ASSESSMENT OF RAZOR CLAM STOCKS IN QUÉBEC'S INSHORE WATERS IN 2012

DFO, Québec Region

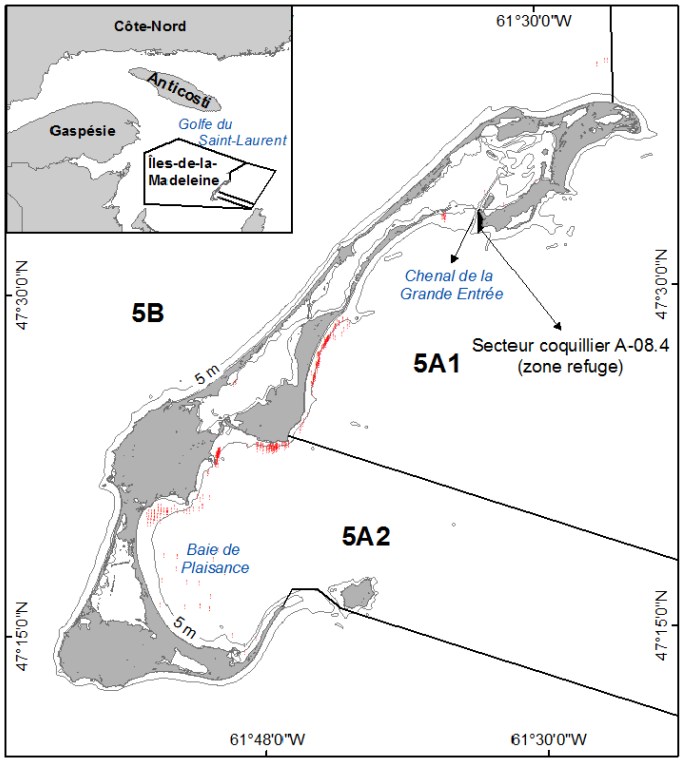

Figure 1. Management sub-areas (5A1, 5A2 and 5B, solid line) and known distribution (red circle) of razor clams in the Îles-de-la-Madeleine.

Context

*In Québec, the razor clam (*Ensis directus*) commercial fishery is practised in the Îles-de-la-Madeleine and on the North Shore in the Havre-Saint-Pierre region. The first trials took place in the early 1990s on the North Shore, and then a few years later in the Îles-de-la-Madeleine. This fishery is practised in a coastal environment with a New England hydraulic dredge or a hydraulic dredge with a conveyor. Fishing Area 5 in the Îles-de-la-Madeleine is divided into three sub-areas, and fishing is primarily conducted in sub-areas 5A1 and 5A2 (Figure 1). On the North Shore, the mechanized fishery is only allowed in sub-area 2.4, located to the north of Île Saint-Charles. There is limited information available on this fishery and a small number of fishers involved in either the Îles-de-la-Madeleine or the North Shore.*

This is the first stock assessment of this resource, which should now take place every three years. The indicators used for monitoring stocks are landings, fishing effort, catch per unit effort and size structure.

SUMMARY

Îles-de-la-Madeleine

- The total allowable catch (TAC) in sub-area 5A1 has been 13 t since 2008. Over the past three years, landings have varied between 12 and 16 t for 10 to 15 fishing days. Since 2008, the TAC is 26 t in sub-area 5A2, and landings have not surpassed 16 t. In 2012, the fishing effort was only 2 days with landings of 1 t. There has not been a fishery in sub-area 5B since at least 2002.
- Fishing only occurs in one bed per sub-area (in 5A1 since 2002, and in 5A2 since 2008).
- The standardized catch per unit effort (CPUE) has been fairly stable in 5A1 since 2009. The CPUE in 5A2 has been declining since 2009, and the 2011 figure was the lowest out of the 2005-2011 period.
- Given that the TAC was reached and CPUEs have been consistent in sub-area 5A1, the TAC could be increased by 10%. Landing and CPUE figures have been low in recent years for sub-area 5A2. It is therefore recommended that the TAC be lowered to 10 t and a refuge area be created.
- In order to facilitate the exploration of new areas, redefining the sub-area boundaries is recommended.

North Shore

- A single bed has been harvested sporadically on the North Shore since 1992. Since 2010, the wedge clam (*Mesodesma* spp.) has been harvested simultaneously with the razor clam; the TAC is 10 t per species. The TAC for the razor clam has never been reached. The fishing effort varied from 3 to 18 days between 2007 and 2011, and there was no fishery in 2012.
- CPUEs have been below the 1993-2011 average since 2009. Low values in 2010 and 2011 may have been caused by the simultaneous fishing of the two species.
- If there is uncertainty regarding the available information, the status quo seems reasonable.

BACKGROUND

The razor clam, *Ensis directus*, is a filter-feeding bivalve mollusc that is found along the Atlantic coast of North America from the south of Labrador to Florida, including the Estuary and Gulf of St. Lawrence. Razor clam habitat extends from the lower limit of the intertidal zone to a depth of 35 m, depending on the region. In Québec, it is mainly fished between 0 and 10 m. The razor clam lives buried in sediment mixtures of sand, clay and gravel. It is a sedentary species living in fairly large aggregations called “beds".

According to the literature, razor clams tend to meet the minimum legal catch size of 100 mm within three or four years on the North Shore. Razor clams can live roughly 10 years and reach a size of 250 mm.

Sexes are separate and there is no sexual dimorphism. According to the literature, spawning mainly occurs in June and July. The gametes are released into the water, where the ovules are fertilized. The larvae are pelagic. The larval phase lasts a few weeks, and its duration depends on the water temperature. After metamorphosis, the juveniles settle on the bottom and begin benthic life. However, the razor clam maintains some mobility that allows it to move around. Young razor clams (< 10 mm) can even move around in the water column.

Overall, the recommended conservation measures aim to ensure the sustainability of each bed by maintaining reproductive potential.

ASSESSMENT

Sources of data

Commercial fishery indicators, that is, landings (t of live weight), fishing effort (number of days) and CPUE (kg/hm) are compiled from information taken from logbooks and purchase slips. CPUE is calculated based on data recorded in logbooks and expressed as live weight per fishing hour and metre of dredge width. In the Îles-de-la-Madeleine, mean CPUE was standardized to account for the effect of the fisher and the year. Razor clam size is measured along the anteroposterior length of the shells. Size structures and average size are measured from samples of razor clam landed or at sea by DFO's commercial sampling program. The size structures are presented as a box and whisker plot that provides information on the median (central line in the box), the 25th and 75th percentiles (upper and lower limits of the box), the range of values represented by the whiskers (vertical lines on either side of the box representing 1.5 times the interquartile) and the extreme values represented by a small square.

The dredge fishery positions are available from the logbooks starting in 2002, and from some samples at sea conducted in 1998 and 2003. The list of bycatch, its abundance and biomass from 2 fishing trips (14 tows) carried out in sub-area 5A1 in the Îles-de-la-Madeleine is also presented.

Several sources of information were used to create the distribution map of the razor clam in the Îles-de-la-Madeleine. The main source is commercial fishery data. Surveys on benthic communities and the impact of mobile gear in Plaisance Bay carried out in 2011 and 2012, surf clam inventories conducted in 2012 and a surf clam bycatch analysis from 2012 were also used.

When there are less than three active fishers, all data that can provide information on the volume landed must remain confidential, unless authorization is obtained from the fishers in question. There are few fishers involved in the commercial razor clam fishery (three active fishers at most in the Îles-de-la-Madeleine and only one on the North Shore). As a result, no information is provided for certain indicators.

Îles-de-la-Madeleine

In the early 1990s, some Îles-de-la-Madeleine fishers began using a New England hydraulic dredge to harvest Arctic surf clam (*Mactromeris polynyma*) and surf clam (*Spisula solidissima*) in the coastal waters of the Îles-de-la-Madeleine. In around 1994, some fishers modified the dredge (decreasing the spacing between the stems) and conducted exploratory razor clam fisheries.

Razor clam commercial landings have been recorded since 1999. Since 2001, the minimum legal size for the razor clam fishery is 100 mm. A management plan to oversee this fishery was established in the fall of 2001. Since 2002, fishers are obligated to fill out a logbook and only have the right to use a single dredge with a maximum width of 1.52 m. Harvesting is permitted from the start of April until the end of December. Also, razor clam harvesting has been prohibited in shellfish area A-08.4 (refuge area) since 2005.

Since 2008, four commercial dredge harvesting licenses have been issued for razor clam in the Îles-de-la-Madeleine. As of 2002, a TAC of 23 t was allotted to area 5. To encourage fishermen to explore the entire area, it was divided into sub-areas (Figure 1). In 2006, the TAC was increased to 26 t and assigned to sub-area 5A. The area was re-divided in 2008. The TAC of 26 t was allotted to sub-area 5A2, and a TAC of 13 t was assigned to sub-area 5A1 (Table 1). The fishery remained competitive in sub-area 5B.

Table 1. TAC, landings (Lan., t), fishing effort (number of days), mean catch per unit effort (CPUE, kg/hm) and average size (mm) at landing for sub-areas 5A, 5A1 and 5A2 for razor clam commercial fishery in the Îles-de-la-Madeleine.

Year	5A		5A1					5A2				
	TAC	Lan.	TAC	Lan.	Effort	CPUE	Size	TAC	Lan.	Effort	CPUE	Size
1998												146 [1]
1999		4.7										
2000		3.3										
2001		7.4										
2002	23	0.5		0.5	2							
2003	23	12.8		11.0	23	61.1	115 [1]		1.8	4		116 [1]
2004	23	11.9		10.4	14	81.2	125		1.5	4		
2005	23	26.4		0.2	1				26.2	23	136.7	122
2006	26	11.7		0.5	1				11.3	11	202.4	128
2007	26	21.4		0	0				21.4	14	185.6	140
2008	39	11.8	13	0	0			26	11.8	7	214.5	149
2009	39	18.1	13	2.7	4	208.4		26	15.5	10	190.9	
2010	39	24.0	13	14.2	10	172.1	155	26	9.8	7	150.7	
2011	39	26.9	13	15.7	13	150.5		26	11.2	16	116.8	157
2012	39	13.2	13	12.3	15	203.1	161	26	1.0	2		
Ref. [2]		16.6		5.5	6.8	134.6	140.2		12.3	10.7	171.1	139.3

[1] Sea sampling.
[2] 2004-2011 reference average for average sizes and 2002-2011 for other indicators.

A significant portion of the Îles-de-la-Madeleine coasts are not being fished, including the north part of sub-area 5A1. According to the information available, sub-area 5B has never been fished.

Since 2003, landings from sub-area 5A (5A1 and 5A2) have ranged between 12 and 27 t (Figure 2 and Table 1). Although the division did not occur until 2008, the landings can be attributed to sub-areas 5A1 and 5A2 based on the positions recorded in the logbooks since 2002.

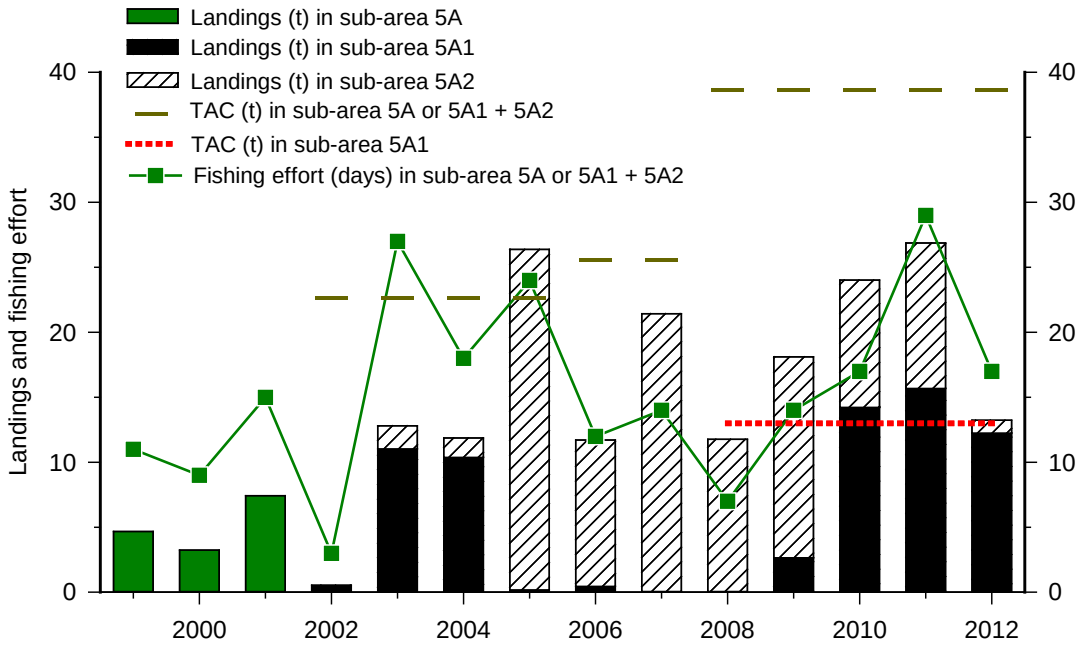

Figure 2. Annual razor clam landings (t), TAC and fishing effort per sub-area in the Îles-de-la-Madeleine.

Sub-area 5A1

The commercial fishery in sub-area 5A1 is currently conducted in a single bed, but the fishery is extending increasingly to the north (Figures 1 and 3).

Annual landings from sub-area 5A1 have ranged from 0 to nearly 16 t (Figure 2 and Table 1). Fishers barely visited this sub-area between 2005 and 2008. The TAC has been reached or slightly exceeded since 2010. In 2012, landings totalled 12 t. Fishing effort was never greater than 23 days, and it fluctuated between 10 and 15 days from 2010 to 2012 (Table 1). The annual standardized CPUE has been relatively stable since 2009, and the 2012 CPUE was 203 kg/hm (Figure 4 and Table 1).

Information on size structures in sub-area 5A1 is only available for four years (Figure 5 and Table 1). In 2003, the size of razor clams landed (dockside) varied between 106 and 188 mm, while the size of those captured (at sea) was between 87 and 162 mm. The average sizes in 2010 and 2012 were 155 mm and 161 mm, respectively. The fishery seemed to be mainly targeting large clams during those two years. The lack of smaller clams could be due to a few years of low recruitment within the population. However, only a small number of samples was taken for the annual size structure estimate; as such, this data must be interpreted carefully.

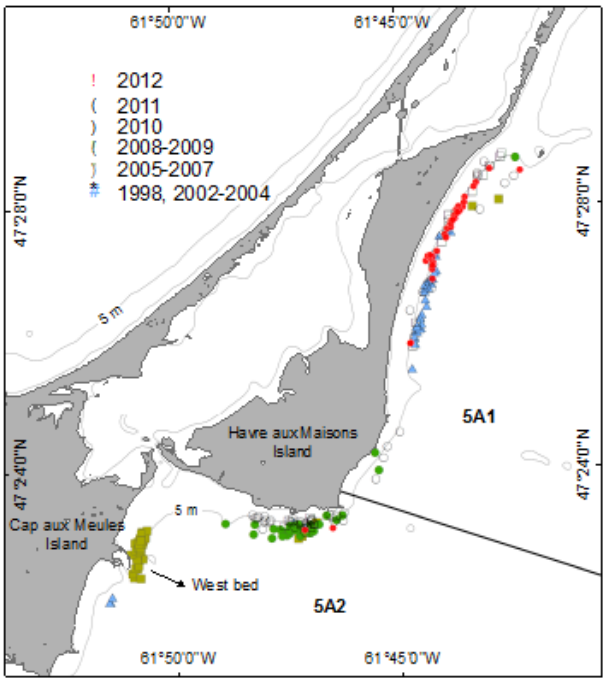

Figure 3. Location of razor clam commercial fisheries by year in sub-areas 5A1 and 5A2 in the Îles-de-la-Madeleine.

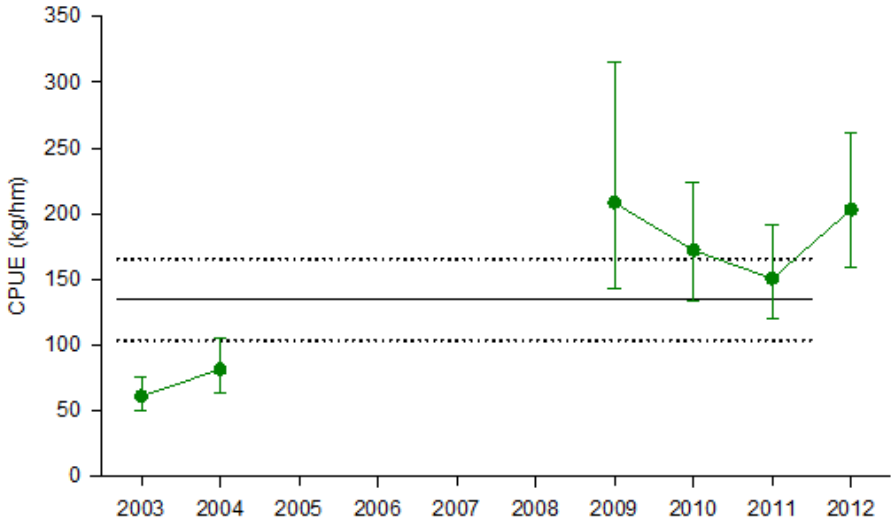

Figure 4. Annual standardized mean catch per unit effort (CPUE ± confidence interval of 95%) for commercial razor clam fishery in sub-area 5A1 of the Îles-de-la-Madeleine. The horizontal lines represent the 2003-2011 reference average (solid line) ± ½ standard deviation (dotted line).

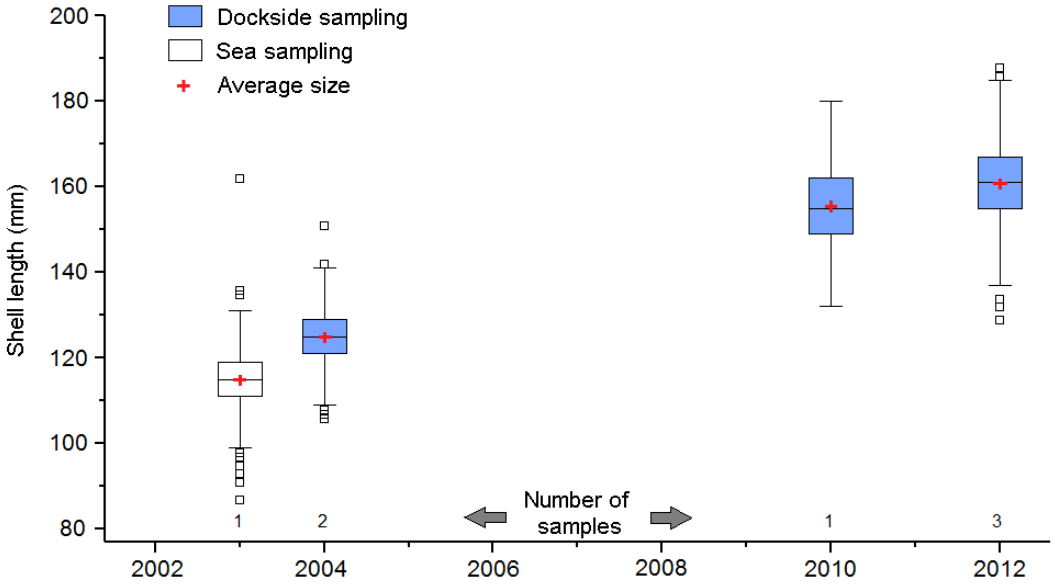

Figure 5. Size structure (box and whisker plots) of razor clams landed (dockside sampling) and caught (sea sampling) in the commercial fishery in sub-area 5A1 in the Îles-de-la-Madeleine.

Sub-area 5A2

From 2005 to 2007, a razor clam bed (west bed) located in sub-area 5A2 near the Cap-aux-Meules dock was harvested (Figure 3). However, this bed disappeared after significant construction on the wharf. Since 2008, razor clam harvesting in this sub-area has occurred on the bed to the south of Havre aux Maisons Island.

Landings varied from 11 t to nearly 16 t between 2008 and 2011, while fishing effort varied from 7 to 16 days (Figure 2 and Table 1). In 2012, the fishing effort was only 2 days with landings of 1 t.

The annual CPUE has been decreasing since 2009 (Figure 6 and Table 1). In 2011, the CPUE hit a historical low at 117 kg/hm, far below the 2005-2011 reference average.

Samples taken in 1998, 2008 and 2011 to estimate the size of caught and landed razor clams were from the bed currently being harvested, while the prior samples were taken from the west bed, which is now gone (Figure 7 and Table 1). The median and average sizes from the 1998, 2008 and 2011 samples are high, with no individuals below 120 mm in the 2008 or 2011 landings, just like in sub-area 5A1. This could also be due to a lack of recruitment in 5A2. However, it must be stated that the sample size was small.

According to a fisher, the razor clams on this bed have been small for a few years. That would explain why the fishery shifted toward sub-area 5A1 in 2012.

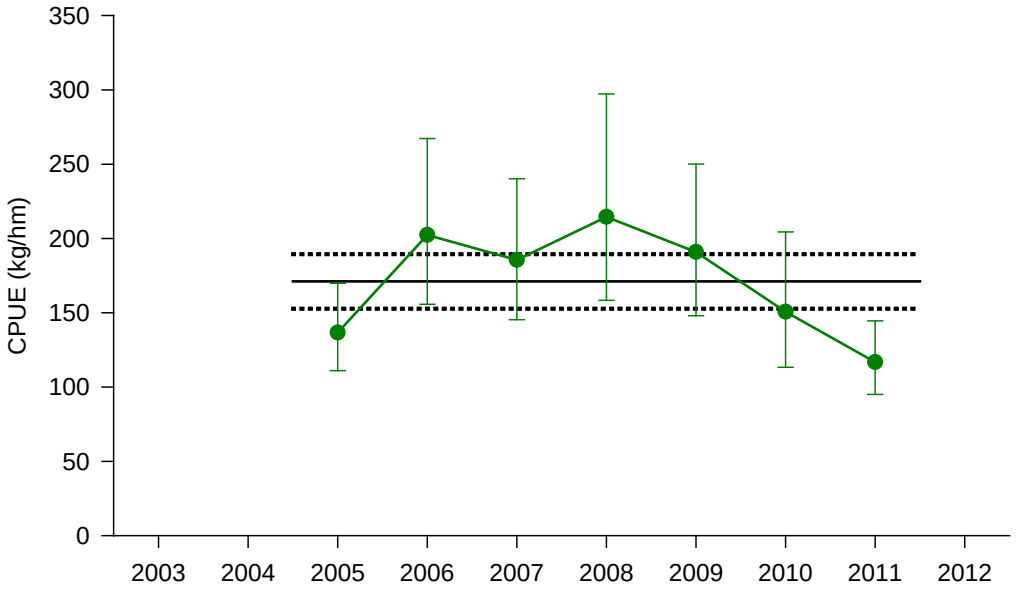

Figure 6. Annual standardized mean catch per unit effort (CPUE ± confidence interval of 95%) for commercial razor clam fishery in sub-area 5A2 of the Îles-de-la-Madeleine. The horizontal lines represent the 2005-2011 reference average (solid line) ± ½ standard deviation (dotted line).

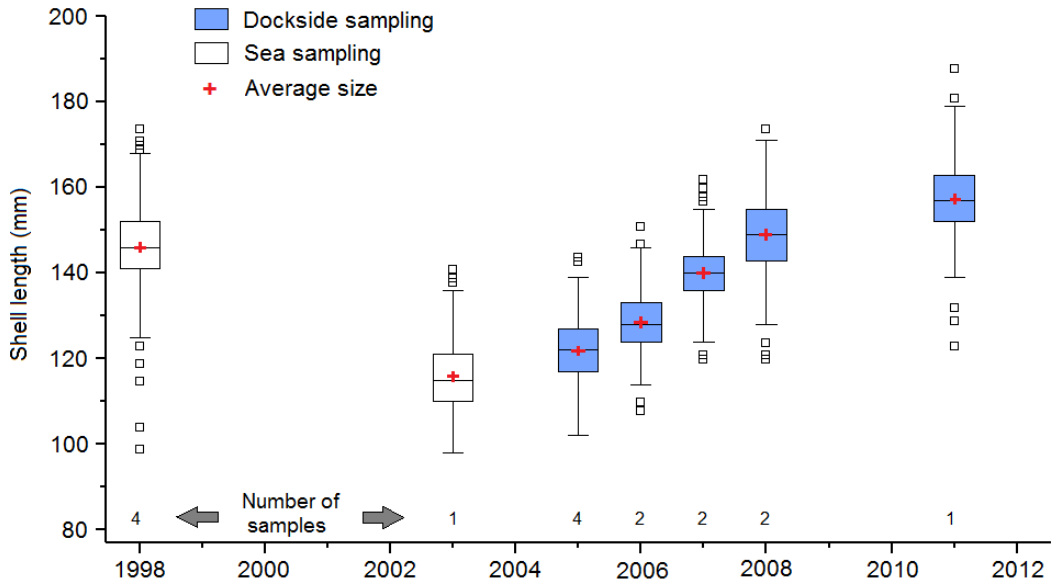

Figure 7. Size structure (box and whisker plots) of razor clams landed (dockside sampling) and captured (sea sampling) in the commercial fishery in sub-area 5A2 in the Îles-de-la-Madeleine.

Bycatch

In 2012, bycatches were assessed in 14 tows (2 trips) carried out in sub-area 5A1. The dredging depth varied between 4.0 and 6.7 m. Twelve taxa were identified in addition to the razor clam (Table 2). The most common taxa that were not targeted were the moon snail (*Lunatia heros*), the sand dollar (*Echinarachnius parma*), the surf clam, the rock crab (*Cancer irroratus*), bristle worms (Polychaeta), the ocean quahog (*Arctica islandica*), the Atlantic razor (*Siliqua costata*) and the Northern quahog (*Mercenaria mercenaria*). Other species were observed less frequently (in one or two tows), including the sea cucumber (*Cucumaria*

frondosa), the American lobster (*Homarus americanus*), the windowpane flounder (*Scophthalmus aquosus*) and the hermit crab (*Pagurus* sp.).

The razor clam is the predominant species in both weight and quantity in the dredging (Table 2). Four species (surf clam, moon snail, sand dollar and rock crab) distinguish themselves from the others and account for 23% of the biomass and abundance. The other species represent less than 0.6% of the catches in both quantity and weight.

Table 2. Frequency on all tows, average biomass and average abundance per tow and average size of all individuals (measured by taxon) of bycatch for razor clam commercial fishery in the Îles-de-la-Madeleine in 2012.

Taxon	Frequency	Biomass		Abundance		Size
	(%)	(kg)	(%)	(number)	(%)	(mm)
Razor Clam	100	19.9	75	348	75	161
Surf clam	93	2.3	9	9	2	109
Moon snail	100	1.9	7	15	3	67
Sand dollar	100	1.4	5	78	17	
Rock crab	86	0.5	2	4	0.9	87
Ocean quahog	64	0.4	0.1	2	0.4	85
Atlantic razor	64	0.1	0.4	3	0.6	61
Bristle worm spp.	71	0.04	0.2	2	0.4	
American Lobster	7	0.04	0.1	0.1	0.02	
Northern quahog	36	0.01	0.03	0.5	0.1	38
Windowpane Flounder	7	0.01	0.05	0.1	0.02	
Sea Cucumber	14	< 0.01	0.02	0.4	0.1	
Hermit crab	7	< 0.01	0.01	0.2	0.1	

North Shore

The razor clam commercial fishery with mechanical gear takes place exclusively in sub-area 2.4 on the bed to the north of Île Saint-Charles, near Havre-Saint-Pierre (Figure 8). Both commercial and recreational fishing are prohibited elsewhere on the North Shore. The gear used is a hydraulic dredge with a conveyor. Owing to its configuration, dredging with this gear is limited to a depth of 4 m and certain types of sediments (sand and sandy mud).

Landings have been recorded since 1992 (purchase slips and index fishermen), but logbooks have only been mandatory since 2002. Two licences have been issued in this sub-area, but only one licence has been active for the past several years. The minimum legal size since 2002 is 100 mm.

Fishing usually takes place in the fall. In 2009, a TAC of 11.4 t was implemented. In 2010, the active fisher was granted authorization to fish both the razor clam and the wedge clam (*Mesodesma* spp.) simultaneously, with a TAC of 10 t per species or a maximum of 20 fishing days.

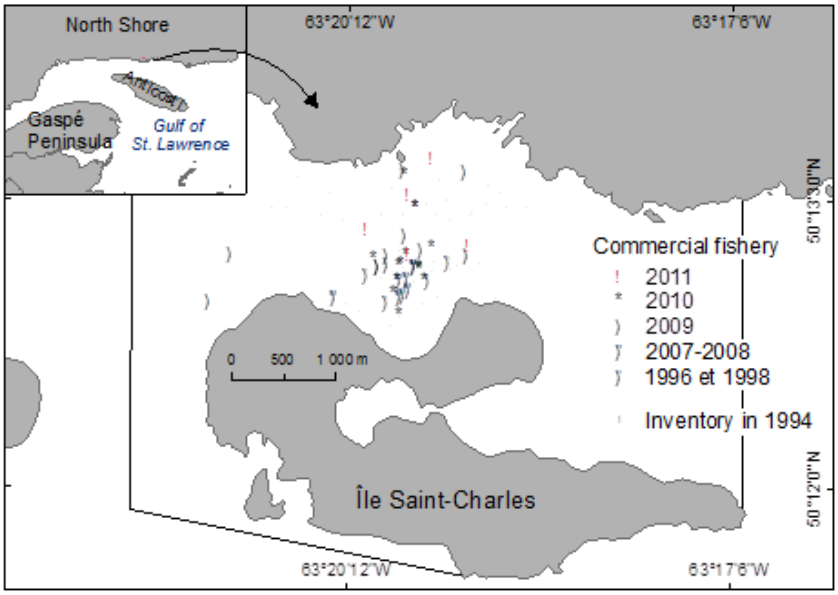

Figure 8. Location of razor clam commercial fishery by year and stations with razor clam presence during 1994 survey in sub-area 2.4 (solid line) on the North Shore.

According to an inventory taken in 1994 using the dredge with conveyor, this razor clam bed covered an area of roughly 1.5 km^2 (Figure 8). The average density in 1994 was 3.2 razor clams/m^2, with densities varying between 0.1 and 24.5 razor clams/m^2 in various stations. The harvested clams were between 92 and 198 mm in length, with an average length of 152 mm.

A weight-length relationship was determined using information gathered on the individuals harvested in 1994 (ln (live weight) = 3.063 ln (length) – 11.580; r^2 = 0.866 ; n = 246 razor clams). An individual that is 100 mm in length would weigh 12.5 g, while one that is 150 mm long would weigh 43 g.

The fishery in sub-area 2.4 is rather sporadic. The TAC has not been reached in recent years. The fishing effort varied from 3 to 18 days between 2007 and 2011, and there was no fishery in 2012. The CPUE was higher when the resource was first harvested—roughly 500-700 kg/hm (Figure 9). Mean CPUE values in 2008 and 2009 were low (roughly 350 kg/hm). The 2010 and 2011 values are the lowest of the historical series. However, there were simultaneous razor clam and wedge clam fisheries during those two years. Given that it is difficult to separate fishing times between the two species, CPUE for the razor clam may be underestimated and not comparable to previous years.

There has not been much sampling of razor clams fished or landed since 1995. The last sampling occurred in 2010, at which time the average size was 153 mm (Figure 10).

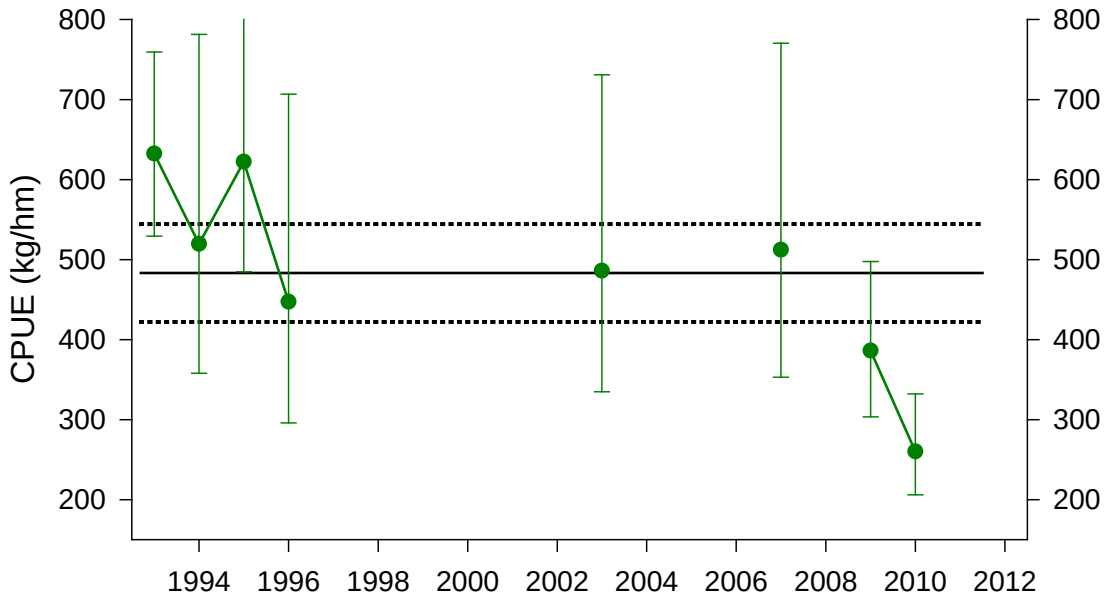

Figure 9. Annual mean catch per unit effort (CPUE ± confidence interval of 95%) for commercial razor clam fishery in sub-area 2.4 on the North Shore. The horizontal lines represent the 1993-2011 reference average (solid line) ± ½ standard deviation (dotted line).

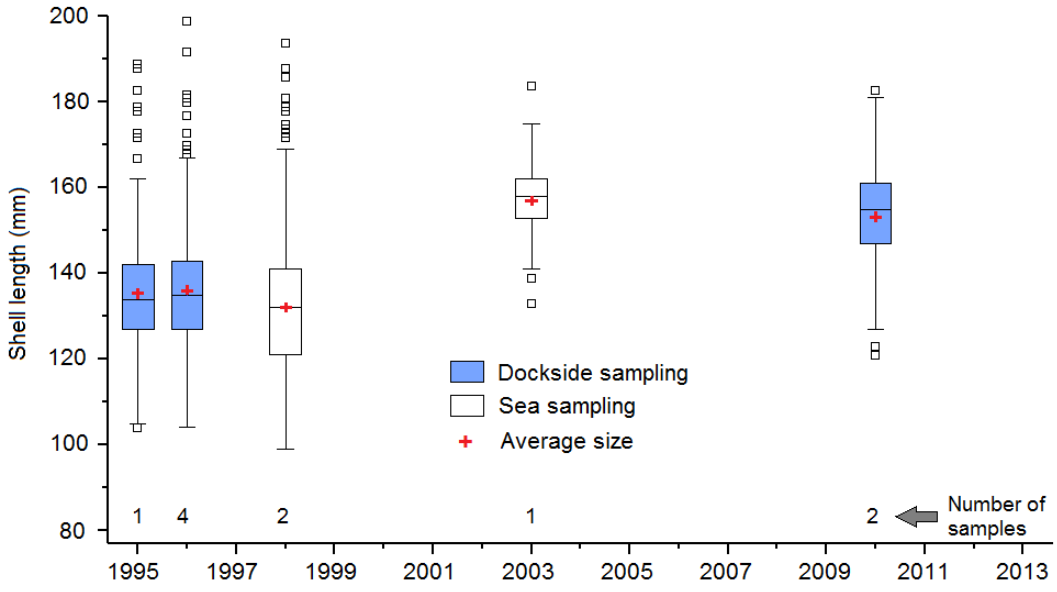

Figure 10. Size structure (box and whisker plots) of razor clams landed (dockside sampling) and captured (sea sampling) in the commercial fishery in sub-area 2.4 on the North Shore.

Sources of Uncertainty

The lack of information on this fishery as a whole could affect the conclusions. The lack of independent indicators from research surveys means that advisories on the state of razor clam stocks depend on the quality of commercial fishery data.

CONCLUSIONS AND ADVICE

Îles-de-la-Madeleine

The razor clam commercial fishery with hydraulic dredge can still be developed in the Îles-de-la-Madeleine. A significant part of the coastal area has not been explored. For a developing fishery, it is preferable to be cautious and to apply an increment-based decision rule to adjust quotas. This rule establishes that an increase in TAC is considered only when it has been reached steadily for three years and when stock status indicators are stable or increasing.

Given that the TAC has been reached over the past three years in sub-area 5A1 and CPUE has been consistent, the TAC could be increased by 10%.

Landing and CPUE figures have been low in recent years for sub-area 5A2. It is therefore recommended that the TAC be reduced to 10 t.

North Shore

Commercial fishing of razor clam in sub-area 2.4 of the North Shore is sporadic. Only one fisher is involved, and there is limited information available on this fishery. Also, the simultaneous fishing of the razor clam and the wedge clam since 2010 makes it difficult to compare the indicators with the historical series. If there is uncertainty regarding the available information, the status quo seems reasonable.

OTHER CONSIDERATIONS

The recommended conservation measures are designed to allow the razor clam populations in the Îles-de-la-Madeleine to renew themselves. A significant decrease in the density of adult razor clams on each bed could compromise the fertilization of ovules and the production of larvae. Any approach aimed at maintaining or even increasing the reproductive potential, either by leaving more adults on the bottom or by creating refuge areas, will have a positive impact on recruitment in all beds in the area.

Inventories completed by imagery in 2011 and 2012 in the Îles-de-la-Madeleine allowed a small, high-density bed of razor clams to be discovered in sub-area 5A2 in the northern part of Plaisance Bay (Figure 1). Given that this bed has never been harvested (at least according to the information available), we recommend that it be protected by creating a refuge area in which razor clam fishing will be prohibited.

Also, in order to facilitate the exploration of new areas, it is recommended that the boundaries of sub-areas 5A1 and 5B be redefined by moving the current boundary (located to the north) south, to the Grande Entrée channel.

SOURCES OF INFORMATION

This science advisory report is from the May 23, 2013 Stock Assessment of Razor Clam in 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.

Caddy, J.F., Chandler, R.A. and Wilder, D.G. 1974. Biology and commercial potential of several underexploited mollusc and crustaceans on the Atlantic coast of Canada. A paper presented to the federal-provincial fisheries committee meeting on utilization of Atlantic resources, Montréal, February 5-7, 1974. 111 p.

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Coulombe, F., Cyr, C. and Roussy, M. 2006. Comparaison des procédés de récolte et de traitement du couteau de mer de l'Irlande, de l'Irlande du Nord et de l'Écosse avec ceux des Îles-de-la-Madeleine. MAPAQ, D.I.T., Report N^{o} 26. 18 p.

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DFO. 1997. Scotian Shelf Atlantic Jack Knife. Atlantic Fisheries. Stock Status Report 96/123E.

Regroupement des pêcheurs professionnels de la Haute et Moyenne Côte-Nord. 1995. Évaluation de la population de couteaux de mer (*Ensis directus*) dans la région de Havre-Saint-Pierre. DFO, Atlantic Fisheries Adjustment Program. Final report N^{o} 60. 25 p.

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