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Quebec Region

ASSESSMENT OF STIMPSON'S SURFCLAM STOCKS IN QUEBEC COASTAL WATERS IN 2020

Source: DFO 2011.

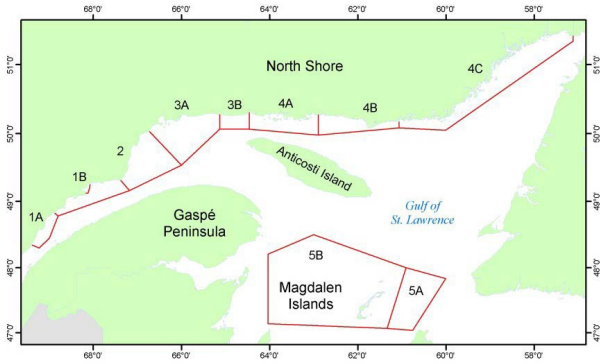

Figure 1. Stimpson's surfclam fishing areas in Quebec.

Context:

The Stimpson's surfclam (Mactromeris polynyma) fishery is a relatively recent activity in the Gulf of St. Lawrence. The most significant beds are located on the Quebec North Shore and in the Magdalen Islands area. This coastal fishery is conducted using hydraulic dredges, on sandy substrates 10 to 60 m deep.

Quebec waters are divided into 10 fishing areas (Figure 1) to which access is limited to a restricted number of fishers. The effort is also controlled by a fishing season and catches are limited by quotas. Until now, the adjustment of the quotas was done with caution due to the slow growth and the sedentariness of this mollusc.

The resource is assessed every three years to determine whether changes that have occurred in its status justify adjustments to the conservation approach and management plan. The main indicators used in this assessment are derived from landing, logbook and commercial catch sampling data.

This Science Advisory Report is from the February 22, 2021, meeting on the assessment of Stimpson's surfclam fishery in the Quebec's inshore waters.

SUMMARY

- Mean annual Stimpson's surfclam landings in Quebec totalled 587 t from 2018 to 2020, a 8% decrease compared with the 2015-2017 period. The North Shore accounted for 99% of landings and the Magdalen Islands for 1%.
- The annual Total Allowable Catch (TAC) for the 2018 to 2020 period averaged over 80% in areas 3A and 3B.
- There was no fishing in areas 1A and 5B in 2018 and area 2 was fished in 2018 only. There was no fishing in area 1B from 2018 to 2020 and areas 4C and 5A remain unexploited.

- The catch per unit of effort (CPUE) averages for the 2018 to 2020 period are above the time series medians (1993-2019) for area 3A, but below the series medians for areas 1A, 2, 3B, 4A, 4B and 5B.
- The 2018-2020 landed surfclam size averages are above the time series medians (1993-2019) for areas 2, 3A, 4B and 5B, but below the series medians for areas 1A, 3B and 4A.
- The zonal exploitation rate in each area based on dredged area is below the recommended rate of 3% in all fishing areas.
- According to the existing decision rules, only area 3A meets all the conditions for a 6% quota increase. For the remaining areas, a *status quo* quota should not affect the status of the resource.
- The fishing effort in one area should be distributed both within and among beds to limit the possibility of local overexploitation.

INTRODUCTION

Species biology

Stimpson's surfclam (*Mactromeris polynyma)* is an endobenthic sedentary bivalve mollusc that lives buried in sediments. High concentrations of surfclams gather in «beds» in sandy sediments on the sublittoral zone or under the low tide line. The burying depth depends on the length of their siphon and, consequently, their size. They use their incurrent siphon to feed, filtering small organisms suspended in water, mostly planktonic micro-algae.

Stimpson's surfclams can be found along the west coast of the Atlantic, from Labrador to Rhode Island, and on the Pacific coast, from Alaska to Vancouver Island, as well as on the coast of Russia. In Quebec, surfclams have been observed on the North Shore at depths ranging between 1 and 46 m. Beds in this region are often related to the mouths of large rivers. In the Magdalen Islands, they can be found at depths ranging from 25 to 60 m. They also occur in low densities in certain areas in the Lower St. Lawrence and on the north shore of the Gaspé Peninsula (Figure 2).

Stimpson's surfclams have a slow growth and a significant lifespan. On the North Shore, they require between 13 and 16 years to reach their legal size of 80 mm (anteroposterior length) and more than 20 years in the Magdalen Islands. The mean size of surfclams landed on the North Shore and the Magdalen Islands is around 110 and 100 mm respectively, which would represent individuals of at least 25 years of age. The largest specimens collected on the North Shore (150 mm) and in the Magdalen Islands (130 mm) could be more than 75 years of age.

Sexes are separate and size at sexual maturity would be around 60 mm, which represents around 9 years of age on the North Shore and 15 years of age in the Magdalen Islands. Surfclams are therefore able to reproduce for a few years before being recruited to the fishery. Ova fertilization occurs in the water column when mature individuals of both sexes in a bed release their gametes in a synchronized manner. In the Middle North Shore, spawning would occur primarily from late June to late July. After eggs hatch, a pelagic larval stage extending over several weeks (the duration depends on the water temperature) precedes benthic life.

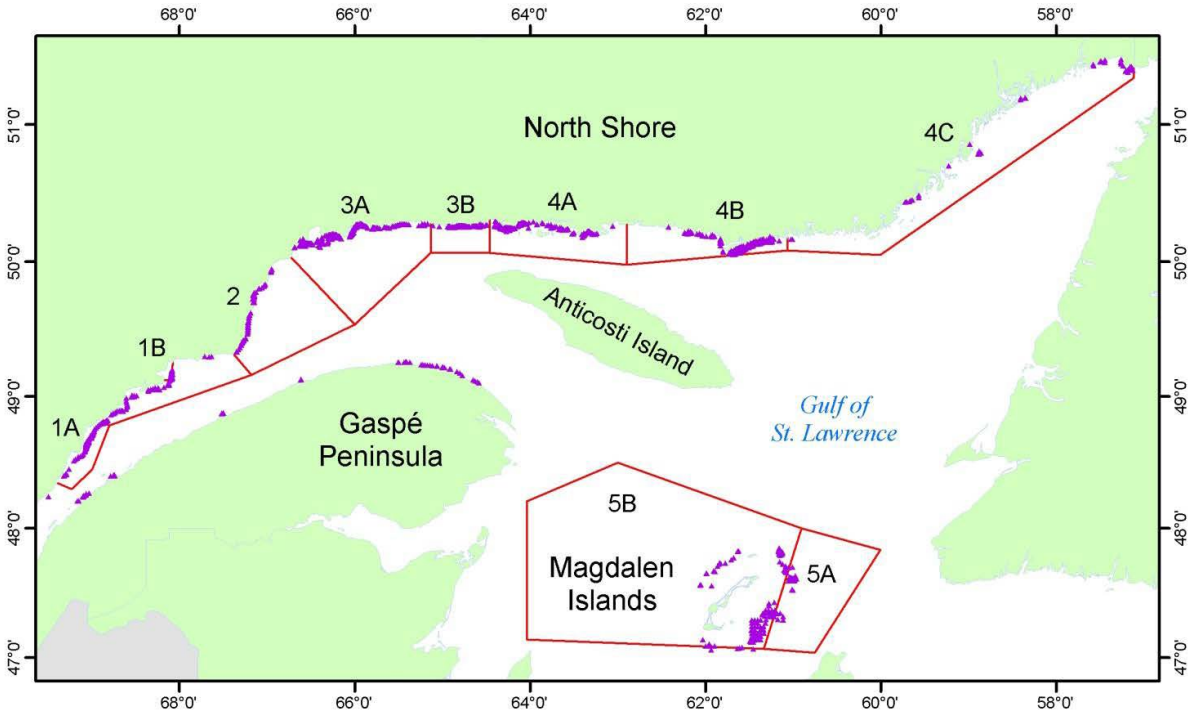

Figure 2. Known distribution (purple triangles) for Stimpson's surfclam in Quebec.

Fishery description

In Quebec, the Stimpson's surfclam fishery is complementary, which means that fishers practice other fisheries during the year. The Quebec has 10 fishing areas: eight on the North Shore and two in the Magdalen Islands (Figure 2). This inshore fishery is managed throughout the area by the number of licences, the fishing season, TAC and a minimum catch size of 80 mm (Table 1). In 2020, 15 permanent licences and three exploratory licences were issued. Some licences give access to more than one fishing area.

The Stimpson's surfclam fishery requires the use of an hydraulic dredge. The New England dredge, used in Quebec, has an efficiency rate of over 90% for catching surfclams measuring 80 mm or longer. This dredge has a basket width that varies between 1.83 m on the North Shore and 2.13 m in the Magdalen Islands. The basket must have parallel stems with a minimum spacing of 3.175 cm so as not to retain individuals measuring less than 80 mm in length. Stimpson's surfclam landings are expressed in tons, live weight, or the whole surfclam.

The first exploratory fisheries in the northern Gulf of St. Lawrence were conducted in 1990 in response to interest expressed by fishers and the processing industry. Beginning in 1993, the fishery developed on the North Shore and in the Magdalen Islands, and annual landings from these two sectors fluctuated between 200 and 500 t from 1994 to 2002 (Figure 3). In 2003, fishers began regular harvesting in area 4B (Figure 2), and from 2003 to 2014, annual landings remained between 700 t and just over 900 t, except in 2007 and 2008 (625 t and 653 t, respectively). Landings then declined from 2014 to 2017 from 787 t to 552 t. For the current assessment period (2018-2020), landings have remained relatively stable and at 2017 levels, ranging from 539 t to 615 t.

Table 1. Management measures for Stimpson's surfclam fishery in 2020.

Management measures	Fishing area									
	1A	1B	2	3A	3B	4A	4B	4C	5A	5B
Number of licences	1	1	4	2	2	2	5	3[1]	4	4
TAC (t)	80.0	68.6	54.9	85.2	93.7	174.5	425.0	170.1	204.0	113.0
TAC management[2]	ITQ	ITQ	Comp.	ITQ	ITQ	ITQ	Comp.	Comp.	Comp.	Comp.
Start of fishing season	14/06							21/07	23/03	
End of fishing season	14/11							17/10	31/12	
Hail in	100 %							0 %	100 %	
Dredge: number	1									
Dredge: width	1.83 m								2.13 m	
Dredge: spacing between stems	3.175 cm									
Minimum legal size	80 mm									

[1] = *Exploratory licence*
[2] = *Comp. (competitive fishery), ITQ (individual transferable quota with restriction)*

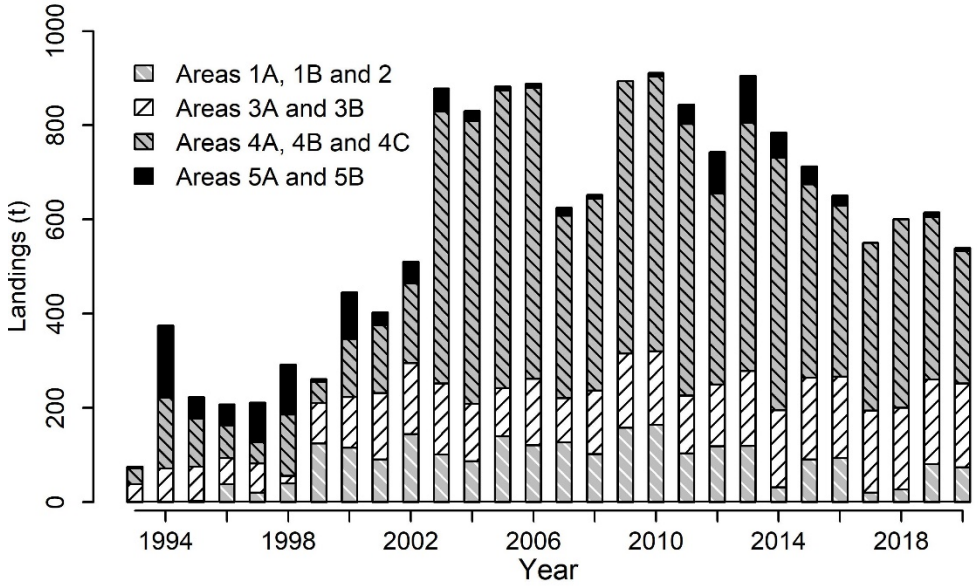

Figure 3. Annual Stimpson's surfclam landings in Quebec per fishing area.

ASSESSMENT

The assessment of the Stimpson's surfclam stock status is mostly based on analysis of commercial fishery data. These data come from three different sources of information: purchase slip, fisher's daily logbook and samples of commercial catches collected dockside by Fisheries and Oceans Canada (DFO). Scientific surveys and exploratory fisheries enhance information regarding species' distribution and population dynamics.

During the 2018-2020 period, the North Shore accounted for 99% of landings and the Magdalen Islands for 1%. Mean landings over the last three years totalled 587 t, a decrease of 8.1% compared to the 2015–2017 period (Figure 3). This decline is due to a large decrease in fishing activities in areas 1B, 4B and 5B for the 2018–2020 period (Table 2). Areas 3A, 3B, 4A and 4B were exploited in each of those years, areas 1A and 5B were exploited in 2019 and

2020, area 2 was exploited only in 2018 whereas areas 1B, 4C and 5A were not exploited. Among these areas, only area 1B was regularly exploited prior to 2018. The annual TAC for the 2018-2020 period averaged over 80% only in areas 3A and 3B (Table 3).

Table 2. Stimpson surfclam commercial fishery effort, in dredged area (km^2), by fishing area and year.

Year	Fishing area									
	1A	1B	2	3A	3B	4A	4B	4C	5A	5B
2015	0.090	0.015	-	0.122	0.106	0.025	0.442	-	-	0.076
2016	0.105	0.024	-	0.104	0.107	-	0.431	-	-	0.048
2017	0.032	-	-	0.126	0.111	-	0.383	-	-	-
2018	-	-	0.097	0.102	0.088	0.094	0.392	-	-	-
2019	0.070	-	-	0.136	0.091	0.090	0.244	-	-	0.021
2020	0.077	-	-	0.133	0.093	0.123	0.135	-	-	0.025
Average 2018–2020	0.049	-	0.032	0.124	0.091	0.103	0.257	-	-	0.015
Median 1993–2019	0.059	0.032	0.056	0.083	0.057	0.102	0.383	0.002	0.028	0.077

Table 3. Mean landings and percentage of TAC reached, by area, between 2018 and 2020.

Fishing area	Mean landings (t)	% TAC reached
1A	51.5	64
1B	0	0
2	8.9	16
3A	83.4	98
3B	93.9	100
4A	132.2	76
4B	209.5	49
4C	0	0
5A	0	0
5B	5.4	5

The mean catch per unit effort (CPUE) for the 2018–2020 period is higher than the time series median in area 3A, but lower than the series median for areas 1A, 2, 3B, 4A, 4B and 5B, (Table 4).

Until now, inside each area, fishers have been able to maintain fairly good yields by distributing the fishing effort within a bed or between beds. This may help limit local overexploitation.

The mean size of landed surfclams are significantly higher than the minimum legal size in all areas (Table 5). For the 2018–2020 period, the mean size is higher than the time series medians for areas 2, 3A, 4B and 5B and below the median for areas 1A, 3B and 4A (Table 5). The number of individuals measuring less than 80 mm in the landings was low, about 0.6%. In most areas, fishers were able to maintain large sizes by moving their fishing effort or by concentrating their effort on individuals from the same aging cohorts.

Table 4. Catches per unit of effort (kg per tow, standardized to 1-m wide dredge) estimated using logbook data.

Year	Fishing area									
	1A	1B	2	3A	3B	4A	4B	4C	5A	5B
2015	100.0	94.2	-	75.8	99.6	167.3	96.9	-	-	57.3
2016	86.5	67.2	-	88.3	99.9	-	97.0	-	-	50.3
2017	73.3	-	-	73.2	97.0	-	106.6	-	-	-
2018	-	-	31.7	90.4	122.3	112.1	90.4	-	-	-
2019	132.2	-	-	72.5	118.5	165.9	100.5	-	-	53.9
2020	109.2	-	-	72.8	115.2	162.0	90.5	-	-	30.3
Average 2018–2020	120.7	-	31.7	78.6	118.7	146.6	93.8	-	-	42.1
Median 1993–2019	122.3	80.0	96.4	75.7	121.8	153.3	106.6	58.8	51.0	56.5

Table 5. Mean length (mm) of Stimpson's surfclams at landing.

Year	Fishing area									
	1A	1B	2	3A	3B	4A	4B	4C	5A	5B
2015	115.7	117.5	-	110.3	109.8	108.2	110.5	-	-	100.3
2016	117.7	112.6	-	110.4	109.9	-	109.4	-	-	98.6
2017	119.0	-	-	111.9	109.7	-	109.2	-	-	-
2018	-	-	114.6	108.7	111.9	113.4	110.2	-	-	-
2019	112.6	-	-	112.3	112.4	113.5	106.2	-	-	100.2
2020	114.6	-	-	110.2	107.6	107.3	107.4	-	-	-
Average 2018–2020	113.6	-	114.6	110.4	110.6	111.4	107.9	-	-	100.2
Median 1993–2019	114.3	108.5	113.5	110.3	111.1	112.3	105.5	-	-	98.9

An exploitation rate indicator was developed for the primary beds harvested and was used during the review of the 2009 to 2011 seasons. In this approach, the exploited bed area was estimated using daily fishing positions recorded in the logbooks between 1993 and 2020. That area is described as the portion in which 95% of the fishing effort was carried out during the series. The area annually dredged per bed was then calculated by multiplying the number of tows conducted during the fishing season by the average duration of a tow, the width of the dredge, and the average speed of the vessel. The exploitation rate for a given year is calculated by area as the ratio between the portion dredged and the harvested portion for all beds in the area. The estimated exploitation rate does not account for possible dredge tow overlapping or the fact that a bed's exploitable area could be larger than what is currently used, as there is often little fishing effort outside known concentrations in the beds.

The mean exploitation rate for 2018–2020 in each area was below the cut-off value of 3% in all areas, but it was relatively high (2.8%) in area 3A (Table 6). Even if the exploitation rates are lower than the cut-off value in all areas, they may still exceed that cut-off on certain beds: Moisie River West in area 3A (3.4%) and Rivière-au-Tonnerre Est in area 3B (4.0%). Such exploitation rates may not be sustainable in the long term.

Research surveys conducted on the North Shore in 2009, 2010 and 2017 showed a presence of high densities of surfclams measuring less than 80 mm in the Longue-Pointe-de-Mingan (area 4A) and Natashquan (area 4B) beds, and lower densities in the Forestville (area 1A) bed. However,

legal size surfclams were more evenly distributed within beds. As a precautionary measure, portions of beds with high concentrations of sub-legal size surfclams should be protected from the fishery given the species' low productivity. Moreover, the 2017 survey on the Forestville bed showed a lower density than that of 2010, for both legal and sub-legal individuals. The presence of a strong cohort of individuals measuring approximately 70 mm in 2010 that reached sizes of ≥ 80 mm in 2017, and the lack of recruitment since then, would explain the lower density of smaller individuals observed in 2017. These results support previous observations that suggest very irregular recruitment for this species.

Table 6. Stimpson's surfclam bed surface area, dredged area and mean exploitation rates from 2018 to 2020.

Fishing area	Bed surface area (km^2)	Bed surface area with 95% effort (km^2)	Dredged surface area (km^2)		Exploitation rate 2018–2020 (%)
			Total 1993–2020	Annual average 2018–2020	
1A	17.015	5.351	1.323	0.049	0.92
1B	15.065	3.009	0.690	0	0
2	28.382	3.131	0.591	0.032	1.03
3A	28.547	4.464	1.664	0.124	2.77
3B	16.589	4.749	1.365	0.091	1.91
4A	17.966	4.190	2.424	0.103	2.46
4B	69.951	15.225	6.863	0.257	1.69
4C	3.217	0	0.002	0	0
5A	20.302	0	0.057	0	0
5B	443.838	4.212	1.921	0.015	0.36

Ecosystem Considerations

Dredges used for harvesting Stimpson's surfclams have an immediate impact on substrate and benthic organisms, as they stir up soft sediment, up to 20 cm deep, to remove the organisms, which causes sedimentation behind and adjacent to the dredge's path. Although dredges are very effective for harvesting surfclams, those that are not harvested along the path are often damaged (Lambert and Goudreau 1995). It is reasonable to assume that individuals of other sessile or poorly mobile species could also be injured or killed. The recovery speed of benthic communities that are affected would vary depending on the site's depth, sediment type and degree of hydrodynamics. Shallower sites with higher hydrodynamics produced by waves or currents seem to recover their initial state of sediment compaction and faunal composition between a few days to a few months after the dredge has passed. Communities more resilient to disturbances live on bottoms where there is greater natural instability. However, there are some uncertainties about the effect of dredging on benthic productivity in general.

Fishers prefer to frequent portions of a bed with high concentrations of surfclams. The annual average surface area dredged from 2018 to 2020 totalled 0.656 km^2 on the North Shore and 0.015 km^2 in the Magdalen Islands. The footprint of the fishery on this habitat is therefore relatively small compared to the surface areas of known beds: 197 km^2 on the North Shore and 464 km^2 in the Magdalen Islands (Table 6).

Sources of Uncertainty

This assessment is based mainly on indices derived from logbook and dockside commercial catch sampling data. Any change in the fishing technique (e.g. an increase in dredging speed) would

have a direct impact on CPUE and exploitation rates. In addition, missing or erroneous georeferenced positions would have an impact on the estimation of the harvested surface portions of the beds and the areas. The use of an electronic logbook, in which all fish tows would be compiled, would help to better describe the fishing pattern, thereby improving the estimation of CPUE and the exploitation rate. Fishery independent information are available only for a limited number of beds. With unknown exploitation rates based on exploitable biomass, bed productivity and recruitment, using an empirical approach seems to be the only means to adjust quotas.

CONCLUSIONS AND ADVICE

Quota increases must be conservative, as the Stimpson surfclam's low growth rate, sedentariness and indications of irregular recruitment make certain beds vulnerable to overexploitation. According to the guidelines established to recommend quota adjustments in each fishing area, increases should not exceed 6% per 3-year period. A quota cannot be increased unless over 80% of it, on average, has been reached consistently during the assessment period and the CPUE and mean size indicators are above the time series median. In addition, the exploitation rate in the area must be below 3%.

According to the existing decision rule, only area 3A meets all the conditions for a quota increase of 6%. The status quo is recommended for all other areas (Table 7).

Table 7. Indicators used in the decision rule to increase the TAC. Indicators in bold indicate that they meet the conditions for a quota increase.

Fishing area	Average landing 2018–2020 (80% of TAC, t)	Average CPUE 2018–2020 (median, kg/tow)	Average size 2018–2020 (median, mm)	Exploitation rate 2018–2020 (%)	Recommended quota increase
1A	51.5 (64.0)	120.7 (122.3)	113.6 (114.3)	**0.92**	No
1B	Not fished between 2018 and 2020				No
2	8.9 (43.9)	31.7 (96.4)	**114.6** (113.5)	**1.03**	No
3A	**83.4** (68.2)	**78.6** (75.7)	**110.4** (110.3)	**2.77**	**Yes**
3B	**93.9** (75.0)	118.7 (121.8)	110.6 (111.1)	**1.91**	No
4A	132.2 (139.6)	146.6 (153.3)	111.4 (112.3)	**2.46**	No
4B	209.5 (340.0)	93.8 (106.6)	**107.9** (105.5)	1.69	No
4C	Not fished between 2018 and 2020				No
5A	Not fished between 2018 and 2020				No
5B	5.4 (90.4)	42.1 (56.5)	**100.2** (98.9)	**0.36**	No

OTHER CONSIDERATIONS

Conservation Approach

The objective of the conservation approach for the Stimpson's surfclam is to protect the reproductive potential and limit the fishery's impact on the ecosystem.

To achieve this, Quebec is divided into several fishing areas where access is limited (number of fishers, fishing season and TAC). In most fishing areas, there are also closed shellfish areas. These closed areas protect a certain portion of the surfclam population from commercial exploitation, but their contribution to the reproductive potential remains unknown. The density of spawners is critical for reproductive success, and protecting small areas with a high density of adults may be beneficial for the population. Furthermore, portions of beds with a high density of sub-legal size surfclams should be protected from the fishery. This is possible because they are distributed less consistently within the beds compared to legal-size surfclams. The exploitation rate must remain low given their low productivity.

Most surfclams are sexually mature at around 60 mm, but the contribution of smaller surfclams to the population's reproductive potential is relatively low (proportional to individuals' size). The current minimum legal size of 80 mm allows individuals to reproduce a few years before being vulnerable to the fishery. In addition, the regulated spacing of the dredge's stems minimizes the harvesting of surfclams smaller than 80 mm.

The impact of the fishery on habitat and by-catches is limited due to use of the hydraulic dredge, which is very effective in minimizing the fishing effort required to reach the TAC.

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SOURCES OF INFORMATION

This Science Advisory Report is from the February 22, 2021 regional advisory meeting on the Assessment of the Stimpson's surfclam fishery in the Quebec's inshore waters. Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

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