

Northwest Atlantic Fisheries Organization



Report of the Scientific Council (in conjunction with NIPAG) Meeting

14 September 2020
By WebEx

NAFO
Halifax, Nova Scotia, Canada
2020



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**REPORT OF THE SCIENTIFIC COUNCIL MEETING
14 September 2020, via WebEx**

Chair: Carmen Fernandez

Rapporteur: Tom Blasdale

1. Opening

Scientific Council, in conjunction with the NAFO/ICES *Pandalus* Assessment Group, met by WebEx on 14 September 2020, to formulate management advice for northern shrimp in NAFO Divisions 3M. Representatives attended from Canada, Denmark (in respect of the Faroe Islands and Greenland), the European Union, France (in respect of St. Pierre et Miquelon), Iceland, Norway and the Russian Federation and Ukraine. A full list of participants is included in Appendix V.

The Chair, Carmen Fernandez, opened the meeting 08:00 Halifax time (12:00 UTC) by welcoming participants. The provisional agenda was adopted as circulated. The Scientific Council Coordinator was appointed as rapporteur.

2. Review of relevant recommendations and advice from 2019

There were no general recommendations. SC agreed that relevant stock-by-stock recommendations from previous years would be reviewed during the presentation of a stock assessment the status presented in the relevant sections of the NIPAG report

3. Formulation of Advice

The response from the Scientific Council is:

a) Northern Shrimp in Division 3M

Advice September 2020 for 2021










Recommendation

The stock has increased from very low levels since 2014 and is now above B_{lim} .

There are indications of improved recruitment in the 2020 survey data. These small shrimp could potentially add to the fishable stock in 2021 and 2022. Considering the uncertainty about the future recruitments and the response of the resource to resumed exploitation, Scientific Council advises that the catch in 2021 should not exceed the 2009 level (5 448 tonnes).

Management objectives

No explicit management plan or management objectives defined by the Commission. Convention general principles are applied. Advice is based on qualitative evaluation of biomass indices in relation to historic levels, and provided in the context of the precautionary approach framework (FC Doc. 04/18).

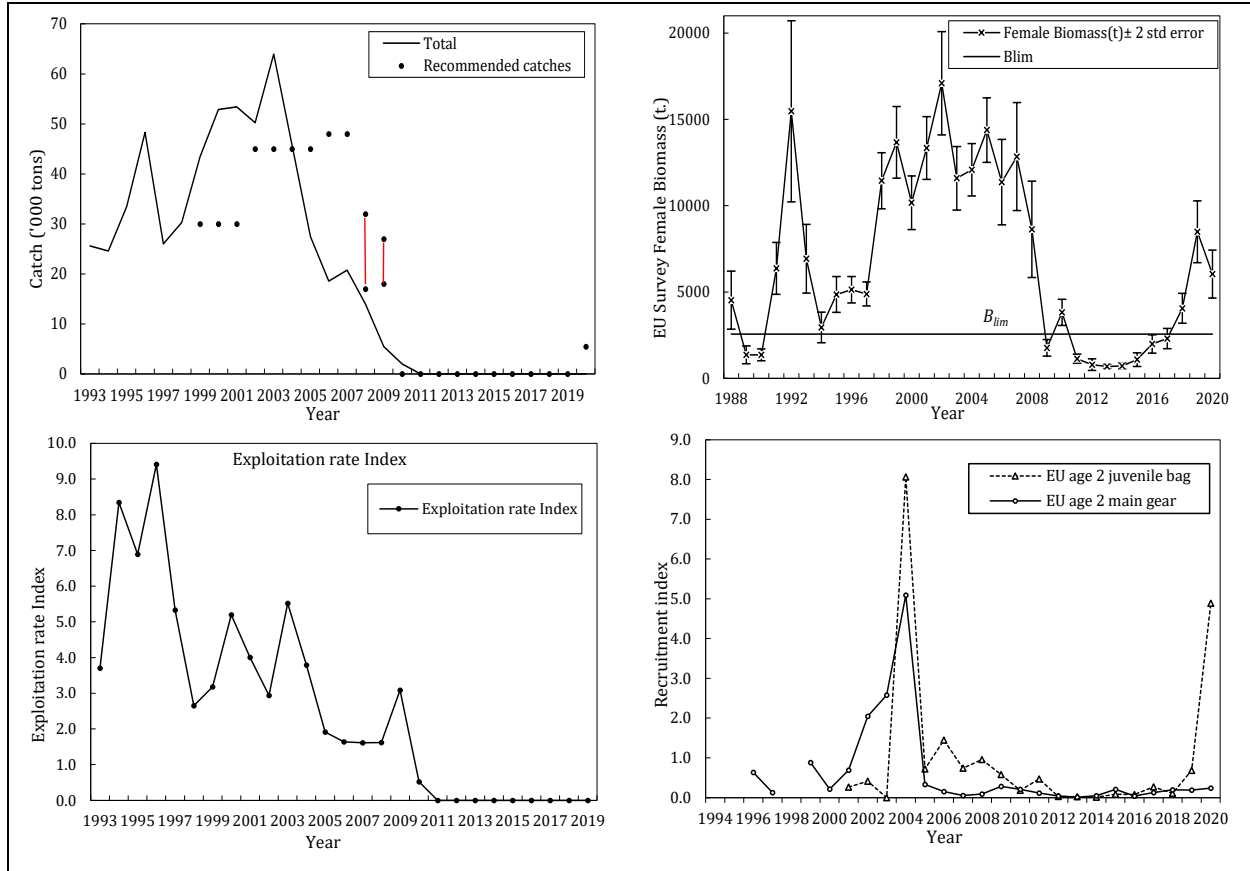
<i>Convention objectives</i>	<i>Status</i>	<i>Comment/consideration</i>	
Restore to or maintain at B_{msy}		Stock above B_{lim} . B_{msy} is unknown.	 OK
Eliminate overfishing		No fishery during 2011 – 2019. Small direct fishery possible in 2020.	 Intermediate
Apply Precautionary Approach		B_{lim} defined. No fishing mortality reference point defined	 Not accomplished
Minimise harmful impacts on living marine resources and ecosystems		VME closures in effect, sorting grids mandatory	 Unknown
Preserve marine biodiversity		Cannot be evaluated	

Management unit

The Northern Shrimp stock on Flemish Cap is considered to be a separate population.

Stock status

The stock has increased since 2014, and in 2020 it has a very low probability (<2.5%) of being below B_{lim} . Recruitment has been poor during the last decade; however, with an overall increasing trend. There are indications of improved recruitment in 2020. Preliminary information from 2020 indicates very low fishing effort, and therefore very low exploitation rate, in the first half of the year



Reference points

Scientific Council considers that a female survey biomass index of 15% of its maximum observed level provides a proxy for B_{lim} (SCS Doc. 04/12).

Projections

Quantitative assessment of risk at various catch options is not possible for this stock at this time.

Assessment

No analytical assessment is available. Evaluation of stock status is based upon fishery and research survey data.

The next assessment will take place prior to the NAFO Annual Meeting in September 2021.

Human impact

Mainly fishery related mortality and low bycatch in other fisheries. Other sources (e.g. pollution, shipping, oil-industry) are considered minor.

Biological and Environmental Interactions

Multispecies models (Pérez-Rodríguez et al. 2016, Pérez-Rodríguez and D. González-Troncoso 2018) suggest that predation by cod and redfish, together with fishing, were the main factors driving the shrimp stock to the collapse after 2007. In the most recent years, decreasing redfish and cod stocks have likely resulted in reduced predation mortality on shrimp, consistent with a period of increase in the shrimp stock.

Results of modelling suggest that, in unexploited conditions, cod and redfish would be expected to be a highly dominant component of the system, and high shrimp stock sizes like the ones observed in the 1998 – 2007 period would not be a stable feature in the Flemish Cap.

Fishery

This fishery is effort-regulated. The effort allocations were reduced by 50% in 2010 and a moratorium was imposed in 2011. The fishery was reopened in 2020. Fishing effort and catches have been close to zero in the first half of 2020. Recent catches and agreed effort by the NAFO Commission were as follows:

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
NIPAG	2 000	0	0	0	0	0	0	0	0	0	0 ¹
STATLANT 21	1976	0	0	0	0	0	0	0	0	0	
Effort (Agreed Days)	5227	0	0	0	0	0	0	0	0	0	2640
SC Recommended Catches (tonnes)	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	5448

¹ preliminary catch during the first half of 2020

Effects of the fishery on the ecosystem

The fishery was closed to directed fishing beginning from 2011 to 2019.

Special comment

In September 2019, the Commission asked the SC to advise on the possible sustainable management methods for northern shrimp in div. 3M, including quota, fishing effort, periods or other technical measures. In its response, SC recommends that the management of 3M shrimp be converted from the existing “effort regulation” to “catch regulation” in line with all other stocks in the NAFO Regulatory Area. Full detail of the response is available in SCS Doc. 19-023.

Source of Information

SCR Doc. 20/051

4. Adjournment

There being no other business, the meeting closed at 14:30 ADT on 14 September 2020

APPENDIX I. REPORT OF THE NAFO/ICES *PANDALUS* ASSESSMENT GROUP (NIPAG)

Chairs: Katherine Sosebee and Ole Ritzau Eigaard

Rapporteur: Tom Blasdale

I. OPENING

NIPAG met be WebEx on 14 September 2020 to assess stocks of northern shrimp in NAFO divisions 3M. Representatives attended from Canada, Denmark (in respect of the Faroe Islands and Greenland), the European Union, France (in respect of St. Pierre et Miquelon), Iceland, Norway and the Russian Federation and Ukraine. A full list of participants is included in Appendix V.

The co-Chairs, Katherine Sosebee (STACFIS chair) and Ole Ritzau Eigaard (ICES chair) opened the meeting by welcoming participants. The provisional agenda was adopted as circulated. The Scientific Council Coordinator was appointed as rapporteur.

II. STOCKS ASSESSMENTS

1. Northern Shrimp (*Pandalus borealis*) on the Flemish Cap (NAFO Div. 3M)

(SCR Doc. 20/051)

a) Environmental Overview

Recent Conditions in Ocean Climate and Lower Trophic Levels

- The ocean climate index in 3M was normal between 2016 and 2019. Before that, 2015 was at its lowest value since 1993, while 2012 was marked by a record high.
- Spring bloom initiation was near normal in 2019 for a third consecutive year. Spring bloom magnitude was below normal in 2019 for the first time since 2015.
- The abundance of copepod and non-copepod zooplankton was above normal in 2019 with the 3rd and 2nd highest anomaly of the time series, respectively.
- Zooplankton biomass was below normal 2019 for the first time since 2014. It was the 3rd lowest anomaly of the time series

Ocean Climate and Ecosystem Indicators

The ocean climate index in Division 3M (Figure 1.1.A) has remained mostly above normal between about 2003 and 2013. After the record-high of 2012, the index gradually decreased reaching in 2015 its lowest value since 1993. The index was however normal during the period 2016-2019, with only 2019 being on the positive side. Spring bloom initiation has been oscillating between short period (2-3 years) of earlier and later timing between 1998 and 2007. The timing of the spring bloom has remained mostly near normal since with the exceptions of two late blooms in 2011 and 2015, and the earliest bloom of the time series in 2016. Spring bloom initiation (Figure 1.1.B) in 2019 was near normal for a 3rd consecutive year. Spring bloom magnitude (Figure 1.1.C) was mainly above normal through the first half of the 2000s before decreasing to near or below normal levels through 2019. Spring production was below normal in 2019 after three consecutive years of near-normal levels. The abundance of copepod (Figure 1.1.D) and non-copepod (Figure 1.1.E) zooplankton showed a general increasing trend since the beginning of the time series. Copepod abundance was above normal in 2019 for a third consecutive year after a period of near-normal levels during the early 2010s. The abundance of non-copepods was above normal in 2019 for a 4th consecutive year and presented the second highest anomaly of the time series. Zooplankton biomass (Figure 1.1.F) showed a generally increasing trend between 1999 and 2010. Biomass then decreased throughout the 2010s except for the record-high biomass observed in 2016 and the above normal level observed in 2018.

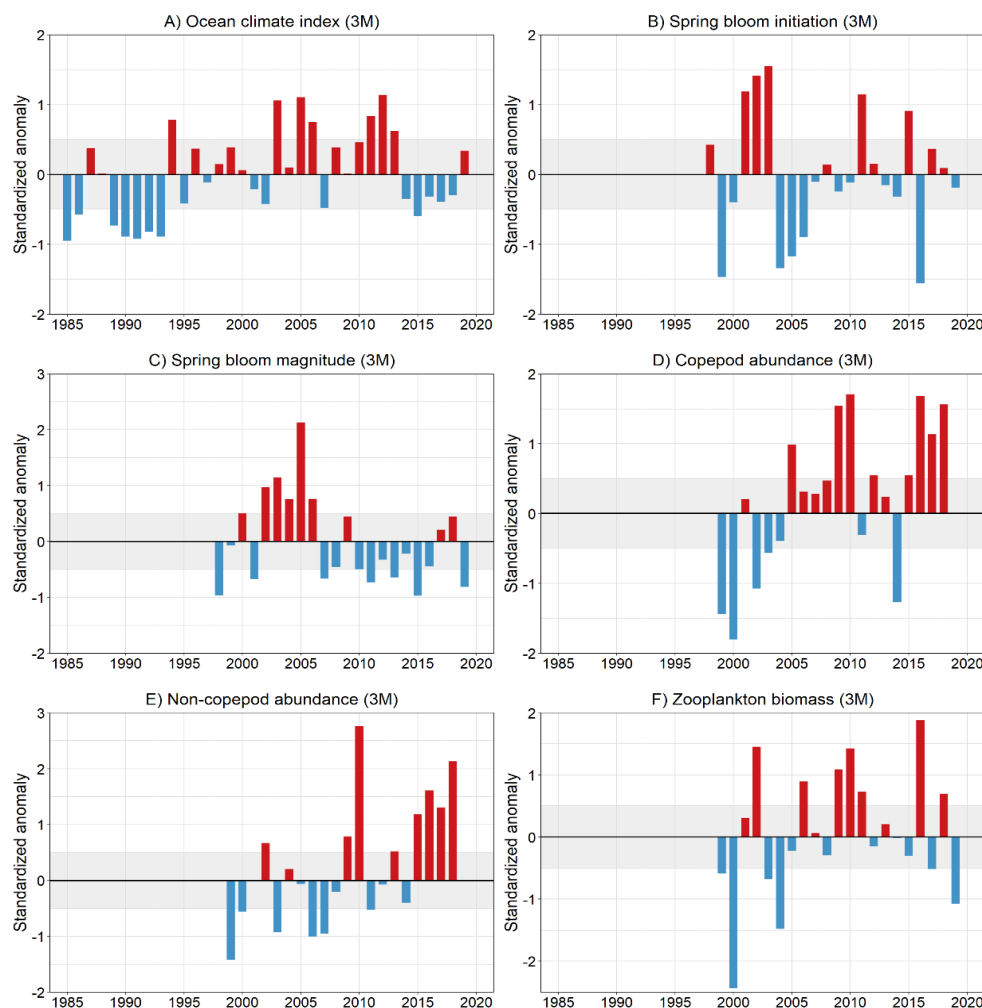


Figure 1.1. Environmental indices for Flemish Cap (in NAFO Div. 3M) during 1990-2019. The ocean climate index (A) for Flemish Cap is the average of 3 time-series of standardized ocean temperature anomalies: sea surface temperatures (SSTs) in Div. 3M, mean temperature over the offshore portion of Flemish Cap hydrographic section (stations FC-15 to FC-35) summer mean bottom temperature over the cap. SSTs and observations along the Flemish Cap hydrographic section are presented in Cyr et al. (2020). Bottom temperatures are derived using the same procedure used in Cyr et al. (2020), but only for the top 1000m of the Cap. Data used for this calculation is mostly from (although not limited to) the EU summer survey. Spring bloom initiation (B) and magnitude (C) indices for the 1998-2019 period are derived from two satellite Ocean Colour boxes (Flemish Pass, and Flemish Cap; see SCR Doc. 20/035 for box location). Zooplankton abundance (D & E) and biomass (F) indices for the 1999-2019 period are derived from a subset of 10 stations along the Flemish Cap Atlantic Zone Monitoring Program oceanographic section covering the Flemish Pass, the Flemish Cap, and the outer shelf break. Positive/negative anomalies indicate conditions above/below (or late/early timing) the long-term average for the reference period. All anomalies are mean standardized anomaly calculated with the following reference periods: ocean climate index, 1981-2010; phytoplankton indices (magnitude and peak timing): 1998-2015; zooplankton indices (copepod, non-copepod, and biomass): 1999-2015. Anomalies within ± 0.5 SD (shaded area) are considered normal conditions.

b) Introduction

The shrimp fishery in Div. 3M began in 1993. Catches peaked at over 60 000 t in 2003 and declined thereafter. A moratorium was imposed from 2011 to 2019.

Fishery and catches: This stock is under effort regulations. The fishery was reopened in 2020 after nine years under moratorium with 2640 fishing days. The effort directed to the shrimp fishery and catches in the first half of 2020 were very low (2 days). Recent catches and effort agreed by the NAFO Commission were as follows (ndf=no directed fishery):

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
NIPAG	5000	2000	0	0	0	0	0	0	0	0	0	0 ¹
STATLANT 21	5374	1976	0	0	0	0	0	0	0	0	0	
SC Recommended Catches	18000–27000	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	Ndf	5448
Effort ² (Agreed Days)	10555	5227	0	0	0	0	0	0	0	0	0	2640

1 Preliminary in the first half of 2020

2 Effort regulated

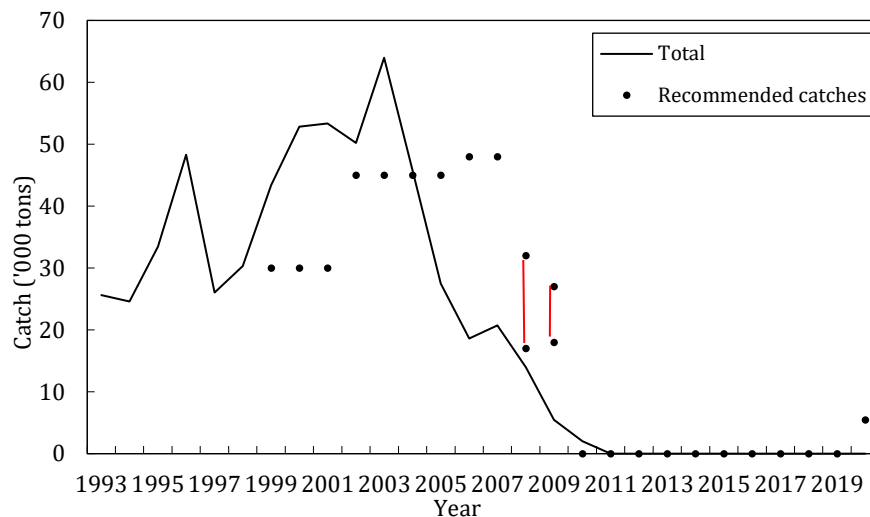


Figure. 1.2. Shrimp in Div. 3M: Catches (t) of shrimp on Flemish Cap and catches recommended in the period 1993-2020.

c) Input Data

i) Commercial fishery data

Time series of size and sex composition data were available mainly from Iceland and Faroes between 1993 and 2005. Because of the moratorium catch and effort data have not been available from 2011 to 2019, and therefore the standardized CPUE series has not been extended.

In 2020, although the shrimp fishery was reopened, length and sex composition from commercial catches were not available due to very low effort and very low catches carried out.

ii) Research Survey Data

EU Bottom Trawl Research Survey. Stratified-random trawl surveys have been conducted on Flemish Cap by the EU in July from 1988 to 2020. A new vessel was introduced in 2003 which continued to use the same trawl employed since 1988. In addition, there were differences in cod-end mesh sizes utilized in the 1994 and 1998 surveys that have likely resulted in biased estimates of total survey biomass. Nevertheless, for this assessment,

the series prior to 2003 were converted into comparable units with the new vessel using the methods accepted by STACFIS in 2004 (NAFO 2004 SC Rep., SCR Doc. 04/77).

d) Assessment

No analytical assessment is available. Evaluation of stock status is based upon interpretation of commercial fishery information and research survey data.

SSB: The survey female biomass index was stable at a high level from 1998 to 2007, and subsequently declined until 2014. Since 2015 the biomass index increased successively and in 2019 the estimated female biomass was well above B_{lim} . In 2020 the female biomass experienced some decrease but remains above B_{lim} . The probability that B_{2020} is below B_{lim} is very low (<2.5%).

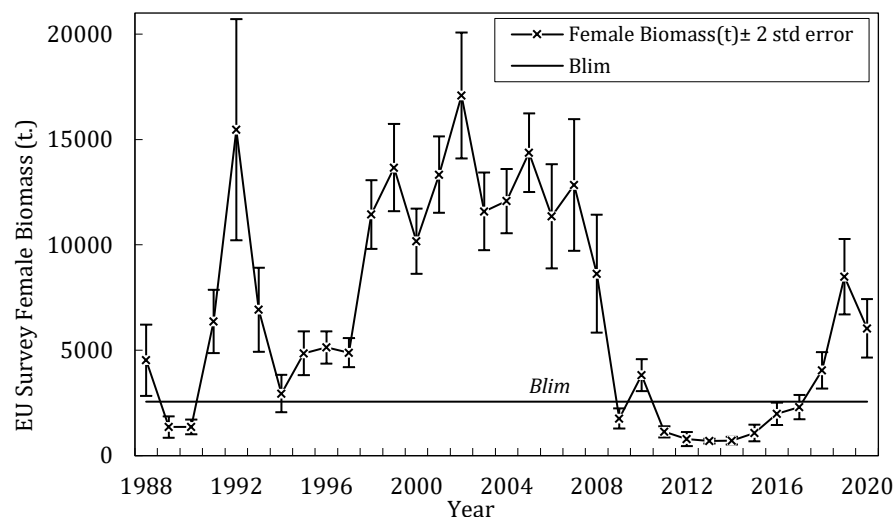


Figure 1.3. Shrimp in Div. 3M: Female biomass index from EU trawl surveys, 1988-2020. Error bars are 2 std. err.

Recruitment: Age estimation was carried out using Rmix library from the preliminary shrimp length distribution and growth rates in the first three years allow the identification of cohorts. Considering the abundance at age 2 as indicator of recruitment, all year-classes from the 2002 cohort to 2017 have been weak from the main gear and from small mesh juvenile bag attached to the net (Figure 1.3). The recruitment index (age 2), however, has been increasing since the lowest observed in 2014. There are indications of improved recruitment in 2020 (Figure 1.4).

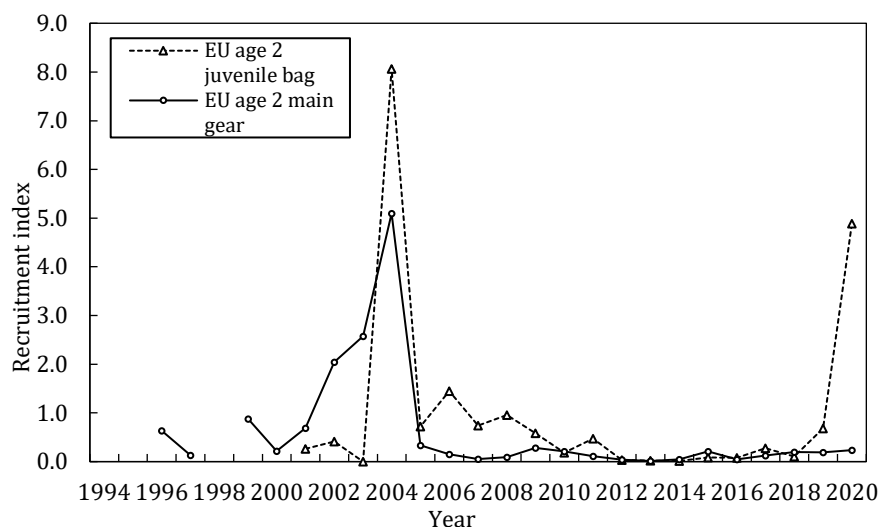


Figure 1.4. Shrimp in Div. 3M: Abundance indices at age 2 from the EU survey. Each series was standardized to its mean.

Exploitation rate: Because of low catches, followed by the moratorium, the exploitation rate index declined to zero and has remained at that level since 2011. Preliminary information from 2020 indicates very low fishing effort, and therefore very low exploitation rate, in the first half of the year.

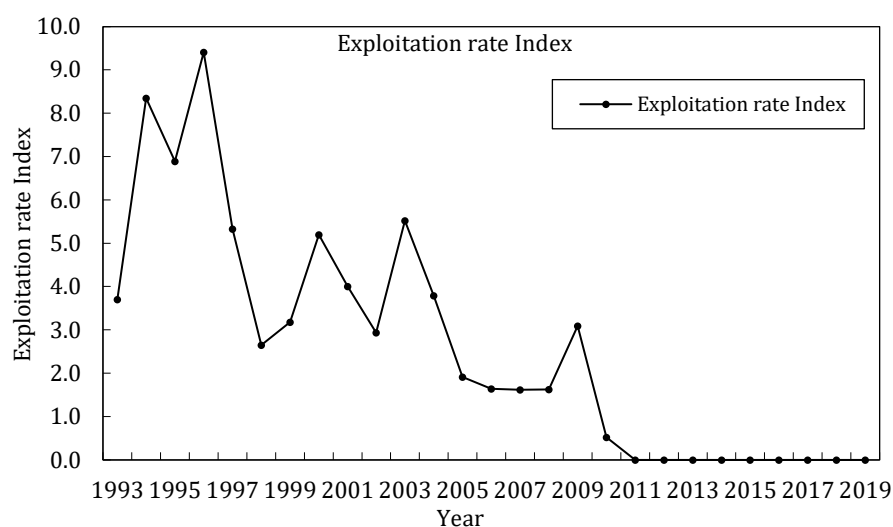


Figure. 1.5. Shrimp in Div. 3M exploitation rate index as derived by catch divided by the EU survey biomass index of the same year.

e) State of the stock

The stock has increased since 2014, and in 2020, the stock has a very low probability (<2.5%) of being below *Blim*. Recruitment has been poor during the last decade however with an overall increasing trend.. There are indications of improved recruitment in 2020. Preliminary information from 2020 indicates very low fishing effort, and therefore very low exploitation rate, in the first half of the year

f) Reference Points

A limit reference point for fishing mortality has not been defined. Scientific Council considers that a female survey biomass index of 15% of its maximum observed level provides a proxy for B_{lim} . This corresponds to an index value of 2 564 t (Figure 1.6).

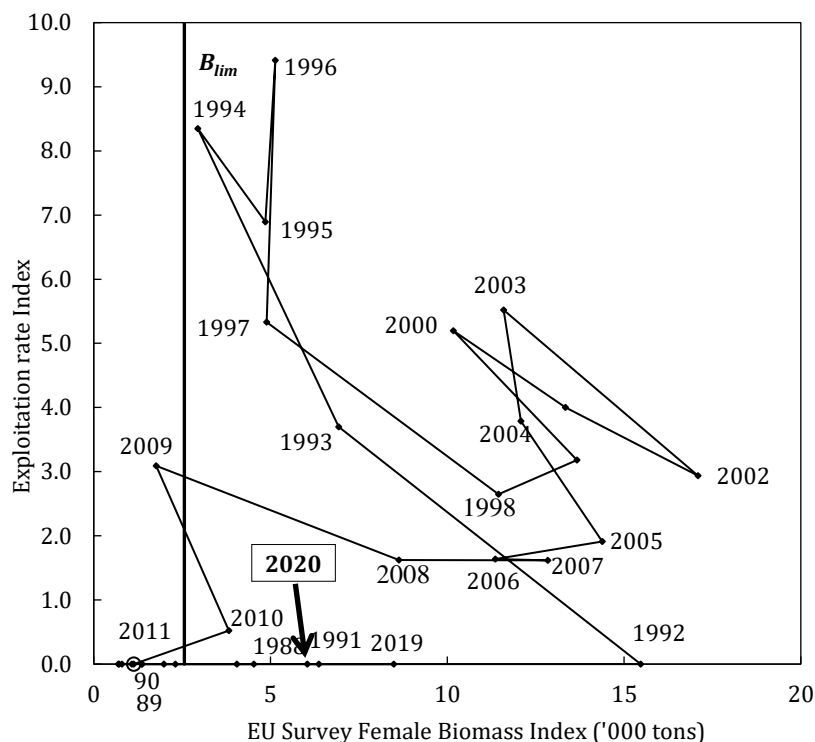


Figure 1.6. Exploitation rate index plotted against female biomass index from EU survey. Line denoting B_{lim} is drawn where biomass is 15% of the maximum point in 2002.

g) Ecosystem considerations

The drastic decline of shrimp biomass around 2008-2010 correlates with an increase of both cod and redfish in Div. 3M. It is uncertain whether this represents a causal relationship and/or covariance as a result of some environmental factor.

Multispecies models (Pérez-Rodríguez et al. 2016, Pérez-Rodríguez and D. González-Troncoso 2018), suggest that predation by cod and redfish, together with fishing, have been the main factors driving the shrimp stock to the collapse after 2007. In the most recent years, decreasing redfish and cod stocks have likely resulted in reduced predation mortality on shrimp, consistent with a period of increase in the shrimp stock.

Results of modelling suggest that, in unexploited conditions, cod and redfish would be expected to be a highly dominant component of the system, and high shrimp stock sizes like the ones observed in the 1998 – 2007 period would not be a stable feature in the Flemish Cap.

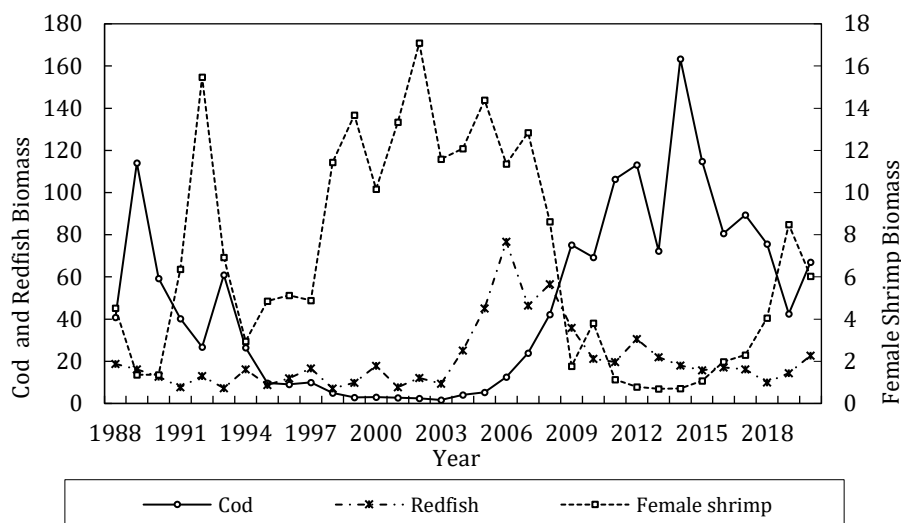


Figure 1.7 Shrimp in Div. 3M: Cod, Redfish and Female shrimp biomass from EU trawl surveys, 1988-2020. 2020 cod and redfish data are preliminary.

h) Research Recommendations

For Northern Shrimp in Div. 3M NIPAG **recommended in 2016** that *further exploration of the relationship between shrimp, cod and the environment be continued in WGESA and NIPAG encourages the shrimp experts to be involved in this work.*

STATUS: No progress from last year.

In 2019, NIPAG **recommended** that *in future years NIPAG should investigate the options to implement an analytical assessment for this stock. Models to explore could include SPiCT, Stock Synthesis (as applied for Northern shrimp in Skagerrak and Norwegian Deep), or other length-based models.*

STATUS: progress will be updated at NIPAG 2020

In 2019, NIPAG **recommended** that *this stock be considered for a benchmark workshop in conjunction with the benchmark of the Skagerrak and Barents Sea stocks anticipated for 2020/21. The NIPAG 2020 meeting will be utilized for a workshop to clarify the data situation and potential assessment models.*

STATUS: progress will be updated at NIPAG 2020

The next assessment will take place prior the NAFO Annual Meeting in September 2021.

References

Pérez-Rodríguez, A. and D. González-Troncoso. 2018. Update of the Flemish Cap multispecies model GadCap as part of the EU SC05 project: "Multispecies Fisheries Assessment for NAFO", NAFO SCR Doc.18/024, serial No.N6808

APPENDIX II. PROVISIONAL AGENDAS

SCIENTIFIC COUNCIL MEETING, 14 September 2020 via WebEx

1. Opening (Chair: Carmen Fernandez)
 - a. Appointment of Rapporteur
 - b. Adoption of Agenda
 - c. Plan of Work
2. Review of Relevant Advice from 2019
3. Formulation of Advice
 - a. Northern shrimp in Div. 3M
5. Adjournment

NAFO/ICES *PANDALUS* ASSESSMENT GROUP, 14 September 2020 via WebEx

1. Opening (Co-chairs Kathrine Sosebee and Ole Ritzau Eigaard)
 - a. Appointment of Rapporteur
 - b. Adoption of Agenda
2. General review
 - a. Review of Relevant Recommendations in 2019
 - b. Presentation of New Survey Data in 2020
3. Stock Assessments
 - a. Northern shrimp (Div. 3M)
4. Other Business
5. Adjournment

APPENDIX III: EXPERTS FOR ASSESSMENT OF CERTAIN STOCKS

The following is the list of Designated Experts for 2020 assessments:

From the Instituto Español de Oceanografía, Vigo (Pontevedra), Spain

Shrimp in Div. 3M

Jose Miguel Casas Sanchez

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APPENDIX IV. LIST OF SCR AND SCS DOCUMENTS

SCR Document			
Doc No.	Serial No	Author	Title
SCR Doc. 20/051	N7102	J.M. Casas Sánchez and M. Álvarez	Division 3M Northern shrimp (<i>Pandalus borealis</i>) – Interim Monitoring Update

SCS Document			
Doc No.	Serial No	Author	Title
SCS Doc. 20/22	N7147	NAFO	Report of the Scientific Council (in conjunction with NIPAG) Meeting, 14 September 2020

APPENDIX V. LIST OF PARTICIPANTS, 14 SEPTEMBER 2020

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