



## THE SAGUENAY FJORD WINTER RECREATIONAL GROUNDFISH FISHERY, 2008-2010

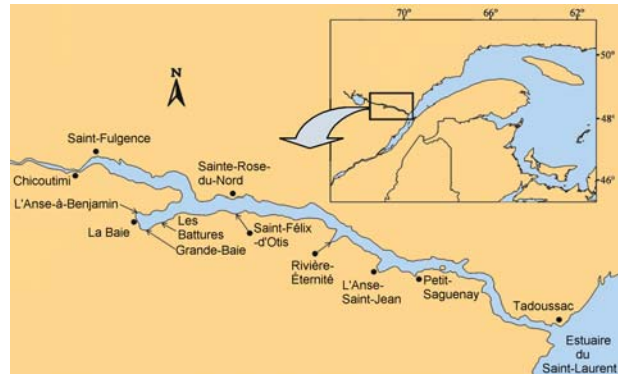


Figure 1. Main fishing sites in the Saguenay Fjord.

### Context

*The winter recreational fishery carried out in the Saguenay Fjord is unique in Quebec by its magnitude and the variety of species that are caught in that area.*

*Enthusiasts of this sport generally come from cities and towns near the fishing sites. However, this activity has sparked interest among North American and even European tourists, who use the services of outfitters. With economic spin-offs estimated at more than \$5 millions, the winter sport fishery is a driving force for the region's tourism industry.*

*As a result of the growing interest in this recreational/tourism activity, various stakeholders are now concerned about resource conservation and the sustainable development of the fishery. In this context, a monitoring program was launched in 1995 under a research agreement involving Saguenay Fjord fishermen associations and committees; Promotion Saguenay; the Musée du Fjord; Alcan Smelters and Chemicals Ltd.; the ministère des Ressources naturelles et de la Faune du Québec; the Société des établissements de plein air du Québec and the Parks Canada, which comanage the Saguenay-St. Lawrence Marine Park; and the Department of Fisheries and Oceans (DFO), which is responsible for scientific monitoring and resource protection.*

### SUMMARY

- Since 1996, the total groundfish fishing effort throughout the Saguenay has remained somewhat the same despite significant fluctuations between years and an ongoing decrease in fishing effort within the limits of the marine park.
- The 2008 and 2009 fishing seasons opened in mid-January and ended by mid-March. During these two years, weather conditions were favourable and there were no temporary closures of fishing sites. However, the 2010 fishing season was cut short by about 50% due to an exceptionally warm winter.

- Redfish represent about 90% of groundfish catches. The number of catches per unit effort (NUE) from the fishery and from the science mission shows a continuous downward trend. Size structures suggest that the 1980 redfish cohort has been exploited and no recruitment has been observed since.
- Atlantic cod and Greenland cod represent about 9% of catches. The fishery and science mission show that since 2007, there has been an increase in terms of NUE for Atlantic cod, but Greenland cod numbers have remained at a very low level.
- Turbot represents less than 1% of catches. The NUE of the fishery shows no trend and the science mission shows there was an increase between 2000-2004 and 2005-2010.
- Saguenay redfish are at a very low level. Groundfish recruitment to the Saguenay relies on the arrival of juveniles from the Estuary. Therefore, exploitation does not affect the recruitment of redfish or of other groundfish to the Saguenay, but determines the speed at which these stocks decline and can impact the integrity of the ecosystem. Consequently, management measures should aim at significantly reducing the fishing effort, in particular for redfish.

## INTRODUCTION

### Background

In the winter recreational fishery in the Saguenay Region, the main groundfish species sought are redfish (*Sebastes* spp.), Atlantic cod (*Gadus morhua*), Greenland cod (*Gadus ogac*) and Greenland halibut, also called turbot (*Reinhardtius hippoglossoides*). There is also rainbow smelt (*Osmerus mordax*), a pelagic species, which is also of considerable interest to fishermen, but it has not been considered in this report.

Based on different methods (genetic, morphometric, parasites, chemical composition of otoliths), Sévigny et al. (2009) concluded that Saguenay groundfish populations are sink populations whose recruitment depends on populations from the St. Lawrence. Sirois et al. (2009) found that groundfish larvae do not survive in the Saguenay waters. The phenotypic differences observed between Gulf of St. Lawrence populations and Saguenay populations support the hypothesis of a migration at the juvenile development stage (Sévigny et al., 2009). The recruitment of Saguenay populations is linked to the status of Estuary and Gulf of St. Lawrence populations. The latest scientific advice on these Gulf of St. Lawrence species indicates that:

- Redfish has a “relatively low level of biomass observed and the prospect of only typical low recruitment ...” (DFO, 2010c),
- “The abundance of the spawning stock [cod] in 2009 and projected to 2010 is well below the limit reference point. The stock has remained in the critical zone for many years.” For the northern Gulf of St. Lawrence (DFO, 2010a) and “The outlook for this stock continues to be very pessimistic...” for the southern Gulf (DFO, 2009),
- “The biomass index [turbot] for 2009 was the lowest over the last ten years...” and has generated “conditions [that are] of some concern...” (DFO, 2010b).

## **Fishery Description and Conservation Measures**

The winter recreational fishery is practiced over the entire upper basin of the Saguenay Fjord, between Saint-Fulgence and Petit-Saguenay. The main fishing villages are associated with the municipalities of Anse-Saint-Jean, Rivière-Éternité, Saint-Félix-d'Otis, Sainte-Rose-du-Nord, Saint-Fulgence and the La Baie area, the latter encompassing Anse-à-Benjamin, Grande-Baie and Les Battures (Figure 1). Around 90% of the fishing effort is deployed in the latter three sites. Generally, fishing sites have two areas: a “pelagic fish” area, where mainly smelt is caught, and a “groundfish” area where are located fishing huts from where fishermen target the species discussed in this report. The second area is located in deeper waters.

Fishermen use two main types of gear to fish: rods for light-line fishing and the tip-up, described as a fishing line mounted on a signalling device that alerts them when a fish takes the bait. There are three main approaches to ice fishing. The first consists in being on site continuously, paying close attention to the gear. When a fish takes the bait, the fisherman pulls up the line, removes the fish, baits the hook and lowers it back into the water. The second approach is of a social nature. Tip-ups are baited and lowered into the water, but fishermen are less attentive. Therefore, a fish that takes the bait could be on the line for a number of hours before being pulled up, making it impossible to catch other fish during that time with this gear. The third approach consists in baiting and lowering tip-ups in the evening and checking the lines only the next day, at the beginning or at the end of the day. The prevalence of these three approaches varies from one site to another.

Conservation measures were introduced at the beginning of the 2004 winter fishery, reducing the daily catch limit to 5 individuals of any groundfish species and by delaying the opening of the fishery to mid-January. The frequentation average (Figure 2) over the 1996-2010 period was around 40,000 fishermen-days. Frequentation increased to about 50,000 fishermen-days in 2008 and 2009 due to favourable ice conditions. The vast majority of fishing activities were concentrated at the three sites in Baie des Ha! Ha!. In 2010, sites were installed 1-2 weeks after the fishing season was opened and ended 3-4 weeks earlier than scheduled, due to the thinning ice. As a result, there was a 55% drop in frequentation compared to 2009, at around 22,000 fishermen-days.

Despite marked fluctuations in terms of annual frequentation, the long-term trend seems to show stability for the Saguenay as a whole. The observed frequentation decline at sites within the Marine Park is offset by the increase in fishing activities at the Baie des Ha! Ha! sites.

## **ASSESSMENT**

### **Data Source**

Since 1995, the DFO has been monitoring the winter recreational fishery in the Saguenay, focusing on the main marine species harvested: redfish, Atlantic cod, Greenland cod, and Greenland halibut. The program is two-fold and requires the participation of volunteer fishermen from the eight main fishing sites. In addition, Promotion Saguenay de ville Saguenay, the Musée du Fjord Saguenay, Ressources naturelles et faune Québec, the Saguenay-St. Lawrence Marine Park (Quebec) and the Saguenay-St. Lawrence Marine Park (Canada) have largely contributed to the assessment of the exploited fish populations in the Saguenay Fjord.

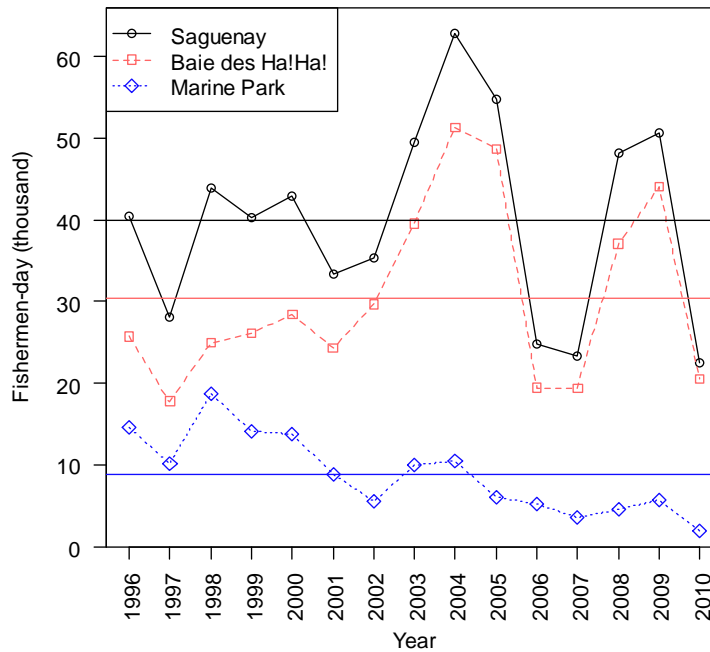


Figure 2. Annual fishermen-day index. The mean for a series average is represented by a horizontal line.

The first part of this program involves sampling fishermen. Around 20 interviews with 15 fishermen are conducted every year at each site. These interviews occur both on week days and weekends throughout the season. Data on catches (numbers, species) and fishing effort (number of hooks, number of fishing hours) are collected. Since 2010, the use of depth sounders has also been noted. The second part of this program focuses on the collection of biological data. For each observation, the species, size and weight are recorded.

Since 2000, a science mission by boat has been conducted in the Saguenay Fjord. This gillnet survey is conducted as soon as possible following winter recreational fishery closure, in April of every year. Sampling stations are grouped in Saint-Fulgence and La Baie area, upstream from the Marine Park limits. The fishing effort has increased from about 30 anchoring sites in the first few years to 103 in 2010.

## **Status of the Resource**

### **Redfish**

Redfish catches are the highest in the winter groundfish fishery in the Saguenay Fjord, representing about 90% of landings.

For the Saguenay as a whole, the recreational fishery abundance index has been declining since 1996 (Figure 3a). Since 2004, fluctuations at a relatively low level have been observed. The level seemed to have stabilized in 2008 and 2009, but there was a sharp decline in the index in 2010. This general downward trend is more obvious in the research surveys (Figure 3b).

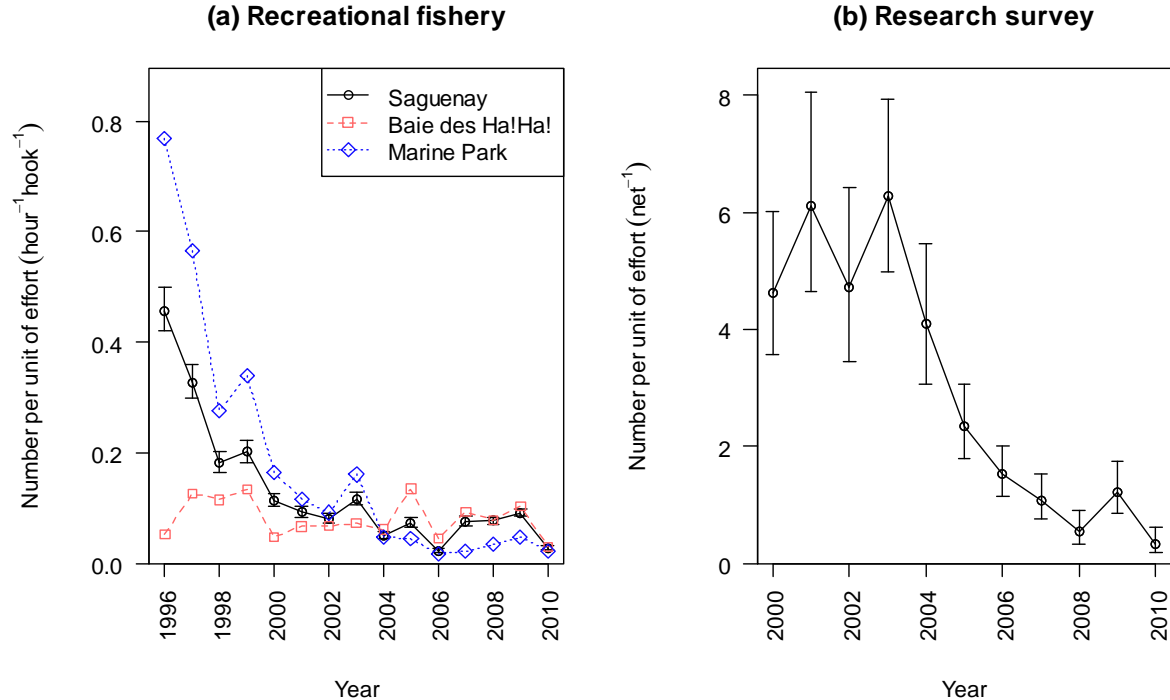


Figure 3. Redfish catch rates from the recreational fishery (a) and from the research survey (b). The vertical lines represent a 95% confidence interval.

The same analysis conducted at sites located within the park limits showed similar results. The downward trend is even more obvious. However, the portrait is different if the analysis is done at the three Baie des Ha! Ha! sites, where the abundance index remained unchanged. Since 2004, catch rates in the Baie des Ha! Ha! have exceeded those within the Marine Park. In all cases, catch rates for 2010 are the lowest in the series.

The total estimated catch (Figure 4) appears to have been decreasing since 1996. Annual variations are sometimes very significant, and are explained by the variability of fishing effort and annual catch rate differences specific to each site. Such variation has been observed over the last 3 years, and 2008 was relatively low (~37,000), followed by a peak in 2009 (~113,000), and a low catch in 2010 (~9,000). The total catch obtained within the Marine Park limits has declined, and represents less than 5% of redfish landed in the Saguenay since 2005.

The size distribution of redfish is unimodal (Figures 5a and 5b) and supports the hypothesis that one or a small number of cohorts support the fishery. The growth observed indicates that these individuals were born in the early 1980s. A significant recruitment was also observed in the Gulf of St. Lawrence during these years. The average size of individuals caught in the 2010 recreational fishery was 30.7 cm compared to 27.9 cm at the beginning of the series, representing a growth of 2.8 cm over 15 years. The data shows no recruitment of young individuals.

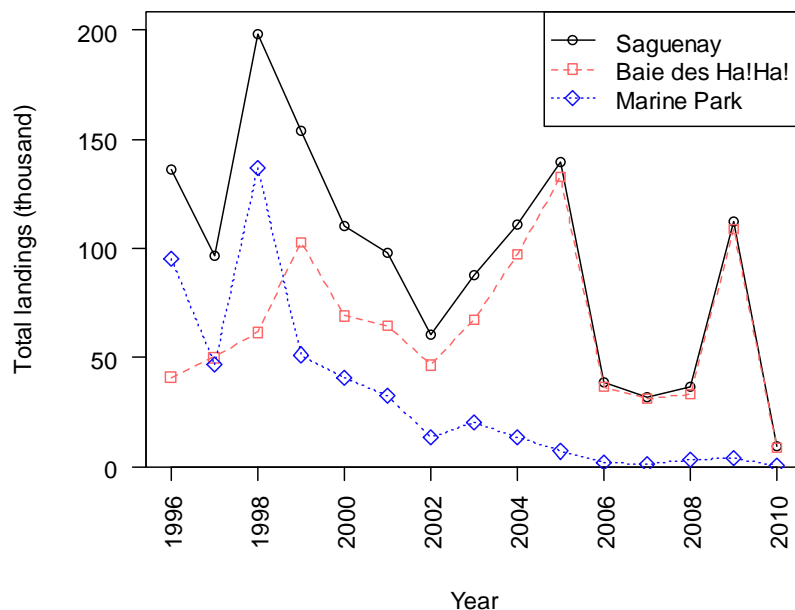


Figure 4. Total redfish landings.

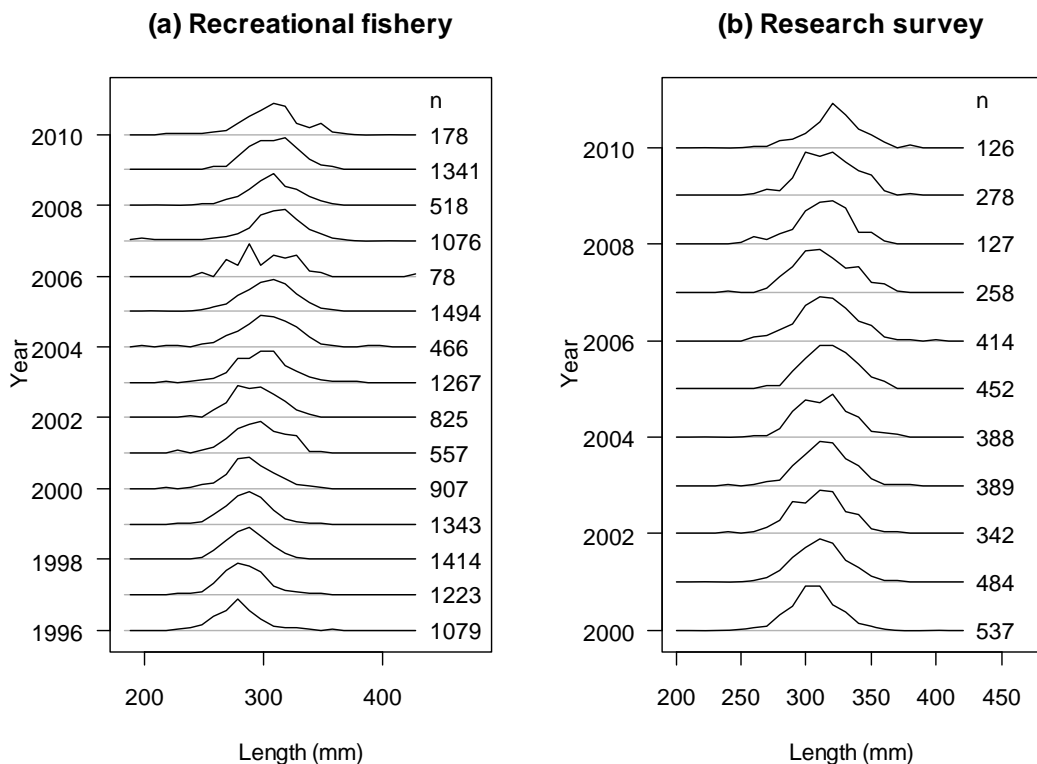


Figure 5. Redfish size frequency distribution from the recreational fishery (a) and from the research survey (b). The sample size "n" represents the data from all sites.

Atlantic cod

For the Saguenay as a whole, the recreational fishery abundance index (Figure 6a) decreased between 2000 and 2007. In 2008, the index surged and has remained high since. The current abundance index level is comparable to the early part of the series. The situation is similar when considering only sites within the Marine Park. In the latter case however, the increase observed since 2008 did not match the level from the early part of the series. The catch rate for the Baie des Ha! Ha! sites has remained low, with significant annual fluctuations.

The research survey seems ineffective for catching Atlantic cod. A small sample size explains the significant uncertainty surrounding the catch rates (Figure 6b). It is difficult to establish a trend for the early part of the series, but the results of recent years reveal the possibility of an increase.

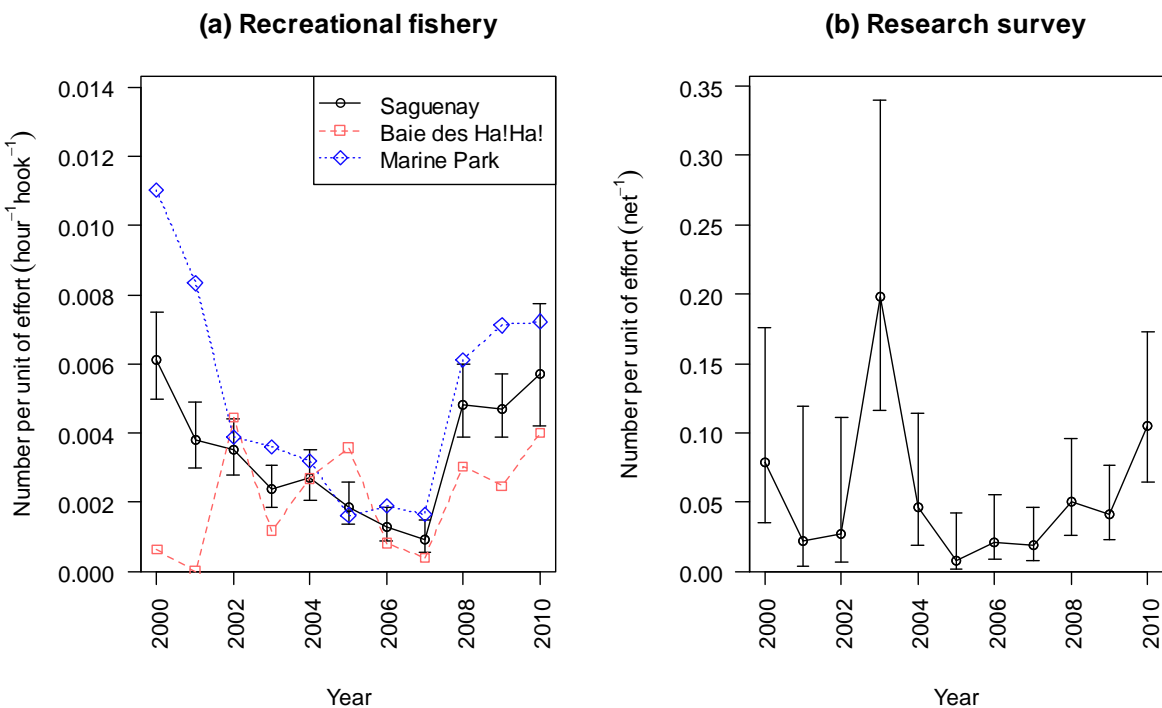


Figure 6. Atlantic cod catch rates from the recreational fishery (a) and from the research survey (b). The vertical lines represent a 95% confidence interval.

The total estimated catch (Figure 7) of Atlantic cod appears to be greatly influenced by the fishing effort in the Baie des Ha! Ha! (Figure 2). If no clear trend can be seen in the catches, variations seem to be mainly due to the landings in the Baie des Ha! Ha!. Landings are estimated at about 1,100 individuals in 2010 and less than 10,000 total over the last 5 years; compared with the estimated 14,000 catches in 2004 alone.

The sample size used to calculate the size frequency distribution (Figures 8a and 8b) does not clearly distinguish cohorts. However, there is some variability in terms of size, including individuals over 70 cm or less than 30 cm. This observation suggests the regular arrival of new individuals in the population, which contributes to the renewal of the stock.

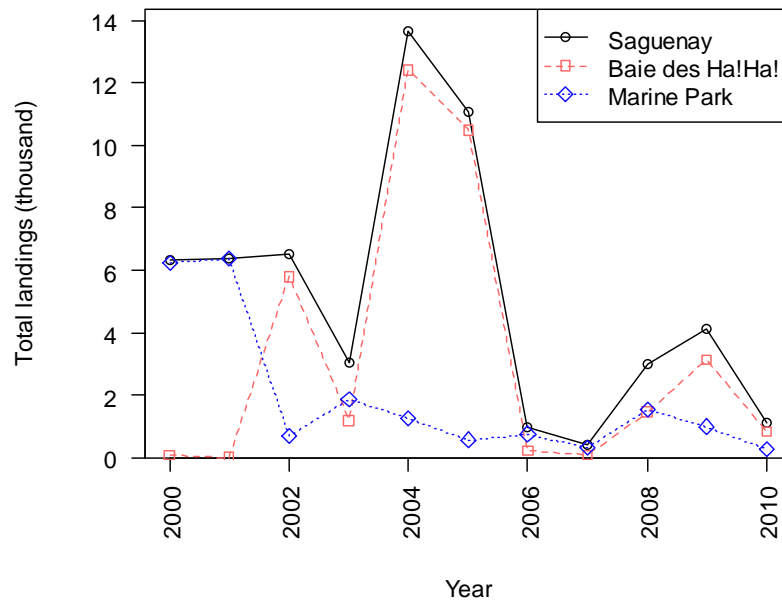


Figure 7. Total Atlantic cod landings.

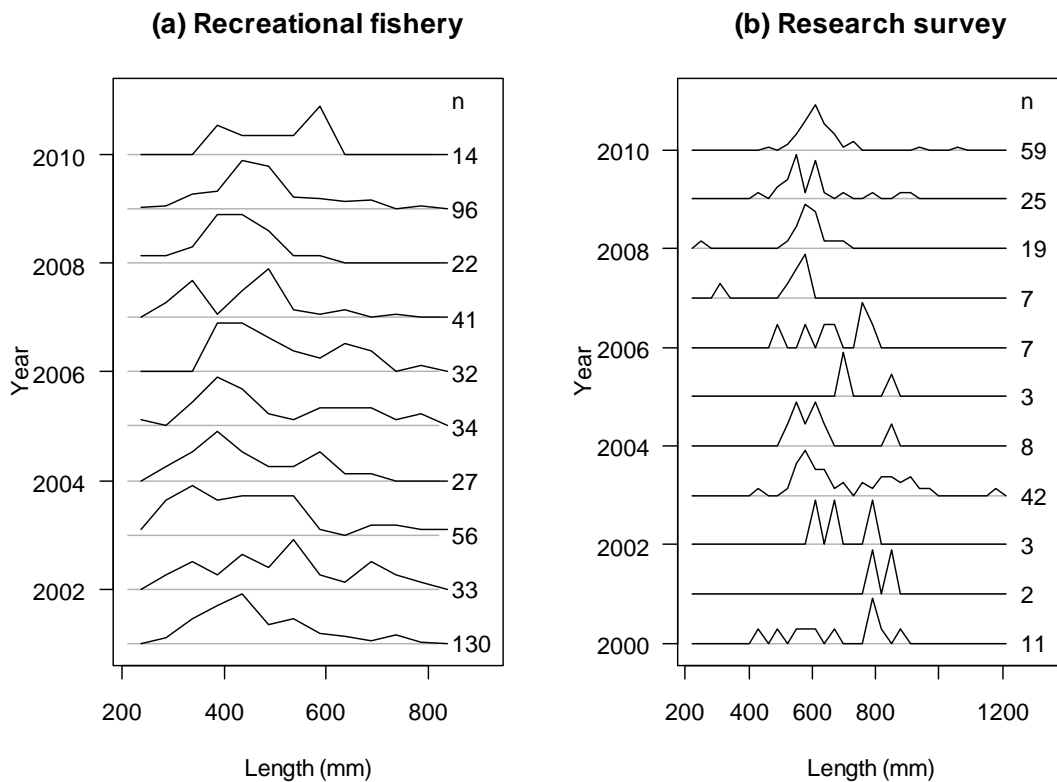


Figure 8. Atlantic cod size frequency distribution from the recreational fishery (a) and from the research survey (b). The sample size “n” represents the data from all sites.



Greenland cod

For the Saguenay as a whole, the recreational fishery abundance index (Figure 9a) shows a downward trend. This decrease is more evident when considering only sites within the Marine Park limits. In all cases, the 2007-2009 values are among the lowest of the series. There is a slight increase in 2010 for the Saguenay overall, but it is unnoticeable in the research survey (Figure 9b). The fault noted concerning the Atlantic cod research survey data also applies to Greenland cod: a small sample size explains the significant uncertainty surrounding the catch rates.

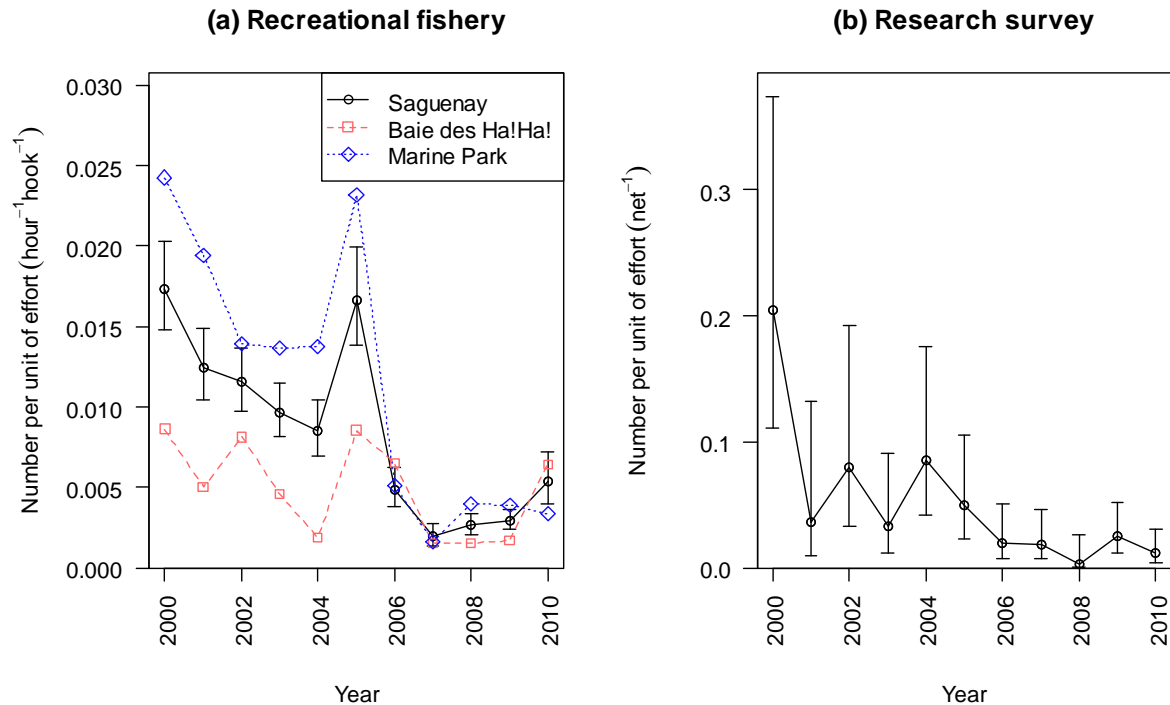


Figure 9. Greenland cod catch rates from the recreational fishery (a) and from the research survey (b). The vertical lines represent a 95% confidence interval.

The total estimated catch (Figure 10) has been decreasing since 2000. Annual landings have not exceeded 2,300 individuals since 2007, and they were ten times more abundant in 2000 and 2001, with 27,000 and 24,000 individuals.

It is difficult to identify cohorts from the size frequency distribution (Figures 11a and 11b). From 2008 to 2010, the sample size ( $n$ ) was rather low, which is the result of the low catch rate by fishermen.

Greenland halibut

The low number of Greenland halibut catches raises some concern about the value of the recreational fishery catch rate (Figure 12a) as a stock status indicator. Two hundred seventy-six (276) fish have been surveyed by the samplers since 1996, which was less than 20 fish per year, and only 4 and 6 fish for 2009 and 2010, respectively. Research survey landings were higher however, and the abundance indicator (Figure 12b) suggests a Greenland halibut stock increase in the Saguenay.

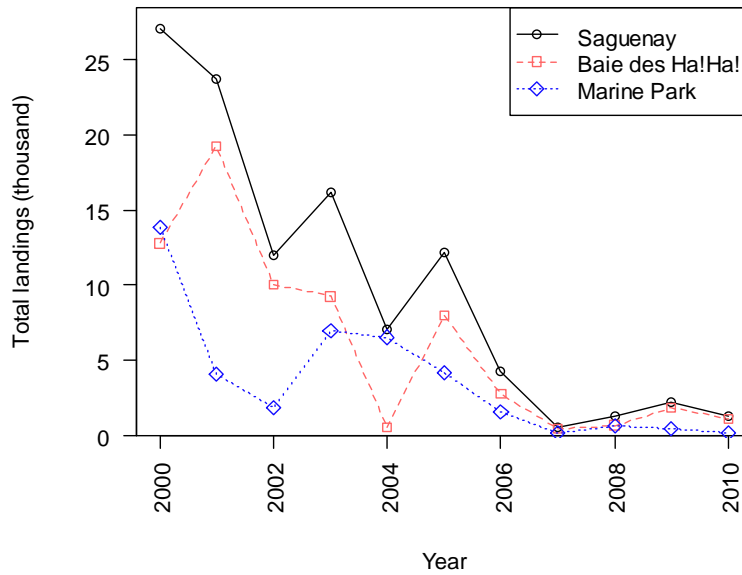


Figure 10. Total Greenland cod landings.

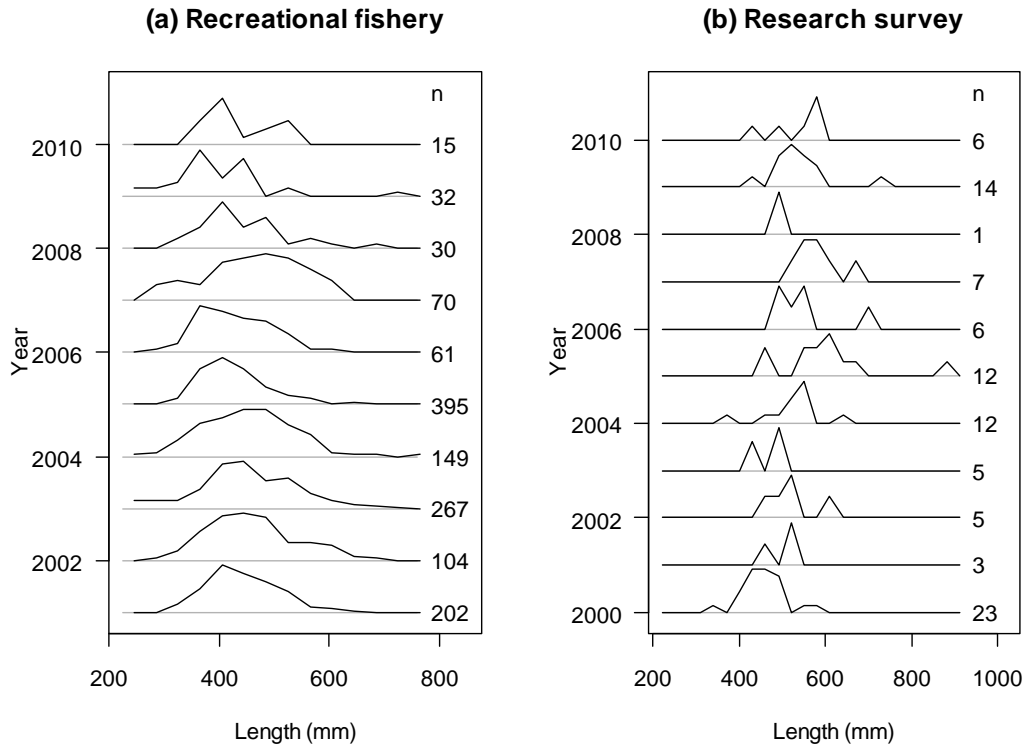


Figure 11. Greenland cod size frequency distribution from the recreational fishery (a) and from the research survey (b). The sample size “n” represents the data from all sites.

The estimated total landings (Figure 13) are generally weak and heavily influenced by sampling. Catches at one site are multiplied by the effort at this site. A few extra fish at a very busy site will induce a large variation. The significant estimated catch in 2004 was probably the result of this method of calculating the total catch. The average annual landings estimated for the last three years is 229 individuals.

The small sample size does not help monitor cohorts based on size frequency distribution (Figures 14a and 14b), and doubts are raised about the selectivity of fishing gear from the research survey (see section "Uncertainties").

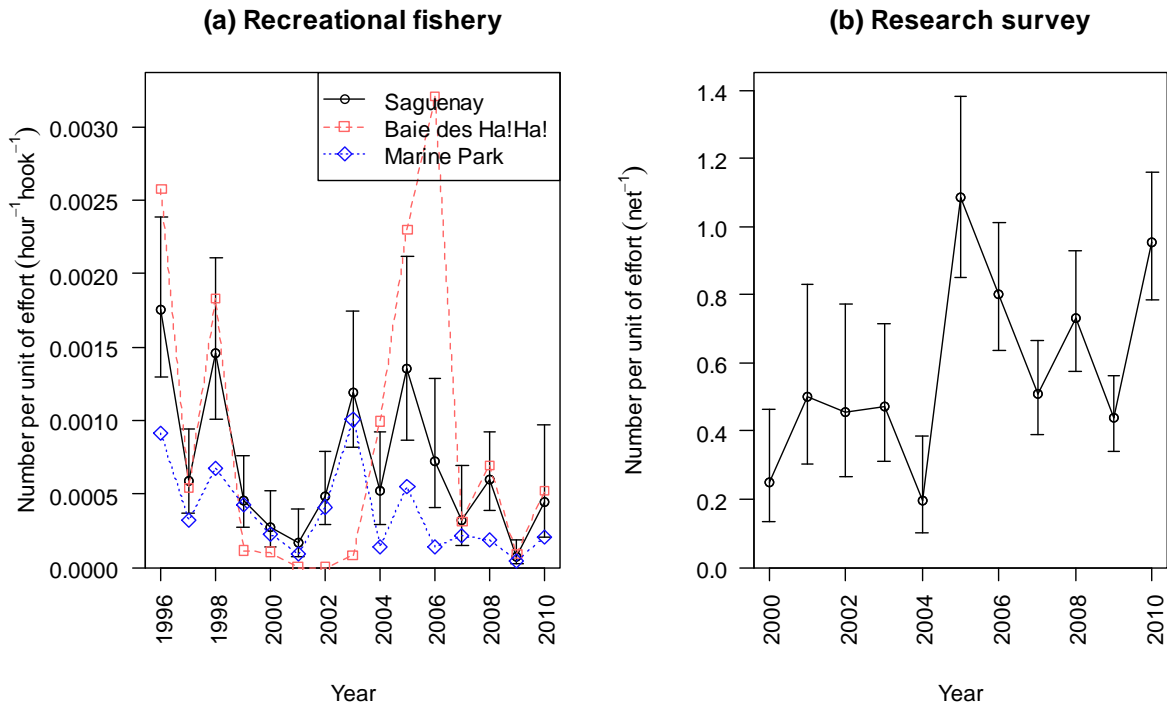


Figure 12. Greenland halibut catch rates from the recreational fishery (a) and from the research survey (b). The vertical lines represent a 95% confidence interval.

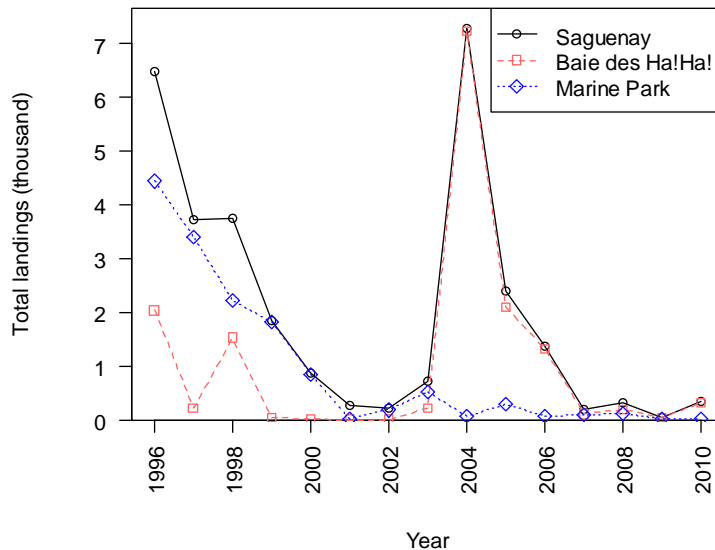


Figure 13. Total Greenland halibut landings.

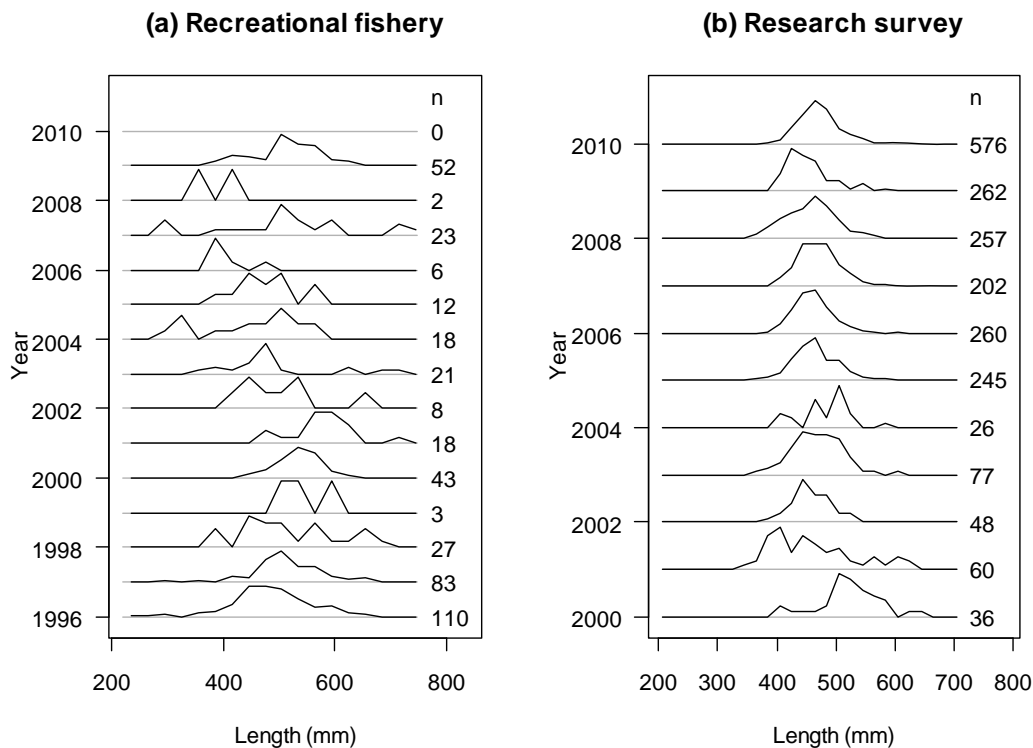


Figure 14. Greenland halibut size frequency distribution from the recreational fishery (a) and from the research survey (b). The sample size "n" represents the data from all sites.

### Sources of uncertainty

The calculation of the annual effort (Figure 2) and, consequently, the total catch (Figures 4, 7, 10 and 13) requires knowing the length of the fishing season, the average number of fishermen per day and, for the total catch, the average daily effort. The approximation methods used to determine these three variables are slightly biased, and current information is insufficient to quantify their uncertainty and the seasonal evolution of this bias.

Spatial coverage of the sampling is small relative to the expected distribution of target species. In fact, fishermen are limited in their ability to track the movements of the resource and are generally restricted to the eight sites in the bays of shallow to medium depth. Current knowledge of fish movements between these sites and deeper areas is insufficient to assess the assumption of population homogeneity. Certain environmental conditions could influence the spatial and temporal distribution of the resource, such as water temperature, when the ice cover appears and its thickness.

The use of a depth sounder has become widespread over the years. This technological development represents a challenge for comparing indicator levels at the beginning and at the end of the time series. No correction was applied to the data to compensate for this new technology.

No recruitment index is available, making it difficult to determine the presence and significance of the migration from the Estuary and Gulf of St. Lawrence. Gillnets used so far in research

surveys are inadequate for capturing small individuals. It is also likely that the selectivity of fishing gear used in the recreational fishery is lower for small individuals.

## CONCLUSIONS AND ADVICE

The interest in the winter recreational fishery in the Saguenay River keeps growing and the number of fish caught is considerable. The data available suggest that the status of marine resources harvested in the Saguenay River is of considerable concern. Redfish, Atlantic and Greenland cod and Greenland halibut landings have dropped considerably compared to the 1990s and have been low for a number of years now. In addition, recruitment is uncertain and does not look promising. The populations' sustainability is at stake. However, the daily catch limit of 5 groundfish introduced in 2004 as well as the reduction of the fishing season seem to have contributed to reduce catch levels. Therefore, it is critical to reduce the fishing effort. Moreover, careful attention will have to be given in order to improve the quality of catch sampling for each species coveted.

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