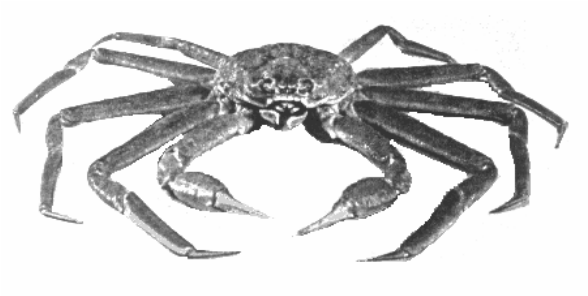
ASSESSMENT OF THE ESTUARY AND NORTHERN GULF OF ST. LAWRENCE (AREAS 13 TO 17, 12A, 12B, 12C AND 16A) SNOW CRAB STOCKS IN 2008



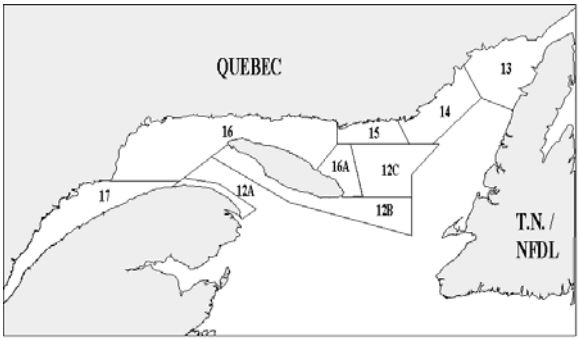


Figure 1: Snow crab management areas in the Estuary and the northern Gulf of St. Lawrence.

Context

The snow crab fishery in the Estuary and the northern Gulf of St. Lawrence began in the late 1960s. The fishery experienced a boom from 1979 to 1985, and a management approach based on the TAC (total allowable catch) was gradually introduced between 1985 and 1995. There are nine management areas (13 to 17, 16A, 12A, 12B and 12C) (Figure 1). Area 16A, which is adjacent to Area 16, was created in 2001 to help Area 13 fishermen who were experiencing hardship.

Landings have varied depending on the adjusted TACs based on the recruitment waves and troughs that have affected the fishery (Figure 2), with maximum levels recorded in 1995 (7,879 t) and 2002 (10,372 t). Landings dropped considerably in 2003 owing to the lower TACs established in response to perceived signs of overfishing, particularly in Area 16.

The fishery is directed exclusively at males with a carapace width of at least 95 mm. White crab (crab that has recently moulted) and adolescent males may be returned to water during the fishing season to enhance their meat yield and give them a chance to reproduce. Furthermore, since 1985, when the proportion of white crab in catches at sea exceeds 20%, it automatically triggers the closing of the fishery in the area concerned, in order to minimize the mortality of these very fragile crabs that will be available to the fishery the following year.

SUMMARY

- Generally, Quebec North Shore stocks are characterized by a significant proportion of recruits and by a stable or slightly decreasing commercial biomass which will drop in upcoming years. Stocks in the Estuary and Gaspé Peninsula have recently experienced a significant drop in terms of commercial biomass, which had been stable in 2008 following a sharp drop in TACs. Recommendations for 2009 vary from stabilizing to moderately increasing the TACs where the commercial biomass and crab size are still high.

- Advices for 2009 encourage the maintenance of an adequate reproductive biomass for males so as to not adversely affect the recovery or maintenance of the population in a given area. Recommendations assume that the natural mortality rate will not differ in 2009 compared with previous years.

In Area 17, the status quo is recommended for the 2009 TACs, which should help stabilize the commercial biomass.

In Area 16, since the catch rates and size are generally high, the TAC could be increased by 10% in 2009 compared to 2008 without negatively impacting the stock.

In Area 15, since the commercial biomass was still high and that only the western part of the area was exploited in 2008, it is recommended that the same TAC be maintained for 2009.

In Area 14, since the catch rates increased both in the fishery and in the postseason survey, a maximum TAC increase of 15% in 2009 compared to 2008 is recommended.

In Area 13, the available information does not provide for any change to the pre-established management plan for the 2009 fishing season.

In Area 12A, while awaiting a stronger recruitment, a 2009 TAC comparable to the 2008 TAC is recommended in order to avoid a drop in commercial biomass.

In Area 12B, in 2009, a slight TAC increase of around 10% from 2008 is recommended.

In Area 12C, since the abundance indices dropped in the postseason survey, the same TAC is recommended for 2009.

In Area 16A, a TAC increase of around 10% in 2009 compared to 2008 is recommended.

INTRODUCTION

Species Biology

In Canada, snow crab can be found from the southern tip of Nova Scotia to midway up Labrador as well as in the Estuary and Gulf of St. Lawrence. In the Gulf of St. Lawrence, males of commercial size live at depths of around 60-220 m, except during their moulting and reproductive period when they migrate to shallower waters. Snow crab stop growing after their terminal moult. The male is referred to as immature or an adolescent (small claws) prior to the terminal moult and as an adult (large claws) afterward. Males range in carapace width (CW) from 40 mm to 165 mm after their terminal moult. If they do not do their terminal moult before, males reach legal size (CW of 95 mm) at about nine years of age. Snow crab recruitment is periodic or episodic and varies considerably over a cycle of 8 to 12 years. The recruitment situation in the fishery can be determined through the regular monitoring of catches (size, carapace condition) and effort (catch per unit effort (CPUE)), and confirmed by scientific trap and trawl surveys.

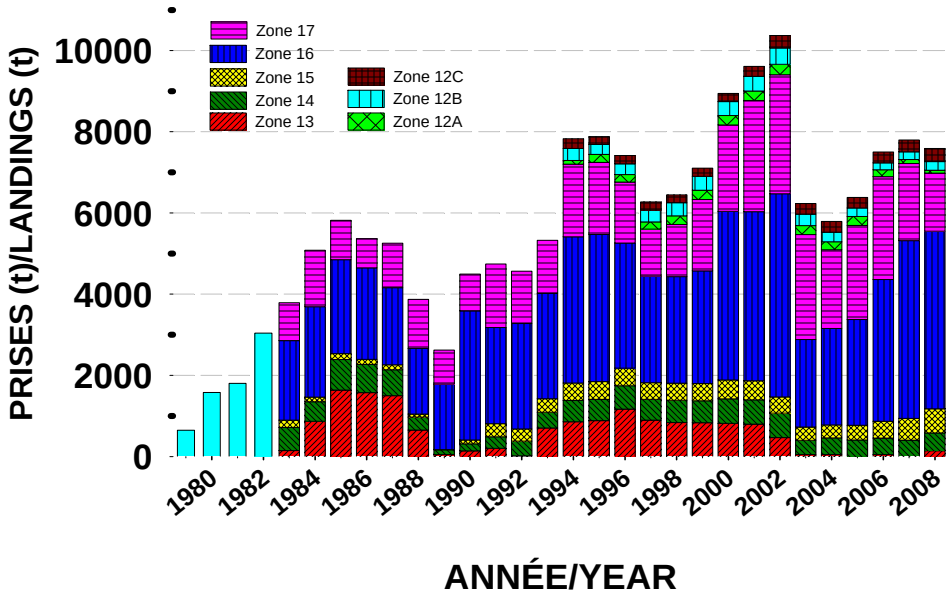


Figure 2. Snow crab landings in the Estuary and northern Gulf of St. Lawrence. From 1979 to 1982, landings were not differentiated per area.

ASSESSMENT OF THE RESOURCE

Fishing data derived from logbooks, processing plant purchase slips and dockside weighing summaries, along with catch sampling data obtained from the Observers Program and DFO samplers, are the basis for the analyses of all areas. In 2008, a trap-based research survey was carried out by Industry in all fishing areas and the findings were incorporated into the stock status analyses. These surveys help determine the mean CPUE (catch per unit effort) per area for commercial size crab and the NUE (number per unit effort) for crab categories of over 78mm carapace width. The results from the trawl research surveys conducted in 2007 and 2008 in Areas 13, 16 and 17 were used to calculate an abundance index for juvenile or adult crab.

The raw CPUE for the fishery were standardized using a multiplicative model to account for seasonal changes, gear type and soaking time. The proportion of new crabs or recruits, recognizable with a new carapace (carapace condition 1 and 2), was determined by samplers dockside and at sea.

Data on the size structure of crab sampled at sea, at dockside and during trap surveys were also used.

Until now, data on female insemination levels have been collected sporadically in certain areas. An annual systematic sampling of each area is preferred in order to use this parameter for stock status assessments, because it is a measure of the female mating success and relative abundance of large adult males.

Snow Crab in Area 17

Fishery Description

There are 22 active license holders in Area 17. The TAC dropped by 44% between 2006 and 2008 and totalled 1,430 t (Figure 3A), including 130 t in temporary allocations. The fishing season opened on April 1st and closed on June 15th, 2008, and the TAC was met.

Resource Status in 2008

In the commercial fishery, the standardized CPUE was maintained at high values from 2000 to 2004 and dropped by 50% between 2004 and 2008 (Figure 3B). In 2008, it is near the low values recorded during the last recruitment recession in 1997. The proportion of new crabs (conditions 1 and 2) has been increasing in the landings over the last few years (Figure 4). Oppositely, the proportion of intermediate-shell crab (condition 3), which arrived in the fishery in massive numbers during the last recruitment wave and that greatly supported the fishery in recent years, has dropped. The proportion of old crabs (conditions 4 and 5) in the landings totalled 4% in 2008. The mean of legal-size crab caught at sea, which increased between 1999 and 2004, dropped in 2005 and 2006 and then rose again in 2007 to a value that has remained stable in 2008 at 112.2 mm (Figure 3C).

Results from the postseason trap survey, a data series that began in 1996 on the north shore and in 1999 on the south shore, indicate a large drop in the CPUE on the north and south shores between 2005 and 2007 (56% and 57% respectively) followed by a slight increase in 2008 more noticeable on the south shore (Figure 5).

On both shores, the NUE for recruits caught in traps was high in 1999, 2000 and 2002 (Figure 6), which led to a relatively abundant commercial biomass available to the fishery until 2005. Since 2003, this abundance index for recruits has remained lower and more stable over the entire area. The proportion of old crabs was low on both shores in 2008. After dropping sharply from 2001 to 2003, the mean number of adolescents between 78 mm and 95 mm CW caught in traps (NUE) has remained stable on both shores (Figure 7). The mean size of legal size crabs has remained stable from 2007 to 2008 over the entire area.

Results from the trawl survey conducted on the north shore of the Estuary in 2005 and 2007 showed a downward trend compared to previous years and indicated low abundance for adolescents measuring less than 78 mm.

In 2008, the average amount of sperm stored in the female's spermatheca remained above the level required for a high success rate of fertilizing eggs.

Conclusions and Advice

Landings and TACs dropped by 25% from 2007 to 2008 totalling 1,430 t.

The catch rate in the commercial fishery dropped in 2008 and increased in the postseason survey compared to 2007.

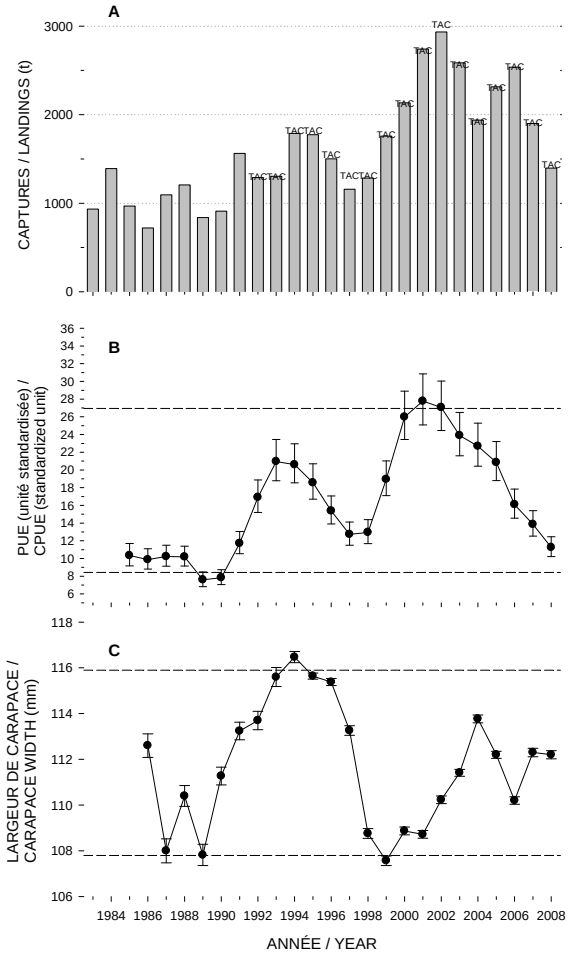
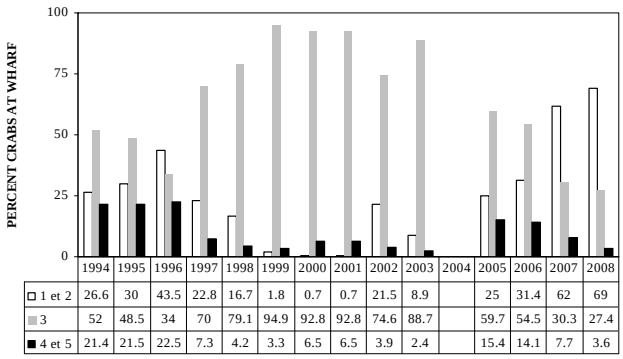


Figure 3. Main fishery parameters for Area 17, 1983–2008: A) landings and TAC; B) standardized CPUE ± confidence interval; and C) mean carapace width ± confidence interval for commercial crabs sampled at sea. The mean of the 3 lowest values and the mean of the 3 highest values, prior to 2008, are indicated by dotted lines in graphs B and C.



	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1 et 2	26.6	30	43.5	22.8	16.7	1.8	0.7	0.7	21.5	8.9		25	31.4	62	69
3	52	48.5	34	70	79.1	94.9	92.8	92.8	74.6	88.7		59.7	54.5	30.3	27.4
4 et 5	21.4	21.5	22.5	7.3	4.2	3.3	6.5	6.5	3.9	2.4		15.4	14.1	7.7	3.6

Figure 4. Carapace conditions for commercial crabs landed in Area 17 between 1994 and 2008.

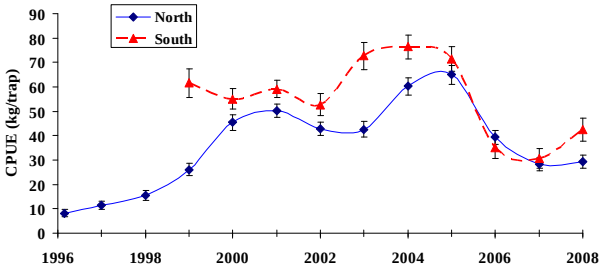


Figure 5. Catch rates (CPUEs) of adult crabs ≥ 95 mm with confidence interval from the postseason survey in Area 17, 1996– 2008.

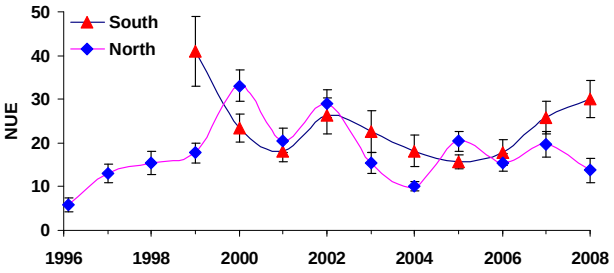


Figure 6. Catch rates (NUE) with confidence interval for recruits from the postseason survey conducted in Area 17, 1996–2008.

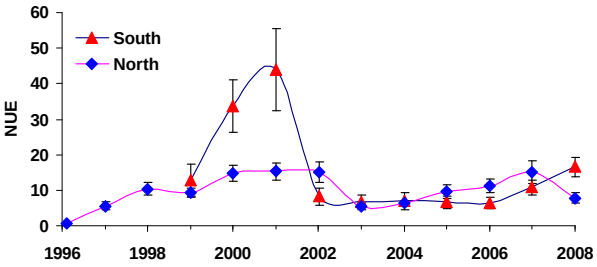


Figure 7. Catch rates (NUE) for adolescents measuring between 78 mm and 95 mm, with confidence interval, from the postseason survey conducted in Area 17, 1996–2008.

The mean size of crab 95+ mm did not vary from 2007 to 2008, neither in the commercial fishery nor in the postseason survey and nears the historic mean.

Since 2007, the fishery has been conducted mostly on recruitment.

According to the postseason survey, the abundance of commercial size crab recruited to the population in 2008 and available to the 2009 fishery has remained low but stable compared to 2007. Based on the abundance index of adolescents (78-95 mm), which was stable and near the mean from the series of available observations, recruitment to the fishery is not likely to increase very much in the short term.

Indicators show that the stock is in better condition on the south side of the Estuary than on the north side.

Recommendation

The status quo is recommended for 2009, which should help stabilize the commercial biomass.

Snow Crab in Area 16

Fishery Description

A total of 39 fishermen hold regular snow crab fishing licenses in Area 16. In 2007 and 2008, the TAC was 4,006 t (Figure 8A), with a portion of this TAC (292 t) in temporary allocations. The fishery opened on April 14th and closed on July 20th; the TAC was met.

Resource Status in 2008

In the fishery, the standardized CPUE dropped from 2000 to 2003, but increased subsequently and reached high values in 2005 and 2006. In 2007, it dropped by 30% and then remained stable in 2008 (Figure 8B). The proportion of new crabs in the landings has been nearly 60% since and, oppositely, the proportion of intermediate-shell (condition 3) has been low for the same period (Figure 9). The mean size of legal-size crab at sea, which had begun increasing in 2003 following a sharp downward period, increased by almost 4 mm between 2005 and 2008, reaching 112.0 mm (Figure 8C).

Postseason trap surveys, conducted every fall since 1994, showed that the CPUE for legal-size crabs increased significantly in 2003, and then remained between 34 and 36 kg/conical trap until 2006. In 2007, the CPUE increased by 28%, to 46 kg/trap, and has remained at relatively high levels since, and dropped slightly in 2008 to 38 kg\trap en 2008 (Figure 10). The mean size of adult crabs of 95+ mm increased between 2003 and 2006 to more than 110 mm, and dropped slightly in 2008 to 109.7 mm, after being stable from 2006 to 2007. The mean NUE for recruits and adolescents, which had been dropping since 2003, increased sharply for both categories in 2007 and then dropped in 2008, to a value still high for recruits and near the series average based on available observations for adolescents (Figure 11). The proportion of new crabs (conditions 1 and 2) has increased significantly since 2006. The proportion of old crabs has been relatively low and stable since 2000 at less than 20%.

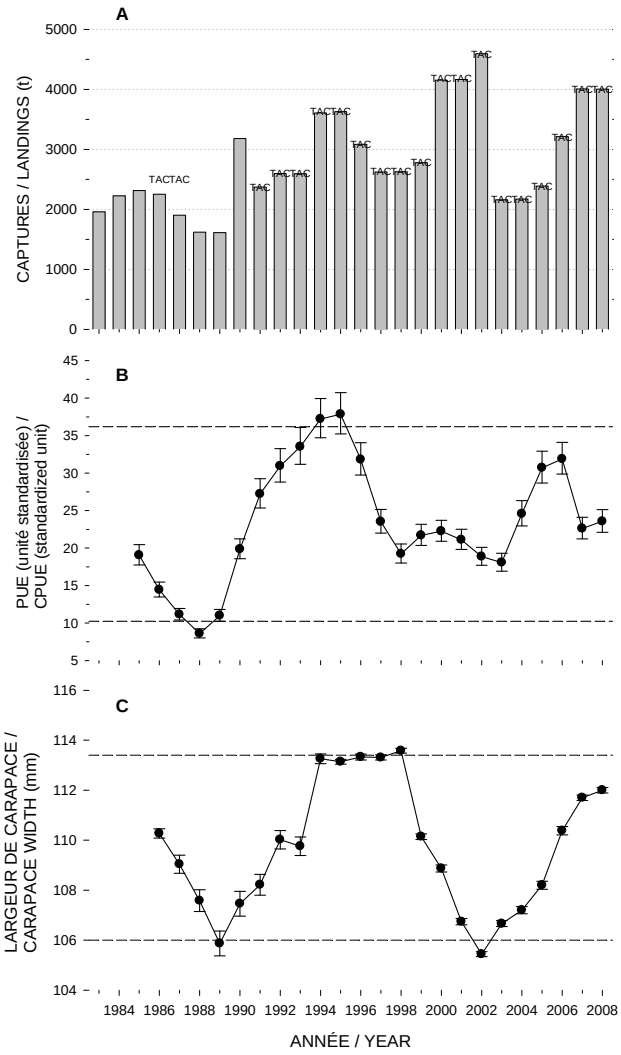
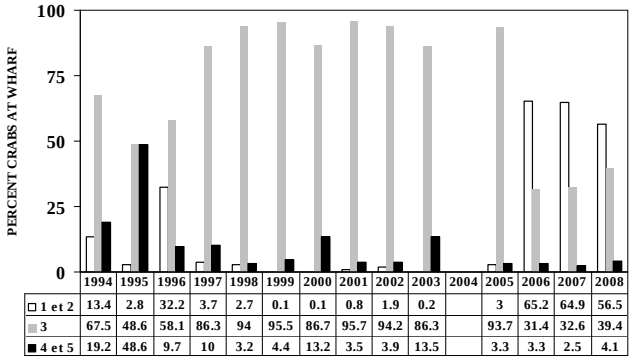


Figure 8. Main fishery parameters for Area 16, 1983–2008: A) landings and TAC; B) standardized CPUE ± confidence interval; and C) mean carapace width ± confidence interval for commercial crabs sampled at sea. The mean of the 3 lowest values and the mean of the 3 highest values, prior to 2008, are indicated by dotted lines in graphs B and C.



	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1 et 2	13.4	2.8	32.2	3.7	2.7	0.1	0.1	0.8	1.9	0.2		3	65.2	64.9	56.5
3	67.5	48.6	58.1	86.3	94	95.5	86.7	95.7	94.2	86.3		93.7	31.4	32.6	39.4
4 et 5	19.2	48.6	9.7	10	3.2	4.4	13.2	3.5	3.9	13.5		3.3	3.3	2.5	4.1

Figure 9. Carapace conditions for commercial crabs landed in Area 16 between 1994 and 2008.

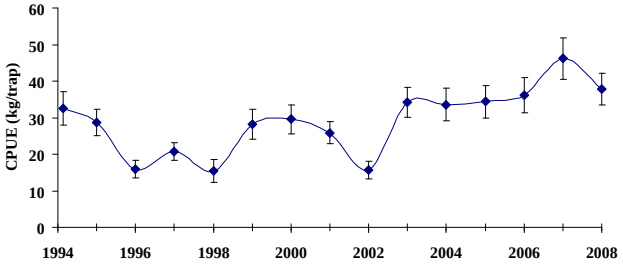


Figure 10. Catch rates (CPUEs) of adult crabs ≥ 95 with confidence interval from the postseason survey in Area 16, 1994– 2008.

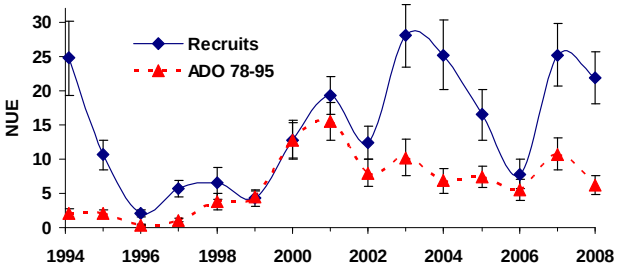


Figure 11. Catch rates (NUE) for recruits and adolescents between 78 mm and 95 mm, with confidence interval, from the postseason survey conducted in Area 16, 1994–2008.

Results from the trawl survey conducted in St. Marguerite Bay in 2007 and 2008, near Sept-Îles, showed a high abundance of small individuals that could represent the next recruitment wave in a few years. The capture of adolescent males between 62 and 95 mm was low during these surveys, which suggests a temporary recruitment drop in the near future.

Partial results from an Industry-led trawl survey conducted in the western and centre portion of Area 16, which was aimed at obtaining an available commercial biomass index, suggest that the exploitation rate in 2008 was in the same range as what was found for other stocks where a more comprehensive survey is conducted.

The spermatheca of females were fuller in 2008 than in 2007, which indicates increased male availability.

Conclusions and Advice

Landings and TAC totalled 4,006 t in 2007 and 2008.

Catch rates in the commercial fishery were stable and near the series average between 2007 and 2008.

During the postseason survey, the catch rate dropped from 2007 to 2008 but remained high.

In 2007 and 2008, landings were mostly made up of new crabs, suggesting that fishing success depends on a recent recruitment.

The mean size of crabs of 95+ mm caught in the fishery slightly increased to a high level, but dropped in the postseason survey.

Based on the postseason survey, the abundance index of commercial crab recruited to the population in 2008 and available to the fishery in 2009 dropped compared to 2007, but remains high, whereas the abundance index of adolescent crab (78-95) dropped from 2007 to 2008 to near the series average based on the available observations.

Preliminary results from a trawl survey conducted in the western and centre portion of Area 16, suggest that the exploitation rate was in the same range as what was found for other stocks where a more comprehensive survey is conducted.

Recommendation

Because the catch rates, recruitment and size are generally high, the TAC could be increased by about 10% in 2009 compared to 2008 without negatively impacting the stock.

Snow Crab in Area 15

Fishery Description

Area 15 has 8 regular fishermen. In 2008, the TAC was 539 t, a 10% increase compared to 2007 (Figure 12A), including 55 t in temporary allocations. In 2008, the fishery opened on May 5th and closed on August 7th and the TAC was met.

Resource Status in 2008

The fishery's standardized CPUE, in decline from 1996 to 2002, increased gradually beginning in 2003 and then stabilized in 2007-2008 (Figure 12B). During the dockside sampling, the proportion of intermediate-shell crabs (condition 3) was clearly lower from 2006 to 2008 compared with values recorded prior to 2006, whereas for the same period, the proportion of new crabs (conditions 1 and 2) was high (Figure 13). Very few old crabs have been landed since 2005. Between 2005 and 2007, the mean CW of legal-size crabs at sea increased from 106.1 mm to 112.1 mm CW, and then varied only slightly from 2007 to 2008 (111.7 mm) (Figure 12C).

The **scientific trap survey**, which has been conducted since 1998, showed that the CPUE of commercial-size crab increased from 2001 to 2007 and then decreased in 2008 (Figure 14). Since 2006, the scientific trap showed a significant proportion of old crabs and oppositely, few new crabs (conditions 1 and 2). This difference with what is landed in the commercial fishery could be explained by the fact that the commercial fishery is concentrated solely in the western part of the area as opposed to the postseason survey which is conducted over the entire area. The mean size of the harvested crab has been gradually increasing since 2002 but then stabilized between 2007 (109 mm) and 2008 (109.5 mm). After reaching a peak in 2002, the mean NUE for recruits dropped until 2008 (Figure 15). The mean NUE for adolescents between 78 mm and 95 mm only slightly changed between 2002 and 2006, and then dropped sharply in 2007 and remained low in 2008 (Figure 15).

Conclusions and Advice

Landings and TAC increased by 10% from 2007 to 2008 and peaked at 593 t.

Catch rates in the commercial fishery was high and stable from 2007 to 2008. However, in the postseason survey, it dropped by 18% from 2007 to 2008 but remains relatively high.

The mean size of crabs caught in the commercial fishery and in the postseason survey was stable from 2007 to 2008 and remains high.

Exploitation mainly occurs in the western part of the area where, since 2006, a significant proportion of new crabs have been landed.

Results from the postseason survey show that the abundance index of commercial crabs recruited to the population and the abundance index of adolescents (78-95 mm) have been dropping, suggesting that the commercial biomass will decrease over the next few years.

Recommendation

Because the commercial biomass remains high and that only the western part of the area was exploited in 2008, it is recommended that the same TAC be maintained in 2009.

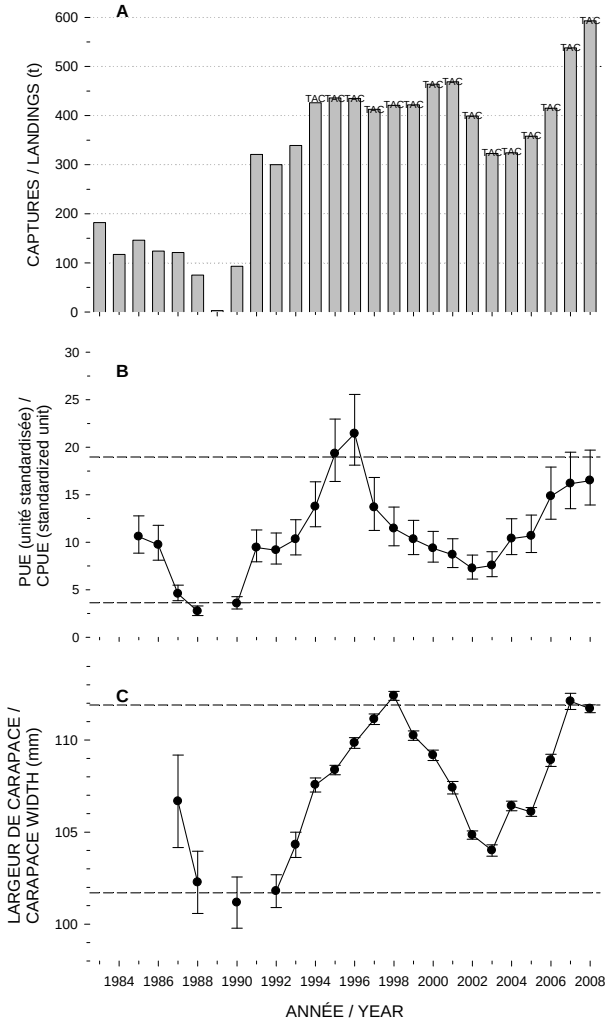
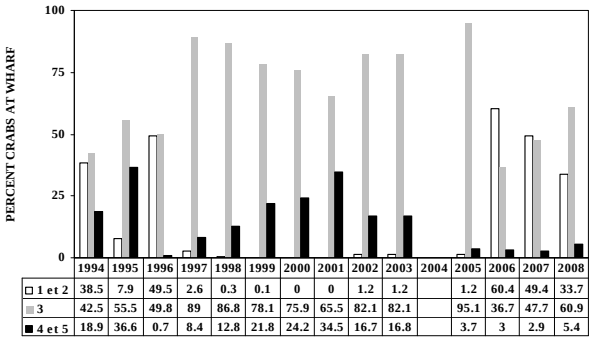


Figure 12. Main fishery parameters for Area 15, 1983–2008: A) landings and TAC; B) standardized CPUE ± confidence interval; and C) mean carapace width ± confidence interval for commercial crabs sampled at sea. The mean of the 3 lowest values and the mean of the 3 highest values, prior to 2008, are indicated by dotted lines in graphs B and C.



	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1 et 2	38.5	7.9	49.5	2.6	0.3	0.1	0	0	1.2	1.2		1.2	60.4	49.4	33.7
3	42.5	55.5	49.8	89	86.8	78.1	75.9	65.5	82.1	82.1		95.1	36.7	47.7	60.9
4 et 5	18.9	36.6	0.7	8.4	12.8	21.8	24.2	34.5	16.7	16.8		3.7	3	2.9	5.4

Figure 13. Carapace conditions for commercial crabs landed in Area 15 between 1994 and 2008.

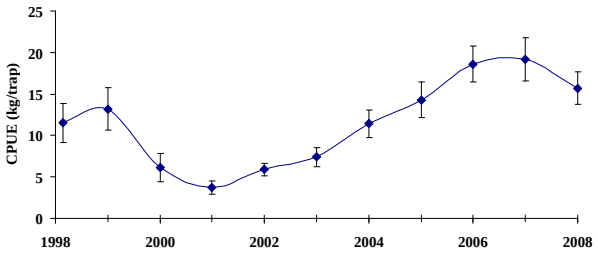


Figure 14. Catch rates (CPUEs) of adult crabs ≥ 95 with confidence interval from the postseason survey in Area 15, 1998– 2008.

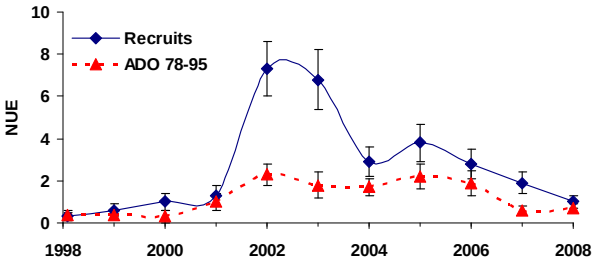


Figure 15. Catch rates (NUE) for recruits and adolescents between 78 mm and 95 mm, with confidence interval, from the postseason survey conducted in Area 15, 1998–2008.

Snow Crab in Area 14

Fishery Description

Area 14 has 21 regular fishermen. The 2008 TAC was 443 t, a 10% increase from 2007, and there were no temporary allocations (Figure 16A). In 2008, the fishing season opened on May 5th and closed on August 10th. The TAC was met.

Resource Status in 2008

The standardized CPUE for the commercial fishery increased in 2008 compared to 2007 and it is at its highest since 2003 (Figure 16B). According to dockside sampling, the proportion of intermediate-shell crabs (condition 3) increased in 2008 compared with 2007, whereas for the same period, the proportion of new crabs (conditions 1 and 2) decreased (Figure 17). Only a few old crabs (conditions 4 and 5) were landed. The mean size of legal-size crabs caught at sea rose from 107.5 mm in 2007, to 109.7 mm in 2008 (Figure 16C).

The **scientific trap survey** conducted since 1996 indicated a CPUE increase for legal-size crab from 2007 to 2008, up to a value near the series average based on the available observations (Figure 18). Intermediate-shell crab (condition 3) and old crabs (conditions 4 and 5) have dominated the catches since 2005. The mean size of legal-size crabs increased for a second consecutive year from 105.1 mm in 2006 to 106.1 mm in 2007 and to 107.4 mm in 2008. The mean NUE for recruits and adolescents between 78 mm and 95 mm dropped from 2003 to 2006 and then increased slightly in 2007 and 2008 (Figure 19), to a level that remains low for recruits and relatively high for adolescents.

Conclusions and Advice

Landings and TAC increased by 10% to 443 t from 2007 to 2008.

Catch rates and mean size have increased in 2008 from 2007 both in the commercial fishery and in the postseason survey.

Based on the results from the postseason survey, the abundance index of commercial crab recruited to the population in 2008 and available to the 2009 fishery is relatively low but similar to the values recorded since 2005. The recruitment outlook in the medium term is positive because the abundance of adolescent crab (78-95 mm) is increasing.

Recommendation

Because the catch rates have been increasing both in the fishery and in the postseason survey, a maximum TAC increase of 15% in 2009 from 2008 is recommended.

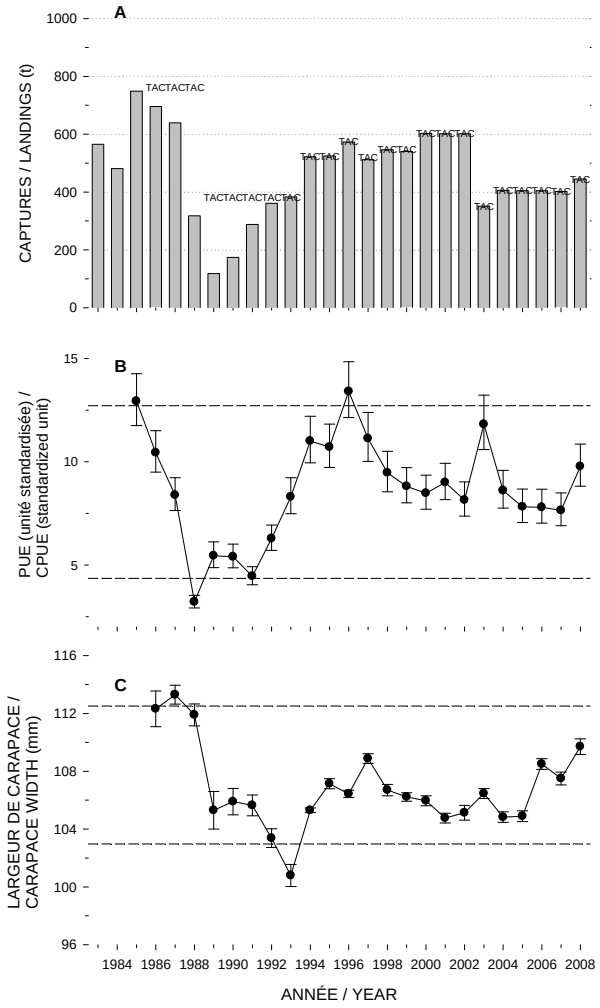
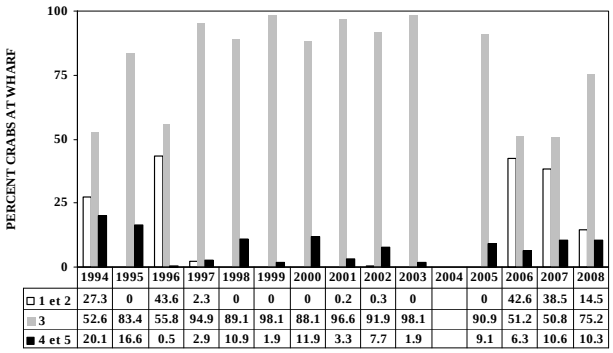


Figure 16. Main fishery parameters for Area 14, 1983–2008: A) landings and TAC; B) standardized CPUE ± confidence interval; and C) mean carapace width ± confidence interval for commercial crabs sampled at sea. The mean of the 3 lowest values and the mean of the 3 highest values, prior to 2008, are indicated by dotted lines in graphs B and C.



	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1 et 2	27.3	0	43.6	2.3	0	0	0	0.2	0.3	0		0	42.6	38.5	14.5
3	52.6	83.4	55.8	94.9	89.1	98.1	88.1	96.6	91.9	98.1		90.9	51.2	50.8	75.2
4 et 5	20.1	16.6	0.5	2.9	10.9	1.9	11.9	3.3	7.7	1.9		9.1	6.3	10.6	10.3

Figure 17. Carapace conditions for commercial crabs landed in Area 14 between 1994 and 2008.

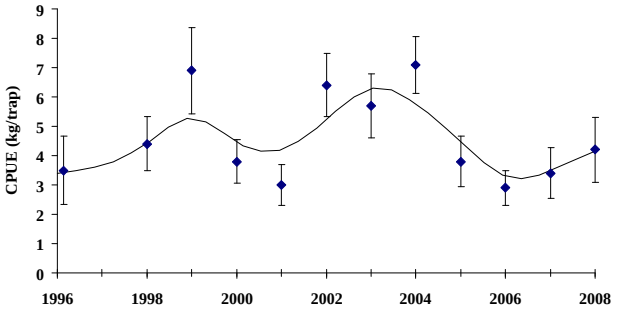


Figure 18. Catch rates (CPUEs) of adult crabs ≥ 95 with confidence interval from the postseason survey in Area 14, 1996– 2008.

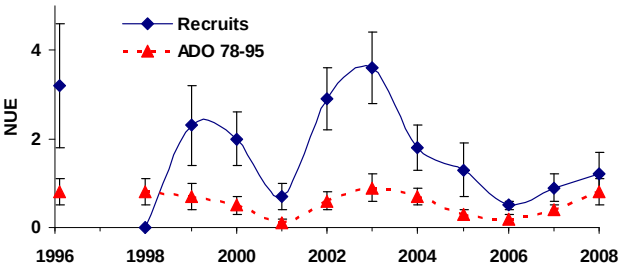


Figure 19. Catch rates (NUE) for recruits and adolescents between 78 mm and 95 mm, with confidence interval, from the postseason survey conducted in Area 14, 1996–2008.

Snow Crab in Area 13

Fishery Description

Area 13 has forty-three fishermen from Quebec and six from Newfoundland. This area was under moratorium from 2003 to 2007 as a result of a significant drop in biomass. An index fishery with an annual TAC of 50 t was nevertheless authorized in 2003, 2004 and 2006 (Figure 20A). The area was reopened to the commercial fishery in 2008 with a TAC of 150 t in 2008 and 2009. Preliminary landings totalled 138 t in 2008.

Resource Status in 2008

In 2006, during the last index fishery, the standardized CPUE were higher than in 2003 and 2004, which suggested a biomass improvement (Figure 20B). However, the 2006 fishery was conducted over a very small portion of the area. Therefore, results could not be compared with the period when the commercial fishery was fully active. In 2008, the mean CPUE of the commercial fishery was relatively high (Figure 20B) and the fishing effort was well distributed. Most of the crab landed were intermediate-shell (condition 3) and there no old crabs (condition 4 and 5) (Figure 21).

The abundance indices (NUE) obtained from **the scientific trap survey** were standardized to compare the results from beginning of the series in 1999. The mean standardized NUE for legal-size crabs from **the scientific trap survey** has been low and stable from 2001 to 2007 on the northern side and then increased in 2008, reaching a value above the series based on the available observations whereas on the south side, the NUE has remained high since 2006 (Figure 22). In 2008, on the northern side, the proportion of intermediate-shell crab (condition 3) in the traps was 75%, and 17% were old crabs (conditions 4 and 5). On the southern side, only new crabs (conditions 1 and 2) were reported in 2005, and the proportion of intermediate-shell crab (condition 3) increased until 2008, reaching 74%. The mean size of crab has remained stable since 2004 in both sectors: in 2008 it was 102.1 mm on the north side and 106.6 mm on the southern side. The mean NUE for recruits has been low since 2005 on the northern side (Figure 23) and decreased to a low value between 2007 and 2008 on the southern side (Figure 24). The mean NUE for adolescent crabs between 78 mm and 95 mm has remained weak in both sectors since 2003, despite increasing a little on the northern side in 2008 (Figure 23 and 24).

Primiparous female insemination levels showed a noticeable drop between 2003 and 2005, and then showed an upward trend. In 2008, this index suggested an average mating success.

The last **trawl survey** covering the northern part of Area 13 and the eastern part of Area 14 occurred in 2008 and showed that the abundance of adult legal-size crab (3.6 crab/10,000 m^2) and adolescent crab between 78 and 95 mm (5.6 crabs/10,000 m^2) was weak. The abundance of adolescents between 62 mm and 78 mm increased in 2008 (34.8 crabs/10,000 m^2) compared with 2006 (15.6 crabs/10,000 m^2). The abundance of males between 40 and 62 mm has increased considerably since 2004 to a relatively high value in 2008 (219.3 crabs/10,000 m^2), whereas those less than 40 mm significantly decreased from a reported maximum of 800 crab/10 000 m^2 in 2006 to 207.5 crab/10 000 m^2 in 2008. Based on the 2008 results, the next recruitment wave should last 3 years and would not arrive in the fishery until 2011 if the natural mortality and premature terminal moult rates are not too high and if growth is regular.

The abundance of primiparous females has increased considerably since 2004 in the trawl survey which provides hope for a strong productivity over the next 3 years if mating success is good.

Conclusions and Advice

The fishery was under moratorium from 2003 to 2007. A 150 t TAC was set for 2008 and 2009. Preliminary landings totalled 138 t in 2008.

Catch rates in 2008 were relatively high, both in the commercial fishery and in the postseason survey north and south, which suggests that the landings permitted for the 2008 season were well dispersed allowing the stock to develop.

Most of the harvested crabs in the fishery were of intermediate-shell size.

The mean size of harvested crab in the commercial fishery was 104 mm. It has varied only slightly since 2004 in the postseason surveys on the northern and southern sides.

Based on the results from the two postseason surveys, the abundance index of commercial crabs recruited to the population in 2008 and available to the fishery in 2009 was weak. It dropped significantly on the southern side. The abundance index of adolescent crabs measuring between 78 and 95 mm increased in the northern part of the area to a low level, and remained low in the southern part.

The results from the trawl survey conducted in the northern part indicate that the abundance indices for adolescent crabs measuring between 40 and 62 mm and between 62 and 78 mm have been increasing, which suggests a positive recruitment outlook in the long term if these crabs survive and don't have their terminal moult prior to reaching legal size.

The available information does not justify any change to the management plan established for the 2009 fishing season.

Snow Crab in Area 12A

Fishery Description

Area 12A has 10 regular licenses. The TAC dropped from 229 t in 2006 to 80 t in 2008 as a result of an overall decrease of commercial biomass abundance indices (Figure 25A). In 2008, the fishery opened on April 1st and closed on June 6th. The TAC wasn't met in 2008 due to management related issues. Landings totalled 73 t.

Resource Status in 2008

In the commercial fishery, the standardized CPUE was relatively stable between 1999 and 2005, and then dropped sharply between 2005 and 2007 and has remained at the same level in 2008 (Figure 25B). A majority of intermediate-shell crabs (condition 3) were landed in 2008 even though the proportion of new crab (conditions 1 and 2) increased significantly between

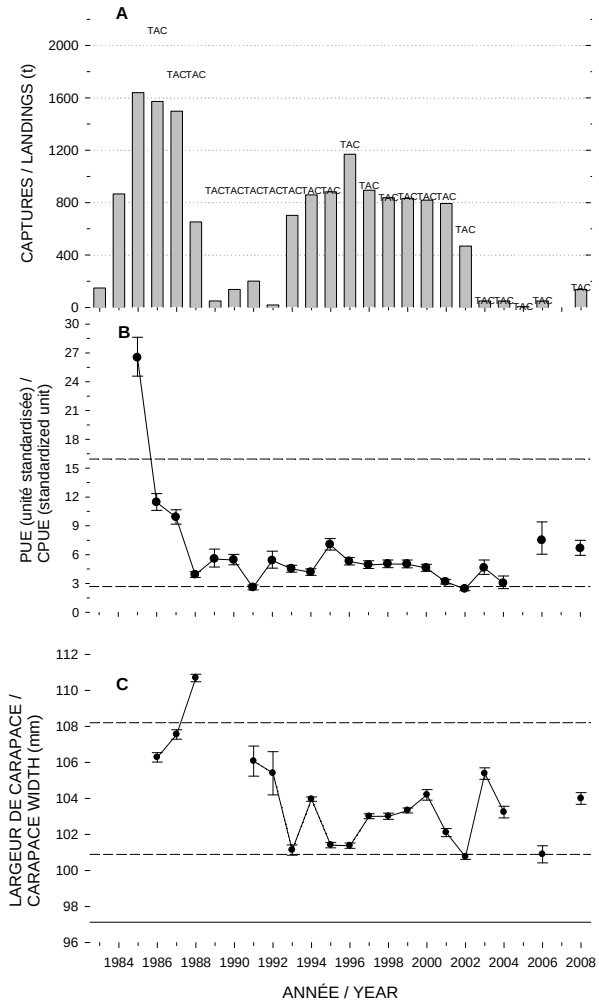
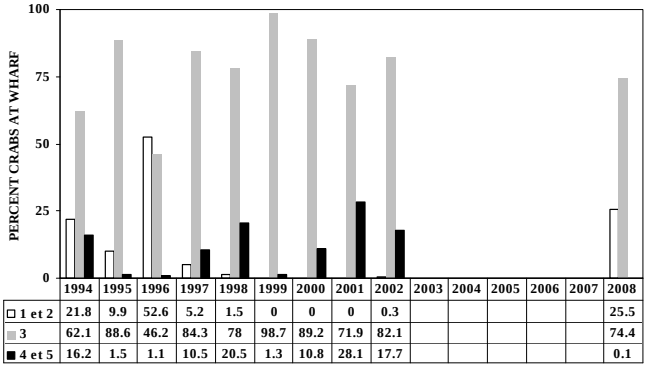


Figure 20. Main fishery parameters for Area 13, 1983–2008: A) landings and TAC; B) standardized CPUE ± confidence interval; and C) mean carapace width ± confidence interval for commercial crabs sampled at sea. The mean of the 3 lowest values and the mean of the 3 highest values, prior to 2008, are indicated by dotted lines in graphs B and C.



	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1 et 2	21.8	9.9	52.6	5.2	1.5	0	0	0	0.3						25.5
3	62.1	88.6	46.2	84.3	78	98.7	89.2	71.9	82.1						74.4
4 et 5	16.2	1.5	1.1	10.5	20.5	1.3	10.8	28.1	17.7						0.1

Figure 21. Carapace conditions for commercial crabs landed in Area 13 between 1994 and 2008.

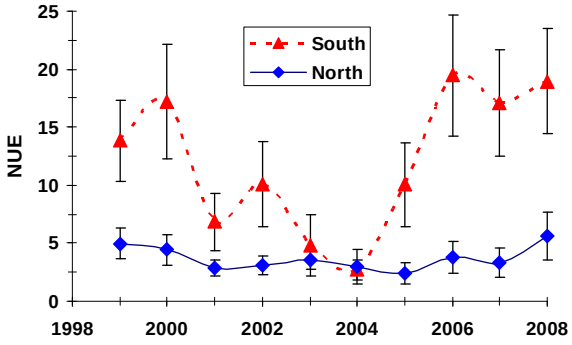


Figure 22. Catch rates (NUE) of adult crabs ≥ 95 with confidence interval from the postseason survey in Area 13 north and south, 1999– 2008.

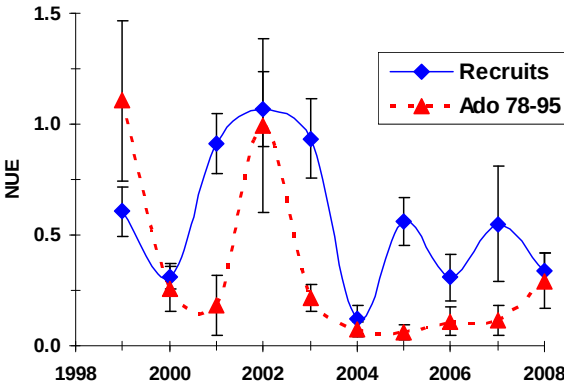


Figure 23. Catch rates (NUE) for recruits and adolescents between 78 mm and 95 mm, with confidence interval, from the postseason survey conducted in Area 13 North, 1999–2008.

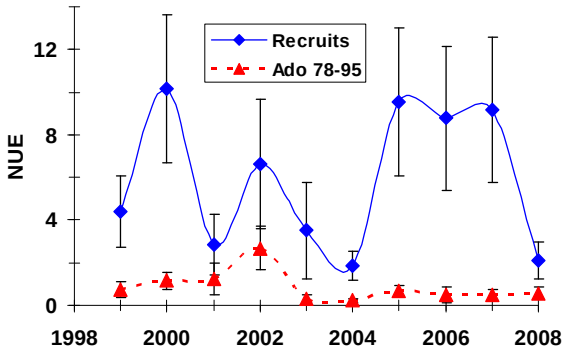


Figure 24. Catch rates (NUE) for recruits and adolescents between 78 mm and 95 mm, with confidence interval, from the postseason survey conducted in Area 13 South, 1999–2008.

2006 and 2008 (Figure 26). The mean size of legal-size crabs sampled at sea increased considerably from 2007 (106.4 mm) to 2008 (108.6 mm) (Figure 25C).

The **scientific trap survey,** which has been conducted since 2000, indicated that the mean CPUE peaked in 2004 and gradually decreased until 2007 (Figure 27). From 2007 to 2008, the CPUE increased suggesting that fishery landings and natural mortality did not exceed recruitment to the fishery. The proportion of intermediate-shell crab (condition 3), which had been dropping since 2004, increased sharply in 2008, but the proportion of new crabs (conditions 1 and 2) (32%) is still significant. Old crabs (conditions 4 and 5) only represented a small proportion of the catches. The mean size of legal-size adult male crabs dropped from 109.2 mm in 2005 to 103 mm in 2007 and increased slightly to 103.9 mm in 2008. The mean NUE for recruits in 2008 is near the 2001-2007 period mean, whereas adolescents between 78 mm and 95 mm CW increased from 2007 to 2008 (Figure 25).

It is important to note that crab abundance in Area 12A is partly due to the overlapping adjacent Area 17 in the west, and Area 12 in the east. Thus, the abundance indices of these two last areas are weak.

Conclusions and Advice

The TAC dropped from 229 t in 2006 to 80 t in 2008. Landings totalled 73 t in 2008.

The catch rate in the commercial fishery remained low but stable from 2007 to 2008. The catch rate in the postseason survey was higher in 2008 than in 2007, suggesting that the TAC decrease was sufficient in order to reach a certain balance between recruitment and total mortality.

The mean size of crab measuring 95+ mm increased in the fishery and in the postseason survey.

Based on the results from the 2008 postseason survey, the abundance index of commercial crabs recruited to the population in 2008 and available to the fishery in 2009 is at around the same level as between 2001 and 2007. The medium term recruitment outlook is positive because the abundance index for adolescent crab (78-95+ mm) is increasing.

Recommendation

Until a stronger recruitment is observed, a TAC similar to that of 2008 is recommended for 2009 in order to avoid a decrease in the commercial biomass.

Snow Crab in Area 12B

Fishery Description

In 2008, Area 12B had 8 commercial fishing licenses. The 214 t TAC introduced in 2006 and 2007 was renewed for 2008 (Figure 29A). In 2008, the fishery opened on March 15th and closed on May 24th. The TAC was not met in 2008 for management reasons and catches totalled 195 t.

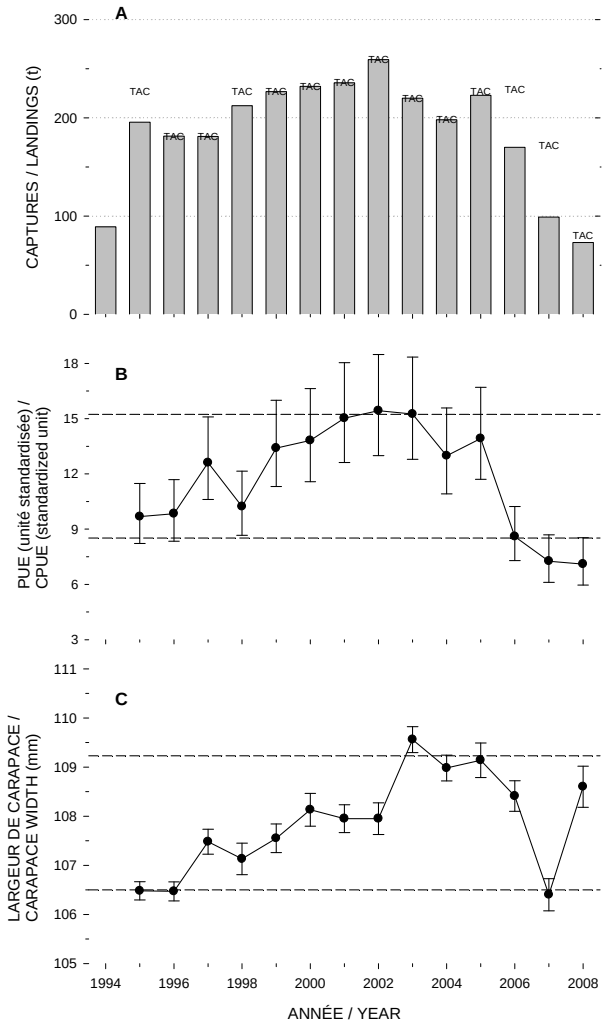
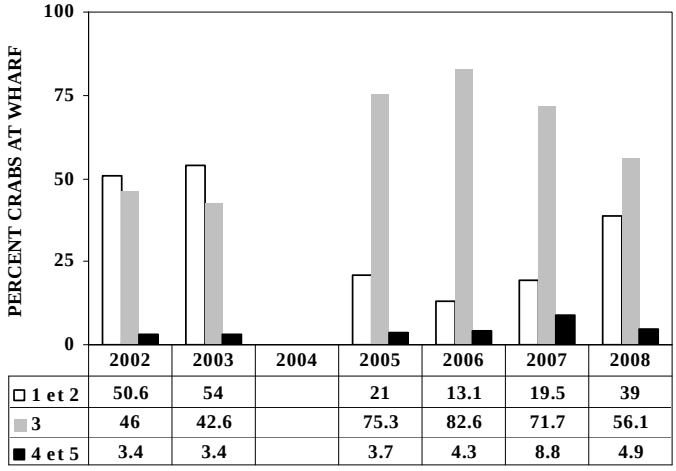


Figure 25. Main fishery parameters for Area 12A, 1995–2008: A) landings and TAC; B) standardized CPUE ± confidence interval; and C) mean carapace width ± confidence interval for commercial crabs sampled at sea. The mean of the 3 lowest values and the mean of the 3 highest values, prior to 2008, are indicated by dotted lines in graphs B and C.



	2002	2003	2004	2005	2006	2007	2008
1 et 2	50.6	54		21	13.1	19.5	39
3	46	42.6		75.3	82.6	71.7	56.1
4 et 5	3.4	3.4		3.7	4.3	8.8	4.9

Figure 26. Carapace conditions for commercial crabs landed in Area 12A between 2002 and 2008.

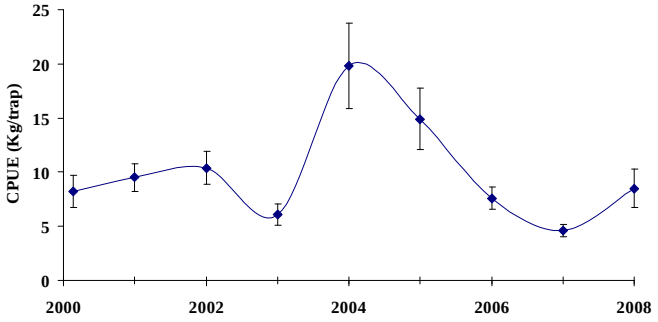


Figure 27. Catch rates (CPUE) of adult crabs ≥ 95 with confidence interval from the postseason survey in Area 12A, 2000– 2008.

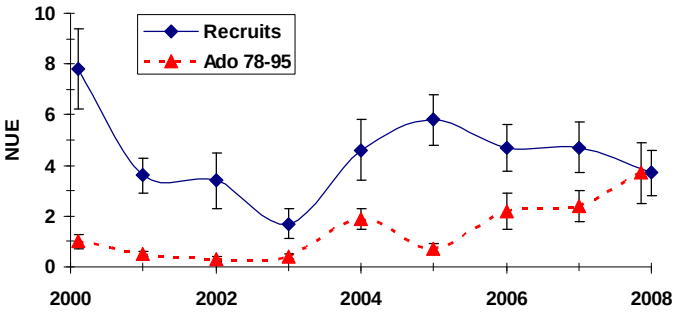


Figure 28. Catch rates (NUE) for recruits and adolescents between 78 mm and 95 mm, with confidence interval, from the postseason survey conducted in Area 12A, 2000–2008.

Resource Status in 2008

The standardized CPUE for the commercial fishery has been weak but stable since 2004 (Figure 29B). The stability of this biomass index could be attributed to reduced landings from 2002 to 2006 and by a low level until 2008. A majority of intermediate-shell crab (condition 3) was landed in 2008 (Figure 30) even though the proportion of new crab (conditions 1 and 2) increased (Figure 30). The mean size of legal-size crab measured at sea (Figure 29C) has been dropping since 2006 and reached the lowest level of the series in 2008, 106.5 mm.

The scientific trap survey conducted since 2001 (except in 2005) showed a sharp drop of the CPUE of legal-size crab from 2001 to 2003 and then stabilized up to 2007, followed by an increase in 2008 (Figure 31). In 2007 and 2008, catches were clearly higher around the center of the area. The proportion of intermediate-shell crab (condition 3), which had been dropping since 2004, increased in 2008 and represented nearly 48% of the catches whereas new crabs (conditions 1 and 2) represented 45% of the harvest. Old crabs (conditions 4 or 5) only accounted for 7% of the harvest. The mean size of legal-size adult crab has been dropping since 2006 and measured 105.2 mm in 2008, which was the lowest value of the series. The mean NUE for recruits dropped from 2007 to 2008 but remained relatively high, whereas the mean NUE for adolescents between 78 and 95 mm has been increasing since 2006 and represents the highest value of the series based on the available observations (Figure 32).

Conclusions and Advice

Since 2006, the TAC has been at 214 t. Landings in 2008 totalled 195 t.

Catch rates in the commercial fishery have been stable since 2004. Catch rates from the postseason survey were higher in 2008 than in 2007.

The mean size of crab measuring 95+ mm caught in the commercial fishery and in the postseason survey dropped in 2008 and is at the lowest level since 1995 for the fishery and since 2001 for the survey.

Based on the results from the postseason survey, the abundance index of commercial crabs recruited to the population in 2008 and available to the fishery in 2009 was slightly lower in 2008 than in 2007, but remains relatively high. The medium term recruitment outlook is positive because the abundance index for adolescent crab (78-95+ mm) is increasing.

Recommendation

In 2009, a small TAC increase of around 10% from 2008 is recommended.

Snow Crab in Area 12C

Fishery Description

Area 12C has five regular fishermen and features two banks (north and south sectors) separated by the deep channel of the Jacques-Cartier Strait. The TAC (Figure 33A) reached a maximum of 320 t in 2008, a 10% increase from 2007. Temporary allocations totalling 100 t were granted in 2008. The fishery opened on April 28th and closed on August 1st. The TAC was met.

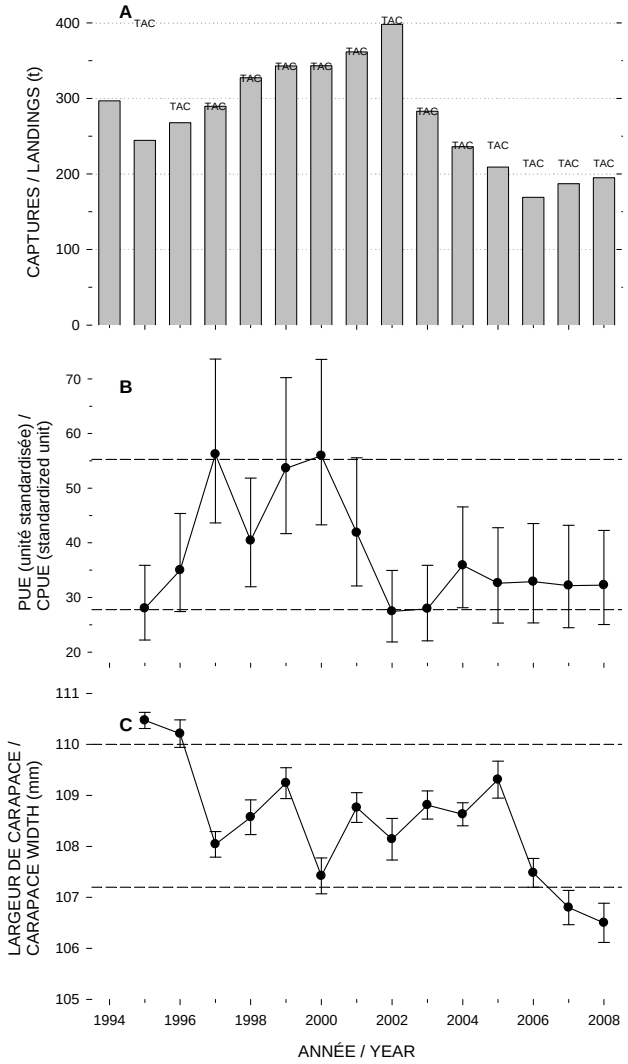
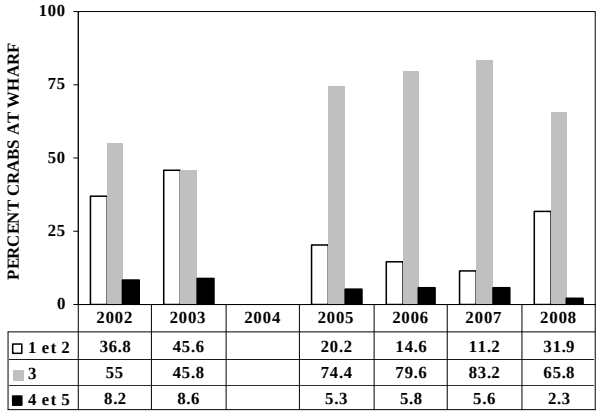


Figure 29. Main fishery parameters for Area 12B, 1994–2008: A) landings and TAC; B) standardized CPUE ± confidence interval; and C) mean carapace width ± confidence interval for commercial crabs sampled at sea. The mean of the 3 lowest values and the mean of the 3 highest values, prior to 2008, are indicated by dotted lines in graphs B and C.



	2002	2003	2004	2005	2006	2007	2008
1 et 2	36.8	45.6		20.2	14.6	11.2	31.9
3	55	45.8		74.4	79.6	83.2	65.8
4 et 5	8.2	8.6		5.3	5.8	5.6	2.3

Figure 30. Carapace conditions for commercial crabs landed in Area 12B between 2002 and 2008.

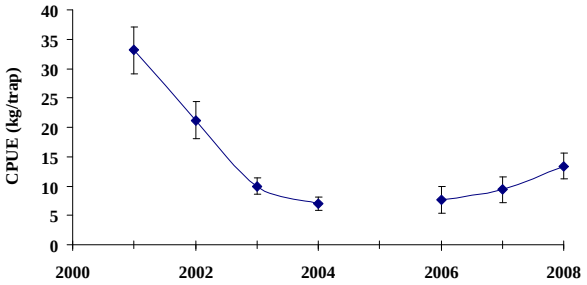


Figure 31. Catch rates (CPUE) of adult crabs ≥ 95 with confidence interval from the postseason survey in Area 12B, 2001– 2008 (except for 2005).

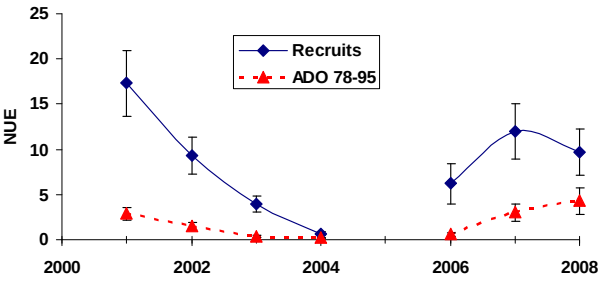


Figure 32. Catch rates (NUE) for recruits and adolescents between 78 mm and 95 mm, with confidence interval, from the postseason survey conducted in Area 12B, 2001–2008 (except for 2005).

Resource Status in 2008

The standardized CPUE for the commercial fishery, which plummeted between 1996 and 1997, remained at relatively low values (except for 2001) until 2007 before increasing in 2008 (Figure 33B). The proportion of intermediate-shell crab (condition 3) dropped from 2005 to 2007 and represented only 26% of the crabs at landing, and then it increased in 2008 to a proportion of 53%. New crabs (conditions 1 and 2) have represented a significant proportion of the landings since 2006 and accounted for 45% in 2008 (Figure 34). The mean size of legal-size crab measured at sea has been increasing since 2002 and reached 114.1 mm in 2008, which was the highest value since 1997 (Figure 33C). Since 2006, the fishing effort has been more concentrated in the northern part of the area than in previous years.

The scientific trap survey conducted since 2000 shows a drop in the mean CPUE since 2005 (Figure 35). The mean size of legal-size adult crab has remained high from 2007 (110.6) to 2008 (110.4). Since 2004, the mean NUE for recruits and adolescents measuring between 78 and 95 mm has been low (Figure 36).

Conclusions and Advice

The TAC increased by 10% to 320 t from 2007 to 2008.

The catch rate from the commercial fishery increased but the postseason survey rate dropped.

From 2007 to 2008, the mean size of crab caught in the commercial fishery increased and is high, whereas in the postseason survey it remained stable and high.

Since 2006, a significant proportion of new crab has been landed. Based on the results from the postseason survey, the abundance index of commercial crabs recruited to the population in 2008 and available to the fishery in 2009 dropped sharply compared to 2007, and the abundance index for adolescent crab (78-95 mm) increased slightly but remains low.

Recommendation

Because the abundance indices dropped in the postseason survey, the status quo is recommended for the 2009 TAC.

Snow Crab in Area 16A

Fishery Description

Area 16A is accessible to the 43 Quebec fishermen holding a snow crab fishing licence in Area 13. In 2007 and 2008, the TAC was 370 t (Figure 37A) and it was met. The fishery opened on April 21st and closed on July 26th.

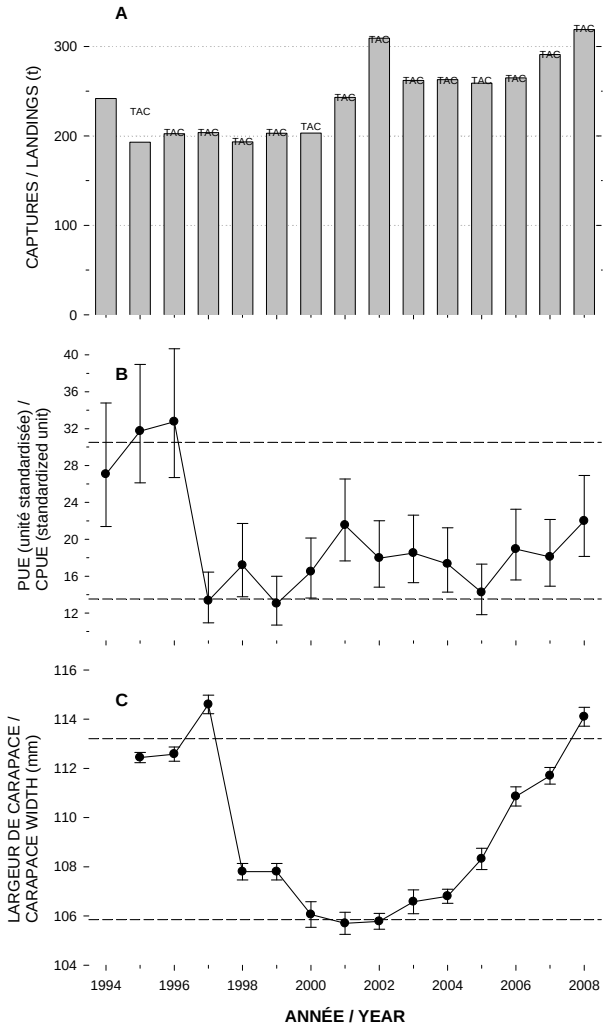
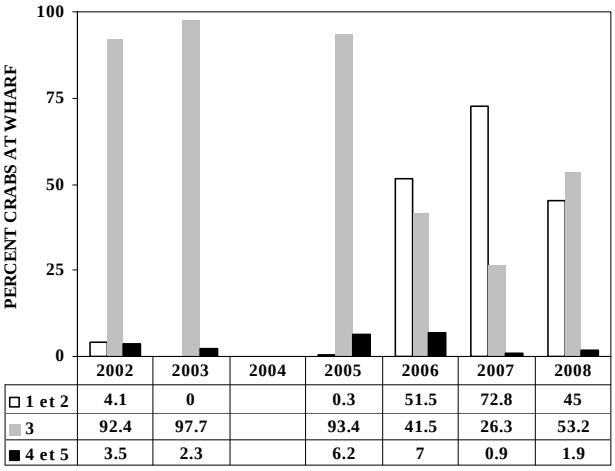


Figure 33. Main fishery parameters for Area 12C, 1994–2008: A) landings and TAC; B) standardized CPUE ± confidence interval; and C) mean carapace width ± confidence interval for commercial crabs sampled at sea. The mean of the 3 lowest values and the mean of the 3 highest values, prior to 2008, are indicated by dotted lines in graphs B and C.



	2002	2003	2004	2005	2006	2007	2008
1 et 2	4.1	0		0.3	51.5	72.8	45
3	92.4	97.7		93.4	41.5	26.3	53.2
4 et 5	3.5	2.3		6.2	7	0.9	1.9

Figure 34. Carapace conditions for commercial crabs landed in Area 12C between 2002 and 2008.

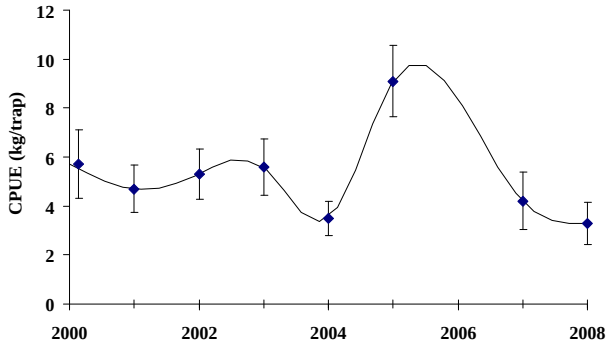


Figure 35. Catch rates (CPUE) of adult crabs ≥ 95 with confidence interval from the postseason survey in Area 12C, 2000– 2008.

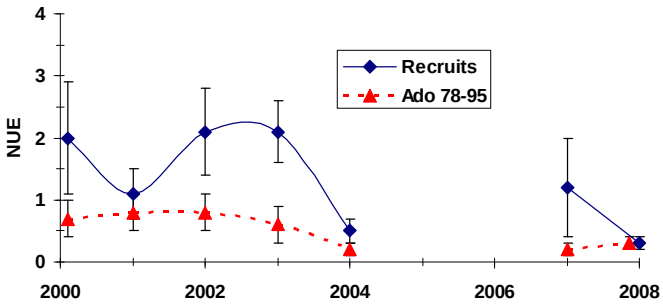


Figure 36. Catch rates (NUE) for recruits and adolescents between 78 mm and 95 mm, with confidence interval, from the postseason survey conducted in Area 12C, 2000–2008.

Resource Status in 2008

In the fishery, the CPUE was relatively stable from 2002 to 2006 and then increased slightly in 2007 and 2008 (Figure 37B). In the landings, the proportion of intermediate-shell crab (condition 3) dropped from 2005 to 2007 and then increased in 2008 to reach nearly 70%. Since 2006, the proportion of new crabs (conditions 1 and 2) has been relatively significant whereas the proportion of old crabs (conditions 4 and 5) has been very low since 2005 (Figure 38). The mean size of legal-size crab at sea has been increasing since 2004 and measured 112.3 mm in 2008 (Figure 37C).

The postseason trap survey, conducted since 2002, showed little CPUE variation for legal-size crab up to 2007, except for 2005 when it increased by 63%. From 2007 to 2008, the mean CPUE for legal-size crab increased slightly (Figure 39). The mean size of adult crab measuring 95+ mm increased between 2003 and 2006 to over 110 mm, and then remained stable until 2008 at 110.7 mm. The mean NUE for recruits has been dropping since 2003 and is now at its lowest value of the series. For adolescents, it was very low in 2006 and 2007, but then increased in 2008 (Figure 40).

Conclusions and Advice

Landings and TAC remained stable in 2007 and 2008 at 370 t.

From 2007 to 2008, the catch rate increased both in the commercial fishery and in the postseason survey.

From 2007 to 2008, the mean size increased in the commercial fishery and it remained stable and high in the postseason survey.

Based on the results from the postseason survey, the abundance index of commercial crabs recruited to the population in 2008 and available to the fishery in 2009 dropped while the abundance index for adolescents (78-95 mm) increased from 2007 to 2008.

Recommendation

A TAC increase of around 10% from 2008 is recommended for 2009.

Sources of Uncertainty

The quality of science advice depends mainly on the accuracy of the parameters obtained through sampling and the subsequent analyses. Information obtained from logbooks and purchase slips during the fishing season affects the accuracy of the parameters that are derived from these documents. For instance, abundance indices and fishing effort calculations obtained from logbooks may include errors that will affect the science advice provided. The selectivity and catchability of traps can vary depending on the type of trap used and trap volume and mesh size, the amount and quality of bait used and soak time, which can vary with the fishing strategies employed and the prevailing environmental conditions. The catchability of adolescent crabs and recruits could also be affected by the occurrence rate of intermediate-size crabs (condition 3) on the seafloor. The selective sorting of catches can also affect the quality of the data obtained.

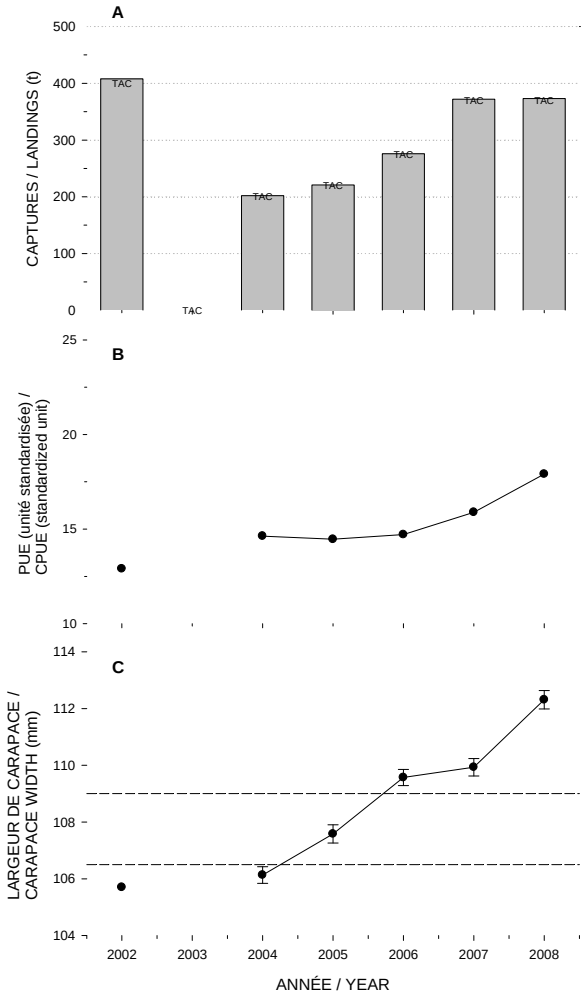
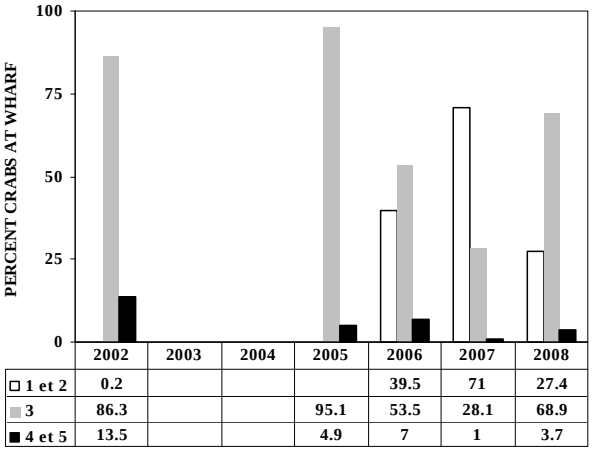


Figure 37. Main fishery parameters for Area 16A, 2002–2008: A) landings and TAC; B) CPUE; and C) mean carapace width ± confidence interval for commercial crabs sampled at sea. The mean of the 3 lowest values and the mean of the 3 highest values, prior to 2008, are indicated by dotted lines in graph C.



	2002	2003	2004	2005	2006	2007	2008
1 et 2	0.2				39.5	71	27.4
3	86.3			95.1	53.5	28.1	68.9
4 et 5	13.5			4.9	7	1	3.7

Figure 38. Carapace conditions for commercial crabs landed in Area 16A between 2002 and 2008.

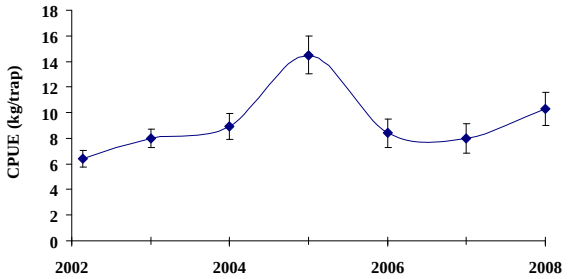


Figure 39. Catch rates (CPUE) of adult crabs ≥ 95 with confidence interval from the postseason survey in Area 16A, 2002–2008.

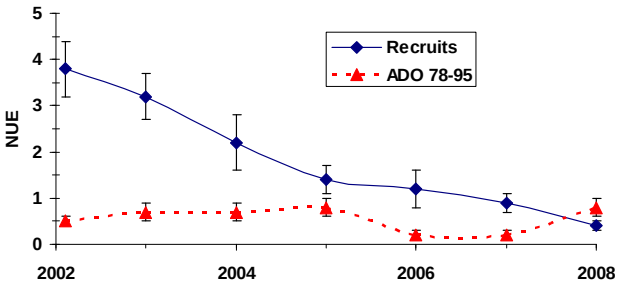


Figure 40. Catch rates (NUE) for recruits and adolescents between 78 mm and 95 mm, with confidence interval, from the postseason survey conducted in Area 16A, 2002–2008.

The abundance and condition indices and the estimates of crab size that are obtained from the trawl and trap surveys depend on the type of gear used and are affected by uncertainties related to catchability variations in the different crab groups targeted. Some types of fishing gear are better suited to given seafloor areas than are other gear types and this factor influences the spatial coverage that is ultimately sampled. The biological characteristics of snow crab can in themselves create sources of uncertainty that impinge on the science advice. For instance, the terminal moulting phase, which occurs at various sizes, will affect crab condition and catchability. Natural mortality can also vary with the life stage and condition of the crabs.

SOURCES OF INFORMATION

Dufour, R. and J.-P. Dallaire 2003. Status of snow crab populations in the St. Lawrence Estuary and the Northern Gulf of St. Lawrence from 1999 to 2001. DFO Can. Sci. Advis. Sec., Res. Doc. 2003/048.

DFO, 2007. Assessment of the Estuary and Northern Gulf of St. Lawrence (Areas 13 to 17 and 12A, 12B and 12C) Snow Crab Stocks in 2007. DFO Can. Sci. Advis. Sec., Sci. Advis. Rep. 2008/043.

FOR MORE INFORMATION

Contact: Jean Lambert
Maurice Lamontagne Institute
850, route de la Mer
Mont-Joli (Quebec)
G5H 3Z4

Tel: (418) 775-0717
Fax: (418) 775-0740
E-mail: Jean.Lambert@dfo-mpo.gc.ca

This report is available from the:

Centre for Science Advice (CSA)
Quebec Region
Fisheries and Oceans Canada
Maurice Lamontagne Institute
P.O. Box 1000, Mont-Joli
Quebec (Canada)
G5H 3Z4

Telephone: (418) 775-0825
Fax: (418) 775-0679
E-Mail: Bras@dfo-mpo.gc.ca
Internet address: www.dfo-mpo.gc.ca/csas

ISSN 1919-5079 (Print)
ISSN 1919-5087 (Online)

La version française est disponible à l'adresse ci-dessus.

CORRECT CITATION FOR THIS PUBLICATION:

DFO. 2009. Assessment of the Estuary and Northern Gulf of St. Lawrence (Areas 13 to 17, 12A, 12B, 12C and 16A) Snow crab stocks in 2008. DFO Can. Sci. Advis. Sec., Sci. Advis. Rep. 2009/027.