



UPDATE OF SEA CUCUMBER STOCK STATUS INDICATORS FOR AREAS B AND C IN THE GASPÉ PENINSULA IN 2019

Context

The stock assessment of sea cucumber in Quebec's coastal waters is carried out every three years, with some exceptions, in order to determine whether changes that have occurred in the stock status require adjustments to the conservation approach and the management plan. The last assessment was done in 2016. The stock assessment scheduled for March 25, 2020 had to be postponed to a later date (to be determined) due to the COVID-19 pandemic.

Following the 2019 fishing season and at the request of Fisheries Management, the sea cucumber fishery indicators, i.e. landings, fishing effort and catch per unit of effort (CPUE), were updated for Areas B and C on the Gaspé Peninsula's north shore. The purpose of this exercise is to provide an overview of changes in the status of sea cucumber stocks and, where applicable, to recommend adjustments to the fishing plan, according to the guidelines of the Conservation harvesting plan.

In the latest Science Advisory Report (DFO 2017), it is stated that "During the interim years, adjusting the fishing effort (Area 3) or the TAC (Areas B and C) only when there is a significant decline in CPUE is recommended. A decrease in CPUE of 20% or more in relation to the average or reference value of the area (Area 3: 2009–2015, Area B: 2016, and Area C: 2015–2016) should result in an equivalent decrease in the TAC in areas B and C or in the fishing effort in area 3. In the case of an increase in CPUE, no adjustment to the fishing effort or to the TAC would be made before the next assessment".

This Science Response Report results from the Science Response Process of May 22, 2020 on the Update of sea cucumber stock status indicators for Units B and C in the Gaspé Peninsula in 2019.

Background

The sea cucumber (*Cucumaria frondosa*) fishery is a recent activity in the Estuary and northern Gulf of St. Lawrence and is still at the exploratory stage. It began in 2008 on the Gaspé Peninsula's north shore and in 2009, on the Middle North Shore near Havre-Saint-Pierre. This fishery is carried out either by diving or by using an LGS-type dredge or a dredge specifically designed for sea cucumbers.

The first trial of sea cucumber fishing in Quebec was conducted in 2008 in Area C, in the northern part of the Gaspé Peninsula (Figure 1). The following year, the fishery was extended to Area A (diving only) and to Area B, adjacent to Area C. In 2010, protected areas were established along the Gaspé coast corresponding to about 15% of the licensed fishing territory. In 2014, closed sites have been established to conduct post-season surveys and assess the impacts of the fishery on fish habitat.

Quebec Region

Areas B and C are managed by a Total Allowable Catch (TAC). These TACs were determined from information obtained in the preliminary, non-systematic inventory conducted in 2004 (Campagna et al. 2005).

In 2015, Areas B and C were subdivided into sub-areas to better distribute the fishing effort throughout the Area. At the same time, in order to avoid conflicts of use with other fisheries, the exploitable area has been reduced through a reduction in the depth range allowed for sea cucumber fishing from 22-40 m to 32-42 m. As a result, TACs were adjusted to reflect the estimated biomasses in this new fishing stratum (32-42 m) using inventory data from Campagna et al. (2005). In addition, a minimum size of 114 mm is in effect in all Areas. In 2018, Area AA was established and only diving harvesting is allowed.

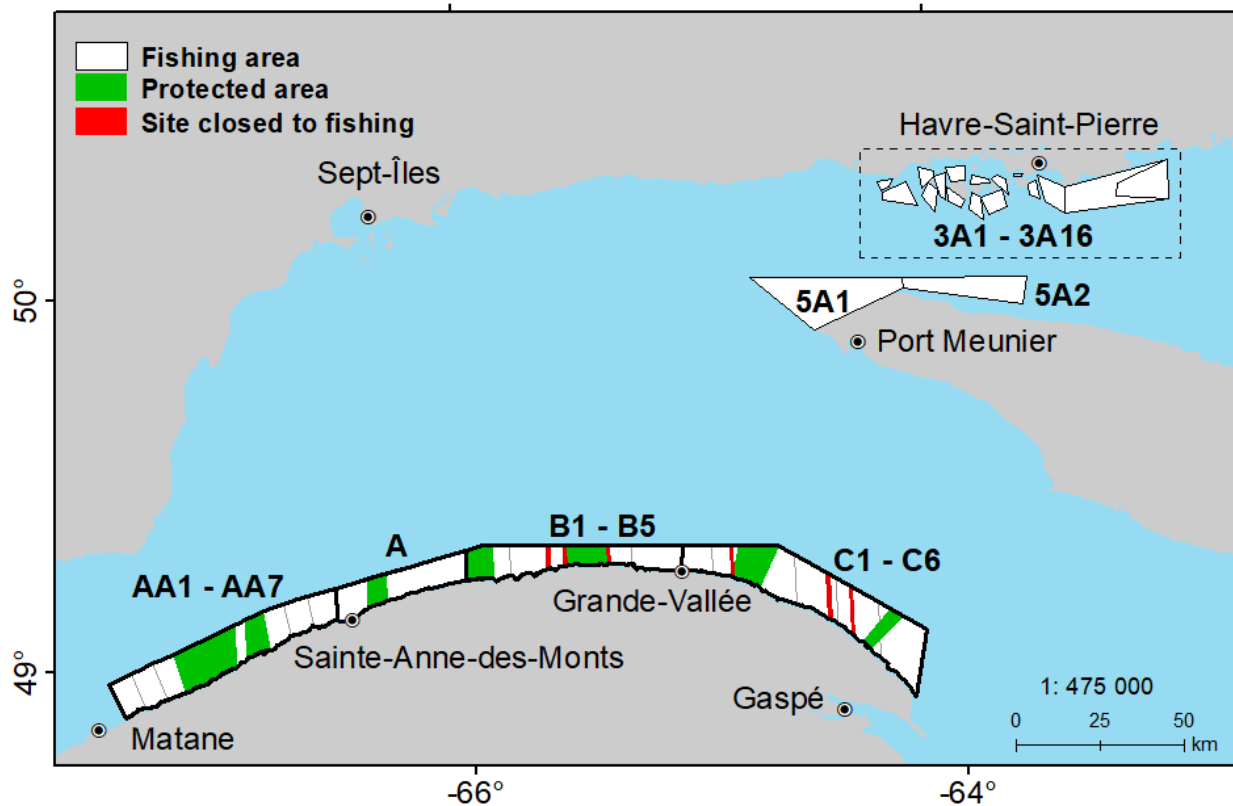


Figure 1. Sea cucumber management Areas (AA, A, B, C, 3 and 5) in Québec, protected areas (in green) and sites closed to fishing (in red).

The key indicator for the commercial fishery in Areas B and C is CPUE (in kg/h·m), calculated from information collected in logbooks and purchase slips, i.e. landings (kg), fishing time (hours) and dredge width (metres).

Description of the fishery

From 2017 to 2019, the average annual landings of sea cucumbers from the Gaspé North Shore dredge fishery was 638.2 t, a 12.0% decrease compared to the 2014-2016 period (Figure 2). These landings came from Area B (46.1%) and Area C (53.9%), since no dragging is allowed in Areas A and AA. The combined average annual effort in Areas B and C increased by

Quebec Region

3.2% from 2014-2016 to 2017-2019. It should be noted, however, that in 2015, no dredge fishing took place in Area B (Figures 2 and 3).

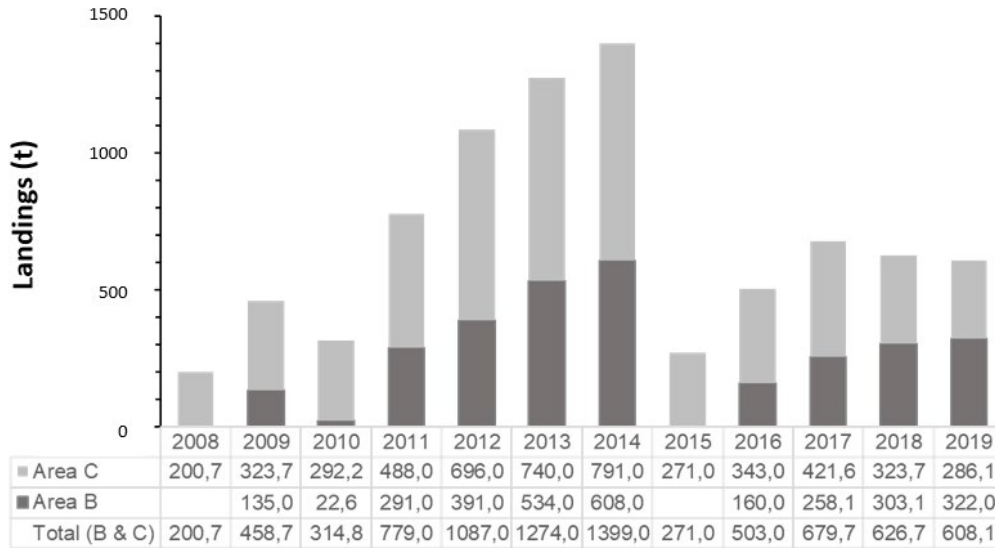


Figure 2. Commercial landing (tonnes) of sea cucumber from the dredge fishery on the north shore of Gaspé Peninsula by management area from 2008 to 2019.

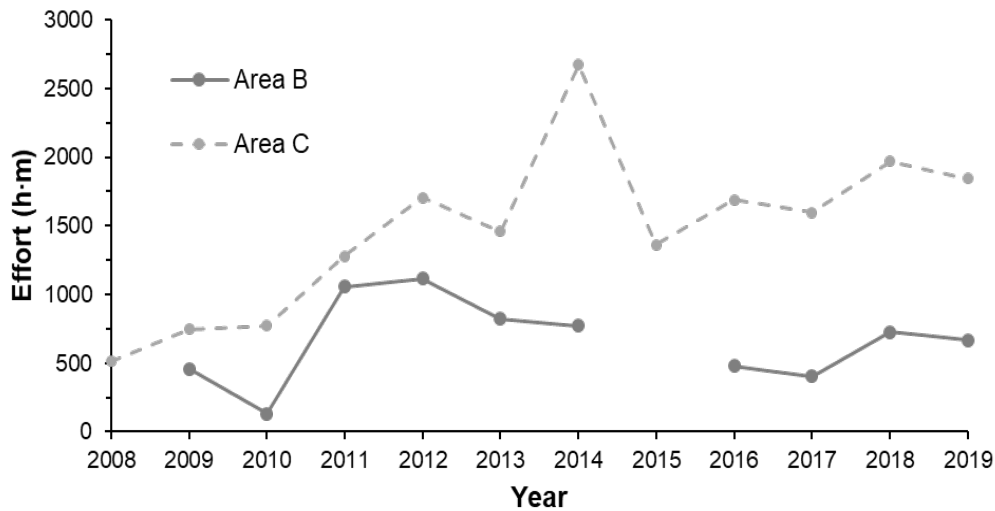


Figure 3. Commercial fishing effort for sea cucumber by dredge on the north shore of Gaspé Peninsula by management area from 2008 to 2019.

Analysis and Response

Indicators of the stock status

Landings and effort

In Area B, landings have gradually increased since the reduction in harvestable area and the temporary suspension of fishing in 2015, reaching 322 t in 2019 (Figure 2). The TAC was 295 t in 2017 and 2018, and 325 t in 2019. The average annual effort in the area for the 2017-2019 period was 600 h·m (41 fishing days) compared to 625 h·m (43.5 fishing days, excluding 2015) in the 2014-2016 period (Figure 3). In 2019, the TACs allocated by sub-area were approached at 89.8%, 78.4% and 96.6% in sub-areas B2, B3 and B4 respectively, and were exceeded at 102.5% and 110.9% in sub-areas B1 and B5.

In Area C, the TAC has been 352 t since 2017. Landings decreased significantly (32.1%) from 2017 to 2019, from 421.6 t to 286.1 t (Figure 2). The average effort for the same period was 1803 h·m, a decrease of 5.5% compared to the 2014-2016 period (1909 h·m) (Figure 3). In 2019, sub-area TACs were met at 87.8%, 94.8%, 95.1, 99.0% and 99.8% in sub-areas C3, C5, C2, C4 and C1 respectively. In sub-area C6, only 50.4% of the TAC was fished despite an effort similar to 2018.

Catch per unit of effort

In Area B, the average CPUE generally increased from 2016 to 2019, reaching 481.9 kg/h·m in 2019 (Figure 4). This represents a 43.6% increase in CPUE over the 2016 reference year (335.5 kg/h·m).

In Area C, CPUE in 2019 (155.3 kg/h·m) was 22.8% lower than the 2015-2016 reference period average (201.2 kg/h·m) (Figure 4). The decrease in CPUE was not uniform across all sub-areas (Figure 5). CPUE in sub-areas C2, C3, C4 and C6 decreased by 24.1, 26.4, 27.8 and 40.4%, respectively, while the decrease was only 2.6% in sub-area C1 and 15.0% in sub-area C5.

Fishery-independent surveys

Fisheries and Oceans Canada conducted a scientific dredge survey covering the entire Areas A, B and C between 10 and 80 m in depth from September 23 to October 18, 2018 (R. Belley, DFO Mont-Joli, unpublished data). Analysis of this survey shows that commercial-sized sea cucumbers (≥ 114 mm) are concentrated mainly in the 20-50 m depth stratum. This survey also showed a gradient in density of commercial sea cucumbers decreasing from west to east (Figure 6). Commercial density by sub-area ranged from 182.3 kg/1000 m² in Sub-area C1 to 27.9 kg/1000 m² in Sub-area C6. It is important to note that the reproductive success of sea cucumbers is density dependent, since gametes are released into the water column where fertilization occurs.

The Mi'gmaq Maliseet Aboriginal Fisheries Management Association (MMAFMA) has been conducting a post-season dredge survey since 2013. Fixed stations targeting the 32 m isobath exploited by the fishery have been sampled since 2016 (M.-H. Rondeau, MMAFMA, unpublished data). The last survey in 2019 also shows a general decreasing gradient of commercial density from west to east, from a maximum of 86.2 kg/1,000 m² in Sub-area C2 to a minimum of 31.0 kg/1,000 m² in Sub-area C6 (Figure 6).

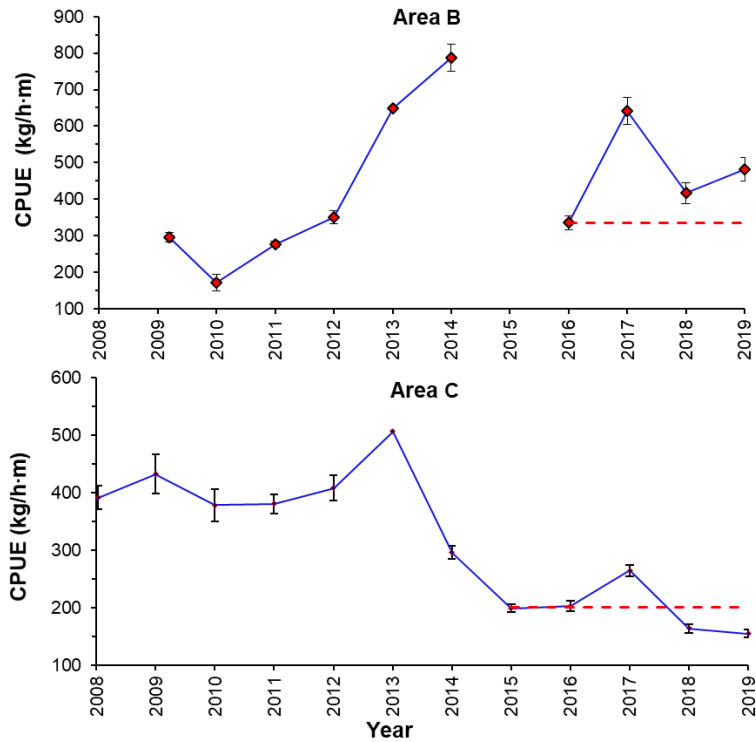


Figure 4. Annual catch per unit of effort (CPUE) (\pm standard error) during the commercial sea cucumber fishery in Areas B and C. Horizontal dotted line represents the reference mean for the area (Area B : 2016, and Area C: 2015-2016).

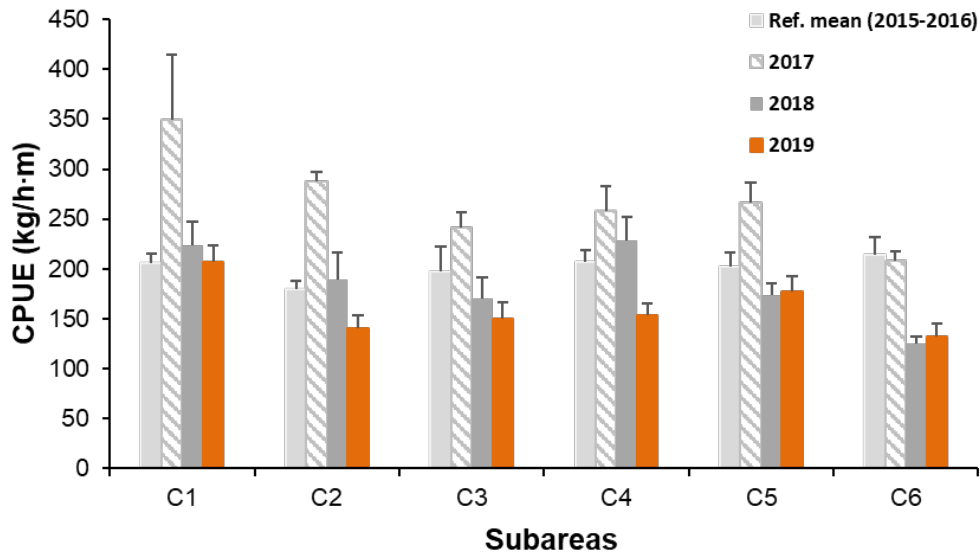


Figure 5. Annual catch per unit of effort (CPUE) (\pm standard error) of the commercial sea cucumber fishery by subareas of Area C. Mean CPUE by subarea is shown for the reference period 2015-2016.

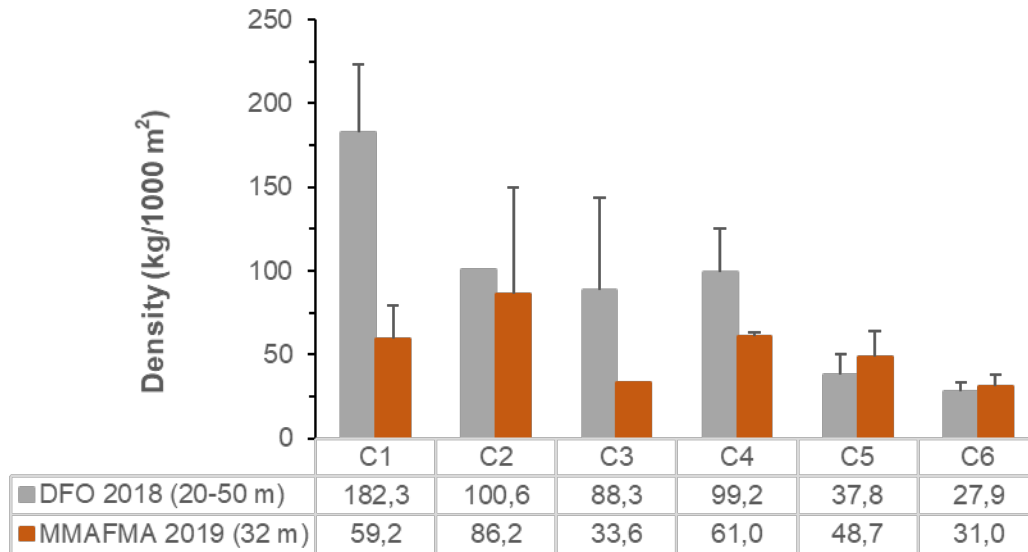


Figure 6. Annual density (\pm standard-error) of sea cucumber during the DFO research survey in 2018 and MMAFMA post-season survey in 2019 in subareas of area C.

TAC adjustment in Area C

Due to a decrease of more than 20% of the average CPUE in the Area C in 2019 compared to its 2015-2016 reference value, the Area C TAC should be adjusted downwards by 22.8%. Different approaches are proposed to adjust the Area C TAC (Table 1).

Option 1 : Decrease the TAC of all sub-areas by 22.8%.

This is the simplest and most consistent approach to implement this reduction. However, it should be noted that the decrease in CPUE has not been uniform across sub-areas and the fishery-independent surveys indicate that commercial density varies spatially within Area C. The relative decrease in CPUE was lowest in sub-area C1 and highest in sub-area C6, while the commercial density followed an inverse pattern. These observations suggest that the reduction in TACs in sub-areas C should be proportional to their own indicators. To do so, two other options are proposed:

Option 2 : Decrease TACs only in sub-areas where the CPUE has decreased by 20% or more.

This option implies the exclusion of sub-areas C1 and C5 from the TAC reduction. The overall reduction of 80.2 t for Area C would be distributed among the remaining sub-areas in proportion to their respective decrease in CPUE in 2019 compared to the 2015-2016 reference period.

Option 3 : Decrease TACs in sub-areas where CPUE has decreased by 20% or more and where the commercial density is lower than the area C average.

This option implies the exclusion of sub-area C1 from the TAC reduction. The overall reduction of 80.2 t for Area C would be distributed among the remaining sub-areas in proportion to: (i) the decrease in their CPUE in 2019 compared to the reference period and (ii) their commercial density indicator. The commercial density indicator is based on the average density of the 20-50 m stratum of the 2018 DFO science survey and the average density of the 2019 post-season MMAFMA survey.

**Science Response: Update of Sea Cucumber
stock status indicators for Areas B and C in the
Gaspé Peninsula in 2019**

Quebec Region

Table 1 : Suggested Total Allowable Catch (TAC in tonnes) by Area C sub-areas according to the three proposed options.

Sub-areas	Initial TAC	Option 1	Option 2	Option 3
C1	25	19.3	25.0	25.0
C2	41	31.7	24.7	33.8
C3	63	48.6	45.2	49.9
C4	38	29.3	19.2	29.7
C5	81	62.5	81.0	62.4
C6	104	80.3	76.7	70.9
Total	352	271.8	271.8	271.8

Sources of Uncertainty

This update relies largely on the quality of the indicators derived from the collected logbooks and purchase slips. Without knowledge of the sustainable exploitation rate, it is difficult to adjust TACs or exploitation strategies other than through a more conservative approach.

The sea cucumber landings are currently done using fishing gears still in development and differing greatly from one sector to another. CPUE estimates between these areas, sub-areas and annually could be influenced by these differences. In addition, fishing techniques favored by harvesters, as well as the number of harvesters, which is not constant each year, may also have an influence on the results.

Conclusions

Area B

The 2019 CPUE update shows that the CPUE remains above the average of the reference year 2016. Therefore, the 2019 TAC does not need to be adjusted for the 2020 fishing season.

Area C

The 2019 CPUE update shows a decrease in CPUE of 22.8% compared to the 2015-2016 reference average.

Changes observed suggest that the current TAC has generated fishing pressure that does not seem to allow the biomass available to the fishery to be maintained. In accordance with the latest Science Advisory Report and the Conservation Harvesting Plan (CHP 2017), the overall TAC for Area C should be reduced by 22.8%, or 80.2 t. Among the various TAC reduction options proposed, Option 3 takes into account both the non-uniform declines in CPUE and the variable commercial density between sub-areas. This approach would rebalance the TACs of the different sub-areas based on their perceived resilience to exploitation by changes in CPUE and the commercial abundance of sea cucumber as assessed by fishery independent surveys.

Contributors

Name	Affiliation
Belley, Rénaud	DFO, Science, Québec Region
Brulotte, Sylvie	DFO, Science, Québec Region
Cyr, Charley	DFO, Science, Québec Region
Juillet, Cédric	DFO, Science, Québec Region
Pomerleau, Corinne	DFO, Science, Québec Region
Sainte-Marie, Bernard	DFO, Science, Québec Region
Tamdrari, Hacène (Lead)	DFO, Science, Québec Region

Approved by

Jean-Yves Savaria
Regional Science Director
Quebec Region
Fisheries and Oceans Canada

Date : June 1st, 2020

Sources of Information

This Science Response Report results from the Science Response Process of May 22, 2020 on the Update of sea cucumber stock status indicators for Units B and C in the Gaspé Peninsula in 2019.

Campagna, S., Lambert, J. and Archambault, P. 2005. Abondance et distribution du concombre de mer (*Cucumaria frondosa*) et prises accidentelles obtenues par dragage entre Matane et Cap-Gaspé (Québec) en 2004. Rapp. tech. can. sci. halieut. aquat. 2620 : ix + 61 p.

CHP. 2017. [Conservation Harvesting Plan – Sea Cucumber – A to C – Gaspé-Lower St. Lawrence \(2017-2019\)](#).

DFO. 2014. [Assessment of the Sea Cucumber fishery in the Quebec's inshore waters in 2013](#). DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2014/054.

DFO. 2017. [Assessment of the Sea Cucumber fishery in Quebec's inshore waters in 2016](#). DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2017/050.

This Report is Available from the:

Center for Science Advice (CSA)
Québec Region
Fisheries and Oceans Canada
Maurice Lamontagne Institute
850 route de la Mer, P.O. Box 1000
Mont-Joli, Quebec, Canada G5H 3Z4

Telephone: 418-775-0825
Email: Bras@dfo-mpo.gc.ca
Internet address: www.dfo-mpo.gc.ca/csas-sccs/

ISSN 1919-3769

© Her Majesty the Queen in Right of Canada, 2020



Correct Citation for this Publication:

DFO. 2020. Update of sea cucumber stock status indicators for Areas B and C in the Gaspé Peninsula in 2019. DFO Can. Sci. Advis. Sec. Sci. Resp. 2020/038.

Aussi disponible en français :

MPO. 2020. Mise à jour des indicateurs de l'état des stocks de concombre de mer des zones B et C de la Gaspésie en 2019. Secr. can. de consult. sci. du MPO, Rép. des Sci. 2020/038.