Review of the 2023 snow crab (Chionoecetes opilio) fishery in the southern Gulf of Saint Lawrence (CFAs 12, 12E, 12F and 19)

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The review of the 2023 snow crab (*Chionoecetes opilio*) fishery in the southern Gulf of Saint Lawrence (sGSL; Crab Fishing Areas (CFAs) 12, 12E, 12 F and 19) is presented. Preliminary landings in the sGSL in 2023 were 35,404 t out of a revised quota of 35,506 t. The allowable quota in the notice to harvesters was 35,216 t. For CFA 12 harvesters, landings were 32,084 t (revised quota of 31,730 t). The catch per unit effort (CPUE) values from logbooks increased in 2023 (72.2 kg per trap haul (kg/th)) compared to 2022 (51.4 kg/th). In CFAs 12E and 12F, landings were 291 t (revised quota of 287 t) and 1,329 t (revised quota of 1,331 t), respectively. In CFA 12E, CPUE values are comparable in 2023 (79.1 kg/th) to 2022 (78.5 kg/th). In CFA 12F, CPUE values increased in 2023 at 96.9 kg/th compared to 2022 (76.4 kg/th). In CFA 19, landings reached 1,700 t (revised quota of 1,708 t). CPUE values for CFA 19 increased considerably from 2022 (112.6 kg/th) to 140.6 kg/th in 2023.

RÉSUMÉ

Landry J.-F., Surette, T., Allain, R., and Moriyasu, M. 2024. Review of the 2023 snow crab (*Chionoecetes opilio*) fishery in the southern Gulf of Saint Lawrence (CFAs 12, 12E, 12F and 19). Can. Data Rep. Fish. Aquat. Sci. 1390: vi + 16 p.

La revue de 2023 de la pêche au crabe des neiges, *Chionoecetes opilio*, dans le sud du golfe du Saint-Laurent (sGSL ; zones de pêche de crabe (ZPC) 12, 12E, 12F et 19) est présentée. Les débarquements préliminaires dans le sGSL en 2023 ont atteint 35 404 t sur un quota révisé de 35 506 t. Le quota alloué dans l'avis aux pêcheurs était de 35 216 t. Pour les pêcheurs de la ZPC 12, les débarquements ont atteint 32 084 t (quota révisé de 31 730 t). La prise par unité d'effort (PUE) selon les carnets de bord a augmenté en 2023 (72,2 kg par casier levé (kg/cl) comparativement à 2022 (51,4 kg/cl). Dans les ZPC 12E et 12F, les débarquements ont atteint 291 t (quota révisé de 287 t) et 1 329 t (quota révisé de 1 330 t), respectivement. Dans la ZPC 12E, la PUE est similaire en 2023 (79,1 kg/cl) à celle de 2022 (78,5 kg/cl). Dans la ZPC 12F, la PUE a augmenté en 2023 à 96.9 kg/cl, par rapport à 2022 (76,4 kg/cl). Dans la ZPC 19, les débarquements étaient de 1 700 t sur un quota révisé de 1 708 t. La PUE de la ZPC 19 a augmenté considérablement par rapport à 2022 (112,6 kg/cl), à 140,6 kg/cl en 2023.

1. INTRODUCTION

Snow crab, *Chionoecetes opilio*, has been commercially exploited in the southern Gulf of Saint Lawrence (sGSL) since the mid-1960s. There are currently four Crab Fishing Areas (CFAs) in the sGSL: 12, 12E, 12F and 19 (Figure 1), with CFA 12 being the largest in terms of area, number of participants, and landings.

The fishing season in CFAs 12, 12E and 12F generally starts as soon as the sGSL is clear of ice in mid-April to early May and until the end of June or when the area quota is caught. In CFA 19, the fishing season starts in July and ends in mid-September or when the quota is caught. The number of traps per license varies by harvester group and CFA. Conical traps are set mainly on mud or sand-mud bottoms, at depths ranging from 50 to 280 m. Management of these fisheries is based on quotas and effort controls (trap allocations, trap dimensions and seasons). Only hard-shelled males ≥ 95 mm of carapace width are commercially exploited and landing of female crab is prohibited.

There are two buffer zones within the sGSL where fishing is prohibited: one is a two nautical mile strip located along the northern edge of CFA 19 and the other is located along the south edge of CFA 19. During the season, the fishery is subject to local area closures to limit the impacts on soft-shell crabs and as well as closures for the protection of north Atlantic right whales (NARW). Large-scale closures from either source can result in significant displacements in fleet fishing effort.

2. METHODS

2.1. FISHERY LOGBOOK DATA

Data on reported landings and fishing effort (number of trap haul) were obtained from fishery logbooks and dockside monitoring data, compiled by the DFO Statistics Branches from the Quebec and Gulf Regions. Post-processing of these data by Science staff involves verification, correction or deletion of erroneous data. This includes corrections for fishing dates, fishing coordinates, landings and effort data. Three to six percent of landings could not be georeferenced due to erroneous or missing coordinate data.

Catch per unit effort (CPUE) values for 2023 were calculated as the ratio of landings over the fishing effort. Only data with reliable effort data were used for calculating CPUE. Mid-term (2011-2022) and long-term (1998-2022) CPUE means were also calculated for comparison. Total effort was estimated from the landings divided by the CPUE estimate.

2.2. AT-SEA OBSERVER DATA

Since 1990, DFO has implemented an observer sampling program onboard commercial vessels which provides data on the size composition of males caught, discarding, as well as the hardness and condition of the crab carapace (Hébert et al., 2021).

2.3. FISHERY CLOSURES

Newly moulted crab are called soft/white crab and have low commercial value due to their lower meat content. Discarding of these vulnerable crab by harvesters can result in mortality of commercial-sized soft/white-shelled crabs. A soft shell protocol is thus applied and aims to limit

the quantity of these newly moulted crab occurring in at-sea catches, as they represent future recruits to the fishery (Hébert et al., 1992). In CFAs 12, 12E and 12F (spring fishery), crabs with a claw hardness of less than 68 units on the durometer were categorized as soft-shelled crabs (Hébert et al. 1992). In CFA 19 (summer fishery), crabs with a claw hardness less than 72 units on the durometer reading were considered as soft and white crabs. This monitoring protocol allows for the seasonal closure of portions of fishing areas, usually in the form of 10 x 10 minute grids or sectors when the proportion of these males exceeds 20% in the catch within a 15-day period. Crab harvesters are given 2 days (CFA 19) or 5 days (CFAs 12, 12E, 12F) to remove their fishing gear upon grid closure.

Local area-closures are also used to minimize risks of entanglement of NARW with fishing gear, which has been an ongoing concern since 2017. With less than 356 NARW remaining in the world, the Government of Canada continues to take action to protect this species (DFO, 2023). Since 2018, protective measures have focused on minimizing risks of NARW entanglements with fishing gear, as well as vessel collisions.

Protective measures for 2023 included both temporary and season-long fishing NARW area closures (DFO, 2023). Upon detection of a NARW, either visually or acoustically, a region consisting of nine 10 x 10 minute grids, centered on the whale's location was closed to non-tended fixed gear fisheries for 15 days. If a NARW was detected again within days 9-15 of the closed area, then the area remained closed until November 15, 2023. If a NARW was not re-detected within the closed area, then the area was re-opened to fishing after day 15. A minimum of two flights with no NARW detection was required for a closed area to be re-opened to fishing.

3. RESULTS

3.1. FLEET AND SEASON

The sGSL snow crab fishery in 2023 had a total of 439 quota allocation shares, which were fished by 461 active vessels during the 2023 fishery. Table 1 shows a breakdown of allocation shares, the number of vessels, and season lengths by CFA. Fishing began on April 11th in CFAs 12, 12E and 12F and on July 13th in CFA 19. CFAs 12, 12E and 12F closed on June 30th, while CFA 19 closed on September 11th.

Observer sea-sampling coverage is presented in Table 2. In CFA 12, observers were at sea for 229 trips, with a total of 1,397 traps sampled and 54,520 crabs measured. Catch size composition in 2023 are shown in Figure 2 where sub-legal crab represent 20.7% of catches prior to discarding. In 2023, trap soak time in CFA 12 was 73 hours, which was comparable to 75 hours in 2022 and 81 hours in 2021.

Observer sea-sampling in CFA 12E consisted of 3 trips sampled, with a total of 36 traps sampled and 1,438 crabs measured. Catch size composition for 2023 are shown in Figure 2 where sub-legal crab represented 12.3% of catches prior to discarding. In 2023, soak time in CFA 12E was similar (46 hours) to 2022 (46 hours) but a decrease from 73 hours in 2021.

In CFA 12F, 12 trips had at sea observers while 103 traps were sampled and 4,087 crabs were measured. Catch size composition for 2023 are shown in Figure 2 where sub-legal crab represented 12.0% of catches prior to discarding. In 2023, soak time in CFA 12F was similar (81 hours) to 2022 (81 hours) and 2021 (82 hours).

Observer sea-sampling in CFA 19 consisted of 46 trips sampled, with a total of 98 traps samples and 3,785 crabs measured. Catch size composition for 2023 are shown in Figure 2 where sub-legal crab represented 14.6% of catches prior to discarding. In 2023, soak time in CFA 19 was 30 hours and was comparable to 33 hours in 2022 and 31 hours in 2021.

3.2. QUOTAS AND LANDINGS

Snow crab has been commercially exploited in the sGSL since the mid-1960s. Snow crab landings from the sGSL were low in the early 1970s but increased more than threefold from 1975 to 1982. There were four periods of landings exceeding 20,000 tonnes (t): 1981 to 1986, 1994 and 1995, 2002 to 2009, and the current period, from 2012 to 2023, the longest in the series (Figure 3).

The revised quota was set at 35,506 t for the 2023 fishery (Table 1). For reasons of annual quota adjustments, reconciliations, and re-distribution of the scientific quota among CFAs, the revised quota does not necessarily correspond to the Total Allowable Catch (TAC) set at the start of the fishing season. This quota includes 450 t set aside to finance stock assessment activities in 2023 (under the Section 10 agreement of the *Fisheries Act*). Preliminary landings of sGSL snow crab in 2023 were 35,404 t, with 32,084 t landed in CFA 12, 291 t in CFA 12E, 1,329 t in CFA 12F, and 1,700 t in CFA 19 (Table 3).

The spatial distribution of snow crab landings from 2019 to 2023 is shown in Figure 4. The distribution of landings is relatively constant from year to year with the exception of 2019 where static closures were implemented for the protection of NARW. In 2023, similar landings were observed in the Bay des Chaleurs, the Magdalen Channel and the Cape Breton Corridor in comparison to 2022. Fishing in CFA 12E is limited to a small area in the southeastern portion of the area while landings in CFA 12F were concentrated along its central portion. In CFA 19, landings were lower from previous years with the bulk of landings occurring the southern portion of the area.

3.3. FISHING EFFORT AND CPUE

Total fishing effort in the sGSL was 473,964 trap haul (th) in 2023, lower than the record high of 606,504 th in 2020 (Table 3). Effort for 2023 was 10% higher than the average effort of 429,140 th from 1998 to 2023. Fishing effort from CFA 12 varied from 187,409 in 2011 to a record 556,780 th in 2020. Effort was 444,480 th in 2023, a decrease of 21% from 2022, at 537,820 th, which was above the long-term average of 384,725 th over the period from 1998 to 2023. CFA 12E fishing effort varied from 1,825 in 2010 to 10,074 in 2006. Effort was 3,678 th in 2023 compared to 2,509 th in 2022, which is lower than the long-term average of 4,913 th. CFA 12F fishing effort varied from a low of 5,112 in 2005 to 23,163 th in 2014. Effort decreased from 15,240 th in 2022 to 13,718 th in 2023 which is above the long-term average of 12,313 th. CFA 19 fishing effort varied from 11,138 th in 2010 to 56,517 th in 2004. Effort was 12,088 in 2023 compared to 23,690 in 2022, which is 55% lower than the long-term average of 27,189 th.

The spatial distribution of fishing effort since 2019 is presented in Figure 5. The distribution of fishing effort is very similar to that of landings with the exception of CFA 19 which has very low effort relative to the rest of the sGSL due to a much lower trap allocation combined with high catch rates. In 2023, a decrease in effort was observed in Baie des Chaleurs, the Bradelle Bank, the Magdalen Channel and along the Cape Breton Corridor compared to 2022.

Historical CPUE values by CFA are presented in Table 3 and Figure 6. In CFA 12, CPUE values increased by 28.8% to 72.2 kilograms per trap haul (kg/th) in 2023 compared to 2022. CPUE values from CFA 12 in 2023 were higher than the mid-term (2011-2022) and long-term (1998-2022) means of 59.6 kg/th and 54.9 kg/th, respectively. CPUE values by CFA 12 crab harvesting group are presented in Table 4. CFAs 12E and 12F both had increases in CPUE values in 2023 compared to 2022, with a 0.8% increase to 79.1 kg/th in CFA 12E and a 26.7% increase to 96.9 kg/th in CFA 12F. CPUE values from CFA 12E in 2023 were well above the mid-term (51.9 kg/th) and long-term (44.9 kg/th) means. Similarly, CPUE values from CFA 12F in 2023 were considerably higher than the mid-term (52.5 kg/th) and long-term (54.1 kg/th) means. The characteristically high CPUE values for CFA 19 was 140.6 kg/th for 2023, an increased by 24.9% compared to 2022. This value was slightly above the mid-term (136.8kg/th) and well above the long-term (108.0 kg/th) means.

The spatial distribution of CPUE from 2019 to 2023 is shown in Figure 7. Overall CPUE values were higher in CFA 12 in 2023 in comparison to 2022 with slightly higher CPUE values observed in the western portion of the Baie des Chaleurs, around the Bradelle Bank, the Magdalen Channel and along the Cape Breton Corridor. Similar CPUE values were observed during 2023 fishing season in CFA 12E in comparison to 2022. CPUE values in CFA 12F were considerably higher in 2023 compared to 2022. As expected, CPUE values in CFA 19 were much higher than anywhere else in the sGSL.

3.4. FISHERY CLOSURES

Local area closures of soft/white crab and for the protection of NARW in 2023 are shown in Figure 8 where numbers represent the total number of days grids were closed during the fishery.

Local area closures due to the presence of NARW began at the end of the fifth week of the fishery in CFAs 12, 12E and 12F, on May 11th. By the beginning of June, significant portions of CFA 12 were closed due to numerous NARW sightings, stretching from the Gaspé coast to the eastern tip of Prince Edward Island. CFA 19 was also affected by NARW closures early in the season on July 17th.

Local area closures due to the occurrence of soft-shelled crab were minimal in CFA 12, with only one grid closures (Figure 8). In CFA 19, white crab closures occurred in sectors E and G, closing on July 29th (Figure 8).

4. CONCLUSION

Similar to 2022, the 2023 snow crab fishery in the sGSL opened in early April and quotas were reached in all CFAs. The spatial distribution of landings in 2023 were similar to 2022, whereas CPUE values increased in all four CFAs compared to 2022.

CPUE values of a given fishing year may correlate to the biomass estimated from the preceding survey, however, many other factors unrelated to crab biomass, such as environmental conditions, local area closures, fishing gear and fishing practices likely obscure the relationship between these two.

Soft/white crab closures were minimal and occurred towards the end of the season, local area closures due to the detection of NARW were widespread throughout the sGSL and most likely resulted in significant displacement in fleet fishing effort in all CFAs.

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7. TABLES

Table 1. Number of allocation shares, number of active vessels, season opening and closing dates, last landing dates, revised quotas, and total landings of the snow crab fishery by Crab Fishing Area in the southern Gulf of Saint Lawrence in 2023.

Characteristics	CFA 12	CFA 12E	CFA 12F	CFA 19	Southern Gulf
Allocation shares	245	4	33	157	439
Active vessels	323	4	27	110	461
Season opening date	April 11	April 11	April 11	July 13	-
Season closing date	June 30	June 30	June 30	September 11	-
Last day of landings	June 30	May 23	June 30	August 4	-
Revised quota (t)[1]	31,730	287	1,330	1,708	35,506[2]
Landings (t)	32,084[3]	291	1,329	1,700	35,404

[1] For reasons of annual quota adjustments, reconciliations, and re-distribution of the scientific quota among Crab Fishing Areas, the revised quota does not necessarily correspond to the TAC in the notice to harvesters.
[2] Quota includes 450 t set aside to finance the stock assessment activities in 2023 (under Section 10 of the *Fisheries Act*).
[3]Total landings in Crab Fishing Area 12 include a portion of landings allocated to Crab Fishing Area 12E that were fished in Crab Fishing Area 12.

Table 2. Fishery characteristics and at-sea observer coverage by Crab Fishing Area in the southern Gulf of Saint Lawrence snow crab fisheries in 2023.

Characteristics	CFA 12	CFA 12E	CFA 12F	CFA 19
Fishing effort (traps hauled)	444,480	3,678	13,718	12,088
Fishing trips	3,694	17	181	808
Trips with observers	229	3	12	46
Traps sampled by observers	1,397	36	103	98
Crab sampled	54,520	1,438	4,087	3,785

Table 3. Landings, fishing effort and catch per unit effort from logbooks in the southern Gulf of Saint Lawrence snow crab, *Chionoecetes opilio*, fisheries (Crab Fishing Areas 12, 12E, 12F and 19) since 1987 (note: landings for 2023 are preliminary).

Year	Landings (t)					Effort (number of traps hauled)				Catch per unit effort (kg / trap haul)			
	12	12E	12F	19	Total	12	12E	12F	19	12	12E	12F	19
1987	11,782	-	-	1,151	12,933	449,293	-	-	37,987	26.2	-	-	30.3
1988	12,355	-	-	1,337	13,692	528,844	-	-	22,794	23.4	-	-	58.7
1989	7,882	-	-	1,334	9,216	356,442	-	-	29,978	22.1	-	-	44.5
1990	6,950	-	-	1,333	8,283	254,578	-	-	28,422	27.3	-	-	46.9
1991	10,019	-	-	1,337	11,356	326,671	-	-	16,733	30.7	-	-	79.9
1992	11,235	-	-	1,678	12,913	362,967	-	-	17,140	31.0	-	-	97.9
1993	14,336	-	-	1,678	16,014	344,698	-	-	18,204	41.6	-	-	92.2
1994	19,995	-	-	1,672	21,667	390,833	-	-	24,495	51.2	-	-	68.3
1995	19,944	217	317	1,575	22,053	416,890	4,033	11,561	24,854	47.8	53.8	27.4	63.4
1996	15,978	164	238	1,342	17,722	318,796	2,714	5,604	24,583	50.1	60.3	42.4	54.6
1997	15,413	163	287	1,386	17,249	303,286	4,695	6,390	21,930	50.8	34.7	44.9	63.2
1998	11,136	161	290	1,988	13,575	243,339	5,624	6,035	31,232	45.8	28.6	48.1	63.1
1999	12,682	159	290	1,979	15,110	289,003	5,415	5,072	19,088	43.9	29.4	57.2	103.7
2000	15,046	150	291	3,225	18,712	436,782	6,528	5,136	55,977	34.5	22.9	56.7	64.1
2001	13,819	155	378	3,910	18,262	326,382	6,700	5,736	46,251	42.3	23.2	63.0	88.5
2002	21,869	165	378	3,279	25,691	544,454	2,916	4,437	43,662	40.2	56.6	85.2	72.3
2003	16,898	345	817	3,103	21,163	337,960	5,471	10,460	29,952	50.0	63.1	78.1	103.6
2004	26,626	349	806	3,894	31,675	484,991	6,277	10,775	56,517	54.9	55.6	74.8	68.9
2005	32,363	449	479	2,827	36,118	508,053	5,571	5,112	41,512	63.7	80.6	93.7	68.1
2006	25,934	411	787	1,989	29,121	402,702	10,074	14,079	23,566	64.4	40.8	55.9	84.4
2007	23,243	220	370	3,034	26,867	353,775	5,914	12,252	42,553	65.7	37.2	30.2	71.3
2008	20,911	187	431	2,929	24,458	370,762	9,232	15,504	38,388	56.4	20.3	27.8	76.3
2009	20,896	67	309	2,370	23,642	433,527	4,653	14,045	33,193	48.2	14.4	22.0	71.4
2010	7,719	50	420	1,360	9,549	161,148	1,825	14,335	11,138	47.9	27.4	29.3	122.1
2011	8,618	76	313	1,701	10,708	162,604	2,413	9,631	12,761	53.0	31.5	32.5	133.3
2012	18,159	185	706	2,906	21,956	267,044	5,623	16,890	16,317	68.0	32.9	41.8	178.1
2013	22,645	204	543	2,657	26,049	296,398	5,097	11,086	17,890	76.4	40.1	49.0	148.5
2014	19,674	178	882	3,745	24,479	317,689	3,765	23,163	25,407	61.8	47.3	38.1	147.4
2015	23,080	192	510	2,129	25,911	339,912	2,918	13,351	14,703	67.9	65.8	38.2	144.8
2016	19,499	144	381	1,701	21,725	304,624	2,796	8,667	11,937	64.0	51.5	43.9	142.5
2017	39,825	203	684	2,944	43,656	553,125	3,333	9,421	20,616	72.0	60.9	72.6	142.8
2018	20,769	260	1,183	2,048	24,260	469,887	5,579	17,120	13,120	44.2	46.6	69.1	156.1
2019	27,554	224	1,166	2,763	31,707	496,468	3,415	18,083	24,518	55.5	65.7	64.5	112.7
2020	24,554	234	1,084	2,284	28,156	556,780	5,098	22,168	22,458	44.1	45.9	45.2	101.7
2021	21,423[1]	223	592	2,241	24,479	363,136	5,314	18,612	18,384	57.4	55.7	59.1	121.0
2022	27,620[1]	197	1,173	2,671	31,661	537,820	2,509	15,240	23,690	51.4	78.5	76.5	112.6
2023	32,084[1]	291	1,329	1,700	35,404	444,480	3,678	13,718	12,088	72.2	79.1	96.9	140.6

[1]Total landings in Crab Fishing Area 12 include landings allocated to Crab Fishing Areas 12E (2021, 2022, 2023) and 12F (2021) that were fished in Crab Fishing Area 12.

Table 4. Catch per unit effort (kg per trap haul) by Crab Fishing Area 12 crab harvester group.

Year	Traditional CFA 12	Traditional CFA 18	Traditional CFA 25-26	First Nations	New entrants
2001	43.5	-	62.7	38.8	32.3
2002	42.3	-	45.2	33.8	31.0
2003	50.5	66.0	43.6	51.4	45.6
2004	55.5	64.4	63.9	55.8	48.4
2005	66.2	70.3	80.2	64.5	50.3
2006	68.7	66.2	79.8	59.7	53.8
2007	69.4	61.4	66.2	65.8	54.4
2008	57.3	77.3	54.6	56.0	49.3
2009	46.6	76.7	48.3	49.8	48.7
2010	48.7	36.3	54.0	45.2	51.0
2011	54.3	53.3	46.6	50.9	51.6
2012	67.7	133.1	66.0	67.8	60.5
2013	77.0	114.5	71.1	75.4	69.6
2014	62.1	88.6	53.4	61.4	57.8
2015	70.1	78.9	61.6	66.0	61.1
2016	64.6	69.6	71.0	61.8	61.5
2017	77.6	77.8	76.4	65.0	65.7
2018	43.4	84.5	45.5	42.5	43.5
2019	58.2	72.8	56.3	52.5	47.1
2020	42.9	61.9	54.2	46.5	41.5
2021	60.0	60.2	76.4	52.6	51.1
2022	50.1	79.0	52.7	45.9	55.8
2023	71.8	111.5	83.4	67.7	69.8

8. FIGURES

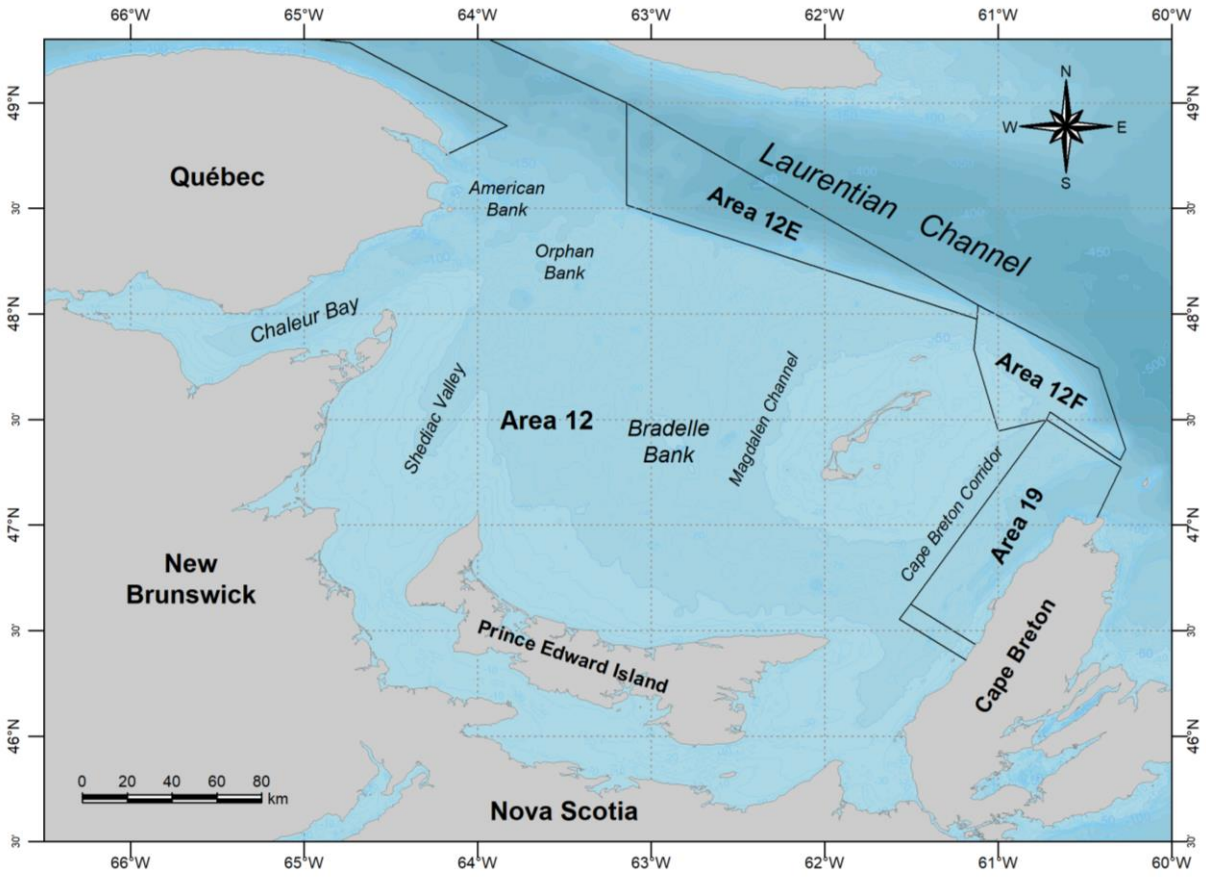

Figure 1. Location of snow crab (*Chionoecetes opilio*) fishing grounds and Crab Fishing Areas in the southern Gulf of Saint Lawrence.

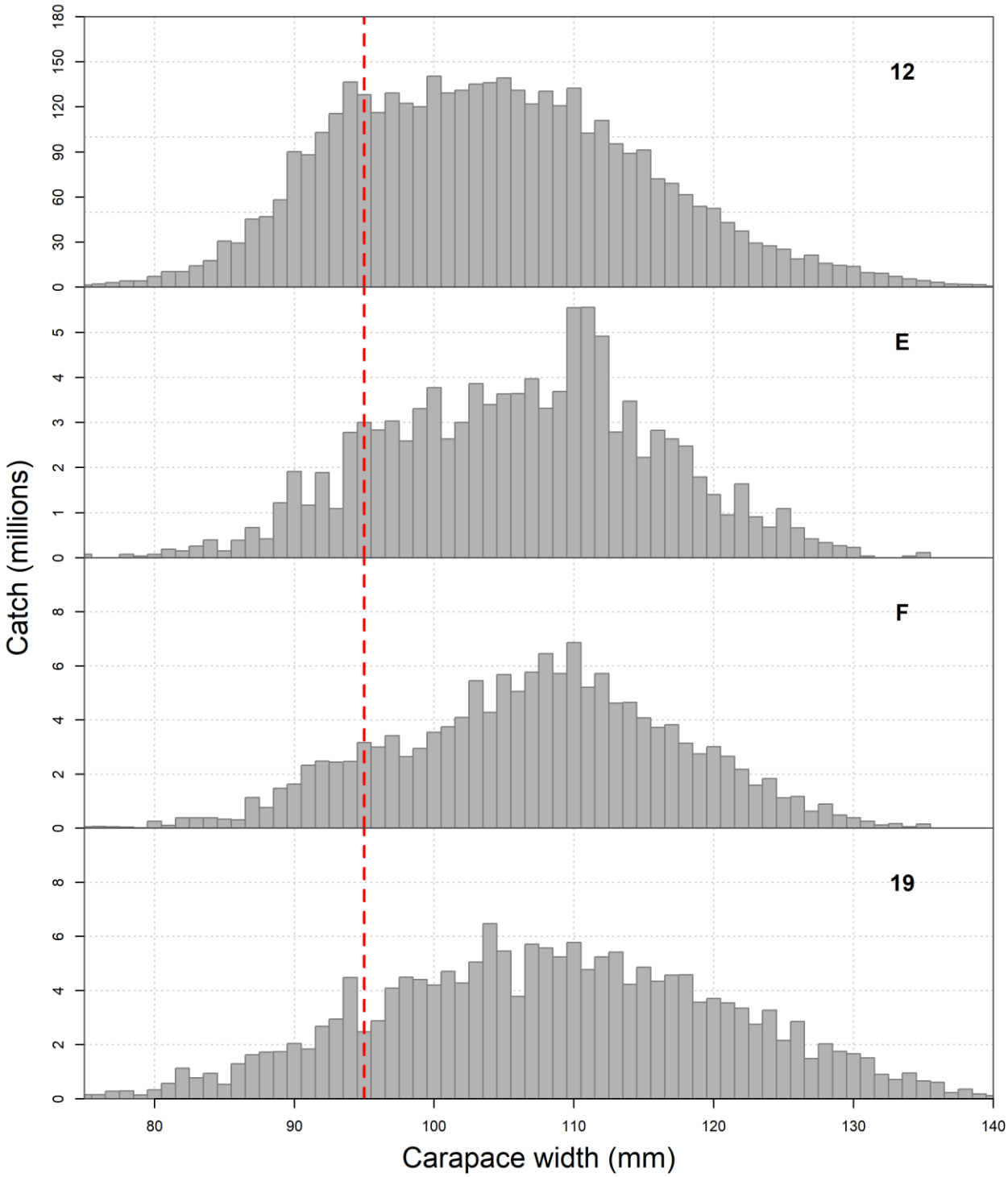

Figure 2. Size frequency distributions of all males crabs measured during the at-sea sampling (before discarding) in Crab Fishing Areas 12, 12E, 12F and 19 in 2023. The red dashed line indicates the legal size of 95mm carapace width.

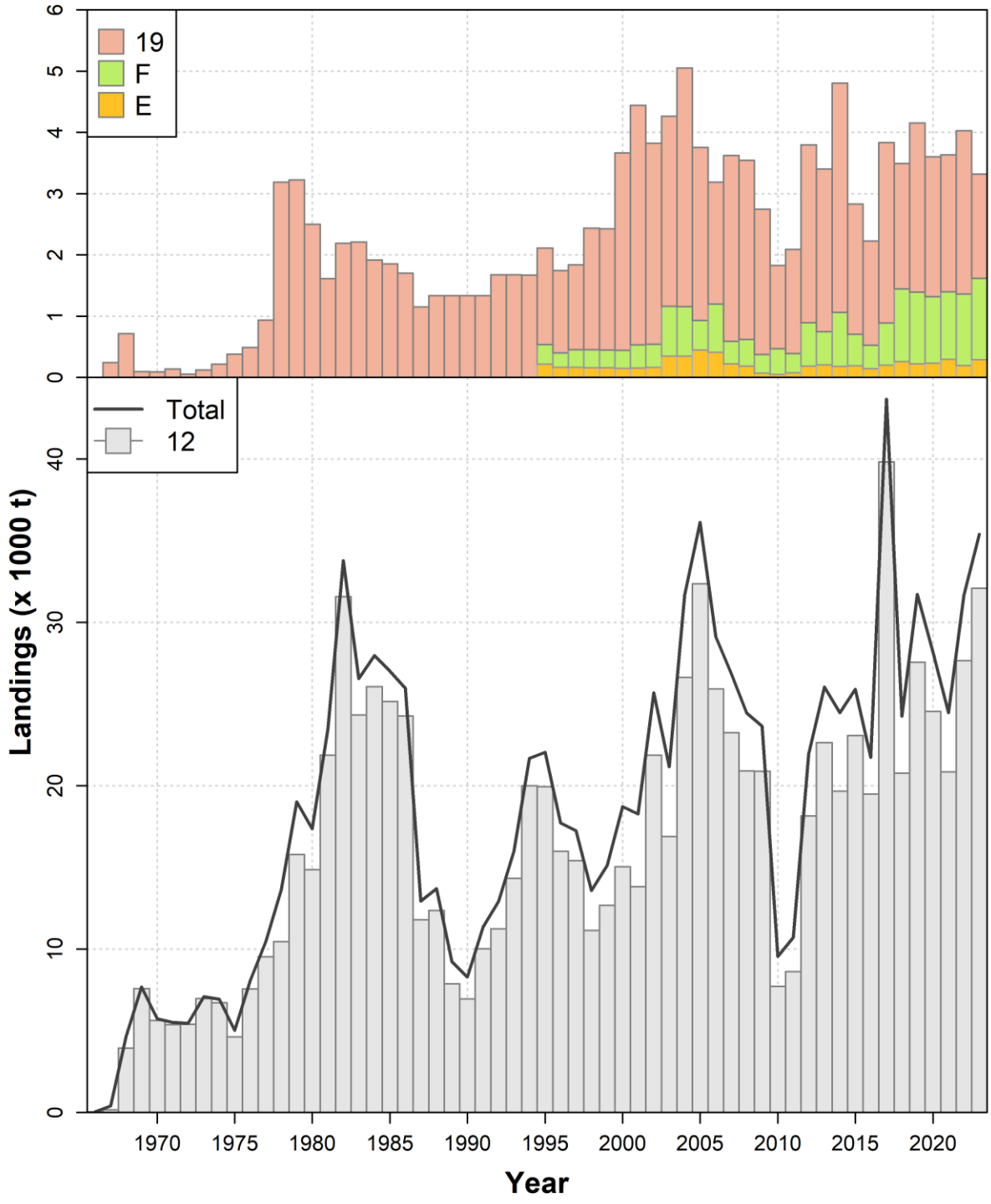

Figure 3. Annual landings (t) in the southern Gulf of Saint Lawrence snow crab fishery by Crab Fishing Area (12, 12E, 12F and 19).

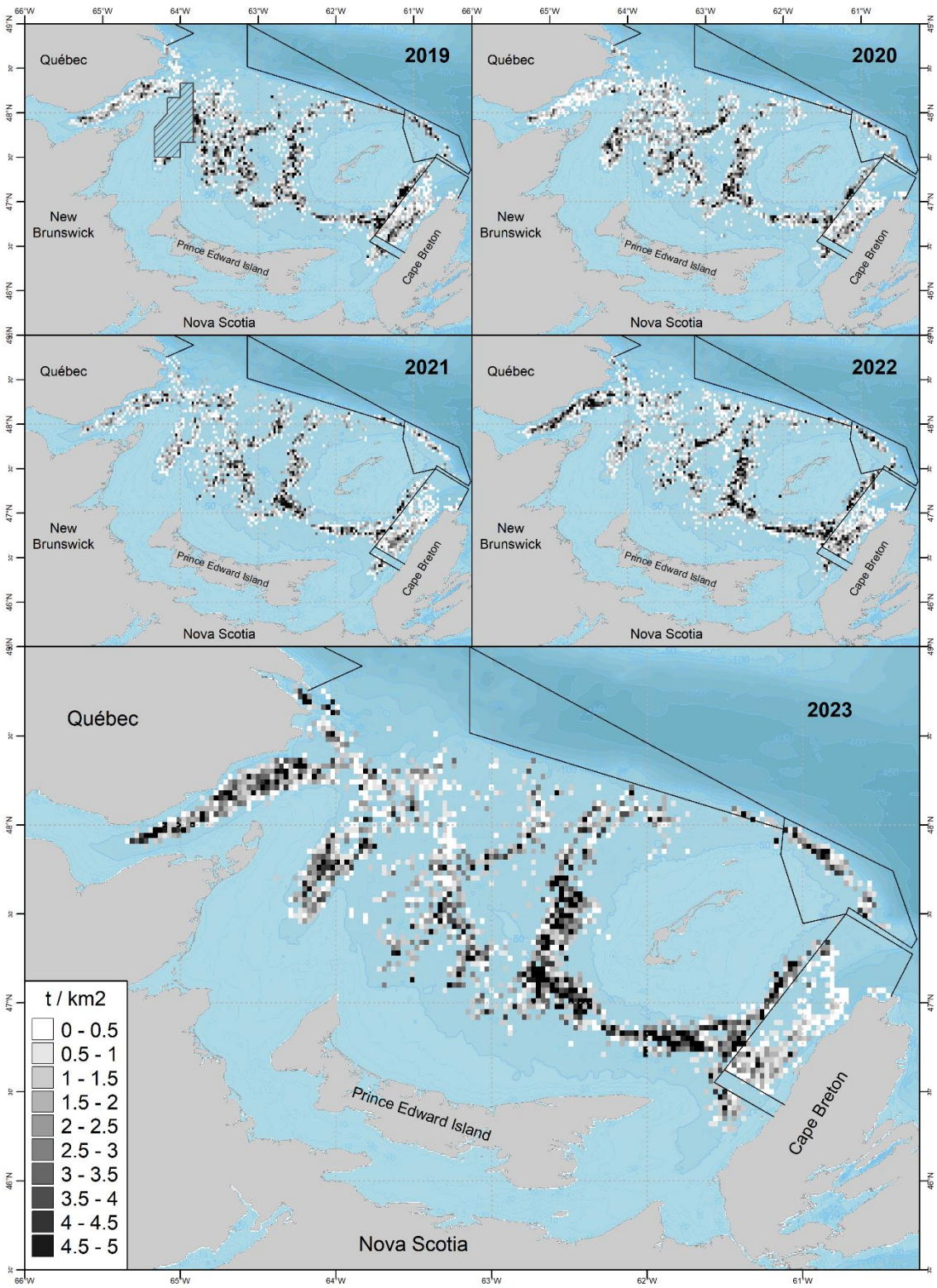

Figure 4. Spatial distribution of landings (t/km^2) in Crab Fishing Areas from the 2019-2023 fishing seasons. Static closures for the protection of North Atlantic right whales are represented by shaded areas in 2019.

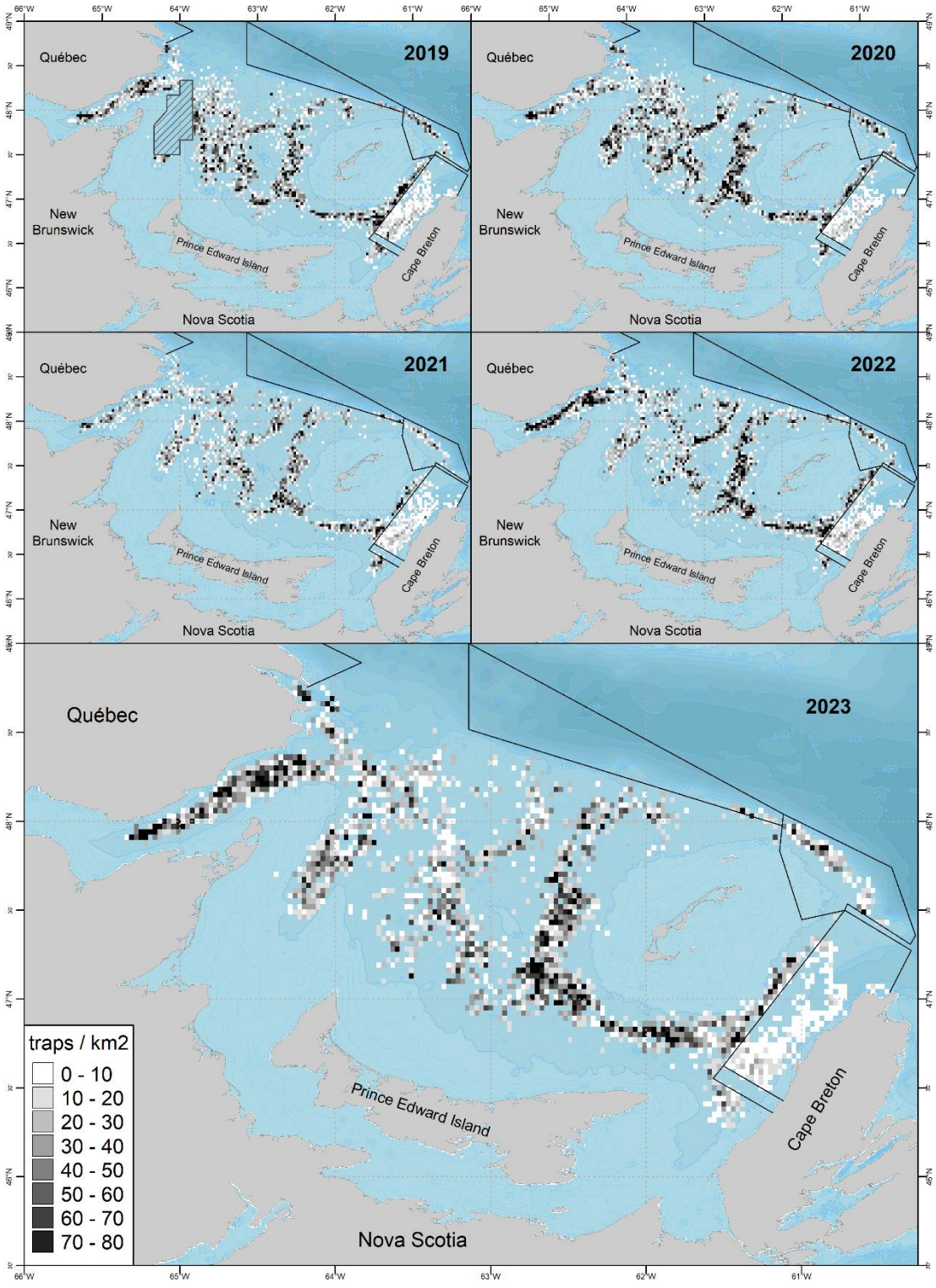

Figure 5. Spatial distribution of fishing effort (traps hauled per km^2) by Crab Fishery Area from the 2019-2023 fishing seasons. Seasonal closures for the protection of North Atlantic right whales are represented by shaded areas in 2019.

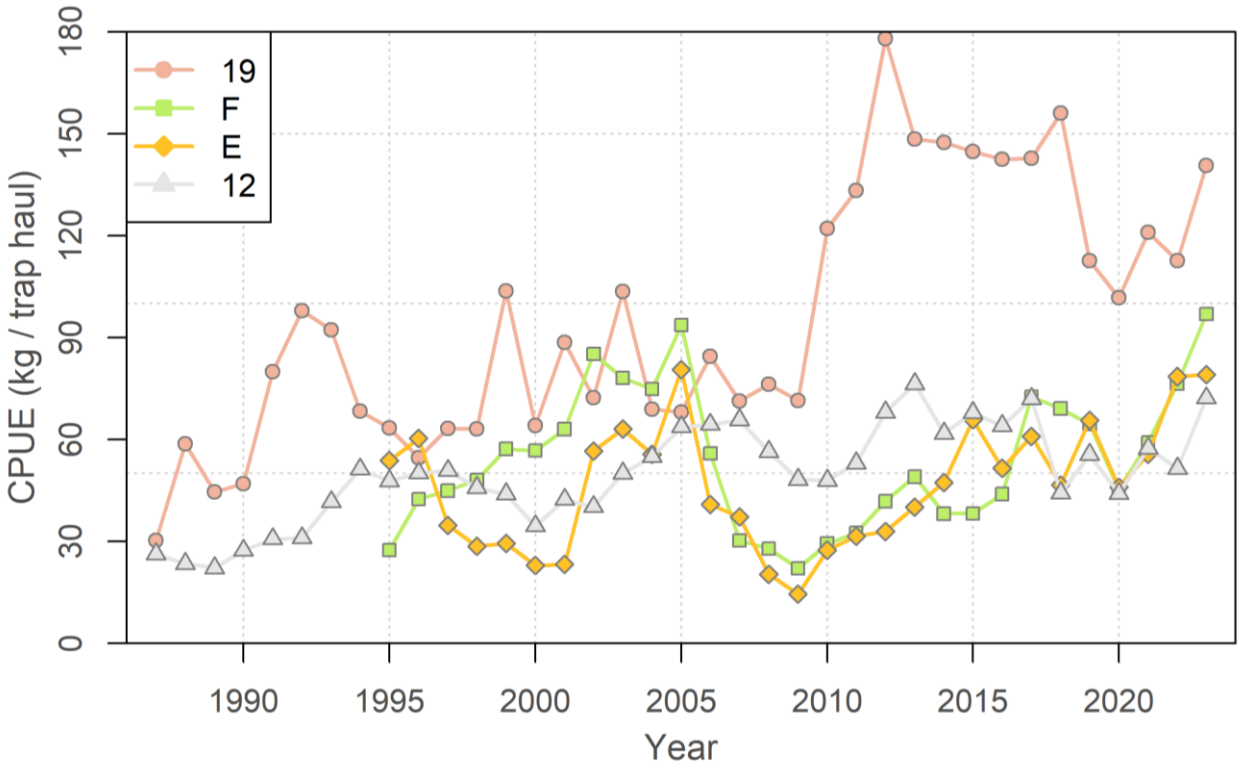

Figure 6. Catch per unit effort (kg/th) by Crab Fishing Area in the southern Gulf of Saint Lawrence based on fishery logbook data.

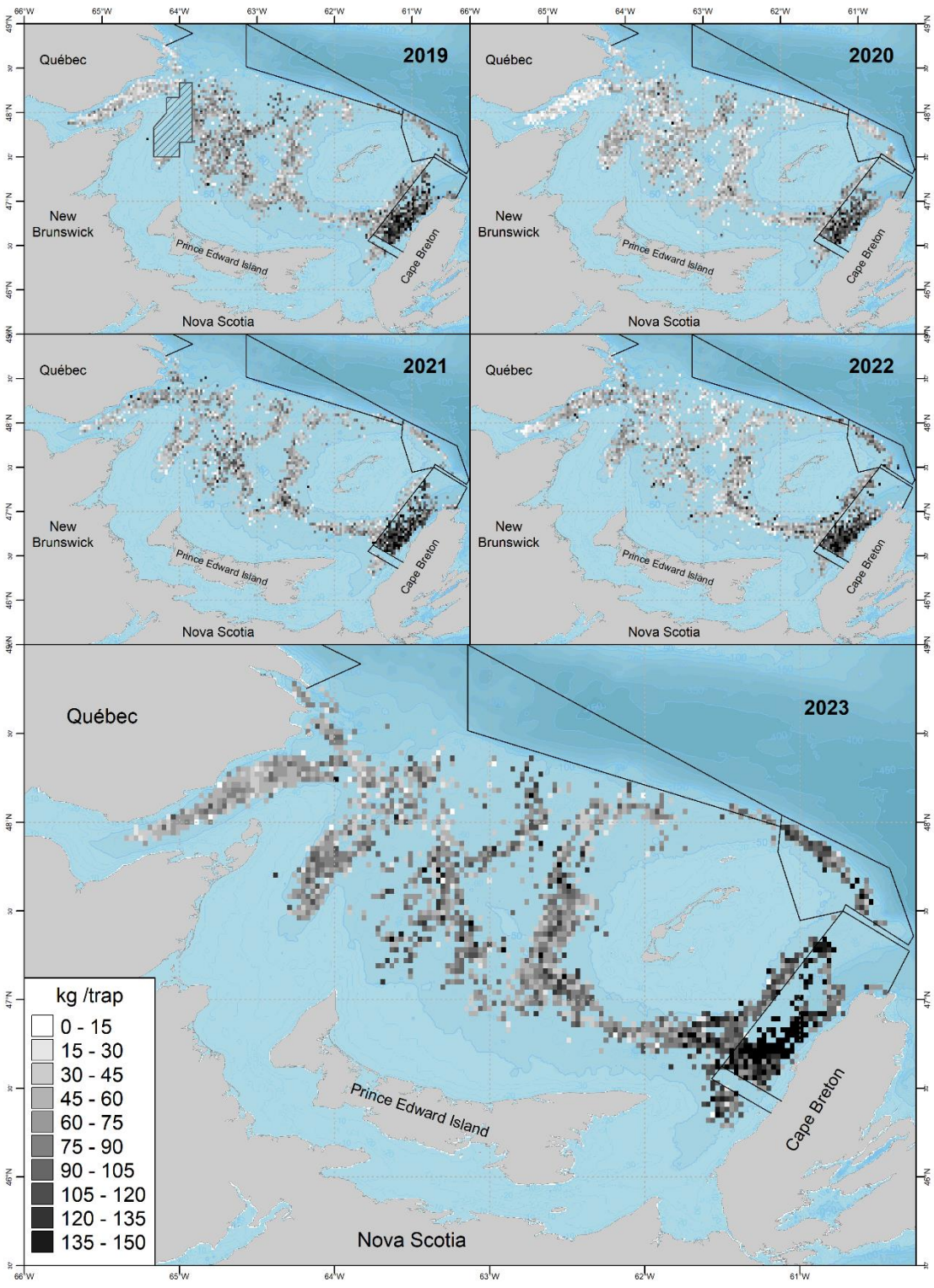

Figure 7. Spatial distribution of catch per unit effort (kg/th), in the Crab Fishing Areas from 2019-2023 fishing seasons. Seasonal closures for the protection of North Atlantic right whales are represented by shaded areas in 2019.

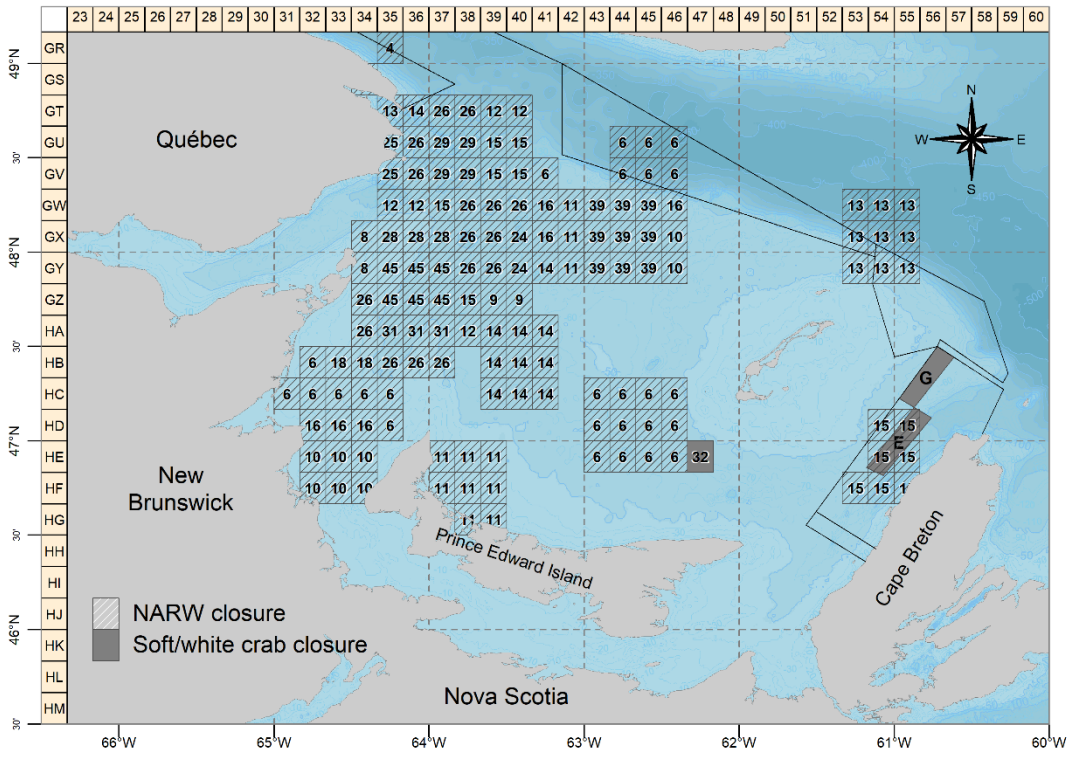

Figure 8. Local area closures of soft/white crab (solid grey area) and for the protection of North Atlantic right whales (hatched area) in 2023. Numbers represent the total number of days grids were closed during the fishery.