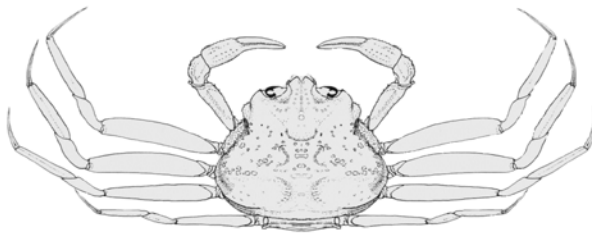




Newfoundland Region

Stock Status Report C2-01 (2002)



Newfoundland and Labrador Snow Crab

Background

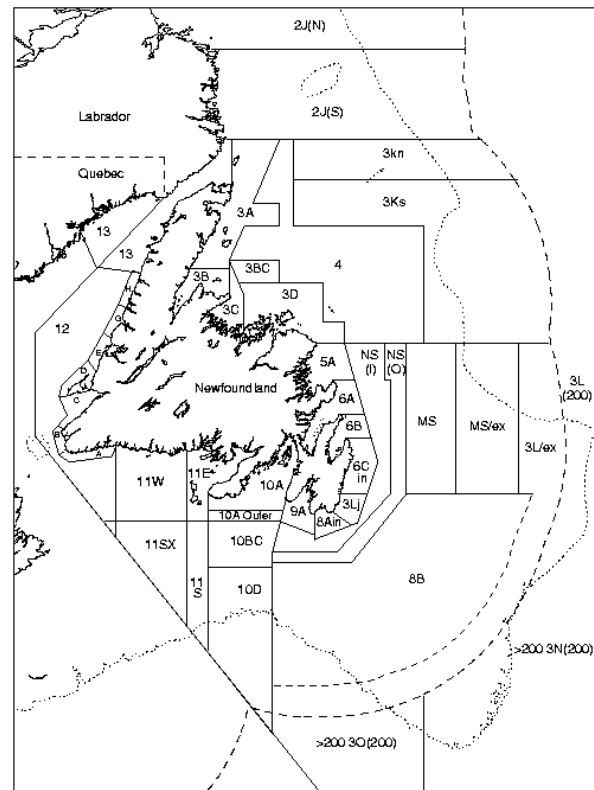
Snow crab occur over a broad depth range in the Northwest Atlantic from Greenland to the Gulf of Maine. Distribution in waters off Newfoundland and southern Labrador is widespread but stock structure is unclear. Commercial sizes are most common on mud or mud/sand, while smaller crabs are also common on harder substrates. Snow crab diet includes fish, clams, polychaete worms, brittle stars, shrimp, snow crab, and other crustaceans. Predators include various groundfish, other snow crabs, and seals.

Crabs grow by molting, generally each year in spring for crabs larger than about 40 mm carapace width (CW). Females cease molting when they achieve sexual maturity between about 40 and 75 mm CW. Males may continue to molt after becoming sexually mature (adolescents) until their terminal molt to adulthood, between about 40 and 115 mm CW. Adult males have enlarged claws, which enhances their mating ability. Crabs may live 5-6 years as adults after the terminal molt.

The fishery is prosecuted using conical baited traps set in longlines. The minimum legal size is 95 mm CW. This regulation excludes females from the fishery while ensuring that a portion of the adult males in the population remain available for reproduction. Adult legal-sized males remain new-shelled with low commercial meat yield throughout the remainder of the year of their terminal molt, and so they are not retained in the spring-summer fishery of that year. They are considered to be pre-recruits until the following year when they begin to contribute to the

exploitable biomass as older hard-shelled adults. The minimum legal mesh size of traps is 65 mm., to allow small crabs to escape. Under-sized and soft-shelled males that are retained in the traps must be returned to the sea and an unknown proportion of these die.

The fishery began in 1968 and was limited to NAFO Divisions 3KL until the mid 1980's. It has since expanded throughout Divisions 2J3KLNOP4R and is prosecuted by several fleets. The resource declined during the early 1980's but then recovered and has remained at a high level throughout the 1990's. Management of the fishery led to the development of multiple quota-controlled management areas with over 3200 licence/permit holders under enterprise allocation in 2001. Stock status is not assessed at this fine management scale.



Newfoundland and Labrador Snow Crab Management Areas, 2001

## Summary

### Division 2J3KLNO

- Landings increased from 6,000 t in 1987 to 59,500 t in 1999. They decreased by 23% to 46,100 t in 2000 while the TAC was reduced by 19%. They increased to 47,200 t in 2001. Inshore landings have accounted for about 16% of the total during each of the past four years.
- Commercial catch rates from offshore fleets increased in the late 1980's and have remained generally high, although they declined after 1998 in Div. 2J3K. This reflects recent high commercial biomass relative to that of the mid 1980's overall that is decreasing in the north.
- The fall bottom trawl surveys, which are executed near the end of the fishery each year, indicate that the resource is broadly distributed throughout the survey area reflecting broad utilization of available habitat, although distribution appears to be variable by depth and substrate type.
- The exploitable biomass index, which was projected from the fall survey of the previous year, decreased between 1999 and 2000 but has been generally stable from 2000 to 2002.
- The projected pre-recruit index for >94 mm new-shelled males decreased during 1997-2000 but has been generally stable from 2000 to 2002.
- The ratio of the commercial catch to the exploitable biomass index increased steadily from 1997 to 2001. It will decrease in 2002 if the catch remains unchanged from the 2001 level. Actual exploitation rates are unknown.

- Survey indices for size groups of small males are highly variable and imprecise. Therefore, recruitment prospects in the medium and long terms are uncertain.
- The abundance of mature females, which is unaffected by the fishery, declined sharply during 1995-1997 and remained low during 1998-2001.
- Current status appears generally favorable from fishery data and research data indicate little change for 2002. Uncertainty associated with each data set is high.
- Prospects beyond 2002 are uncertain.

### Subdivision 3Ps

- Landings increased from 600 t when the fishery began in 1985 to 7,920 t in 2000. They remained virtually unchanged (7,840 t) in 2001. TAC's have been reached each year.
- The offshore commercial catch rate increased steadily to 1999 and has since declined, but remains above the low level of the 1980's.
- Indices 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 1,640 t in 2000 and remained virtually unchanged (1,675 t) in 2001. TAC's have not been reached in some years.

- The commercial catch rate has remained stable over the past 4 years at a lower level than in other divisions.
- Resource status and prospects are uncertain because of the lack of any fishery-independent data.

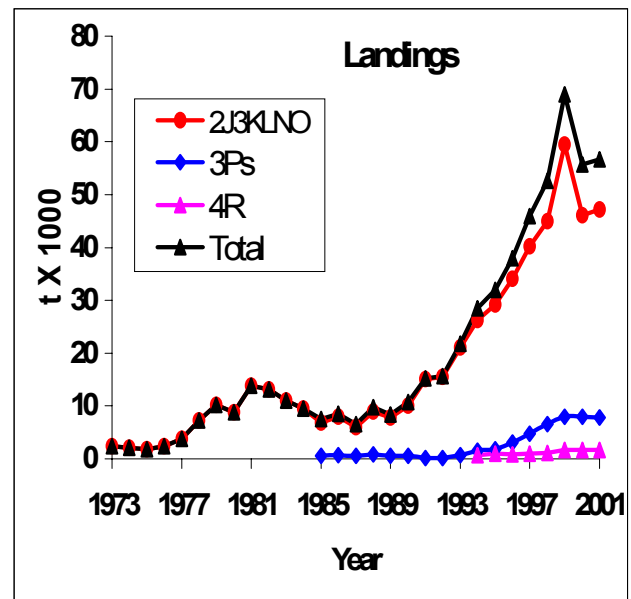
### *The Fishery*

The fishery began in Trinity Bay (Management area 6A) in 1968. Initially, crabs were taken as gillnet by-catch but within several years there was a directed trap fishery in inshore areas along the northeast coast of Div. 3KL during spring through fall. Until the early 1980's the fishery was prosecuted by approximately 50 vessels, limited to 800 traps each. In 1981 fishing was restricted to the NAFO division where the licence holder resided. During 1982-87 there were major declines in the resource in traditional areas in 3K and 3L while new fisheries started in 2J, 3Ps, 4R and offshore 3K. Since the late 1980s, the resource has increased in all areas.

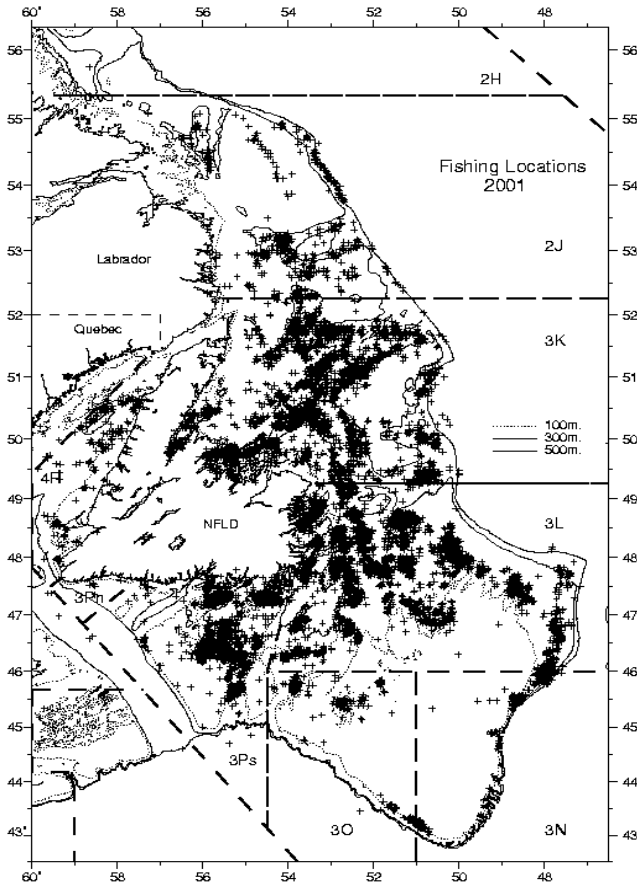
Licences supplemental to groundfishing were issued in 3K in 1985, in 3L in 1987 and in 2J in the early 1990's. Since 1989 there has been a further expansion in the offshore. Temporary seasonal permits for vessels <35 ft. were introduced in 1995. There are now several fleets and more than 3200 licence or permit holders.

In the late 1980's quota control was initiated in all management areas of each division. The season was also shortened and timed differently for the fulltime and supplementary fleets. A dockside monitoring program designed and managed by fishers to control quotas and quality was initiated in 1994. All fleets have designated trap limits, quotas, trip limits, fishing areas within divisions, and differing seasons.

Landings for 2J3KLNOP4R combined increased steadily from about 10,000 t annually during the late 1980's to 69,000 t in 1999 largely due to expansion of the fishery to offshore areas. They decreased by 19% to 55,600 t in 2000 in association with a 17% reduction in overall TAC, before increasing slightly to 56,700 t in 2001.



Effort, as indicated by estimated trap hauls, has approximately tripled throughout the 1990's. It declined in 2000 due to TAC reductions then increased slightly in 2001. Increasing effort in the 1990's was primarily due to vessels <35 feet with temporary seasonal permits. Effort has been broadly distributed in recent years indicating that commercial concentrations exist over a broad area. Overall, catch rates have remained high but are declining in Divisions 2J3K and Subdivision 3Ps.



## Division 2J3KLNO

### Commercial Fishery

**Landings** increased from 6,000 t in 1987 to 59,500 t in 1999 with increases in TAC's. Landings frequently exceeded TAC's because of additional special exploratory allocations.

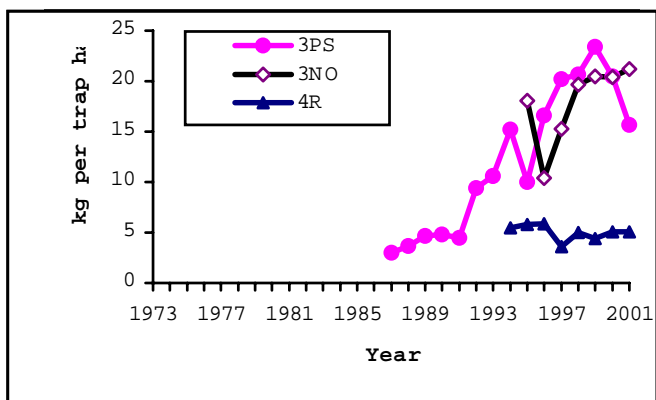
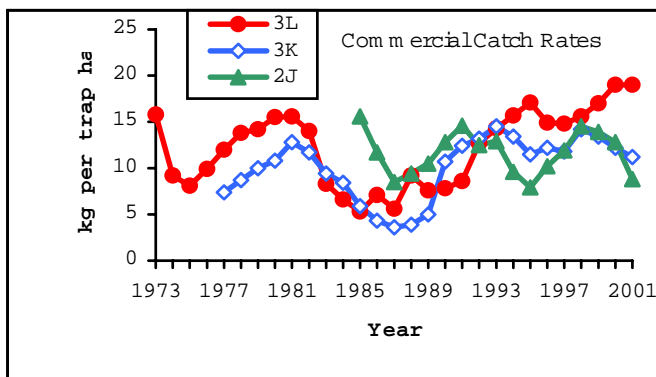
The TAC was set at 51,620 t in 1999, the first year of the past 3-year management plan, but was reduced to 42,032 t for 2000, due to a projected decrease in exploitable biomass. Meanwhile, landings decreased by 23% to 46,100 t in 2000, due to reductions in TAC and exploratory allocations. The TAC increased to 43,113 t in 2001 and landings increased to 47,200 t.

Inshore landings have accounted for about 16% of the total during each of the past four years.

### Resource Status

Because of changes in management measures as well as spatial and temporal changes in fishing practices, 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 considered possible to interpret catch rates in the context of longer-term trends.

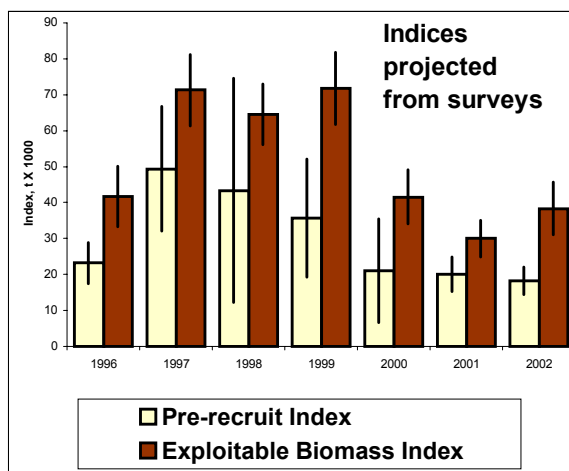
**Commercial catch rates** increased in the late 1980's and early 1990's and have remained generally high in offshore areas, although they declined after 1998 in Div. 2J3K. This reflects recent high commercial biomass relative to that of the mid 1980's overall that is decreasing in the north.



The multi-species **fall bottom trawl survey** (a post-season survey with respect to snow crab) provides an index of the exploitable biomass (older-shelled adults of legal size) available for the fishery in the following year. It also provides data on adolescents larger than 75 mm that are used to project an index of pre-recruit legal-sized males that would result from imminent molting in spring. These new-shelled crabs would begin to recruit to the fishery as older hard-shelled adults one year later.

The **exploitable biomass index** decreased by about 42% between 1999 and 2000 but has been generally stable from 2000 to 2002.

The **pre-recruit index** also decreased between 1999 and 2000 but has been stable from 2000 to 2002. The estimates of the immediate pre-recruit index have been lower and, usually, less precise than those of the exploitable biomass index. This is believed to reflect lower and more variable catchability of smaller adolescents than of the larger adults.



Indices for size groups of small males are highly variable and imprecise.

The abundance index of **mature females** declined sharply during 1995-1997 and

remained low during 1998-2001. This suggests reduced egg production.

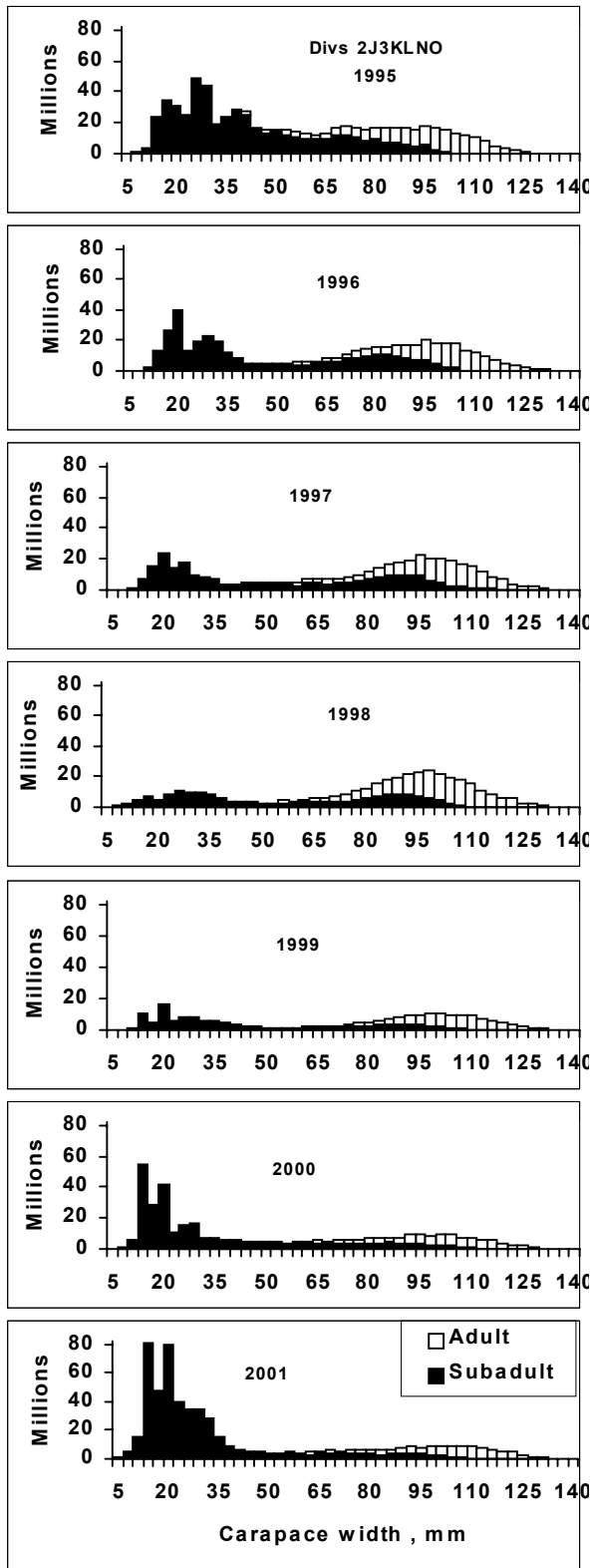
Male **size distributions** from Div. 2J3KLNO fall surveys reflect the stable biomass of legal-sized (95 mm and larger) adults in the 1996-1998 surveys. They also show the substantial decrease in adults between the 1998 and 1999 surveys that was followed by the lower but stable biomass thereafter.

The abundance index for smallest males (<40 mm) has increased in both 2000 and 2001 in Div. 2J and 3K but only in 2001 in Div. 3L.

The ratio of commercial catch to the projected exploitable biomass index decreased between 1996 and 1997. It increased steadily during 1997-2001. Actual **exploitation rates** are unknown.

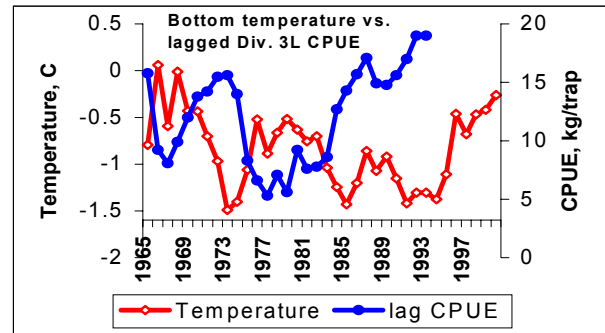
Changes in exploitation rate are believed to have minimal impact on reproductive potential, which is protected through other management regulations (see Management Considerations).

There has been a broadly distributed incidence of **bitter crab disease (BCD)** during 1996-2001. 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. Highest BCD prevalence appeared to be in Div. 3K during 1996-1998, in Div. 2J in 1999, and in Div. 3K again in 2000. It increased in Div. 3L in 2001, coincident with an increase in the abundance index of small males. However, overall it remains at lower levels than during 1996-1998. Spatial and temporal trends are not apparent and implications for mortality are unknown.



Relatively warm oceanographic conditions have persisted since 1995 and a negative relationship exists between Station 27 (off

St. John's) bottom **temperature** and Div. 3L commercial catch rates 8 years later. This supports the hypothesis that cold conditions early in the life cycle are associated with the production of strong year classes, but there is uncertainty due to the shortness of the time series.



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

**Sources of Uncertainty**

Although work is ongoing to derive a means of better interpreting commercial catch rate data, uncertainty remains regarding the effects of changes in fishing practices (eg. area fished, fishing season, soak time, trap mesh size) on catch rates and their interpretation as indicators of resource status. Further analysis is required to better account for these effects.

Poor handling practices result in unquantified fishing mortality on discarded crabs. There is also uncertainty regarding the survival of soft-shelled, undersized, and small legal-sized (highgraded) crabs that are caught but discarded.

A recent study has shown that catchability decreases with decreasing crab size. Also, catchability is lower on hard bottom than on soft bottom. Consequently, catchability is

particularly low for smallest crabs on shallow-water hard substrates and is highest for largest crabs on deep mud substrates.

Because crab distribution changes between years resulting in variable distribution by substrate type, additional interannual variability is introduced to the survey results. All of these lead to uncertainties in interpretation of year-to-year changes and further research is required to clarify the impact on survey estimates.

Biomass indices that are projected from surveys are affected by uncertainties associated with variation in biological parameters such as proportion molting, growth rate, and natural mortality (including that due to BCD).

The apparent reduction in female abundance during 1995-97 while in itself uncertain, is a source of uncertainty with regard to longer-term prospects for the resource.

High spatial variability together with low and variable catchability by the survey trawl lead to uncertainty in interpreting the long-term recruitment implications of the apparent increase in smallest males in 2000 and 2001 in 2J3K and 2001 in 3L.

There is considerable uncertainty regarding the causal basis, and predictability, of long-term recruitment trends. Cannibalism on settling year classes has been proposed as a density-dependent mechanism that results in successive weak year classes and an intrinsic oscillation in recruitment. Cannibalism is known to occur in this area, but there are no data on spatial or annual variation in its prevalence. The negative relationship that exists between temperature and commercial catch rates 8 years later suggests that a density-independent mechanism affects year class strength early in the life cycle and, subsequently, recruitment. However there is

high uncertainty associated with the limited time series that this relationship is based upon, together with the substantial ecosystem changes that have occurred within that short time period.

### ***Outlook***

The 2001 survey results support the previous conclusion that the biomass declined after 1999. The biomass has apparently remained stable since then. Current status appears generally favourable from the fishery data.

Research data indicate little change in the exploitable biomass for 2002. The ratio of catch to exploitable biomass will decrease in 2002 if the catch remains unchanged from the 2001 level although actual exploitation rates are unknown.

Because indices for size groups of small males are highly variable and imprecise, recruitment prospects in the medium and long terms are uncertain.

### ***Industry Perspectives***

The perception by industry is that fishery performance in 2001 was favourable, except for some areas within Div. 2J. Fishery performance in 2002 is expected to be similar to that of 2001. Handling practices have reportedly improved over the past few years, implying reduced mortality on released crabs.

### **Subdivision 3Ps**

#### ***Commercial Fishery***

**Landings** increased from 600 t when the fishery began in 1985 to about 7,920 t in 2000 and remained virtually unchanged (7,840 t) in 2001. The TAC was 7,700 t during 1999-2000 and 7,600 t in 2001.

TAC's have been reached or exceeded each year. Inshore landings have accounted for about 45% of the total during 1999-2001.

### *Resource Status*

The offshore **commercial catch rate** increased steadily to 1999 but has since declined, although remaining above the low level of the 1980's.

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

### *Outlook*

The commercial catch rate in 2001 remained at a high level relative to that of the 1980's. There are no clear 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 fishery-independent data.

## **Division 4R**

### *Commercial Fishery*

**Landings** increased from 650 t when the fishery began in 1994 to 1,060 t in 1998. The TAC increased from 1,330 t in 1999 to 1,430 t in 2000 and 1,539 t in 2001. Landings further increased to 1,610 t in 1999 due to TAC increases and remained virtually unchanged in 2000 (1,640 t) and 2001 (1,675 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 4 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 legal-sized crabs by the survey trawl is unknown. It is however, believed to be less than 1.

The steady increase in the ratio of catch to exploitable biomass index in Div. 2J3KLNO over the past four years is consistent with declining recruitment. However, this is not a conservation concern. 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 any increase in exploitation rate is believed to have minimal impact on reproductive potential.



***For more Information:***

Contact: Earl G. Dawe  
Science Oceans and Environment  
Branch  
Fisheries and Oceans Canada  
Newfoundland Region  
P.O. Box 5667  
St. John's, NF A1C 5X1

Tel: (709) 772-2076

Fax: (709) 772-4105

E-Mail: [Dawee@dfo-mpo.gc.ca](mailto:Dawee@dfo-mpo.gc.ca)

***References***

Colbourne, E. 2002. Physical Oceanographic conditions on the Newfoundland and Labrador Shelves during 2001. CSAS Res. Doc. 23/02.

Colbourne, E. 2002. Oceanographic conditions in NAFO Subdivisions 3Pn and 3Ps during 2001 with comparisons to the previous year and the long-term (1971-2000) average. CSAS Res. Doc. 24/02.

E. G. Dawe, H. J. Drew, P. J. Veitch, R. Turpin, P. G. O'Keefe, and P. C. Beck. 2002. An Assessment of Newfoundland and Labrador Snow Crab in 2001. CSAS Res. Doc. 50/02.

E. G. Dawe, B. R. McCallum, S. J. Walsh, P. C. Beck, H. J. Drew and E. M Seward. 2002. A study of the catchability of snow crab by the Campelen 1800 survey trawl. CSAS Res. Doc. 51/02.

This report is available from the:

Newfoundland Region  
Science, Oceans and Environment Branch  
Fisheries and Oceans Canada  
P.O. Box 5667  
St. John's NF A1C 5X1  
Phone Number (709) 772-8892  
Fax Number (709) 772-6100  
e-mail address [parmiterd@dfo-mpo.gc.ca](mailto:parmiterd@dfo-mpo.gc.ca)  
Internet address <http://www.dfo-mpo.gc.ca/csas>

ISSN 1480-4913

***Correct citation for this publication***

DFO, 2002. Newfoundland and Labrador snow crab. DFO Science Stock Status Report C2-01 (2002).

### Consensus of snow crab resource status-2J3KLNO reached at RAP

Table below must not be considered in isolation from the text of the Stock Status Report due to the risk of erroneous interpretation of overall stock status.

THE FISHERY	
Catch	Decreased by 23% from 59,500 t in 1999 to 46,100 t in 2000. Catch increased to 47,200 t in 2001. TAC's have been reached each year.
Effort	The number of trap hauls in offshore areas approximately tripled throughout the 1990's before declining by about 23 % in 2000. It increased slightly in 2001.
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. Handling practices reportedly improved over the past few years.
Impact of other fisheries	Unquantified bycatch in groundfish gillnet fisheries and unknown mortalities associated with trawl fisheries.

INDEX	OBSERVATION	INTERPRETATION	EVALUATION
-------	-------------	----------------	------------

FISHERY DATA			
CPUE-kg/trap haul	Increased in the late 1980's and has remained generally high but declined after 1998 in Div. 2J3K.	High commercial biomass relative to the mid 1980's overall but decreasing in the north.	?
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	Spring - fall fishery; little effort after July since 1998.	Annual changes affect CPUE and introduce uncertainty.	?

RESEARCH DATA			
Distribution	Broadly distributed throughout the survey area but appears to be variable by depth and substrate type.	Reflects broad utilization of available habitat.	+
Exploitable Biomass index	This projected index decreased between 1999 and 2000 and remained stable since then.	Stable from 2000 onward but variable catchability of crabs by substrate type leads to uncertainty.	?
Pre-recruit index	Projected index for >94 mm new-shelled males decreased during 1997- 2000 and remained stable since then.	Little change for 2002 but variable catchability by substrate type leads to uncertainty.	?
Recruitment index	Indices for size groups of small males are highly variable and imprecise.	High spatial variability with low and variable trawl catchability of small males lead to uncertainty.	?
Bitter crab disease	Occurs in 2J3KL, especially in 30-80 mm crabs of both sexes. Spatial and temporal trends unclear.	Mortality implications unknown.	?
Females	Fall abundance index of mature females declined sharply during 1995-1997 and remained low during 1998-2001.	High spatial variability with low and variable trawl catchability of females lead to uncertainty.	?

OTHER DATA			
Industry perception	Except for some areas within Div. 2J, fishery performance in 2001 was favourable.	Fishery performance in 2002 is expected to be similar to that of 2001.	+
Predation	Abundance of predatory groundfish species low since the early 1990's but cannibalism occurs.	Mortality implications unknown.	?
Environmental Index	Warmer conditions since 1995. A negative relationship exists between temperature and CPUE 8 years later.	Uncertainty	?

ASSESSMENT			
Exploitation Rate	Ratio of catch to projected biomass index increased steadily from 1997 to 2001.		
Stock status	Current: Generally favourable from fishery data. Research data indicate little change for 2002 but high uncertainty.	?	
	Prospects: Recruitment beyond 2002 is uncertain.	?	

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