Fisheries and Oceans Canada | Pêches et Océans Canada
Ecosystems and Oceans Science | Sciences des écosystèmes et des océans

Canadian Science Advisory Secretariat (CSAS)

Proceedings Series 2019/016

Newfoundland and Labrador Region

Proceedings of the Regional Peer Review for Development of a Precautionary Approach Framework for Snow Crab in the Newfoundland and Labrador Region

Meeting date: June 6-7, 2018
Location: St. John's, NL

Chairpersons: Christina Bourne and Julia Pantin
Editor: Emilie Novaczek

Science Branch
Fisheries and Oceans Canada
PO Box 5667
St. John's, NL A1C 5X1

October 2019

Canada

Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings may include research recommendations, uncertainties, and the rationale for decisions made during the meeting. Proceedings may also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

Published by:

Fisheries and Oceans Canada
Canadian Science Advisory Secretariat
200 Kent Street
Ottawa ON K1A 0E6

http://www.dfo-mpo.gc.ca/csas-sccs/
csas-sccs@dfo-mpo.gc.ca

ISSN 1701-1280

Correct citation for this publication:

DFO. 2019. Proceedings of the Regional Peer Review for Development of a Precautionary Approach Framework for Snow Crab in the Newfoundland and Labrador Region; June 6-7, 2018. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2019/016.

Aussi disponible en français :

MPO. 2019. Compte rendu de la réunion d'examen par les pairs sur l'élaboration d'un cadre de l'approche de précaution pour le crabe des neiges dans la région de Terre-Neuve et du Labrador; du 6 au 7 juin 2018. Secr. can. de consult. sci. du MPO, Compte rendu 2019/016.

TABLE OF CONTENTS

SUMMARY

A Regional Peer Review Process was held June 6-7, 2018 in St. John's, Newfoundland and Labrador (NL). The purpose of this meeting was to define Limit Reference Points (LRPs) consistent with the Precautionary Approach (PA), for Snow Crab in Northwest Atlantic Fisheries Organization (NAFO) Divisions 2HJ3KLNOP4R, based on the best scientific information available. The application of precaution requires increased risk avoidance where there are risks of serious harm and high uncertainty.

This Proceedings Report includes a summary of presentations and a synthesis of the subsequent discussion and decisions. Appendices include the meeting Terms of Reference, agenda, and list of attendees. Participation in this meeting included Fisheries and Oceans Canada (DFO) Science, Resource Management and Policy and Economics Branches, the Fish Food and Allied Workers Union (FFAW), and academia.

In addition to these Proceedings, a comprehensive Research Document will be published; both will be available online on the Canadian Science Advisory Secretariat's website.

INTRODUCTION

The status of Snow Crab in the Northwest Atlantic Fisheries Organization (NAFO) Divisions 2HJ3KLNOP4R was last assessed in 2017. At that time, fishery catch per unit effort (CPUE) was at or near historical lows in most divisions, the exploitable biomass index was at or near lowest observed levels in all divisions, and total mortality was estimated at or near the time series' high. The key objectives of this meeting were to assess a proposal for implementation of an assessment and decision making framework for Newfoundland and Labrador (NL) Snow Crab that are consistent with the Precautionary Approach (PA) (Appendix 1). Among other outcomes, the meeting was intended to establish Limit Reference Points (LRPs) for resource status and removal levels. The application of precaution requires increased risk avoidance where there is the possibility of serious harm coupled with high uncertainty.

The implementation of the PA framework is part of the DFO mandate. The PA was published in 2009 as part of the Sustainable Fisheries Framework; the framework includes three stock status zones delimited by the LRP and the Upper Stock Reference (USR). When a stock is in the Critical Zone (i.e. below the LRP), conservation is the management priority, and removals must be reduced to the lowest possible level. When a stock is in the Cautious Zone (i.e. between the LRP and the USR), management strategy is balanced between socio-economic considerations and conservation. Above the USR, the stock is defined as in the Healthy Zone, and socio-economic considerations are the management priority. Metrics for the reference points are often expressed as direct measures of stock productivity (i.e. spawning stock biomass), however the language of the policy is flexible to accommodate alternatives for stocks where this type of measure is not possible or appropriate.

PROPOSAL FOR A PRECAUTIONARY APPROACH FOR SNOW CRAB

Darrell Mullowney, Krista Baker, Eric Pederson, Derek Osborne

FISHERY AND LIFE HISTORY

The Snow Crab fishery is sex selective (females are not retained) and size selective (only hard-shelled, male crabs >95 mm carapace length are retained). However, large males are expected to contribute to overall biological fitness of the population. Excessive removal of large males is likely to alter population level reproductive potential, by promoting mating of less fecund males (Sainte-Marie et al. 2008) and may result in sperm limitation (Rondeau and Saint-Marie 2001). Genetic forcing to smaller sizes may occur in a population subject to size selective removals (Sainte-Marie et al. 2008), however research to date indicates that Snow Crab size is a plastic trait linked closely to temperature (Dawe et al. 2012). High removals of large males may also allow less competitive crabs to enter traps, simultaneously increasing CPUE and discard mortality (Mullowney et al. 2017). These conditions represent the potential for harm to NL Snow Crab under current management.

The Gulf and Maritimes Regions have already applied the PA framework to Snow Crab, with reference points based on exploitable male biomass. A NL Region DFO Science working group was established in 2012 to develop a proposal for implementation of a PA framework for the NL Snow Crab resource. To date, the working group has concluded that due to the life history, population dynamics, and limitations of biomass estimates for this region, a conventional PA framework based on a biomass index would not be appropriate for Snow Crab in NL. Despite current management measures intended to safeguard stock productivity (e.g. size limits, and protection of females), in recent years fishery CPUE has approached historical lows in most divisions and the exploitable biomass index was at or near lowest observed levels in all

divisions. The working group has therefore recommended the development and adoption of an alternative assessment approach designed to promote conservation and fishing efficiency.

The proposal put forward at this meeting replaces the conventional assessment approach (i.e. based on exploitable biomass) with a multi-metric approach, based on egg clutch fullness, CPUE, and discard rate. Sustainability of the Snow Crab fishery is reliant on numerous complex relationships; the authors argue that a single indicator of population health can be unreliable, particularly when large uncertainties exist related to population dynamics, and that multiple indicators enable management to implement a variety of measures to address specific issues that may arise.

Discussion

Participants briefly discussed the ecosystem role of Snow Crab.

PROPOSED ASSESSMENT METRICS

The authors proposed an alternative framework that incorporates multiple indicators: percent of females with a full egg clutch, CPUE, and discard rate. The percentage of females with a full clutch ("egg clutch fullness") during the survey is an indicator of reproductive potential. A reduction in this metric is cause for concern, as it would suggest that the population's ability to reproduce has been compromised in some way. Reductions in CPUE are associated with decreased exploitable biomass, increased discards, and/or increased exploitation rate. Consistent decline in CPUE may also indicate reduced reproductive potential. Increases in the discard rate have historically been associated with high incidences of either soft-shell pre-recruit males or under-size terminally molted males in the catch. High discards are also thought to be reflective of reduced availability of large, mature males (when large males are present, they outcompete the under-sized crabs at the trap entry). Finally, although the capture of females is not known to be common in the fishery, the metric of discards was deemed to extend protection to this part of the population in the event increased capture rates of females occurs in the future.

Data on egg clutch fullness are collected during the annual DFO multi-species trawl survey and inshore trap surveys. Multi-species trawl surveys have consistently occurred in NAFO Divisions 2J3KLNO since 1995 (fall) and in Subdivision 3Ps (spring) since 1996. Inshore trap survey time series vary between divisions, starting as early at 1979 in some areas (e.g. Conception Bay) and as recently as 2013 (e.g. Trinity Bay). The egg clutch data were deemed to be of sufficient quality to be used in the assessment based on the size of the dataset, the length of the time-series, and the number of source surveys. Classification of clutch condition is binary (i.e. full or not full). Crabs noted as "recently liberated" were included as "full" for the purposes of this analysis. Full clutches are expected to be very frequent, based on the promiscuous mating style of Snow Crab. Females may be inseminated by several partners each year (Sainte-Marie and Hazel 1992, Sainte-Marie et al. 2008), and can store sperm to fertilize subsequent egg clutches (Sainte-Marie and Carriere 1995).

CPUE is applied here as a metric of relative biomass for Snow Crab which, in NL, provides a longer time-series than survey data and can be reliably predicted based on climate indices and exploitation rate (for details, see Mullowney et al. 2018). CPUE data are derived from fisheries logbooks. Logbook return, including time and location of fishing activities as well as the level of catch (tonnes) and effort (trap hauls), is a license requirement for Snow Crab, and the return rate is >80% in recent years. Research on the reliability of logbooks, based on comparison of logbook data to aquatic invasive species (AIS) and dockside monitoring, show that CPUE is an accurate index of relative biomass for this stock (Mullowney and Dawe 2009).

Fishery discards are included as a metric with the intention of providing a broad safeguard for the non-commercial components of the Snow Crab population (i.e. females, under-sized males, and soft-shell, pre-recruit males). The total mortality due to discards, which represents a biological cost and fishery wastage, is unknown. Recent studies estimate only about 5% mortality among discarded Snow Crab (Grant 2003, Urban 2015), however these low mortality rates reflect best handling practices, specifically in the form of minimal dropping distances and exposure time on deck. Mortality rates increase substantially under poor handling practices (Grant 2003). Further, it must be noted that both studies featured predominately hard-shelled crab and both authors cautioned that unobserved latent mortality was unaccounted for in their studies.

Data on discard rates are provided by the at-sea observer program, due to limitations of the logbook data on discards. At-sea observer coverage is very low for this fishery and the deployment strategy is not systematic. DFO Science recommends a random deployment, while Enforcement and Management require targeted enforcements for their purposes. The resulting mixed approach introduces spatio-temporal concerns that are exacerbated due to low overall coverage. Inclusion of a discard rate index in the PA framework, as proposed here, will require an increase in observer data quantity and quality moving forward. Issues of observer data quality do not reflect the adequacy of the sampling being conducted by observers, rather they stem from the limited coverage and non-representative deployment system.

Models were generated for projection of CPUE and discards to allow for scenario-based management. CPUE was calculated as a seasonal average, excluding the first 5% of the fishing season and all catch after 200 days to remove the effect of exploratory fishing at the start of the season and the end of season recruitment pulse. The model reproduced observed CPUE with high accuracy. Analysis of discard data shows that discards increase throughout the fishing season, as the fishable biomass is depleted.

The multi-metric approach allows for more flexible and more specific management responses. Establishing sustainable exploitation levels remains the central focus of management actions (i.e. setting an appropriate Total Allowable Catch [TAC]), however other avenues are possible, including but not limited to:

- Imposing seasonal depth restrictions (i.e. closing shallow areas in the spring during mating) to promote egg clutch success;
- Shortening or shifting the fishing season could increase overall CPUE and reduce discards;
- Handling requirements to reduce discard mortality among soft shell crab;
- Gear modifications to reduce catch of undersized individuals.

Management measures could be applied in different combinations depending on which zone each assessment metric fall within and the metric used to place them there. For example, if the egg clutch metric fell into the Cautious Zone, exploitation may be reduced and/or shallow fishing areas may be closed during the spring mating period, a time when females are most vulnerable. However, if egg clutches fall into the Healthy Zone then this metric would not trigger restrictive management measures. In that case, managers may move to the next metric: CPUE. If CPUE fell into the Cautious or Critical Zones, exploitation may be reduced and/or the fishing season may be shortened to prevent fishing on the late season pulse of new recruits and residual undersized crabs. Similarly, if discards were found to be in the Cautious or Critical Zone, managers may choose to pursue gear modifications (i.e. mesh size), alter soak times (longer soaks allow small crabs more time to leave the trap), and/or reduce exploitation rate through the TAC. In a hypothetical application of this multi-metric approach to the 2018 season, egg clutches fall into the Healthy Zone, however in NAFO Subdivision 2HJ, for example, reduced

exploitation and/or additional management measures listed above may be recommended due to a trend of decreasing CPUE and increasing discards. In Subdivision 3Ps, where CPUE and discards fall into the Critical Zone, the advice may be to reduce removals to the lowest possible level (CPUE) and increase mesh size to reduce discards.

Discussion

Participants agreed with the basic proposal that a stock assessment based on multiple indicators was appropriate to sustainable management of Snow Crab in NL. The egg clutch fullness metric was accepted with little discussion.

As proposed, the CPUE indicator was taken as an average over the fishing season, which some participants were concerned would be influenced by variation in exploitation rate or length of the fishing season. Start-of-season or end-of-previous-season CPUE were suggested as alternatives. Based on expected depletion of fishable biomass throughout the season, some participants felt that a metric of the available biomass as the season started was most appropriate, because it would not be impacted by fishing season length. However, it was also noted that the start-of-season CPUE estimate may be artificially higher, and fishing behaviour at the beginning of the season may introduce more noise into the dataset. An end-of-season CPUE estimate, as an indicator of available biomass for the next season, would be uninfluenced by trap saturation but would require a cut-off threshold to control for season length. Change in CPUE throughout the season can be significant and some participants raised concern that a division where CPUE declined from 15 kg to 5 kg/trap in a season would generate the same average metric as a division with a steady CPUE of 7 kg/trap. Participants requested further calculation to investigate sensitivity of this metric to time period (i.e. start or end of season, season length). On the second day of the meeting, these calculations were presented; all formulations of the CPUE metric (including or excluding season start, full season, ending at day 200, minimum observed values) were highly correlated (90-95%) for all divisions. The CPUE metric was accepted as presented with the consensus of meeting participants.

There was concern that the proposed LRP for CPUE may not accurately reflect the catch rate potential in all divisions, with some areas consistently producing low CPUE without any apparent indications of serious harm to the resource over prolonged periods of time. The authors responded that high CPUEs, specifically those from Divisions 3LNO, were removed from all calculations of historic CPUEs used in the proposal and that the proposed LRP therefore closely reflected historically low CPUE areas.

Many participants were interested in discard rate as a metric, and what that value may indicate for the stock. One participant noted that harvesters only report competitive exclusion of soft-shelled crabs at the trap, and that soak time has a significant impact on the catch rate of undersized males, a factor that is not consistent between trap surveys and the fishery. Authors agreed that longer soak times would allow more escapes but pointed out that the 3Ps fishery records a large proportion (~50%) of small crab discard despite long soak times. This may indicate a regional difference in 3Ps, however the authors felt that a broad approach to discards in the PA framework was still most appropriate for stock management, as all discarded portions of the population have ecological value. Meeting participants agreed that CPUE declines and discard rates increase as the large crabs are depleted (thus reducing competition at the trap, resulting in higher catches of soft-shell and undersized crabs) applies across NAFO subdivisions. An external reviewer also suggested that the authors should present both the proportions and the absolute numbers (e.g. for number of crabs per trap or discard rate). For example, 50% discard rate may lead to very different biological interpretation if it refers to one out of two crabs in a trap. The fishery discards metric was accepted as presented with the

consensus of meeting participants, with the understanding that authors would present absolute numbers alongside proportions in the resulting research document.

Some participants felt that, based on the demonstrated relationship between climate (i.e. North Atlantic Oscillation [NAO] index) and Snow Crab recruitment, it would also be beneficial to include climate in the assessment. A representative from the Maritimes and Gulf Region noted that there is work underway to address climate in Snow Crab assessments, and DFO scientists from both regions agreed to continue dialogue on this point. However, at present, the presenters and meeting participants recognize that there is not a readily available way to incorporate climate as a condition that can be projected but not controlled by management actions.

REFERENCE POINTS

Egg Clutch Fullness

Two approaches were used to develop LRPs for egg clutches: a resource recovery threshold ("$E_{Recovery}$") and standard deviation within all observations ("E_{Normal}"). "$E_{Recovery}$" was defined as the lowest observed level from which the population recovered to consistent productive levels. Productive is defined by a fishery CPUE greater than 5 kg/trap after a lag of 8-10 years to allow to growth and recruitment into the fishery. "E_{Normal}" was based on the 68-95-99.7 rule for normal distributions, with 68% of observations falling within 1 standard deviation of the mean (suggested upper stock reference) and observations below 3 standard deviations are unlikely to be due to chance alone (suggested as the lower reference point).

The proposed LRP (0.60) and USR (0.80) represent a compromise across approaches and surveys (Table 1).

Table 1. Proposed LRP and USR for egg clutch fullness.

-	**Survey**	**LRP**	**USR**
$E_{Recovery}$	Trawl	0.61	-
-	Trap	0.73	-
E_{Normal}	Trawl	0.59	0.79
-	Trap	0.64	0.83
$E_{Proposed}$	**-**	**0.60**	**0.80**

Catch Per Unit Effort

Similar to the approach taken to generate reference points for egg clutch fullness, "$C_{Recovery}$" (based on a recovered CPUE >5 kg/trap 9-11 years later) and "C_{Normal}" (based on the 40th and 80th percentiles) were calculated for the CPUE metric. "$C_{Saturate}$", defined as the 40th and 80th percentiles of modelled saturation point of CPUE, and ""$C_{Efficient}$", based on CPUE in relation to a recruit per pre-recruit (RPP) index, were also presented. The average lower limit for CPUE across the presented methods was 5.3 kg/trap, however based on records that indicate the resource can recover from CPUE levels below 5.3 kg/trap, the proposed LRP is 5.0 kg/trap. The average upper stock reference was 13.4 kg/trap. The authors proposed a USR of 13.0 kg/trap.

Table 2. Proposed LRP and USR for CPUE.

-	LRP	USR
$C_{Recovery}$	3.3 kg/trap	-
C_{Normal}	7.7 kg/trap	11.3 kg/trap
$C_{Saturate}$	6.5 kg/trap	13.0 kg/trap
$C_{Efficient}$	3.8 kg/trap	16.0 kg/trap
$C_{Proposed}$	**5 kg/trap**	**13 kg/trap**

Discards

Two of the above methods were adapted to fishery discards: "D_{Normal}" (40th and 80th percentiles) and "$D_{Efficient}$" (based on 40th and 80th percentiles of the RPP index). The proposed LRP (30%) and USR (15%) are supported by both approaches.

Table 3. Proposed LRP and USR for discards.

-	LRP	USR
D_{Normal}	33%	18%
$D_{Efficient}$	28%	11%
$D_{Proposal}$	**30%**	**15%**

Discussion

The proposed reference points for egg clutches (0.6, 0.8) were accepted quickly, with little discussion.

Participants and presenters agreed that CPUE is likely to be more sensitive to changes in management measures or fishing practices and is likely to garner more support from fishers than an alternative metric of relative biomass. There was some discussion on how the proposed reference points would impact assessment results for each division. For example, based on CPUE LRP of 5 kg/trap, 3Ps is currently in the Critical Zone, though there is slight improvement in 2018, compared to 2017. Although this may cause concern for the fishery in 3Ps, some participants felt that 5 kg/trap was too low and suggested that the data could be interpreted to support an LRP of 7 kg/trap based on the increase in discards documented when CPUE drops below this level. Participants reached consensus and accepted the proposed reference points (5 kg/trap, 13 kg/trap).

There were concerns raised about using CPUE as a metric of relative biomass than biomass itself. The authors acknowledged there were both strengths and weaknesses to using CPUE in lieu of biomass and committed to more thoroughly elaborating on the matter in the resulting research document. Among the strengths of CPUE were that it generally reflected annual survey biomass estimates, with the relationship between the two metrics well understood, it has a longer time-series than biomass estimates, and as various surveys are used to derive

biomass across divisions there is no ‘common currency’ for biomass, and CPUE was thought to promote harvester ownership of the PA. Among the potential shortcomings of CPUE were the potential for hyper-stability to mask changes in stock size and the potential for human error or falsification in calculating the index.

Several participants questioned whether discards should be treated as a firm limit or as a target by fisheries managers. For much of the time-series and most areas, there has been very little mortality imposed on small crab – these conditions are reflected in the most recent assessments and Science Advisory Reports for Snow Crab. However, in 2017 and 2018 as much as half of the catch in some divisions has been discarded, with unknown mortality rates. Although there was prolonged debate on the precise role of discards in the assessment, the meeting was able to reach consensus that discards represent an important metric to the current state of the fishery and future sustainability of the stock. Participants accepted the proposed reference points (30%, 15%).

CONCLUSIONS

Previous conclusions from a working group on this issue and meeting participants agreed that a conventional spawning stock biomass based assessment is not appropriate for the life history and state of the fishery for Snow Crab in NL. Based on the research presented at this meeting, it was agreed that a PA framework based on multiple indicators and specific scenario-based science advice dependent on the indicator (or combination of indicators) represents important progress for the sustainable management of Snow Crab. Presenters and meeting participants discussed perceived opportunities, strengths, and weaknesses of the proposed PA.

As proposed, this approach provides the opportunity to promote transparency in decision making and harvester ownership of the process, by uniting harvesters, managers, and scientists in the common goal of reducing discards and increasing CPUE. Strengths of this approach are that it invokes conservation and fishing efficiency with flexibility to changing regimes, with intuitive responses for each metric scenario. However, weaknesses are present due to reliance on limited fishery observer data, disparity between spatial scales of the management areas and biological or ecological processes, data deficiency in NAFO Divisions 4R3Pn, and the absence of a mechanism to test for comparative outcomes.

There was extensive discussion about whether the three metrics represent a hierarchical framework and how stock status under the PA would be determined using the three indicators. Several meeting participants supported the idea that egg clutches constitute a primary concern, while CPUE and discard could be treated as targets. In that scenario, the decision framework is hierarchical, with egg clutches taking precedence. However, it was also argued that a non-hierarchical decision tree approach offers more flexibility to shifting regimes and could be more precautionary. Ultimately, participants agreed that this distinction constituted a management decision linked to the application of an associated harvest control rule, and thus fell outside the scope of this meeting.

REFERENCES CITED

Dawe, E.G., Mullowney, D.R., Moriyasu, M., and E. Wade. 2012. Effects of temperature on size-at-terminal molt and molting frequency in snow crab *Chionoecetes opilio* from two Canadian Atlantic ecosystems. Mar Ecol 469: 279-296.

DFO. 2009. A Fishery Decision-Making Framework Incorporating the Precautionary Approach. Accessed June, 2018.

Grant, S.M. 2003. Mortality of snow crab discarded in Newfoundland and Labrador's trap fishery: At-sea experiments on the effect of drop height and air exposure duration. Can. Tech. Rep. Fish. Aquat. Sci. 2481: vi + 28p.

Mullowney, D.R., and E.G. Dawe. 2009. Development of performance indices for the Newfoundland and Labrador Snow Crab (*Chionoecetes opilio*) fishery using data from a vessel monitoring system. Fish Res 100: 248-254.

Mullowney, D., Coffey,W., Baker, K., Evans, G., Fiander, D., Colbourne, E., Maddock Parsons D., Koen-Alonso, M., and N. Wells. 2017. An assessment of Newfoundland and Labrador Snow Crab (*Chionoecetes opilio*) in 2016. DFO Can. Sci. Advis. Sec. Res. Doc. 2017/081. viii+172 p.

Mullowney, D., Baker, K., Pederson, E., and D. Osborne. 2018. Basis for a precautionary approach and decision making framework for the Newfoundland and Labrador Snow Crab (*Chionoectes opilio*) fishery. Can. Sci. Advis. Sec. Res. Doc. 2018/054.

Rondeau, A., and B. Sainte-Marie. 2001. Variable mate-guarding time and sperm allocation by male Snow Crab (Chionoecetes opilio) in response to sexual competition, and their impact on the mating success of females. Biol Bull 201: 204–217.

Sainte-Marie, B., and C. Carriere. 1995. Fertilization of the second clutch of eggs of Snow Crab, *Chionoecetes opilio,* from females mated once or twice after their molt to maturity. Fish Bull 93: 759-764.

Sainte-Marie, B., and F. Hazel. 1992. Moulting and mating of Snow Crabs, *Chionoecetes opilio* (O Fabricius), in shallow waters of the northwestern Gulf of St Lawrence. Can J Fish Aquat Sci 49: 1282–1293.

Sainte-Marie, B., Gosselin, T., Se´vigny, J.M., and N. Urbani. 2008. The Snow Crab mating system: opportunity for natural and unnatural selection in a changing environment. Bull Mar Sci 83: 131-161.

Urban, J.D. 2015. Discard mortality rates in the Bering Sea snow crab (Chionoecetes opilio) fishery. ICES J. Mar. Sci. 72: 1525-1529.

APPENDIX I: TERMS OF REFERENCE

DEVELOPMENT OF A PRECAUTIONARY APPROACH FRAMEWORK FOR SNOW CRAB IN THE NL REGION

Regional Peer Review – Newfoundland and Labrador Region

June 6-7, 2018
St. John's, NL

Chairpersons: Christina Bourne and Julia Pantin

Context

The Precautionary Approach (PA) is a general philosophy to managing threats of serious or irreversible harm where there is scientific uncertainty. The application of precaution requires increased risk avoidance where there are risks of serious harm and high uncertainty. These conditions often apply in fisheries; therefore precaution should be incorporated in fisheries management.

Canada is committed domestically and internationally to the use of PA in fishery decision-making. Over the last few years, there have been several initiatives in Canada to define the PA in a fisheries context, to identify benchmarks that would be consistent with the approach and to apply it in fisheries management. The fundamental principles guiding this approach have been outlined in two key documents produced by DFO: 1) the 2006 Science Advisory Report that identifies the minimal requirements for harvesting strategies to be compliant with the PA; and 2) the 2009 Decision-Making Framework Incorporating the Precautionary Approach; a policy document to guide the incorporation of PA principles in the management of Canadian fisheries.

To be compliant with the PA, fishery management plans should include harvest strategies that incorporate a science-based Limit Reference Point (as well as Upper Stock Reference and Removal Reference points). It is expected that the management decisions should respect the indicated actions in each of the stock zones (i.e., Healthy, Cautious, and Critical) in relation to these points.

Objectives

The key objective of the meeting is to define limit reference points, consistent with the precautionary approach, for Newfoundland and Labrador Snow Crab, based on the best scientific information available, including that from the most recent assessment, as well as past assessments of the stock.

Specifically, the following objectives have been set:

1. Review reference point methodologies and proposed approaches for the identification of reference points for the NL Snow Crab stock;
2. Apply the chosen methodology(ies) to estimate the reference points, as per the decision-making framework developed by DFO for the application of Precaution in this fishery;
3. Review methods for projecting metrics (i.e.: CPUE and discards) associated with reference points for the NL Snow Crab stock.

Expected Publications

- Research Document
- Proceedings

Expected Participation

- DFO Science and Fisheries Management
- External subject matter experts

References

DFO 2006. A Harvest Strategy Compliant with the Precautionary Approach. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2006/023.

DFO 2009. A fishery decision-making framework incorporating the Precautionary Approach. October 2011 version online.

APPENDIX II: PARTICIPANTS LIST

NAME	AFFILLIATION
James Meade	DFO – Centre for Science Advice
Freya Nales	DFO - Resource Management, National Capital Region
David Ball	DFO - Resource Management, NL Region
Earle Dawe	DFO Emeritus
Erin Carruthers	Fish, Food and Allied Workers Union
Emily Novaczek	Rapporteur
Katherine Skanes	DFO – Science, NL Region
Derek Osborne	DFO – Science, NL Region
Julia Pantin	DFO – Science, NL Region
Christina Bourne	DFO – Science, NL Region
Darrell Mullowney	DFO – Science, NL Region
Krista Baker	DFO – Science, NL Region
Eric Pedersen	DFO – Science, NL Region
Stephanie Boudreau	DFO – Science, Gulf Region
Elizabeth Coughlan	DFO – Science, NL Region
Geoff Evans	DFO Emeritus
Annette Rumbolt	DFO – Resource Management, NL Region
Robyn Morris	DFO – Resource Management, NL Region
Brittany Beauchamp	DFO – Science - National Capital Region
Frank Corbett	DFO – Policy and Economics, NL Region
Brett Favaro	Marine Institute