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Canadian Science Advisory Secretariat
Quebec Region **Science Advisory Report 2018/022**

ASSESSMENT OF STIMPSON'S SURFCLAM STOCKS OF QUEBEC COASTAL WATERS IN 2017

Source: DFO 2011.

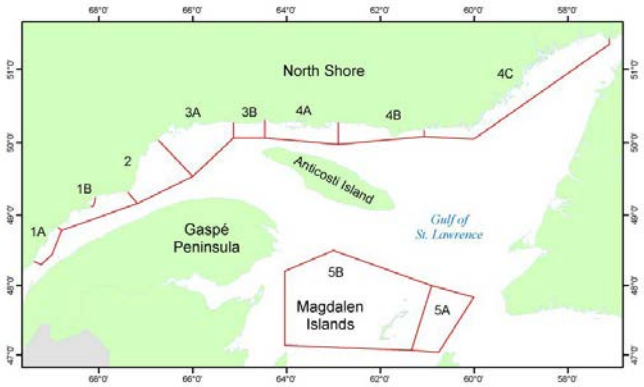

Figure 1. Stimpson's surfclam fishing areas in Quebec.

Context:

The Stimpson's surfclam (Mactromeris polynyma) fishery began in the early 1990s in the Gulf of St. Lawrence. The most significant beds are located on the 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 20, 2018, meeting on the assessment of Stimpson's surfclam stocks in Quebec coastal waters.

SUMMARY

- Mean annual Stimpson's surfclam landings in Quebec totalled 638 t from 2015 to 2017, a 22% decrease compared with the 2012-2014 period. The North Shore accounted for 97% of landings and the Magdalen Islands for 3%.
- Since 2015, areas 2, 4C and 5A have not been exploited. Area 4A was exploited only in 2015, and areas 1B and 5B were exploited in 2015 and 2016. Areas 1A, 3A, 3B and 4B were exploited every year and, on average, more than 80% of the total allowable catch (TAC) was reached in these areas, with the exception of Area 1A (74%).

- The average catch per unit effort (CPUE) has been decreasing in Area 1A since 2009, and the average for 2015 to 2017 is significantly below the median. It is also below the median in areas 3B, 4B and 5B, whereas it is slightly above the median in areas 1B, 3A and 4A.
- The average size of surfclams landed for the 2015–2017 period was clearly above the median in areas 1A, 1B and 4B and slightly above in areas 3A and 4A, whereas it was slightly below in areas 4A, 3B and 5B.
- The exploitation rate index was lower than 3% in the areas exploited between 2015 and 2017. It should be noted that relatively high exploitation rates (between 2.5 and 3%) were observed in areas 3A, 3B and 4B. Some of the beds in these areas have an exploitation rate of 3% or higher, and it would be wise to decrease or limit effort on these beds.
- According to the existing decision rules, only Area 3A meets all the conditions for a 6% quota increase.
- For Area 1A, the trend in certain indicators raises some concern about the stock's ability to support the fishing pressure of recent years over a long period.
- As a precautionary measure, portions of beds with concentrations of sub-legal size (<80 mm) surfclams should be protected from the fishery given the species' low productivity. In addition, the fishing effort in one area should be distributed 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. Surfclams gather in «beds» in sandy sediments on the sublittoral zone or under the low tide line. Their 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.

Stimpson's surfclams can be found along the west coast of the Atlantic, from Baffin Island to Rhode Island, and on the Pacific coast, from Alaska to Vancouver Island, as well as on the east coast of Russia. On the North Shore, surfclams have been observed at depths ranging between 1 and 46 m. The distribution of beds in this region is 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 harvested 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. Surfclams are therefore able to reproduce for a few years before being recruited to the fishery. Ova fertilization takes place in the water column through synchronous gamete transfer by individuals of both sexes that are close to each other. 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.

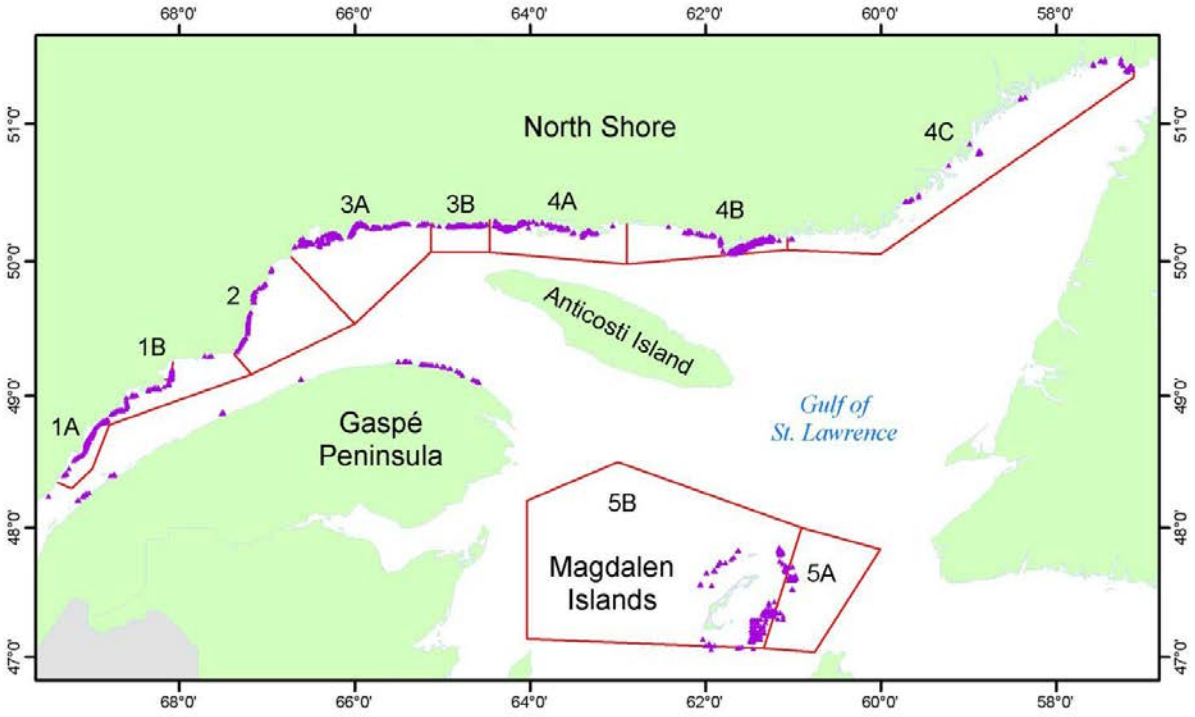

Figure 2. Known distribution (triangles) for Stimpson's surfclam in Quebec.

Description of the Fishery

The first exploratory fisheries in the northern Gulf of St. Lawrence were conducted in 1990 in response to interest expressed by fishers and 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 until 2002 (Figure 3). In 2003, fishers began regular harvesting in Area 4B (Figure 2), and annual Quebec landings have since varied from 550 to more than 900 t, but have been decreasing since 2013. The Stimpson's surfclam fishery requires the use of a 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 1.22 and 2.13 m, and a length of 1.83 m. 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.

In Quebec, the Stimpson's surfclam fishery is complementary, which means that fishers practise other fisheries during the year. The region 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 2017, 15 permanent licences and three exploratory licences were issued. Some licences give access to more than one fishing area.

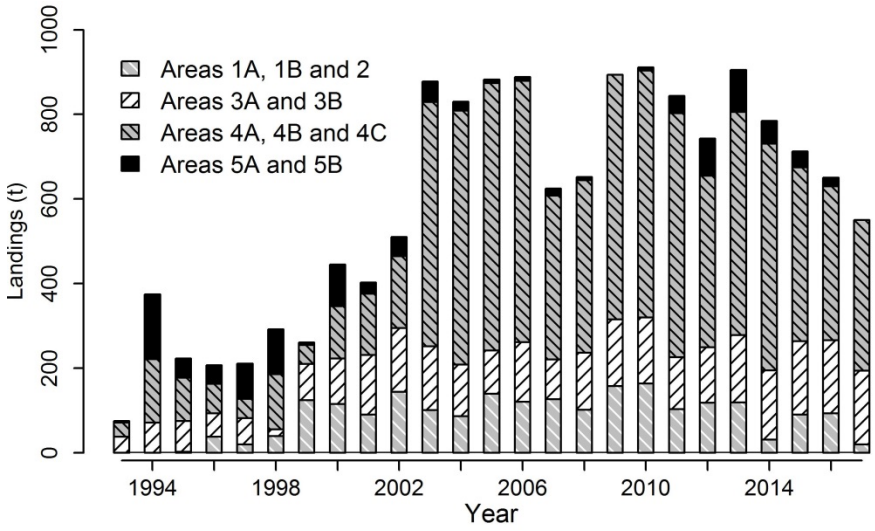

Figure 3. Annual Stimpson's surfclam landings in Quebec per fishing area.

Table 1. Management measures for Stimpson's surfclam fishery in 2017.

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	80.4	93.7	174.5	425.0	170.1	204.0	113.0
TAC[2] management	ITQ	ITQ	Comp.	ITQ	ITQ	ITQ	Comp.	Comp.	Comp.	Comp.
Start of fishing season	10/06	10/06	10/06	10/06	10/06	10/06	10/06	21/07	31/03	31/03
End of fishing season	10/11	10/11	10/11	10/11	10/11	10/11	10/11	17/10	31/12	31/12
Hail in	100%							0%	100%	
Number of dredges	1									
Maximum dredge width	1.83 m								2.13 m	
Minimum spacing between stems	3.175 cm									
Minimum legal size	80 mm									

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

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.

Stimpson's surfclam landings are expressed in tons, live weight, or the whole surfclam. Mean landings over the last three years totalled 638 t, a decrease of 21.6% compared to the 2012–2014 period (Figure 3). This decrease is due to decreased fishing activities in areas 4A and 5B for the entire 2015–2017 period. During that period, the North Shore accounted for 97% of landings and the Magdalen Islands for 3%. On average, over 80% of the annual TAC for the 2015–2017 period was reached in areas 3A, 3B and 4B (Table 2). Area 1A was exploited in each of those years, but only 74% of the TAC was reached for that period because of a large decrease in landings in 2017. During that period, areas 1B and 5B were exploited in 2015 and 2016, Area 4A was exploited only in 2015, whereas areas 2, 4C and 5A were not exploited. Among these areas, only Area 4A was regularly exploited prior to 2015.

Table 2. Mean landings and percentage of TAC reached, by area, between 2015 and 2017.

Fishing Area	Mean landings (t)	% TAC reached
1A	59.2	74
1B	8.9	13
2	0	0
3A	80.5	100
3B	93.0	99
4A	12.3	7
4B	364.3	86
4C	0	0
5A	0	0
5B	19.4	17

The mean catches per unit effort (CPUE) for the 2015–2017 period were slightly higher than the time series medians for areas 1B, 3A and 4A, significantly lower than the series medians for areas 1A and 3B, and slightly lower than the medians for areas 4B and 5B (Table 3). In Area 1A, the CPUE has been decreasing since 2009 and, in 2017, it was significantly below the median.

Until now, with the exception of Area 1A, fishers have been able to maintain their area yields by distributing the fishing effort within a bed or between beds. This may help limit local overexploitation.

Mean sizes of landed surfclams are significantly higher than the minimum legal size in all areas (Table 4). For the 2015–2017 period, they were significantly higher than the time series medians for areas 1A, 1B and 4B and slightly higher for areas 3A and 5B. They were slightly below the median for areas 3B and 4A (Table 4). The number of individuals measuring less than 80 mm in the landings was low. In several areas, fishers were able to maintain large sizes by moving their fishing effort or by exploiting mainly individuals from the same aging cohorts.

Table 3. Catches per unit of effort (kg per tow for a 1-m wide dredge) estimated using logbook data, by fishing area.

Year	Fishing Area									
	1A	1B	2	3A	3B	4A	4B	4C	5A	5B
2012	134	95	-	101	151	131	108	-	-	48
2013	122	-	87	60	78	135	97	-	-	58
2014	-	-	95	73	107	157	109	-	-	58
2015	100	94	-	76	100	167	97	-	-	57
2016	86	67	-	88	100	-	97	-	-	51
2017	73	-	-	73	97	-	107	-	-	
Average $_{2015–2017}$	86.6	80.7	-	79.1	98.8	167.3	100.2	-	-	53.9
Median $_{1993–2016}$	122.3	80.0	97.8	75.8	122.4	153.3	107.6	-	-	57.3

Table 4. Mean length (mm) of Stimpson's surfclams at landing.

Year	Fishing Area									
	1A	1B	2	3A	3B	4A	4B	4C	5A	5B
2012	117	118	-	107	113	114	104	-	-	97
2013	115	-	113	118	109	112	106	-	-	99
2014	-	-	113	109	114	108	108	-	-	94
2015	115	117	-	109	111	108	111	-	-	100
2016	117	113	-	109	111	-	109	-	-	99
2017	119	-	-	110	111	-	109	-	-	
Average $_{2015–2017}$	117.3	115.0	-	109.2	111.2	108.4	109.7	-	-	99.5
Median $_{1993–2016}$	114.2	108.5	-	108.7	112.2	112.2	104.6	-	-	98.8

An exploitation rate indicator was developed for the primary beds harvested and was used during the review of the 2009 to 2011 seasons. Using the same approach, the exploited bed area was estimated using daily fishing positions recorded in the logbooks between 1993 and 2017. That area is described as the portion in which 95% of the fishing effort was carried out during that period. 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 2015–2017 in each area was below the cut-off value of 3% in all areas, but it was relatively high (≥ 2.5%) in areas 3A, 3B and 4B (Table 5). 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: Cap Colombier in Area 1A (4.7%), Baie Sainte-Marguerite in Area 3A (5.0%) and Rivière-au-Tonnerre Est in Area 3B (5.6%). 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,

commercial size surfclams were more evenly distributed within the beds. As a precautionary measure, portions of beds with high concentrations of sub-legal size (<80 mm) 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 surfclams measuring 80 mm or more and for smaller ones. 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 5. Stimpson's surfclam bed surface area, dredged area and mean exploitation rates from 2015 to 2017.

Fishing Area	Bed surface area (km^2)	Bed surface area with 95% effort (km^2)	Dredged surface area (km^2)		Exploitation rate 2015–2017 (%)
			Total 1993–2017	Annual average 2015–2017	
1A	17.015	5.230	1.176	0.075	1.43
1B	15.065	2.999	0.690	0.012	0.40
2	28.382	2.827	0.629	0.000	0.00
3A	287.192	4.629	1.668	0.117	2.55
3B	165.887	4.382	1.229	0.108	2.46
4A	17.966	3.891	2.115	0.008	0.22
4B	69.951	13.978	6.085	0.414	2.96
4C	3.217	0.000	0.002	0.000	0.00
5A	20.302	0.000	0.057	0.000	0.00
5B	438.479	4.194	1.875	0.041	0.97

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 other species could also be affected in the same manner. 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 2015 to 2017 totalled 0.734 km^2 on the North Shore and 0.041 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: 605 km^2 on the North Shore and 459 km^2 in the Magdalen Islands (Table 5).

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. 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. Independent sources of 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 and sedentariness 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. However, for Area 1A, the trend in certain indicators raises some concern about the stock's ability to support the fishing pressure of recent years over a long period.

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 (< 80 mm) surfclams should be protected from the fishery. This is possible because they are distributed less consistently within the beds compared to commercial-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.

SOURCES OF INFORMATION

This Science Advisory Report is from the February 20, 2018, meeting on the assessment of Stimpson's surfclam stocks in Quebec coastal waters. Additional publications from this meeting will be posted on the Fisheries and Oceans Canada Science Advisory Schedule as they become available.

Bourassa, L., Giguère, M., Brulotte, S., Cyr, C., and Perreault, L. 2008. Évaluation de la croissance, du taux d'exploitation et du recrutement à la pêche de la mactre de Stimpson (*Mactromeris polynyma*) de la Moyenne-Côte-Nord, Québec. Can. Tech. Rep. Fish. Aquat. Sci. 2799: x + 39 p.

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Trottier, S. et Goudreau, P. 2015. Évaluation des stocks de mactre de Stimpson (*Mactromeris polynyma*) des eaux côtières du Québec en 2014. Secr. can. de consult. sci. du MPO. Doc. de rech. 2015/063. vii + 72 p.

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