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Canadian Science Advisory Secretariat
Science Response 2021/003

Quebec Region

UPDATE OF INDICATORS OF THE SAGUENAY FJORD WINTER RECREATIONAL GROUND FISH FISHERY, 2019-2020

Context

Information from the Saguenay Fjord winter recreational groundfish fishery monitoring program is reviewed every two years.

According to the last assessment conducted in November 2018, catch rates of the main species harvested were generally low and stable, and it was recommended that fishing effort be maintained at levels similar to previous years for the 2019 and 2020 fishing seasons. However, Atlantic cod and Greenland halibut catch rates have been increasing since 2013, and the outlook for redfish was encouraging, given the arrival of strong cohorts in the Saguenay. In addition, studies carried out about a decade ago suggested that marine fish populations in the Saguenay Fjord, specifically Atlantic cod and redfish, are “sink” population and that recruitment to them is dependent on the influx of juveniles from the St. Lawrence Estuary. Although groundfish reproduction does occur in the Saguenay, larval survival in these species may be jeopardized by conditions in the warm and brackish surface layer, preventing significant local contribution to recruitment. The status of marine fish populations in the Saguenay is therefore closely tied to the status of Estuary and Gulf of St. Lawrence stocks.

In this context, and given the fluctuations seen in the abundance of certain species in the Saguenay as well as the precarious situation of the St. Lawrence groundfish stocks that are the source of recruitment for the populations in the Saguenay, Fisheries Management would like an update of the indicators to determine if the management measures in place should be adjusted for future fishing seasons. The recreational fishery is currently managed through a fishing season and daily catch limits.

This update presents an analysis of the most recent data obtained from the recreational fishery monitoring program, specifically from the logbook initiative introduced in 2015. The gillnet scientific survey that was carried out by Fisheries and Oceans Canada (DFO) every April from 2000 to 2018 is no longer conducted. No fishery-independent data were available for this update.

This Science Response results from the Science Response Process of November 12, 2020 on the Update of Indicators of the Saguenay Fjord Winter Recreational Groundfish Fishery.

Background

The Saguenay Fjord winter recreational groundfish fishery took off in the early 1980s. It is unique in Quebec because of its size and the variety of species caught in the area. As a result of the growing interest in this recreational tourism activity in the mid-1990s, a number of stakeholders became concerned about resource conservation and the sustainable development of this fishery. A monitoring program was launched in 1995, and is coordinated by DFO and delivered in collaboration with the Société des établissements de plein air du Québec and Parks Canada, which co-manage the Saguenay–St. Lawrence Marine Park, with the participation of Promotion Saguenay and various Saguenay fishers' associations and committees. Since the 2020 fishing season, the organization Contact Nature has taken over from Promotion Saguenay. The program's success relies on the substantial contribution of each of the partners, who are responsible for gathering and inputting information from each of the villages under their jurisdiction.

The main groundfish species caught in the Saguenay winter recreational fishery are, in order of importance, redfish (*Sebastes* spp.), Atlantic cod (*Gadus morhua*), Greenland cod (*Gadus ogac*) and Greenland halibut (*Reinhardtius hippoglossoides*), also known as turbot.

The abundance of certain species, including the Atlantic cod stocks in the northern and southern Gulf of St. Lawrence that may provide recruits to the Saguenay, has declined substantially since the early 1990s. The abundance of Greenland halibut in the Gulf of St. Lawrence has also been in decline for the past 15 years or so. However, this stock regularly produces moderate to high abundance cohorts. These juveniles are mainly located in the Estuary and may disperse into the Saguenay Fjord.

The situation is different for redfish, whose abundance in the Estuary and Gulf of St. Lawrence is the highest it has been in 30 years. This high abundance level is due to the large influx of cohorts in 2011, 2012 and 2013, which consisted mainly of deepwater redfish (*Sebastes mentella*). These new cohorts have also been observed in the Saguenay Fjord since 2014, for example, during a major stranding at Saint-Fulgence, in DFO research surveys and in the winter recreational smelt fishery. Significant recruitment of these fish to the recreational groundfish fishery has been observed since 2019.

Description of the fishery

The winter recreational fishery extends throughout the entire upper basin of the Saguenay Fjord, between Saint-Fulgence and L'Anse-Saint-Jean, and is concentrated in eight fishing villages set up on the pack ice (Figure 1). The borough of La Baie includes the villages of L'Anse-à-Benjamin, Grande-Baie and Les Battures. Note that the Les Battures site has been closed since 2013 due to a problem with the ice cover. The other villages are associated with the municipalities of Saint-Fulgence, L'Anse-Saint-Jean, Rivière-Éternité, Saint-Félix-d'Otis and Sainte-Rose-du-Nord. These last four sites are located within the limits of the Saguenay–St. Lawrence Marine Park (SSLMP).

Ice conditions were favourable for the 2019 fishing season, and various sites were set up for the entire season. However, unfavourable ice conditions in 2020 led to an approximate two-week delay in setting up cabins in L'Anse-à-Benjamin, Grande-Baie and Rivière-Éternité, and the Sainte-Rose-du-Nord, Saint-Fulgence and L'Anse-Saint-Jean villages could not be set up.

Fishing villages generally include two areas where cabins are set up: a pelagic fish area near shore, where smelt (*Osmerus mordax*) is the main catch, and a groundfish area further out in deeper waters, where the species discussed in this report are caught.

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No licence is required for this fishery and only line fishing is permitted. Rods, tip-ups and rollers are used. There is no restriction on the number of lines and hooks used. In addition, the regulations contain a mandatory release clause for crustaceans, molluscs, Atlantic halibut (*Hippoglossus hippoglossus*), wolffish, sharks and skates. Selling, bartering and wasting fish is also prohibited.

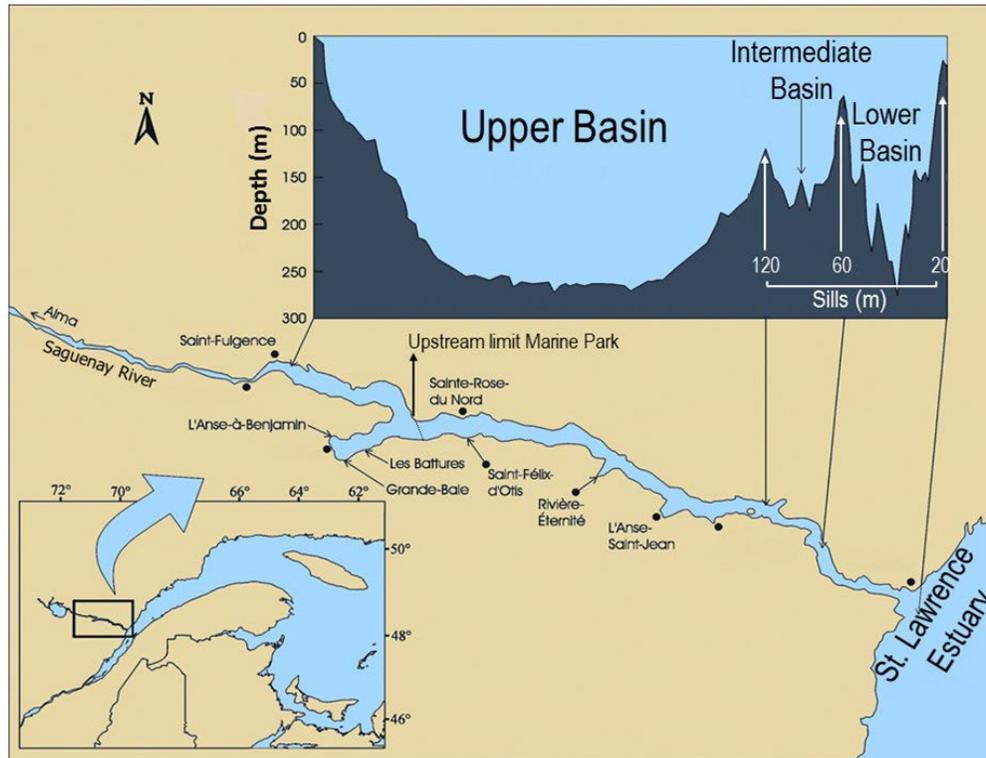


Figure 1. Bathymetric map and profile of the Saguenay. Fishing villages are set up on the pack ice in Saint-Fulgence, L'Anse-à-Benjamin, Grande-Baie, Les Battures, Sainte-Rose-du-Nord, Saint-Félix-d'Otis, Rivière-Éternité and L'Anse-Saint-Jean. The map also identifies the upstream boundary of the Saguenay–St. Lawrence Marine Park.

Conservation measures implemented since the monitoring program first began focus primarily on two aspects: 1) the daily groundfish catch limit and 2) the length of the fishing season. The first management measures in 1995 combined a daily limit of 25 groundfish and a season length of more than 100 days. Over the years, the monitoring program has identified significant decreases in the abundance of harvested fish, which has led to changes in management measures such as a gradual lowering of the daily catch limit and a reduction in season length. For the 2019 and 2020 fishing seasons, the daily catch limit was 5 groundfish, and the season was 58 days long.

In 2019 and 2020, an average of 978 cabins were set up on the pack ice in the pelagic fish and groundfish areas, which represents a decrease of about 440 cabins compared to the average for 1998–2018. This decline can be explained by the absence of fishing villages in Saint-Rose-du-Nord, Saint-Fulgence and L'Anse-Saint-Jean in 2020 and by the decreased number of cabins in the La Baie fishing villages. Close to 60% of cabins are set up in the villages' groundfish areas.

Analysis and Response

The information presented in this section is based on data obtained from the winter recreational fishery monitoring program, which includes three components.

The first component (1996–2020) involves describing fishing activities by interviewing recreational fishers in different fishing villages. The annual sampling plan involves visiting each site 20 times, on weekdays and weekends throughout the entire fishing season. On each of these visits, samplers aim to interview 15 randomly selected fishers. Since 2010, an average of about 1,100 fishers have been interviewed every year. Fishers provide information on their catch (species, number) and fishing effort (number of lines, hooks per line and hours fished). Samplers also estimate site frequentation by counting the number of fishers in the groundfish area at the time of their visit. The primary objective is to identify trends in the catch per unit effort (CPUE) for the main species caught, i.e. redfish, Atlantic cod, Greenland cod and Greenland halibut. The information collected is also used to estimate annual frequentation in number of fishermen-days.

The second component (1996–2020) focuses on collecting biological data on the different species caught, e.g. size and weight. These data are collected by samplers and fishers recruited in each village. Between 2010 and 2020, data on an average of 785 fish were compiled annually.

A third component, introduced in 2015, consists of logbooks completed by recreational fishers who fish inside and outside of fishing villages. Fishing activities conducted outside of villages are poorly represented in Component 1 of the monitoring program. One of the main advantages of logbooks is that the fisher contributes his effort and catches for his entire fishing activity. By comparison, in Component 1, fishers are interviewed and information is collected when they happen to meet samplers, which may be before they have ended their day of fishing. Since 2015, around 20 logbooks have been filled out every year, for an average of about 400 fishing activities per year.

Indicators

Monitoring program – Component 1

Frequentation

The estimated average frequentation for 1996–2020 is approximately 27,000 fishermen-days per fishing season. Despite substantial fluctuations in annual frequentation, the long-term trend shows some stability for the whole Saguenay region (Figure 2). In 2020, the absence of fishing villages in Sainte-Rose-du-Nord and L'Anse-Saint-Jean led to a significant decline in the number of fishermen-days in the SSLMP. This decrease was offset by an increase in frequentation in the La Baie fishing villages.

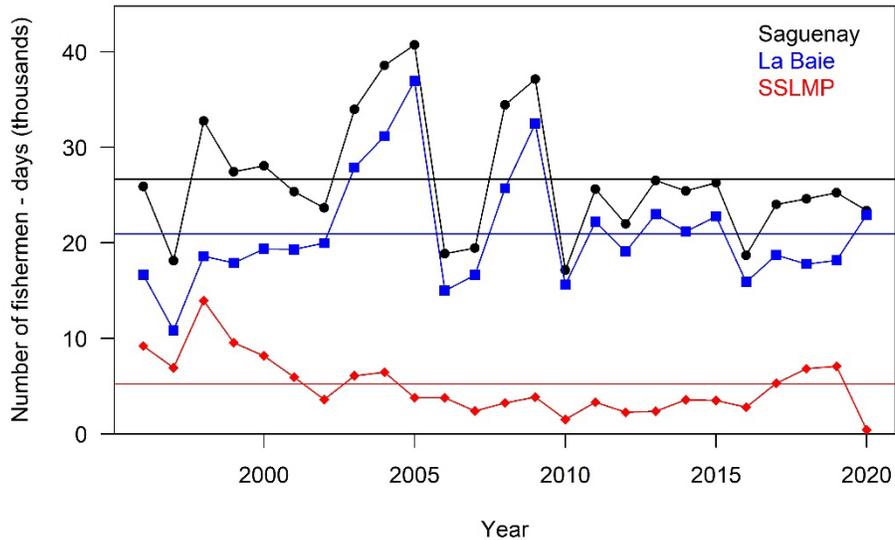


Figure 2. Estimated annual frequentation of the recreational groundfish fishery for the entire Saguenay region (black circle) and by area, i.e. La Baie (blue square) and the SSLMP (red diamond). The Saguenay region data are aggregate data from all of the fishing villages sampled. La Baie includes data from L'Anse-à-Benjamin, Les Battures and Grande-Baie. The SSLMP covers the Sainte-Rose-du-Nord, L'Anse-Saint-Jean, Rivière-Éternité and Saint-Félix-d'Otis sites. The average (1996–2019) of each series is represented by a horizontal line

Total annual catch

In the 2020 winter recreational fishery, redfish, Atlantic cod, Greenland halibut and Greenland cod accounted for 97%, 2%, 1% and < 1%, respectively, of the estimated total catch (Figure 3). Since 2010, redfish and Greenland cod catches have mainly come from fishing villages in La Baie, while Atlantic cod and Greenland halibut catches are generally higher in villages in the SSLMP (Figure 4).

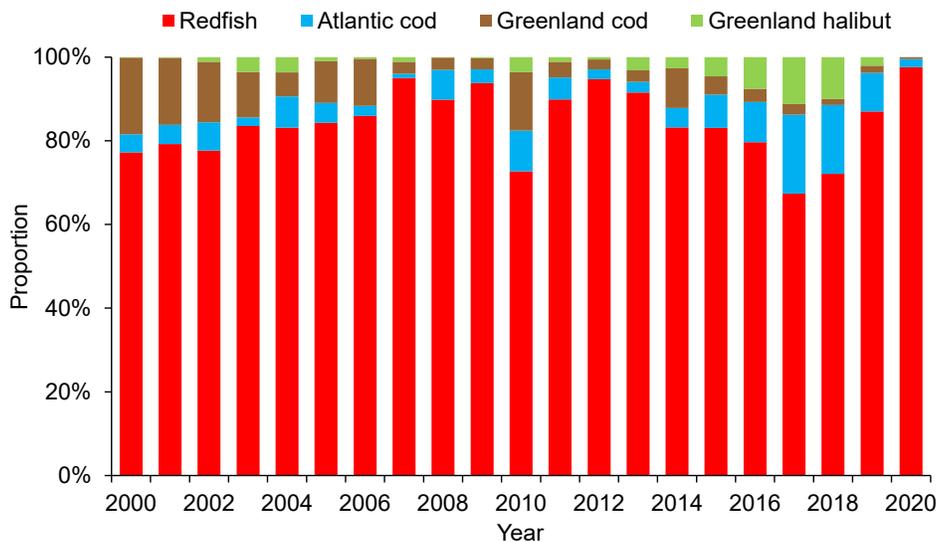


Figure 3. Annual proportion of main species caught in the Saguenay Fjord winter recreational groundfish fishery.

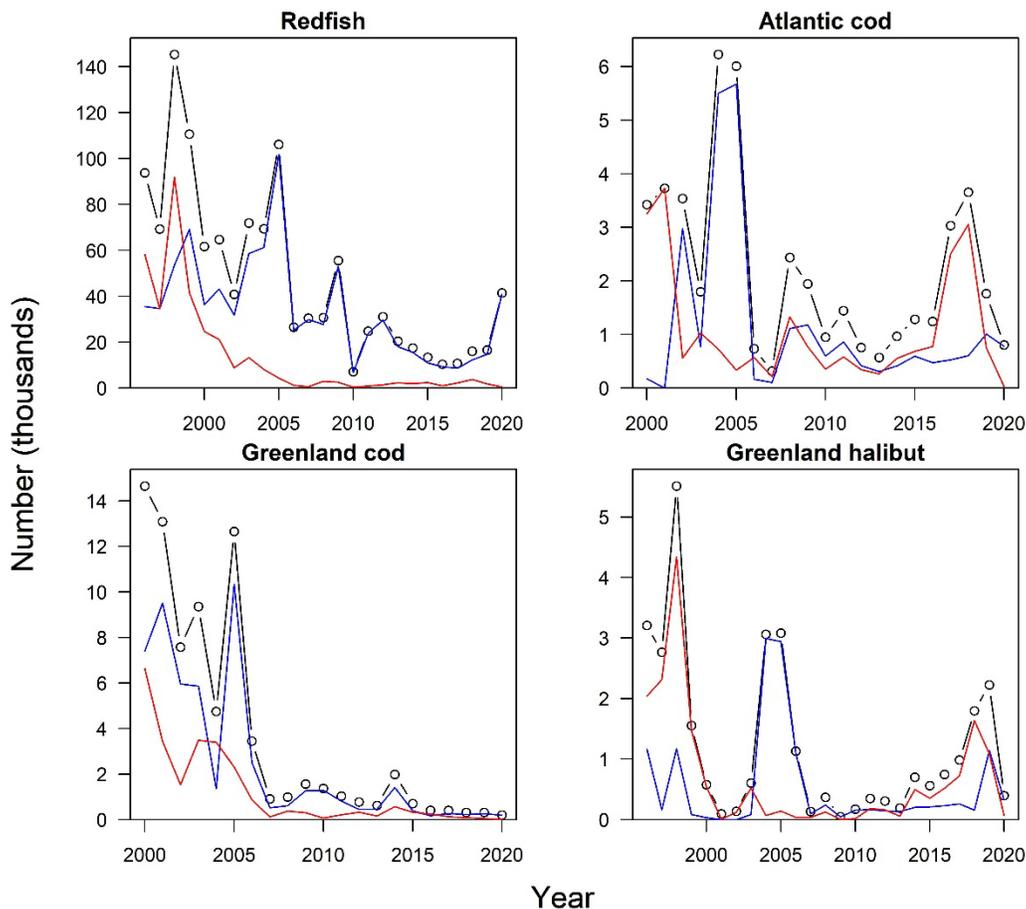


Figure 4. Estimated total catch by year and by species across the entire Saguenay (black circles) and in the La Baie (blue line) and SSLMP (red line) areas in the Saguenay Fjord winter recreational groundfish fishery.

Catch rate

The catch rate of a species is used as an indicator of fishing success, and it provides information on annual variations in species abundance. Catch rates are calculated as the number of fish caught per unit effort, where effort is the product of the number of lines used, the number of hooks per line and the number of hours fished.

The data were standardized to account for the variability that results from different factors, such as the fishing village and the day on which the fishing took place (weekday or weekend). Standardization makes it possible to identify yearly trends in catch rates.

The redfish catch rate index shows a continual downward trend from 1996 to 2006, followed by low, generally below average values up until 2019 (Figure 5). In 2020, a slight increase to just above the series average was noted.

The catch rates for Atlantic cod, Greenland cod and Greenland halibut are much lower than those for redfish. The Atlantic cod catch rate has fluctuated since 2000, peaking in 2017. Since then, it has been declining and was close to the series average in 2020 (Figure 5). For Greenland halibut, the catch rate remained relatively low and stable from 1996 to 2013, and then increased, reaching a maximum value in 2019. It declined in 2020 but remains above the

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series average. For Greenland cod, the catch rate followed a downward trend from 2000 to 2006, thereafter fluctuating at a low level with generally below average values. In 2020, the catch rate reached the lowest value in the time series.

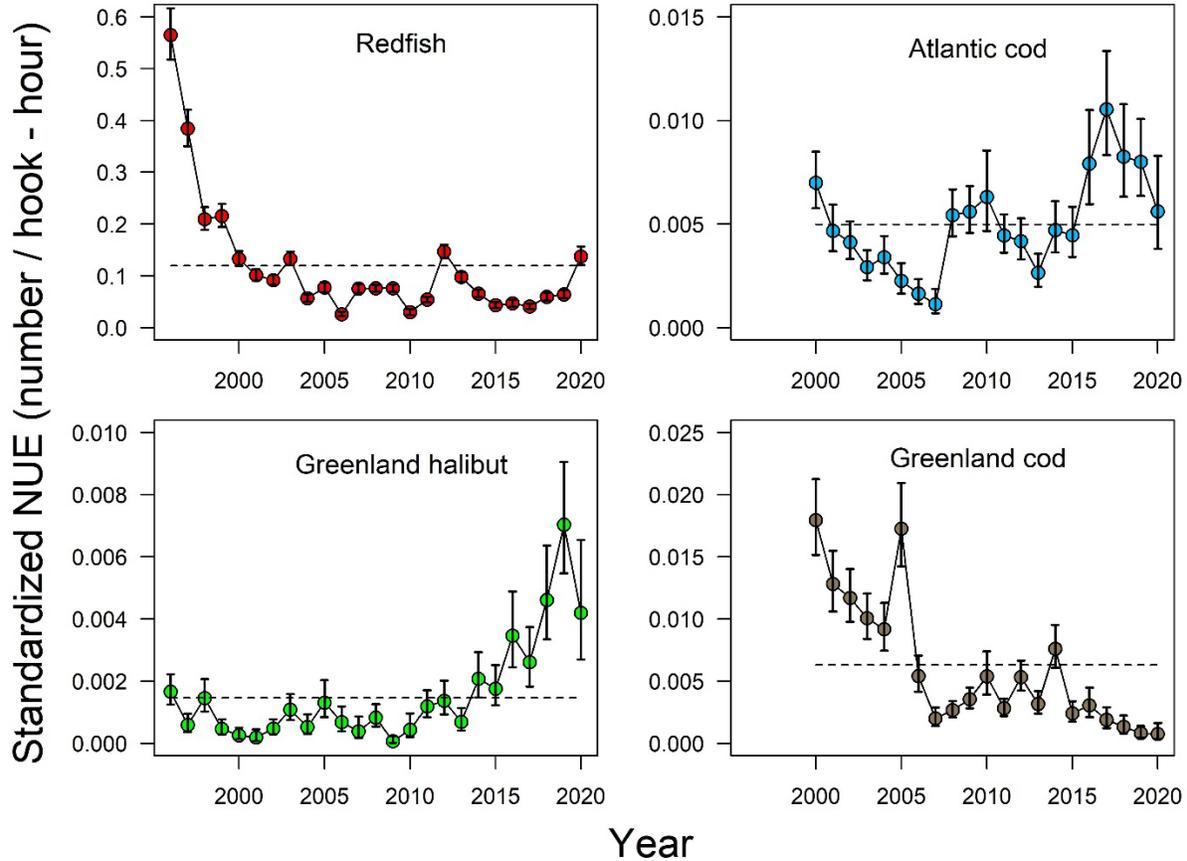


Figure 5. Standardized annual catch rates in number per unit effort ($[NUE] \pm 95\%$ confidence interval) for redfish, Atlantic cod, Greenland cod and Greenland halibut, based on data from Component 1 of the monitoring program. The horizontal lines represent the 1996–2019 series average for redfish and Greenland halibut, and the 2000–2019 series average for Atlantic cod and Greenland cod. Prior to 2000, no distinction was made between Atlantic cod and Greenland cod, and redfish species were not distinguished in the monitoring program.

Monitoring program - Component 2

Biological data

Size distribution frequencies of Greenland halibut, Atlantic cod and Greenland cod show a wide range of sizes, indicating the presence of several cohorts in the fishery (Figure 6). Variations in the mean size also indicate that new cohorts are recruiting to the fishery. Figure 6 tracks the trajectory of Atlantic cod and Greenland halibut cohorts over a period of several years.

The situation was different for redfish. The slow and steady increase in the median size of redfish in the fishery from 1996 to 2016 suggested that no significant recruitment events occurred and that the fishery was concentrated on a small number of cohorts (Figure 6). However, it has been observed that a higher number of redfish less than 25 cm have been

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caught since 2016. The percentage of small redfish in the fishery rose from 6% in 2016 to 51% in 2020 (Figure 7). This increase in redfish is the result of the influx to the Saguenay of fish from the 2011, 2012 and 2013 cohorts—whose abundance in the Estuary and Gulf of St. Lawrence has reached the highest level in 30 years. The new redfish cohorts are recruiting well to the recreational fishery but the fish are still small and many are returned to the water.

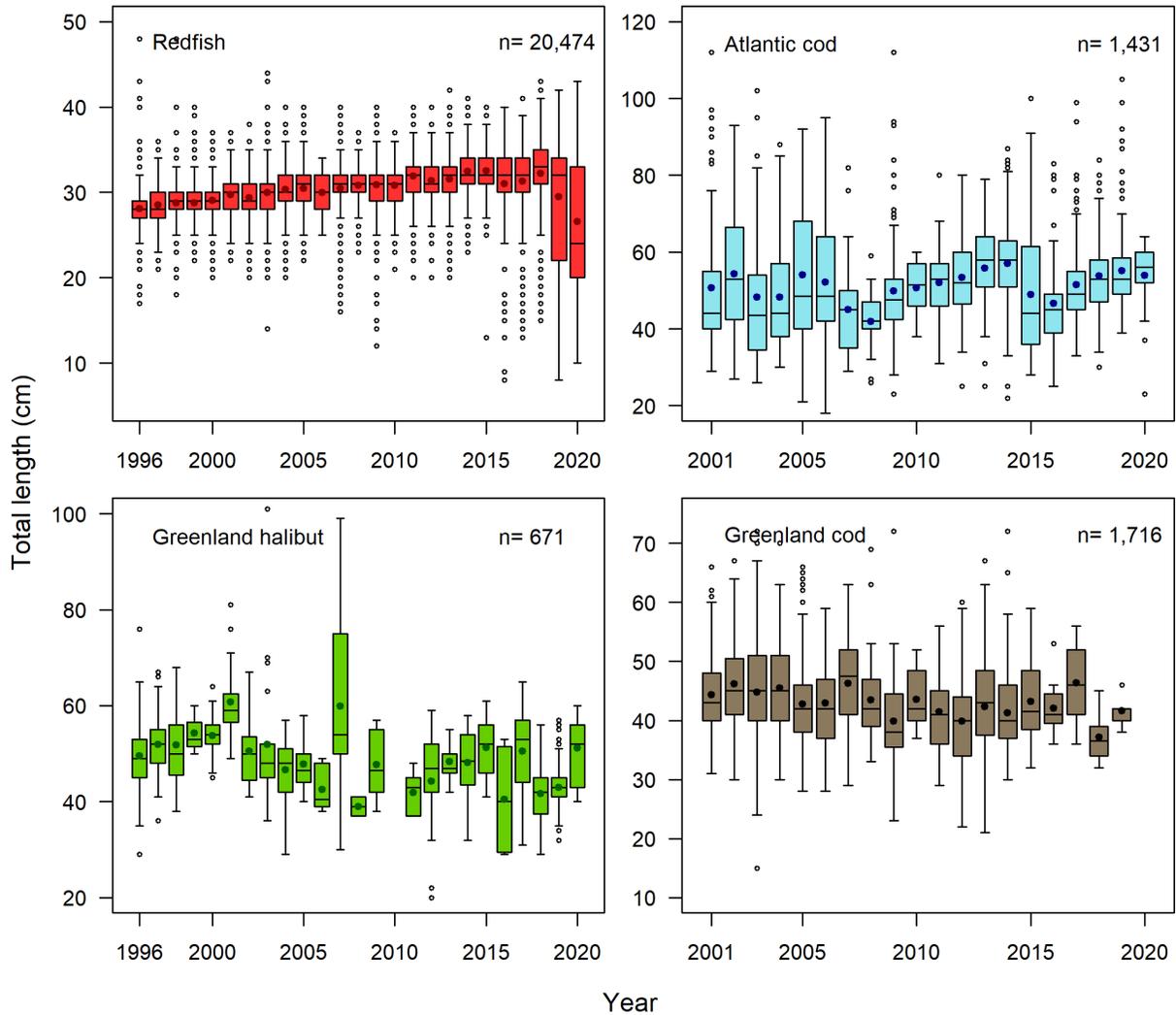


Figure 6. Size frequency distributions (total length) of redfish, Atlantic cod, Greenland halibut and Greenland cod sampled from the Saguenay Fjord winter recreational groundfish fishery. Box-and-whisker plot: the median is shown by the line inside the box, and the mean is shown by the solid circle. The boxes range from the 25th to the 75th percentile, the whiskers range from the 5th to the 95th percentile, and the empty circles represent outliers.

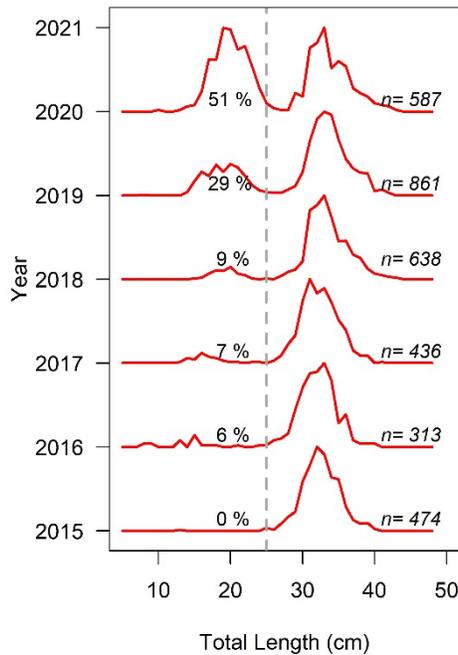


Figure 7. Size frequency distributions (total length) of redfish sampled between 2015 and 2020 in the Saguenay Fjord winter recreational groundfish fishery. The percentage of fish less than 25 cm long is shown by year on the graph.

Monitoring program - Component 3 - Logbooks

Fishing success

The information collected through the logbook initiative indicates that the fishing success of participants is increasing. The percentage of activities where fishers caught their daily limit of five groundfish increased from 12% to 47% between 2016 and 2020 (Figure 8). This success is due to large catches of small redfish, which are regularly released after being caught. This practice is in accordance with the regulations.

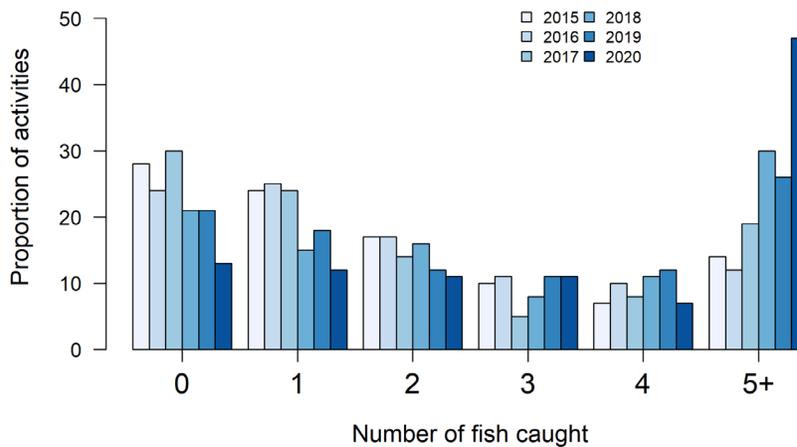


Figure 8. Fishing success, assessed against the daily catch limit of five groundfish on the basis of information collected from logbooks. The 5+ category is explained by the fact that catch and release is permitted in this fishery.

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Catch rate

Redfish catch rates calculated from logbook data show a slight increase between 2016 and 2018, stabilizing thereafter (Figure 9). Catch rates for Atlantic cod, Greenland cod and Greenland halibut were much lower than redfish catch rates. Although no clear trend was observed for either species of cod, an upward trend was seen in the catch rate for Greenland halibut between 2017 and 2020.

An analysis of the data available on the use of sonar during fishing activities shows that catch rates for redfish are always higher when sonar is used (Figure 10). However, the use of sonar does not appear to offer any advantage for capturing Atlantic cod, Greenland cod or Greenland halibut. These results are consistent with the comments received from recreational fishers in attendance at the 2018 peer review. According to their feedback, Redfish are caught as they move within the water column and become detectable on sonar. The other species (i.e. both cod species and Greenland halibut) are caught near the seabed, where these fish are less visible on sonar. On average, sonar was used in 75% of fishing activities reported in logbooks.

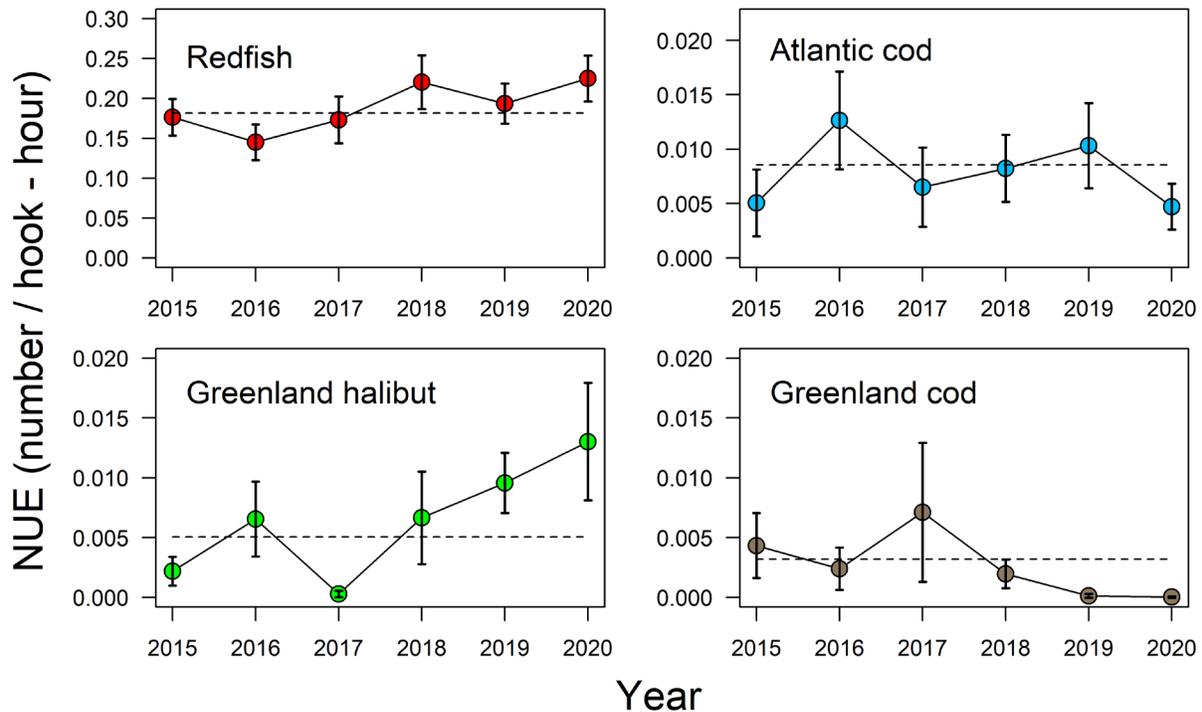


Figure 9. Annual catch rates in number of fish per unit effort (NUE), based on logbook data for redfish, Atlantic cod, Greenland halibut and Greenland cod. The dotted horizontal lines represent the 2015–2019 average for each of the series.

Catch rates calculated from logbook data were not standardized. Such an approach would be desirable to produce an index that would take into account factors such as the use of sonar and the practice of fishing outside the village.

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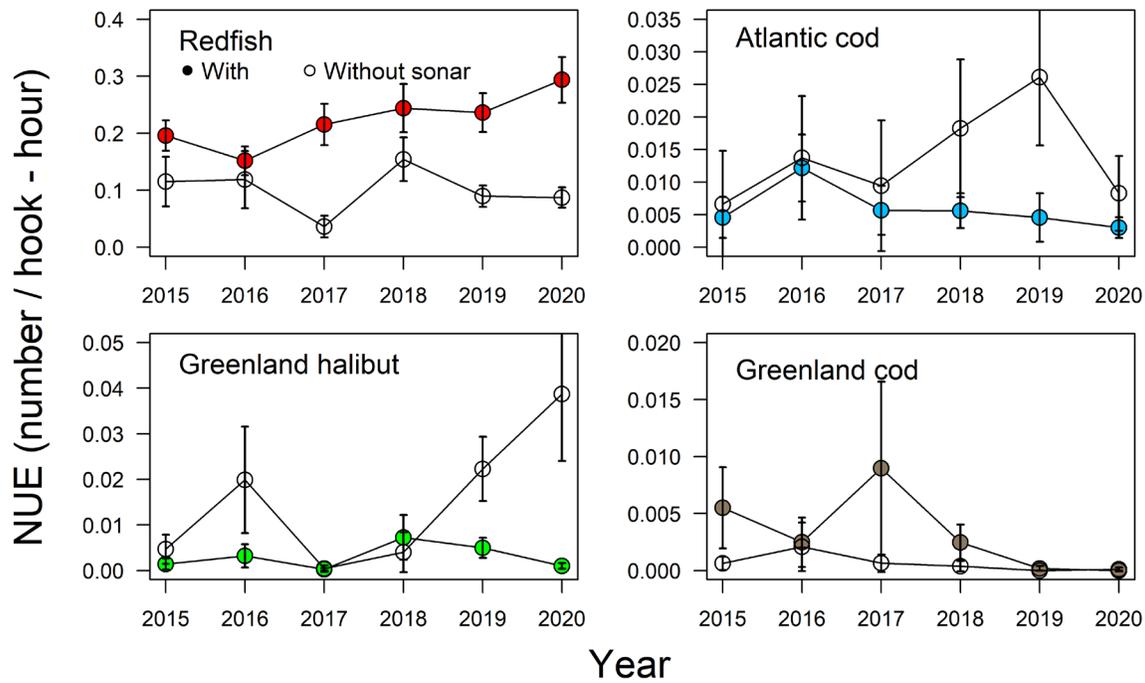


Figure 10. Annual catch rates in number of fish per unit effort (NUE), based on logbook data for redfish, Atlantic cod, Greenland halibut and Greenland cod from fishers who use sonar (solid dots) or do not use sonar (blank dots).

Conclusions

Redfish is the most commonly caught species in the Saguenay recreational fishery, accounting for 91% of landings during the 2019 and 2020 fishing seasons. In the Estuary and Gulf of St. Lawrence, an increase in the abundance of redfish has been observed for a number of years following the large influx of cohorts in 2011, 2012 and 2013. These juveniles were also observed in the Saguenay. The data collected from the monitoring program show that the recruitment of these new cohorts to the fishery has increased since 2019. Redfish catch rates in Components 1 and 3 of the monitoring program saw an increase in 2020. The fishing success of the logbook participants also shows a clear increase (from 12% to 47% between 2016 and 2020) in the percentage of activities where the daily limit of five groundfish was reached. However, the redfish caught are still small and are often returned to the water, where their post-release survival is low. Due to their slow growth, the new redfish cohorts will require several more years to reach a size large enough for all of them be retained by recreational fishers. However, the species enjoys a long lifespan and is expected to be able to support the fishery for many years. The outlook for the winter recreational redfish fishery in the Saguenay Fjord is therefore promising.

For Atlantic cod, Greenland cod and Greenland halibut, catch rates in the winter recreational fishery are low. However, a recent increase in Greenland halibut catch rates has been observed in Components 1 and 3 of the monitoring program, with values above the 2020 series average for both components. Atlantic cod catch rates for Component 1 have been declining since 2017 and are close to the series average in 2020, whereas Component 3 catch rates show no clear trend. The biological data on Atlantic cod and Greenland halibut point to the presence of several cohorts in the fishery, suggesting there is regular recruitment from the Lower St. Lawrence Estuary. The Atlantic cod and Greenland halibut stocks that supply the Saguenay are in the

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critical and cautious zones of their corresponding precautionary approach, which could have an impact on longer-term recruitment in the Saguenay. No information is available on the abundance of Greenland cod in the Gulf of St. Lawrence.

This update of the main monitoring program indicators for the Saguenay Fjord winter recreational groundfish fishery has not revealed any major or unexpected changes since the most recent assessment, which was conducted in November 2018. The previous advice therefore remains valid.

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