

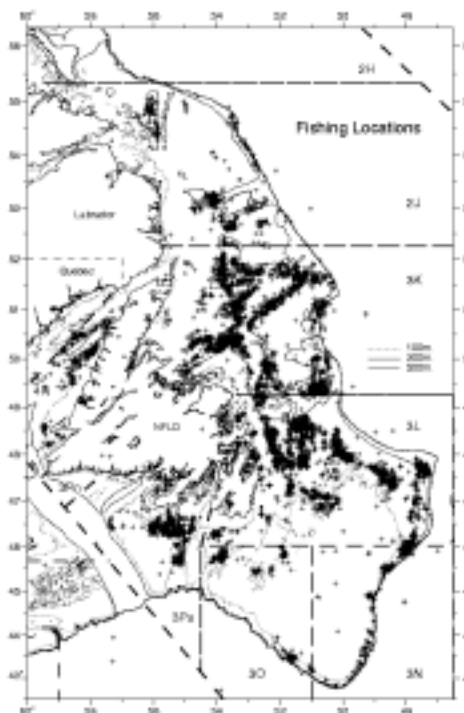
Newfoundland and Labrador Snow Crab Stock Status Update

Introduction

The snow crab fishery is managed within a three-year (1999-2001) integrated plan. Stock status was assessed prior to implementation of the plan (DFO, 1999), providing the basis for TAC determination.

A decrease in exploitable biomass projected for Div. 2J3KLNO for 2000 led to a reduction in the overall TAC from 60,650 t to 51,062 t. TAC's were reduced only in Div. 2J3KLNO (from 51,620 t to 42,032 t) while they remained unchanged for Subdiv. 3Ps (7,700 t) and 4R (1,330 t).

A fully-detailed review of the status of this resource was documented in 2000 (DFO 2000), and this report represents an interim update. The interim review, conducted in March 2001, compared the 2000 fishery and research data with those of previous years to determine whether or not significant changes in stock status have occurred.



Summary

Landings from all areas increased steadily from the late 1980's to a record high of 69,200 t in 1999. They decreased by 20% to 55,600 t in 2000.

Division 2J3KLNO

- Landings increased from 6,000 t in 1987 to 59,600 t in 1999. They decreased by 23% to 46,100 t in 2000 while the TAC was reduced by 19%. Inshore landings have accounted for 17% of the total during each of the past three years.

- Commercial catch rates from offshore fleets increased in the late 1980's and early 1990's and have remained high in recent years, reflecting recent high commercial biomass relative to the mid 1980's.
- The ratio of the commercial catch to an exploitable biomass index for offshore areas, which is projected from the fall survey of the previous year, decreased by 26% between 1996-1997 but increased steadily since then, doubling during 1997-2000. While exploitation has been increasing, the actual rate is unknown.
- Overall, the fall survey biomass index of legal-sized crabs in 2000 was lower than that for the 1996-1998 period, and generally similar to that in 1999.
- The fall survey biomass index of 76-94 mm small-clawed males (immediate prerecruits) was similar in 2000 to that in 1999 at about half the 1997-1998 level.
- The exploitable biomass for 2001 is projected to remain similar to that of 2000, at a lower level than during 1997-1999.
- Recruitment prospects in the medium and longer terms are uncertain.
- Factors that affect commercial biomass include recruitment, growth, exploitation, discard mortality, bitter crab disease, environmental variation, predation, and cannibalism.

Subdivision 3Ps

- Landings increased from 600 t when the fishery began in 1987 to 7,900 t in 1999 and remained similar (7,920 t) in 2000.
- The offshore commercial catch rate was relatively stable during 1987-1991, increased steadily through the 1990's, and has remained high since 1996.
- Data from spring bottom trawl surveys in Subdivision 3Ps are unreliable. Resource status and prospects are uncertain because of the lack of fishery independent data.

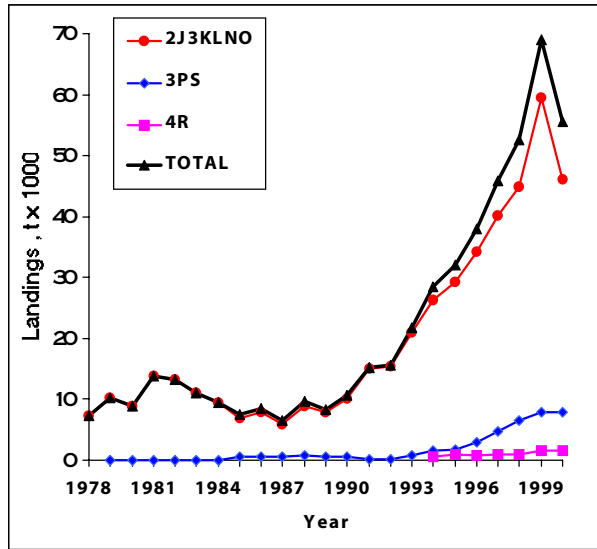
Division 4R

- Landings increased from 650 t when the fishery began in 1994 to 1,610 t in 1999 and remained virtually unchanged (1,640 t) in 2000.
- The commercial catch rate in Division 4R has remained stable over the past 3 years at a lower level than in other divisions.
- Resource status and prospects are uncertain because of the lack of fishery independent data.

Div. 2J3KLNO

Commercial Fishery

Landings increased from 6,000 t in 1987 to 59,600 t in 1999 due primarily to increases in TAC's. Landings frequently exceeded TAC's because of additional special exploratory allocations.



The TAC was set at 51,620 t in 1999, the first year of the current management plan, but was reduced by 19% to 42,032 t for 2000, due to a projected decrease in exploitable biomass. Meanwhile, landings decreased by 23% to 46,100 t in 2000, due to reductions in TAC and exploratory allocations.

Inshore landings have accounted for 17% of the total during each of the past three years.

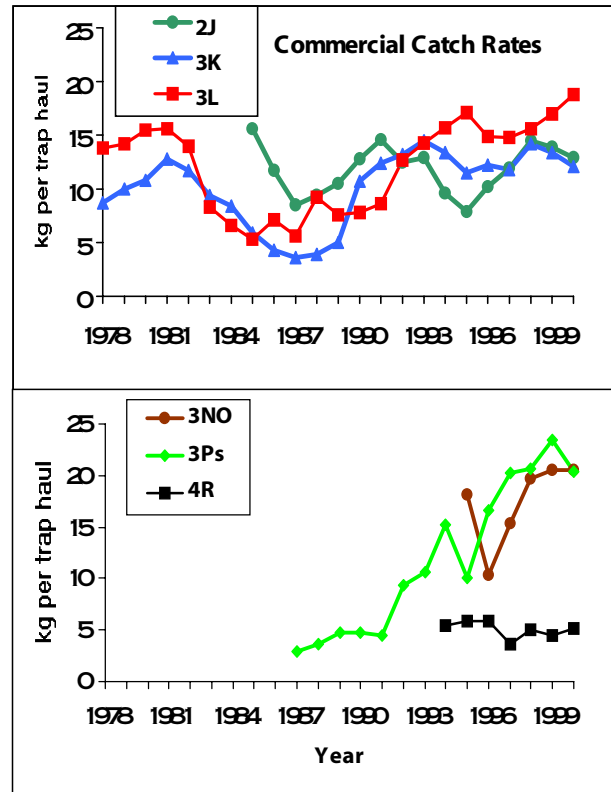
Resource Status

Because of changes in management measures as well as spatial and temporal changes in fishing practices, slight year-to-year changes in **catch rates** may not reflect changes in stock status. Also, the fishery is prosecuted within a limited depth range, so fishery trends may not be representative of the entire population. However, it is possible to interpret catch rates in the context of longer-term trends.

Commercial catch rates increased in the late 1980's and early 1990's and have remained high in offshore areas in recent years. This reflects recent high commercial biomass relative to the mid 1980's. Although offshore catch rates declined from 1999 to

2000 in all divisions except 3L, they remained at the generally high level observed since the mid 1990's.

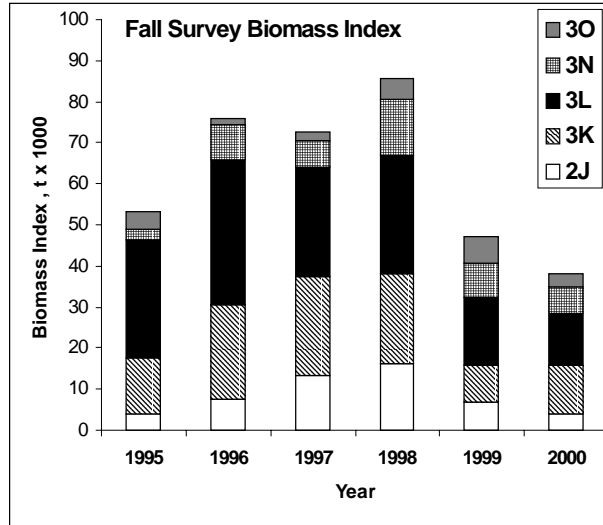
Research trap catch rates in two of three local inshore Div. 3L fishing areas show a recent decline. This suggests local declines in biomass within Div. 3L.



The **fall survey (post-fishery) biomass index** of legal-sized crabs, which was relatively stable at 73,000-86,000 t during 1996-1998, decreased to 47,000 t in 1999 and 38,000 t in 2000.

The biomass index of 76-94 mm small-clawed males (immediate prerecruits) in 2000 remained similar to that of 1999, at about half the 1997-1998 level.

Survey catches of 40-75 mm males have generally been low relative to those of larger and smaller crabs. This may reflect effects of lower trawl catchability for this size range than for larger and smaller crabs.



Males smaller than 40 mm steadily declined during 1995-1999 but increased in 2000.

The biomass index of mature females declined sharply during 1995-1997 and remained low during 1998-2000. This suggests reduced egg production.

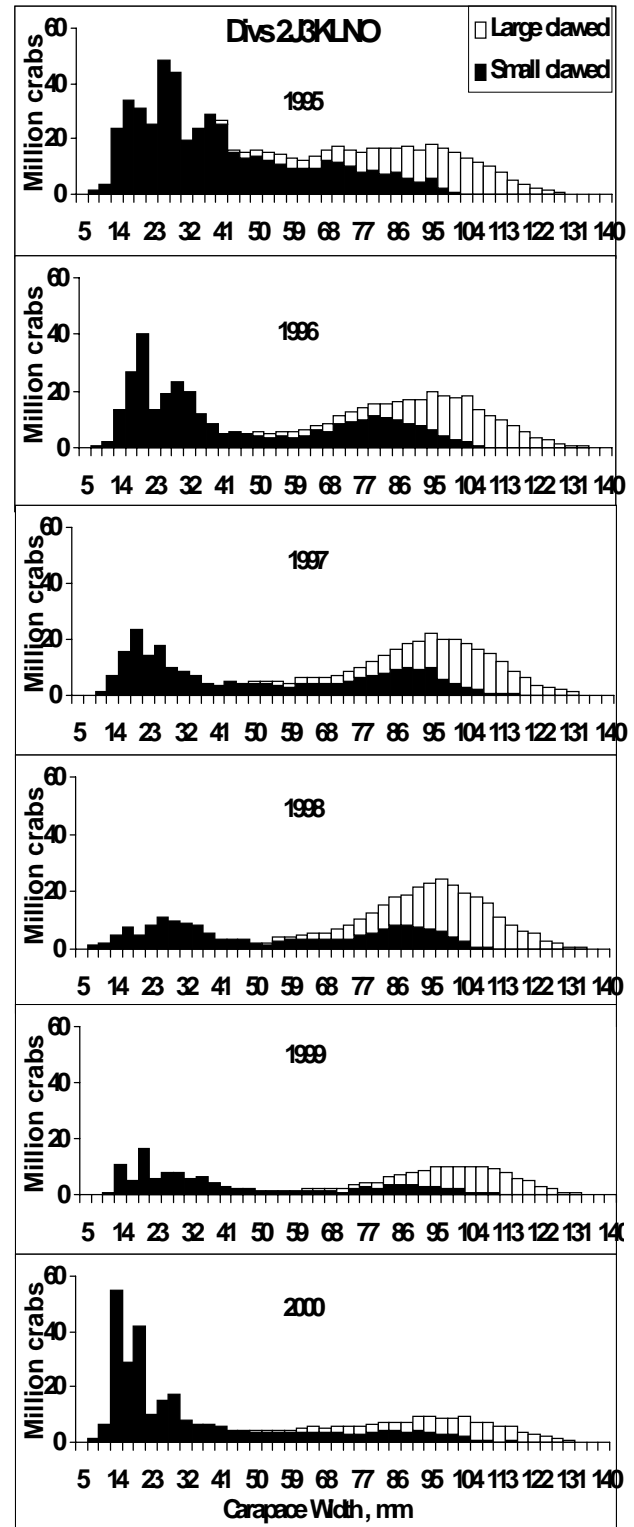
The declines in males smaller than 75 mm and in females are not associated with mortalities caused by the fishery.

Size distributions from Div. 2J3KLNO fall surveys reflect the stable commercial (crabs of 95 mm and larger) biomass levels during 1996-1998 and the lower levels in 1999 and 2000. They also reflect the reduced biomass of prerecruits (small-clawed males of 76-94 mm) in 1999-2000 compared to 1996-1998 and hence the reduced recruitment to legal size projected for both 2000 and 2001.

Whereas the decrease in biomass and abundance-at-size indices between 1998 and 1999 was consistent across all divisions, the direction of change was inconsistent among divisions between 1999 and 2000.

Indices for legal-sized, prerecruit and the smallest males increased in 2000 in Div. 3K. These increases followed two years of

decline for largest crabs and four years of decline for smallest crabs. That the apparent increase in abundance in Div. 3K in 2000 occurred across all sizes, strongly suggests a year effect on catchability of the survey trawl.



In divisions 2J and 3L, the indices for legal-sized and prerecruit crab declined in 2000. The declines in Div. 3L may be linked to limitations in survey coverage that resulted in relatively imprecise estimates for 2000.

The 2000 survey suggested an increase in the abundance of small males (<40 mm) in Div. 2J.

There was a 44% decline in the **projected exploitable biomass** across all divisions for 2000 compared to that projected for 1999. Based on the 2000 survey results, a further 22% decline is projected for 2001 although the interpretation of the survey trends discussed above makes it difficult to determine whether this is biologically meaningful or a year effect in the surveys.

The contribution to the 2001 exploitable biomass of recently-molted (new-shelled) crabs, by both prerecruit and legal-sized small-clawed crabs, is projected to increase from 33% in 2000 to 40% in 2001.

The ratio of commercial catch to the projected exploitable biomass index for offshore areas decreased by 26% between 1996 and 1997. It subsequently increased steadily, so that it was 50% higher than the 1996 ratio in 2000. Although exploitation has been increasing, the actual rate is unknown.

This increase in exploitation rate is believed to have had minimal impact on reproductive potential, which is protected through other management regulations.

There has been a broadly distributed incidence of **bitter crab disease** (BCD) during 1996-2000. This disease, which is fatal to crabs, appears to be acquired during molting. The fall bottom trawl surveys indicate that it occurs in Div. 2J3KL,

especially in 30-80 mm crabs of both sexes, but appears to be virtually absent in Div. 3NO. Although spatial and temporal trends are unclear, BCD may have imposed significant natural mortality. Highest BCD prevalence appeared to be in Div. 3K during 1996-1998, in Div. 2J in 1999, and in Div. 3K again in 2000, although at lower levels than during 1996-1998.

Bottom water **temperatures** have increased since 1995. The effects of such environmental variation on larval supply, mortality, catchability, growth, and size-at-adulthood are unknown.

The abundance of **predatory groundfish** species has remained low since the early 1990's but the implications for mortality are unknown.

Handling practices have reportedly improved in 2000, implying reduced mortality on released crabs.

Sources of Uncertainty

Factors that contribute to uncertainty in annual survey results have been described previously (DFO, 2000). In addition to those variables, there are sources of uncertainty pertaining to interpretation of the 2000 survey results compared to the 1999 results as described above.

Differences among divisions in the direction and magnitude of changes as well as in survey coverage contribute additional uncertainty. The apparent increase in abundance in Div. 3K in 2000 occurred across all sizes, strongly suggesting a year effect on catchability of the survey trawl.

The reliability of survey catch rates of the intermediate size group (40-75 mm) as an indicator of future recruitment is suspect due

to uncertainties surrounding their catchability in the survey trawl. High spatial variation in the distribution of males smaller than 40 mm leads to uncertainty regarding long-term recruitment prospects

The increased dependence of the exploitable biomass on recruitment introduces increased uncertainty for 2001 because proportions molting and surviving are unknown and variable.

The recent reduction in females and hence egg production is a source of uncertainty with regard to longer-term prospects for the resource.

Outlook

The 2000 survey results support the previous conclusion that a decline in the exploitable biomass occurred after 1999. However, the uncertainty in interpreting the changes in survey indices within and among divisions between 1999 and 2000 makes it difficult to determine if the differences between the 1999 and 2000 fall survey results are real or represent inter-annual survey variability. Thus it can be concluded that, overall, the post-fishery status of the resource in 2000 was lower than that for the 1996-1998 period, and probably similar to that in 1999. Also, the exploitable biomass for 2001 is expected to be similar to that of 2000.

Subdivision 3Ps

Commercial Fishery

Landings increased from 600 t when the fishery began in 1985 to about 7,900 t in 1999 and remained similar (7,920 t) in 2000. The TAC was constant in 1999 and 2000, at 7,700 t. TAC's have been reached or exceeded each year. Inshore landings have accounted for about 45% of the total during

1999 and 2000. Landings from the French Fishery have reportedly been in the range of 500-650 t during 1999 and 2000.

Resource Status

The offshore **commercial catch rate** was relatively stable during 1987-1991, increased steadily through the 1990's, and decreased in 2000, while remaining at the generally high level maintained since 1996.

Bottom trawl surveys in Subdivision 3Ps are unreliable for interpreting trends in biomass because these surveys are executed in spring when molting and mating occurs, and a large portion of the population is poorly represented in survey trawl catches.

Outlook

The commercial catch rate in 2000 remained at a high level. There are no indications that the status of the crab resource in this area has changed. Prospects for the future are uncertain because of the lack of reliable survey data.

Division 4R

Commercial Fishery

Landings increased from 650 t when the fishery began in 1994 to 1,060 t in 1998. They further increased to 1,610 t in 1999 due to TAC increases and remained virtually unchanged (1,640 t) in 2000. The TAC was constant in 1999 and 2000, at 1,330 t. TAC's have not been reached in some years.

Resource Status

The **commercial catch rate** in Division 4R has remained stable over the past 3 years at a lower level than in other divisions.

There are no **research data** available from this division.

Outlook

Commercial catch rates do not suggest any change in resource status. Prospects for the future are uncertain because of the lack of any fishery-independent data.

Management Considerations

Actual exploitation rates are unknown because the catchability of the survey trawl is unknown. The steady increase in the proportion of the exploitable biomass harvested in Div. 2J3KLNO over the past three years does not cause concern because exploitation rate is expected to increase during a period of declining recruitment without impact on reproductive potential.

Reproductive potential is protected by conservation measures that exclude females and males smaller than 95 mm, including a portion of the adult (large-clawed) males, from the fishery. Therefore the recent increase in exploitation rate is believed to have had minimal impact on reproductive potential.

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Summary of snow crab resource status-2J3KLNO

THE FISHERY	
Catch	Decreased by 23% from 59,600 t in 1999 to 46,100 t in 2000 while the TAC decreased by 19%. TAC's have been reached each year.
Effort	The number of trap hauls in offshore areas more than doubled from 1987 to 1998. It further increased by 35% in 1999, and decreased by 22% in 2000.
Conservation measures	There is no fishery on females or on males smaller than 95 mm, including a portion of the adult (large-clawed) males; this protects reproductive potential. Unknown mortality on released under-sized (<95 mm) males.
Discards	Small legal-sized (95-101 mm), and soft-shelled males are subject to discarding and an unknown associated mortality.
Impact of other fisheries	Unquantified bycatch in groundfish gillnet fisheries and unknown mortalities associated with trawl fisheries.

INDEX	OBSERVATION	INTERPRETATION	EVALUATION
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FISHERY DATA			
CPUE-kg/trap haul	Increased in late 1980's and has remained high during 1992-2000.	High commercial biomass relative to the mid 1980's	+
Spatial pattern	Effort expanded in the 1980's-1990's and has been broadly distributed in recent years.	Prospects for further expansion are limited. Annual changes affect CPUE and introduce uncertainty.	?
Temporal pattern	Apr-Dec fishery; little effort after July since 1998.	Annual changes affect CPUE and introduce uncertainty.	?

RESEARCH DATA			
Distribution	Broadly distributed throughout the fall survey area.	Reflects large area of suitable habitat.	+
Biomass index	Fall biomass index (t x 1000) of >94 mm males decreased from 73-86 during 1996-1998 to 47 in 1999 and 38 in 2000.	Decrease in commercial biomass.	-
Immediate recruitment	Fall biomass index of 76-94 mm small-clawed males in 1999 and 2000 was about half the 1997-1998 level.	Decrease in immediate prerecruits.	-
Mid-term recruitment	Index of 40-75 mm small-clawed males decreased during 95-99 and increased during 2000.	Reliability of index as an indicator for future recruitment is suspect.	?
Long-term recruitment	Fall biomass index of males smaller than 40 mm declined throughout 1995-1999 and increased in 2000.	High spatial variation leads to uncertainty regarding long-term recruitment prospects.	?
Bitter crab disease	Occurs in 2J3KL, especially in 30-80 mm crabs of both sexes. Spatial and temporal trends unclear.	May have imposed significant mortality.	?
Females	Fall biomass index of mature females declined sharply during 1995-1997 and remained low during 1998-2000.	High spatial variability leads to uncertainty.	?

OTHER DATA			
Industry perception			
Predation	Abundance of predatory groundfish species low during the 1990's but cannibalism may occur.	Mortality implications unknown.	?
Environmental Index	Increased temperatures since 1995 could affect growth, mortality and size-at-adulthood.	Uncertainty	?

ASSESSMENT			
Exploitation Rate	Ratio of catch to projected biomass index steadily increased from 0.31 in 1997 to 0.63 in 2000.	Reflects increased exploitation.	
Stock status	Current: Appears favourable from fishery data, but fall survey indicates reduced commercial biomass.	?	
	Prospects: Continued lower commercial biomass relative to 1996 - 1998 levels. Recruitment beyond 2001 is uncertain.	?	

Concerns regarding future prospects	-
Uncertainty regarding index quality or impact	?
Positive evaluation	+