



STOCK ASSESSMENT OF WHELKS IN QUEBEC'S INSHORE WATERS IN 2021

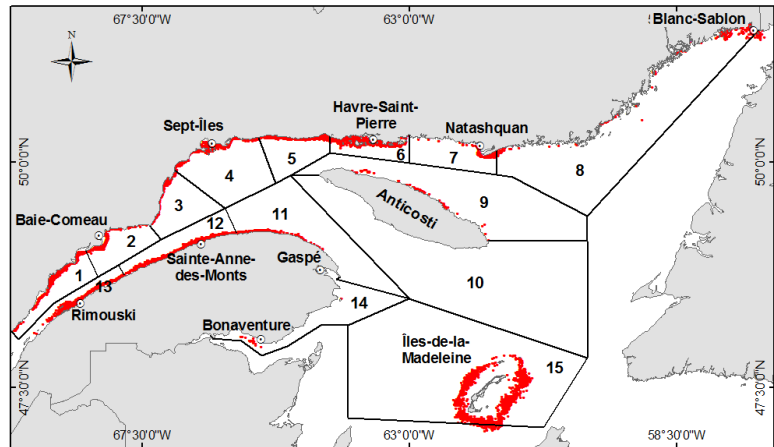


Figure 1. Fishing areas (areas 1 to 15) and known distribution (red circles) of whelks in Québec.

Source: DFO.

Context:

The commercial whelk fishery began in the Estuary and Gulf of St. Lawrence in the 1940s. It expanded to the North Shore in the early 1990s and to the Îles-de-la-Madeleine in 2003. It has been more intensive in the Gaspé Peninsula – Lower St. Lawrence since 2005. The whelk fishery is an inshore fishery that uses traps. It focuses essentially on *Buccinum undatum*, although some other species of *Buccinum* are present in the Estuary and Gulf of St. Lawrence. The fishery is regulated in all areas as to the number of licences, the number of traps and the minimum legal size which varies according to the fishing areas. Quotas on landings are in place in areas 1, 2, 11, 12, 13 and 15.

A research survey is conducted every two years in the Forestville, Pointe-aux-Outardes and Baie-Comeau (areas 1 and 2). In addition, the average size at which 50% of whelks are sexually mature has been assessed in the majority of fishing areas.

The resource is assessed every three years, with some exceptions, and the last whelk stock assessment took place in winter 2018. The main indicators used for monitoring stocks are landings, fishing effort, catch per unit effort (CPUE) and size structure.

This Science Advisory Report is from the April 29, 2022 Assessment of whelk stocks in the Québec's inshore waters (fishing areas 1-9 and 11-15). Additional publications from this meeting will be posted on the [Fisheries and Oceans Canada \(DFO\) Science Advisory Schedule](#) as they become available.

SUMMARY

- In 2021, whelk landings in Québec totalled 909.6 t, a sharp decrease (-32%) compared to 2017 (1,332.0 t). In 2021, 73% of landings came from the North Shore, 18% from the Îles-de-la-Madeleine and 8% from the Gaspé Peninsula–Lower St. Lawrence.
- Landings had decreased in most fishing areas compared to 2017. The largest decreases were seen in areas 1 (-31%), areas 4-5 (-76%, pooled data), area 6 (-55%), and area 12 (-63%). In contrast, landings in areas 2 (+136%) and 8 (+212%) increased from 2017. The TAC, where applicable, was met only in area 12. For areas managed by a total allowable catch (TAC), it was not reached in areas 1, 12, 13 and 15 and was exceeded by 4.2 t (3.8% of the current TAC) in area 2.
- The trend in catch per unit effort (CPUE) over the 2018-2021 period is positive in area 8, relatively stable in areas 1 and 2, and declining in areas 3, 4-5, 6, 12, 13, and 15. In 2021, CPUE in areas 3, 4-5, 12, 13, and 15 was between -3% and -49% below their 2002-2018 historical median.
- The research survey conducted in 2019 in areas 1 and 2 showed that the density of whelks ≥ 70 mm decreased from 2017 at Foresville, Pointe-aux-Outardes and Baie-Comeau sites. In addition, total whelk density (≥ 20 mm) was significantly lower than the highest value observed historically.
- Areas 10 and 14 are not fished, and fishing effort has been sporadic and low in areas 9 and 11. It is therefore impossible to comment on the status of the resource in these areas.
- According to a recent assessment, the average size at which 50% of female *Buccinum undatum* are sexually mature (T_{50}) ranges from 62 to 93 mm. To protect reproductive potential, the minimum legal size (MLS) should be adjusted to reflect T_{50} . Such an adjustment would represent an increase in MLS for areas 4, 5, 6, 7, 8, 12 and 13.
- The stock status in some areas of the Gaspé Peninsula (areas 12 and 13), the Middle North Shore (areas 3, 4, 5 and 6) and the Îles-de-la-Madeleine (area 15) is of concern. These stocks do not seem to be able to sustain the current fishing effort over the long term. There are declining trends in CPUE and local declines within some areas. These stocks are therefore vulnerable to overexploitation and local depletion. Consequently, management measures should be adjusted to better align with the T_{50} and lead to a significant decrease in fishing effort to ensure the sustainability of this resource.
- Monitoring of the severity of whelk infestation by parasitic polychaete borers in area 15, a threat raised in recent years by commercial fishermen, will need to continue to assess the impact on survival, reproduction, growth and recruitment of affected whelks.

BACKGROUND

The Waved Whelk, *Buccinum undatum*, is a gastropod mollusc that is found along the western Atlantic coast from New Jersey to Arctic, including the Estuary and Gulf of St. Lawrence (Figure 1). It is common in cold waters from the subtidal area (below the low tidemark) to depths of 30 metres or more. The whelk is an opportunistic predatory carnivore and a scavenger. It mainly eats invertebrates. Its life span is approximately 15 years. In the St. Lawrence, it can reach a shell height of 120–130 mm. Whelk can move at speeds of ~15 cm/min, covering several dozen metres when food or predators are in the vicinity.

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The sexes are differentiated. According to data collected from 2015 to 2017 in the various fishing areas, the sex ratio varies with whelk size and area. In whelks ≥ 35 mm (shell height), the sex ratio is nearly even, although it often favours females in individuals ≥ 90 mm.

Whelk fertilization takes place internally. On the North Shore and the Gaspé Peninsula, the mating season occurs in May and June. Eggs are laid two to three weeks after mating, mostly in June and July. Egg-laying is generally collective; females assemble to lay eggs on one site. They are enclosed in chitin capsules clumped together in a mass several centimetres wide attached to the substrate. There is no planktonic larval stage. In the Estuary and Northern Gulf of St. Lawrence, juveniles emerge from the capsules after five to eight months of development (November to February) and are about 2-3 mm in size.

Whelk growth is fairly slow and in Québec the minimum legal size is reached after 6-7 years. Adults lead a sedentary life. They spend most of their time immobile and half buried in sediments. This behaviour and the absence of a larval phase limit exchanges with adjacent populations and the possibility of rapidly recolonizing overexploited sites.

ASSESSMENT

Commercial Fishery

There are 15 whelk fishing areas in Québec waters. Areas 1 to 8 are along the North Shore, areas 9 and 10 around Anticosti Island, areas 11 to 14 in the Gaspé Peninsula–Lower St. Lawrence, and area 15 around the Îles-de-la-Madeleine (Figure 1). Area 10 has not been fished since 1997, and there were a few days of fishing in areas 9, 11 and 14 in recent years. It is therefore impossible to determine the status of the resource in these areas. In recent years, there have regularly been less than five active fishers in areas 2, 3, 4, 5 and 7. Fishing effort and catch-per-unit effort data for areas 4 and 5 were aggregated between 2018 and 2021 to comply with confidentiality policy.

In 2021, there were 229 whelk licence holders in Québec; however, only 59 of them were active (Table 1). Between 50 and 200 traps are authorized per licence. The total number of authorized traps for all licences in each fishing area varies between 550 and 6,400 traps, while the number of used or active traps is low, ranging from 100 to 1,650 traps per fishing area. In 2021, the proportion of active traps was between 12 and 100% depending on the fishing area. This proportion remains low ($< 50\%$) in areas 3, 4-5, 8, and 12 (Table 1).

Table 1. Number of licences issued, total number of active licences, number of active traps, total number of traps authorized and percentage of active traps per fishing area in 2021.

	Fishing Area										
	1	2	3	4	5	6	7	8	12	13	15
Licences issued	8	6	7	27	17	15	6	64	29	9	11
Active licences	7	4	1	3	4	7	0	8	7	7	11
Active traps	935	480	100	835 ²	850	0	850	1,150	800	1,650	
Authorized traps	1,125	550	850	4,109 ²	1,450	600	6,400	2,725	900	1,650	
Percentage of active traps¹	83%	87%	12%	20% ²	59%	0%	13%	42%	89%	100%	

¹ Number of active traps / number of authorized traps x 100.

² Data from areas 4 and 5 combined.

The fishing season, which lasts six months in all fishing areas, extends from April or May to October or November. In areas 1 and 2 on the North Shore, total allowable catches (TACs) of

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491 and 109 t respectively were implemented in 2003. In the Lower St. Lawrence and the Gaspé Peninsula, there have been TACs in areas 11, 12 and 13 since 2010. In the last three years, they were 32, 75 and 82 t respectively. In the Îles-de-la-Madeleine (area 15), there has been a TAC since 2003, and in 2021 it was 330 t. In 2021, the TAC was not reached in areas 1, 11, 12, 13 and 15, while it was exceeded in area 2 by 4.2 t.

Table 2. Annual whelk landings (t) by fishing area and for all of Québec.

Year	Fishing Area											Québec ¹
	1	2	3	4	5	6	7	8	12	13	15	
2005	202	72	30	114	272	193	62	63	84	24	442	1,623
2006	247	39	28	107	221	196	90	47	150	34	392	1,587
2007	151	cd ²	14	83	168	152	42	21	127	77	382	1,269
2008	118	cd	16	48	146	216	19	24	117	67	352	1,147
2009	300	cd	6	51	274	330	67	11	110	57	23	1,255
2010	204	cd	10	60	363	358	34	38	129	91	150	1,484
2011	132	cd	14	42	312	314	22	21	95	78	265	1,368
2012	114	cd	12	64	409	296	49	27	75	81	239	1,432
2013	241	cd	6	82	250	280	45	36	70	66	327	1,445
2014	290	cd	6	41	115	270	22	23	46	66	15	952
2015	225	cd	1	60	148	308	24	31	48	50	11	937
2016	428	cd	3	47	160	366	76	30	47	89	111	1 418
2017	378	cd	3	57	142	307	50	30	46	59	204	1 332
2018	277	48	4		84 ³	212	77	21	50	83	252	1 108
2019	308	51	2		42 ³	196	8	14	30	68	242	962
2020	222	81	4		69 ³	161	1	56	29	72	202	899
2021	260	113	4		49 ³	138	0	103	17	59	167	910

¹ Total for all fishing areas in Québec.

² cd : Confidential data.

³ Data from areas 4 and 5 combined.

Whelk landings in Québec peaked at 2,000 t live weight in 2003, when the fishery was introduced in the Îles-de-la-Madeleine (Figure 2). Subsequently, landings decreased until 2008, mainly on the North Shore, followed by a stabilization. In 2021, they totalled 910 t (Table 2), of which 73% were from the North Shore, 8% from the Gaspé Peninsula–Lower St. Lawrence and 18% from the Îles-de-la-Madeleine (Figure 2). Landings had decreased in most fishing areas compared to 2017.

Fishing effort reached a maximum value of 385,800 trap hauls in 2003. Effort then decreased, reaching 206,200 trap hauls in 2008 (Table 3). Effort has since varied between 151,500 and 261,900 trap hauls per year. In 2021, there were 156,200 trap hauls. This effort represented a decrease of 36% on the North Shore, 29% in the Gaspé Peninsula–Lower St. Lawrence and 6% in the Îles-de-la-Madeleine compared to their respective reference median.

The annual average standardized catch per unit effort (CPUE) calculated based on logbooks differs by fishing area (Table 4). From 2003 to 2013, the highest CPUEs were observed in the Îles-de-la-Madeleine, with values between 16.6 and 21.1 kg/trap. During the last three years, high CPUEs were also obtained in areas 1 and 2. For the other areas, the reference median CPUE (2002–2018 period) is between 3.8 and 5.8 kg/trap. In 2021, the CPUE was above the reference median in area 8, near the median in area 1, and below the median in areas 2, 3, 4 and 5, 6, 12, 13 and 15. The CPUE measured in 2021 were among the lowest observed values in the historical series (Table 4).

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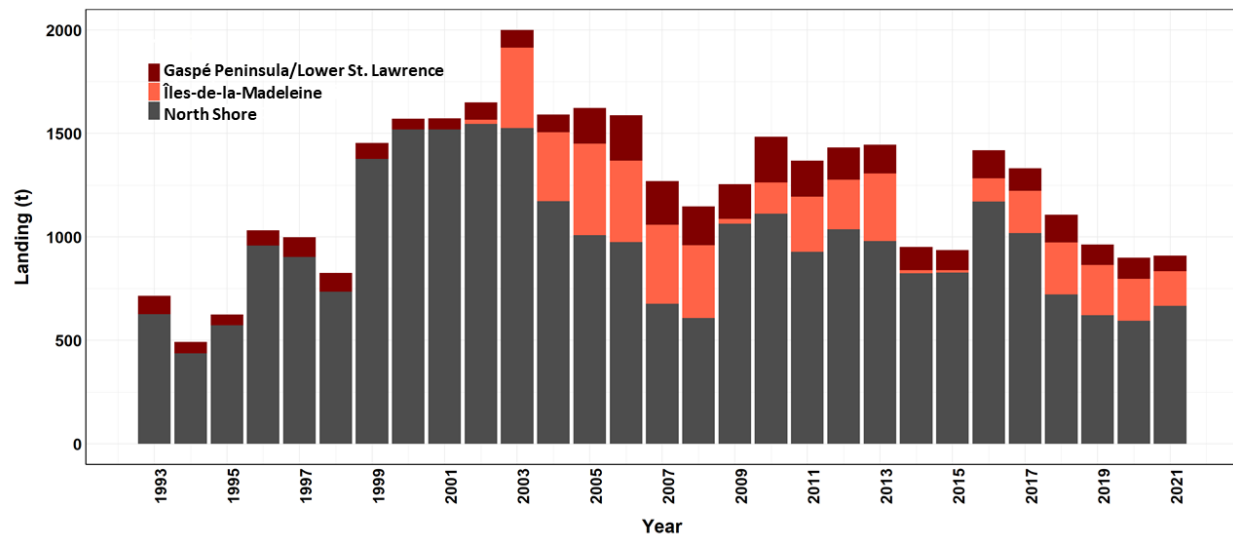


Figure 2. Annual whelk landings by region.

Table 3. Annual fishing effort (trap haul x 10²) by fishing area and for all of Québec.

Year	Fishing Area											Québec ¹
	1	2	3	4	5	6	7	8	12	13	15	
2005	277	105	61	414	854	758	88	143	266	55	192	3 409
2006	319	51	49	354	658	646	110	150	369	64	172	3 052
2007	223	cd ²	30	246	538	472	61	53	324	124	178	2 317
2008	153	cd	33	164	409	569	42	75	303	109	164	2 062
2009	331	cd	16	149	622	643	93	23	272	85	10	2 291
2010	288	cd	18	207	758	643	61	131	279	101	65	2 619
2011	195	cd	29	106	547	634	45	67	215	88	136	2 147
2012	136	cd	26	157	799	675	76	79	199	110	119	2 449
2013	217	cd	17	190	625	610	73	87	180	90	172	2 306
2014	276	cd	15	105	294	553	41	69	188	92	27	1 732
2015	190	cd	2	131	331	622	38	88	144	83	11	1 672
2016	271	cd	13	121	470	780	93	104	147	127	87	2 270
2017	250	cd	10	174	464	705	63	117	119	101	93	2 143
2018	213	30	12	379 ³	513	104	80	156	128	140	1 764	
2019	330	37	9	203 ³	515	22	33	95	122	150	1 515	
2020	301	90	17	323 ³	485	2	79	96	150	145	1 695	
2021	299	122	16	242 ³	374	0	160	65	155	128	1 562	

¹ Total for all fishing areas.

² Confidential data.

³ Data from areas 4 and 5 combined.

Table 4. Standardized whelk catches per unit effort (kg of live weight/trap) by fishing area based on logbooks.

Year	Fishing Area										
	1	2	3	4	5	6	7	8	12	13	15
2001	12.9	12.8	6.5	4.6	4.4	5.2	-	-	3.1	4.6	-
2002	11.1	8.4	5.3	3.1	4.4	6.0	10.7	4.8	2.9	4.1	-
2003	9.3	11.1	5.8	2.8	4.6	4.8	4.9	3.5	1.8	3.4	20.2
2004	6.6	9.1	5.7	3.1	4.1	3.9	6.5	4.1	3.3	3.9	18.6
2005	7.3	7.8	5.2	3.0	3.9	3.3	7.0	4.6	3.7	2.8	20.8
2006	7.7	7.3	5.6	3.1	4.1	3.7	7.6	3.4	4.1	5.3	20.1
2007	6.9	13.2	4.6	3.6	3.5	3.9	7.1	4.8	4.6	6.2	19.3
2008	7.3	10.3	4.4	2.7	4.0	4.4	5.0	3.8	3.9	6.2	18.3
2009	8.8	9.7	2.7	3.6	5.3	6.1	7.3	5.5	4.3	6.3	21.1
2010	7.1	11.4	5.2	3.0	5.9	5.7	5.2	3.4	4.6	8.4	20.9
2011	6.8	12.8	3.5	3.8	6.7	5.5	4.9	3.7	4.6	8.9	17.6
2012	8.2	10.6	4.3	4.1	6.3	4.9	5.8	4.1	4.1	7.4	17.2
2013	10.5	11.4	3.7	4.8	4.7	4.9	6.0	5.0	4.3	7.0	16.7
2014	10.5	10.6	3.1	4.0	4.3	5.1	5.3	4.1	2.5	7.3	4.7
2015	11.4	8.1	-	4.5	4.4	5.3	6.1	3.9	3.4	5.5	-
2016	15.3	10.7	3.1	3.9	3.7	5.2	8.0	3.4	3.7	5.9	9.7
2017	15.5	14.1	1.9	3.2	3.3	4.7	8.1	3.3	4.3	4.5	17.5
2018	12.1	14.5	2.1	2.1 ³		4.2	6.9	2.6	3.4	5.3	15.8
2019	9.3	12.8	2.8	2.1 ³		3.9	-	3.8	3.5	5.1	14.1
2020	7.0	8.9	1.9	2.1 ³		3.4	-	5.1	2.9	4.5	12.5
2021	8.8	9.6	2.7	2.1 ³		4.0	-	6.0	2.9	2.9	11.6
Median¹	8.9	10.8	4.4	3.9 ³		4.9	6.5	3.8	3.8	5.8	18.2
Difference²	-1%	-12%	-38%	-43% ³		-20%	-	57%	-23%	-49%	-44%

¹ Reference median from 2001 to 2018, except for area 15, where the 2003–2018 median was calculated excluding the years 2014–2016 due to the high presence of shell-boring polychaetes which may have affected CPUE during those years.

² Relative difference between 2021 value and the median.

³ Data from areas 4 and 5 combined.

Since 2004, DFO's commercial sampling program has provided information on the size (shell height) of landed whelk. Since 2015, average sizes of whelks landed have been fairly stable in all areas (Table 5). In 2021, they were between 81 and 99 mm depending on the fishing area and were similar to or above their respective reference median.

Table 5. Annual average size (mm) of whelk landed by fishing area.

Year	Fishing Area										
	1	2	3	4	5	6	7	8	12	13	15
2005	74	74	-	87	80	83	81	77	88	77	82
2006	77	71	-	83	80	87	84	76	85	80	83
2007	79	74	-	89	85	85	83	76	85	87	81
2008	78	72	-	89	85	83	87	71	88	83	88
2009	78	79	-	89	86	84	87	74	87	83	88
2010	79	82	-	90	89	88	87	75	88	87	85
2011	81	75	-	91	88	88	90	73	87	85	87

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Year	Fishing Area										
	1	2	3	4	5	6	7	8	12	13	15
2012	80	78	92	95	90	89	90	74	89	85	83
2013	79	78	-	94	91	88	90	73	89	85	85
2014	78	82	-	95	88	88	86	75	90	84	93
2015	79	78	95	96	91	88	88	80	93	86	81
2016	80	80	97	96	92	86	86	78	91	87	86
2017	78	79	-	97	94	88	91	80	91	89	84
2018	80	79	94	96	94	91	90	78	95	90	89
2019	81	82	-	101	92	90	95	91	97	93	89
2020	83	83	-	99	94	92	-	87	96	-	89
2021	83	81	-	99	96	93	-	84	95	91	87
Median¹	79	78	94	92	89	88	87	75	88	85	85
Difference²	6%	4%	-	7%	8%	6%	-	11%	8%	7%	2%

¹ Reference median from 2005 to 2018.

² Relative difference of the 2021 value to the reference median.

Since 2007, the percentage of landed whelk below the minimum legal size has generally been below 10% (Table 6). In 2021, the percentage of undersized whelk landed was below 4%, except in area 8 (5.8%). It should be noted that in area 8, the proportion of small whelks landed before 2015 was 19% or more, whereas in recent years this proportion has decreased significantly.

Table 6. Annual proportion (%) of whelk smaller than the minimum legal size in commercial landings.

Year	Fishing Area										
	1	2	3	4	5	6	7	8	12	13	15
2005	29.0	31.3	-	3.5	11.3	10.2	8.8	25.4	3.4	16.0	7.9
2006	18.7	42.0	-	13.9	14.7	3.3	3.6	26.6	3.8	9.0	4.0
2007	8.2	26.7	-	3.1	6.4	4.2	9.7	26.6	3.1	0.8	7.2
2008	15.1	42.8	-	3.4	4.2	6.1	5.3	39.3	1.7	5.5	2.0
2009	13.9	11.4	-	2.8	2.5	5.6	3.6	32.4	2.5	6.3	1.5
2010	12.6	5.7	-	2.1	1.5	1.7	7.4	26.7	2.9	2.0	2.1
2011	4.8	21.5	-	1.5	1.4	1.8	1.5	31.9	2.9	0.3	1.5
2012	6.6	10.4	0.3	0.2	0.6	2.0	1.4	31.5	3.2	0.9	3.4
2013	8.3	12.3	-	0.4	0.6	2.0	1.8	32.0	1.6	0.4	7.0
2014	9.9	2.5	-	0.2	4	2.2	2.7	18.7	2.0	0.5	0.7
2015	8.5	8.0	0.4	0.2	1.4	3.0	5.0	7.6	0.5	0.3	2.3
2016	3.7	4.6	0	0.2	1.3	5.7	2.7	9.0	1.1	0.8	1.2
2017	9.5	4.6	-	0.2	0.6	2.8	2.6	6.7	1.0	0.4	3.4
2018	4.6	8.9	1.3	0.4	-	1.8	2.5	10.7	0.4	0.4	2.0
2019	4.9	3.2	-	1.4	6.8	13.1	4.6	1.2	0.6	0.4	2.0
2020	2.0	1.8	-	0.7	4.8	3.3	-	11.2	0.6	-	3.0
2021	1.6	3.1	-	1.0	2.1	3.7	-	5.8	0	0.7	3.7

Research survey

A research survey has been conducted every two years since 2005 in the Forestville, Pointe-aux-Outardes, and Baie-Comeau on the Upper North Shore (areas 1 and 2). The survey planned for 2021 was not conducted due to logistical constraints. The surveys are conducted using a Digby scallop dredge with four baskets lined with 19-mm Vexar™ netting. Since 2009,

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almost all whelks harvested belong to the species *B. undatum*. Only a few *B. glaciale*, *B. scalariforme* and *B. totteni* and *Buccinum sp.* individuals have been found during the surveys.

Since 2001, total average densities of whelks (≥ 20 mm) have been high in Forestville (Table 7). Until 2015, these whelks were mostly individuals under the legal size, but in 2017, whelks of legal size (≥ 70 mm) dominated with a density of 10.4 whelks/100 m². In 2019, whelk densities in Forestville were down by half from 2017. In Pointe-aux-Outardes, densities of legal-size whelks were down slightly in 2019 to 5.2 whelks/100 m² from the higher value in 2017 (7.1 whelks/100 m²) (Table 7). In Baie-Comeau, total densities and densities of legal-size whelks are variable from year to year (Table 7). In 2017, the average density of legal-size whelks was the highest value in the series with 42.5 whelks/100 m², but it has declined significantly in 2019. In the three surveyed sectors, density of whelks (≥ 20 mm) was considerably lower than the highest value observed historically (Table 7).

Tableau 7. Average whelk size (mm), average density (number/100 m² \pm 95% confidence interval) of whelks by size class, average density (number/100 m² \pm 95% confidence interval) and average weight (g) of egg masses by sector and year obtained during research surveys.

Sector and Year	Average whelk size	Whelk density		Egg mass density	Average egg mass weight
		≥ 20 mm	≥ 70 mm		
Forestville					
2005	63	6.6 \pm 0.5	3.3 \pm 0.3	0.02 \pm 0.04	-
2007	60	5.5 \pm 0.4	2.5 \pm 0.2	-	-
2009	53	6.6 \pm 0.6	1.9 \pm 0.2	0.01 \pm 0.01	51
2011	52	11.9 \pm 1.0	2.9 \pm 0.2	0.02 \pm 0.01	222
2013	60	15.7 \pm 1.2	5.8 \pm 0.4	0.01 \pm 0.01	133
2015	58	16.1 \pm 1.5	4.7 \pm 0.4	0.04 \pm 0.01	159
2017	72	14.9 \pm 0.8	10.4 \pm 1.5	0.03 \pm 0.01	202
2019	62	7.0 \pm 0.6	4.7 \pm 0.4	0.26 \pm 0.04	173
Pointe-aux-Outardes					
2005	71	3.3 \pm 0.7	2.0 \pm 0.6	1.0 \pm 0.3	-
2007	73	4.2 \pm 0.8	2.9 \pm 0.6	-	-
2009	62	4.6 \pm 0.7	2.1 \pm 0.4	1.1 \pm 0.4	69
2011	56	11.9 \pm 2.3	3.5 \pm 0.6	1.4 \pm 0.6	77
2013	70	6.8 \pm 1.6	4.1 \pm 1.0	1.5 \pm 0.5	75
2015	71	9.5 \pm 1.1	6.1 \pm 0.6	1.0 \pm 0.2	80
2017	76	8.9 \pm 1.6	7.1 \pm 1.3	1.3 \pm 0.5	79
2019	66	6.9 \pm 1.2	5.2 \pm 0.8	1.6 \pm 0.5	106
Baie-Comeau					
2005	60	42.7 \pm 12.7	8.2 \pm 3.4	1.5 \pm 1.0	-
2007	62	21.7 \pm 4.1	6.7 \pm 1.3	-	-
2009	57	24.3 \pm 5.6	6.2 \pm 1.3	0.7 \pm 0.2	72
2011	65	41.7 \pm 8.2	16.8 \pm 4.0	4.2 \pm 1.9	130
2013	69	36.2 \pm 12.9	18.7 \pm 5.6	1.6 \pm 0.6	166
2015	67	16.7 \pm 3.3	9.1 \pm 1.6	2.2 \pm 0.8	111
2017	74	59.1 \pm 20.4	42.5 \pm 14.8	1.7 \pm 0.8	93
2019	63	13.1 \pm 2.3	9.6 \pm 1.7	0.8 \pm 0.3	111

The size of harvested whelks varies little from year to year and between sectors. Since the beginning of the surveys in 2005, the size has varied from 5 to 112 mm. In 2019, the average

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size was 62 mm in Forestville, 66 mm in Pointe-aux-Outardes and 63 mm in Baie-Comeau (Table 7).

The abundance of *B. undatum* egg masses was also assessed as part of these surveys. Egg mass density is still higher in Pointe-aux-Outardes and Baie-Comeau than Forestville (Table 7). In 2019, there were 0.2 masses/100 m² in Forestville, 1.6 masses/100 m² in Pointe-aux-Outardes and 0.8 masses/100 m² in Baie-Comeau. However, the average weight of each mass is generally higher in Forestville (Table 7).

Sexual maturity, parasitism and boring polychaetes

The size at sexual maturity is greater in female than in male whelks. Thus, the minimum legal size (MLS) is based on the size of females. In 2022, the size at which 50% of females are sexually mature (T₅₀) was re-evaluated in some fishing areas with new samples collected in 2013 and between 2018 and 2021. New samples were from areas 1 and 2 (2013 and 2019 research survey), area 13 (2018; 3 samples), area 8 (2021; 1 sample), and area 15 (2021; 10 samples of commercial size whelks from the fishery).

The T₅₀ of the females ranged from 62 to 92.8 mm depending on the fishing area. Areas 1 and 2 of the Upper North Shore have the lowest values with 69.9 and 62 mm, while other areas have T₅₀ ≥ 74 mm (Table 8). The T₅₀ of females in areas 3 and 7 could not be determined because of an insufficient number of individuals, but is estimated to be greater than 75 mm. In area 8, the samples to determine the T₅₀ (67 mm) collected in 2021 were from outside of the traditional fishing grounds and, therefore, this value was not retained. Instead, the T₅₀ previously established with samples collected in 2016 (80.2 mm) were kept (Table 8). New samples may be collected in the fishing grounds to update this value.

To protect the spawning population and ensure the sustainability of this resource, the MLS should be adjusted according to the T₅₀ in several fishing areas. Such an adjustment would represent an increase in the MLS in areas 4, 5, 6, 7, 8, 12 and 13 (Table 8).

Table 8. Average size at which 50% of female whelks are sexually mature (T₅₀), current minimal legal size (MLS) and suggested MLS for some fishing areas (in grey).

Fishing Area	T₅₀ (mm)	Current MLS (mm)	Suggested MLS (mm)
1	69.9	70	70
2	62.0	70	70
3	-	80	80
4	89.7	80	90
5	92.8	80	90
6	85.7	80	85
7	-	80	85
8	80.2	75	80
12	79.5	75	80
13	76.0	75	80
15	74.6	75	75

The severity of infestation by boring polychaetes in whelk shells was assessed in samples from Îles-de-la-Madeleine (area 15) in 2021 (150 individuals from the commercial fishery; whelk ≥ 75 mm). These polychaetes dig tunnels in the shell, and during severe infestation (≥ 25% of the shell affected), the shell becomes porous and very fragile. Several species of polychaetes have

been identified, with *Polydora websteri* being the most common. In 2021, 91% of whelks \geq 80 mm had slight damage, while 8% of whelks had severe lesions to their shells.

Sources of uncertainty

For almost all fishing areas, the absence of fishery-independent indicators, such as those from research surveys, renders the advice for whelk dependent on the quality of the data from logbooks and from sampling of the commercial catch. Data that is partial or does not reflect reality (e.g., a trap haul different from that registered in the logbook) could significantly affect indicator values. Since in several areas whelk fishing is a complementary activity, the fishing effort sometimes varies during the season and from year to year. The arrival of less-experienced fishers or the departure of experienced fishers can also affect catch rates. Environmental conditions such as water temperature at fishing sites can also affect the performance of the fishery. Consequently, the actual status of the resource could be different from our interpretation, and recommendations may not be completely aligned with reality.

CONCLUSIONS AND ADVICE

Whelk is a sedentary benthic species that attaches its eggs to the substrate during the egg-laying period. Development continues on the egg-laying site, and there is no pelagic larval stage to help disperse the young. These biological characteristics make whelk vulnerable to local overfishing. The conservation principles implemented for this species are designed to protect the reproductive potential of each population, or in this case, of each fishing area.

The main commercial fishery management measures (minimum legal size, fishing season, limited number of licences issued and traps authorized, TAC in certain areas) were adopted with the goal of improving fishery management and avoiding overfishing this resource.

To promote conservation of this resource, the harvest of immature individuals should be avoided, and at least 50% of females should be allowed to breed once before they are harvested. In light of recent information, this conservation measure is even more important, since a significant percentage of whelk \geq 80 mm no longer contribute to the population's reproductive potential (parasitized gonad). In most areas, the current legal minimum size protects only a portion of sexually immature whelks. The legal minimum size should therefore be adjusted to the T_{50} of females in each area. The legal size could be left at 70 mm in areas 1 and 2, at 80 mm in area 3 and at 75 mm in area 15. However, it should be increased to at least 80 mm in areas 8, 12 and 13, at least 85 mm in areas 6 and 7 and at least 90 mm in areas 4 and 5.

The stock status in some areas of the Gaspé Peninsula (areas 12 and 13), the Middle North Shore (areas 3, 4, 5 and 6) and the the Îles-de-la-Madeleine (area 15) is of concern. These stocks do not seem to be able to sustain the current fishing effort over the long term. There are declining trends in CPUE and local declines within some areas. These stocks are therefore vulnerable to overexploitation and local depletion.

Challenges in relation to latent effort (number of unused traps versus number of authorized traps) are still encountered in areas 3, 4 and 5, 6, 8, and 12, where the number of traps used in 2021 represented only between 12% and 60% of the total number of authorized traps (Table 1). These stocks may not be able to support deployment of the entire potential effort. Consequently, management measures should be adjusted to better align with T_{50} and lead to a significant decrease in fishing effort to ensure the sustainability of this resource.

The infestation of whelks with boring polychaete in area 15 still affects a large portion of the adult population. Thus, caution should be maintained in this area as CPUE has been declining since 2017. At this time, the impact of severe infestation on whelk condition, behavior, survival, growth, reproduction, and recruitment is unknown.

OTHER CONSIDERATIONS

The current selectivity of the traps does not permit the harvesting of only legal-size whelk. Consequently, sorting is done on board vessels. In order to limit accidental mortality of sublegal-size whelk, it is important that they be handled with care and released back into the water as soon as possible and at the site where they were fished. It is recommended that selective fishing gear and methods for handling sublegal-size whelk on board vessels be developed and used.

Care must be taken when it comes to fishing effort (number of traps) being concentrated on a single vessel. It is important for the fishing effort in a given fishing area to be distributed uniformly enough over the entire available area to reduce the risk of local overfishing. For a few years, buddying up licences has been authorized in certain fishing areas to reduce operating costs. We need to ensure that these licences are active and that the fishing areas visited are not restricted to those of only one of the fishers involved.

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SOURCES OF INFORMATION

This Science Advisory Report is from the regional peer review meeting of April 29, 2022 on the Assessment of whelk stocks in the Quebec's inshore waters (fishing areas 1-9 and 11-15).

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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