018, resulting in an increase in the relative exploitation rate to 8.9%.

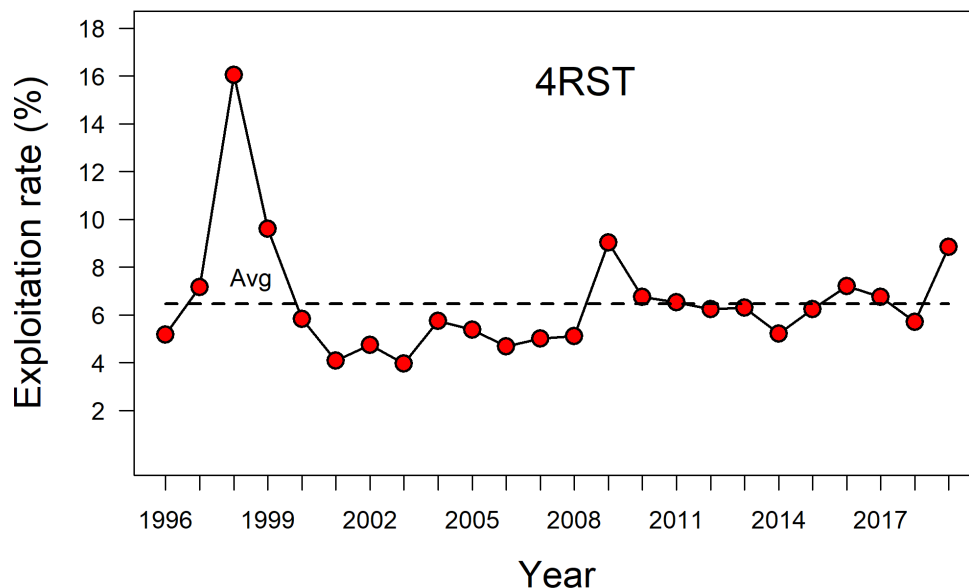


Figure 4. Relative exploitation rate of Greenland halibut in the Gulf of St. Lawrence. The dotted line represents the long-term average of the series (1996-2018).

### Monitoring indicator and trigger for a full evaluation in an interim-year

The indicator for monitoring the status of the Greenland halibut stock in the interim-year is the biomass of fish larger than 40 cm assessed with data from the DFO nGSL survey (Figure 5). This indicator is considered to be an approximation of the mature stock biomass as well as the biomass that will be available to the fishery the following year. The trigger that may warrant a re-assessment of the stock ahead of schedule has been set to a decrease of more than 30% of the indicator when it is in the cautious or critical zone under the precautionary approach (DFO 2019). The precautionary approach is under development for this stock and an upper stock reference point (USR) proposed by Science has not yet been adopted. However, based on the trajectory of this indicator, it can be concluded that the stock is currently in the cautious zone. The downward trend observed for the indicator over the past decade continued in 2019 and biomass reached close to 20,840 t. The indicator decreased by 24% between 2018 and 2019, which is below the value set as a trigger for a full stock reassessment.

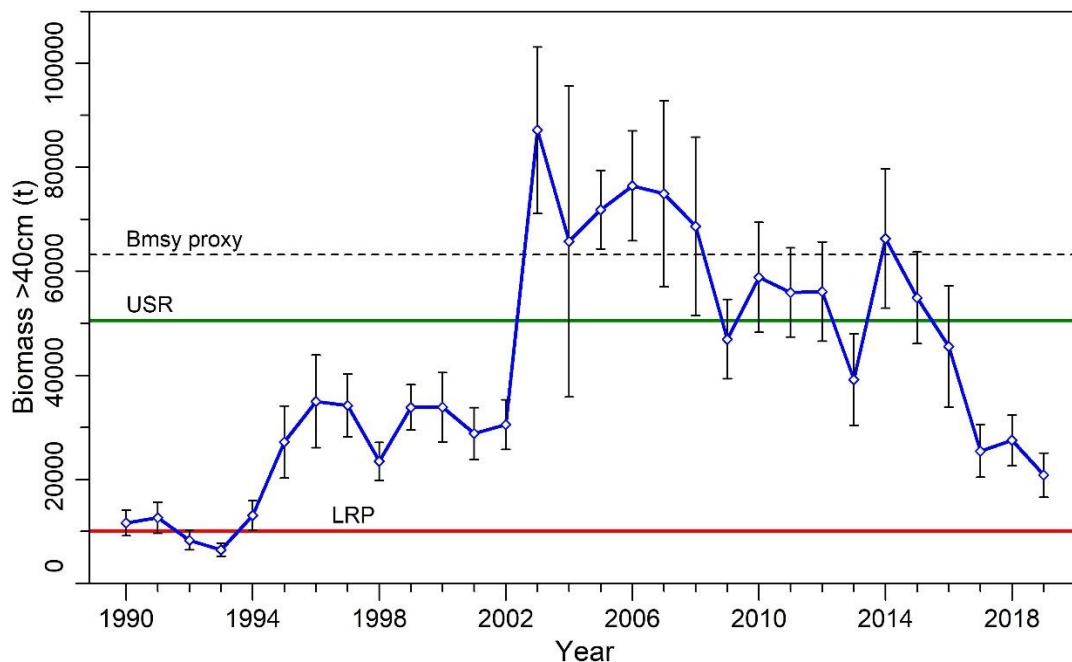


Figure 5. Annual biomass indicator for Greenland halibut larger than 40 cm based on data from the DFO nGSL research survey. The bottom horizontal solid line (red) locates the limit reference point (PRL, 10,000 t) as part of the precautionary approach and delineates the critical and cautious zone. The upper horizontal solid line (green) locates the upper reference point (USR, 50,500 t) proposed by Science and delineates the caution and healthy zone. The black dotted line indicates the proxy of biomass at maximum sustainable yield ( $B_{msy}$ ). The error bars indicate the 95% confidence interval.

## Conclusions

Ecosystem conditions unfavorable to the GSL Greenland halibut stock did not improve in 2019. The downward trend in the biomass of fish larger than 40 cm that began more than 10 years ago continued in 2019 to reach close to 20,840 t. The relative exploitation rate has increased during this fishing season.

Analysis of the stock status indicator shows the indicator's trigger value has not been reached. Therefore, a full re-assessment of the stock is not warranted and the conclusions of the previous scientific advice remain appropriate.

*"The short-term outlook for the Greenland halibut stock in the GSL is poor given the observed ecosystem changes, a slowdown in the growth of the 2013 cohort, and decreases in the abundance and biomass indices for fish >40 cm. The decrease in abundance and biomass indices for fish >40 cm corresponds to a period during which the exploitation rates have been higher than in the previous period where the stock rebuilt and remained abundant. This could indicate that the exploitation rates of the last ten years were too high. As a result, a reduction in the exploitation rate seems necessary to stop the decline in the stock and promote its recovery."* (DFO 2019)

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## Sources of information

DFO. 2016. [Guidelines for providing interim-year updates and science advice for multi-year assessments](#). DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2016/020.

DFO. 2019. [Assessment of the Gulf of St. Lawrence \(4RST\) Greenland Halibut stock in 2018](#). DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2019/023.

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