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Northwest Atlantic Fisheries Organization

Report of the Scientific Council Meeting

31 May - 13 June 2024
Halifax, Nova Scotia

NAFO
Halifax, Nova Scotia, Canada
2024

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Scientific Council June Meeting Participants
31 May – 13 June 2024

Included in this photo: Paul Regular, Anthony Thompson, Javier Murillo-Perez, Mar Sacau Cuadrado, Doug S. Butterworth, Katherine Sosebee, Ricardo Alpoim, Mariano Koen-Alonso, Katherine Skanes, Kevin Hedges, Andrew Kenny, Henrik Christiansen, Brynn Devine, Fernando González-Costas, Dawn Maddock Parsons, Laura Wheeland, Andrea Perreault, Adolfo Merino Buisac, Patrícia Gonçalves, Irene Garrido Fernandez, Rasmus Nygaard, Rick Rideout, Lisa Hendrickson, Adriana Nogueira, Inuk Petersen, Martha Krohn, Diana González-Troncoso, Mark Simpson.

Scientific Council Chairs 2024

From left to right: Rick Rideout, Chair of STACPUB; Martha Krohn, Chair of STACFIS; Diana González-Troncoso, Chair of Scientific Council; and Mark Simpson, Vice Chair of Scientific Council and Chair of STACREC. Missing from photo: Miguel Caetano, Chair of STACFEN.

REPORT OF SCIENTIFIC COUNCIL MEETING
31 May -13 June 2024

Chair: Diana González-Troncoso Rapporteur: Jana Aker

I. PLENARY SESSIONS

The Scientific Council met at the Atrium building, Saint Mary's University, Halifax, NS, Canada, during 31 May – 13 June 2024, to consider the various matters in its Agenda. Representatives attended from Canada, Denmark (in respect of Faroe Islands and Greenland), the European Union, Japan, the Russian Federation, Ukraine, the United Kingdom and the United States of America. Observers from the Food and Agriculture Organization (FAO), Ecology Action Center and Oceans North were also present. The Executive Secretary and other members of the Secretariat were in attendance.

The Executive Committee met prior to the opening session of the Scientific Council to discuss the provisional agenda and plan of work.

The Scientific Council was called to order at 10:11 on 31 May 2024. The provisional agenda was **adopted** (Appendix V). The NAFO Secretariat appointed the rapporteur.

The opening session was adjourned at 10:30 on 31 May 2024. Several sessions were held throughout the course of the meeting to deal with specific items on the agenda. The Scientific Council considered and **adopted** all the standing committee reports on 13 June 2024.

The Scientific Council considered and **adopted** the Scientific Council Report of this meeting of 31 May - 13 June 2024. The Chair received approval to leave the report in draft form for about two weeks to allow for minor editing and proof-reading on the usual strict understanding there would be no substantive changes.

The meeting was adjourned at 12:05 on 13 June 2024.

The Reports of the Standing Committees as adopted by the Council are appended as follows: Appendix I - Report of the Standing Committee on Fisheries Environment (STACFEN), Appendix II - Report of Standing Committee on Publications (STACPUB), Appendix III - Report of Standing Committee on Research Coordination (STACREC), and Appendix IV - Report of Standing Committee on Fisheries Science (STACFIS).

The Agenda, List of Research (SCR) and Summary (SCS) Documents, and List of Representatives, Advisers and Experts, are given in Appendices V-VII.

The Scientific Council's considerations on the Standing Committee Reports, and other matters addressed by the Council, follow in Sections II-XV.

II. REVIEW OF SCIENTIFIC COUNCIL RECOMMENDATIONS IN 2023

Recommendations from 2023 are considered in the relevant sections of this report.

III. FISHERIES ENVIRONMENT

The Scientific Council **adopted** the Report of the Standing Committee on Fisheries Environment (STACFEN), as presented by Chair, Miguel Caetano. The full report of STACFEN is in Appendix I.

The recommendations made by STACFEN for the work of the Scientific Council as **endorsed** by the Scientific Council, are as follows:

- STACFEN **recommends** *considering Secretariat support for an invited speaker to address emerging issues and concerns (Climate changes impact on fish stocks) for the NAFO Convention Area during the 2025 STACFEN meeting. Contributions from invited speakers may generate new insights and discussions within the committee regarding integrating environmental information into the stock assessment process.*
- STACFEN **recommends** that *consideration be given to the participation of members in the NAFO/ICES/FAO symposium on "Applying the ecosystem approach to fisheries management in ABNJ" to be held 11-13 March 2025 in Rome. The integration of environmental information into stock assessment is one of the important issues to be discussed at the symposium and is a topic for discussion in the NAFO Scientific Council.*
- STACFEN **recommends** that *consideration be given to convening a meeting with STACFIS and WG-ESA members to evaluate the options and design an approach to integrate climate change considerations throughout Scientific Council operation.*

IV. PUBLICATIONS

The Scientific Council **adopted** the Report of the Standing Committee on Publication (STACPUB) as presented by the Chair, Rick Rideout. The full report of STACPUB is in Appendix II.

The recommendations made by STACPUB for the work of the Scientific Council as **endorsed** by the Scientific Council, are as follows:

- STACPUB **recommends** *removing the note from the SCR documents that states: "NOT TO BE CITED WITHOUT PRIOR REFERENCE TO THE AUTHOR(S)", starting in 2025*.
- STACPUB **recommends** *including a citation in SCR documents, starting in 2025, beneath the address field as follows: AUTHOR LAST NAME, FIRST INITIAL. YEAR. Document title. Scientific Council Research Document, SCR Doc. 24/XX: pp-pp.*

V. RESEARCH COORDINATION

The Scientific Council **adopted** the Report of the Standing Committee on Research Coordination (STACREC) as presented by the Chair, Mark Simpson. The full report of STACREC is in Appendix III.

The recommendations made by STACREC for the work of the Scientific Council as **endorsed** by the Scientific Council, are as follows:

- In June 2022, STACREC **recommended** *exploring in the future the spatio-temporal models used during the Joint ICES/NAFO shrimp benchmark in January 2022 to handle gaps in the surveys.* This recommendation is deferred.
- In 2018, STACREC **recommended** that *all surveys should aim to examine redfish composition at the species level, while recognizing that this may not always be achievable due to trade-offs between different activities and aims of surveys.* STACREC continues to discuss this recommendation.
- STACREC **recommends** *a comprehensive study to investigate redfish stock structure in NAFO Divisions 2 and 3, with consideration of species splitting and recent approaches to studying redfish stock structure in other RFMOs.*

VI. FISHERIES SCIENCE

The Scientific Council **adopted** the Report of the Standing Committee on Fisheries Science (STACFIS) as presented by the Chair, Martha Krohn. The full report of STACFIS is in Appendix IV.

There were no general recommendations arising from STACFIS. The Council endorsed recommendations specific to each stock and they are highlighted under the relevant stock considerations in the STACFIS report.

VII. MANAGEMENT ADVICE AND RESPONSES TO SPECIAL REQUESTS

1. The NAFO Commission

The Commission requests are outlined in SCS Doc. 24/01.

The Scientific Council noted the Commission requests for advice on Northern shrimp (Northern shrimp in Division 3M and Divisions 3LNO) will be undertaken during the Scientific Council meeting on 17 to 19 September 2024.

a) Request for Advice on TACs and Other Management Measures

The Fisheries Commission at its meeting of September 2010 reviewed the assessment schedule of the Scientific Council and with the concurrence of the Coastal States agreed to request advice for certain stocks on either a two-year or three-year rotational basis. In recent years, thorough assessments of certain stocks have been undertaken outside of the assessment cycle either at the request of the Commission or by the Scientific Council's own accord based on recent stock developments.

Cod in Division 3M

Advice June 2024 for 2025-2026

Recommendation for 2025 and 2026

Catches up to 3/4 F_{lim} are projected to result in a very low probability (≤10%) of the stock going below B_{lim} and of fishing mortality exceeding F_{lim}. SSB is projected to increase with a probability of more than 50% under all fishing scenarios with fishing mortality less than 0.56 F_{lim}.

Scientific Council recommends a level of *F* that promotes SSB growth.

Management objectives

No explicit management plan or management objectives have been defined by the Commission. General principles from the *Convention on Cooperation in the Northwest Atlantic Fisheries* are applied.

Convention Principle	Status	Comment
Restore to or maintain at Bmsy	🟡	Bmsy undefined, B > Blim
Eliminate Overfishing (Stock)	🟢	F < Flim
Eliminate Overfishing (Ecosystem)	🟢	Total EPU catches < 2TCI
Apply Precautionary Approach	🟢	Blim and Flim defined
Minimize harmful impacts on living marine resources and ecosystems	🟡	Directed fishery, VME closures in effect, effectiveness of bycatch regulations uncertain
Preserve marine biodiversity	⚪	Cannot be evaluated

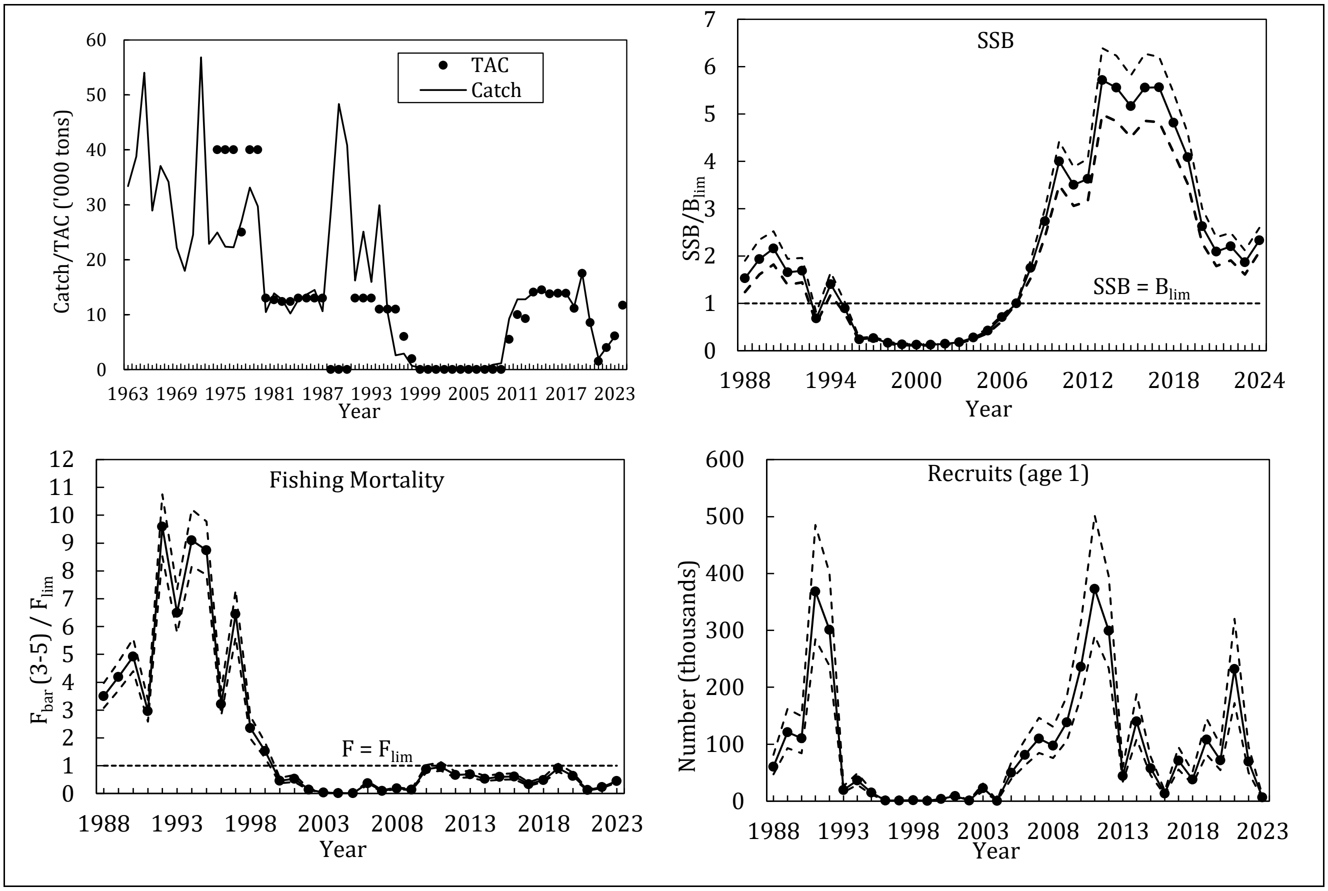
🟢 OK
🟡 Intermediate
🔴 Not accomplished
⚪ Unknown

Management unit

The cod stock in Flemish Cap (NAFO Division 3M) is considered to be a separate population.

Stock status

SSB declined rapidly since 2017 but has remained stable during the last 4 years and is estimated to be above B_{lim}. Since 2013, recruitment has varied at intermediate levels but much lower than those observed in 2011-2012. In 2021, a good recruitment was observed, while in 2023 is at a very low level. Fishing mortality has remained below F_{lim} since the fishery reopened in 2010. In 2021, the minimum level of F since the re-opening was reached, increasing since then. In 2023, *F* is below F_{lim} with high probability.



Reference points

B_{lim} = SSB$_{2007}$: Median = 14 632 tons of spawning biomass (Scientific Council, 2024).

F_{lim} = F$_{30\%SPR}$: Median = 0.153 (Scientific Council, 2024).

Projections

Stochastic projections of the stock dynamics from 2024 to the start of 2027 were conducted. F_{bar} is the mean of the F at ages 3-5 and is used as the indicator of overall fishing mortality; F_{sq} is the status quo F, calculated as the mean of the last three years F_{bar} (2021-2023).

	B		SSB		Yield
	Median and 80% CI				
$F_{bar} = 0$					
2024	69964	(61172 - 80992)	34191	(30581 - 37965)	11708
2025	71077	(58334 - 87704)	38180	(32789 - 44159)	0
2026	85529	(70215 - 108862)	54962	(47380 - 63261)	0
2027	97470	(75277 - 128007)	56346	(49099 - 64824)	
$F_{bar} = F_{sq}$ (median = 0.042)					
2024	69964	(61172 - 80992)	34191	(30581 - 37965)	11708
2025	71077	(58334 - 87704)	38180	(32789 - 44159)	5580
2026	79679	(64255 - 102904)	49425	(42014 - 57552)	7112
2027	84088	(62475 - 114436)	44197	(36922 - 52632)	
$F_{bar} = 1/2F_{lim}$ (median = 0.076)					
2024	69964	(61172 - 80992)	34191	(30581 - 37965)	11708
2025	71077	(58334 - 87704)	38180	(32789 - 44159)	9786
2026	75187	(59830 - 98431)	45287	(37898 - 53368)	11351
2027	74899	(53930 - 104982)	36282	(28988 - 44515)	
$F_{bar} = 0.56\ F_{lim}$ (median = 0.086)					
2024	69964	(61172 - 80992)	34191	(30581 - 37965)	11708
2025	71077	(58334 - 87704)	38180	(32789 - 44159)	10913
2026	73981	(58650 - 97233)	44158	(36816 - 52286)	12310
2027	72678	(51812 - 102907)	34312	(27034 - 42517)	
$F_{bar} = F_{2024}$ (median = 0.093)					
2024	69964	(61172 - 80992)	34191	(30581 - 37965)	11708
2025	71077	(58334 - 87704)	38180	(32789 - 44159)	11613
2026	73231	(57914 - 96493)	43491	(36115 - 51656)	12820
2027	71372	(50559 - 101399)	33209	(25935 - 41462)	
$F_{bar} = 2/3F_{lim}$ (median = 0.102)					
2024	69964	(61172 - 80992)	34191	(30581 - 37965)	11708
2025	71077	(58334 - 87704)	38180	(32789 - 44159)	12613
2026	72160	(56868 - 95434)	42483	(35219 - 50627)	13622
2027	69541	(48765 - 99338)	31548	(24214 - 39695)	
$F_{bar} = 3/4F_{lim}$ (median = 0.114)					
2024	69964	(61172 - 80992)	34191	(30581 - 37965)	11708
2025	71077	(58334 - 87704)	38180	(32789 - 44159)	13949
2026	70731	(55473 - 94021)	41172	(33870 - 49383)	14558
2027	67180	(46452 - 96710)	29424	(22151 - 37537)	
$F_{bar} = F_{lim}$ (median = 0.153)					
2024	69964	(61172 - 80992)	34191	(30581 - 37965)	11708
2025	71077	(58334 - 87704)	38180	(32789 - 44159)	17711
2026	66783	(51499 - 90043)	37545	(30323 - 45626)	16719
2027	60872	(40592 - 90361)	23935	(16734 - 32123)	

		Yield			P(SSB < SSB_{lim})				P(F > F_{lim})			
		2024	2025	2026	2024	2025	2026	2027	2024	2025	2026	P(SSB_{27} > SSB_{24})
F =	0	11708	0	0	<1%	<1%	<1%	<1%	<1%	<1%	<1%	100%
F_{sq} =	0.042	11708	5580	7112	<1%	<1%	<1%	<1%	<1%	<1%	<1%	100%
1/2F_{lim} =	0.076	11708	9786	11351	<1%	<1%	<1%	<1%	<1%	<1%	<1%	66%
0.56 F_{lim}=	0.086	11708	10913	12310	<1%	<1%	<1%	<1%	<1%	<1%	<1%	50%
F_{2024} =	0.093	11708	11613	12820	<1%	<1%	<1%	<1%	<1%	<1%	<1%	41%
2/3F_{lim} =	0.102	11708	12613	13622	<1%	<1%	<1%	<1%	<1%	<1%	2%	29%
3/4F_{lim} =	0.114	11708	13949	14558	<1%	<1%	<1%	1%	<1%	2%	10%	18%
F_{lim} =	0.152	11708	17711	16719	<1%	<1%	<1%	4%	<1%	50%	50%	3%

The results indicate that under all scenarios with $F_{bar} \leq F_{2024}$, total biomass during the projected years will increase, whereas the SSB is projected to increase in 2027 from 2024 with a probability higher than 50% under scenarios with $F_{bar} < 0.56\ F_{lim}$. The probability of SSB being below B_{lim} is very low (≤4%) in all the scenarios.

Under all scenarios, the probability of F_{bar} exceeding F_{lim} is less than or equal to 10% in 2026.

Assessment

A Bayesian SCAA model, introduced at the 2018 benchmark, was used as the basis for the assessment of this stock with data from 1988 to 2023.

The next full assessment for this stock will be in 2026.

Human impact

Mainly fishery related mortality. Other sources (e.g., pollution, shipping, oil-industry) are undocumented.

Biological and environmental interactions

Redfish, shrimp and smaller cod are important prey items for cod. There are strong trophic interactions between these species in the Flemish Cap.

The Flemish Cap (3M) Ecosystem Production Unit (EPU), with the exception of a short-lived increase in 2005-2009, has shown a fairly stable total biomass over time despite the changes in individual stocks. This indicates no major changes in overall ecosystem productivity.

Ecosystem sustainability of catches

The impact of bottom fishing activities on VMEs in the NRA was last assessed in 2021. The risk of Significant Adverse Impacts (SAIs) on sponge and large gorgonian VMEs was assessed to be low, while this risk for sea pen VMEs has been assessed as intermediate. The risks of SAIs on small gorgonian, black coral, bryozoan and sea squirt VMEs were assessed as high. A number of areas in the Flemish Cap (3M) EPU have been closed to bottom fishing to protect VMEs.

3M cod is included in the piscivores guild of the Flemish Cap (3M) Ecosystem Production Unit (EPU). Other NAFO managed stocks in this guild and EPU are 3M redfish and 2+3KLMNOPs Greenland halibut. The Catch/TCI in 2023 was below the 2TCI ecosystem reference point (3M Piscivore $Catch_{2023}$/TCI=1.12).

Fishery

Cod is caught in directed trawl and longline fisheries and as bycatch in the directed redfish fishery by trawlers. The fishery is regulated by quota. New technical regulations were introduced in 2021, in particular a closure of the directed fishery in the first quarter as well as sorting grids to protect juveniles.

Recent catch estimates and TACs (‘000 tonnes) are as follows:

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
TAC	13.8	13.9	13.9	11.1	17.5	8.5	1.5	4.0	6.1	11.7
STATLANT 21	12.8	13.3	13.9	11.2	17.4	8.5	1.9	NA[1]	NA[1]	
STACFIS	13.8	14.0	13.9	11.5	17.5	8.5	2.1	4.0	6.2	

[1] NA - In 2022-2023, STATLANT 21 information is incomplete.

Special comments

Scientific Council proposes to conduct a full assessment of Atlantic cod in Division 3M every two years, since biological parameters and the stock status have remained quite stable in recent years. For this reason, this year SC is providing advice for this stock for the next two years. The stock will be monitored via IMR in interim years and an assessment can be triggered by Scientific Council if changes are observed

Sources of information

SCS Doc. 24/06, 08, 10, 11; SCR Doc. SCR 24/05, 16.

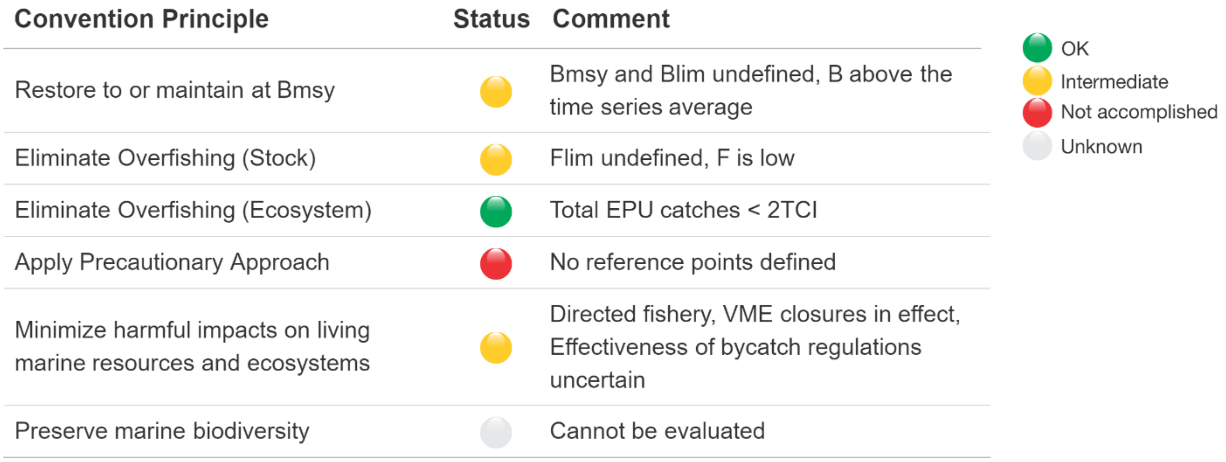
Redfish (*Sebastes mentella* and *Sebastes fasciatus*) in Division 3M — Advice June 2024 for 2025-2026

Recommendation for 2025 and 2026

Given the life history of this stock, considering that the current *F* levels are below $F_{0.1}$, and to try to maintain the stock around the long-term average, Scientific Council advises that catches do not exceed the *F* corresponding to the current TAC (17 503 t in 2025 and 15 636 t in 2026).

Management objectives

No explicit management plan or management objectives defined by the Commission. General principles from the *Convention on Cooperation in the Northwest Atlantic Fisheries* are applied.



Convention Principle	Status	Comment
Restore to or maintain at Bmsy	🟡	Bmsy and Blim undefined, B above the time series average
Eliminate Overfishing (Stock)	🟡	Flim undefined, F is low
Eliminate Overfishing (Ecosystem)	🟢	Total EPU catches < 2TCI
Apply Precautionary Approach	🔴	No reference points defined
Minimize harmful impacts on living marine resources and ecosystems	🟡	Directed fishery, VME closures in effect, Effectiveness of bycatch regulations uncertain
Preserve marine biodiversity	⚪	Cannot be evaluated

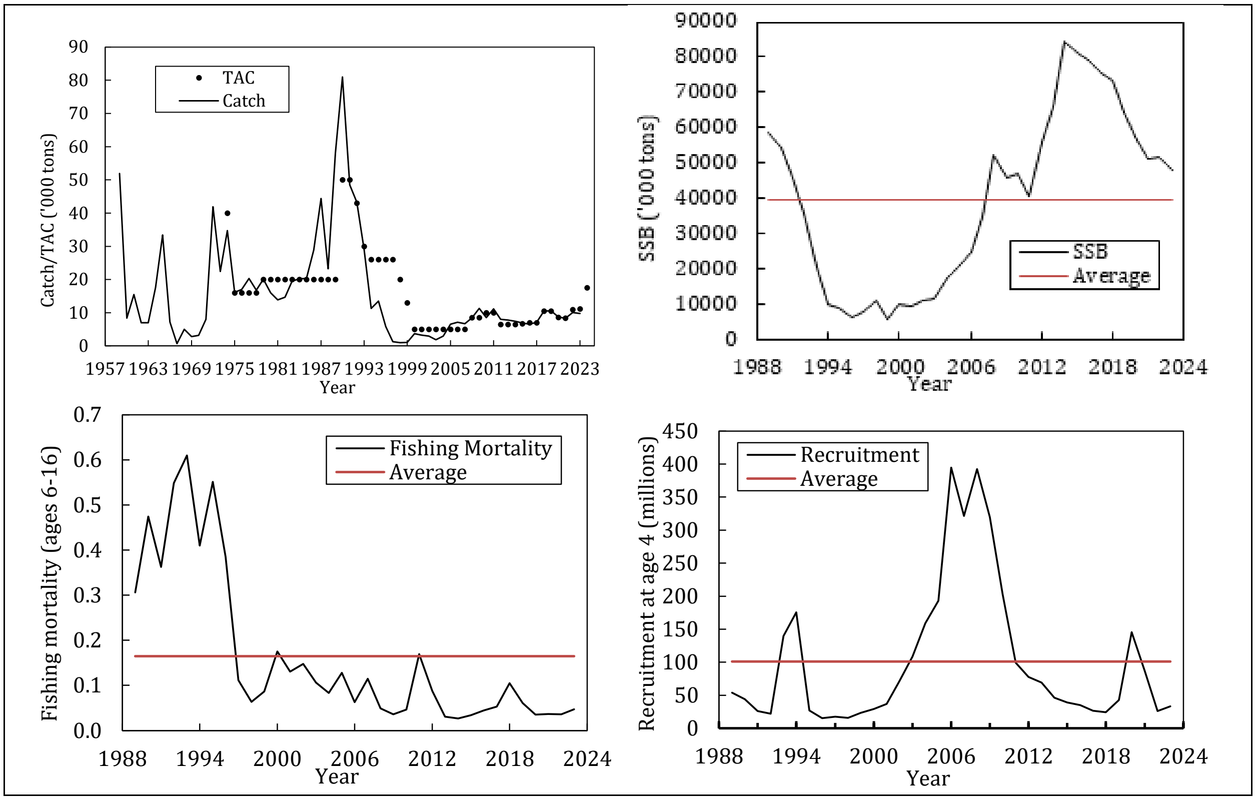
🟢 OK
🟡 Intermediate
🔴 Not accomplished
⚪ Unknown

Management unit

Catches of redfish in Division 3M include three species of the genus *Sebastes; S. mentella, S. norvegicus* (=*S. marinus*) and *S. fasciatus*. For management purposes, they are considered as one stock. The assessment and advice are based on data for only two species (*S. mentella* & *S. fasciatus*), labeled as beaked redfish. The TAC advice is adjusted to reflect all three species on the Flemish Cap, based upon the relative species distribution in recent surveys.

Stock status

SSB has declined since 2014, but in 2023 is still well above the long-term mean. After an extended period of declining recruitment, the recruitment estimates for 2020 and 2021 are above or at the mean, while the 2022 and 2023 values are low. Fishing mortality remains relatively low compared to the 1980s and 1990s.



Reference points

No reference points have been adopted.

Projections

Short term (2025-2027) stochastic projections were carried out for spawning stock biomass (SSB) and catch, under most recent level of natural mortality and considering seven options for fishing mortality and catch levels (F_0, $F_{0.1}$, F=M, $F_{statusquo}$, 1.25 TAC, TAC and 0.75 TAC). Projections assume that redfish catches (all species) in 2024 are equal to the redfish TAC. Recruitment in 2024 was given by the geometric mean of the most recent recruitments (age 4 XSA, 2021-2023) and randomly resampled with residuals from the geometric mean for 2025 and 2026.

The potential yields estimated in the projections are lower than seen in the 2023 assessment, because of the retrospective pattern in the last assessment. With the exception of the F=0 scenario, in all projection scenarios the SSB is projected to decline, and to be at around the average for the assessment time-series (since the late 1980s) by 2027.

F=0

Year	SSB Median and 80% CI	Yield	TAC
2024$_{deterministic}$	52117	17503	17503
2025	47961 (42714 - 56635)	0	0
2026	48861 (43686 - 57065)	0	0
2027	49353 (44212 - 57395)		

$F_{0.1}$=0.0675

Year	SSB Median and 80% CI	Yield	TAC
2024$_{deterministic}$	52117	17503	17503
2025	47961 (42714 - 56635)	20498	21521
2026	42764 (38347 - 49877)	17831	18721
2027	38223 (34332 - 44124)		

F=M=0.1

Year	SSB Median and 80% CI	Yield	TAC
2024$_{deterministic}$	52117	17503	17503
2025	47961 (42714 - 56635)	29379	30846
2026	40154 (36071 - 46724)	24021	25220
2027	33951 (30549 - 39038)		

F_{sq} = 0.0585

Year	SSB Median and 80% CI	Yield	TAC
2024$_{deterministic}$	52117	17503	17503
2025	47961 (42714 - 56635)	17917	18811
2026	43531 (39018 - 50785)	15872	16664
2027	39509 (35470 - 45624)		

1.25 TAC (F= 0.068708)

Year	SSB Median and 80% CI	Yield	TAC
2024$_{deterministic}$	52117	17503	17503
2025	47961 (42714 - 56635)	20839	21879
2026	42663 (38259 - 49752)	18088	18990
2027	38056 (34176 - 43937)		

TAC (F= 0.05416)

Year	SSB Median and 80% CI	Yield	TAC
2024$_{deterministic}$	52117	17503	17503
2025	47961 (42714 - 56635)	16671	17503
2026	43888 (39345 - 51229)	14893	15636
2027	40160 (36040 - 46393)		

0.75 TAC (F=0.040047)

Year	SSB Median and 80% CI	Yield	TAC
2024$_{deterministic}$	52117	17503	17503
2025	47961 (42714 - 56635)	12503	13127
2026	45119 (40452 - 52695)	11486	12060
2027	42344 (37976 - 49021)		

average beaked redfish proportion in the 2021-2023 3M redfish catch 0.952

	F=0	$F_{0.1}$	*F=M*	*Fsq*	1.25 TAC	TAC	0.75 TAC
P(SSB_{2025}>SSB_{2024})	>10%	>10%	>10%	>10%	>10%	>10%	>10%
P(SSB_{2026}>SSB_{2024})	>10%	<10%	<10%	<10%	<10%	<10%	>10%
P(SSB_{2027}>SSB_{2024})	>10%	<10%	<10%	<10%	<10%	<10%	<10%

Assessment

Input data comes from the EU Flemish Cap bottom trawl survey and the fishery. A quantitative model (XSA) introduced in 2003 was used. Increased natural mortality was assumed from 2006 to 2010, but natural mortality was low (more typical of redfish) in other years. There is no evidence that natural mortality has increased recently from the level of 0.1 adopted in the 2017 assessment, and therefore the 2023 XSA assessment was run with average M from 2015 onwards fixed at 0.1.

The next full assessment of this stock will be in 2026.

Human impact

Mainly fishery related mortality. Other sources (e.g., pollution, shipping, oil-industry) are undocumented.

Biology and Environmental Interactions

Shrimp and cod are important prey and predator of redfish. There are strong trophic interactions between these species in the Flemish Cap.

The Flemish Cap (3M) Ecosystem Production Unit (EPU), with the exception of a short-lived increase in 2005-2009, has shown a fairly stable total biomass over time despite the changes in individual stocks. This indicates no major changes in overall ecosystem productivity

Ecosystem sustainability of catches

3M redfish is included in the piscivores guild of the Flemish Cap (3M) Ecosystem Production Unit (EPU). Other NAFO managed stocks in this guild and EPU are 3M cod and 2+3KLMNOPs Greenland halibut. The Catch/TCI for 2023 was below the 2TCI ecosystem reference point (3M Piscivore Catch_{2023}/TCI=1.12).

The impact of bottom fishing activities on VMEs in the NRA was last assessed in 2021. The risk of Significant Adverse Impacts (SAIs) on sponge and large gorgonian VMEs was assessed to be low, while this risk for sea pen VMEs has been assessed as intermediate. The risks of SAIs on small gorgonian, black coral, bryozoan and sea squirt VMEs were assessed as high. A number of areas in the Flemish Cap (3M) EPU have been closed to bottom fishing to protect VMEs.

Fishery

Redfish is caught in directed bottom trawl fisheries at intermediate depths (300-700m), but also as bycatch in fisheries directed for cod and Greenland halibut. The fishery in NAFO Division 3M is regulated by minimum mesh size and quota.

Recent catch estimates and TACs ('000 t) are as follows:

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
TAC	6.7	7.0	7.0	10.5	10.5	8.6	8.4	10.9	11.2	17.5
STATLANT 21[1]	6.9	6.6	7.1	10.5	10.5	8.6	8.6	NA[3]	NA[3]	
STACFIS Total catch [1]	6.9	6.6	7.1	10.5	10.6	8.8	8.3	10.0	9.7	
STACFIS Catch [2]	5.2	6.2	6.9	10.3	10.2	8.7	8.3	9.4	9.4	

[1] TAC, STATLANT 21 and STACFIS Total catch refer to all three redfish species combined.
[2] STACFIS beaked redfish catch estimate, based on beaked redfish proportions on observed catch.
[3] NA - In 2022-2023, STATLANT 21 information is incomplete.

Sources of information

SCR Doc. 24/005, 024, 23/003, 040; SCS Doc. 24/08, 11, 23/06, 13.

Redfish in Divisions 3LN Advice June2024 for 2025-2026

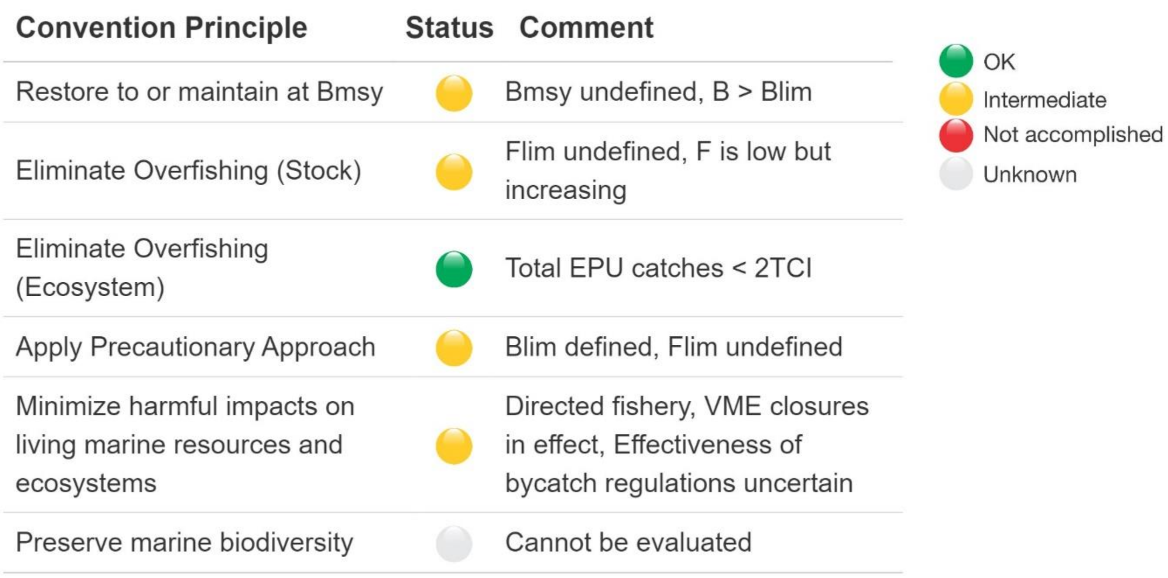
Recommendation for 2025 and 2026

The stock has decreased since 2015 and there is a 42% risk of the stock being below B_{lim} in 2023. Recruitment has been at or below the long-term average since the mid-2010s.

To be consistent with the NAFO Precautionary Approach, Scientific Council advises that no directed fishery should occur in 2025 and 2026. Bycatch should be kept at the lowest possible level.

Management objectives

No explicit management plan or management objectives have been defined by the Commission. General principles from *the Convention on Cooperation in the Northwest Atlantic Fisheries* are applied.



Convention Principle	Status	Comment
Restore to or maintain at Bmsy	🟡	Bmsy undefined, B > Blim
Eliminate Overfishing (Stock)	🟡	Flim undefined, F is low but increasing
Eliminate Overfishing (Ecosystem)	🟢	Total EPU catches < 2TCI
Apply Precautionary Approach	🟡	Blim defined, Flim undefined
Minimize harmful impacts on living marine resources and ecosystems	🟡	Directed fishery, VME closures in effect, Effectiveness of bycatch regulations uncertain
Preserve marine biodiversity	⚪	Cannot be evaluated

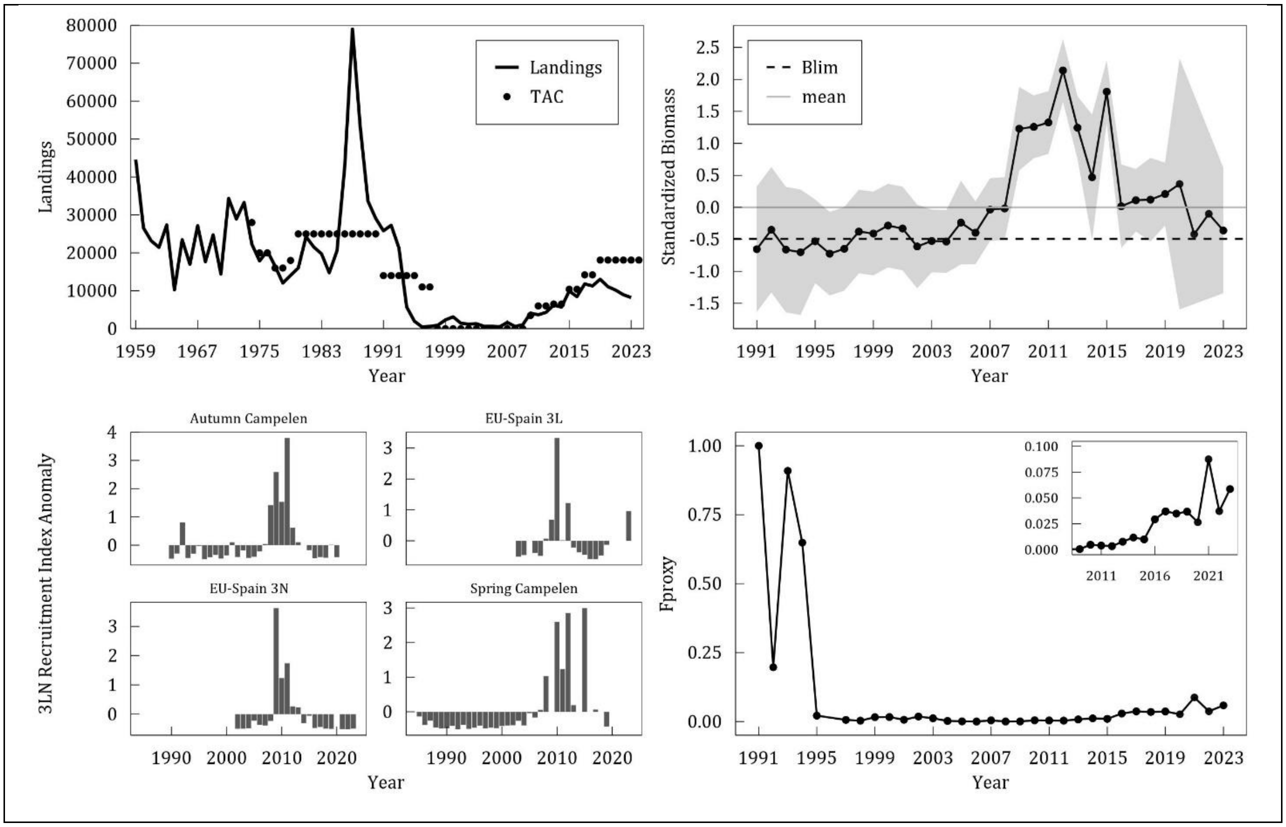
🟢 OK
🟡 Intermediate
🔴 Not accomplished
⚪ Unknown

Management unit

The management unit is defined as NAFO Divisions 3LN.

Stock status

The stock has decreased since 2015 and B_{2023}/B_{lim} is estimated at 1.38. There is a 42% risk of the stock being below B_{lim} in 2023. Recruitment (abundance 15-20 cm) has been below the long-term average since the mid-2010s in all surveys, with the exception of the 2023 EU-Spain survey in 3L. Relative fishing mortality has been increasing in recent years, but remains well below the time series high seen in the early 1990's.



Reference points

A biomass reference point is derived from the combined standardized biomass index 3N EU-Spain, Canadian Fall Campelen and Spring Teleost (B_{lim}=B_{rec}) from the period 1991-2005. This period was chosen as it represented a time when stock biomass recovered from a prolonged low level.

Assessment

This assessment is based on a combined 3L and 3N EU-Spain, Canadian Fall Campelen and Spring Teleost mean standardized index. The next assessment is scheduled for 2026.

Work is ongoing to develop an MSE for this stock.

Human impact

Mainly fishery related mortality has been documented. Mortality from other human sources (e.g. pollution, shipping, oil-industry) are undocumented.

Biology and environmental interactions

There are two species of the genus *Sebastes* with distribution overlapping in several areas of Northwest Atlantic, namely on the Gulf of St. Lawrence, Laurentian Channel, off Newfoundland and south of Labrador Sea: the deep sea redfish (*Sebastes mentella*), with a maximum abundance at depths greater than 350m, and Acadian redfish (*Sebastes fasciatus*), preferring shallower waters of less than 300m.

The Grand Bank (3LNO) Ecosystem Production Unit (EPU) is currently experiencing low productivity conditions, with EPU biomass well below pre-collapse levels (pre-1990s). Rebuilding was observed since the 1990s, but declines across multiple trophic levels and stocks occurred after 2014. While positive signals have been observed since these declines, biomass has yet to return to the early-mid 2010s level.

Ecosystem sustainability of catches

The impact of bottom fishing activities on VMEs in the NRA was last assessed in 2021. The risk of Significant Adverse Impacts (SAIs) on sponge and large gorgonian VMEs was assessed to be low, while this risk for sea pen VMEs has been assessed as intermediate. The risks of SAIs on small gorgonian, black coral, bryozoan and sea squirt VMEs were assessed as high. Areas within Divisions 3LN have been closed to bottom fishing to protect VMEs.

3LN redfish is included in the piscivores guild of the Grand Bank (3LNO) Ecosystem Production Unit (EPU). Other NAFO managed stocks in this guild within the EPU include 3O redfish, 3NO cod, 3NOPs white hake and 2+3KLMNOPs Greenland halibut. The Catch/TCI for 2023 was below the 2TCI ecosystem reference point (3LNO Piscivore Catch_{2023}/TCI=1.34).

Fishery

Landings of this stock are primarily from directed fisheries. Following evaluation in the previous MSE, a stepwise harvest control rule (HCR) was adopted for this stock in 2014. Since then, the TAC has increased in steps from 6 500 tonnes to 18 100 tonnes, the maximum level evaluated for the HCR at the MSE. Catches have been decreasing since 2019 and have remained below the TAC.

Recent catch estimates and TACs (‘000 tonnes) are:

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
TAC	10.4	10.4	14.2	14.2	18.1	18.1	18.1	18.1	18.1	18.1
STATLANT 21	10.2	8.5	11.8	11.3	13.1	11.7	11.8	NA[1]	NA[1]	
STACFIS catch	9.9	8.5	11.8	11.3	13.1	11.1	10.2	9.0	8.2	

[1] In 2022-2023, STATLANT 21 information is incomplete.

Special comments

Redfish are known to have variable and episodic recruitment, with potentially large periods of time between recruitment pulses and poorly understood relationships between stock size and recruitment. Impacts of delineations of stock boundaries and synchronicity between adjacent stocks are unknown. Work is ongoing to develop an MSE for this stock.

Sources of information

SCR Docs. 24/007, 008, 036, 048; SCS Doc. 24/06, 08, 09, 10, 11.

Witch flounder in Divisions 3NO

Advice June 2024 for 2025–2026

Recommendation for 2025 and 2026

In the projection period the probability of being below B_{lim} is very low (≤10%), however the probability of exceeding F_{lim} is projected to be above 30% for F greater than 75% F_{msy}. Scientific Council therefore recommends that F should be no higher than 75% F_{msy}.

Management objectives

No explicit management plan or management objectives are defined by the Commission. General principles from the *Convention on Cooperation in the Northwest Atlantic Fisheries* are applied.

Convention Principle	Status	Comment
Restore to or maintain at Bmsy	🟡	Blim < B < Bmsy
Eliminate Overfishing (Stock)	🟢	F < Flim
Eliminate Overfishing (Ecosystem)	🟢	Total EPU catches < 2TCI
Apply Precautionary Approach	🟢	Blim and Flim defined
Minimize harmful impacts on living marine resources and ecosystems	🟡	Directed fishery, VME closures in effect, Effectiveness of bycatch regulations uncertain
Preserve marine biodiversity	⚪	Cannot be evaluated

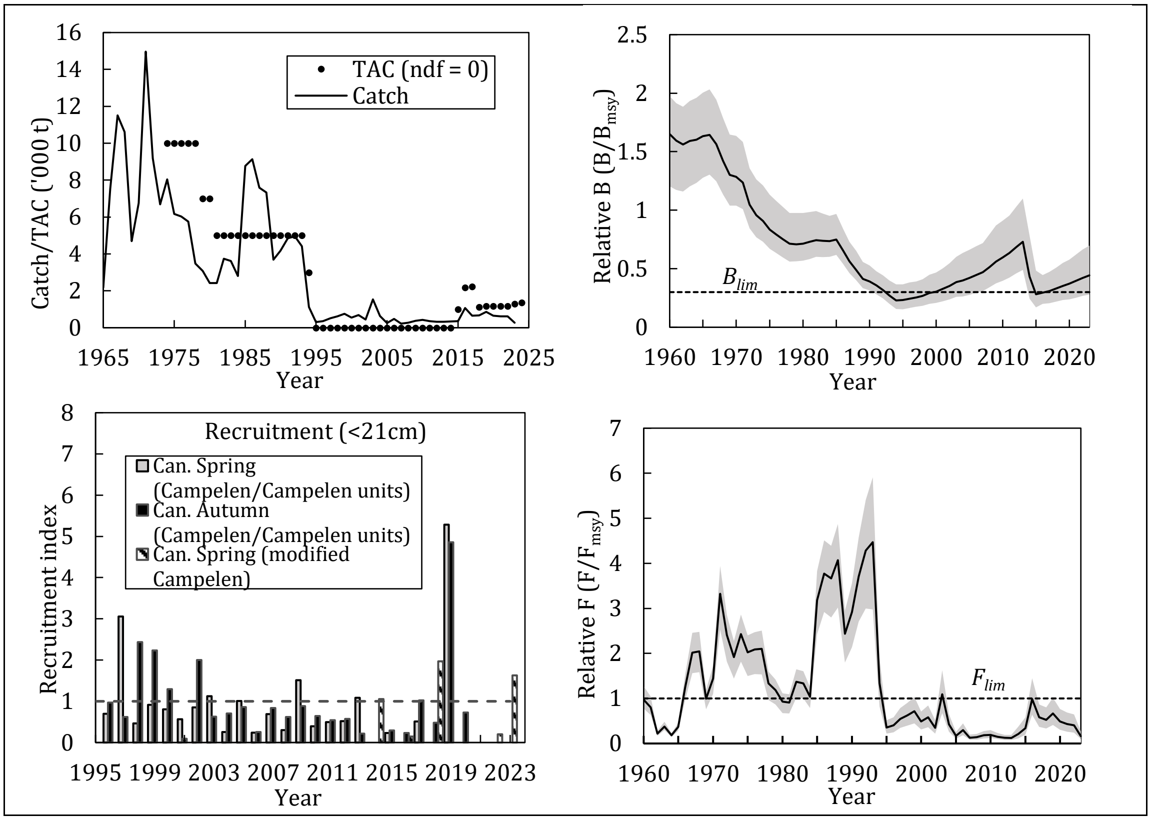
🟢 OK
🟡 Intermediate
🔴 Not accomplished
⚪ Unknown

Management unit

The management unit is NAFO Divisions 3NO. The stock mainly occurs in Division 3O along the southwestern slopes of the Grand Bank. In most years the distribution is concentrated toward the slopes but in certain years a higher percentage may be distributed in shallower water.

Stock status

The stock has increased slightly since 2015 and is estimated at 44% B_{msy}. At the beginning of 2024, there is an 11% risk of the stock being below B_{lim} and less than 1% risk of F being above F_{lim}. Recent recruitment is about average.



Reference points

B_{lim} is 30% B_{msy} and F_{lim} is F_{msy} (STACFIS 2004 p 133).

Projections

The probability of F being above F_{lim} ranged from <1% to 51% for the catch scenarios tested. The population is projected to grow under all scenarios and the probability that the biomass in 2027 is greater than the biomass in 2024 is greater than 61% in all scenarios. The population is projected to remain below B_{msy} through to the beginning of 2027 for all levels of F examined with a probability of 91% or greater. The probability of projected biomass being below B_{lim} by 2027 was 5% to 10% in all catch scenarios examined and was 5% by 2027 in the F=0 scenario.

Projections with Catch in 2024= 1367 t (TAC)		
Year	Yield (t) median	Projected relative B (B/Bmsy) median (80% CL)
F0		
2025	0	0.50 (0.30, 0.82)
2026	0	0.55 (0.33, 0.90)
2027		0.59 (0.36, 0.98)
F Status quo (0.010)		
2025	301	0.50 (0.30, 0.82)
2026	324	0.54 (0.32, 0.89)
2027		0.58 (0.35, 0.97)
2/3 Fmsy (0.0407)		
2025	1240	0.50 (0.30, 0.82)
2026	1305	0.53 (0.31, 0.87)
2027		0.55 (0.32, 0.93)
75% Fmsy (0.0458)		
2025	1395	0.50 (0.30, 0.82)
2026	1461	0.52 (0.31, 0.87)
2027		0.55 (0.31, 0.92)
85% Fmsy (0.0519)		
2025	1581	0.50 (0.30, 0.82)
2026	1646	0.52 (0.30, 0.87)
2027		0.54 (0.31, 0.91)
Fmsy (0.0611)		
2025	1860	0.50 (0.30, 0.82)
2026	1920	0.51 (0.30, 0.86)
2027		0.53 (0.30, 0.90)

C2024=TAC (1367 t)	Yield			$P(F>F_{lim})$			$P(B<B_{lim})$				$P(B<B_{msy})$			
	2024	2025	2026	2024	2025	2026	2024	2025	2026	2027	2024	2025	2026	2027
F0	1367	0	0	26%	<1%	<1%	11%	10%	7%	5%	97%	96%	93%	91%
F2023=0.0100	1367	301	324	26%	<1%	<1%	11%	10%	7%	5%	97%	96%	94%	91%
2/3 Fmsy = 0.0407	1367	1240	1305	26%	17%	18%	11%	10%	9%	8%	97%	96%	94%	92%
75% Fmsy = 0.0458	1367	1395	1461	26%	25%	26%	11%	10%	9%	9%	97%	96%	94%	93%
85% Fmsy = 0.0519	1367	1581	1646	26%	35%	36%	11%	10%	10%	9%	97%	96%	94%	93%
Fmsy= 0.0611	1367	1860	1920	26%	51%	51%	11%	10%	10%	10%	97%	96%	94%	93%

Assessment

A Schaefer surplus production model in a Bayesian framework was used for the assessment of this stock. The results were comparable to the previous assessment. Input data comes from research surveys and the fishery.

The next full assessment of this stock will be in 2026.

Human impact

Mainly fishery related mortality. Other potential sources (e.g. pollution, shipping, and oil-industry) are undocumented.

Biological and environmental interactions

Witch flounder in NAFO Divisions 3NO are distributed mainly along the tail and southwestern slopes of the Grand Bank. The Grand Bank (3LNO) Ecosystem Production Unit (EPU) is currently experiencing low productivity conditions, with EPU biomass well below pre-collapse levels (pre-1990s). Rebuilding was observed since the 1990s, but declines across multiple trophic levels and stocks occurred after 2014. While positive signals have been observed since these declines, biomass has yet to return to the early-mid 2010s level.

Ecosystem sustainability of catches

General impacts of fishing gears on the ecosystem should be considered. Areas within Divisions 3NO have been closed to bottom fishing to protect sponge and coral species.

Witch flounder is included in the benthivore guild of the Grand Bank (3LNO) Ecosystem Production Unit (EPU). Other NAFO managed stocks in this guild within the EPU include 3LNOPs thorny skate, 3LNO yellowtail flounder, 3LNO American plaice and 3LNO shrimp. The Catch/TCI is below the 2TCI ecosystem reference point in 2023 (3LNO Benthivore Catch_{2023}/TCI=0.65).

Fishery

The fishery was reopened to directed fishing in 2015 and is exploited by otter trawl. Prior to the reopening, witch flounder were caught primarily as bycatch in bottom otter trawl fisheries for yellowtail flounder, redfish, skate and Greenland halibut.

Recent catch estimates and TACs ('000t) are:

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
TAC	1.0	2.2	2.2	1.1	1.2	1.2	1.2	1.2	1.3	1.4
STATLANT 21	0.4	0.6	0.6	0.7	0.9	0.6	0.6	NA[1]	NA[1]	
STACFIS	0.4	1.1	0.7	0.7	0.9	0.7	0.6	0.6	0.3	

[1] NA - In 2022-2023, STATLANT 21 information is incomplete.

Special comments

It is unclear if the recruitment index (survey number of fish <21 cm.) is representative. Nevertheless, recent recruitment appears to be average.

Sources of Information

SCR 24/007, 014, 018, 037; SCS 24/06, 08, 09, 11.

Thorny skate in Divisions 3LNO and Subdivision 3Ps

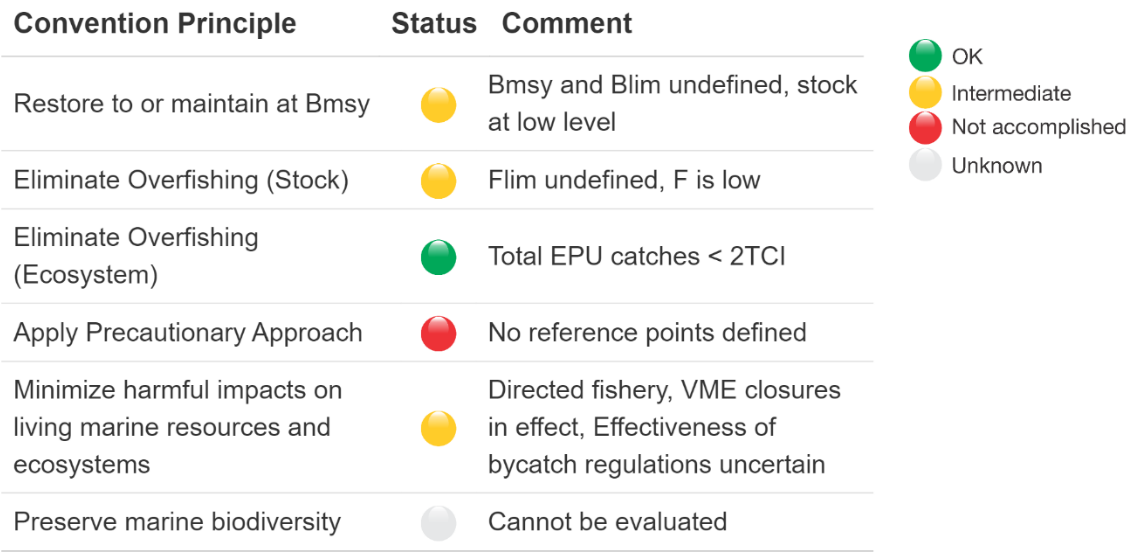
Advice June 2024 for 2025-2026

Recommendation for 2025 and 2026

No new survey information is available to determine stock status, however, given the low level of thorny skate catch in recent years (average 3 460 t, 2019 - 2023), it is unlikely that there have been major changes to the state of the stock. Given the low resilience to fishing mortality and higher historic stock levels, Scientific Council advises no increase in catches.

Management objectives

No explicit management plan or management objectives defined by the Commission. General principles from the *Convention on Cooperation in the Northwest Atlantic Fisheries* are applied.



Convention Principle	Status	Comment
Restore to or maintain at Bmsy	🟡	Bmsy and Blim undefined, stock at low level
Eliminate Overfishing (Stock)	🟡	Flim undefined, F is low
Eliminate Overfishing (Ecosystem)	🟢	Total EPU catches < 2TCI
Apply Precautionary Approach	🔴	No reference points defined
Minimize harmful impacts on living marine resources and ecosystems	🟡	Directed fishery, VME closures in effect, Effectiveness of bycatch regulations uncertain
Preserve marine biodiversity	⚪	Cannot be evaluated

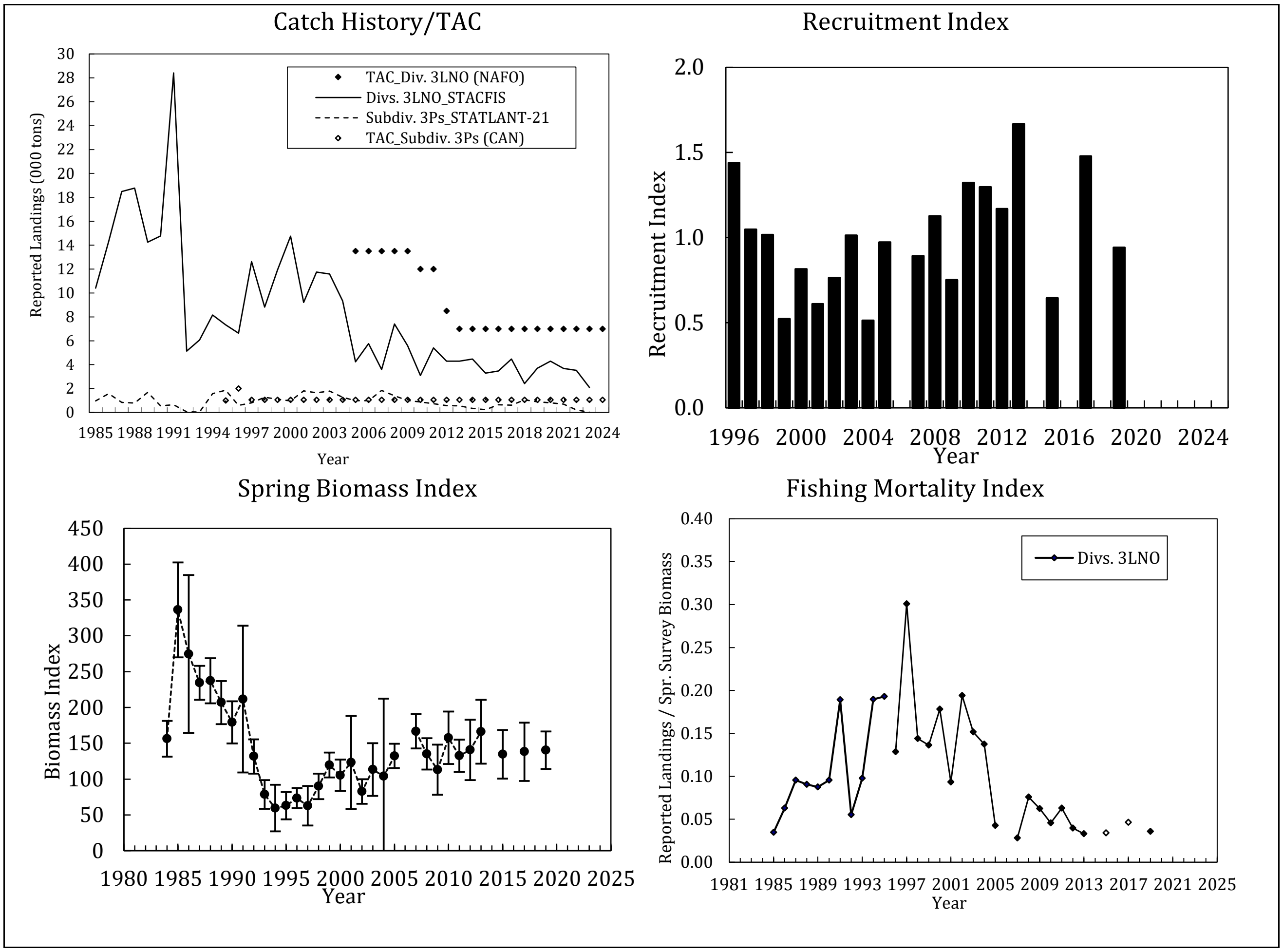
🟢 OK
🟡 Intermediate
🔴 Not accomplished
⚪ Unknown

Management unit

The management unit is confined to NAFO Divisions 3LNO, which is a portion of the stock that is distributed in NAFO Divisions 3LNO and Subdivision 3Ps.

Stock status

The stock was above B_{lim} in 2019. No new survey information is available to determine stock status. However, due to the longevity of the species and the low level of catch in recent years, it is unlikely that there have been major changes to the state of the stock. Recruitment is currently unknown. Fishing mortality is currently unknown but thought to be low.



Reference points

There are no accepted reference points for this stock. The previously used B_{lim} is no longer applicable.

Assessment

Based upon a qualitative evaluation of stock biomass trends and recruitment indices, the assessment is considered data limited and as such associated with a relatively high uncertainty. Input data are research survey indices and fishery data. Due to the lack of conversion factors in Canadian surveys, and incomplete or missing surveys, survey data after 2019 were not considered in evaluation of stock status.

The next full assessment of this stock will be in 2026.

Human impact

Mainly fishery related mortality has been documented. Mortality from other human sources (e.g. pollution, shipping, oil-industry) are undocumented.

Biology and Environmental interactions

Thorny skate are found over a broad range of depths (down to 840 m) and bottom temperatures (-1.7 - 11.5ºC). Thorny skate feed on a wide variety of prey species, mostly on crustaceans and fish. Recent studies have found that polychaete worms and shrimp dominate the diet of thorny skates in Divisions 3LNO, while hyperiids, snow crabs, sand lance and euphausiids are also important prey items.

The Grand Bank (3LNO) Ecosystem Production Unit (EPU) is currently experiencing low productivity conditions, with EPU biomass well below pre-collapse levels (pre-1990s). Rebuilding was observed since the 1990s, but declines across multiple trophic levels and stocks occurred after 2014. While positive signals have been observed since these declines, biomass has yet to return to the early-mid 2010s level.

Ecosystem sustainability of catches

The impact of bottom fishing activities on VMEs in the NRA was last assessed in 2021. The risk of Significant Adverse Impacts (SAIs) on sponge and large gorgonian VMEs was assessed to be low, while this risk for sea pen VMEs has been assessed as intermediate. The risks of SAIs on small gorgonian, black coral, bryozoan and sea squirt VMEs were assessed as high. Areas within Divisions 3LNOPs have been closed to bottom fishing to protect VMEs.

3LNOPs thorny skate is included in the benthivore guild of the Grand Bank (3LNO) Ecosystem Production Unit (EPU). Other NAFO managed stocks in this guild within the EPU include 3LNO yellowtail flounder, 3LNO American plaice, 3NO witch flounder and 3LNO shrimp. There is no TCI information for the Southern Newfoundland (3Ps) EPU. The 3LNO Catch/TCI in 2023 was below the 2TCI ecosystem reference point (3LNO Benthivore Catch_{2023}/TCI=0.65).

Fishery

Thorny skate is caught in directed gillnet, trawl and long-line fisheries. In directed thorny skate fisheries, Atlantic cod, monkfish, American plaice and other species are landed as bycatch. In turn, thorny skate are also caught as bycatch in gillnet, trawl and long-line fisheries directing for other species. The fishery in NAFO Divisions 3LNO is regulated by quota.

Recent catch estimates and TACs are:

Divisions 3LNO:	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
TAC	7	7	7	7	7	7	7	7	7	7
STATLANT 21	3.3	3.5	4.2	1.5	3.7	4.0	4.0	NA[1]	NA[1]	
STACFIS	3.4	3.5	4.5	2.4	3.7	4.3	3.7	3.5	2.1	

[1] NA - In 2022-2023, STATLANT 21 information is incomplete

Special comments

The life history characteristics of thorny skate result in low rates of population growth and are thought to lead to low resilience to fishing mortality.

Sources of Information

SCR Doc. 24/007, 008, 037, 038; SCS Doc. 24/06, 08, 09, 11.

American plaice in Divisions 3LNO Advice June 2024 for 2025 and beyond

Recommendation for 2025 and beyond

Advice for American plaice in Divisions 3LNO is provided based on an Interim Monitoring Report which indicates no major changes in this stock. Scientific Council recommends that, in accordance with the rebuilding plan, there should be no directed fishing on American plaice in Divisions 3LNO until an assessment indicates a very low probability of being below B_{lim}. Bycatches of American plaice should be kept to the lowest possible level and restricted to unavoidable bycatch in fisheries directing for other species.

There will be no full assessment until interim monitoring shows that conditions have changed.

During the 2023 Annual meeting, the Commission requested that in June 2024, advice should be provided for 2025-2027 for 3LNO American plaice. Following a discussion during the January 2024 meeting about lack of data and workload issues, SC concluded that the Commission request for advice for the 3LNO American plaice would be responded via an Interim Monitoring Report, unless changes in the state of the stock arise. The most recent Canadian surveys cannot be directly compared to previous series due to a lack of conversion factors to new survey vessels for this stock. However, given the overall scale of recent Canadian indices, and with the continued low levels of American plaice reported in the EU-Spain surveys, there is nothing to indicate a change in the status of the stock.

There will be no full assessment until interim monitoring shows that conditions have changed.

b) Monitoring of Stocks for which Multi-year Advice was Provided in 2022 or 2023

Interim monitoring updates of these stocks were conducted, and Scientific Council reiterates its previous advice as follows:

Recommendation for American plaice in Division 3M for 2024-2026: The stock has recovered to the levels of the mid 1990s, however, recruitment has been poor since 2018. Scientific Council considers that there is not sufficient supporting evidence that the stock would be able to sustain a fishery at this time and recommends that there be no directed fishing in 2024, 2025 and 2026. Bycatch should be kept at the lowest possible level.

Recommendation for cod in Divisions 3NO for 2022 and beyond: No directed fishing from 2022 to allow for stock rebuilding. Bycatch of cod in fisheries targeting other species should be kept at the lowest possible level. Projections of the stock were not performed but given the poor strength of all year-classes subsequent to 2006, the stock will not reach B_{lim} in the next three years. There will be no full assessment until interim monitoring shows that conditions have changed.

Recommendation for yellowtail flounder in Divisions 3LNO for 2024-2025: Scientific Council advises that fishing mortality up to 75% F_{msy}, corresponding to catches of 15 560 t and 15 810 t in 2024 and 2025, respectively, have risk of no more than 30% of exceeding $\mathrm{F}_{\mathrm{lim}}$, and are projected to maintain the stock around B_{msy} with a low risk of being below B_{lim}.

Recommendation for redfish in Division 3O for 2023-2025: The stock is below an interim survey-based proxy for B_{msy} but above the limit reference point (B_{lim} =0.3B_{msy}-proxy) with a probability >99%. There is insufficient information on which to base predictions of annual yield potential. Catches have averaged about 9 000 t over the period used for the MSY proxy calculation (1991 -2021). Scientific Council is unable to advise on an appropriate TAC for 2023, 2024 and 2025.

Recommendation for capelin in Divisions 3NO for 2022 and beyond: No directed fishery. There will be no full assessment until interim monitoring shows that conditions have changed.

Recommendation for roughhead grenadier in Subareas 2 and 3: There will be no new assessment until monitoring shows that conditions have changed.

Recommendation for alfonsino in Division 6G for 2019 and beyond: The substantial decline in CPUE and catches on the Kükenthal Peak in the past year indicates that the stock may be depleted. SC advises to close the fishery until biomass increases to exploitable levels. There will be no full assessment until interim monitoring shows that conditions have changed.

Recommendation for white hake in Divisions 3NO and Subdivision 3Ps for 2024 and beyond: Stock status is unknown. Catches of white hake in 3NO should not increase above recent levels (the average of the most recent five years is around 400 tonnes). There will be no full assessment until interim monitoring shows that conditions have changed.

Recommendation for northern shortfin squid in Subareas 3+4 for 2023-2025: Although the primary stock indices for Div. 4VWX were not available during 2021 and 2022, the 2022 biomass indices for both Divisions 3NO and Division 3M EU summer surveys were near the lowest levels of their respective time series, suggesting that the stock has returned to a low productivity state. SC advises catches between 19 000 and 34 000 tonnes per year (two proxies for F_{lim}, the potential yield which the northern stock component may be able to sustain under a low productivity regime).

c) Special Requests for Management Advice

i) Greenland halibut in Subarea 2 + Divisions 3KLMNO monitor, compute the TAC using the most recently agreed HCR and determine whether exceptional circumstances are occurring (request #2, Commission priority).

Commission request #2 (Commission priority): *The Commission requests the Scientific Council to monitor the status of Greenland halibut in Subarea 2 + Divisions 3KLMNO annually to compute the TAC using the most recently agreed HCR and determine whether exceptional circumstances are occurring. If exceptional circumstances are occurring, the exceptional circumstances protocol will provide guidance on what steps should be taken*.

Scientific Council responded:

The response to this request is deferred until the September 2024 Scientific Council meeting following the recommendation of the WG-RBMS.

During the April 2024 WG-RBMS meeting, the working group stated that formal advice is not expected from the June 2024 Scientific Council meeting, but to provide final advice on the 2025 TAC at its meeting in September, pending the adoption of the new MSE harvest control rule by the Commission at the 2024 Annual Meeting.

For that, the response to this request is deferred until the September 2024 Scientific Council meeting.

ii) Continue to advance work on the 2+3KLMNO Greenland halibut MSE processes as per the approved 2024 workplan (request #3a, Commission priority).

Commission request #3a *(Commission priority): The Commission requests that Scientific Council continue to advance work on the 2+3KLMNO Greenland halibut and 3LN redfish MSE processes during 2023-2024, as per the approved 2024 workplan [COM-SC RBMS-WP 23-06 (Rev. 3)]:*

a. For the Greenland Halibut MSE: test Candidate Management Procedures (CMP) performance against established management objectives and initial discussions on exceptional circumstances protocol.

Scientific Council responded:

The CMP for Greenland Halibut in NAFO Subarea 2 and Divisions 3KLMNO has been tested and proven robust under a broad range of conditions. It adapts effectively to changes in resource indices and accounts for biases or variations in data, or to Scientific Council assumptions about the future dynamics of this stock. Scientific Council recommends the adoption of this CMP. The Exceptional Circumstance protocol has also been reviewed and revised, and the proposed protocol is attached below.

The Candidate Management Procedures (CMP; description attached below) for Greenland halibut in NAFO Subarea 2 and Divisions 3KLMNO has been tested to ensure its robustness and adaptive capabilities (COM-SC Doc. 24-01; SCR Doc. 24/002REV; SCR Doc. 24/001REV2). Although the CMP on occasions fails a few secondary performance statistics criteria ($P(B_{2030}^{5-9} < 0.8B_{\mathrm{MSY}}^{5-9})$, $P(B_{2030}^{5-9} < B_{2025}^{5-9})$, $P(B_{2030}^{5-9} < 0.75B_{2025}^{5-9})$), these failures occur only in low-plausibility scenarios, such as those involving lengthy periods of low recruitment or of high mortality (OM10, OM12). These scenarios are not a major concern given their low likelihood. Moreover, performance failures occur primarily in the near-term due to declines in biomass driven by these adverse conditions. The CMP reduces the TAC in response to these declines and the stock rebounds back towards B_{msy} in the longer-term. This demonstrates the CMP's desired adaptive capabilities through its feedback mechanisms.

Results from more plausible scenarios generally project expected gradual increases in catches and biomass towards optimal sustainable levels. While each simulation exhibits natural variability, the CMP adapts to changes effectively and accounts for potential biases in survey data, fishery implementation issues, or variations in vital rates such as mortality and recruitment. In short, the CMP has been shown to be robust to a broad range of conditions. While some low-plausibility scenarios proved to be challenging, these extreme tests do demonstrate the adaptive capabilities of the CMP.

Scientific Council also discussed the Exceptional Circumstances protocol revised at the January 2024 meeting of SC (SCS Doc. 24/02), and agreed to recommend the addition of one extra criterion regarding missing survey data: "*Missing more than two of the five survey indices from the terminal year*." This was added to account for what would be concerning circumstances where the Scientific Council would have little information on the size of the stock in the terminal year. Proposed Exceptional Circumstances are attached below.

Candidate Management Procedure proposed for adoption:

The CMP combines a "target based" and "slope based" rule, which was tuned to reach B_{msy} by 2044 under OM1 using the SCAA framework. The full set of control parameters are shown in Table 1.

*Target based (**t**)*

The target rule is:

$$\mathrm{TAC}_{y+1}^{target} = \mathrm{TAC}_y \left(1 + \gamma(J_y - 1)\right) \qquad (1)$$

where TAC_y is the TAC recommended for year y, γ is the "response strength" tuning parameter, J_y is a composite measure of the immediate past level in the mean weight per tow from surveys (I_y^i) that are available to use for calculations for year y; five survey series are used, with i = 1, 2, 3, 4, and 5 corresponding respectively to Canada Autumn 2J3K, Canada Autumn 3LNO, EU-Spain 3L, EU-Spain 3NO and EU 3M 0-1400m:

$$J_y = \sum_{i=1}^{5} \frac{1}{(\sigma^i)^2} \frac{J_{current,y}^i}{J_{target}^i} / \sum_{i=1}^{5} \frac{1}{(\sigma^i)^2} \qquad (2)$$

with $(\sigma^i)^2$ being the estimated variance for index i (estimated in the SCAA model fitting procedure),

$$J_{current,y}^i = \frac{1}{q} \sum_{y'=y-q}^{y-1} I_{y'}^i \qquad (3)$$

$$J_{target}^i = \alpha \frac{1}{5} \sum_{y'=2011}^{2015} I_{y'}^i \qquad \text{(where } \alpha \text{ is a control/tuning parameter for the MP)} \qquad (4)$$

and q indicating the period of years used to determine current status. Note the assumption that when a TAC is set in year y for year $y + 1$, indices will not at that time yet be available for the current year y. Missing survey values are treated as missing in the calculation using the rule, as was done in the MSE. In such cases, q in equation (3) is reduced accordingly.

*Slope based (**s**)*

The slope rule is:

$$\mathrm{TAC}_{y+1}^{slope} = \mathrm{TAC}_y \left[1 + \lambda_{up/down}(s_y - X)\right] \qquad (5)$$

where $\lambda_{up/down}$ and X are tuning parameters, s_y^i is a measure of the immediate past trend in the survey-based mean weight per tow indices, computed by linearly regressing lnI_y^i, vs year y' for $y' = y - 5$ to $y' = y - 1$, for each of the five surveys considered, with:

$$s_y = \sum_{i=1}^{5} \frac{1}{(\sigma^i)^2} s_y^i / \sum_{i=1}^{5} \frac{1}{(\sigma^i)^2} \qquad (6)$$

with the standard error of the residuals of the observed compared to model-predicted logarithm of survey index i (σ^i) as estimated in the SCAA base case operating model. Missing survey values are treated as missing in the calculation using the rule, as was done in the MSE. In such cases, the slope for each index, s_y^i, in equation (6) is calculated from the available values within the last five years.

*Combination Target and Slope based (**s+t**)*

For the target and slope based combination:

1) $\mathrm{TAC}_{y+1}^{target}$ is computed from equation (1),
2) $\mathrm{TAC}_{y+1}^{slope}$ is computed from equation (5), and
3) $\mathrm{TAC}_{y+1} = \mu\left(\mathrm{TAC}_{y+1}^{target} + \mathrm{TAC}_{y+1}^{slope}\right)/2$, where μ is a tuning parameter.

Finally, constraints on the maximum allowable annual change in TAC are applied, viz.:

$$\text{if} \quad \mathrm{TAC}_{y+1} > \mathrm{TAC}_y\left(1+\varDelta_{up}\right) \quad \text{then} \quad \mathrm{TAC}_{y+1} = \mathrm{TAC}_y\left(1+\varDelta_{up}\right) \tag{7}$$

and

$$\text{if} \quad \mathrm{TAC}_{y+1} < \mathrm{TAC}_y(1-\varDelta_{\mathrm{down}}) \quad \text{then} \quad \mathrm{TAC}_{y+1} = \mathrm{TAC}_y(1-\varDelta_{\mathrm{down}}) \tag{8}$$

During the MSE process, this inter-annual constraint was set at 10%, for both TAC increases and decreases.

Table 1. Control parameter values for the CMP. The parameters μ, α, and X were adjusted to achieve a median biomass equal to B_{msy} for the exploitable component of the resource biomass in 2044 for the Base Case SCAA Operating Model.

μ	0.963
γ	0.15
q	3
α	0.972
λ_{up}	1
λ_{down}	2
X	-0.0056
$\varDelta_{up}$	0.1
$\varDelta_{down}$	0.1

The following criteria are proposed to constitute Exceptional Circumstances:

1. Missing survey data:

- *More than two values missing, in a five-year period, from a survey used in the MP;*
- *Missing more than two of the five survey indices from the terminal year.*

2. The composite survey index used in the MP, in a given year, is above or below the 90 percent probability envelopes projected by the base case operating models from SSM and SCAA under the MS;

3. TACs are established that are not generated from the MP.

The following elements will require application of expert judgment to determine whether Exceptional Circumstances are occurring:

1. the five survey indices relative to the 80, 90, and 95 percent probability envelopes projected by the base case operating models (SSM and SCAA) for each survey;

2. survey data at age four (the age before recruitment to the fishery) compared to its series mean to monitor the status of recruitment;

3. discrepancies between catches and the TAC calculated using the MP.

iii) Continue to advance work on the 3LN redfish MSE processes as per the approved 2024 workplan (request #3b, Commission priority).

Commission request #3b *(Commission priority): The Commission requests that Scientific Council continue to advance work on the 2+3KLMNO Greenland halibut and 3LN redfish MSE processes during 2023-2024, as per the approved 2024 workplan [COM-SC RBMS-WP 23-06 (Rev. 3)]:*

b. For the 3LN Redfish MSE: (1) review and finalize Operating Models, (2) review any further work on performance statistics; (3) select the CMP(s) for RBMS consideration and potential testing against established management objectives.

Scientific Council responded:

Due to workload and capacity constraints, no progress has been made on the 3LN redfish MSE since January. Scientific Council reviewed and recommended an extended workplan, which targets the adoption of a new MP by the Commission in September 2026. However, Scientific Council notes that the workplan should remain flexible as the novelty of the work makes it difficult to determine the time required to complete different tasks of this work.

Due to workload and capacity constraints, no progress has been made on the 3LN Redfish MSE since January. SC reviewed and recommended an extended workplan, which targets the adoption of a new MP by the Commission in September 2026. However, SC notes that the workplan should remain flexible as the novelty of the work makes it difficult to determine the time required to complete the tasks of this work. For instance, developing plausible scenarios of recruitment for this stock is not a trivial task, given its episodic and unpredictable dynamics.

The proposed workplan by Scientific Council is as follows:

Expected Delivery	NAFO Body	Proposed Workplan
Aug 2024	WG-RBMS	Review and adoption of new workplan.
Sept 2024	COM	Update on progress and workplan.
Sept 2024-May 2025	Scientific Council	Continue development of OMs, continue work on CMPs and performance statistics including risk tolerances and constraints by the Technical Team. An intersessional SC meeting may be added if required to support advancement.
June 2025	Scientific Council	Review of OMs. If consensus is achieved these will be finalized, otherwise next steps for development will be identified. Review of workplan.
July 2025	WG-RBMS	Update on progress. Discussion on OMs and viability of the MSE. Review of workplan.
Sept 2025	COM	Update on progress

This workplan aims for a completion for September 2026, however Scientific Council notes that timelines are notional and subject to revision based on workload, capacity and challenges with technical aspects of the work.

iv) Provide catch information in relation to 2TCI, including recent cumulative catch levels and a scoping of expected cumulative catch levels (request #4).

Commission request 4: *The Commission requests that the Scientific Council continue to work on tiers 1 and 2 of the Roadmap, specifically to:*

a. Annually provide catch information in relation to 2TCI, including recent cumulative catch levels and a scoping of expected cumulative catch levels;
b. As practicable and taking into account Scientific Council capacity constraints, develop stock summary sheets for NAFO managed stocks that are evaluated using HCR or MSE processes.;

Scientific Council responded:

Implementation of the Tier 1 of the Roadmap includes the evaluation of the sustainability of total catches by functional guild at the Ecosystem Production Unit (EPU) level, and the production of Ecosystem Summary Sheets (ESSs) for the Grand Bank (3LNO) and Flemish Cap (3M) EPUs.

A procedure for approximating the catches for the current and following years was developed and used to produce a scoping of these expected catch levels against the 2TCI Ecosystem Reference Point. The results from this procedure have been integrated in the Ecosystem Sustainability of Catches Report. This exercise indicates that the catches in 2024-2025 are expected to remain below 2TCI, but piscivore guild catches in the Flemish Cap (3M) EPU are scoped to be near the 2TCI threshold.

There was limited progress in the development of Tier 2 and Stock Summary Sheets (SSSs) for stocks managed under MSE, due to workload issues. Work on these topics remains ongoing.

A process for interim monitoring for ESSs was developed, and a workplan for the regular update of the ESSs every 5 years is in development.

Workload and capacity limitations within the Scientific Council, coupled with the decreasing support for Scientific Council work, are expected to hinder the Scientific Council's ability to carry out its work as scheduled if not addressed.

Catch information in relation to 2TCI

The Roadmap is the framework that NAFO is implementing to deliver an ecosystem approach for the management of NAFO fisheries and ecosystems. Within the Roadmap, sustainability of fisheries catches is achieved through a nested series of assessments aimed at evaluating sustainability at different levels of organization. Within these assessments, Tier 1 is focused on sustainability at the ecosystem level, Tier 2 is focused on sustainability at the multispecies level (e.g. species interactions), and Tier 3 is focused on sustainability at the stock level (i.e. traditional stock-assessment).

The current implementation of Tier 1 includes two distinct elements, a) the evaluation of the sustainability of total catches by functional guild at the Ecosystem Production Unit (EPU) spatial scale, and b) the production of Ecosystem Summary Sheets (ESSs) to provide a synoptic view on the ecological state of EPU and the general performance of the management measures within the ecosystem unit.

In this response, Scientific Council (SC) addresses the specific points requested by the Commission, but also provides an overview of the state of work related to Tier 1. There has not been substantive progress on Tier 2 due to capacity and workload issues.

The evaluation of the ecosystem sustainability of total catches relies on comparing the total catch by functional guild with the corresponding Ecosystem Reference Point, defined as twice the estimated Total Catch Index (2TCI). Total catches above this Ecosystem Reference Point correspond to a high risk of Ecosystem Overfishing.

While the examination of total catches against 2TCI is useful to examine if high risk of Ecosystem Overfishing has occurred, the analysis is constrained by the last year with full catch data available. The utility of this type of analysis for management decisions would be much higher if a forward looking version of this analysis associated with the incoming SC stock advice could be produced.

While formally predicting future catches and Catch/TCI Ratios is neither straightforward nor trivial, it is possible to provide a simple scoping of these catches based on standing TAC decisions, levels and distribution of catch in the most recent years, and assuming that incoming management decisions will follow the SC stock advice. This scoping would constitute a simple approximation to the order of magnitude of the current and near future catches, and can be used to provide sensible values for the expected catch levels against the Ecosystem Reference Point. SC developed a protocol for producing this scoping of catches (Table 2) and used it to generate a scoping for the ecosystem sustainability of catches for 2024 and 2025. This scoping was integrated in the "Ecosystem Sustainability of Catches Report" (see below).

Table 2. Schematic considerations for the compilation of catch information and their use for a scoping exercise done in year *t* for catch levels expected in year *t* (current year) and *t*+1 (year to come).

1. Stocks assessed by SC:
   a. Catch: current TAC (or recent maximum catch if deemed appropriate) for year *t*, and maximum catch advice recommended by SC for year *t*+1, noting that this catch advice needs to be done solely considering the stock assessment and without influence by TCI information.
   b. Stock area: if the stock area expands beyond the EPU, the catch should be allocated to the EPU based on the fraction of the total catch for the stock that was taken in the EPU in the year *t*-1 (the latest full year for which information is available).
2. Stocks without assessment or catch advice:
   a. Catch: Level observed in the EPU in year *t*-1 (the latest full year for which information is available).
   b. Stock area: not applicable.
3. Stocks assessed by Coastal State:
   a. Catch: Current quota decision (or recent maximum catch if deemed appropriate) for year *t*, and maximum catch advice from the relevant authority for year *t*+1. If only the quota decision for year *t* is available, the quota decision should be assumed for year *t*+1. If the quota decision for year *t* and the catch advice for year *t*+1 are not available at the time of the scoping exercise, the level of catch observed in the EPU in year *t*-1 should be used instead.
   b. Stock area: if the stock area expands beyond the EPU, the catch should be allocated to the EPU based on the fraction of the total catch for the stock that was taken in the EPU in the year *t*-1 (the latest full year for which information is available). If the quota decision for year *t* and catch advice for year *t*+1 are not available at the time of the scoping exercise, the use of level of catch observed in the EPU in year *t*-1 makes stock area scaling unnecessary.

As indicated in the 2023 SC advice, the “Ecosystem Sustainability of Catches Report” is now focused on the Flemish Cap (3M) and the Grand Bank (3LNO) EPUs. As agreed at COM-SC WG-EAFFM, information on Catch/TCI in the Stock Summary Sheets (SSSs) is now limited to the value of the ratio and without indication of risk level. References to risk levels (low, intermediate, and high) are kept in the “Ecosystem Sustainability of Catches Report”.

SC continues working on updating the primary production inputs for the Ecosystem Production Potential (EPP) models, on which TCI estimates are based. Advancing on this work is considered important by SC, and collaborations between STACFEN and WG-ESA are ongoing on this subject. Workload issues have prevented SC to complete this work.

Stock Summary Sheets for NAFO managed stocks that are evaluated using HCR or MSE processes

In terms of developing Stock Summary Sheets for stocks managed with Harvest Control Rules (HCRs) under Management Strategy Evaluation (MSE), SC could not advance in any substantive way due to current workload. Work on this topic remains ongoing.

Monitoring of the Ecosystem Summary Sheets

Ecosystem Summary Sheets (ESSs) are scheduled to be updated every five years, and the next update is scheduled for 2027. Similarly to the Stock Summary Sheets, this means that in the intervening years, an interim monitoring scheme is needed to evaluate if major changes have occurred that justify triggering an ESS update ahead of schedule. SC developed such a scheme, including the selection of the information to be used for the interim monitoring. This interim monitoring will be focused on ecological changes and done at WG-ESA in November where, if required, the out-of-scheduled update would be triggered so that the updated ESS can be tabled at SC in the following June. Results of this interim monitoring will be reported to SC at the June meeting.

SC also started the development of a workplan to update the ESSs, and identified priority elements within the ESSs to be improved in the next scheduled update. These priority elements include the determination of endangered, threatened and protected species, and the analysis and reporting of by-catch and discards. The ESS update workplan is scheduled to be completed at the 2024 WG-ESA November meeting.

The lack of Ecosystem Designated Expert (EDE) for the Grand Bank (3LNO) EPU, the interim nature of the currently appointed EDE for the Flemish Cap (3M) EPU, the decreasing support for SC work in general and WG-ESA in particular, together with the current workload of WG-ESA, are issues that if not addressed, would be expected to hinder SC ability to carry out this work as scheduled.

Report on Ecosystem Sustainability of Catches

Since 2005 the Grand Bank (3LNO) and the Flemish Cap (3M) Ecosystem Production Units (EPUs) have shown aggregate catch levels by functional guild which are consistent with the productivity of the EPUs and the prevention of high risk of ecosystem overfishing.

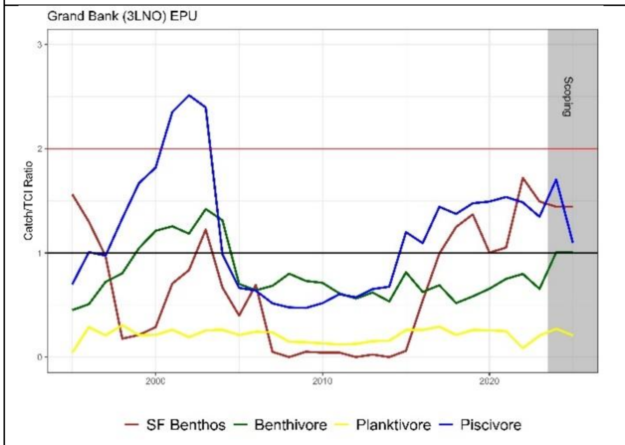
Scoped catch levels for 2024-2025 remain below the 2TCI Ecosystem Reference Point, but piscivore guild catches in the Flemish Cap (3M) are scoped to be near the 2TCI boundary.

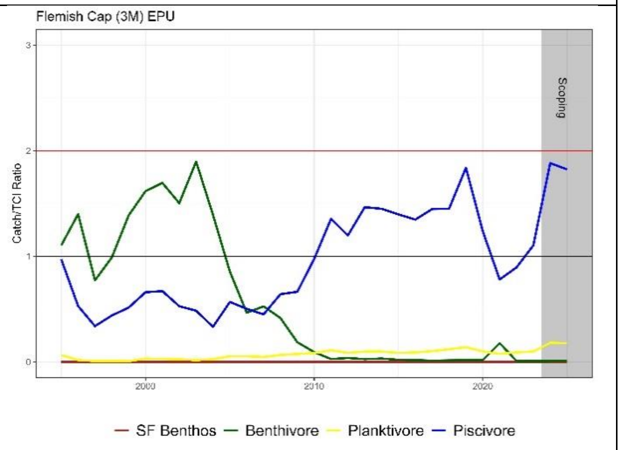
Approach:

Total Catch Index (TCI): This index is an indicator of the level of aggregated catch for a given functional guild (aggregate of species) that is consistent with the current productivity of the ecosystem (ecosystem sustainability). The comparison of aggregate catches with TCI is informative of the risk of ecosystem overfishing.

NAFO has adopted 2TCI as an ecosystem reference point to inform on ecosystem overfishing (EO).

Analysis includes reported catches up to 2023, and scoping of likely catches for 2024-2025, assuming the SC recommended catch levels for 2025.





Summary:

During the 1960-1995 period, Ecosystem Production Units (EPUs) in the Newfoundland and Labrador, and Flemish Cap bioregions experienced sustained catch levels consistent with ecosystem overfishing.

Since 2005 aggregated catches for all functional guilds have been below the 2TCI Ecosystem Reference Point in the Grand Bank (3LNO) and the Flemish Cap (3M) EPUs.

The catch levels for 2023 indicate an intermediate risk of ecosystem overfishing on both the Flemish Cap (3M) and the Grand Bank (3LNO) EPUs.

All catch levels are consistent with preventing a high risk of ecosystem overfishing.

The scoping exercise indicates that catch levels in 2024-2025 would be below 2TCI, and consistent with an intermediate risk of ecosystem overfishing for both EPUs, but the piscivore guild catches in the Flemish Cap (3M) are scoped to be near the 2TCI boundary.

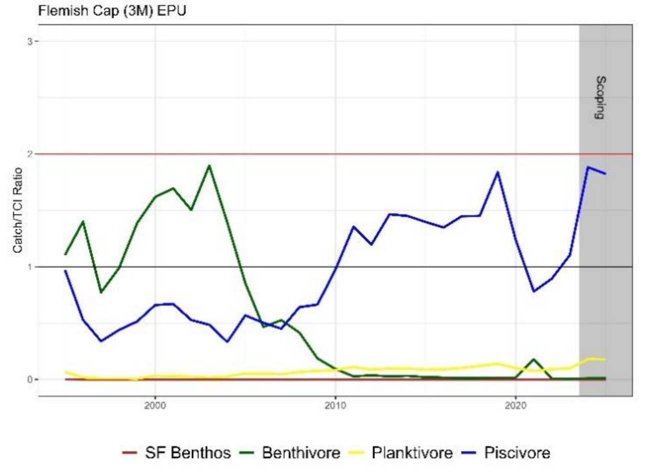
Risk of ecosystem overfishing:

Catch > 2TCI: high risk of ecosystem overfishing

Catch between 1 and 2 TCI: intermediate risk of ecosystem overfishing

Catch < TCI: low risk of ecosystem overfishing

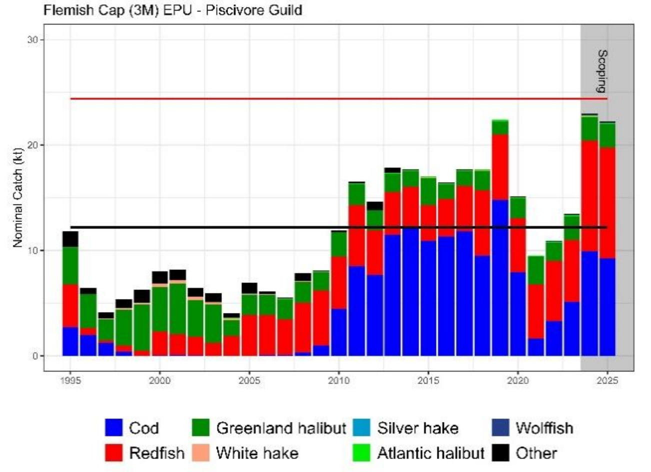
Flemish Cap (3M) Ecosystem Production Unit (EPU)



Overview

2023 catches for all functional guilds were below 2TCI, indicating that fishing levels have been consistent with preventing a high risk of ecosystem overfishing.

Piscivore guild catches for 2024-2025 are scoped to be near the 2TCI Ecosystem Reference Point.



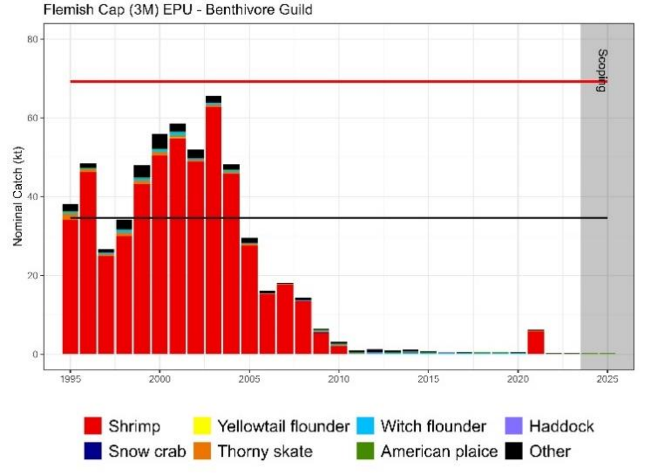
Piscivores Guild: intermediate risk of EO

Current 2TCI=24kt

Catches are dominated by redfish, Greenland halibut and Atlantic cod.

Redfish (3M), Greenland halibut (2+3KLMNO) and Atlantic cod (3M) stocks are managed by NAFO.

Catches for 2024-2025 are scoped to be near the 2TCI Ecosystem Reference Point.



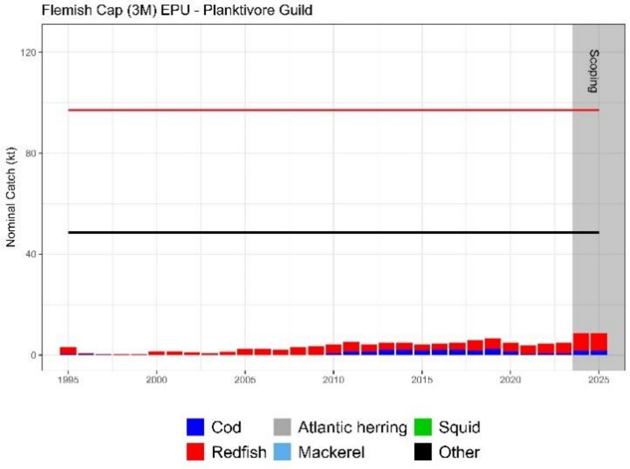
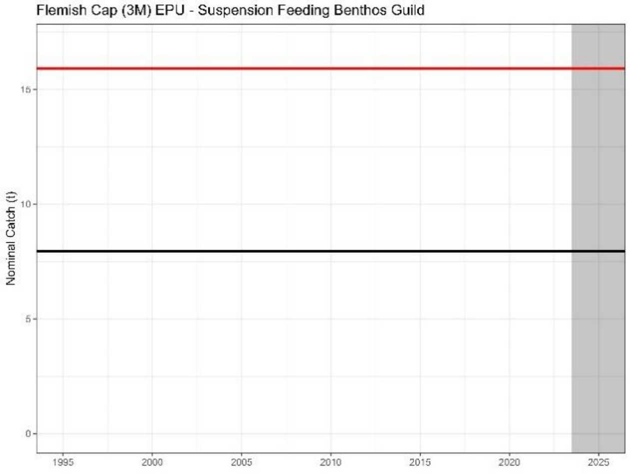
Benthivores Guild: low risk of EO

Current 2TCI=69kt

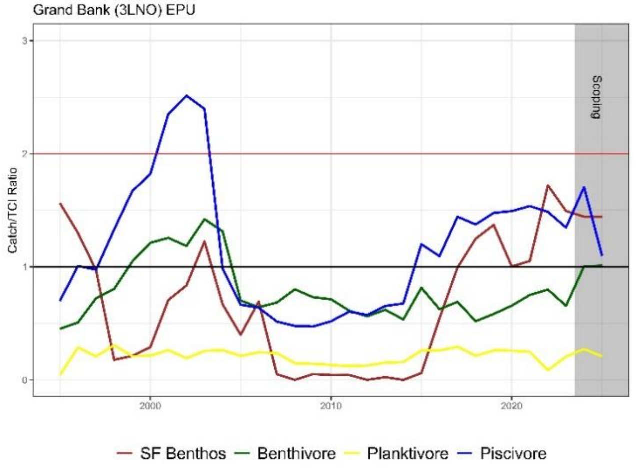
Catches are dominated by shrimp.

Shrimp (3M) stock is managed by NAFO.

Catches for 2024-2025 are scoped to be below TCI.

	**Planktivore Guild: low risk of EO** Current 2TCI=97kt There are no fisheries directed to planktivores in this EPU. Catches are dominated by younger ages of Atlantic cod and redfish. A fraction of Atlantic cod and redfish catches is mapped to this functional guild to account for the planktivore production of these stocks during the early part of their life histories. Catches for 2024-2025 are scoped to be below TCI.
	**Suspension Feeding Benthos Guild: low risk of EO** Current 2TCI=159kt There are no fisheries directed to Suspension Feeding Benthos in this EPU.

Grand Bank (3LNO) Ecosystem Production Unit (EPU)



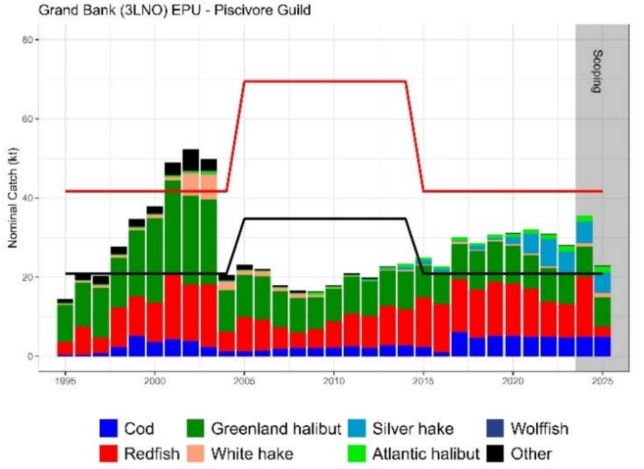
Overview

2023 catches for all functional guilds were below 2TCI, indicating that fishing levels have been consistent with preventing a high risk of ecosystem overfishing.

Catches for Piscivores and Suspension Feeding Benthos were between 1 and 2 TCI, indicating an intermediate risk of ecosystem overfishing.

Catches for Benthivores and Planktivores were below TCI, indicating a low risk of ecosystem overfishing.

Piscivore, Suspension Feeding Benthos and Benthivore guild catches for 2024-2025 are scoped to be between 1 and 2 TCI.



Piscivores Guild: intermediate risk of EO

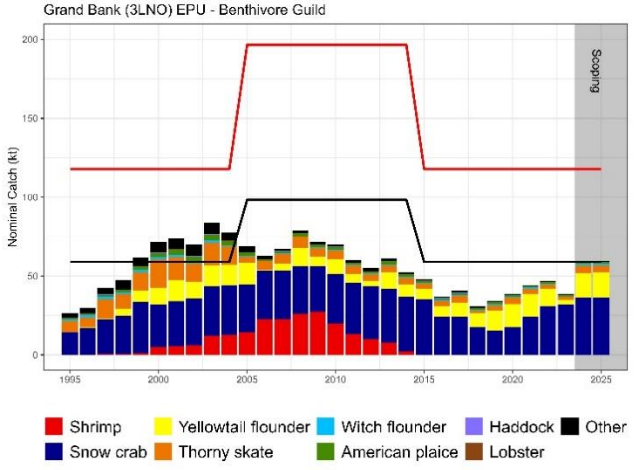
Current 2TCI=42kt

Catches are dominated by redfish, Greenland halibut and Atlantic cod.

Redfish (3LN and 3O stocks), Greenland halibut (2+3KLMNO) and Atlantic cod (3NO - moratorium-) stocks are managed by NAFO, while the Atlantic cod (2J3KL) stock is managed by Canada.

Catches of silver hake are noticeably increasing since 2018, likely linked to ecosystem changes related to warming trends.

Catches for 2024-2025 are scoped to be between 1 and 2 TCI.



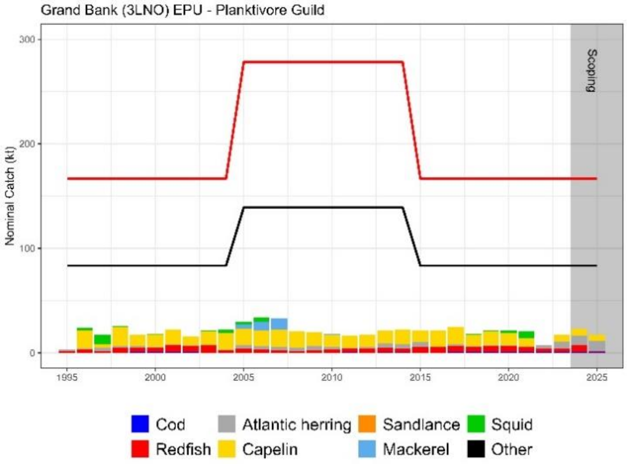
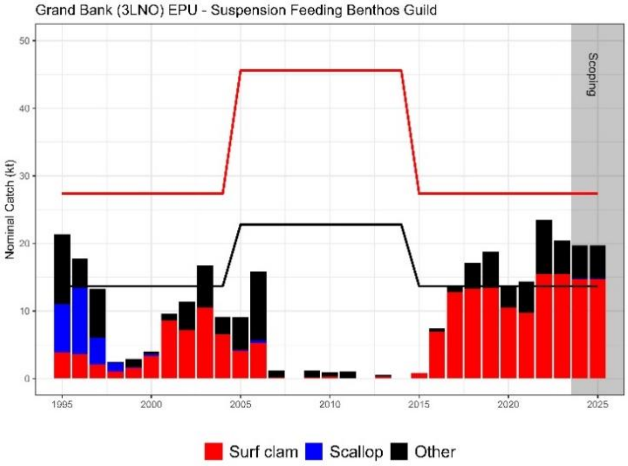
Benthivores Guild: low risk of EO

Current 2TCI=118kt

Catches are dominated by yellowtail flounder and snow crab.

Yellowtail flounder (3LNO) is managed by NAFO, while the snow crab (3LNO) is managed by Canada.

Catches for 2024-2025 are scoped to be near TCI.

	**Planktivore Guild: low risk of EO** Current 2TCI=167kt Catches are dominated by capelin (2J3KL). Capelin (2J3KL) is a stock managed by Canada. A fraction of Atlantic cod and redfish catches is mapped to this functional guild to account for the planktivore production of these stocks during early part of their life histories. Catches for 2024-2025 are scoped to be below TCI.
	**Suspension Feeding Benthos Guild: intermediate risk of EO** Current 2TCI=27kt Catches are dominated by surf clam. The surf clam fishery is managed by Canada. Catches for 2024-2025 are scoped to be between 1 and 2 TCI.

v) *Support the Secretariat in developing a centralized data repository using ArcGIS online to host the data and data-products for scientific advice (request #5a).*

Commission Request 5: *In relation to the habitat impact assessment component of the Roadmap (VME and SAI analyses), the Commission requests that Scientific Council to:*

> Support the Secretariat in developing a centralized data repository using ArcGIS online to host the data and data-products for scientific advice.

Scientific Council Responded:

A data sub-group of WG-ESA was convened to address Commission Request 5(a). Discussions focused on four key areas of development, (i) production of 37 separate standard data layers, (ii) data management, (iii) ArcGIS online testing, and (iv) advancing standardized analysis and reporting tools. The ArcGIS data repository is expected to be fully operational in 2026.

A data sub-group of WG-ESA was convened to address Commission Request 5(a). Discussions focussed on four key areas of development, (i) production of 37 separate standard data layers, which builds upon the existing list of standard data layers for inclusion on a NAFO hosted ArcGIS online portal, (ii) data management, to develop a workflow for data management within ArcGIS online platform taking into account the requirements for metadata, file organization, file naming protocol, the format of the workflow itself, individual roles and responsibilities, (iii) ArcGIS online testing, to include the configuration and testing of the NAFO-hosted ArcGIS online platform, and (iv) advancing standardized analysis and reporting tools. Details of the SC response on each of these items is given in the 2023 WG-ESA report (NAFO SCS Doc. 23/25).

The ArcGIS data repository is expected to be fully operational in 2026 following the production and compilation of the data layers necessary for the review of VMEs and the re-assessment of bottom fisheries to be undertaken in 2024 and 2025, respectively.

vi) Continue working with WG-EAFFM towards developing operational objectives for the protection of VMEs and biodiversity in the NRA (request #5b).

Commission Request 5: *In relation to the habitat impact assessment component of the Roadmap (VME and SAI analyses), the Commission requests that Scientific Council to:*

Continue working with WG-EAFFM towards developing operational objectives for the protection of VMEs and biodiversity in the NRA.

Scientific Council Responded:

Scientific Council notes the Commission agreed in 2023 to adopt a framework to establish operational *goals, objectives, targets* and *indicators,* for ecosystem components assessed as part of the NAFO roadmap. During its September 2023 meeting Scientific Council assigned this request a lower priority. Further discussion with WG-EAFFM on the proposed *framework document* is expected to occur at the WG-EAFFM meeting in August 2024.

vii) Work towards the reassessment of VMEs and impact of bottom fisheries on VMEs for 2026 (request #5c).

Commission request 5*. In relation to the habitat impact assessment component of the Roadmap (VME and SAI analyses), the Commission requests that Scientific Council:*

Work towards the reassessment of VMEs and impact of bottom fisheries on VMEs for 2026.

Scientific Council responded:

Scientific Council notes the review of VMEs and reassessment of bottom fisheries are both required for Commission consideration in 2026. Scientific Council agreed to undertake the review of VMEs in November 2024 – to be presented to WG-EAFFM and Commission in 2025, and the reassessment of bottom fisheries in November 2025 – to be presented to WG-EAFFM and Commission in 2026. Work on both parts is progressing as planned, and will follow the structure of previous assessments.

Scientific Council (SC) notes the review of VMEs and reassessment of bottom fisheries (assessment of SAI) are both required for Commission consideration in 2026. SC agreed to undertake the review of VMEs in November 2024 and the reassessment of bottom fisheries in November 2025. Results of the review of VME will be presented to WG-EAFFM and Commission in 2025 and the results of the SAI assessment (including management options) will be presented to WG-EAFFM and Commission in 2026. Work on both parts is progressing as planned and will follow the structure of previous assessments. Specific tasks, in chronological order, for the review of NAFO VMEs and the reassessment of bottom fisheries are detailed in 2023 WG-ESA report (NAFO SCS Doc. 23/25).

The basic steps for the SAI-VME analysis involve i) the use of Kernel Density Estimation (KDE) to delineate VME polygons, ii) the use of Species Distribution Models (SDMs) for the VME indicator species to refine the boundaries of the VME polygons, and then iii) the use of the refined VME polygons to conduct the specific SAI analyses. SC agreed that the KDE analysis (i) will be conducted using data from the entire 3LNO and 3M EPUs, while the SDMs (ii) and the specific SAI analyses (iii) will be conducted at the NRA scale.

viii) Continue progression on the review of the NAFO PA Framework in accordance to the PAF review work plan approved in 2020 and revised in 2023 (request #6).

Commission request 6. *The Commission requests Scientific Council to continue progression on the review of the NAFO PA Framework in accordance to the PAF review work plan approved in 2020 and revised in 2023 (NAFO COM-SC RBMS-WP 23-19 (Revised)), specifically to undertake testing of the Provisional Draft PA Framework (COM-SC RBMS-WP 23-20 (Revised)).*

The simulation testing of the proposed Precautionary Approach (PA) involves two complementary approaches, a generic approach aimed at testing the proposed PA framework based on simulated populations defined on the basis of generic life history strategies, and a specific approach aimed at testing the framework on two concrete case studies, 3M cod and 3NO witch flounder.

Results from these two approaches were presented and discussed, but additional work is required to address the issues emerging from the Scientific Council discussion. Scientific Council will continue working on this request, and will hold an intersessional Scientific Council meeting to complete this work between the end of July and beginning of August 2024, ahead of the 2024 August RBMS meeting. The response to this request is deferred until this intersessional Scientific Council meeting.

ix) Update the 3-5 year work plan (request #7)

Commission request 7: *The Commission requests Scientific Council to update the 3-5 year work plan, which reflects requests arising from the 2023 Annual Meeting, other multi-year stock assessments and other scientific inquiries already planned for the near future. The work plan should identify what resources are necessary to successfully address these issues, gaps in current resources to meet those needs and proposed prioritization by the Scientific Council of upcoming work based on those gaps.*

Scientific Council responded:

NAFO Scientific Council updated the 2024-2025 annual plan and identified resource gaps and priorities.

While this plan is reviewed and updated twice a year, it has shown a limited capacity to solve the repeated concern about Scientific Council workload.

Scientific Council reiterates that because there is no dedicated NAFO funding source for scientific research, the activities are subject to Contracting Party allocations that may not be stable/guaranteed. Scientific Council work continues to fall to a small number of scientists who are over-burdened with requests.

Scientific Council **recommends** that *the NAFO Commission should conduct a detailed workload assessment of the NAFO Scientific Council with the intention of revisiting the way scientific work is organized and seeking for possible solutions to improve efficiency and effectiveness.*

The workload levels in the last decade have been unsustainable. It has put significant strain on individual scientists, and has removed any form of normalcy to Scientific Council work.

Scientific Council **recommends** that *as complex requests are completed, they are not immediately replaced, with the objective to bring workload levels to the level of Scientific Council capacity.*

Scientific Council (SC) updated the 2024-2025 annual plan (Figure 1) and identified resource gaps and priorities.

This work plan is updated and reviewed each June and September to include all requests, with prioritization and rationale where appropriate, as well as the resources required to respond to the requests.

The work plan was first requested by the Commission in 2018 in response to Scientific Council concerns over increased workload. The situation has not improved since then. Scientific Council identified an increase in the number, complexity, and diversity of requests as well as an increased number of SC and WG meetings in recent years, concurrent with reduced support by Contracting Parties to do the work, including diminishing in-person participation in those meetings. These circumstances have made it exceedingly difficult to fully address all requests over the year.

Scientific Council reiterates that the work plan should facilitate a more concrete discussion of trade-offs between effort dedicated to scientific activities, including addressing new versus the current/strategic requests. This rarely happens because the work falls to a small number of scientists who are over-burdened with recurring requests, often pressured to deliver, and therefore are incapable of delivering on new, strategic requests. This is in addition to their other non-NAFO work.

The plan includes requests from the Commission from the annual meeting, including stock assessments and other scientific inquiries (e.g. requests from coastal states). The plan also includes requests SC has made of its own accord. Scientific Council reiterated that where there is no dedicated NAFO funding source for scientific research, the activities are subject to Contracting Party allocations that may not be stable/guaranteed.

All SC attempts to organize its work commensurate to its capacity during the recent meetings have failed and there are not prospects of improvement at medium-term mainly because of the observed increase in the work of the SC and the unrealistic expectations set by the Commission.

While this plan is reviewed and updated twice a year, it has shown a limited capacity to solve the repeated concern about SC workload. The main reason is that this workplan comes after the Commission requests every year and the only possible option is to incorporate new topics without any previous consideration on the capacity to address them (reactive approach, not proactive).

The NAFO Informal Group to Reflect on the Workload of the Scientific Council met in April 2024 and proposed different options to address the SC workload. One of which was the drafting of a cover letter detailing the additional resources required to answer new requests. Scientific Council reviewed the cover letter and felt it would not address the workload issue because it only addresses new requests and does not ensure resourcing for those requests.

Scientific Council **recommends** that *the Commission should conduct a detailed workload assessment of the Scientific Council with the intention of revisiting the way scientific work is requested and planned and seeking for possible solutions to improve efficiency and effectiveness.*

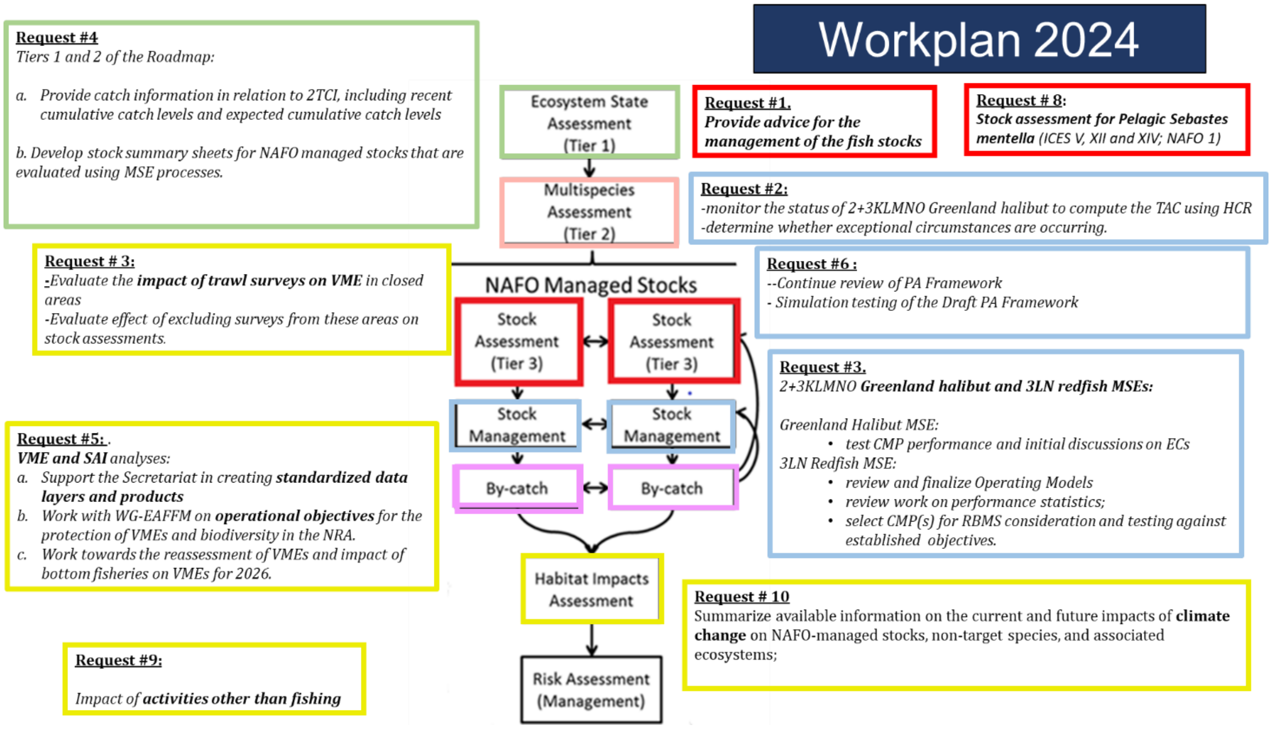
Among others, the workload assessment should include the following tasks:

- identification and description of the recurrent activities carried out by the SC in recent years (the current work plan could be an excellent starting point adding horizontal and supporting activities carried out by the different CPs such data validation, otoliths reading, ALK,…),
- description of the allocated human resources to the identified recurrent activities (required job profile/skills, time estimations or number of hours/FTE performed by profile and activity, worktime arrangements and rotation of the staff),
- analysis of the workload distribution and recommendations to rebalance workload and priorities (including how to handle non-recurrent activities).

Scientific Council emphasized the importance of stability in the work plan, i.e. that new requests should be clearly justified as they will have impact on delivering existing work plan items.

The workload levels in the last decade have been unsustainable. It has put significant strain on individual scientists, and has removed any form of normalcy to SC work.

Scientific Council **recommends** that *as complex requests are completed, they are not immediately replaced, with the objective to bring workload levels to the level of Scientific Council capacity.*



Request #4
Tiers 1 and 2 of the Roadmap:

a. Provide catch information in relation to 2TCI, including recent cumulative catch levels and expected cumulative catch levels

b. Develop stock summary sheets for NAFO managed stocks that are evaluated using MSE processes.

Request #1.
Provide advice for the management of the fish stocks

Request # 8:
Stock assessment for Pelagic Sebastes mentella *(ICES V, XII and XIV; NAFO 1)*

Request #2:
-monitor the status of 2+3KLMNO Greenland halibut to compute the TAC using HCR
-determine whether exceptional circumstances are occurring.

Request # 3:
-Evaluate the ***impact of trawl surveys on VME*** *in closed areas*
-Evaluate effect of excluding surveys from these areas on stock assessments.

Request #6 :
--Continue review of PA Framework
- Simulation testing of the Draft PA Framework

Request #3.
2+3KLMNO ***Greenland halibut and 3LN redfish MSEs:***

Greenland Halibut MSE:
- *test CMP performance and initial discussions on ECs*

3LN Redfish MSE:
- *review and finalize Operating Models*
- *review work on performance statistics;*
- *select CMP(s) for RBMS consideration and testing against established objectives.*

Request #5: .
VME and SAI *analyses:*
a. Support the Secretariat in creating ***standardized data layers and products***
b. Work with WG-EAFFM on ***operational objectives*** *for the protection of VMEs and biodiversity in the NRA.*
c. Work towards the reassessment of VMEs and impact of bottom fisheries on VMEs for 2026.

Request # 10
Summarize available information on the current and future impacts of **climate change** on NAFO-managed stocks, non-target species, and associated ecosystems;

Request #9:

Impact of ***activities other than fishing***

Figure 1. Commission requests being addressed by the Scientific Council during 2024-2025.

x) ***Include any new Canadian stock assessments for cod 2J3KL (Canada), witch flounder 2J3KL (Canada) as an annex to the SC's annual report (request #8).***

Commission request 8: *The Commission requests that any new Canadian stock assessments for Cod 2J3KL and Witch flounder 2J3KL, and any new ICES stock assessments for Pelagic Sebastes mentella (ICES Divisions V, XII and XIV; NAFO 1) be included as an annex to the Scientific Council's annual report.*

Scientific Council responded:

No new data available at this time.

Update of the cod in Divisions 2J3KL (Canada)

A new assessment of this stock was carried out in 2024, but the report has not been released yet. Once the report is public, the link will be included in the SC report.

Update of the witch flounder in Divisions 2J3KL (Canada)

No new information was available.

Update of the Pelagic *Sebastes mentella* (ICES Divisions V, XII and XIV; NAFO Subarea 1 (ICES)

No new information is available as of 2021. The ICES Northwest Working Group (NWWG) will assess these stocks at its meeting on 4-6 September 2024.

xi) ***Monitor and provide update on relevant research related to the potential impacts of activities other than fishing in the Convention Area, subject to the capacity of the Scientific Council (request #9).***

Commission request 9: *The Commission requests the SC to monitor and provide regular updates on relevant research related to the potential impacts of activities other than fishing in the Convention Area, subject to the capacity of the Scientific Council.*

Scientific Council responded:

Updates on recent and relevant research related to activities other than fishing have been made available to the Scientific Council (oil and gas and seabed marine litter).

With respect to oil and gas, and besides accidental events, routine industry activities can have detrimental environmental effects during each of its main phases (exploration, production and decommissioning). Ongoing work to evaluate impacts of oil and gas activities in the NAFO Convention Area includes studies of seismic surveys on fish and shellfish, as well as the development of methods to assess abandoned wells.

The overlap between oil and gas areas with NAFO fisheries, VMEs and closed areas has increased in the period 2018-2024.

With respect to seabed marine litter in the NRA, studies are showing that 16% of the locations examined had litter. Plastic is the dominant material in this litter, with fishing-related litter being mostly found in the slopes of the Grand Bank of Newfoundland, and on the northern and southern slopes of the Flemish Pass.

Scientific Council also notes that current expertise within WG-ESA and Scientific Council is insufficient to assess the long-term impacts of these activities on fisheries, VMEs and the marine ecosystem. Scientific Council also reiterates that CPs continue to provide expertise in evaluation of marine environmental impacts of activities other than fishing (e.g. oil and gas).

Scientific Council acknowledges the value of the NEREIDA contract by providing updates on the available information on the activities other than fishing (particularly oil and gas and seabed marine litter).

Besides accidental events, routine oil and gas activities can have detrimental environmental effects during each of the main phases of exploration, production and decommissioning. Work to evaluate the impacts of these activities is ongoing in the NAFO Convention Area.

There are ongoing studies on the effects of seismic surveys on snow crab and groundfish, as well as development of methods to assess abandoned wells in the NAFO area. Current state of development of this research was presented at WG-ESA and summarized in its report (NAFO, 2023). Outside the NAFO area, work on a framework for an Environmental Risk Assessment for chemical contamination as a result of accidental spills was also presented at SC (see STACFEN report).

Detailed analyses on overlap between oil and gas activity areas with NAFO fisheries, VMEs and closed areas, and seabed marine litter have been made possible through the NEREIDA project.

Overlap between Oil and Gas activity areas with NAFO fisheries, VMEs and closed areas.

The analysis of the spatial overlap between oil and gas activity areas and NAFO fisheries, VMEs and closed areas in NAFO Divisions 3LM was updated (Figure 2). Several active exploration licences overlap with NAFO fisheries, VMEs and closed areas, including two new significant discovery licences.

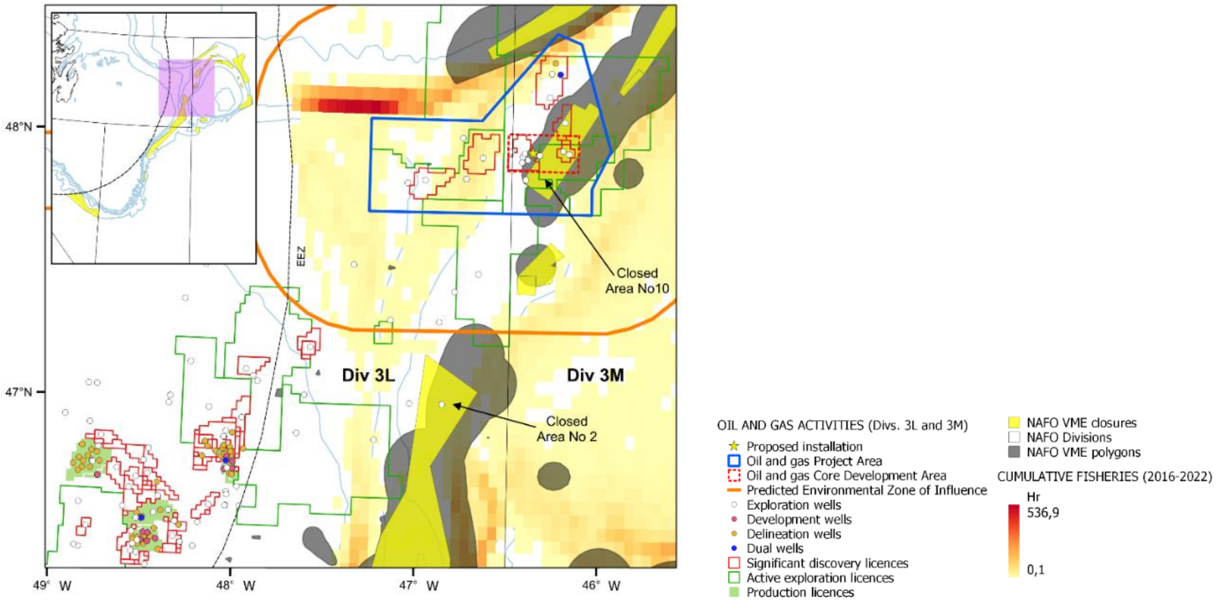


Figure 2. Overlap between oil and gas activities (oil and gas active exploration licences, significant discovery licences and wells) and fishing effort in NAFO Divisions 3LM. The yellow star indicates the location of the proposed production installation within the "Bay du Nord Development Project" in the Flemish Pass (outlined in blue). Sources: CNLOPB website (licences and wells); NEREIDA (cumulative bottom fisheries 2016-2022).

The spatial data from 2018-2024 shows an increasing overlap between oil and gas significant discovery licences and wells with (i) NAFO fisheries, (ii) VMEs and (iii) areas closed to bottom fishing (Figure 3). This increase is due to both the increase in the number of significant discovery licenses, and the extension of the NAFO closure No. 10. VMEs in closure No. 10 (i.e., sea pens, sponges and black corals) are part of an interconnected network, and hence, impacts on one VME could have cascading effects on other VME areas.

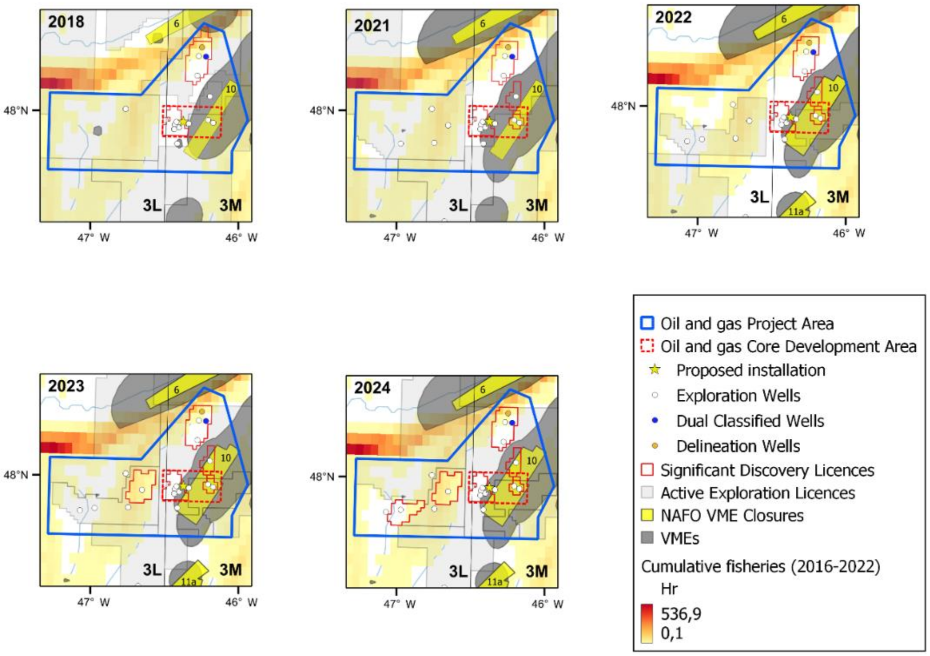


Figure 3. Evolution of overlap between oil and gas active exploration licences, significant discovery licences and wells, and NAFO fisheries, VMEs and Area closure No. 10 in Divisions 3L and 3M (2018-2024). Sources: CNLOPB website (licences and wells); NEREIDA (cumulative bottom fisheries 2016-2022)

Occurrence, characterization and spatial distribution of seabed marine litter in the NRA

Occurrence, characterization and spatial distribution of seabed marine litter in the NRA were analysed, based on data collected from EU groundfish surveys (Divisions 3LMNO: 2018-2023 period). Seabed litter was found in a total of 16.7% of the trawls. Plastic and fishing-related litter items were the most frequently found. Plastic accounted for 63.6% of the litter items, whilst metal accounted for 12.9% of the total. Remnants of fishing gear (7.8%), organic litter (4.4%), rubber (1.7%) and glass/ceramics (0.4%) were the least common. Items classified as "other anthropogenic litter" accounted for 8.3% of the litter items. In terms of occurrence (Figure 4) and density of marine litter (Figure 5), the highest densities were found in Divisions 3LNO, mainly on the slopes of the Grand Banks of Newfoundland, and on the northern and southern slopes of Flemish Pass. In Division 3L fishery-related litter items (Figure 6) were identified as being associated with both NAFO managed and non-managed fishing activities.

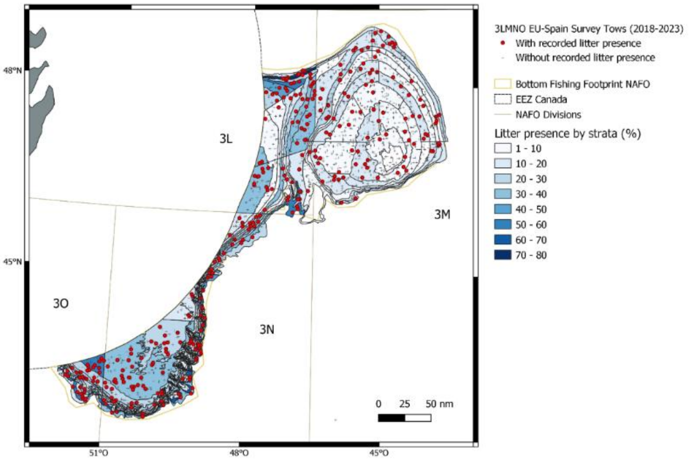


Figure 4. Occurrence of seabed litter from the EU groundfish surveys (2018-2023). Hauls with seabed litter presence (red points) and hauls with no recorded litter (black crosses) are shown. In the background the percentage of tows with litter presence by sampling strata is shown (in blue scale).

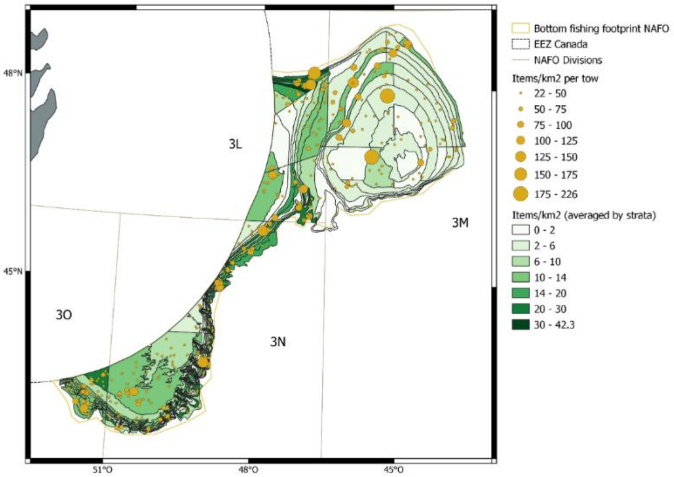


Figure 5. Seabed litter densities (number of items/km^2) per tow (yellow points) and averaged by sampling strata (in green scale), from the EU groundfish surveys (2018-2023).

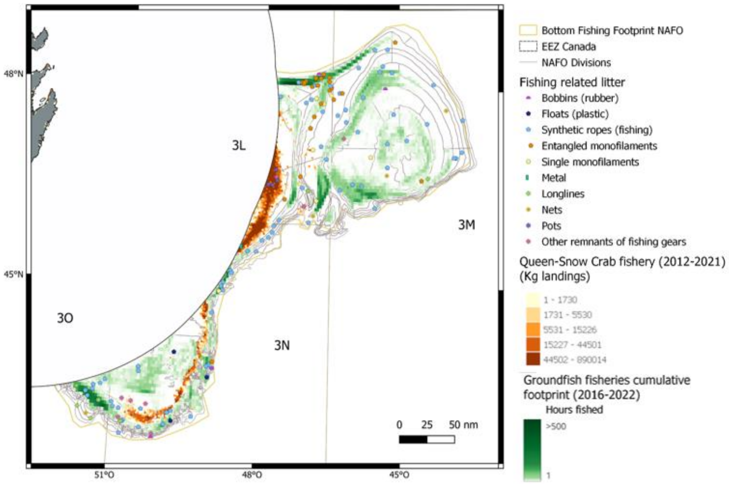


Figure 6. Spatial distribution of fishing related litter by items (seabed litter), from the EU groundfish surveys (2018-2023). NAFO groundfish fisheries (green scale; Source NEREIDA) and the snow crab fisheries (orange scale; Source DFO) are displayed.

xii) Summarize the information it currently has available regarding the current and future impacts of climate change on NAFO-managed stocks, non-target species, and associated ecosystems; and identify any consequential data gaps, research needs and opportunities for productive research (request #10).

Commission request 10: *The Commission requests that the Scientific Council at its 2024 meeting: summarize the information it currently has available regarding the current and future impacts of climate change on NAFO-managed stocks, non-target species, and associated ecosystems; and identify any consequential data gaps, research needs and opportunities for productive research.*

Scientific Council responded:

Through the Deep-sea Fisheries (DSF) Project (FAO), an expert consultant was contracted to summarize knowledge and increase awareness of climate change impacts on fisheries and ecosystems within the NAFO Regulatory Area, and provide guidance on adaptation and mitigation for climate-resilient fisheries. This study highlights the urgent need to integrate climate change considerations into fisheries management to ensure sustainable and resilient fisheries in the NAFO area.

Climate change impacts cannot be avoided, and need to be explicitly addressed in the work of Scientific Council and taken into account in the scientific advice. Specific operational elements of the way forward still need to be identified but necessitates a multidisciplinary approach, including expertise from biologists and oceanographers, as well as modelers and stock assessment scientists.

Scientific Council does not have the capacity to develop an approach to effectively incorporate climate change considerations as part of its regular operations, but climate change cannot be ignored in the work of NAFO. As a first step towards the goal of developing climate-informed Scientific Council advice, Scientific Council proposes a dedicated in-person meeting to bring together the multidisciplinary experts required to evaluate the options and design an approach to integrate climate change considerations throughout Scientific Council operations.

Scientific Council highlights that progress on this issue would necessarily be conditioned by the resources and capacity made available by Contracting Parties, including participation of appropriate expertise at the proposed meeting.

Through the Deep-sea Fisheries (DSF) Project, FAO, an expert consultant was contracted to summarize knowledge and increase awareness of climate change impacts on fisheries and ecosystems within the NAFO Regulatory Area and provide guidance on adaptation and mitigation for climate-resilient fisheries. For that, a comprehensive literature review was completed, supplemented by analyses of projected climate changes and their likely ecological impacts across the NAFO Convention Area. The study (SCR Doc. 24/009) highlights the urgent need to integrate climate change considerations into fisheries management to ensure sustainable and resilient fisheries in the NAFO area. Addressing climate change's complex and multifaceted impacts on marine ecosystems and fisheries requires a coordinated and adaptive management approach informed by robust scientific data and predictive modelling. Immediate action and continuous adaptation are essential to mitigate the adverse effects of climate change and ensure the long-term sustainability of fisheries resources.

The main results of this study were:

The northwest Atlantic Ocean is a climate change hotspot:

- *Observed climate trends:* Significant warming surface and bottom temperatures, deoxygenation, acidification, reduced sea ice, altered mixing, nutrient flux and primary production, and increased frequency and intensity of climate extremes.
- *Projected warming to 2100:* Surface temperatures are projected to rise by up to 4°C and bottom temperatures by up to 2-3°C by 2100.
- *Projected warming to 2050:* The average surface warming of ~1°C, with some areas experiencing warming up to 2.5°C under high emissions. The average bottom warming across both emission scenarios is 0.45°C, with some regions warming by as much as 2.1°C under high emissions. Some parts of the Grand Banks experience more significant warming on the sea bottom than at its surface.
- *Marine heatwaves:* Projected increases in the frequency and duration of marine heatwaves with significant ecological and socio-economic impacts.
- *Primary production:* Projected declines in primary production and changes in phytoplankton species composition and blooms.
- *Sea ice reduction:* Further declines in Arctic sea ice extent and thickness were projected.

Climate impacts on species, ecosystems and fisheries are complex and multifaceted:

- *Productivity and Mortality:* Altered productivity rates and increased mortality in various species.
- *Phenology and Trophic Mismatch:* Changes in seasonal timing and mismatches in predator-prey relationships.
- *Trophic amplification:* Disproportionate climate impacts on high trophic species.
- *Distribution Shifts:* Species are moving poleward and into deeper waters in search of suitable habitat. Under high emissions, 23% of transboundary fish stocks are expected to shift by 2030, increasing to 45% by 2100 at the global scale.
- *Disease:* shifting distribution and prevalence of bacterial and viral pathogens, including vibrio, affecting marine life.
- *Size and maturity:* warming is associated with reduced body sizes and earlier ages at maturity.
- *Biomass Decline:* Marine animal biomass is expected to decline across most of the southern NAFO area, with increases in the Arctic under high emissions scenarios.
- *Catch Potential:* Increased catch potential in higher latitudes and decreased potential in tropical regions due to poleward redistribution of fish stocks.
- *Disruption of Fisheries:* Significant disruption is expected, requiring fisheries to adapt to spatial redistribution or face reduced catches.

Climate impacts on NAFO-managed species:

- *High-Risk Species:* Half of the NAFO-managed species, including Atlantic wolffish, capelin, northern shrimp, roughhead grenadier, splendid alfonsino, witch flounder and yellowtail flounder, are likely to be adversely affected by climate changes.
- *Moderate-Risk Species:* Atlantic cod, Greenland halibut, redfish and thorny skate are at moderate risk.

- *Low-Risk Species:* American plaice, white hake and shortfin squid are at lower risk, although these assessments carry higher uncertainty due to limited studies.

Integrating climate into NAFO fisheries management:

- *Integrated data products:* Integrated and ready-to-use data products allow researchers to better incorporate climate variability and change into fisheries assessment and advice.
- *Remote sensing:* Greater use of remote sensing climate data products allows synoptic monitoring of marine climate conditions at high resolutions.
- *Climate modelling and forecasting:* Developing/applying high-resolution regional climate models for the northwest Atlantic Ocean to anticipate climate changes and their impacts on NAFO living resources.
- *Climate response database:* Consolidating the available scientific literature on climate changes and their impacts on NAFO species, including their environmental niches, into a centralized database to facilitate a more robust understanding of which climate impact pathways are most important for stocks, how they operate, and how to mitigate them.
- *Climate risk assessment:* Synoptic, spatially explicit climate vulnerability or risk estimates for NAFO-managed species and their ecosystems could support evidence-based decision-making under climate change, helping decision-makers to identify priorities for scientific and management efforts to implement proactive management measures, reduce impacts, increase resilience and advance the adaptive capacity of fisheries.
- *Monitoring distribution shifts:* Apply joint dynamic species distribution models to evaluate species distribution in real-time or to predict where species will be months or years ahead, helping understand where survey or fishing efforts should be deployed, anticipating stock shifts across management boundaries, and proactively addressing transboundary conflicts.
- *Climate monitoring:* Further programs to monitor e.g. climate-driven disease transmission, phenological shifts, climate vulnerability to early life stages, key climate variables and fish stocks would better detect and respond to climate changes.
- *Climate-considered stock assessments:* Using approaches such as management strategy evaluations, climate-conditioned advice, or other methods.
- *International cooperation and data sharing:* to address climate impacts comprehensively.
- *Adaptive management:* to address climate impacts on fisheries.
- *Sustainability:* Promote sustainable fishing practices to mitigate adverse climate effects and support resilient fisheries.
- *Research:* Encourage further research on the impacts of climate change on marine ecosystems and fisheries.
- *Strengthen multidisciplinary collaborations:* Include climate scientists, oceanographers, ecologists, social scientists, fisheries managers and policymakers in the fisheries assessment and management process to develop effective climate-resilient strategies.

The Scientific Council (SC) thanked the FAO and the Deep-sea Fisheries Project for facilitating the contract with the consultant to have this work completed.

Scientific Council notes that climate change is a serious and growing concern to fish stocks and marine ecosystems worldwide, and that the Northwest Atlantic is no exception. Climate change impacts cannot be avoided, and need to be explicitly addressed in the work of SC and taken into account in the scientific advice.

The consultant report offered suggestions on how this could be accomplished, including the creation of a Tier 0 in the Roadmap to develop Climate Impacts Assessments. These could summarize expected climate impacts, and inform further actions within Tiers 1-3 aimed at making the Scientific Council advice climate-informed, and the NAFO fisheries more resilient to climate change impacts.

While the consultant report provided useful insights and recommendations, specific operational steps on the way forward still need to be identified. The incorporation of climate change considerations necessitates a multidisciplinary approach, including expertise from biologists and oceanographers, as well as modellers and stock assessment scientists. An understanding of the range of the uncertainty in all the steps involved would be necessary to provide a realistic view of the process and develop a path forward.

At the present time, Scientific Council (specifically STACFEN, STACFIS and WG-ESA) does not have the capacity to develop an approach to effectively incorporate climate change considerations as part of its regular operations. However, as the summary of impacts detailed above clearly shows, climate change is not a concern that can be ignored. Therefore, as a first step towards the goal of developing climate-informed SC advice, Scientific Council proposed the organization of a dedicated in-person meeting to evaluate the options and design an approach to integrate climate change considerations throughout SC operations. Such a meeting would necessarily require participation of scientists from multiple disciplines as the approach required is indeed a multidisciplinary one.

Progress on this issue would necessarily be conditioned by the resources and capacity made available by Contracting Parties. Scientific Council reiterates and emphasizes that dedicated resources will be required to advance with the effective and timely taking of climate change impacts into account within SC work and advice. This need has already been acknowledged by the Commission in COM Doc. 23-13, but should be reflected in the Commission requests going forward.

2. Coastal States

a) Request by Denmark (Greenland) for Advice on Management in 2025 and 2026 (Annex 2)

Requests for management advice from Denmark (on behalf of Greenland) are presented in Annex 2 of Appendix V. Advice on stocks for which interim monitoring was requested is given in section 3c. below. Advice on *Pandalus borealis* is deferred to the September Scientific Council/NIPAG meeting.

The Scientific Council responded:

Recommendation for 2025 and 2026

Following the application of the ICES guidance on data limited stocks (DLS) method 3.2, the Scientific Council advises that the TAC in 2025 and 2026 should not exceed 6 258 tons.

Management objectives

No explicit management plan or management objectives has been defined by the Government of Greenland but a management plan is currently under development.

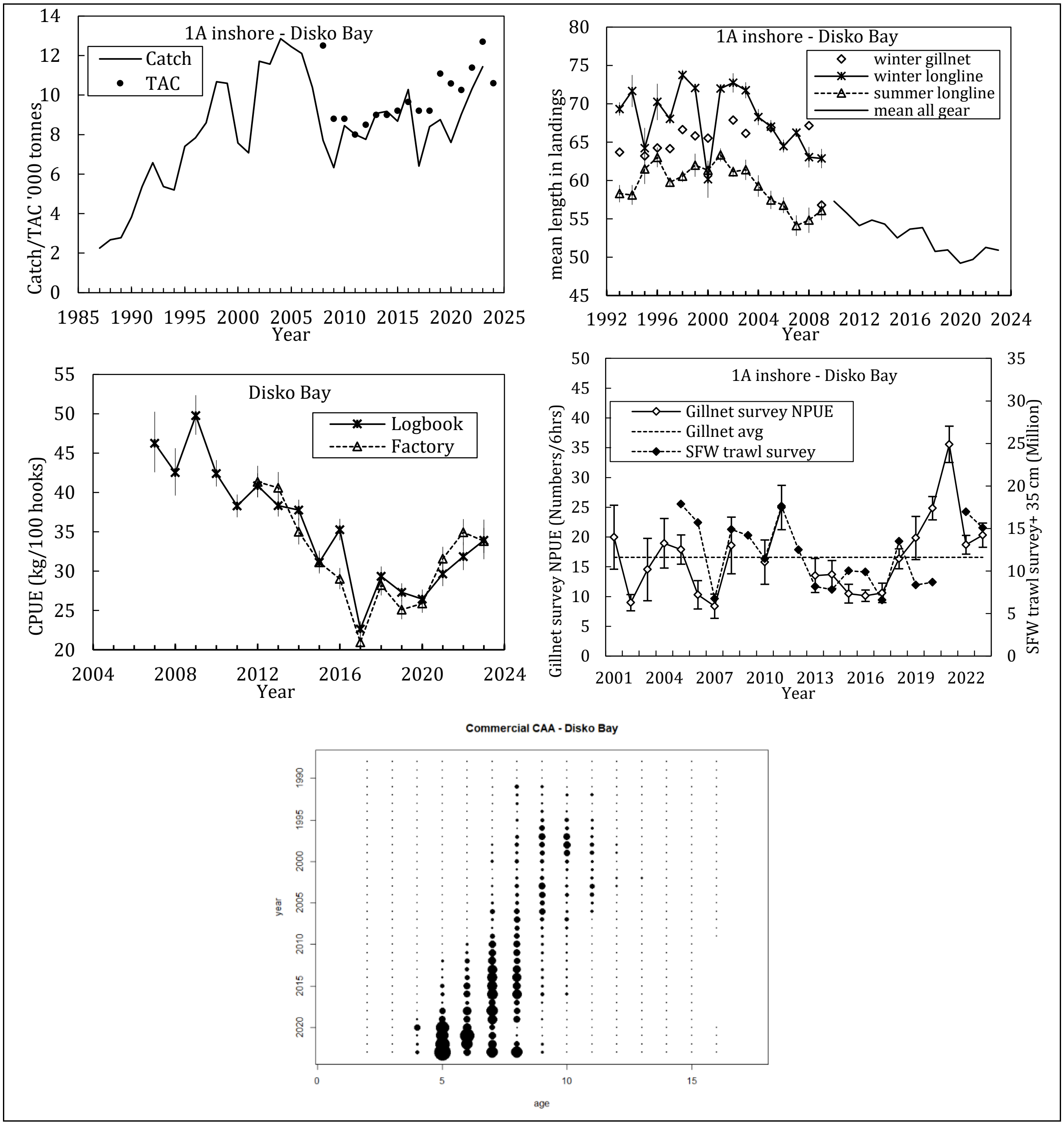
Management unit

Three inshore stocks in Division 1A (Disko Bay, Uummanaq and Upernavik) are believed to recruit from the Subareas 0+1 offshore spawning stock (in the Davis Strait), and there is little migration between the separated areas and the stock in Subareas 0+1 offshore. Separate advice is given for each area, within the specific management unit, in Division 1A inshore.

Stock status

The fishery has increased gradually over 4 decades, with signs of a decrease in the stock biomass in the most recent two decades. Although the commercial CPUEs have increased since 2017, the indices remain 17% below 2012 values. The mean size of the landed fish has decreased from 57 cm in 2010 to 51 cm in 2023 equivalent to a 32 % reduction in mean weight. After an increase in gillnet survey indices from 2017 to 2021, survey indices have quickly returned to around average levels. The trawl survey biomass indices are slightly higher in the recent two years.

The available data indicate that the fishery is currently based on incoming year classes ages 5, 7 and 8 and will be affected by variability in recruitment.



Reference points

Could not be established.

Assessment

No analytical assessment. Survey indices, mean length in the landings, commercial CPUE’s and catch at age information were used to monitor the stock.

Basis for advice

The application of the ICES guidance on data limited stocks (DLS) method 3.2 (ICES 2012a and 2012b, ICES 2014) using the Greenland Shrimp and Fish survey (Divisions 1A-F) was accepted by SC in 2016, as the basis for giving TAC advice on Greenland Halibut in the Disko Bay. This method was applied again to provide the following advice for the next two years. This rule was developed and tested as an empirical approach that uses the trend in the stock response to fishing pressure (ICES 2012a, Jardim *et al*. 2015). The empirical basis was given a generic expression

$C_{y+1}=\text{advice}_{\text{recent}}*r$

where r=index mean for 2020-2023/index mean for 2016-2019 = 1.39 (no trawl survey in 2021).

Should changes in excess of +- 20% be generated using this rule, a 20% cap is applied. In 2016 to 2018, no precautionary buffer was applied, but in 2020 a precautionary buffer was applied to account for decreases in the mean length in the fish landings and commercial CPUEs.

This results in the following advised catch:

2025 $\text{Catch}_{\text{advised}}$ = 6 258 t (catch advised for 2023 and 2024=5 215*1.2)

This rule should be reviewed in the next assessment.

Multi-year advice is recommended when applying this index-ratio based rule. Also, Greenland has requested advice for as many years as is considered appropriate. A two year advice cycle is suggested at this time.

The next assessment is planned for 2026.

Human impact

Mainly fishery related mortality. Removal of lost fishing gear (lost gillnets, longlines and more) by the GINR research vessel RV Sanna has been conducted in 2020, 2021 and 2023. Other mortality sources (e.g. pollution, shipping, oil-industry) are undocumented.

Biology and environmental interactions

No studies were reviewed in this assessment.

Ecosystem sustainability of catches

The impact of bottom fishing activities on VMEs in Subarea 0 was assessed in 2016. Three areas have been designated as marine refuges, that exclude bottom contact fisheries: Disko Fan, Davis Strait and Hatton Basin. Areas in SA 1 have also been closed to bottom fishing to protect benthic habitats.

Greenland halibut is included in the piscivore guild. There is no EPUs nor TCIs defined for this region. The ecosystem sustainability of catches cannot be evaluated. Greenland shark is a bycatch species of concern in the fishery given its low reproductive rate, slow growth rate and limited ecological information.

Fishery

Catches increased in the 1980s, peaked from 2004 to 2006 at more than 12 000 t, but then decreased substantially to just above 6 000 t in 2009. From this level, catches gradually increased reaching 10 760 t in 2016. In 2017, catch rates were unusually low and only 6 409 t were caught in Disko Bay. Since then catches have gradually increased reaching 11 435 t in 2023.

Recent catch estimates ('000 tons) are as follows:

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
1A Disko Bay – TAC	9.2	9.6	9.2	9.2	11.1	10.6	10.3	11.4	12.7	10.6
1A Disko Bay – STACFIS	8.7	10. 8	6.4	8.4	8.8	7.6	9.0	10.3	11.4	

Effects of the fishery on the ecosystem

Greenland halibut in the area is targeted with longlines and gillnets. Both gears select adult fish with large body size and do not retain recruits or small sized fish. Impacts on VMEs have not been addressed.

Special comments

Although the index provided by the Greenland Shrimp and Fish trawl survey experienced vessel changes in 2018 -2020, the results are considered to be comparable with those from earlier years.

Recruits are mainly received from the offshore stock in Subareas 0+1 offshore.

Sources of Information

SCR Doc. 24/019, 026, 031; SCS Doc. 24/14.

Greenland halibut in Division 1A inshore – Upernavik

Advice June 2024 for 2025-2026

Recommendation for 2025 and 2026

Following the application of the ICES guidance on data limited stocks (DLS) method 3.2, the Scientific Council recommends that catch should not exceed 5 801 t.

Management objectives

No explicit management plan or management objectives have been defined by the Government of Greenland. A management plan is currently under development.

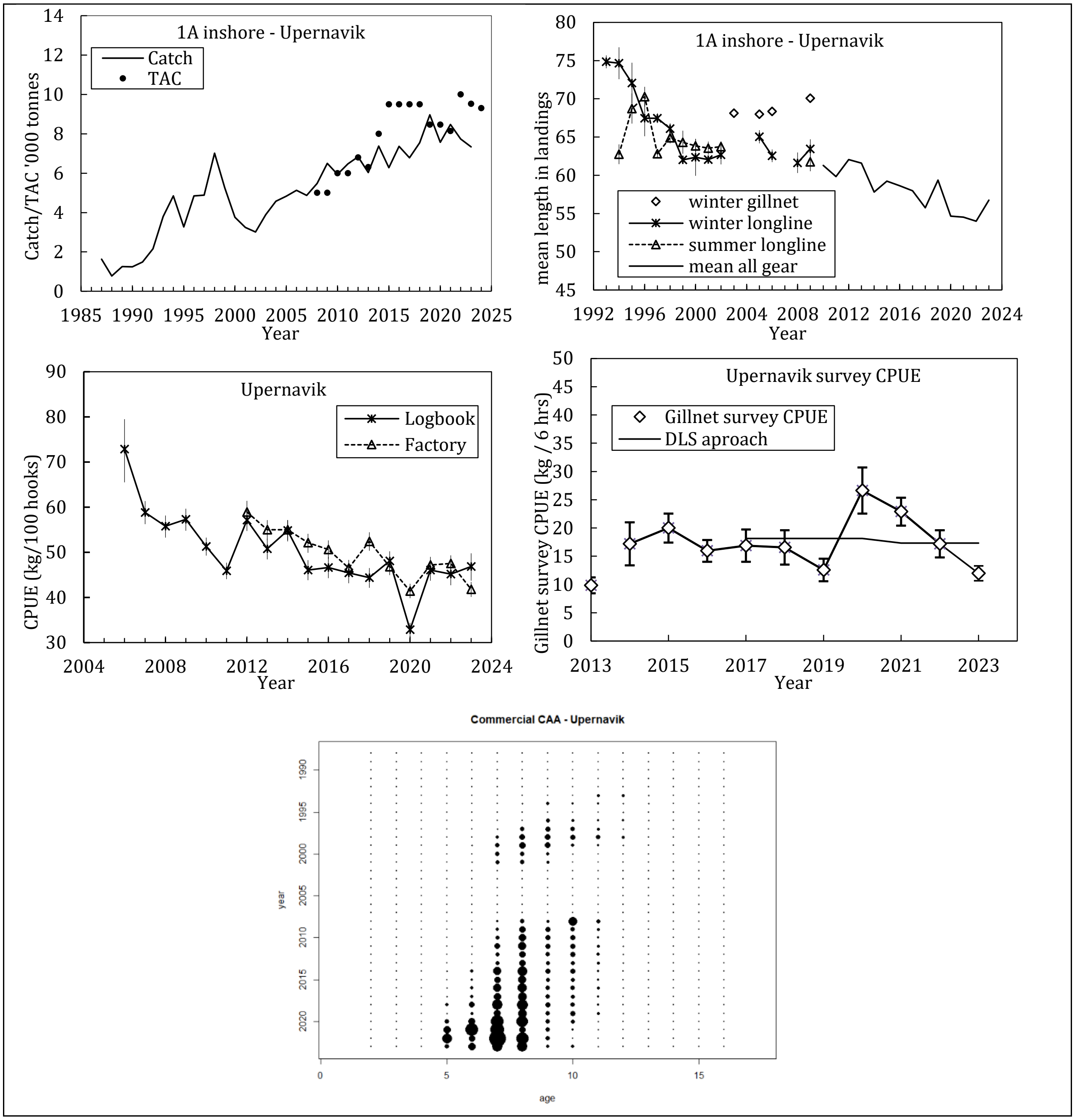
Management unit

Three inshore stocks in Division 1A (Disko Bay, Uummanaq and Upernavik) are believed to recruit from the Subareas 0+1 offshore spawning stock (in the Davis Strait), and there is little migration between the separated areas and the stock in Subareas 0+1 offshore. Separate advice is given for each area, within the specific management unit, in Division 1A inshore.

Stock status

The commercial logbook CPUE has decreased by 18 % and the factory data based CPUE has decreased by 29 % since 2012. The mean size of the landed fish has decreased from 62 cm in 2013 to 57 cm in 2023 equivalent to a 23 % reduction in mean weight. The gillnet survey NPUE and CPUE increased relative to earlier levels in 2020 and 2021 but has decreased since then. The fishery is currently based on ages 7 and 8.

The gradual reduction in the size of the landed fish and minor decrease in CPUE could indicate a slow decrease of the stock.



Reference points

Could not be established.

Assessment

Survey indices, mean length in the landings, commercial CPUEs and catch at age information were considered the best information to monitor the stock.

Basis for advice

The ICES Harvest Control Rule 3.2 for data limited stocks was used as a basis for giving TAC advice (mean survey index 2021-2023/mean 2017-2020=0.956). Should changes in excess of +- 20% be generated using this rule, a 20% cap is applied. In 2022, no precautionary buffer was applied.

This results in the following advised catch:

2025 and 2026 $\text{Catch}_{\text{advised}}$ = 5 801 t (catch advised for 2023 and 2024=6 070*0.956)

Multi-year advice is recommended when applying this index-ratio based rule. Also, Greenland has requested advice for as many years as is considered appropriate. A two year advice cycle is suggested at this time.

The next assessment is planned for 2026.

This rule should be reviewed in the next assessment.

Human impact

Mainly fishery-related mortality. Retrieval of lost fishing gear (lost gillnets, longlines and more) by the GINR research vessel RV Sanna was conducted in 2023. Other mortality sources (e.g. pollution, shipping, oil-industry) are undocumented.

Biological and Environmental interactions

No studies were reviewed in this assessment.

Ecosystem sustainability of catches

The impact of bottom fishing activities on VMEs in Subarea 0 was assessed in 2016. Three areas have been designated as marine refuges, that exclude bottom contact fisheries: Disko Fan, Davis Strait and Hatton Basin. Areas in Subarea 1 have also been closed to bottom fishing to protect benthic habitats.

Greenland halibut is included in the piscivore guild. There is no EPUs nor TCIs defined for this region. The ecosystem sustainability of catches cannot be evaluated. Greenland shark is a bycatch species of concern in the fishery given its low reproductive rate, slow growth rate and limited ecological information.

Fishery

Catches increased from the mid 1980s and peaked in 1998 at a level of 7 000 t. Landings then decreased sharply, but then increased from 2015-2019 to 9 000 t, and has decreased steadily since then, with the catch in 2023 being 7 300 t.

Recent catch estimates ('000 ton) are as follows:

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
1A Upernavik - TAC	9.5	9.6	9.7	9.5	8.5	8.5	9.9	10.0	9.5	9.3
1A Upernavik - Catch	6.3	7.4	6.8	7.5	9.0	7.6	8.5	7.7	7.3	
STACFIS Total	6.3	7.4	6.8	7.5	9.0	7.6	8.5	7.7	7.3	

Effects of the fishery on the ecosystem

Greenland halibut in the area is targeted with longlines and gillnets. Both gears select adult fish with large body size and do not retain recruits or small-sized fish. Ghost fishing by lost gillnets has been observed, but its effects are unknown.

Special comments

Recruits are mainly received from the offshore stock in Subareas 0+1 offshore.

Sources of Information

SCR Doc. 24/027, 028, 035; SCS Doc. 24/014.

Recommendation for 2025 and 2026

Following the application of the ICES guidance on data limited stocks (DLS) method 3.2, the Scientific Council recommends that TAC in 2025 and 2026 should not exceed 4 674 t. A PA buffer is applied in 2024 for the first time.

Management objectives

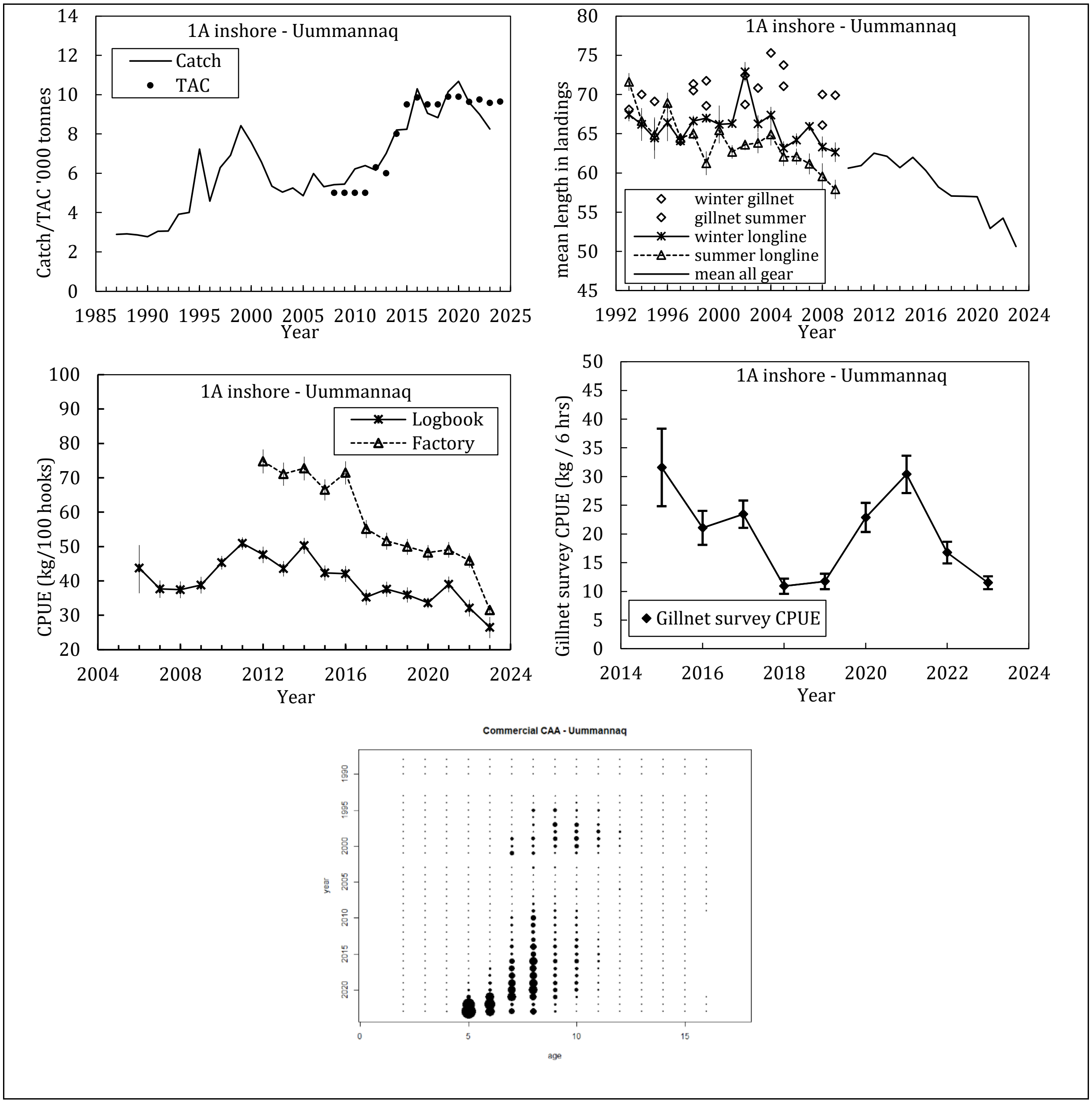
No explicit management plan or management objectives has been defined by the Government of Greenland. A management plan is currently under development.

Management unit

Three inshore stocks in Division 1A (Disko Bay, Uummannaq and Upernavik) are believed to recruit from the Subareas 0+1 offshore spawning stock (in the Davis Strait), and there is little migration between the separated areas and the stock in Subareas 0+1 offshore. Separate advice is given for each area, within the specific management unit, in Division1A inshore.

Stock status

The commercial logbook CPUE has decreased by 44 % and the factory based CPUE has decreased by 58 % since 2012. The mean size of the landed fish has decreased from 60 cm in 2016 to 50 cm in 2023 equivalent to a 43 % reduction in mean weight. The fishery is mainly based on incoming year classes ages 5 and 6 in 2023. The stock shows signs of depletion.



Reference points

Could not be established.

Assessment

No analytical assessment was performed. Survey indices, mean length in the landings, commercial CPUEs and catch at age information were considered the best information to monitor the stock.

Basis for advice

The ICES Harvest Control Rule 3.2 for data limited stocks was used as a basis for giving TAC advice (mean survey index 2021-2023/mean 2017-2020=1.134). Since both the mean length in the fish landings and the commercial CPUEs have decreased in both 2022 and 2023 and stock status relative to reference points is unknown, a PA buffer is applied in 2024 for the first time.

Multi-year advice is recommended when applying this index-ratio based rule. Also, Greenland has requested advice for as many years as is considered appropriate. A two-year advice cycle is suggested at this time.

This results in the following advised catch:

2025 and 2026 $\text{Catch}_{\text{advised}}$ = 4 674 t (catch advised for 2023 and 2024=5 153*1.13*0.8)

This rule should be reviewed in the next assessment.

Human impact

Mainly fishery-related mortality. Retrieval of lost fishing gear (lost gillnets, longlines and more) by the GINR research vessel RV Sanna was conducted in 2023. Other mortality sources (e.g. pollution, shipping, oil-industry) are undocumented.

Biological and Environmental interactions

No studies were reviewed in this assessment.

Ecosystem sustainability of catches

The impact of bottom fishing activities on VMEs in Subarea 0 was assessed in 2016. Three areas have been designated as marine refuges, that exclude bottom contact fisheries: Disko Fan, Davis Strait and Hatton Basin. Areas in Subarea 1 have also been closed to bottom fishing to protect benthic habitats.

Greenland halibut is included in the piscivore guild. There is no EPUs nor TCIs defined for this region. The ecosystem sustainability of catches cannot be evaluated. Greenland Shark is a bycatch species of concern in the fishery given its low reproductive rate, slow growth rate and limited ecological information.

Fishery

Catches in the Uummannaq fjord gradually increased from the 1980s reaching 8 425 t in 1999, but then decreased to ~ 5 000 in 2002. Since 2004, catches gradually increased reaching 10 670 t in 2020. In 2023 catch decreased to 8 250 t.

Recent catch estimates (‘000 ton) are as follows:

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
1A Uummannaq - TAC	9.5	9.9	9.5	9.5	9.9	9.5	9.6	9.8	9.6	9.7
1A Uummannaq - catch	8.2	10.3	9.0	8.8	10.2	10.7	9.6	9.0	8.3	
STACFIS Total	8.2	10.3	9.0	8.8	10.2	10.7	9.6	9.0	8.3	

Effects of the fishery on the ecosystem

Greenland halibut in the area is targeted with longlines and gillnets. Both gears select adult fish with large body size and do not retain recruits or small-sized fish. Ghost fishing by lost gillnets has been observed, but its effects in the Uummannaq fjord is unknown.

Special comments

Recruits are mainly received from the offshore stock in Subareas 0+1 offshore.

Sources of Information

SCR Doc. 24/029, 034; SCS Doc. 24/014.

b) Request by Canada and Greenland for Advice on Management in 2025 and 2026 (Annex 2, Annex 3)

Requests for management advice from Canada and Denmark (on behalf of Greenland) are presented in Annex 2 and 3 of Appendix V. Advice on stocks for which interim monitoring was requested is given in section 3c. below. Advice on *Pandalus borealis* is deferred to the September Scientific Council/NIPAG meeting.

Scientific Council responded:

Greenland halibut in Subareas 0+1 (offshore)

Advice June 2024 for 2025-2026

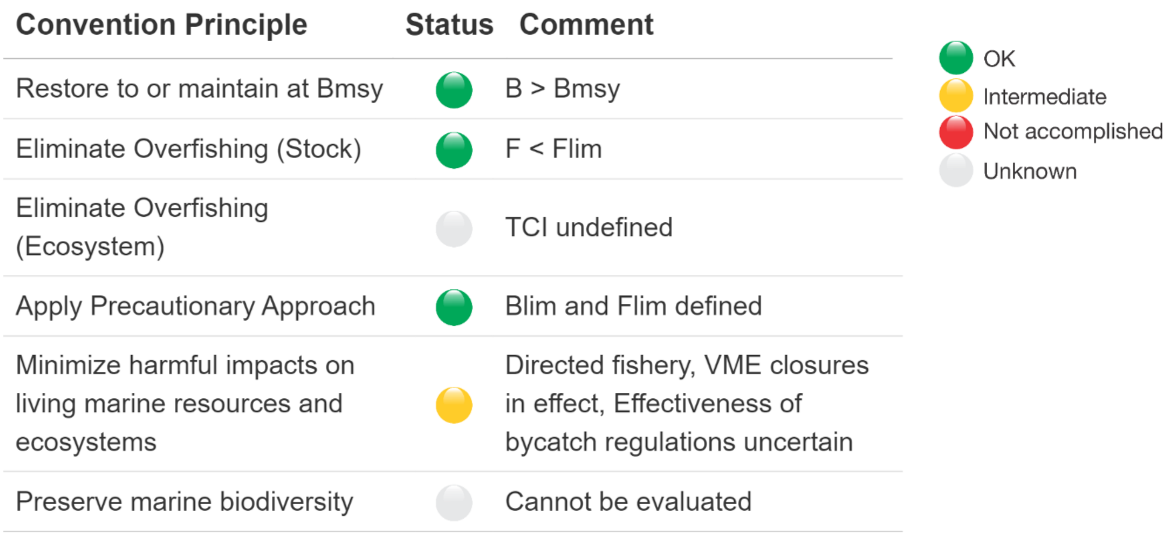
Recommendation for 2025 and 2026

In the projection period the probability of being below B_{lim} is very low (<1%), and the probability of exceeding F_{lim} is projected to be below 30% for any catch less than 90% of current TAC.

Scientific Council therefore recommends that catch should not exceed 90% of current TAC.

Management objectives

Canada and Denmark (on behalf of Greenland) requested that the Scientific Council provide an overall assessment of status and trends in the total stock area throughout its range. Stock status should be evaluated in the context of management requirements for long-term sustainability and the advice provided should be consistent with NAFO's Precautionary Approach Framework.



Convention Principle	Status	Comment
Restore to or maintain at Bmsy	🟢	B > Bmsy
Eliminate Overfishing (Stock)	🟢	F < Flim
Eliminate Overfishing (Ecosystem)	⚪	TCI undefined
Apply Precautionary Approach	🟢	Blim and Flim defined
Minimize harmful impacts on living marine resources and ecosystems	🟡	Directed fishery, VME closures in effect, Effectiveness of bycatch regulations uncertain
Preserve marine biodiversity	⚪	Cannot be evaluated

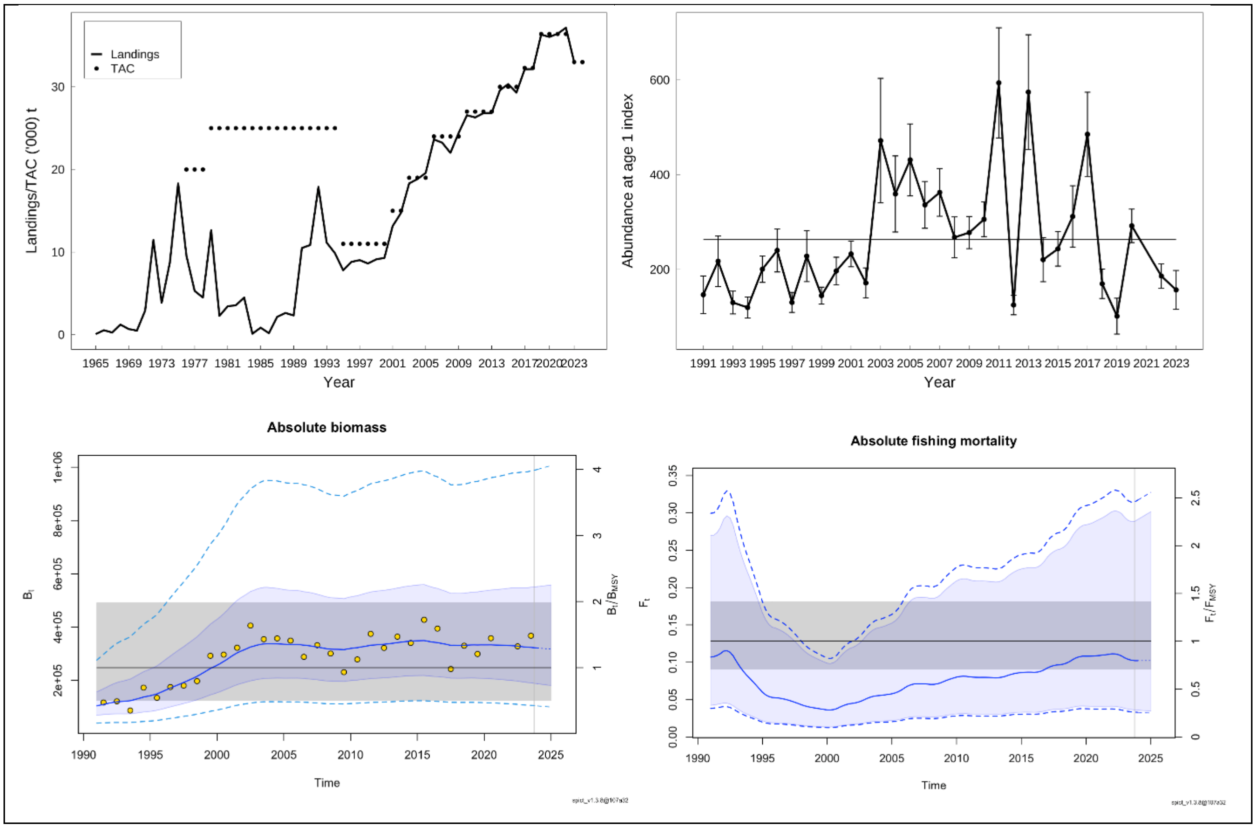
🟢 OK
🟡 Intermediate
🔴 Not accomplished
⚪ Unknown

Management unit

The Greenland halibut stock in Subareas 0+1 (offshore) is part of a larger population complex distributed throughout the Northwest Atlantic.

Stock status

Median biomass is above B_{msy} (B/B_{msy} = 1.3) and the probability of being below B_{lim} is less than 1%. Fishing mortality is below F_{msy} (F/F_{msy} = 0.78) and the probability of being above F_{lim} is 34%.



Reference points

B_{lim} is 30% B_{msy} and F_{lim} is F_{msy} (SCS 04/12).

Projections

Medium-term projections were carried forward to the year 2026 for catch scenarios with catch = TAC = 33 305t for 2024. Constant removals were applied from 2025-2026 at several levels of F (F=0, $F_{status\ quo}$, 75% F_{msy}, 85% F_{msy} and F_{msy}) or catch (TAC and 90% TAC). At the end of the projection period, the risk of biomass being below B_{lim} was less than 1% in all cases.

For the $F_{\text{status quo}}$ projections, the probability that $F > F_{lim} = F_{msy}$ in 2025-2026 was 34%, and with 2/3 F_{msy} the probability was 23%. At 75% F_{msy}, the probability that F > F_{lim} was 30%. Projected at the level of 85% F_{lim}, the probability that F > F_{lim} was 39% and for F_{msy} projections, this probability increased to 50%. For biomass projections, in all scenarios for 2025-2026 the probability of biomass being below B_{lim} was less than 1%. The probability that biomass in 2026 is less than biomass in 2024 is between 19 and 70% for all projections.

Projections with Catch 2024 = 33305 t		
Year	Yield (´000t)	Projected relative Biomass (B/Bmsy) median (80%CL)
F =0		
2024	33.3	1.3 (0.91-1.84)
2025	0	1.28 (0.89 - 1.85)
2026	0	1.4 (1.02-1.92)
Fstatusquo = 0.102		
2024	33.3	1.3 (0.91-1.84)
2025	32.33	1.28 (0.89-1.85)
2026	32.04	1.27 (0.87-1.86)
2/3Fmsy= 0.085		
2024	33.3	1.3 (0.91-1.84)
2025	27.23	1.28 (0.89- 1.85)
2026	27.39	1.28(0.91-1.88)
75%Fmsy = 0.096		
2024	33.3	1.3 (0.9-1.85)
2025	30.51	1.28 (0.89- 1.86)
2026	30.4	1.26 (0.89-1.87)
85%Fmsy = 0.109		
2024	33.3	1.3 (0.91-1.84)
2025	34.42	1.27 (0.89-1.85)
2026	33.91	1.26 (0.86-1.85)
Fmsy = 0.128		
2024	33.3	1.3 (0.91-1.84)
2025	40.21	1.28 (0.89-1.85)
2026	38.92	1.24 (0.83-1.84)
TAC = 33 305		
2024	33.3	1.3 (0.91-1.84)
2025	33.3	1.28 (0.89-1.85)
2026	33.3	1.27 (0.86-1.85)
90% TAC = 29 975		
2024	33.3	1.3 (0.91-1.84)
2025	29.97	1.28 (0.89-1.85)
2026	29.97	1.28 (0.88-1.86)

	yield (´000t)		P (F> Flim)			P(B<Blim)			P(B>Bmsy)			P(B2026 < B2024)
Catch2024= 333	2025	2026	2024	2025	2026	2024	2025	2026	2024	2025	2026	
F=0	0	0	34%	<1%	<1%	<1%	<1%	<1%	83%	81%	91%	19%
F statusquo	32.33	32.04	34%	34%	34%	<1%	<1%	<1%	83%	81%	79%	60%
2/3 Fmsy	27.23	27.39	34%	23%	23%	<1%	<1%	<1%	83%	81%	81%	53%
75 % Fmsy	30.51	30.4	34%	30%	30%	<1%	<1%	<1%	83%	81%	80%	58%
85% Fmsy	34.42	33.91	34%	38%	39%	<1%	<1%	<1%	83%	81%	78%	63%
Fmsy	40.21	38.92	34%	50%	50%	<1%	<1%	<1%	83%	81%	76%	70%
TAC	33.3	33.3	34%	36%	37%	<1%	<1%	<1%	83%	81%	79%	62%
90%TAC	29.97	29.97	34%	29%	29%	<1%	<1%	<1%	83%	81%	80%	57%

Assessment

A Stochastic Production model in Continuous Time (SPiCT) was used for the assessment of this stock. Input to this model include landings data and a standardized index of exploitable stock biomass from combined survey data.

The next assessment is expected to be in 2026.

Human impact

Mainly fishery related mortality has been documented. Other sources (e.g. pollution, shipping, oil-industry) are undocumented.

Biology and Environmental interactions

No specific studies were reviewed during this assessment.

Ecosystem sustainability of catches

The impact of bottom fishing activities on VMEs in Subarea 0 was assessed in 2016. Three areas have been designated as marine refuges, that exclude bottom contact fisheries: Disko Fan, Davis Strait and Hatton Basin. Areas in Subarea 1 have also been closed to bottom fishing to protect benthic habitats.

Greenland halibut is included in the piscivore guild. There is no EPUs nor TCIs defined for this region. The ecosystem sustainability of catches cannot be evaluated. Greenland shark is a bycatch species of concern in the Subareas 0+1 (offshore) fishery given its low reproductive rate, slow growth rate and limited ecological information.

Fishery

Catches were first reported in 1965. Catches increased from 1989 to 1992 due to a new trawl fishery in Division 0B with participation by Canada, Norway, Russia and Faeroe Islands and an expansion of the Division 1CD fishery with participation by Japan, Norway and Faeroe Islands. Catch declined from 1992 to 1995 primarily due to a reduction of effort by non-Canadian fleets in Division 0B. Since 1995 catches have been near the TAC and increasing in step with increases in the TAC, with catches reaching a high in 2022. Catches decreased to 32 990t following a decreasing TAC in 2023.

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
TAC	30	30	32.3	32.3	36.4	36.4	36.4	36.4	33.3	33.3
SA 0	15.4	14.1	15.9	16.0	18.3	17.9	19.1[2]	18.3	16.4	
SA 1	14.9	15.2	16.2	16.2	18.0	18.1	17.3	18.8	16.6	
Total STACFIS[1]	30.3	29.3	32.1	32.2	36.3	36.0	36.4	37.2	33.0	

[1] Based on STATLANT, with information from Canada and Greenland authorities to exclude inshore catches.
[2] STACFIS estimate using 1.48 conversion factor for J-cut, tailed product.
[3] Based on official catches from the Greenland Office of Fisheries Licences (GLFK) because STATLANT were not available.

Sources of information

SCR Docs. 24/013, 019, 020, 021, 022; SCS Doc. 24/14.

c) Monitoring of Stocks for which Multi-year Advice was provided in 2022 or 2023

Scientific Council recommends for:
Demersal redfish and deep-sea redfish (*Sebastes* spp.) in Subarea 1 for 2024 and beyond: Scientific Council advises that there should be no directed fishery until a significant improvement in stock status is detected.

Wolffish in Subarea 1 for 2024 – 2026:
Atlantic wolffish: The Scientific Council advises that there should be no directed fishery and bycatch should be kept to the lowest possible level.
Spotted wolffish: The Scientific Council advises that the TAC should not exceed mean catches from the period 2012 to 2015 when indices were increasing for both stocks. This corresponds to a catch of 775 tons.

VIII. REVIEW OF FUTURE MEETINGS ARRANGEMENTS

1. Scientific Council instersessional meeting, summer 2024

The Scientific Council will have an intersessional online meeting to complete the simulation testing of the new proposed PAF in summer 2024. Date TBD.

2. Scientific Council and STACFIS Shrimp Assessment Meeting, 17 – 19 September 2024

The Scientific Council and STACFIS Shrimp Assessment meeting will be held in Halifax, Canada, 17-19 September 2024.

3. Scientific Council, 23 to 27 September 2024

The Scientific Council September 2024 meeting will be held in Halifax, Canada, 23-27 September 2024.

4. WG-ESA, 12- 21 November 2024

The Working Group on Ecosystem Science and Assessment will meet at the NAFO Secretariat, Halifax, Nova Scotia, Canada, 12- 21 November 2024.

5. Scientific Council, June 2025

The Scientific Council June meeting will be held in Halifax, Nova Scotia, 30 May - 12 June 2025. The NAFO Secretariat will look into alternate meeting venues.

6. Scientific Council (in conjunction with NIPAG), 2025

Dates and location to be determined.

7. Scientific Council, September 2025

The Scientific Council September 2025 meeting will be held in Halifax, Canada, 15-19 September 2025.

8. WG-ESA, November 2025

Dates and location to be determined.

9. NAFO/ICES Joint Groups

a) NIPAG, 2025

Dates and location to be determined.

b) ICES – NAFO Working Group on Deep-water Ecosystem

Dates and location to be determined.

c) WG-HARP

Dates and location to be determined.

10. Commission- Scientific Council Joint Working Groups

a) WG-EAFFM

The joint Commission- Scientific Council Working Group on the Ecosystem approach to Fisheries Management (WG-EAFFM) will be held in Bergen, Norway, 5-7 August 2024.

b) WG-RBMS

The joint Commission- Scientific Council Working Group on Risk Based Management Systems (WG-RBMS) will be held in Bergen, Norway, 8-10 August 2024.

c) CESAG

The next meeting of the Catch Estimation Strategy Advisory Group (CESAG) may take place in Spring 2025.

IX. ARRANGEMENTS FOR SPECIAL SESSIONS

1. 11th International flatfish symposium

The 11th International flatfish symposium is scheduled to take place from 25-28 November 2024 in Wageningen, the Netherlands. The Scientific Council agreed that Laura Wheeland (Canada) attends as a representative of the NAFO Scientific Council. The NAFO Secretariat informed the Scientific Council that there are fund available in the 2024 Scientific Council budget to support Laura's attendance.

2. EAFM Symposium, 2025

The EAFM Symposium is scheduled to take place from 11-13 March 2025 in Rome, Italy.

Anthony Thompson (DSF Project, FAO) provided an update on the planning for the joint FAO, NAFO and ICES Symposium Applying the Ecosystem Approach to Fisheries Management in ABNJ. The Scientific Council noted the importance of the symposium, and the potential contributions to JNAFS. Scientific Council discussed the appropriate representatives and agreed that the following Scientific Council representative should attend: Diana González-Troncoso (Scientific Council Chair), Mar Sacau Cuadrado (WG-EAFFM / WG-ESA co-Chair), Alfonso Pérez Rodríguez (WG-ESA co-Chair), Miguel Caetano (STACFEN Chair), Rick Rideout (STACPUB Chair), Frederic Cyr (Canada), Mariano Koen-Alonso (Canada), Ellen Kenchington (Canada) Paul Regular (Canada), Irene Garrido Fernandez (European Union) and Patrícia Gonçalves (European Union).

3. Topics for future Special Sessions

Workshop on cod Division 3M readers

The Scientific Council agreed that a review of the comparative age reading for 3M cod should be added as there had not been a session on this since 2017. Currently, readers from Spain, Faroes and Norway read the 3M cod otoliths. An exchange between these readers would be very useful to try to establish a protocol.

Scientific Council Process

The Scientific Council noted a need to review the current Scientific Council structure and process for providing advice, and that an additional special session with dedicated time would be required to have those discussions. A potential option would be to add an additional day onto the June meeting to have those dedicated discussions.

Reference Points Workshop

Many stocks managed by NAFO have no Reference Points or they are interim. Some of them are based on survey indices, that can not be calculated in the next years due to the lack of Canadian surveys. Methods for calculating the RPs can be discussed during a Workshop

Climate Change Meeting

Scientific Council does not have the capacity to develop an approach to effectively incorporate climate change considerations as part of its regular operations, but climate change can not be ignored in the work of NAFO. As a first step towards the goal of developing climate-informed SC advice, Scientific Council proposes a dedicated in-person meeting to bring together the multidisciplinary experts required to evaluate the options and design an approach to integrate climate change considerations throughout Scientific Council operations.

X. MEETING REPORTS

1. Working Group on Ecosystem Science and Assessment (WG-ESA), 14-23 November 2023

The report of the meeting of the Working Group on Ecosystem Science and Assessment (WG-ESA), held at the NAFO Secretariat, Halifax, Nova Scotia, during 14-23 November 2023 (SCS Doc. 23/25), was presented by co-Chair Mar Sacau Cuadrado (EU) and acting co-Chair Diana González-Troncoso (EU).

Some topics related with the WG-ESA were updated during this meeting:

a) NEREIDA project

NEREIDA's work on seabed marine litter and oil and gas

The NEREIDA project is funded by the European Union through the NAFO Secretariat. The proposed activities are specifically designed to address the Commission request related to *monitor and provide regular updates on relevant research related to the potential impacts of activities other than fishing*. The ultimate goal is to understand some of these activities taking place in the NRA (i.e. seabed marine litter and offshore oil and gas), in relation to their potential impact on the fishery resources, the ecosystem and the fishing activity regulated by NAFO. It should be noted that this study is not intended to duplicate work done through existing impact assessment processes. The NEREIDA work started with a significant delay due to administrative problems and results are expected to be presented during November 2024 WG-ESA meeting. This delay has had an impact on the original work schedule. Updates on recent and relevant research related to NEREIDA work on seabed litter and oil and gas activities were made available to the SC.

Seabed marine litter (SCR Doc. 24/046)

Continuing the pilot study (García-Alegre *et al*., 2020) a cross-checking of the seabed litter information and the photographic records collected during the EU groundfish surveys (2018-2023) with the IEO seabed litter database was done. This work has allowed to perform the analysis of the occurrence, showing that plastics and fishing related litter were the most frequent litter groups collected in the region. Besides, the spatial distribution of seabed litter by occurrence and densities was mapped. Finally, it was noted that a review and update of the current seabed marine litter data collection procedures used in the EU groundfish surveys is being carried out with the aim of developing an improved protocol and new data forms.

Oil and gas (SCR Doc. 24/047)

Main natural components (geomorphological features, fishery resources, epibenthic assemblages, marine mammals, seabirds, sea turtles, VMEs and its connectivity) and human activities (bottom fisheries, shipping, offshore oil and gas, undersea cables, conservation and management, and marine research) identified in the NRA were mapped, based on available spatial data. In addition, an updated map of the current spatial location of oil and gas exploration activities (licences and wells) and its overlap with NAFO fisheries, VMEs and closed areas, as well as maps showing the evolution over time along the period 2018-2024 were produced. In recent years, an increase in overlap has been observed. All this information was organized and integrated into a GIS in order to visualize spatial overlaps between different users of the marine space (e.g., oil and gas exploration and fisheries), and between users and the marine environment (e.g., oil and gas and VMEs). A literature review was conducted showing that, besides accidental events, oil and gas activities can produce impacts during the exploration, exploitation and decommissioning phases.

References

García-Alegre A., Román-Marcote E., Gago J., González-Nuevo G., Sacau M., Durán Muñoz P. (2020). Seabed litter distribution in the high seas of the Flemish Pass area (NW Atlantic). Scientia Marina 84(1). https://doi.org/10.3989/scimar.04945.27A

NEREIDA´s work on the update on the analysis of VMS and Logbook data to study the bottom fishing footprint (SCR 23/056)

An update on the analysis of Vessel Monitoring System (VMS) and Logbook data to study the bottom fishing footprint was carried out using data for the 2016 to 2022 period and was made available to the SC. Data gathered through the IEO Scientific Observer Program on board fishing vessels were used to assess both the coverage and accuracy of the data employed in studying fishing effort and footprint. The findings reveal that both NAFO's VMS and logbook databases contain errors, and the effects of misreporting are enhanced when these datasets are merged. Data from scientific observers allowed the measurement of these errors, resulting in approximately 40-70% of the total pings being considered with the merging approach. Despite the merging approach is widely considered an improvement in relation to the former method (i.e. simple speed filter) and a powerful tool for describing the spatial distribution of fishing activity, this improvement relies on the coverage and quality of the available information. Moreover, yearly cumulative fishing effort maps (hours fished per cell) together with yearly fisheries-specific effort maps (2016-2022) were presented to SC, using the new improved "coupling of VMS and Logbook data" methodology. These maps will help to better understand if and how the distribution and intensity of fishing effort in the NAFO Regulatory Area changes over time. In addition, an overlay analysis was performed to estimate the area of the seven VME taxa polygons that overlapped with the cumulative fishing footprint and the different fishery-specific footprints.

b) OECMs submission

At the 2023 Annual Meeting the Commission adopted the recommendation from WG-EAFFM that *the Secretariat, in consultation with the Scientific Council as required, to submit the seamount closure areas and the sponge VME fishery closures 1 to 6 to the CBD Secretariat and to the UN Environment Programme World Conservation Monitoring Centre (UNEP WCMC) for inclusion in the World Database on OECMs*. The submission was reviewed by WG-ESA at the November 2023 meeting for final submission by the Secretariat. The Executive Secretary updated that the submission process was more complex than was previously discussed, and the process for RFMOs to submit areas as OECMs is still unclear, and that there is a review process in place. In previous correspondence and meeting, it was noted that no review process was required for submission, as normally they are submitted by CBD focal points, and that process was not defined for RFMOs. The Executive Secretary noted that there should be a second review by the Commission since they adopted the recommendation under the assumption that no further review was required. The Secretariat, relevant SC members and WG-EAFFM will continue working on the OECM submission.

2. NAFO Joint Commission-Scientific Council Working Group on Risk-Based Management Strategies (WG-RBMS), 16-17 April 2024

The report of the meeting of the NAFO Joint Commission-Scientific Council Working Group on Risk-Based Management Strategies (WG-RBMS), held virtually from 16-17 April 2024 (COM-SC Doc. 24-01), was presented by the co-Chair Fernando González-Costas. Updates were provided relating to the status of the work towards the Greenland halibut MSE process, the 3LN redfish MSE and the revisions of the Precautionary Approach, the details of which were discussed until their relevant agenda items during the Scientific Council meeting.

3. NAFO Precautionary Approach Working Group (PA-WG), 04 April and 13 May 2024

The reports of the NAFO Precautionary Approach Working Group (PA-WG) meetings (SCS Doc. 24/05; SCS Doc. 24/13) were presented by the Chair of the working group, Fernando González-Costas (European Union). The PA-WG Chair thanked the technical teams for their efforts and the progress made on the precautionary approach. The presentation included the different approaches that will be used in the testing of the Precautionary Approach framework (PAF), the formulation of the HCR, the different models and scenarios that will be used in the testing process, as well as the Performance Statistics (PSs) to measure the Management Objectives approved by the RBMS (NAFO/COM-SC Doc. 24-01) to test the PAF.

Under this point, the technical team in charge of specific testing presented SCR 24/17 on the possible stock-recruitment relationships that could be used in the 3M cod case study. The SC considered Beverton-Holt with a steepness of 0.7 as the best stock/recruitment relationship option for this testing exercise and, if time permits, another scenario could be implemented assuming a Ricker stock/recruitment relationship with steepness of 0.7. It was also agreed that in the case of 3M cod, the values related to MSY reference points would be used as framework reference points: $B_{trigger}$=0.75*B_{msy}, B_{lim}=0.3*B_{msy} and F_{target}=0.85*F_{msy}.

The PS table discussed at the May 2024 PA-WG meeting was also revised. The SC agreed to change the formulation of the PS that measures the objective of "Maintain approximately MSY catches in the long term" and that the definitive table of the objectives and PSs be included in the May 2024 PA-WG report.

4. Report from ICES-NAFO Working Group on Deepwater Ecosystems (WG-DEC), 25-29 March 2024

A summary of the Joint ICES/NAFO Working Group on Deep-water Ecology (WG-DEC) was presented in STACREC (see STACREC report, section 7.d).

5. Presentation of a summary presentation of the ICES/NAFO/NAMMCO Working Group on Harp and Hooded Seals (WG-HARP)

At the invitation of the STACREC chair, a summary presentation of the ICES/NAFO/NAMMCO Working Group on Harp and Hooded Seals (WG-HARP) was presented (see STACREC report, section 7.e). Review of Scientific Council Working Procedures/Protocol

6. General Plan of Work for September 2024 Annual Meeting

No new issues were raised that will affect the regular work plan for the September meeting.

XI. OTHER MATTERS

1. Designated Experts

The list of Designated Experts can be found below:

From the Science Branch, Northwest Atlantic Fisheries Centre, Department of Fisheries and Oceans, St. John's, Newfoundland & Labrador, Canada

Cod in Div. 3NO	Rick Rideout	rick.rideout@dfo-mpo.gc.ca
Redfish Div. 3O	Laura Wheeland	laura.wheeland@dfo-mpo.gc.ca
Redfish 3LN	Andrea Perreault	andrea.perreault@dfo-mpo.gc.ca
American Plaice in Div. 3LNO	Laura Wheeland	laura.wheeland@dfo-mpo.gc.ca
Witch flounder in Div. 3NO	Dawn Maddock Parsons	dawn.parsons@dfo-mpo.gc.ca
Yellowtail flounder in Div. 3LNO	Dawn Maddock Parsons	dawn.parsons@dfo-mpo.gc.ca
Greenland halibut in SA 2+3KLMNO	Paul Regular	paul.regular@dfo-mpo.gc.ca
Northern shrimp in Div. 3LNO	Nicolas Le Corre	nicolas.lecorre@dfo-mpo.gc.ca
Ecosystem Designated expert 3LNO	Vacant	

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

Roughhead grenadier in SA 2+3	Fernando González-Costas	fernando.gonzalez@ieo.csic.es
Splendid alfonsino in Subarea 6	Fernando González-Costas	fernando.gonzalez@ieo.csic.es
Cod in Div. 3M	Irene Garrido Fernández	irene.garrido@ieo.csic.es
Shrimp in Div. 3M	Jose Miguel Casas Sánchez	mikel.casas@ieo.csic.es
Ecosystem Designated expert 3M	Diana González-Troncoso	diana.gonzalez@ieo.csic.es

From the Instituto Nacional de Recursos Biológicos (INRB/IPMA), Lisbon, Portugal

American plaice in Div. 3M	Ricardo Alpoim	ralpoim@ipma.pt
Golden redfish in Div. 3M	Ricardo Alpoim	ralpoim@ipma.pt
Redfish in Div. 3M	Ricardo Alpoim	ralpoim@ipma.pt

From the Greenland Institute of Natural Resources, Nuuk, Greenland

Demersal Redfish in SA1	Rasmus Nygaard	rany@natur.gl
Wolfish in SA1	Rasmus Nygaard	rany@natur.gl
Greenland halibut in Div. 1 inshore	Rasmus Nygaard	rany@natur.gl
Greenland halibut in SA 0+1 (offshore)	Adriana Nogueira	adno@natur.gl
Northern shrimp in SA 0+1	AnnDorte Burmeister	anndorte@natur.gl
Northern shrimp in Denmark Strait	Tanja Buch	TaBb@natur.gl

From Knipovich Polar Research Institute of Marine Fisheries and Oceanography (PINRO), Russian Federation

Capelin in Div. 3NO	Konstantin Fomin	fomin@pinro.ru

From National Marine Fisheries Service, NEFSC, Woods Hole, Massachusetts, United States of America

Northern Shortfin Squid in SA 3 & 4	Lisa Hendrickson	lisa.hendrickson@noaa.gov
Thorny skate in Div. 3LNO	Katherine Sosebee	katherine.sosebee@noaa.gov
White hake in Div. 3NO	Katherine Sosebee	katherine.sosebee@noaa.gov

2. Election of Chairs

No new Chairs were elected in 2024.

3. Budget items

Scientific Council considered the draft budget for 2025 provided by the Secretariat. The Scientific Council noted the need to increase the budget for assessment reviewers in 2025 to account for increases in travel costs, and the importance of SC members attending the EAFM Symposium in March 2025 (see agenda item IX.2). Additionally, in relation to the workload discussions (agenda item XII.4(b)), the Scientific Council requested funding be made available to hire a dedicated analyst to contribute both to the Management Strategy Evaluation for 3LN redfish and other analytical work of the Scientific Council for one year. The Secretariat was tasked with calculating the estimated costs for these items and updating the budget accordingly.

4. Other business

a) Scientific Council meeting format

Scientific Council noted that its meeting in June is the key meeting in which the main decisions of the group are taken and that in-person participation in this meeting is critical for effectively addressing the long list of requests for advice. In June 2024 in particular, having the full STACFEN session online was not effective and prevented their members from fully participating in the meeting. Scientific Council **recommends** that *the June meeting should desirably be in-person.*

b) Scientific Council workload discussions

The Chair presented the meeting summary of the NAFO Informal Group to Reflect on the Workload of the Scientific Council, that took place on 22 April 2024, and highlighted some of the proposed options to assist in alleviating the workload of the Scientific Council.

Several options were included in the conclusions of that meeting:

-*The Commission, Scientific Council and STACFAD Chairs will develop a draft of a coversheet for new proposals that will be reviewed by the Scientific Council at its meeting in June 2024 and the WG-RBMS and WG-EAFFM at their meetings in August 2024.*

The draft coversheet for new proposals outlining things such as the additional work required by the Scientific Council to complete the request, and the resources that would be required and allocated to complete the work, was revised by the SC. SC noted that it is expected that SC time and resources would be required to complete the coversheet which would mean additional work from SC. SC noted that one useful piece from the coversheet is the requirement of resources commitments to address and support the requests. As a result, the Scientific Council **agrees** that a coversheet for new proposals would not help to alleviate the workload and **recommends** that *other proposed options should be reflected on further.*

-*The Scientific Council, at its meeting in June 2024, will have detailed discussions on the Scientific Council workplan (SCS Doc. 23/19). The Scientific Council should identify specific areas where work will not be able to be completed without additional support. Where additional support is needed, the Scientific Council should identify how that support can be provided (e.g. through external contracts) and include any proposed funding requirements in the 2025 budget proposal.*

Adjustment of the timeline of some issues (stock assessments, MSEs, VMEs reassessments…) could be done.

As a part of the workplan discussions, SC considered priorities for additional resources, should they be made available. It was noted that there are competing priorities within the SC – including, but not limited to, climate change considerations, MSE and assessment advancement, and data management – and that these do not necessarily align with the identified priority requests from the Commission. SC noted that a fulsome evaluation of long-term priorities, workload and process is needed to scope resource requirements. The use of an external contractor may be required to undertake this evaluation in an objective manner. SC will continue discussions on this evaluation to inform budgetary discussions for 2026-27.

To help address short-term workload, Scientific Council **requests** funding be made available to hire a dedicated analyst to contribute both to the Management Strategy Evaluation for 3LN redfish and other analytical work of the Scientific Council for one year. This process is a high priority for both the Commission and the SC. Funds have been requested in the draft budget for 2025.

-*With regards to increase scientific capacity within the NAFO Secretariat, continue discussions in Scientific Council on the specifics of potential contracts so that they can be included in the budget proposal and discussed by STACFAD at the 2024 Annual Meeting, or an additional staff member.*

Discussions will continue in this subject.

-*With regards recruitment and outreach, discussions on the Journal of Northwest Atlantic Fishery Science will continue at the June 2024 Scientific Council meeting.*

Discussions on raising the JNAFS profile took place in STACPUB (see Appendix II).

b) Deadlines for submission of documents and data for Scientific Council meetings

Scientific Council **recommends** that *the documents and data for Scientific Council meetings be uploaded to the Share Point in a time that permits the review of the documentation well in advance its presentation at the meetings.*

Scientific Council requests to DEs to present the full assessment no later than second Friday of the meeting.

Scientific Council reminded Contracting Parties that STATLANT 21A data are required to be sent before 01 May.

The Scientific Council additionally reflected on the presentation of the meetings documents during the meeting, with some members having difficulty locating documents on the SharePoint. Several options were discussed to address this issue. As a first step, the Scientific Council **agreed** that the Secretariat should post a link to the relevant document being discussed in the meeting chat to facilitate quick access to the documents being discussed.

c) FAO DSF Project – recent outputs

Tony Thompson updated the progress of the FAO Deep-Sea Fisheries (DSP) Project, that shared two recent outputs of interest to NAFO and the Scientific Council.

Firstly, a publication that draws on many aspects of NAFOs work: Thompson, A.B. and Reid, K. 2024. *Review of the implementation of the International Guidelines for the Management of Deep-sea Fisheries in the High Seas*. FAO Fisheries and Aquaculture Technical Paper, No. 703. Rome, FAO. https://doi.org/10.4060/cd0243en.

Secondly, an e-learning course suitable for managers and scientists who would like to know more about the management of deep-sea fisheries in the ABNJ https://elearning.fao.org/course/view.php?id=1117.

d) Merit Awards

Dawn Maddock Parsons

NAFO Scientific Council (SC) was pleased to present a merit award to Dawn Maddock Parsons (Canada) to acknowledge and celebrate the extensive contributions that she has made to SC over her extensive career. Dawn began her contributions in 1997 when attending one of the first meetings on the NAFO precautionary approach. Over the following years Dawn contributed to the stock assessments of 3LN redfish and was the Designated Expert (DE) of 3O redfish, 2J3KL witch flounder and more recently has been the DE for yellowtail flounder in NAFO Divisions 3LNO and witch flounder in NAFO Divisions 3NO. Dawn is well known by SC for her meticulous STACFIS reports and SC drafts which always pass in the first draft. Dawn is also known for providing sage advice and comments on the assessments of her colleagues. Dawn's absence at SC will be greatly noticed by all members of SC. SC wishes Dawn all the best in her future retirement.

Lisa Hendrickson

On behalf of Scientific Council, the Chair, Diana Gonzalez (EU-Spain), thanked Lisa Hendrickson (USA) for her long, outstanding career as part of the Scientific Council. Lisa began her career at NAFO in 1998 to work primarily on *Illex* squid. She became the Designated Expert for *Illex* in 2001. After a brief hiatus from NAFO during which Lisa continued to act as DE, Lisa returned and has been a champion for Splendid alfonsino, Greenland shark, and sea mounts and climate change research. Lisa has been a relentless supporter and promoter of the Journal of Northwest Atlantic Fishery Science (JNAFS) and long-standing Associate Editor. She is also a founding member of STACFEM. Lisa was presented with a certificate in recognition of her contributions and her sense of humor.

XII. ADOPTION OF COMMITTEE REPORTS

The Scientific Council, during the course of this meeting, reviewed the Standing Committee recommendations. Having considered each recommendation and also the text of the reports, the Scientific Council **adopted** the reports of STACFEN, STACREC, STACPUB and STACFIS. It was noted that some text insertions and modifications as discussed at this Scientific Council plenary will be incorporated later by the Scientific Council Chair and the Secretariat.

XIII. SCIENTIFIC COUNCIL RECOMMENDATIONS TO THE COMMISSION

The Scientific Council Chair undertook to address the recommendations from this meeting and to submit relevant ones to the Commission.

XIV. ADOPTION OF SCIENTIFIC COUNCIL REPORT

At its concluding session on 13 June 2024, the Scientific Council considered the draft report of this meeting, and adopted the report with the understanding that the Chair and the Secretariat will incorporate later the text insertions related to plenary sessions and other modifications as discussed at plenary.

XV. ADJOURNMENT

The Chair thanked the participants for their hard work and cooperation, noting particularly the efforts of the Designated Experts and the Standing Committee Chairs. The Chair thanked the Secretariat for their valuable support and Saint Mary's University for the excellent facilities. The meeting was adjourned at 12:05 on 13 June 2024.

APPENDIX I. REPORT OF THE STANDING COMMITTEE ON FISHERIES ENVIRONMENT (STACFEN)

Chair: Miguel Caetano Rapporteur: Miguel Caetano

The Committee met on the 31 of May and 01 of June 2024 to discuss environment-related topics and to report on various matters referred to it by the Scientific Council. All STACFEN members, including the Chair, participate by videoconference. Representatives attended from Canada, Denmark (in respect of the Faroe Islands and Greenland), European Union (Portugal, Spain and Estonia), Japan, the Russian Federation, Ukraine and the United States of America. The Executive Secretary and other members of the Secretariat were in attendance.

1. Opening

The Chair opened the meeting by welcoming participants to this June 2024 Meeting of STACFEN.

The Committee noted the following documents would be reviewed: SCR Doc. 24/006, 010, 011, 012, 014, 015, 030, 042.

2. Appointment of Rapporteur

Miguel Caetano (STACFEN chair) also acted as a rapporteur.

3. Adoption of the Agenda

The provisional agenda was adopted with no further modifications.

4. Review of Recommendations in 2023

STACFEN **recommended** *considering Secretariat support for an invited speaker to address emerging issues and concerns for the NAFO Convention Area during the 2024 STACFEN meeting. Contributions from invited speakers may generate new insights and discussions within the committee regarding integrating environmental information into the stock assessment process.*

STATUS: STACFEN invited two scientists specialized in ecotoxicology and ecological modelling. Prof. Miguel Santos, from the Faculty of Science, University of Porto, has developed his career in hazard assessment of endocrine disrupting chemicals and contaminants of emerging concern, with a particular focus on accidental marine spills. The presentation, entitled "Preparedness and response to accidental marine spills with a focus on environmental monitoring of oils and HNS", had a positive impact on the SC, promoting a broad discussion, particularly on issues related to the establishment of thresholds for each substance used in the modelling. Prof. Irene Martins heads the "Marine Ecosystem Modelling" team of the Interdisciplinary Centre for Marine and Environmental Research at the University of Porto. In recent years, her research has focused on developing ecological models to understand and predict the dynamics of marine ecosystems under stressors such as climate change and pollutants. The presentation, entitled "An integrated numerical framework for environmental risk assessment (ERA) in marine ecosystems affected by accidental spills", raised several questions to the SC, which had a positive impact and promoted a broad discussion, particularly on model variability. Other comments from the Scientific Council also point to the existence of a critical mass associated with the Contracting Parties on issues related to the impacts of oil and gas activities.

STACFEN **recommended** *the presentation of work linking the decadal variation of oceanographic-climate changes over the Convention Area.*

STATUS: STACFEN (Igor Yashayaev) presented a plenary presentation entitled "Oceanographic Conditions in the Labrador Sea in the Context of Seasonal, Interannual and Multidecadal Changes" (SCR Doc. 24/014) with clear information on the decadal variation of oceanographic-climate changes in the Labrador Sea (NAFO Subareas 0-3). Frederic Cyr (STACFEN) also presented a plenary talk on "Environmental Control on the Productivity of a Heavily Fished Ecosystem", highlighting the natural variability of climate change in the NW Atlantic, including the NAFO Regulatory Area, and its impact on several fish stocks.

STACFEN **recommended** that *further discussions occur between STACFEN and STACFIS members on environmental data integration into the various stock assessments.*

STATUS: Frederic Cyr of STACFEN made a presentation on the historical relationship between STACFIS and STACFEN, which included a very critical reflection on the status of STACFEN's participation in NAFO work, in particular on issues related to the June Scientific Council meeting. This reflection had the full support of the STACFEN Chair and members who were only able to participate virtually in the meeting and therefore had a limited participation in the June Scientific Council meeting. Although this constrictive STACFEN activity cannot be solved, further work with WG-ESA can be developed due to the scientific proximity of the topics and their interaction with STACFIS. Furthermore, the Commission requested additional work concerning the climate change effects on fisheries. In view of the additional work required from the Commission, the Scientific Council recalls that the participation in meetings is a responsibility of the Contracting Parties, which has become in phase opposite to the work required.

5. Inventory of environmental data in the NAFO convention area - Report 2023 SCR 24/015

The Marine Environmental Data Section (MEDS) of the Oceans Science Branch of Fisheries and Oceans Canada act as the Regional Environmental Data Center for NAFO. As part of this role, MEDS provides an annual inventory of environmental data collected in the NAFO Convention Area to the STACFEN, including inventories and maps of physical oceanographic observations such as ocean profiles, near surface thermosalinographs, drifting buoys, currents, waves, tides and water level measurements for the 2023 calendar year. Reporting includes data and information from NAFO member countries where these are provided to the data center.

In order for MEDS to carry out its responsibility of reporting to the Scientific Council, the Designated National Representatives selected by STACFEN are requested to provide MEDS with all marine environmental data collected in the Northwest Atlantic for the preceding years. The data of highest priority are those from the standard sections and stations, as described in NAFO SCR Doc. 88/001.

Data that have been formatted and archived at MEDS are available to all members on request and are available from DFO institutes. Requests can be made by e-mail to dfo.meds-sdmm.mpo@dfo-mpo.gc.ca, by completing an on-line order form on the MEDS web site at https://meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/program/index-eng.html or by writing to Oceans Science Branch, Fisheries and Oceans Canada, 12th Floor, 200 Kent St., Ottawa, Ont. Canada K1A 0E6. The following table summarizes data received by MEDS for the NAFO Convention Area (NCA) in 2023.

Data observed in NAFO Convention Area in 2023

Data Type	**Platform Type**	**Counts/Duration**
Oceanographic profiles	Autonomous drifting (Argo)	4965* profiles from 174 platforms
	Moorings (Viking)	776* profiles from 6 platforms**
	Gliders	13403* profiles from 9 platforms
	Marine mammals	1018* profiles from 5 animal tags
	Ship	8704 profiles (4599 CTD; 1347 CTD RT*; 2390 Bottle; 188 XBT; 180 XBT RT*)
Surface/near-surface observations	Ship (thermosalinograph)	70689 obs. from 11 ships
	Drifting buoys	282106* obs. from 122 buoys
	Moored buoys	601583* obs. from 21 buoys**
	Fixed platforms	100364* obs. from 3 platforms
	Water level gauges	35 sites, avg. ~1 year each

*Data formatted for real-time transmission on the GTS.

**All Canadian wave buoys indicated in this report measure waves, and the moorings measuring CTD oceanographic profiles are also equipped with surface buoys measuring waves.

Data observed prior to 2023 in NAFO Convention Area and acquired or processed between January 2023 and May 2024

Data Type	**Platform Type**	**Counts/Duration**
Oceanographic profiles	Ship	12376 profiles (9513 CTD + 2402 bottle + 461 XBT profiles) from 329 cruises

6. Plenary presentation by the invited scientist Miguel Alberto Fernandes Machado e Santos "Preparedness and response to accidental marine spills with a focus on environmental monitoring of oils and HNS"

The severity of a spill impact depends on several variables, such as the location of the spill, weather conditions, properties of oils or the hazardous substances transported, and ways such substances are packaged and stowed. They will also depend on the level of preparedness of responders. In this presentation, it was briefly addressed some of the major challenges in the field using as case studies the outcomes and recommendations of several international projects in the field.

7. Plenary presentation by the invited scientist Irene Isabel da Cruz Martins: "An integrated numerical framework for environmental risk assessment (ERA) in marine ecosystems affected by accidental spills"

This presentation highlights the use of a comprehensive approach, combining numerical tools and databases, for Environmental Risk Assessment (ERA) in marine ecosystems impacted by accidental spills. To demonstrate the potential of this framework, the fate and impacts of different hazardous and noxious substances (HNS) on two different Atlantic deep-sea ecosystems, one seamount and one deep-sea hydrothermal vent, were shown. Approaches like the current one are essential for enhancing preparedness and support spill response at Sea.

8. Plenary presentation by Frederic Cyr: "Environmental Control on the Productivity of a Heavily Fished Ecosystem"

Sustainable fisheries management requires an understanding of the links between environmental conditions and fish stock populations, especially in the context of climate change. From this perspective, identifying phases where ocean climate fluctuations and changes in ecosystem productivity coincide could provide a powerful tool to help inform fisheries management. Using more than 70 years of climate and fisheries data, this study shows that the Newfoundland and Labrador (NL) ecosystem productivity, from primary producers to piscivorous fish, changes in relative synchronicity with the climate of the northern hemisphere over decadal time scales. Such correspondence between the climate and lower and higher trophic levels has not been achieved previously in the Northwest Atlantic in the context of fisheries. This work advances ideas for incorporating environmental knowledge into fisheries management on the NL shelves, or in other regions facing similar dynamics

9. Highlights of Environmental Conditions in NAFO Subareas 0 to 4 for 2023 (SCR Doc. 24/012)

This document presents composite physical and biological indices in NAFO Subareas 0-4 in support of the Standing Committee on Fisheries Science (STACFIS). The information is organized in 4 sub-regions: Greenland and Davis Strait (NAFO Subareas 0 and 1), Flemish Cap (NAFO Division 3M), Grand Banks (NAFO Divisions 3LNO) and the Northwest Atlantic as a whole (NAFO Subareas 2, 3 and 4) for widely distributed stocks. When put in context with their long-term average, the large majority of ocean indicators were above normal in 2023, although the year was characterized by a relatively cold spring. The year 2023 was especially warm in NAFO Division 3M (Flemish Cap), where the index was at its warmest value since the time series started in 1985. The composite climate indices for subareas 2, 3 and 4 altogether was at its 5th warmest value, but four of the five warmest years all occurred in the last five years (including the record warm in 2021). The timing of the spring phytoplankton bloom was later than normal on average, likely due to the cooler temperatures observed on the Grand Bank and the Scotian Shelf (Subareas 3-4) in 2023. A decline in the abundance of copepod in Subareas 2 and 4 resulted in an overall lower-than-normal zooplankton biomass zooplankton biomass for the first time in nine years.

a) Ocean Climate and Ecosystem Indicators for Greenland and Davis Strait (NAFO Subareas 0 and 1)

The ocean climate index in Subareas 0-1 has been predominantly above or near normal since the early 2000s, except for 2015 and 2018 that were below normal. After being in 2021 at its highest value since the record high of 2010, the index was normal in 2022 and again above normal in 2023. Before the warm period of the last decade, cold conditions persisted between the mid-1980s and the mid-1990s.

Spring bloom peak production timing has been primarily near normal between 2003 and 2023, with earlier-than-normal (negative anomalies) and later-than-normal (positive anomalies) blooms alternating on a two to five-year time scale. Spring bloom intensity (average spring chlorophyll-*a* concentration) displayed a general increase from below normal to above normal between 2005 and 2015, before declining to near-normal where it has since remained. In 2023, mean timing of the spring bloom was near normal for a second consecutive after the record late bloom of 2020, while bloom intensity remained near normal for 7th consecutive year.

Recent Highlights in Ocean Climate and Lower Trophic Levels for Subareas 0-1

- **The ocean climate index in Subareas 0-1 above normal in 2023.**
- **Near-normal timing and intensity of the spring bloom in 2023.**

b) Ocean Climate and Ecosystem Indicators for Flemish Cap (NAFO Division 3M)

The ocean climate index in Division 3M has remained mostly positive between the late 1990s and 2013, and negative between 2014 and 2019, including in 2015 where it reached its lowest value since 1992. Since 2020, a warming phase has been emerging, with years 2023 and 2022 ranking respectively as the warmest and second warmest years since the time series started in 1985.

The timing of the spring bloom has been oscillating between earlier and later than normal with no clear variation pattern between 2003 and 2016. In 2017, the timing of the bloom was the latest of this time series, coinciding with very cold ocean conditions in the NW Atlantic that spring. After being mostly earlier than average between 2018 and 2021, the timing of the bloom was the second and third latest of this time series in 2022 and 2023, respectively. Spring bloom intensity exhibited a general decrease from 2005 to through the mid-2010s despite significant fluctuations on an annual to biannual timescale. Bloom intensity has remained primarily near to below normal since 2014 with the exception of the second highest intensity of the time series in 2018. In 2023, spring bloom timing was later than normal (3rd latest of the time series) for a second consecutive year while intensity was at the 3rd lowest level of the time series and at its lowest level since 2014.

Total copepod abundance rapidly increased between 1999 and 2010 and has remained near to above normal from 2005 through 2021 except for the low abundances recorded in 2014 and 2019. In 2023, copepod abundance remained below normal for a second consecutive year following the 2nd lowest level of the time series of 2022. The abundance of non-copepods showed a general increase from 1999 through 2020 with abundance transitioning from mainly near to below normal, to near to above normal in 2015. Non-copepod abundance was near-normal in 2023 after having declined to below normal in 2022 for the first time in 10 years. Similarly to copepod abundance, zooplankton biomass exhibited an overall increase from 1999 through the mid-2010s and a declined afterward. In 2023, zooplankton biomass was slightly below normal for the first time in six years.

Recent Highlights in Ocean Climate and Lower Trophic Levels for Division 3M

- **A warming climate phase has been emerging since 2020 in Division 3M. Years 2023 and 2022 ranked as the warmest and second warmest on record.**
- **The timing the phytoplankton spring bloom was the second and third latest of this timeseries in 2022 and 2023, respectively.**
- **Spring bloom intensity was lower than normal for the first time in nine years in 2023.**
- **Total copepod abundance was below normal in 2022 (second lowest value of the time series) and 2023.**

b) Ocean Climate and Ecosystem Indicators for Grand Bank (NAFO Divisions 3LNO)

The ocean climate index in Divisions 3LNO was well below normal (indicative of cold conditions) between the mid-1980s and the mid-1990s. Following this cold period, the index was mostly normal to above normal between the late 1990s and 2013 (with the exception of 2009 that was below normal), reaching a peak in 2011. The index returned to normal conditions between 2014 and 2017 (except for 2016 was normal). While years 2020 to 2022 were well above normal (including 2021 and 2020, respectively the warmest and second warmest years on record for this time series started in 1985), the index returned to normal values in 2023.

Spring bloom timing has been quite variable on the Grand Bank since 2003 despite a period of consistently earlier-than-normal blooms from 2009 through 2013. Some later-than-normal blooms were observed in 2015, 2017 and 2019 but bloom timing has remained near-normal since then. The lower-than-normal spring bloom intensity observed over the past three years were among the lowest of the time series, including a record-low level for 2022.

The abundance of both copepods and non-copepods exhibited a significant increase throughout the time series, transitioning from primarily below normal to primarily above normal around 2010. Abundance has remained above normal since 2016 for both groups (except for copepod in 2018), with the two highest levels observed in 2016 and 2021. Despite remaining slightly above-normal, the 2022 and 2023 abundances represented a considerable decline compared to 2021. Total zooplankton biomass generally declined from the early 2000s through 2014 but has increased to near or above normal afterward. In 2023, zooplankton biomass was near normal for the second consecutive year, which, similarly to copepod and non-copepod abundance, represented a decline compared to slightly above-normal level of 2021.

Recent Highlights in Ocean Climate and Lower Trophic Levels for Divisions 3LNO

- **In 2023, the ocean climate in NAFO Divisions 3LNO - Grand Bank was back to normal after being well above normal between 2020 and 2022.**
- **Spring bloom intensity was below normal for a third consecutive year in 2023 (including record low in 2022).**
- **The abundance of copepods and non-copepods has been mainly above normal since 2016.**

c) Ocean Climate and Ecosystem Indicators for Newfoundland and Labrador shelf, Scotian Shelf and Gulf of Maine (NAFO Subareas 2, 3 and 4)

The cumulative climate index for NAFO Subareas 2, 3 and 4 (from the Labrador Shelf to the Scotian Shelf) highlights the different climate phases undergone by the ecosystem since the mid-1980s. After a period below normal from the mid-1980s to the early 1990s, the index has remained relatively high since (all years since 1995 are normal or above normal). Since 2020, a warm phase has been emerging, which includes the three warmest years on record (respectively 2021, 2022 and 2020) and 2023 that ranks as the 5th warmest. This time series started in1950, although only shown here since 1985.

Mean timing of the spring phytoplankton bloom was variable across Subareas 2-3-4 with no clear temporal pattern. After being the earliest and second earliest of the time series in 2022 and 2021, respectively, the timing of the spring bloom was at its latest in 2023. Spring bloom intensity was variable during the 2000s, exhibited a gradual decline from near normal to a time series record low between 2011 and 2017, before increasing to above normal in 2018. Mean bloom intensity has remained near normal since 2019.

Total copepod abundance increased from 1999 to 2005, and declined afterward to slightly below normal level in 2012. The abundance of copepod was variable and primarily near normal throughout most of the 2010s, reached its two highest levels in 2020 and 2021, and declined to below normal in 2023. The abundance of non-copepods was near-to-below normal from 1999 to 2015 and above normal afterward except for the near-normal level of 2023. Trends in the abundance of copepods and non-copepods were mainly driven by subareas 2 and 3 with less variability for Subarea 4. Zooplankton biomass exhibited a general decline across Subareas 2-4 between 2002 and 2015, and has remained near normal since (except for the above-normal level of 2021) with generally higher biomass in Subareas 2 and 3 compared to Subarea 4.

Recent Highlights in Ocean Climate and Lower Trophic Levels for Subareas 2, 3 and 4

- **In 2023, the climate indices in Subareas 2, 3 and 4 were all above normal, making this year the 5th warmest on record. This continues a warming phase started in 2020 (years 2020-2022 were the three warmest on record).**
- **The timing of the spring phytoplankton bloom in 2023 was the latest observed in this time series, mostly because of the late bloom timings observed in Subareas 2 and 3.**
- **Mean copepod abundance was at its lowest since 2000 (third lowest of the time series).**
- **The abundance of non-copepods declined to near normal in 2023 after having remained above normal for seven consecutive years.**

10. Review of the physical, biological and chemical environment in the NAFO Convention Area during 2023

a) NAFO Subarea 1. Report on hydrographic conditions off West Greenland June 2023 (SCR Doc. 24/006).

Hydrographic conditions were monitored along 6 hydrographic standard sections in June 2023 across the continental shelf off West Greenland. Three offshore stations have been chosen to document changes in hydrographic conditions off the southern part of West Greenland. Salinity of the coastal and offshore waters showed the same trend with marked decrease. After a year with above its long-term mean salinity, the Subpolar Mode Water mass continued to freshen.

b) Subareas 1 and 2. 2023 Oceanographic Conditions in the Labrador Sea in the Context of Seasonal, Interannual and Multidecadal Changes (SCR Doc. 24/014).

In the Labrador Sea, the coldest and freshest North Atlantic basin south of the Greenland-Scotland Ridge, high winter surface heat losses result in the formation of a cold, fresh and dense water mass water mass, Labrador Sea Water, that sinks to the intermediate and deep layers and spreads across the ocean, contributing to the global ocean overturning circulation, and playing an important role in renewing and ventilating the deep ocean reservoir. This process – convective mixing – undergoes multi-year cycles of intensification (deepening) and relaxation (shoaling), which have been also shown to modulate long-term changes in the atmospheric gas uptake by the sea. The most recent convective cycle started in 2012, following two consecutive years of shallow winter mixing. Convection progressed deepening year by year until 2018, when it became the deepest for the entire 1996-2023 period. However, the highest winter cooling for the 1994-2023 period was in 2015, while the deepest convection occurred three years later. This time lag was due to the preconditioning of the water column by the 2012-2015 winter mixing events, making it susceptible to deep convection in three more years. The progressive deepening of winter convection from 2012 to 2018 (exceeding the depth of 2000 m in 2018) generated the largest, densest and deepest class of Labrador Sea Water since 1995. Convection weakened afterwards, rapidly shoaling by 800 m per year in the winters of 2021 and 2023 relative to 2020 and 2022, respectively. Distinct processes were responsible for these two convective shutdowns. In 2021, a collapse and an eastward shift of the stratospheric polar vortex, and a weakening and a southwestward shift of the Icelandic Low, resulted in extremely low surface cooling and convection depth. In 2023, by contrast, convective shutdown was caused by extensive upper layer freshening originated from extreme Arctic sea-ice melt due to Arctic Amplification of Global Warming.

In 2023, the central Labrador Sea experienced a near-normal cumulative surface heat loss, which was much higher than in 2021. The 2023 winter (Dec.-Mar.) North Atlantic Oscillation, Arctic Oscillation and Stratospheric Polar Vortex indices were also near-normal. However, in 2023, winter convection was 100 m shallower than in 2021, with below-normal winter cooling, and the shallowest since 2010, emphasising the prevailing role of freshening in control of winter convection in 2023.

With respect to temperature anomalies averaged annually over the central Labrador Sea, in the 2002-2023 period that was sufficiently covered with profiling Argo float measurements, the upper 100 m layer was the coldest in 2015 and 2018. Following 2018, this layer attained above-normal annual mean temperatures during 2019-2023, becoming the warmest for the 2011-2023 period in 2023. The intermediate, 200-2000 m, layer of the Labrador Sea started to cool immediately after reaching its warmest state for the 1972-2023 period in 2011. This persistent 2012-2018 cooling trend was imposed on the intermediate layer by the progressive deepening of winter convection over the same period. The situation changed in 2019, with the depth of winter convection eventually reducing to 800 m in 2021, and then to less than 700 m in 2023. As a result, the intermediate layer has been warming since 2019. The corresponding annual density decreases contributed to a negative 2018-2023 density trend. Between 2018 and 2023, the annual mean intermediate layer density reduced by more than 0.02 kg/m^3.

The freshening of the upper 100 m layer that occurred after 2017 reversed after reaching its peak in 2022. However, the 300-700 m layer continued to freshen in 2023, even showing the largest annual freshening rate ever recorded. As a result, this layer exhibited a persistent six-year, 2018-2023, freshening trend, attributed to the effect of Arctic freshwater discharge on the Labrador Sea. With respect to the intermediate, 200-2000 m, layer as a whole, the freshening trend also persisted through the same, 2018-2023, period. The reduction in the depth of winter convection in 2023 led to a decrease in the dissolved oxygen concentration below 600 m. Sea ice area from Davis Strait to southern Labrador Sea decreased between 2022 and 2023 to near-normal.

b) Optical, Chemical, and Biological Oceanographic Conditions in the Labrador Sea from summer 2019 and 2023 (SCR Doc. 24/042).

The chemistry and biology of the Labrador Sea and adjacent shelves have undergone significant changes over the 2019–2023 period compared to previous years. The Atlantic Zonal Off-shelf Monitoring Program (AZOMP) revealed an increase in dissolved inorganic carbon and a decrease in pH, a trend that extends back to the beginning of the monitoring program in the mid-1990's. While the mean concentration of chlorofluorocarbon (CFC-12) over the water column has remained stable, the concentration of sulfur hexafluoride (SF_6) has been increasing steadily since we began to measure it in 2011, reflecting the atmospheric history of these gases. The mean temperature of the top layer (0–100 m) has been mainly below normal since 2011, except for the Hamilton Bank where two warmer-than-normal years were observed in 2015 and 2018, and in the Central Labrador Sea when mean temperature was above normal in 2012. In 2019, the entire Labrador Sea temperature was above normal with a record-high mean temperature in the Central Labrador Sea, while mean temperature was below normal in 2022. The shelves mean temperature were close to normal in 2023 and the Central Labrador Sea temperature was above-normal. In the 2019-2023 period, both surface and deep nutrients levels were below normal except for the Greenland Shelf in 2022 and surface silicate in 2023, however, the timing of the mission with respect to the spring phytoplankton bloom development may impacts the nutrient budget. In fact, the timing of the mission before 2019 occurred earlier each year compared to the previous year due to the constraints of crew change, and consistent dates in sea-going expeditions are needed to remove uncertainties related to sampling time. Deep nutrients exhibited inter-annual and regional variations until 2018. In recent years (2019-2023), deep-nutrients have remained below average in all three regions of interest, suggesting a profound change in the biogeochemistry of the Labrador Sea.

While integrated chlorophyll-*a* levels were below normal in 2019, continuing a trend that started in 2014, except in 2015 in the Central Labrador Sea, values in 2022 and 2023 were above average, with a record-high integrated chlorophyll-*a* value in 2022 on the Hamilton Bank. An unusually large bloom of *Phaeocystis* sp., that covered a large extent of the Labrador Sea, occurred in 2022 and explains the high values. This is the second largest *Phaeocystis* sp. bloom event in the Labrador Sea after 2015. Satellite-derived chlorophyll-*a* concentration reveals the large variability in the peak timing of the spring bloom and in the fall bloom initiation. While the mean annual satellite-derived chlorophyll-*a* on Hamilton Bank was mainly above-normal, values were below-normal between 2019-2021 on the Greenland Shelf and Central Labrador Sea, and above normal in 2022-2023. Unfortunately, the late (2020) or lack of (2021) in situ data collection due to the COVID pandemic and the lack of ship availability, respectively, did not allow inclusion of these two years in the current report with the exception of satellite ocean color metrics, such that recent in situ trends need to be interpreted with caution.

c) Subareas 2, 3 and 4. Environmental and Physical Oceanographic Conditions on the Eastern Canadian shelves (NAFO Subareas 2, 3 and 4) during 2023 (SCR Doc. 24/010)

Oceanographic and meteorological observations in NAFO Subareas 2, 3 and 4 during 2023 are presented and referenced to their long-term averages. The winter North Atlantic Oscillation (NAO) index, a key indicator of the direction and intensity of the winter wind field patterns over the Northwest (NW) Atlantic, was near neutral (+0.2) in 2023. Since 2014, all years except 2021 were positive (normally indicative of colder conditions). The vast majority of parameters and indices presented in this report ranged from normal to warmer than normal in 2023 (normal being defined as the average over the 1991–2020 climatological period). The air temperatures across the NW Atlantic were above normal in 2023 at all sites reported except St. John's. The sea-ice season volume and area across the Newfoundland and Labrador shelf were about normal (-0.5 SD) for a second year in a row. Sea surface temperatures averaged over the ice-free months were at their second warmest level since the 1980s. The last three years were the warmest years recorded, including the record warm in 2022. The transport on the Scotian Slope was above normal for the first time in a decade (+1.4 SD), potentially contributing to a return the normal conditions observed in many areas of the Scotian Shelf after a record warm year in 2022.

d) Subareas 2, 3 and 4. Biogeochemical oceanographic conditions in the Northwest Atlantic (NAFO Subareas 2-3-4) during 2023 (SCR Doc. 24/011).

This report reviews the spatial and temporal variability in biogeochemical indices derived from satellite observations (spring and fall bloom timing and intensity) and in situ measurements of oceanographic variables (nitrate and chlorophyll-*a* concentration, and zooplankton abundance and biomass) across NAFO Subareas 2, 3 and 4 with an emphasis on the year 2023. Nitrate inventories on the Grand Bank and in Southern Newfoundland decreased to near-normal levels in 2023 but remained unchanged elsewhere compared to the previous year. Chlorophyll-*a* inventories were variable across the zone without any strong departure from the climatological mean. Spring and fall bloom timing was later and earlier than normal, respectively, on the Scotian Shelf and the Georges Bank, while bloom intensity reached record-high levels in the Gulf of St. Lawrence in both spring and fall. Zooplankton biomass and copepod abundance were mainly near to below normal across the zone for the second consecutive year. For regions from the Grand Bank to the north, this represents a decline compared to the near to above-normal levels observed during the 2016-2021 period. The abundance of large *Calanus finmarchicus* copepods was near to above normal with no negative anomalies in any of the regions for the first time in twelve years. The abundance of smaller, but more abundant, *Pseudocalanus* spp. copepods remained high on the Grand Bank and Newfoundland Shelf, where above-normal levels have been recorded almost consistently since 2013. The abundance of non-copepod zooplankton was primarily above normal from the Grand Bank to the north, and near normal from the Scotian Shelf to the south, continuing a trend that started around the mid-2010s.

e) Hydrographic Conditions on the Northeast United States Continental Shelf in 2023 – NAFO Subareas 5 and 6 (SCR Doc. 24/030).

An overview is presented of the atmospheric and oceanographic conditions on the Northeast U.S. Continental Shelf during 2023. The analysis utilizes hydrographic observations collected by the operational oceanography programs of the Northeast Fisheries Science Center (NEFSC), which represents the most comprehensive consistently sampled ongoing environmental record within the region. On average, waters on the Northeast U.S. Continental Shelf were anomalously fresh and slightly warmer in 2023 relative to the 1991-2020 climatological mean condition. Notable cold and fresh anomalies were observed in the northern Middle Atlantic Bight and Gulf of Maine during fall, likely caused by advection of water from the north. Cold and fresh anomalies dominated the properties in the deep Northeast Channel, reflective of a shift in the composition of source water entering the Gulf of Maine. In the western Gulf of Maine during spring, the entire water column was warmer and fresher than normal, including the Cold Intermediate Layer.

11. The Formulation of Recommendations Based on Environmental Conditions

STACFEN **recommends** *considering Secretariat support for an invited speaker to address emerging issues and concerns (Climate changes impact on fish stocks) for the NAFO Convention Area during the 2025 STACFEN meeting. Contributions from invited speakers may generate new insights and discussions within the committee regarding integrating environmental information into the stock assessment process.*

STACFEN **recommends** that *consideration be given to the participation of members in the NAFO/ICES/FAO symposium on "Applying the ecosystem approach to fisheries management in ABNJ" to be held 11-13 March 2025 in Rome. The integration of environmental information into stock assessment is one of the important issues to be discussed at the symposium and is a topic for discussion in the NAFO Scientific Council.*

STACFEN **recommends** that *consideration be given to convening a meeting with STACFIS and WG-ESA members to evaluate the options and design an approach to integrate climate change considerations throughout Scientific Council operation.*

12. National Representatives

The National Representatives for hydrographic data submissions was updated by the Secretariat: E. Valdes (Cuba), Erin Turnbull (Canada), **Vacant** (Denmark), **Vacant** (France), **Vacant** (Germany), **Vacant** (Japan), H. Sagen (Norway), **Vacant** (Portugal), **Vacant** (Russian Federation), E. Tel (Spain), L. J. Rickards (United Kingdom) and P. Fratantoni (USA).

13. Other Matters

a) Work planning for Commission request #10 "Addressing the Impacts of Climate Change on NAFO Fisheries and Ecosystems".

The SC has benefited from working with FAO to develop a comprehensive work to address the Commission's request #10 through a consultative process. The NAFO SC established a ToR to guide the establishment of the Consultation, which included the following points:

1) Summarize the current state of knowledge on climate change projections for the Northwest Atlantic for the next 10-50 years, with emphasis on comparisons across models (e.g. type of model, resolution, level of downscaling), how the projected changes (e.g. temperature levels, heat waves, frequency of extreme events, and including their level of uncertainty) may differ for different scenarios, and what are the recommended applications/standards for the use of these scenarios for ecological analyses in fisheries and marine ecology (i.e. current best practice);

2) Review the state of knowledge of the potential impacts of climate change on Northwest Atlantic fish stocks and ecosystems, discriminating the degree to which direct and indirect effects have been considered/addressed. To the extent possible, compare and rank these potential impacts in terms of a) their likely magnitude, b) their time of emergence (i.e. when they could be expected to manifest), and c) dependency of climate change scenario (i.e. how their potential impact/ranking depends on a specific scenario); and

3) Review the state of knowledge on proposed approaches to incorporate climate change in stock-assessment and ecosystem-based fisheries management, with emphasis in Northwest Atlantic stocks and ecosystems.

Based on the results of 1) and 2), identify and rank the likely critical data and process gaps that would need to be addressed to implement these approaches for NAFO stocks and ecosystems. The FAO contracted scientist, Daniel Boyce of Dalhousie University, Canada, was selected to develop this work in close collaboration with an SC steering committee. The work presented to the SC was entitled "Addressing the impacts of climate variability and change on NAFO fisheries" and responds to SCR 24/009.

The main objective was to increase knowledge and awareness of the impacts of climate change on fisheries and ecosystems within the NAFO Convention Area, and to provide guidance on adaptation and mitigation measures for climate-resilient fisheries. The main methodology used was a comprehensive literature review, supplemented by analyses of projected climate change and its ecological impacts across the NAFO Convention Area. This report was the base for the response to Commission Request #10 (in this report, under "Special Requests for Management Advice", section xii).

14. Adjournment

The Chair thanked STACFEN members for their excellent contributions and the Secretariat for their support and contributions.

The meeting was adjourned at 10:30 on 12 June 2024.

APPENDIX II. REPORT OF THE STANDING COMMITTEE ON PUBLICATIONS (STACPUB)

Chair: Rick Rideout Rapporteur: NAFO Secretariat

The Committee met at Saint Mary's University, 903 Robie St. Halifax, NS, on 05 June 2024 at 2:30 p.m., to consider publications and communications related topics and report on various matters referred to it by the Scientific Council. Representatives attended from Canada, Denmark (in respect of Faroe Islands and Greenland), European Union (Portugal, Spain, Estonia), Japan, Russian Federation, Ukraine, United Kingdom and the United States of America.

1. Opening

The Chair opened the meeting by welcoming the participants.

2. Appointment of Rapporteur

The NAFO Secretariat was appointed rapporteur.

3. Adoption of Agenda

The agenda was presented and adopted at the beginning of the meeting.

4. Update on NAFO Publications

The NAFO Scientific Council Reports (Redbook) volume 45 for 2023 was published online in May 2024, and ten copies were printed. There were no NAFO Scientific Council Studies submissions received in 2023, and STACPUB encouraged participants to make use of the Scientific Council Studies platform. The reports of the NAFO joint Commission-Scientific Council meetings are found in the Meeting Proceedings for September 2022-August 2023, which was published online in November 2023, and three copies were printed. The Secretariat reported that all NAFO published documents for 2023 have been submitted to ASFA (Aquatic Science & Fisheries Abstracts) as of May 2023.

5. JNAFS Profile

The NAFO Secretariat updated that volume 54, Regular issue of the journal, was published online December 2023, containing three articles. There were six submissions in total for 2023. Volume 55 has two articles in review with the authors.

The STACPUB Chair noted that the current role of the General Editor is being covered by two members of the NAFO Secretariat while the Scientific Council Coordinator position is vacant. The Executive Secretary noted that the role of general editor for the journal was included as a point in the vacancy announcement and the new Scientific Council Coordinator will be expected to continue in the General Editor role. The current associate editors for the journal are: M. Caetano, L. Hendrickson, D. Kulka, J. Morgan, A. Pérez Rodríguez, P. Regular and R. Rideout.

The Chair updated STACPUB about a subgroup meeting that took place in November of 2023 to discuss ways to further promote the journal, with the end goal of increasing the number of papers submitted to the journal. The subgroup discussed four primary tactics: 1) make an application to get JNAFS into Web of Science, 2) modernize the JNAFS website to improve the digital experience of authors considering a submission to the journal, 3) support science symposia and publish the proceedings of those symposia, and 4) produce and distribute promotional materials (posters, post cards, etc.) that can be circulated to science institutes and at science conferences/meetings. A second subgroup meeting that was supposed to take place prior to the June Scientific Council meeting had to be cancelled due to scheduling conflicts. However, an update on the four strategies was provided to and discussed by STACPUB. The following updates were discussed: 1) The JNAFS submission to Web of Science (WoS) was not successful. The Secretariat is exploring the WoS response, but it is expected that criteria will not be met in the short term. In the meantime, efforts will continue on other fronts to promote the journal. 2) Work is underway to consider options (including costs, html control, etc.) for improving/hosting the JNAFS website. 3) NAFO is co-sponsoring the symposium on EAFM in Rome in 2025, along with FAO and ICES, and the manuscripts from this symposium will be published in JNAFS in 2026. 4) The Secretariat has produced promotional posters and pamphlets that were made available to STACPUB members for any upcoming meetings that it would be appropriate to promote JNAFS. The journal subgroup will meet again to continue the discussions.

6. NAFO/SC Publication Policies

a) Publication of Working Papers

At the 2023 STACPUB meeting, there was a recommendation to make Scientific Council working papers from previous years available to Scientific Council members and participants of Scientific Council meetings. The Secretariat completed this work but noted that the working paper archive had not been made live as there were some concerns about having previous drafts available for documents that have since become final. STACPUB agreed that having the working papers available would ensure there was no loss of institutional knowledge in the Scientific Council. It was agreed that the archive on the Scientific Council Meetings SharePoint site could be made live. STACPUB thanked the Secretariat for their efforts in the creation of the archive.

b) SCR Reference

The STACPUB Chair raised a question about the reference on the top of the SCR documents that states "NOT TO BE CITED WITHOUT PRIOR REFERENCE TO THE AUTHOR(S)" and if this statement was still necessary. STACPUB, reflecting on the statement and noted that the SCR publication policy was reviewed in 2010 and there was a decision to maintain the statement. After further discussion, STACPUB agreed that this statement was difficult to interpret and no longer relevant/needed on SCR documents going forward. Since SCR documents are readily available online via the public NAFO website, no citation permissions are required. Instead, it was suggested to insert the proper citation in the documents to ensure that the authors are being cited rather than NAFO.

STACPUB **recommends** *removing the note from the SCR documents that states: "NOT TO BE CITED WITHOUT PRIOR REFERENCE TO THE AUTHOR(S)", starting in 2025.*

STACPUB **recommends** *including a citation in SCR documents, starting in 2025, beneath the address field as follows:* AUTHOR LAST NAME, FIRST INITIAL. YEAR. Document title. *Scientific Council Research Document,* SCR Doc. 24/XX: pp-pp.

7. NAFO logo

It was noted that a new NAFO logo was adopted at the 2023 Annual Meeting. In the interim, the Secretariat has been working to rebrand all documents, posters, the website, and other information materials to align with the new logo. It is expected that the logo will be fully launched at the September 2024 Annual Meeting.

8. Revisions to NAFO Website

The Secretariat updated STACPUB that it is in the process of making updates to some of the content on the NAFO website, and outdated information had been removed. Some of the webpages that were removed included information on the previous precautionary approach framework and the ecosystem approach, as they had not been updated since 2014. STACPUB reflected on the importance of this work in NAFO, and agreed that it should be reflected on the NAFO website. Several options were discussed on how the pages could be updated. The suggestions for potential options included full pages with information that would have to be reviewed by Scientific Council, pages with links to the latest work, and/or the creation of a small Scientific Council working group to assist the NAFO Secretariat in the development of the pages. The Secretariat noted that they will work towards getting the latest information back on the website and keep Scientific Council informed on the progress and request assistance as required.

9. Other Matters

No other matters were discussed.

10. Adjournment

The Chair thanked the participants for their valuable contributions and the Secretariat for their support.

APPENDIX III. REPORT OF THE STANDING COMMITTEE ON RESEARCH COORDINATION (STACREC)

Chair: Mark Simpson Rapporteur: NAFO Secretariat

1. Opening

The Committee met on two occasions. First a virtual meeting was conducted on May 9th, during which information on biological surveys carried out in 2023 in the NAFO Regulatory Area were presented, availability of catch data was reviewed and future surveys for 2024 were discussed. Secondly the committee met on various occasions throughout the June Scientific Council meeting at the Atrium Building, Saint Mary's University to discuss matters pertaining to statistics and research referred to it by the Scientific Council. Representatives attended from Canada, Denmark (in respect of the Faroe Islands and Greenland), European Union, Japan, Russian Federation, Ukraine, United Kingdom and United States of America.

2. Appointment of Rapporteur

The meetings were preceded by the Appointment of a Rapporteur. The NAFO Secretariat (Dayna Bell MacCallum and Jana Aker) were appointed as rapporteurs for these meetings.

3. Review of previous recommendations from 2023 and new recommendations from 2024

a) Recommendations about surveys coverage

In 2015, STACREC **recommended** that *an analysis of sampling rates be conducted to evaluate the impact on the precision of survey estimates*. As a separate aspect, in September 2017 STACREC discussed *possibilities for combining multiple surveys in different areas and at different times of the year to produce aggregate indices*. In 2018, SC agreed at the September meeting that this constitutes a relevant topic for a special session, but in the future due to other commitments. In September 2019 it was agreed that a speaker on this general topic would be invited to the June 2020 SC meeting, and the STACREC chair will take the lead in arranging this invitation. However, due to the pandemic, it was not possible to have an invited speaker in June. Though, a Canadian scientist attended the ICES WKUSER (Workshop on Unavoidable Survey Effort Reduction) in January 2020 and presented information on survey coverage issues. Feedback from this meeting was presented to STACREC in May 2021. A follow-up WKUSER was held in September 2022. The same Canadian scientist attended the meeting and presented the results during the June 2023 STACREC meeting. The conclusion was that by implementing the recommendations from the workshop, scientists and survey managers can make informed decisions and maintain the integrity of survey time series data.

In June 2022, STACREC **recommended** to *explore in the future the spatio-temporal models used during the Joint ICES/NAFO shrimp benchmark in January 2022 to handle gaps in the surveys.* This recommendation is deferred.

Linked with this, in June 2019 and June 2020 STACREC **recommended** *specific actions for future years whenever survey coverage issues arise.* These actions can be found in the 2020 STACREC report which was tabled in September in NAFO SCS Doc. 20-19.

b) Recommendations about redfish

Most of the surveys conducted (except for the EU-3M survey in recent years) record redfish without separating by species and STACREC **recommended** in 2018 that *all surveys should aim to examine redfish composition at the species level, while recognizing that this may not always be achievable due to trade-offs between different activities and aims of surveys.*

STACREC continues to discuss this recommendation. There are difficulties to achieve this task that were noted in 2018 (such as the lack of an agreed methodology for species identification that all surveys would use in a consistent manner and lack of time and resources in some surveys to take on additional tasks). It was **agreed** that, as a first step, an attempt could be made at separating golden (*S. norvegicus*) from beaked (*S. mentella* and *S. fasciatus*) redfish for fish above a certain length, as this seems a relatively easy task.

Canada is carrying out a series of studies for separating redfish catch, and preliminary results are aimed to be presented during September 2024.

A preliminary compilation of information on the stock structure of redfish in Division 3O in relation to adjoining redfish stocks (Units 2, 3Ps and 3LN) was presented in the June 2019 SC meeting. It was concluded that the initial basis for delineating stock structure was weak. STACREC ***recommends*** *a comprehensive study to investigate redfish stock structure in NAFO Divisions 2 and 3, with consideration of species splitting and recent approaches to studying redfish stock structure in other RFMOs.*

Canada is carrying out genetic studies across Subareas 2 and 3, and preliminary results were expected to be presented during the June 2024 SC meeting, however the Canadian lead on this project (Dr. Ian Bradbury) declined to present at this time due to delays in the analysis. This presentation is deferred until a future time.

c) Recommendations about reviewers

During the June 2023 meeting it was recommended that an expert reviewer on data limited stocks attend the June 2024 meeting. An invitation was not made for the June 2024 meeting given the ongoing workloads related to the two MSE processes, the PA renewal, comparative fishing and climate change requests, however discussion on clarification of the type of invitation were held. Given that Scientific Council has a number of stocks that are assessed using survey indices it was resolved that an invitation should be made to an expert in providing advice based on survey indices such as those used by ICES (WKLIFE), or similar expertise from another RFMO. The seminar could focus on the provision of advice or other survey-based management issues such as provision of proxy limit reference points that are relevant to the NAFO Precautionary Approach. The STACREC chair will take the lead in arranging this invitation.

4. Fishery Statistics

a) Progress report on Secretariat activities in 2023/2024

i) Presentation of catch estimates from the CESAG, daily catch reports and STATLANT 21A and 21B

The NAFO Secretariat presented the catch estimates developed by CESAG and made the supplementary data that went into the analyses available for the Scientific Council to review. The Secretariat noted that the catches were estimated based on the strategy outlined in Annex 1 of COM-SC Doc. 17-08, amended following a recommendation from STACFIS in 2018, to include catch estimates of broken down by quarter and gear type.

In accordance with Rule 4.4 of the Rules of Procedure of the Scientific Council, as amended by Scientific Council in June 2006, the deadline dates for this year’s submission of STATLANT 21A data and 21B data for the preceding year are 1 May and 31 August, respectively. The Secretariat produced a compilation of the countries that have submitted to STATLANT and made this available to the meeting.

Due to legal issue regarding the confidentiality of data provided to the European Commission by Member States, some member States of the EU were not able to provide STATLANT 21A data in time for the June 2024 Scientific Council meeting. Canada also did not meet the requirements for data submission with only one of five regions submitting the required data in a timely fashion.

Table 1. Dates of receipt of STATLANT 21A reports for 2021-2023 and 21B reports for 2020-2022 received prior to 01 June 2024.

Country/ component	**STATLANT 21A (deadline, 1 May)**			**STATLANT 21B (deadline, 31 August)**		
	2021	**2022**	**2023**	**2020**	**2021**	**2022**
CAN-CA	14 Jul 22	28 May 24	28 May 24			
CAN-SF	6 Jun 22	24 Apr 23	03 May 24			
CAN-G	27 May 22	26 Apr 23	10 May 24		6 Sep 22	28 Aug 23
CAN-NL	26 May 22	28 Apr 23	30 Apr 24	31 Aug 21		
CAN-Q						
CUB						
E/BUL						
E/EST	28 Apr 22	21 Apr 23	29 Apr 24	23 Aug 21	26 Aug 22	
E/DNK	30 Mar 22	9 Jun 23	30 Apr 24	21 Jul 21	15 Aug 22	
E/FRA						
E/DEU	7 Apr 22	9 Jun 23	30 Apr 24	30 Aug 21	25 Aug 22	
E/LVA	21 Apr 22	5 Apr 23	30 Apr 24			
E/LTU	31 May 22	9 Jun 23	23 Apr 24	3 Jul 21		
EU/POL	24 Jun 22					
E/PRT	19 Apr 22			28 Aug 21	30 Sep 22	
E/ESP	14 Jun 22	9 Jun 23	24 Apr 24	7 Jun 21	15 Jun 22	
GBR						
FRO	6 Apr 22	5 Jun 23	30 Apr 24	12 Jan 21	6 Apr 22	07 Jun 23
GRL	6 May 22	1 May 23	01 May 24	30 Aug 21	25 Aug 22	22 Aug 23
ISL						
JPN	27 Apr 22	28 Apr 23	24 Apr 24	24 Aug 21	30 Aug 22	30 Aug 23
KOR						
NOR	22 Apr 22	9 Jun 23	29 May 24	1 Sep 21	2 Sep 22	
RUS	27 Apr 22	28 Apr 23	23 Apr 24	30 Aug 21	25 Aug 22	8 Sep 23
USA	25 May 22 updated: 7 May 24	31 May 23 updated: 7 May 24	7 May 24			
FRA-SP	26 Apr 22	27 Apr 23	26 Apr 24		25 Aug 22	
UKR						

5. Research Activities

a) Biological Sampling

i) Report on activities in 2023/2024

STACREC reviewed the list of Biological Sampling Data for 2023 prepared by the Secretariat and noted that any updates will be inserted during the summer. The SCS Document will be finalized for the September 2024 Meeting.

ii) Report by National Representatives on commercial sampling conducted

Canada-Newfoundland (SCS Doc. 24/09):

Information was obtained from the various fisheries taking place in all areas from Subareas 0, 2, 3 and portions of Subarea 4. Information was included on fisheries for the following stocks/species: American plaice (SA 2 + Division 3K, Div. 3LNO, Subdiv. 3Ps), Atlantic cod (Div. 2GH, Div. 2J3KL, Div. 3NO, Subdiv. 3Ps), Atlantic salmon (SA 2, SA 3, SA4), capelin (SA 2 + Div. 3KL, Div. 3NO), Greenland halibut (SA 2 + Div. 3KLMNO), haddock (Div. 3LNO, Subdiv. 3Ps), Iceland scallop (Div. 2HJ, Div. 3LNO, Subdiv. 3Ps, Div. 4R), American lobster (Div. 3K, Div. 3L, Div. 3Pn, Div. 3Ps, Div. 4R), pollock (Div. 3LNO, Subdiv. 3Ps), Northern shrimp (SA 2 + Div. 3K, Div. 3LNO), redfish (SA 2 + Div. 3K, Div. 3LN, Div. 3O, Div. 3P4VW), sea scallop (Div. 3KLNO, Subdiv. 3Ps, Div. 4R), snow crab (Div. 2HJ, Div. 3KLNO, Subdiv. 3Ps, Div. 4R), squid (SA 2+3), thorny skate (Div. 3LNO, Subdiv 3Ps) and white hake (Div. 3NO, Subdiv. 3Ps). Additionally, a summary of recent stock assessments and research projects for several of marine species are included in this report.

Denmark/Faroe Islands (SCS 24/10):

The Faroese fishery targets mainly cod in Subarea 3, with other species, such as Greenland halibut and redfish, being caught to a lesser extent. A total of 1 628.5 t of cod was recorded in 2023. The fishery is conducted exclusively by longliners since 2017. Biological samples of cod are collected since 2014 (length and weight measurements). The Faroese quota of cod in 3M is 22.35% of the total.

Denmark/Greenland (SCS 24/014):

Data on catch rates from STATLANT were obtained from trawl, gillnet and longline fisheries in NAFO Div. 1A-F for Atlantic halibut, Atlantic cod, Atlantic wolffish, black dogfish, capelin, Greenland cod, Greenland halibut, roundnose grenadier, redfish, Greenland shark, northern prawn, northern rays, northern wolffish, spotted wolfish, tusk and wolffish. Length frequencies from Greenland were available for Greenland halibut from trawl offshore fishery in 1AB and 1CD, longline fishery in 1A, 1D, and 1F inshore, gillnet fishery in 1A inshore, and pound net inshore in 1A; for cod from the trawl inshore fishery in 1A and 1D, the gillnet fishery 1D inshore, with fishing rods in 1D inshore, and from pound nets in 1D inshore; for roundnose grenadier with the offshore trawl in 1A. In total 250 length samples were taken, and 4 895 987 individuals of Greenland halibut and cod were measured, from commercial samples in NAFO Div. 1A-F. A total of 2 710 otoliths in Div. 1A, 1C, 1D, 1E and 1F from cod, redfish and Greenland halibut were collected.

EU-Germany (NAFO SCS Doc. 24/15):

No biological sampling was conducted in commercial fisheries in 2023.

EU-Portugal (NAFO SCS Doc. 24/11):

Data on catch rates were obtained from trawl catches for: redfish (Div. 3LMNO), Greenland halibut (Div. 3LMN), silver hake (3NO), thorny skate (3O), roughhead grenadier (3L) and cod (Div. 3M). Data on length composition of the catch were obtained for redfish (S. *mentella*) (3LMNO), redfish (S. *marinus*) (3LM), American plaice (3MNO), Greenland halibut (3LM), cod (3M), roughhead grenadier (3L), silver hake (3NO), witch flounder (3O), white hake (3O) and thorny skate (3MNO).

EU-Spain (NAFO SCS Doc. 24/08):

A total of 8 Spanish trawlers operated in Divs. 3LMNO NAFO Regulatory Area (NRA) during 2023, amounting to 1 270 days (19 651 hours) of fishing effort. Total catches for all species combined in Divisions 3LMNO were 16 929 tons.

In addition to NAFO observers (NAFO Observers Program), eight IEO scientific observer was onboard Spanish vessels during 2023, comprising a total of 357 observed fishing days, around 28% coverage of the total Spanish effort. Besides recording catches, discards and effort, these observers carried out biological sampling of the main species taken in the catch. For Greenland halibut, roughhead grenadier, American plaice and cod this includes recording weight at length, sex-ratio, maturity stages, performing stomach contents analyses and collecting material for reproductive studies. Otoliths of these four species were also taken for age determination. In 2023, 511 length samples were taken, with 68 632 individuals of different species examined to obtain the length distributions.

During 2023 there was no fishing activity of the Spanish fleet in NAFO Division 6G.

Japan (NAFO SCS Doc. 24/07):

Since 2016, one Japanese otter trawler operated in Divisions 3L and 3M. The total catch including discards was 1 214 tons in 2023. The main target species and stock area in 2023 was Greenland halibut (1 151 tons) in Divisions 3LM. Following a recommendation from the 2023 September Scientific Council meeting, aggregated total catch length distributions for five stocks were calculated by Division based on the designated protocol. The aggregated total catch length distributions of Subarea 2+3KLMNO GHL in Division 3L formed unimodal in each year. The mean total length gradually decreased from 50 to 46cm during 2016-2021, but gradually increased from 46 to 48cm during 2021-2023.

Russia (NAFO SCS Doc. 24/06):

Catch rates were available from Greenland halibut (Divs. 3LM, with bycatch statistics), Atlantic cod (Divs. 3M with bycatch statistics, 3LNO), redfish (Divs. 3LN, 3M, 3O, with bycatch statistics), yellowtail flounder (Div. 3N), skates (Div. 3LMNO), American plaice (Divs. 3LMNO), witch flounder (Divs. 3NO), roughhead grenadier (Divs. 3LN), roundnose grenadier (Div. 3LM), white hake (Div. 3O), Atlantic halibut (3LMNO).

Length frequencies were obtained from Greenland halibut (Divs. 3LM), redfish (Divs. 3LMNO), Atlantic cod (Divs. 3LMNO), roughhead grenadier (Divs. 3LMN), roundnose grenadier (Divs. 3LM), blue wolffish (Divs. 3LMN), spotted wolffish (Divs. 3LMN), Atlantic wolffish (Divs. 3LMNO), Atlantic halibut (Divs. 3LMNO), yellowtail flounder (Divs. 3NO), witch flounder (Divs. 3LMNO), American plaice (Divs. 3LMNO), blue antimora (*Antimora rostrata*) in Divs. 3LM, black dogfish (*Centroscyllium fabricii*) in Divs. 3LMN, white hake in Divs. 3LMNO, starry skate (*Raja radiata*) in Divs. 3LMNO, spinytail skate (*Raja spinicauda*) in Divs. 3LMNO, Nezumia (*Nezumia bairdii*) in Divs. 3LMN, greater eelpout (*Lycodes esmarkii*) in Divs. 3LN. Age-length distribution for Greenland halibut in Divs. 3LMN and redfish in Divs. 3LN, as well as statistics on marine mammal occurrences and VME indicator species catches, are also available.

USA (SCS Doc. 24/12):

The report described catches and survey indices of 32 stocks of groundfish and elasmobranchs. Research on the environment, plankton, finfishes, marine mammals and apex predators were described. Descriptions of cooperative research included a longline survey in the Gulf of Maine and Shark tagging. Other studies included age and growth, food habits and tagging studies. A description of the Population Dynamics Branch assessment review process was given. A new section on survey technology was added and described the development of the use of an unscrewed underwater vehicle to supplement the sea scallop camera work.

iii) Report on data availability for stock assessments (by Designated Experts)

It was noted that designated experts should be prepared to speak on data availability for stock assessments. It was noted that there are some issues with data availability for the Canadian indices due to the work on the conversion factors, but the specific issues were addressed under the individual stocks.

b) Biological Surveys

i) Review of survey activities in 2023 and early 2024 (by National Representatives and Designated Experts)

On May 9th 2024, a STACREC meeting reviewed the survey activities and data by contracting parties prior to the Scientific Council meeting in June.

Information available from recent surveys is summarized below.

Recent surveys are as follow:

	Div.	2019	2020	2021	2022	2023
Greenland deep-water	1CD	●	–	–	●	●
Greenland shallow	1AF	●	●	–	●	●
Greenland shrimp and fish survey	1AF	●	●	–	●	●
Disko Bay gillnet survey	Disko Bay	●	●	●	●	●
Uummannaq gillnet survey	Uummannaq	●	●	●	●	●
Upernavik gillnet survey	Upernavik	●	●	●	●	●
Canada – Baffin Bay	SA0	○	–	–	○	●
Canadian-Spring	3L	●	–	–	–	●
Canadian-Spring	3N	●	–	–	○	●
Canadian-Spring	3O	●	–	–	○	●
Canadian-Spring	3P	●	–	●	●	–
Canadian -Autumn	2H	○*	○*	○*	–	○*
Canadian -Autumn	2J	○*	●	○*	–	●
Canadian -Autumn	3K	○*	●	○*	–	●
Canadian -Autumn	3L	○*	○*	–	–	●
Canadian -Autumn	3N	●	●	–	–	●
Canadian -Autumn	3O	●	●	–	–	●
EU	3L	●	–	–	–	●
EU	3NO	●	–	●	●	●
EU	3M	●	●	●	●	●

● = complete, ○= partially complete, – = incomplete

*Incomplete or partial deep strata (deep is defined as >750m in 2HJ3K, >732m in 3L).

Canada – Newfoundland and Labrador (SCR Doc. 24/036, 24/037):

The 2022 and 2023 Canadian surveys used the CCGS Teleost alongside new research vessels CCGS Capt Jacques Cartier and CCGS John Cabot that now replace the previous longstanding vessels. Survey coverage issues in 2022 were largely a result of challenges with availability of the outgoing vessels and the need to prioritize comparative fishing at the expense of survey coverage. In 2022, there was limited coverage of Div. 3L in the spring survey and there was no autumn survey. In 2023, there was no coverage of Subdivision 3Ps in the spring survey due to limited availability of the survey vessel. This was the first completed spring survey of Div. 3LNO since 2019. The 2023 autumn survey was relatively successful, albeit with a reduced set density. It marked the first time since 2014 that the deep strata of Div. 3L were successfully covered. However, due to faulty trawl floats the deep strata (>750m), Div. 2H were again missed in 2023. These results continue a relatively longstanding tendency of survey coverage issues in both the autumn and spring surveys.

Canada – Subarea 0 (SCR Doc. 24/023)

During 1999-2017 surveys were completed in Div. 0A-south (to 72N) using the R.V. Pâmiut with an Alfredo III trawl. In 2018 the R.V. Pâmiut was retired and a replacement vessel was not available. In 2019 the F.V. Helga Maria with the Alfredo III trawl and trawl doors from the R.V. Pâmiut was used as an interim vessel, but data analyses detected significant differences in catchability below 700 m, therefore the survey was not used to assess stock status. Surveys in Subarea 0 were completed in 2022 and 2023 using the RV Tarajoq with a Bacalao trawl; this vessel and trawl will be used for the survey in future years. Survey stratification was expanded in 2022 relative to previous years, adding a 200-400 m depth stratum and expanding the survey to include all of Div. 0B. The survey now fishes the following depth strata in each of Divs. 0A-south and 0B: 201-400, 401-600, 601-800, 801-1000, 1001-1200, 1201-1400, 1401-1500 m. The survey was planned with 30 days at-sea to complete 80 stations in Div. 0A-south and 110 stations in Div. 0B. The 2023 survey completed 79 stations in Div. 0A-south and 92 stations in Div. 0B, with the majority (17/19 stations) of the missed stations in the 200-400 m strata. Survey biomass and abundance indices were calculated but cannot be directly compared to previous indices calculated from data collected using the R.V. Pâmiut with an Alfredo III trawl.

Denmark/Greenland (SCS 24/014, SCR 20/015, 24/006, 24/013, 24/019):

A hydrographic cruise was carried out across the continental shelf off West Greenland to sample 6 standard sections onboard RV Tarajoq during the period 29 May to 18 June and onboard the Royal Danish Navy vessel HDMS Knud Rasmussen during the period 23 June to 29 June (NAFO 1B-F). Data from three offshore stations were taken to document changes in hydrographic conditions off Southwest Greenland (NAFO Div. 1D-F). Results were presented as Scientific Council Research Document.

The Greenland Shrimp and Fish trawl survey in West Greenland in NAFO Div. 1A-F (50 - 600 m) was initiated in 1988. From 1988 to 1900, several vessels conducted the survey. From 1991 to 2017, the surveys were conducted on board RV Paamiut. In 2018 and 2019-2020, two different charter vessels were used, Sjudarberg and Helga Maria, respectively, and in 2022 and 2023, the survey was completed with the new RV Tarajoq. The three vessels used all the standard gear from RV Paamiut (Cosmos trawl gear with a mesh size 20 mesh liner in the cod-end, doors, all equipment such as bridles etc., and Marport sensors on doors and headlines), in an effort to make the 2018, 2019-2020 and 2022-2023 surveys as identical as possible with previous years' surveys. The effect of the survey vessel change has been examined by looking at gear performance variables and survey length frequencies. The performance of all variables examined remained relatively stable with the three different vessels suggesting that the indices can be comparable. The survey was carried out between May 22 – July 11 in 2023. The survey follows a buffered stratified random sampling. A total of 278 valid hauls were conducted. Survey results including biomass and abundance indices for Greenland halibut, cod, deep-sea redfish, golden redfish, American plaice, Atlantic wolfish, spotted wolfish and thorny skate were presented as Scientific Council Research Document.

The Greenland deep-sea survey in NAFO Div. 1CD (400-1500 m) was initiated in 1997, following a buffered stratified random sampling. From 1997 to 2017, surveys were conducted on board RV Paamiut. No surveys were conducted in 2018, 2020 and 2021. In 2019, a charter vessel was used, CV Helga Maria, which used all the standard gear from the research vessel Paamiut (cosmos trawl, doors, all equipment such as bridles etc., and

Marport sensors on doors and headlines). The performance of the gear and the length frequencies from the two different vessels have been examined. Results suggest that the performance of the trawl gear is different at depths > 700 m, which could affect abundance estimates. In contrast, the length frequencies remained stable suggesting that the catchability may have not been affected. In 2022, a new time series survey started with the new RV Tarajoq, using a new gear Bacalao 476. The survey was conducted between November 22 – December 5 in 2023. A Bacalao 476 trawl with a mesh size of 136 mm and a 30-mm mesh-liner in the cod-end was used. A total of 67 valid hauls were conducted. Survey results including mean catch, mean number, biomass and abundance indices, and length frequencies for Greenland halibut, roundnose grenadier, roughhead grenadier and deep-sea redfish were presented as Scientific Council Research Document.

The Greenland halibut gillnet surveys in 1A inshore were initiated in 2001, in the Disko Bay. The survey normally covers four transects and each gillnet set is compiled of five different nets with different mesh size (46, 55, 60, 70 and 90 mm half mesh). From 2013 to 2015, the surveys in Uummannaq and Upernavik gradually changed from longline surveys to gillnet surveys. Surveys are conducted with RV Sanna. In 2023, 53, 38 and 38 gillnet stations were set in Disko Bay, Uummannaq and Upernavik, respectively. Results are presented as three Scientific Research Document.

The Greenland halibut bottom trawl survey in 1D inshore (Nuuk, Ameralik and Qarajat fjords) was initiated in 2015. The survey has been conducted with RV Sanna equipped with a 1440 mesh bacalao trawl. The survey is bottom-stratified with fixed stations (stations were selected where bottom conditions allow bottom trawling). A total of 19 valid stations were conducted in 2023. Survey results, including biomass and abundance indices for Greenland halibut, shrimp, deep-sea redfish and golden redfish, were presented as Scientific Council Research Document.

EU-Spain and EU-Portugal (SCR 24/005, 007 and 008):

Since 1995, Spain carries out annually a Spring-Summer survey in the NAFO Regulatory Area of Div. 3NO. In 2003 it was decided to extend the Spanish 3NO survey toward Div. 3L (Flemish Pass). In 2023, the bottom trawl survey in Flemish Pass (Div. 3L) was carry out on board R/V Vizconde de Eza using the usual survey gear (Campelen 1800) from August 9th to 27th. The area surveyed was Flemish Pass to depths up 800 fathoms (1463 m) following the same procedure as in previous years. The number of hauls was 100 and 5 of them were nulls. Survey results, including abundance indices and length distributions of the main commercial species, are presented as a Scientific Council Research document. Survey results for Divs. 3LNO of the northern shrimp (*Pandalus borealis*) were presented in SCR Doc. 23/054. Samples for histological (Greenland halibut and roughhead grenadier) and aging (Greenland halibut, American plaice, roughhead grenadier and cod) studies were taken. Ninety-seven hydrographic profile samplings were made in a depth range of 122-1380 m.

The Spanish bottom trawl survey in NAFO Regulatory Area Divs. 3NO was conducted from 5th of June to 4th of July 2023 on board the R/V Vizconde de Eza. The gear was a Campelen otter trawl with 20 mm mesh size in the cod-end. Following the method used last years, a total of 103 valid hauls were taken within a depth range of 41-1461 m according to a stratified random design and 83 hydrographic profiles. Furthermore, a stratified sampling by length class and sex was used to sample otoliths of Atlantic cod, American plaice and Greenland halibut for growth studies. Also, gonads of Greenland halibut were sampled from histological maturity and fecundity studies. The results of this survey, including biomass indices with their errors and length distributions, as well as the calculated biomass based on conversion of length frequencies for Greenland halibut, American plaice, Atlantic cod, yellowtail flounder, redfish, witch flounder, roughhead grenadier, thorny skate and white hake are presented as a Scientific Council Research Document. In addition, age distributions are presented for Greenland halibut and Atlantic cod.

The EU Spain and Portugal bottom trawl survey in Flemish Cap (Div. 3M) was carried out on board R/V Vizconde de Eza using the usual survey gear (Lofoten) from July 4th to August 6th 2023. The area surveyed was Flemish Cap Bank to depths up to 800 fathoms (1460 m) following the same procedure as in previous years. The number of hauls was 184 and three of them were null. Survey results including abundance indices of the main commercial species and age distributions for cod, redfish, American plaice, roughhead grenadier and Greenland halibut are presented as a Scientific Council Research document. Flemish Cap survey results for Northern shrimp (*Pandalus borealis*) were presented in SCR Doc. 23/052 and SCR Doc. 23/053. Samples for histological assessment of sexual maturity of cod, redfish, Greenland halibut and roughhead grenadier were taken. Oceanography studies continued to take place.

VME data from the 2023 EU; EU-Spain and Portugal bottom trawl groundfish surveys in NAFO Regulatory Area (Divs. 3LMNO):

New data on deep-water corals and sponges were presented from the 2023 EU-Spain and Portugal bottom trawl groundfish surveys. The data were made available to the NAFO WG-ESA to improve mapping of Vulnerable Marine Ecosystems (VMEs) species in the NAFO Regulatory Area (Divs. 3LMNO). Distribution maps of presence and catches above threshold for RV data of sponges (100 kg/tow), large gorgonians (0.6 kg/tow), small gorgonians (0.2 kg/tow), sea pens (1.3 kg/tow), Boltenia sea squirts (0.35 kg/tow), bryozoans (0.2 kg/tow) and black corals (0.4 kg/tow) were presented.

During 2023, R/V Vizconde de Eza carried out three surveys, one in Division 3M (Flemish Cap) sampling between 137 -1455 m, with a total of 184 tows (181 valid; 3 no valid); other in Divisions 3NO (Grand Banks of Newfoundland) sampling between 43 - 1430 m depth with a total of 106 tows (103 valid; 3 no valid); and other in Division 3L, sampling between 129 -1481 m, with a total of 100 tows (95 valid; 5 no valid). In total there were 390 bottom trawl tows, 11 of them considered invalid due to technical problems during the fishing operation. 166 hauls out of 379 valid tows have shown zero catches (i.e. no presence) of VME indicator species. This represents 43.8% of the total valid hauls. A brief description of the survey methodology can be found in Durán Muñoz *et al.* (2020).

Sponges were recorded in 111 of the 379 valid tows (29.3% of valid tows analyzed), at mean depths between 51 and 1481 m. There were two significant catches of sponges (≥ 100 kg/tow) in these tows, both of which fell within the VME polygons for sponges.

Large gorgonians were recorded in 9 of the 379 valid tows (2.4% of valid tows analyzed), at mean depths between 463 and 959 m. There was one significant catch of large gorgonians (≥ 0.6 kg/tow) in these tows, which fell outside the VME polygons for large gorgonians.

Small gorgonians were recorded in 42 of the 379 valid tows (11.08% of valid tows analyzed), at mean depths between 227 and 1 481 m. There were no significant catches of small gorgonians (≥ 0.2 kg/tow) in these tows.

Sea pens were recorded in 133 of the 379 valid tows (35.1% of valid tows analyzed), at mean depths between 63 and 1 444 m. There was one significant catch of sea pens (≥ 1.3 kg/tow) in these tows, which fell within the VME polygons for sea pens.

Black corals were recorded in 15 of the 379 valid tows (4.0% of valid tows analyzed), at mean depths between 468 and 1 187 m. There were two significant catches of black corals (≥ 0.4 kg/tow) in these tows, both of which fell outside the VME polygons for black corals.

Sea squirts were recorded in 7 of the 379 valid tows (1.85% of valid tows analyzed), at mean depths between 43 and 228 m. There was one significant catch of sea squirts (*Boltenia ovifera*) (≥ 0.35 kg/tow) in these tows, which fell within the VME polygons for sea squirts.

Bryozoans were recorded in 31 of the 379 valid tows (8.18% of valid tows analyzed), at mean depths between 43 and 1225 m. There were no significant catches of bryozoans (≥ 0.2 kg/tow) in these tows.

Above information, including distribution maps of VME species groups, is further detailed in SCR Doc. 23/055.

Reference:

Durán Muñoz, P., Sacau, M., García-Alegre, A. and Román, E. (2020). Cold-water corals and deep-sea sponges bycatch mitigation: Dealing with groundfish survey data in the management of the northwest Atlantic Ocean high seas fisheries, *Marine Policy. Volume* 116, June 2020, 103712, DOI: 10.1016/j.marpol.2019.103712.

USA (SCR 24/039; SCS Doc. 24/012):

The US conducted a spring survey in 2023 covering NAFO Subarea 5 aboard the FSV Henry B. Bigelow. There were 70 out of the normal 350-380 successfully completed. The tows only covered Georges Bank and only occurred during the daytime. The fall survey successfully completed 335 stations in NAFO Subareas 4, 5 and 6. The US also conducted a shrimp survey in Subarea 5 in the summer of 2023 with 63 successful stations. In addition, spring and fall bottom longline surveys have now been conducted for 10 years, including in fall 2020 when all other surveys were missing. Results in terms of biomass/tow normalized to the mean of the 2014-2021(2) are presented for select species that had at least the bottom trawl and one other survey (Western Gulf of Maine cod, Gulf of Maine haddock, white hake, northern red hake, Atlantic halibut, Atlantic wolfish, spiny dogfish, barndoor skate and thorny skate). In general, the indices for the different surveys follow similar trends in the various surveys.

ii) Survey protocol development

At the May 9th STACREC meeting a protocol for the Faroese longline survey was presented (SCR Doc. 24/041). The survey protocol for the Faroese longline survey has been in development in NAFO Division 3M since 2021. The aim and objective of this work is to develop a survey to get an indication of the cod (*Gadus morhua*) stock with an alternative gear and build a time series which can potentially be incorporated to the assessment. The 2023 survey covered 28 stations in 3M. The number of hooks in every longline set was set to 3 600. Average CPUE (kg per hook) was similar to those in 2021 and 2022 (~1kg/hook).

Biological sampling consisted of 280 measurements of length, weight, gender and age readings.

The scope of the Faroese survey is limited to 64 longline random stations covering strata 1-20, 24, 28, 33 (EU survey) of Flemish Cap during a four-week period from mid-May to mid-June. A minimum of two sets/stations are surveyed in each stratum to ensure statistically valid estimates and deviations.

Following are the criteria for rejecting sets:

- Deviations from the standard soaking time and the number of hooks employed in all sets.
- Damages caused in the longline gear.
- Unjustified change in the geographical position of selected units.
- Rejected sets are not to be used in the compilation of survey indices although sampled individuals can be retained for further investigations.

An observer will be present carrying out the sampling procedure and ensure that crew members follow the scientific standards established in the protocol. Data collected will be delivered to the Faroe Marine Research Institute (FAMRI) for quality check and error filtering. The observer is responsible to ensure all data and samples collected during the survey are delivered to FAMRI upon port return.

The number of hooks per longline-set is fixed at 1 000. Fishing activity is standardized by limiting the soak time, aiming at a range from 5 to 10 hours and bait type restricted to squid.

The target species of the survey is cod but by-catch/non-target species, e.g., redfish (*Sebastes marinus, S. mentella* and *S. fasciatus*), Greenland halibut (*Reinhardtius hippoglossoides*), wolffish (*Anarhichas lupus),* Spotted wolfish (*Anarichas minor*) and any other fish species will also be recorded. To describe the hook occupancy, registration of 50 hook condition will be recorded for each set at retrieval. Due to the increased possibility of entanglement at the beginning of the line, registration of hook condition is to begin after first 100 hooks are retrieved. Possible hook conditions are:

- Bait only
- Cod
- Bycatch/other species
- Hook empty
- Hook missing
- Damaged/broken hook

For each station full biological sampling of cod is done. The biological sampling includes:

- length in cm
- round weight in kg
- sex
- maturity
- otolith collection

Length measurements of fish are made on the total length (cm). Weight measurements are recorded in kg. As a rule, 100 individuals of the target species are to be sampled in each station. Of these, 20 are to be measured in both length and weight. The total number of otoliths sampled per set is 10 and for sex identification and maturation 20. For non-target species only length and weight are to be measured. The objective is to sample 20 individuals of non-target species conditioned on fish availability.

6. Review of SCR and SCS Documents

There were no documents to be revised.

7. Other Matters

a) Update on Comparative Fishing and Conversion Factors for the Canadian-NL Research Vessel Surveys (SCR 24/037).

The CAN-NL Comparative Fishing program was undertaken from 2021-2023 as Canada transitioned to new survey vessels, the CCGS Capt. Jacques Cartier and CCGS John Cabot. This program has now concluded and conversion factors have been estimated during Canadian peer-review processes (DFO 2024a, 2024b).

During the May STACREC meeting an overview of estimated conversion factors for NAFO stocks was provided. It was noted that there were significant gaps in the program, and that discussions were ongoing on how to best apply available conversion factors across stock areas.

In June, an update was provided on the implementation of conversion factors to the Canadian survey data. Stock-by-stock discussions were had on the representativeness of comparative fishing sampling, to determine if estimated conversion factors could be extended to other areas. The outcome of those discussions is summarized in Table 2.

It was also noted that this comparative fishing program has provided evidence that the previous assumption of equal catchability between the previous survey vessels CCGS Alfred Needler and its sistership the CCGS Wilfred Templeman with the CCGS Teleost may not be appropriate for all species. Investigations into the impact of mixing these vessels in previously reported time series were recommended. Preliminary checks indicate historic trends in stock size were likely robust to this mixing, however, this did not consider potential size-effects. Additionally, recent increased interchanging of vessels – particularly in the spring from 2014-2019 – was noted. Further investigations are warranted in assessments as these survey time series are applied.

Table 2. Stock-by-stock summary of conversion factor conclusions for the CAN-NL multispecies survey data in spring and fall by vessel. Note that the CCGS Wilfred Templeman and CCGS Alfred Needler are sister ships and considered to have equal catchability. Rho =1 indicates equivalent catchability to the new vessels.

Stock	**CCGS Wilfred Templeman & CCGS Alfred Needler**		**CCGS Teleost**	
	CAN-Spring	**CAN-Fall**	**CAN-Spring**	**CAN-Fall**
3NO Atlantic Cod	Rho =1	Rho =1	Rho =1	Rho =1
2+3KLMNO Greenland Halibut	No appropriate conversion factor available.	Extend 3KL conclusion of Rho =1 across the fall survey area.	Rho =1	Extend 2+3KL length-based conversion factor across the fall survey area.
3LNO Yellowtail Flounder	Length-based conversion factor.	Length-based conversion factor.	Rho =1	No appropriate conversion factor available.
3LN Redfish	No appropriate conversion factor available.	No appropriate conversion factor available.	Rho =1	No appropriate conversion factor available.
3O Redfish	No appropriate conversion factor available.	No appropriate conversion factor available.	Rho =1	No appropriate conversion factor available.
3LNO American Plaice	No appropriate conversion factor available.	No appropriate conversion factor available.	Rho =1	No appropriate conversion factor available.
2J3KL Witch Flounder	No appropriate conversion factor available.	Extend use of 3KL Length-based conversion factor across 2J3KL.	Rho =1	Length-based conversion factor.
3NO Witch Flounder	No appropriate conversion factor available.	No appropriate conversion factor available.	Rho =1	No appropriate conversion factor available.
2+3K Roughead Grenadier	Assume Rho =1 based on consistency across other surveys.	Extend 3KL conclusion of Rho =1	Rho =1	Extend 2+3KL conclusion of Rho =1.
3NOPs White Hake	No appropriate conversion factor available.	No appropriate conversion factor available.	Rho =1 for 3NOPs	No appropriate conversion factor available.
3LNOPs Thorny Skate	No appropriate conversion factor available.	Conversion factor estimated for Div. 3L only. Conversion cannot be extended to 3NOPs.	Length-based conversion for 3LNO. Conversion cannot be extended to 3Ps.	Conversion factor estimated for Div. 3L only. Conversion cannot be extended to 3NOPs.
3LNO Shrimp	No appropriate conversion factor available.	Extend use of 3KL length-based conversion factor.	Rho =1	Extend use of 2HJ3KL length-based conversion factor.
3NO Capelin	No appropriate conversion factor available.	No appropriate conversion factor available.	Rho =1	No appropriate conversion factor available.

Quang Huynh presented an update on exploring survey calibration in the absence of comparative fishing. A model-based calibration method first presented to NAFO SC in June 2023 was subsequently tested using data from a vessel calibration conducted by DFO Newfoundland. The paper compares calibration factors from spatiotemporal models with those from a 1995 comparative fishing experiment for the Newfoundland and Labrador survey when it changed from the Engel and to Campelen trawl in 2J+3KL. Calibration factors for Atlantic cod were similar between methods, but there was a larger discrepancy for Greenland halibut. The model-based calibration method was also tested by breaking data from a single vessel into two periods and calibrating between the periods; the model correctly determined there was no vessel effect on catchability in this test. The results demonstrated that there was little retrospective behavior in the model-based calibration as new survey data were added, although there was more variability in the calibration factor as the time gap between surveys increased. The spatiotemporal model can propagate the error in the calibration factor estimated in the resulting index. Additional validation and simulation work will inform use of this approach for surveys when comparative fishing was not possible.

References:

2024a - DFO. 2024. Newfoundland & Labrador Comparative Fishing Analysis – Part 1. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2024/002. (https://www.dfo-mpo.gc.ca/csas-sccs/Publications/SAR-AS/2024/2024_002-eng.pdf)

2024b- DFO i*n press*. Newfoundland & Labrador Comparative Fishing Analysis – Part 2. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2024/###

b) Presentation of the Canadian Scotian Shelf and Southern Grand Banks Industry-DFO Halibut Longline Survey.

At the invitation of the STACREC chair, Nell den Heyer (Canada) presented an overview of the Canadian Scotian Shelf and Southern Grand Banks Industry-DFO Halibut longline survey. The presentation provided a brief overview of the 2022 Halibut Framework Assessment and the importance of the longline survey in the assessment and management of this stock of Atlantic Halibut. The survey provides the halibut biomass index for the assessment model, and in interim assessment years is used to provide science advice on the TAC. The survey also provides a platform for traditional and electronic tagging and scientific sampling for otoliths, maturity, genomics and diet, and generates length compositions for the assessment model and to assess catches of non-targeted species. The stratified random survey design covers to the whole management unit (areas and depths) using a standardize survey protocol (i.e. for soak times, bait types, hook size, gear configuration and sampling location). In addition, the role of At-Sea Scientific Observer on the survey to record set related data such as set location/time (start/end of setting; start/end of hauling), depth, gear specifications, hook occupancy (300/1000 hook: baited, catch, empty, missing, broken), and bottom temperature recorded during set was emphasized. During the survey, information on fork length, sex, genetic samples, maturity gut fullness and otoliths are also collected. Finally, information on hook occupancy while the gear is being hauled back is also used to standardize catchability to better measure local density of halibut. Overall, the success of this longline survey reflects the adherence to the standardized protocols, experienced At-Sea Observers and experienced industry crews conducting the survey. Lessons learned from the operation of this survey can be influential in the development of the Faroese longline cod survey in NAFO Division 3M.

c) Presentation of the WG-ESA data management subgroup on ArcGIS.

At the 2023 meeting of WG-ESA, a data management sub-group was struck to develop a centralized data repository using ArcGIS Online to host data and data products for scientific advice. The sub-group focused on 4 main items: to develop a list of standard data layers; data management workflows; testing the ArcGIS online platform; and advancing data management to include analysis and reporting tools.

A centralized portal would improve data governance, serve as the authoritative source for commonly used datasets, facilitate the establishment of data management workflows, and ensure these data are secure, accurate, and available to Scientific Council. Additionally, it would provide WG members and secretariat staff the ability to create mapping products from these layers. The data management subgroup will continue working on outlining the required functionalities of the centralized portal, and report back to the NAFO Secretariat, who will work with ESRI to determine the options and costs.

d) Presentation of the report from ICES-NAFO Working Group on Deepwater Ecosystems (WG-DEC), 25-29 March 2024

A summary of the Joint ICES/NAFO Working Group on Deep-water Ecology (WG-DEC) that took place from 25-20 March 2024 at the ICES Headquarters, Copenhagen (hybrid) was provided by Javier Murillo-Perez.

WG-DEC, chaired by Ana Colaço (PT); David Stirling (UK); and Rui Vieira (UK), was at ICES HQ and online, from 25-29 March 2024. WG-DEC organized the work around seven terms of reference and different break-out groups were created to work on them. The group reviewed, validated and QA/QC-checked the new information on the occurrence and distribution of Vulnerable Marine Ecosystems (VMEs). Three countries (Ireland, Norway and UK) submitted new VME data in 2024. In total, 1 038 new VME indicator records (no habitat records) and 32 absence records were added to the database. During the meeting discussion, it was noticed that some countries were not aware of the data call. It was recommended that the group expert could contact the country lead to encourage the data submission as the data call goes to all ACOM members and EU contacts. A decline in quality of NEAFC VMS Data was observed, where the number of active vessels using unknown gear type is over half of the total. It was also noticed that current QA/QC procedures are good, but historical data did not benefit from this, which means that there are some historical records with data inconsistences and spatial errors which need to be corrected working with the data centre and data submitters. WG-DEC evaluated the inclusion of connectivity in the context of VME closures and elaborated a framework describing different approaches to integrate connectivity in VME closures, data needed and what is available now for VMEs. A lot of the effort on this year meeting was in the preparation of frameworks for future workshops. One of them will aim to improve the VME index that currently presents several limitations. The new VME Index will focus on assessing the likelihood of VME occurrence, independently of the relative vulnerabilities of VME indicators, but making full use of trawl catch surveys. A second workshop was recommended for the incorporation of species distribution models into the ICES VME advice framework. Both of these workshops are expected to occur at the beginning of 2025. WG-DEC also conducted a literature review of the impact of different bottom-contact static gears on VMEs and began a preparatory framework for a future workshop aiming to review and assess the impact of different gear types on VMEs across the ICES area. Next WG-DEC is scheduled for the first/second week of April 2025, likely at the ICES HQ.

e) Presentation of a summary presentation of the ICES/NAFO/NAMMCO Working Group on Harp and Hooded Seals (WG-HARP)

At the invitation of the STACREC chair, Shelley Lang (Canada) provided a summary presentation of the ICES/NAFO/NAMMCO Working Group on Harp and Hooded Seals (WG-HARP). The presentation provided an overview of the August 21-25, 2023 meeting of WG-HARP in Tromsø, Norway. The main objectives of the meeting were to review the 2022 Greenland Sea harp and hooded seal pup production surveys and, using the model agreed on at the WK-BSEALS2023, review the status of the Northeast Atlantic harp and hooded seal populations and provide estimates of population size and trend and harvest advice. For the Northwest Atlantic harp seal and hooded seals, the new harp seal assessment model was presented with an overview of the 2022 Northwest Atlantic harp seal survey.

For the Greenland Sea Hooded Seals, the model from WK-BSEALS2023 was fit to the historical catch records, fecundity rates, age specific proportions of mature females and pup production estimates. The population remains below its limit reference point and no commercial harvest is advised (there has been no commercial harvest since 2007). For the White Sea/Barents Sea Harp Seals the model from WK-BSEALS2023 was fit to the same data types as used for the Greenland Sea Hooded Seals with an additional index for capelin SSB. Commercial harvest for this population has been low since 2009. As a result of a lack of contemporary data (there has been no pup production survey since 2013), the model estimate for 2023 abundance was considered unreliable and WG-HARP was unable to provide harvest advice. WG-HARP recommended that a new pup production survey be completed as soon as possible. For the Greenland Sea harp seal population the model from WK-BSEALS2023 was fit to the same data types as used for the White Sea/Barents Sea Harp Seals but included indices of both cod & capelin SSB. However, WG-HARP considered the population estimates unreliable and, therefore, harvest advice was provided using adaptative management based on pup production trends and Potential Biological Removal based an estimate of total population obtained by scaling the 2022 pup production estimate.

For the Northwest Atlantic Harp Seals a new hierarchical Bayesian state-space model that was reviewed by the Canadian National Marine Mammal Peer Review Committee (NMMPRC) in October 2022 was applied to removals (catch, bycatch, S&L), reproductive rates, pup production estimates, and age structure. To incorporate ecosystem variability and its impact on fecundity and juvenile survival this model formulation includes two environmental factors, an annual ice anomaly and the Newfoundland Climate Index. The updated 2019 population estimate for this population was 4.7 million seals. An aerial photographic survey of this population was conducted in March 2022, and results will be incorporated into the upcoming 2024 stock assessment. For the Northwest Atlantic Hooded Seal population, current population status is unknown. There have been no pup production surveys for this population since 2005 (last assessed in 2006). Catches remain low for this population.

8. Adjournment

The meeting was adjourned on 11 June 2024.

APPENDIX IV. REPORT OF THE STANDING COMMITTEE ON FISHERIES SCIENCE (STACFIS)

Chair: Martha Krohn Rapporteur: NAFO Secretariat

I. OPENING

The Committee met from 31 May – 13 June 2024 to consider and report on matters referred to it by the Scientific Council, particularly those pertaining to the provision of scientific advice on certain fish stocks. Representatives attended from Canada, Denmark (in respect of Faroe Islands and Greenland), the European Union, Japan, the Russian Federation, Ukraine, the United Kingdom and the United States of America. Observers from the Ecology Action Center, Oceans North and the Food and Agriculture Organization of the United Nations were also present. The Executive Secretary and other members of the Secretariat were in attendance. The Chair, Martha Krohn (Canada) opened the meeting by welcoming participants. The agenda was reviewed, and a plan of work developed for the meeting in accordance with the Scientific Council plan of work. The provisional agenda was adopted. Owing to the limited time available during the meeting, it was not possible to consider drafts of all report sections in plenary. As in previous years, designated reviewers were assigned for each stock for which an interim monitoring update was scheduled (see SC Report). Following presentation and discussion of full assessments, Designated Experts produced drafts of their respective report sections which were reviewed in plenary.

II. GENERAL REVIEW OF CATCHES AND FISHING ACTIVITY

1. Review of Recommendations.

STACFIS agreed that relevant stock-by-stock recommendations from previous years would be considered during the review of a stock assessment or noted within interim monitoring report as the case may be and the status presented in the relevant sections of the STACFIS report.

2. General Review of Catches and Fishing Activity

The NAFO Secretariat presented the catch estimates developed by CESAG and made the supplementary data that went into the analyses available for the Scientific Council to review. The Secretariat noted that the catches were estimated based on the strategy outlined in Annex 1 of COM-SC Doc. 17-08, amended following a recommendation from STACFIS in 2018, to include catch estimates of broken down by quarter and gear type. It was also noted that some Contracting Parties had not submitted catch for 2023 at the time of the meeting, therefore many of the STATLANT 21A catches reported in the catch tables in this report are stated as not available (NA).

III. STOCKS ASSESSMENTS

STOCKS OFF GREENLAND AND IN DAVIS STRAIT: SA 0 AND SA 1

Environmental Overview

Hydrographic conditions in this region depend on a balance of ice melt, advection of polar and sub-polar waters and atmospheric forcing, including the major winter heat loss to the atmosphere that occurs in the central Labrador Sea. The cold and fresh polar waters carried south by the east Baffin Island Current are counter balanced by warmer waters that are carried northward by the offshore branch of the West Greenland Current (WGC). The water masses constituting the WGC originate from the western Irminger Basin where the East Greenland Currents (EGC) meets the Irminger Current (IC). While the EGC transports ice and cold low-salinity Surface Polar Water to the south along the eastern coast of Greenland, the IC is a branch of the North Atlantic current and transports warm and salty Atlantic Waters northwards along the Reykjanes Ridge. After the currents converge, they turn around the southern tip of Greenland, forming a single jet (the WGC) that propagates northward along the western coast of Greenland. The WGC is important for Labrador Sea Water formation, which is an essential element of the Atlantic Meridional Overturning Circulation. At the northern edge of the Labrador Sea, after receiving freshwater input from Greenland and Davis Strait, part of the WGC bifurcates southward along the Canadian shelf edge as the Labrador Current.

1. Greenland halibut (*Reinhardtius hippoglossoides*) in Subareas 0+1 offshore

Full assessment (SCR Doc. 24/013, 24/019, 24/020, 24/021, 24/022; SCS Doc. 24/14)

a) Introduction

The Greenland halibut stock in Subareas 0 and 1 (offshore) is part of a larger population complex distributed throughout the Northwest Atlantic. The fishery distribution includes Canadian (Subarea 0) and Greenland (Subarea 1) offshore waters. Canada and Greenland manage the fisheries and request advice from NAFO Scientific Council. In 1994, analysis of tagging and other biological information resulted in the creation of separate management areas for inshore Division 1A, and in 2020 studies of parasites, analysis of historic tagging and fishery data resulted in the creation of separate management areas for inshore Divisions 1B-F.

b) Description of the Fishery

Bottom otter trawl gear is used by most fleets in the Subarea 1 fishery. Longline vessels occasionally fish in the offshore, however gillnet gear is not allowed. The Subarea 0 fishery is a mix of trawl and gillnet (between 30-40% of the catch in recent years) with the occasional use of longline. Trawlers in both Subareas have used both single and double trawl configurations since about 2000. The gillnet fishery in Subarea 0 began in 2005; use of baited gillnets began around 2015 and has increased since. Baiting gillnets has been shown to increase catch rates.

Catches were first reported in 1965 and rose to 20 027 t in 1975 before declining to 2 031 t in 1986. Catches increased from 1989 to 1992 (reaching a level of 17 888 t) due to a new trawl fishery in Division 0B with participation by Canada, Norway, Russia and Faeroe Islands and an expansion of the Divisions 1CD fishery with participation by Japan, Norway and Faeroe Islands. Catch declined from 1992 to 1995 primarily due to a reduction of effort by non-Canadian fleets in Division 0B. From 1995 to 2023, catches have been near the TAC. Over this period catches increased in step with increases in the TAC, until 2019. Catches decreased in 2023, following the advice (Figure 1.1).

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
TAC	30	30	32.3	32.3	36.4	36.4	36.4	36.4	33.3	33.3
SA 0	15.4	14.1	15.9	16.0	18.3	17.9	19.1[2]	18.3[2]	16.4[2,3]	
SA 1	14.9	15.2	16.2	16.2	18.0	18.1	17.3	18.8	16.6[3]	
Total STACFIS[1]	30.3	29.3	32.1	32.2	36.3	36.0	36.4	37.2	33.0	

[1] Based on STATLANT, with information from Canada and Greenland authorities to exclude inshore catches.

[2] STACFIS estimate using 1.48 conversion factor for J-cut, tailed product.

[3] Based on official catches from the Greenland Office of Fisheries Licences (GLFK) because STATLANT were not available.

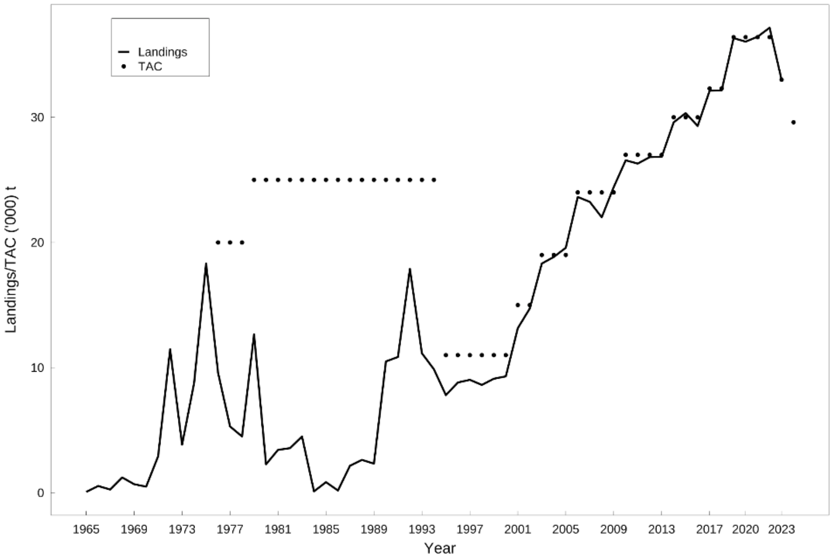


Figure 1.1. Greenland halibut in Subareas 0 and 1 (offshore): catches and TACs.

c) Input data

Research Surveys

Shallow survey in Divisions 1A-F: The shallow survey in NAFO Divisions 1A-F covers the continental shelf from Cape Farewell in the south to latitude 72°30'N including the Disko Bay. This survey covers depths from 50 to 600 m for the period 1991-2023 (no survey was conducted in 2021). The survey has been carried out with four different vessels (1991-2017: R/V Paamiut, 2018: CV Sjurdarberg, 2019-2020: Helga Maria and 2022-2023: RV Tarajoq). All vessels have similar size, used the same fishing gear from 2005 (door, gear trawl and sensors) and same crew. Examination of gear parameters found that these vessel changes had a minimal effect on trawl performance. The survey used a Skjervoy gear until 2004, and in 2005 the gear was replaced by a Cosmos trawl.

The biomass indices increased gradually through the 1990's and until the last year with the old Skjaervoy trawl in 2004. From 2005 to 2014 the biomass index decreased. Since 2014 the index biomass has been gradually increasing (Figure 1.2). Clear modes can be observed in the length distribution at 12-15 and 19-23 cm every year corresponding to ages 1 and 2. In 2023, age 2 biomass was higher than age 1 for the first time in the whole time-series (Figure 1.3).

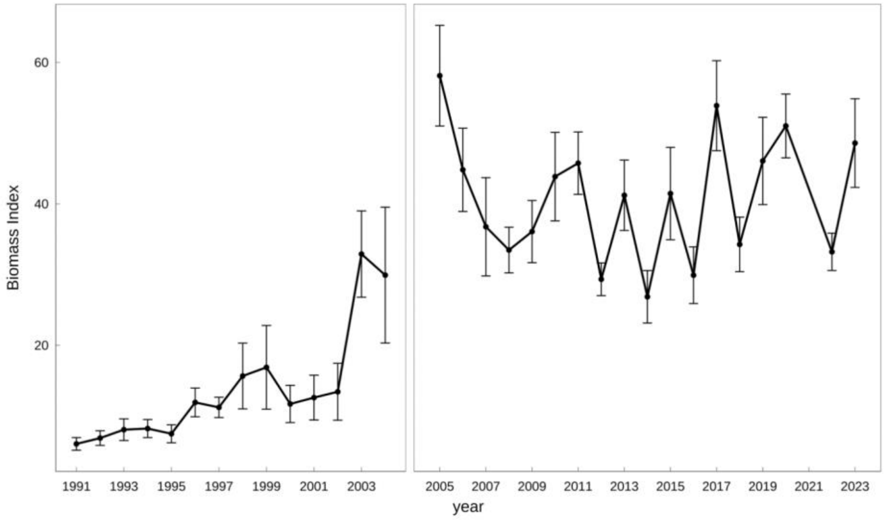


Figure 1.2. Greenland halibut in Subareas 0+1 (offshore): Divisions 1A-F biomass index from surveys with the Skjervoy gear (left panel), and Cosmos gear (right panel).

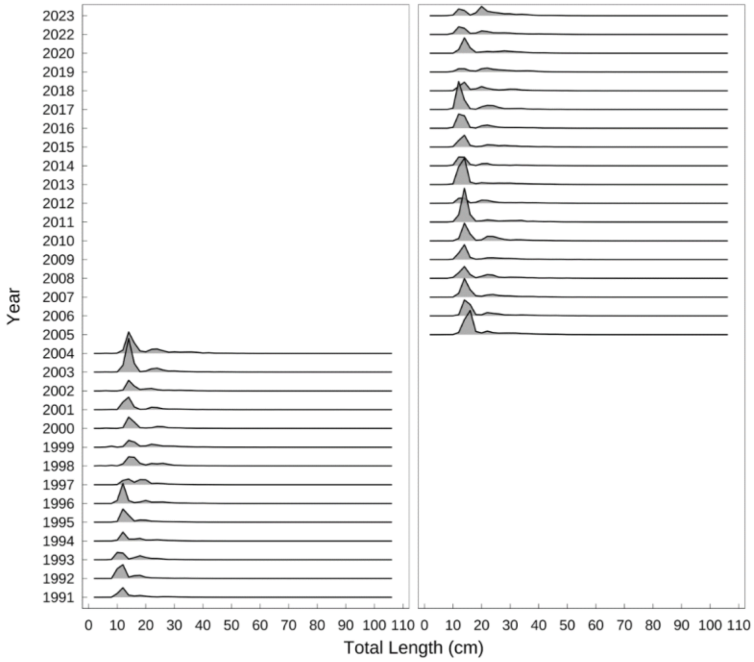


Figure 1.3. Greenland halibut in Subarea 0+1 (offshore): length frequency distribution for fish caught during surveys with the gear Skjervoy (left panel), and Cosmos gear (right panel).

The deep surveys in Divisions 1CD and 0A were conducted by Greenland and Canada, respectively, but given the common survey protocols (same vessels, gear and sampling design), a combined index for Divisions 1CD and Division 0A has been used to give advice for the years where both surveys were carried out: 1999, 2001, 2004, 2008, 2012, 2014-2017 with RV Paamiut using an Alfredo trawl. The index remained stable at a relatively high level during 1999-2012. The combined index was also estimated in 2019 with CV Helga Maria using the same Alfredo trawl, but it was not comparable with the rest of the time-series. From 2022-2023, a new time-series started with the RV Tarajoq and a Bacalao trawl, without the possibility of conducting calibration experiments between the 2 vessels and gears. No surveys were carried out in 2018, 2020 and 2021. The index increased between 2014 and 2016 while it declined in 2017. The decline observed in 2017 was a result of a decline in the 0A-South survey biomass. Plots for the biomass index and the length frequencies for the survey series 1999-2017 and for the independent indices from 2019 and 2022 are included. Survey length frequency distribution has a similar range to preceding years but there were higher numbers of small fish in the catch, likely because of the change to using a Bacalao trawl (Figures 1.4 and 1.5).

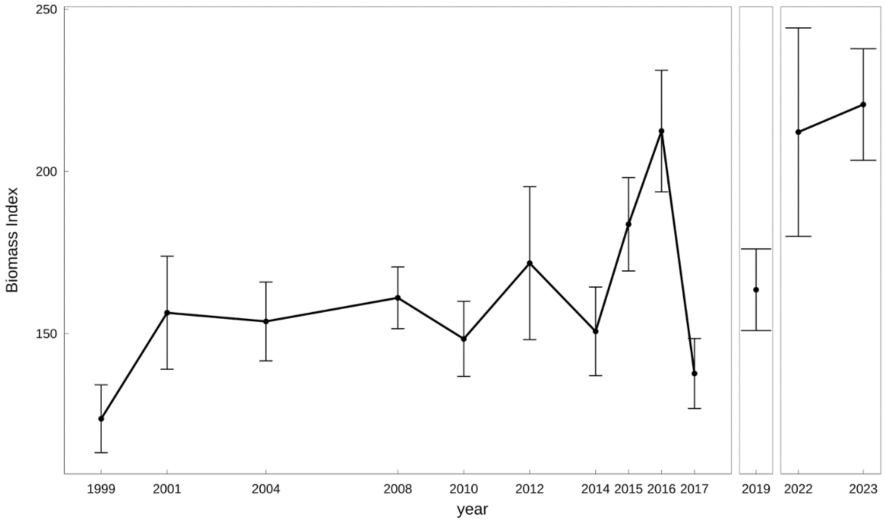


Figure 1.4. Greenland halibut in Subareas 0+1 (offshore): Divisions 0A-South and Divisions 1CD combined biomass index from surveys with the R/V Paamiut and Alfredo 3 gear (left panel), C/V Helga Maria and Alfredo 3 gear (middle panel) and R/V Tarajoq and Bacalao 476 gear (right panel).

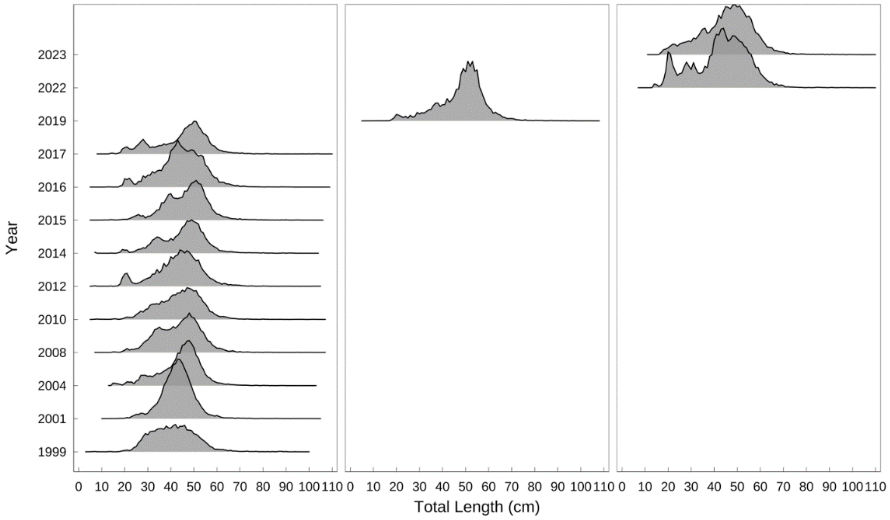


Figure 1.5. Greenland halibut in Subareas 0+1 (offshore): length frequency distribution for fish caught during surveys with the R/V Paamiut and Alfredo gear (left panel), C/V Helga Maria and Alfredo gear (middle panel) and R/V Tarajoq and Bacalao gear (right panel).

A standardized combined index for the exploitable biomass of the stock (biomass > 35 cm fork length) was produced with a Delta-Lognormal Generalized Additive Model (Delta-GAM). The model used density, depth and distribution data on Greenland halibut from three buffered stratified random surveys: the shallow survey in Divisions 1A-F, the deep survey in Divisions 1CD and the deep survey in Division 0A (Figure 1.6).

The overlap in years between "Skjervoy" and "Alfredo", between "Cosmos" and "Alfredo", and finally between "Cosmos" and "Bacalao", made estimation of gear effects possible.

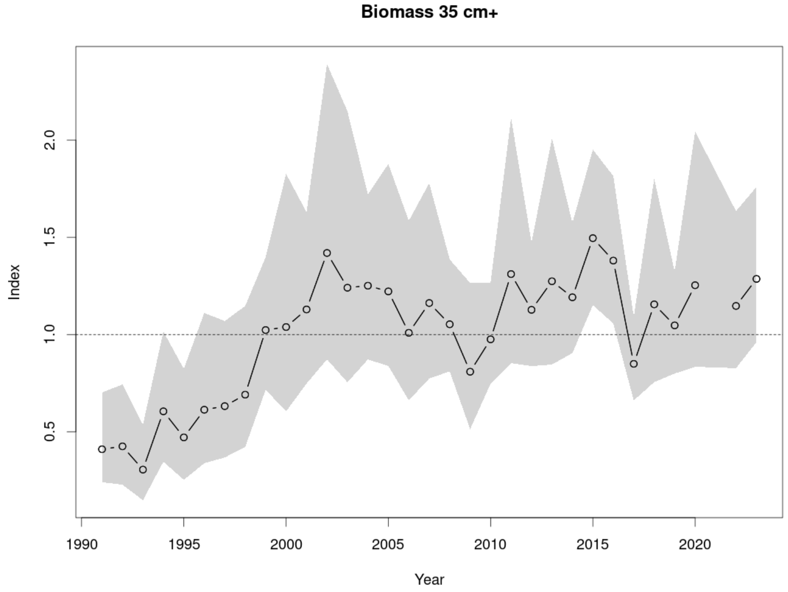


Figure 1.6. Estimated biomass index (rescaled to mean 1). Grey shaded area indicates 95% confidence interval.

d) Recruitment

An Age-1 Abundance Index is estimated from the shallow survey in Divisions 1AF. The index was generally stable from 1991 to 2002, and then increased in 2003, it has been highly variable since, and has been below average in the last 2 years (Figure 1.7).

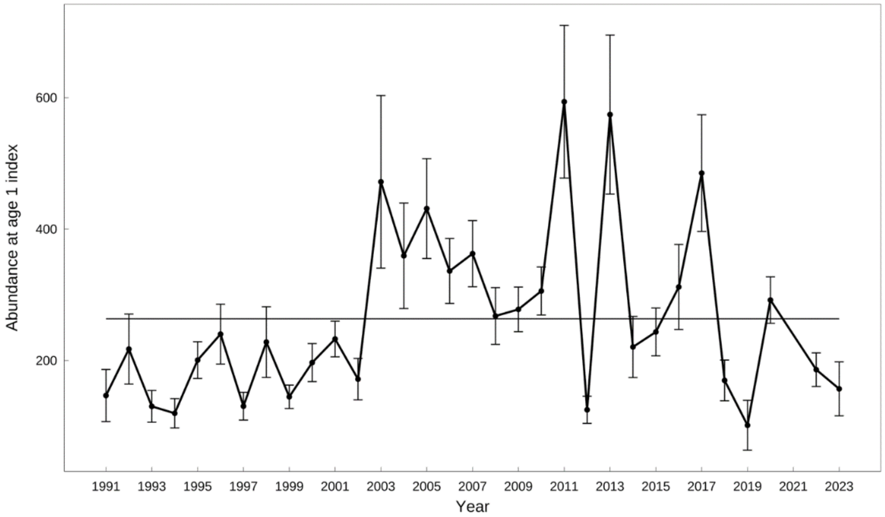


Figure 1.7. Greenland halibut in Subarea 0 and 1 (offshore): index at age 1 derived from the Greenland Shrimp and Fish Survey. A conversion factor for the times series 1991-2004 was applied. Horizontal line is the average abundance for the period 1991-2023.

e) Assessment Results

During the 2024 SC June meeting a surplus production model in continuous time (SPiCT) model was presented and accepted as a valid assessment tool for this stock. The SPiCT model used as input data a standardized combined index for the exploitable biomass of the stock (biomass > 35 cm fork length), as well as commercial catch data. The index combined the shallow survey in 1AF and the deep surveys in Divisions 0A-1CD with a Delta-Lognormal Generalized Additive Model (Delta-GAM).

The relative B/B_{msy} was 1.3, and the relative F/F_{msy} was 0.78 (Figure 1.8) in 2023.

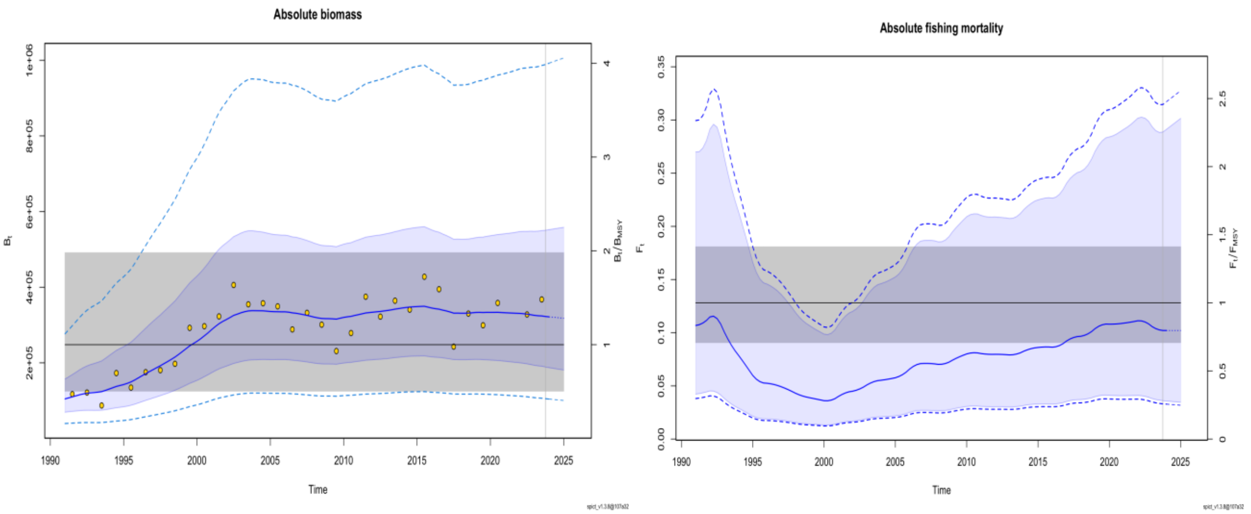


Figure 1.8. Biomass and fishing mortality for Greenland halibut in Subareas 0+1 offshore. Dash blue line: conf. limit for absolute biomass, Blue shaded region: conf. limit for relative biomass, Grey shaded region – conf. limit for B_{msy}.

Estimates of stock dynamic parameters from the SPiCT model are given in Table 1.1

Table 1.1. Parameters from SPiCT.

	Estimate	CI lower	CI upper	log.est
alpha2 (noise term for survey, α = SDIndex/SDBiomass)	2.70	1.22	5.97	0.99
beta (β = SDCatch/SDF)	0.44	0.22	0.85	-0.83
r (intrinsic population growth rate)	0.26	0.18	0.36	-1.36
m (deterministic MSY)	32228	18778	55311	10.38
K (Carrying capacity)	499913	252217	990865	13.12
q1 (Catchability for survey)	0.07	0.02	0.19	-2.72
sdb (Standard deviation, biomass)	0.06	0.03	0.11	-2.83
sdf (Standard deviation, fishing mortality)	0.14	0.10	0.20	-1.97
sdi (Standard deviation, Survey)	0.16	0.12	0.22	-1.84
Sdc (Standard deviation, catch)	0.06	0.04	0.10	-2.81
B (Biomass end of 2023)	322570	105264	988479	12.68
F (Fishing mortality end of 2023)	0.10	0.03	0.31	-2.28
Relative reference points				
B/Bmsy, end current year (proj.) (%)	1.30	0.76	2.22	0.26
F/Fmsy, end current year (proj.) (%)	0.80	0.28	2.25	-0.23

f) Retrospective analysis

A five-year retrospective analysis was performed (Figure 1.9) and results were found to be consistent for biomass and fishing mortality with respect to the removal of successive years.

The model tends to under-estimate biomass and over-estimate fishing mortality, but this directional pattern is reduced for relative biomass and fishing mortality. Interannual changes are well within levels of uncertainty estimate in the model.

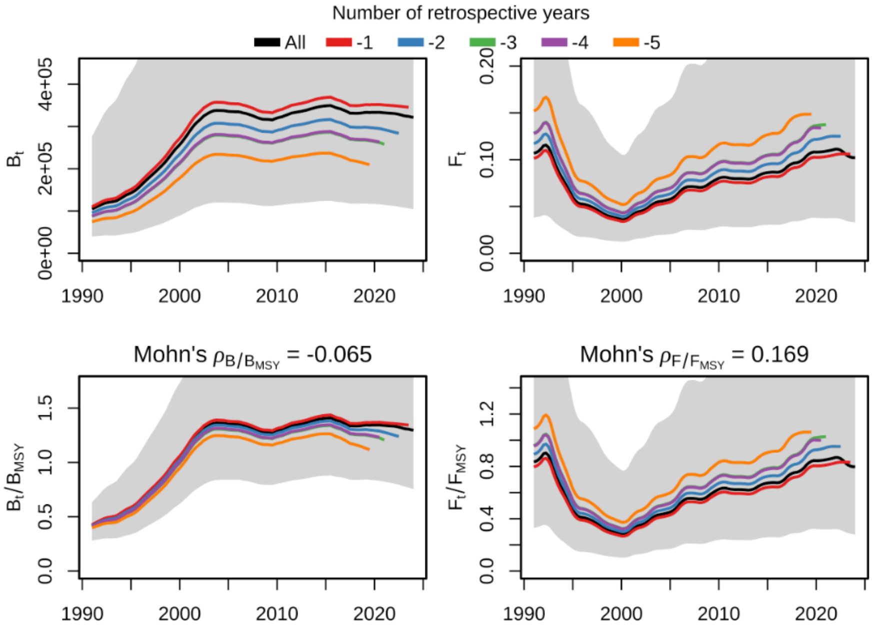


Figure 1.9. Five-year retrospective plots of fishing mortality and fishable biomass. Confidence intervals are 95%.

g) Precautionary Reference Points

The SPiCT model was used to derive reference points for the stock. Reference points are estimated from the surplus production model. Scientific Council considers that 30% B_{msy} is a suitable biomass limit reference point (B_{lim}) and F_{msy} a suitable fishing mortality limit reference point (F_{lim}) for stocks where a production model is used. At present, the risk of the stock being below B_{lim} is less than 1% and the risk of being above F_{lim} is less than 34% (Figure 1.10).

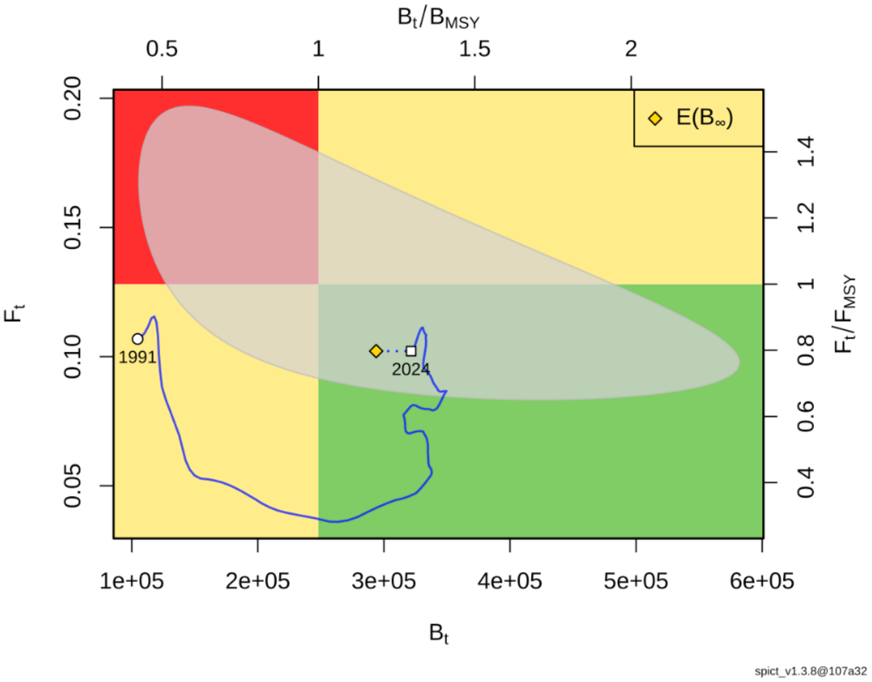


Figure 1.10. Biomass vs fishing mortality during 1991 – 2023. The yellow diamond indicates the mean biomass over a long period if the current fishing pressure remains. This is the fished equilibrium and is denoted E(B_{inf}). The grey shaded banana-shaped area indicates the 95% confidence region of the pair F_{msy}, B_{msy}.

h) State of the stock

Biomass: Biomass is currently above B_{msy} (B/B_{msy} = 1.3). The probability of being below B_{lim} is currently < 1%.

Fishing mortality: Fishing mortality is currently below F_{msy} (F/F_{msy} = 0.78). The probability of being above F_{msy} is currently 34%.

Recruitment: It is unclear if age-1 abundance is representative of future recruitment, but it is considered to contribute to the perception of overall stock and has been below the time series average (1991-2023) in the last two years.

i) Projections

Medium-term projections were carried forward to the year 2026 for catch scenarios with catch = TAC = 33 305 t for 2024. Constant removals were applied from 2025-2026 at several levels of F (F=0, $F_{status\ quo}$, 75% F_{msy}, 85% F_{msy} and $F_{msy,}$) or catch (TAC and 90% TAC). At the end of the projection period, the risk of biomass being below B_{lim} was less than 1 % in all cases.

For the $F_{\text{status quo}}$ projections, the probability that $F > F_{lim}$=F_{msy} in 2025-2026 was 34%, and with 2/3 F_{msy} the probability was 23%. At 75% F_{msy}, the probability that F > F_{lim} was 30%. Projected at the level of 85% F_{lim}, the probability that F > F_{lim} was 39% and for F_{msy} projections, this probability increased to 50%. For biomass projections, in all scenarios for 2025-2026 the probability of biomass being below B_{lim} was less than 1%. The probability that biomass in 2026 is less than biomass in 2024 is between 19 and 70% for all projections (Tables 1.2 and 1.3, Figure 1.11).

Table 1.2. Medium-term projections for Greenland halibut. Estimates for yield and relative biomass (B/B_{msy}) with 80% confidence interval are shown, for projected F values of F_0, $F_{status\ quo}$, 75%F_{msy}, 85%F_{msy} and F_{msy}. Catch in 2024 were assumed at 33 305 t (TAC).

Projections with Catch 2024 = 33305 t		
Year	Yield (´000t)	Projected relative Biomass (B/Bmsy) median (80%CL)
F =0		
2024	33.3	1.3 (0.91-1.84)
2025	0	1.28 (0.89 - 1.85)
2026	0	1.4 (1.02-1.92)
Fstatusquo = 0.102		
2024	33.3	1.3 (0.91-1.84)
2025	32.33	1.28 (0.89-1.85)
2026	32.04	1.27 (0.87-1.86)
2/3Fmsy= 0.085		
2024	33.3	1.3 (0.91-1.84)
2025	27.23	1.28 (0.89- 1.85)
2026	27.39	1.28(0.91-1.88)
75%Fmsy = 0.096		
2024	33.3	1.3 (0.9-1.85)
2025	30.51	1.28 (0.89- 1.86)
2026	30.4	1.26 (0.89-1.87)
85%Fmsy = 0.109		
2024	33.3	1.3 (0.91-1.84)
2025	34.42	1.27 (0.89-1.85)
2026	33.91	1.26 (0.86-1.85)
Fmsy = 0.128		
2024	33.3	1.3 (0.91-1.84)
2025	40.21	1.28 (0.89-1.85)
2026	38.92	1.24 (0.83-1.84)
TAC = 33 305		
2024	33.3	1.3 (0.91-1.84)
2025	33.3	1.28 (0.89-1.85)
2026	33.3	1.27 (0.86-1.85)
90% TAC = 29 975		
2024	33.3	1.3 (0.91-1.84)
2025	29.97	1.28 (0.89-1.85)
2026	29.97	1.28 (0.88-1.86)

Table 1.3. Yield (000 t) and risk (%) of B_y<B_{msy} and F_y>F_{msy} (F_{lim}=F_{msy}) at projected F values of $F0$, $F_{status\ quo}$, 75% F_{msy}, 85% F_{msy}, F_{msy}, TAC and 90%TAC. Catch in 2024 was assumed at 33 305 t (TAC).

	yield (´000t)		P (F> Flim)			P(B<Blim)			P(B>Bmsy)			P(B2026 < B2024)
Catch2024= 33305	2025	2026	2024	2025	2026	2024	2025	2026	2024	2025	2026	
F=0	0	0	34%	<1%	<1%	<1%	<1%	<1%	83%	81%	91%	19%
F statusquo	32.33	32.04	34%	34%	34%	<1%	<1%	<1%	83%	81%	79%	60%
2/3 Fmsy	27.23	27.39	34%	23%	23%	<1%	<1%	<1%	83%	81%	81%	53%
75 % Fmsy	30.51	30.4	34%	30%	30%	<1%	<1%	<1%	83%	81%	80%	58%
85% Fmsy	34.42	33.91	34%	38%	39%	<1%	<1%	<1%	83%	81%	78%	63%
Fmsy	40.21	38.92	34%	50%	50%	<1%	<1%	<1%	83%	81%	76%	70%
TAC	33.3	33.3	34%	36%	37%	<1%	<1%	<1%	83%	81%	79%	62%
90%TAC	29.97	29.97	34%	29%	29%	<1%	<1%	<1%	83%	81%	80%	57%

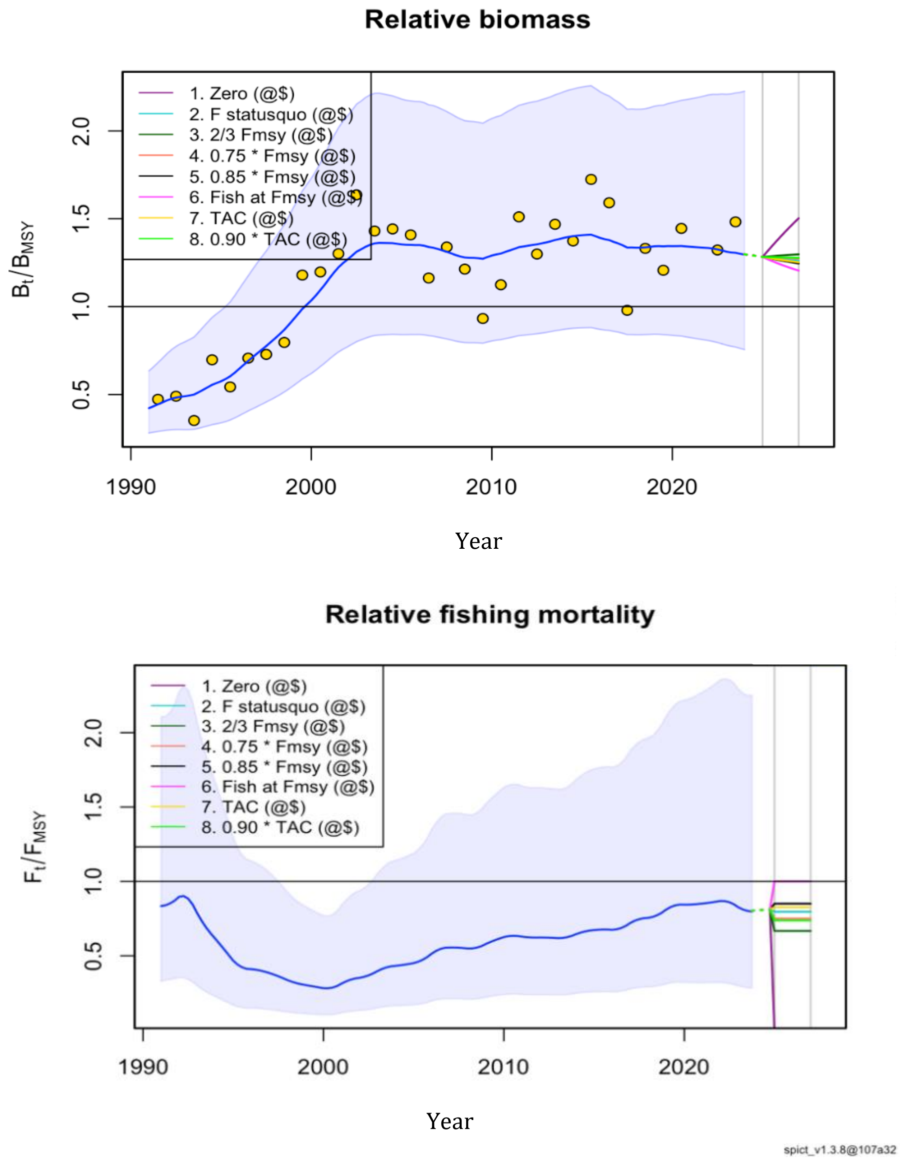


Figure 1.11. Greenland halibut Subareas 0+1 offshore: stochastic projections from 2025-2026 at five levels of removals (F=0, $F_{\text{status quo}}$, 75% F_{msy}, 85% F_{msy}, F_{msy}, TAC and 90%TAC) with catch equal to 33 305 t for 2024. Top plot shows projected relative biomass ratios (B/B_{msy}), and lower plot is projected relative fishing ratios (F/F_{msy}).

The next full assessment of this stock is expected to be in 2026.

j) Research Recommendations:

STACFIS recommends to further explore the uncertainty in the assessment model.

2. Greenland halibut (*Reinhardtius hippoglossoides*) Division 1A inshore Divisions 1BC inshore, Division 1D inshore and Divisions 1EF inshore

Full Assessment (SCR Doc. 24/019, 025, 026, 027, 028, 029, 031, 034, 035; SCS Doc. 24/14)

a) Introduction

The fishery targeting Greenland halibut developed in the Disko Bay and south Greenland in the beginning of the twentieth century. The fishery is conducted with longlines or gillnets from small vessels, open boats and through holes in the sea ice during the winter months. The fishery gradually spread from the Disko Bay to Uummannaq and Upernavik, but the catches remained low until the 1980s.

Quota regulations were introduced in 2008. In 2012, the TAC was split in two components with ITQ's for vessels and shared quota for small open boats. To protect juvenile fish in the area, sorting grids have been mandatory since 2002 in the offshore shrimp fishery at West Greenland and since 2011 in the inshore shrimp fishery in the Disko Bay. Trawl fishery is not allowed in the Uummannaq fjord and Upernavik area. In 2017, mesh size in gillnets were reduced from 110 mm to 95mm half mesh.

The stocks (Disko Bay, Uummannaq and Upernavik) are believed to depend on recruits from the offshore stock and adults are considered isolated from the stock in Davis Strait and Baffin Bay. Advice is given for each of the three areas on a two-year basis and a separate TAC is set for each of the inshore areas in Division 1A. Inshore stocks south of Division 1A were separated from the offshore stock in 2020.

Disko Bay

b) Catch history

Catches increased in the 1980s, peaked from 2004 to 2006 at more than 12 000 t, but then decreased substantially to just above 6 000 t in 2009. From this level, catches gradually increased reaching 10 760 t in 2016. In 2017, catch rates were unusually low and only 6 409 t were caught in Disko Bay. Since then, catches have gradually increased reaching 11 435 t in 2023 (Table 2.1 and Figure 2.1.1).

Table 2.1. Recent TACs and catches ('000 tons) are as follows:

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
1A Disko Bay – TAC	9.2	9.6	9.1	9.2	11.1	10.6	10.3	11.4	12.7	10.6
1A Disko Bay - Catch	8.7	10. 8	6.4	8.4	8.8	7.6	9.0	10.3	11.4	
STACFIS Total	8.7	10. 8	6.4	8.4	8.8	7.6	9.0	10.3	11.4	

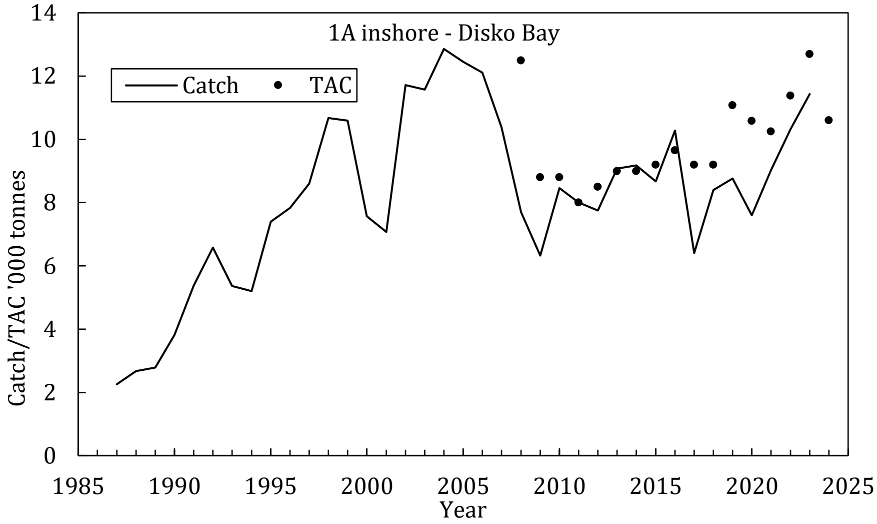


Figure 2.1.1. Greenland halibut in Division 1A inshore: Greenland halibut catches and TAC in t in Disko Bay.

c) Data overview

i) Commercial fishery data

Mean length in the landings gradually decreased for more than a decade in both the winter and summer longline fishery and in the overall mean length weighted by gear and fishing ground (Figure 2.1.2).

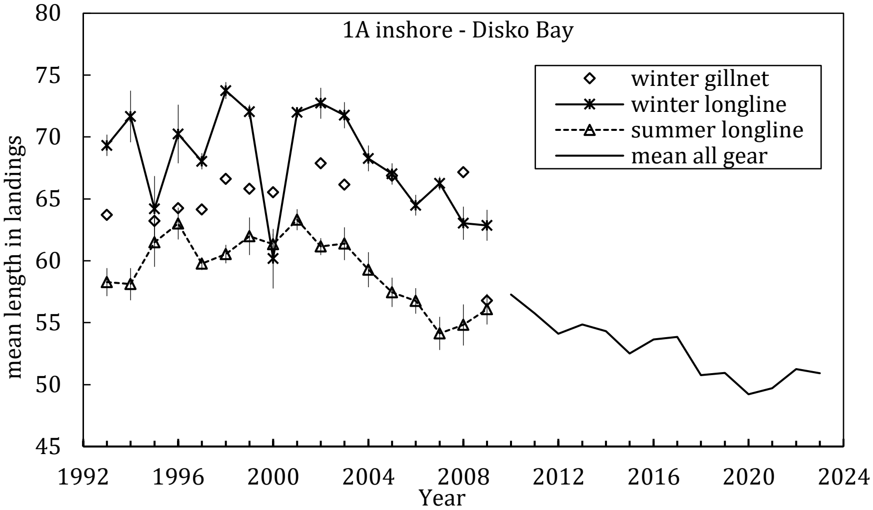


Figure 2.1.2. Greenland halibut in Division 1A inshore: Mean length in landings from longline fishery by season (summer and winter) and overall mean taking account of fishing ground, season and gear.

ii) CPUE indices from the commercial catch

Two commercial CPUE indices are presented for the stock, one based on logbooks and one based on factory landings data (Figure 2.1.3). These indices decreased from 2007 to 2017 but have increased since then.

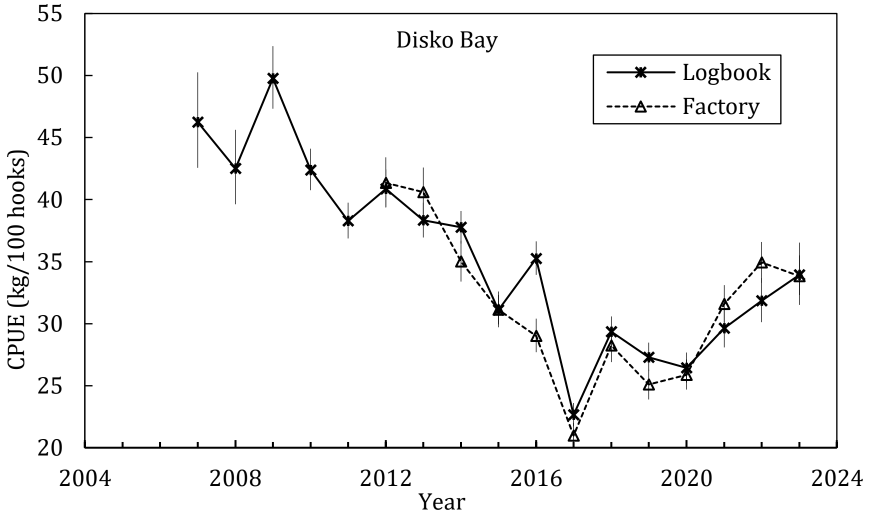


Figure 2.1.3. Greenland halibut in Division 1A inshore: Commercial CPUE from logbooks (vessels) and factory data (vessels, boats and ice fishery) fishing in Disko Bay.

In each individual area an ALK based on age readings from the surveys was combined with commercial landings and length frequencies accounting for month and gear, to create the Catch At Age bubble plot (Figure 2.1.4). The catch at age indicates a gradual shift towards younger Greenland halibut in the catches and the fishery in 2023 was dominated by ages 5, 7 and 8.

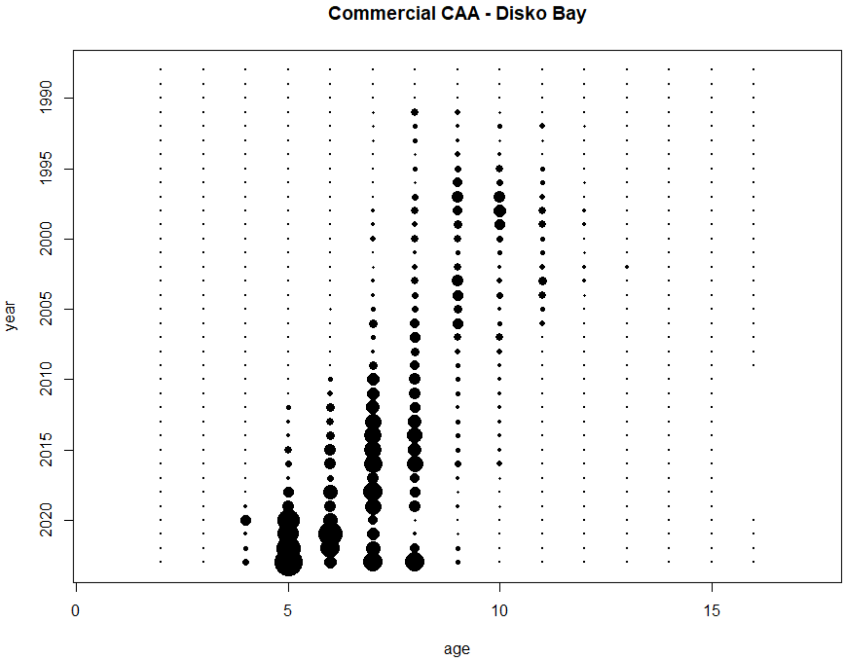


Figure. 2.1.4. Greenland halibut in Division 1A inshore: Disko Bay commercial catch at age.

iii) Research survey data

The Disko Bay part of Greenland Shrimp and Fish Survey (Figure 2.1.5) indicated increasing biomass and abundance trends during the 1990s. After the gear change in 2005, the biomass and abundance indices gradually decreased and then stabilized after 2014, the last two years returned to a higher level.

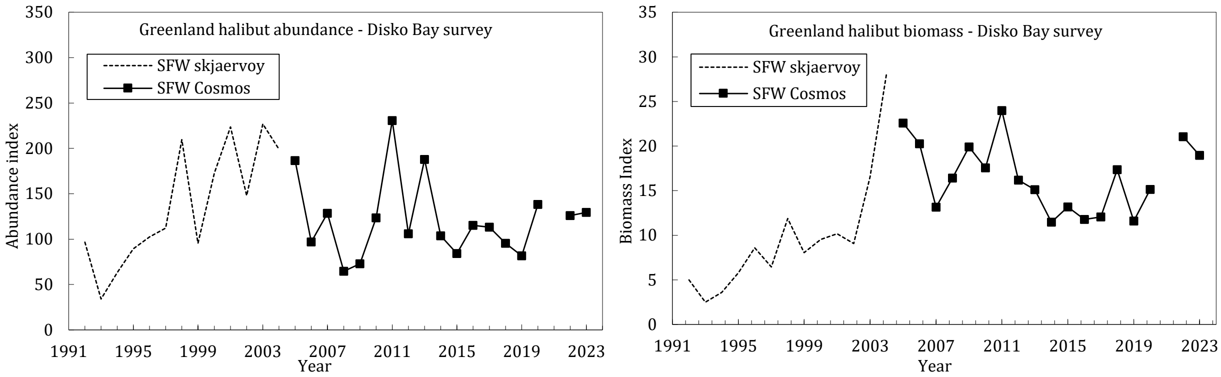


Figure 2.1.5. Greenland halibut in Division 1A inshore: Abundance and biomass indices in the Disko Bay from the Greenland Shrimp Fish trawl survey.

From the Disko Bay gillnet survey, catch in Numbers-Per-Unit-Effort (NPUE) can be taken as an index of abundance and the gillnet Catch-Per-Unit-Effort can be taken as an index of Biomass (Figure 2.1.6). The NPUE slowly decreased from 2001 to 2017. After 2017 the NPUE have been above average since 2019. The NPUE index shows a similar trend as the abundance of Greenland halibut larger than 35 cm from the Shrimp and fish trawl survey. The increasing numbers of Greenland halibut is related to good recruitment. The gillnet survey CPUE time series show a similar trend.

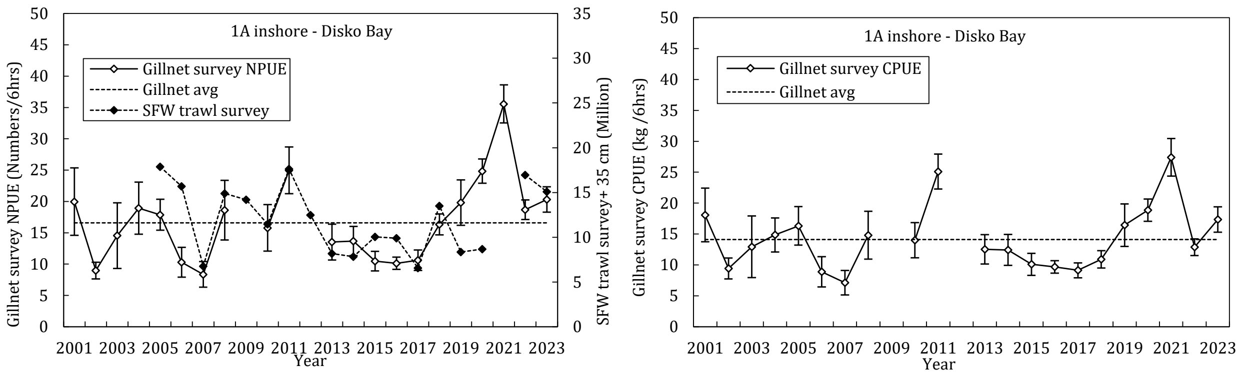


Figure 2.1.6. Greenland halibut in Division 1A inshore: Gillnet survey NPUE and CPUE +/-SE.

Division 1A - Uummannaq

a) Catch history

Catches in the Uummannaq fjord gradually increased from the 1980's reaching 8 425 t in 1999, but then decreased to ~ 5 000 in 2002. Since 2004, catches gradually increased reaching 10 670 t in 2020. In 2023 catch decreased to 8 250 t (Table 2.2.1 and Figure 2.2.1).

Table 2.2.1. Recent TACs and catches ('000 tons) are as follows:

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
1A Uummannaq - TAC	9.5	9.9	9.5	9.5	9.9	9.5	9.6	9.8	9.6	9.7
1A Uummannaq - catch	8.2	10.3	9.0	8.8	10.2	10.7	9.6	9.0	8.3	
STACFIS Total	8.2	10.3	9.0	8.8	10.2	10.7	9.6	9.0	8.3	

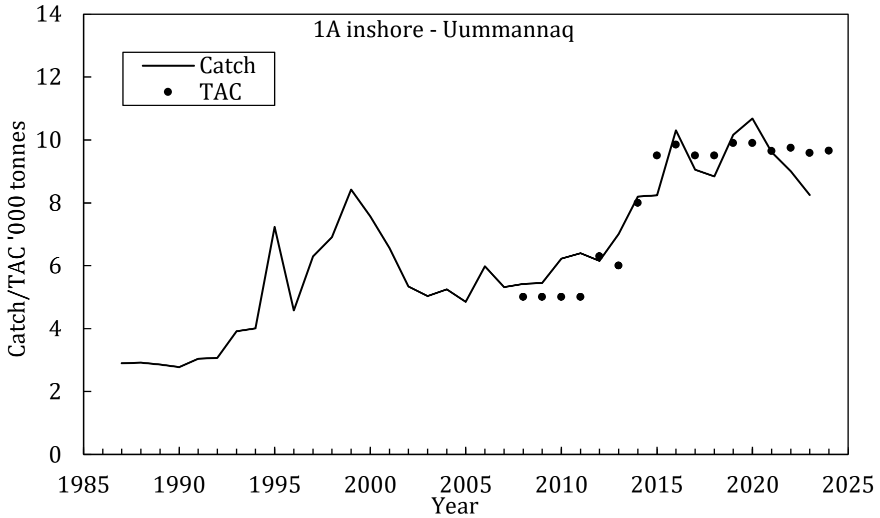


Figure 2.2.1. Greenland halibut in Division 1A inshore: Catches and TAC in t in Uummannaq.

b) Data overview

i) Commercial fishery data

In **Division 1A Uummannaq,** the length distributions in the commercial landings have gradually decreased since 1993 (Figure 2.2.2). Since 2020 the mean size has decreased close to 6 cm.

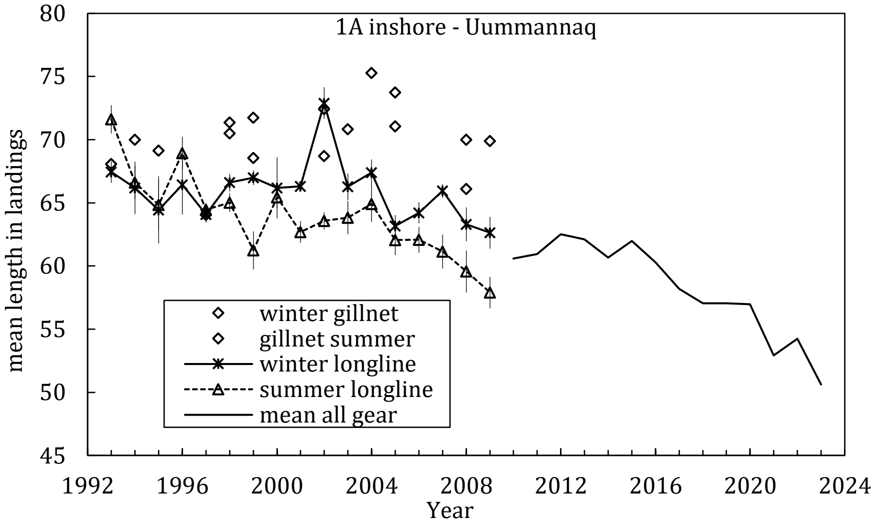


Figure 2.2.2. Greenland halibut in Division 1A inshore: Mean length in landings from longline and gillnet fishery by season and overall mean weighted by gear.

CPUE indices from the commercial catch

The standardized CPUE based on logbooks and factory landings have declined since around 2014 and in 2023 they were the lowest for both series (Figure 2.2.3).

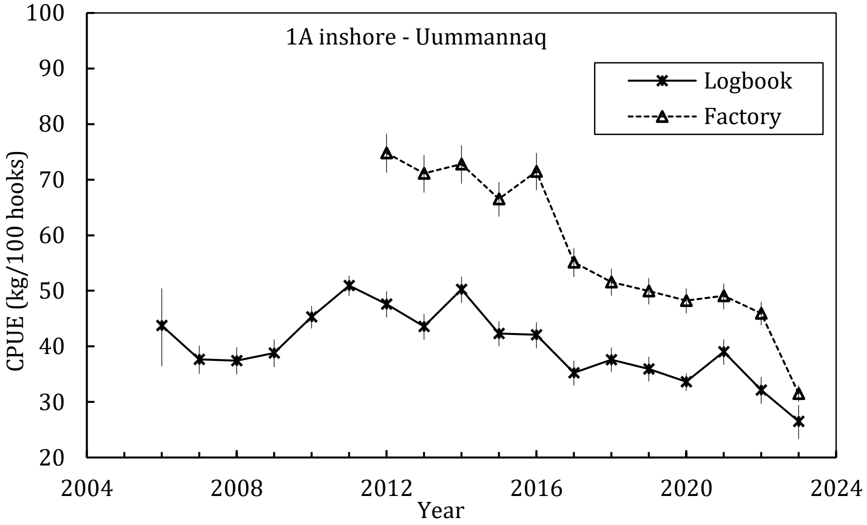


Figure 2.2.3 Greenland halibut in Division 1A inshore: Commercial CPUE from logbooks (vessels) and factory data (vessels, boats and ice fishery) fishing in Uummannaq.

The catch at age indicate a gradual shift towards younger Greenland halibut in the catches and the fishery in 2023 was mainly based on ages 5 and 6 (Figure 2.2.4).

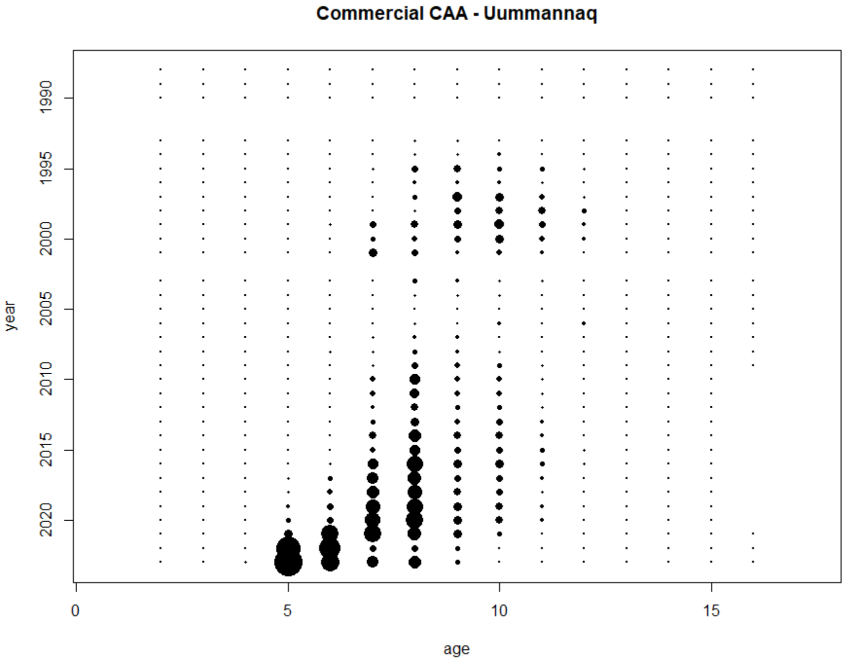


Figure 2.2.4. Greenland halibut in Division 1A inshore: Uummannaq commercial CAA.

ii) Research survey data

The Uummannaq gillnet survey indices declined from 2015-2018, increased until 2021 and have declined in the last two years (Figure 2.2.4).

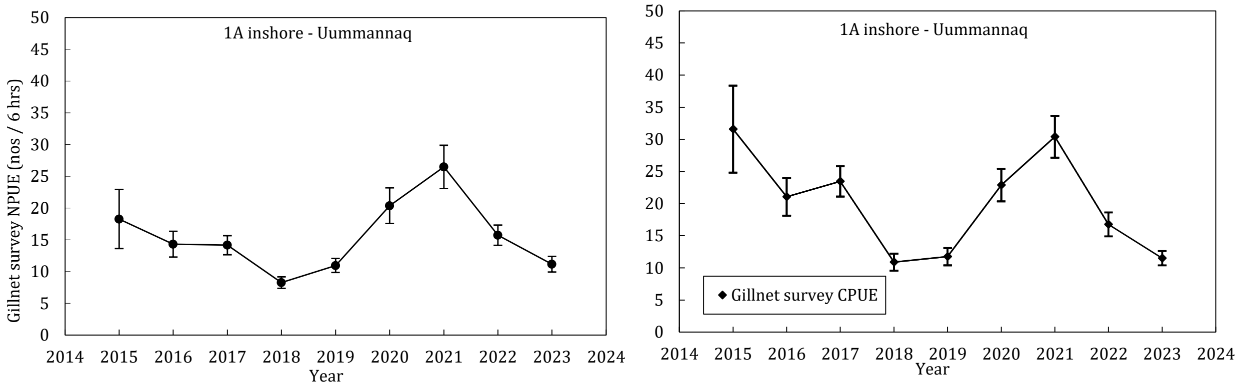


Figure 2.2.4. Greenland halibut in Division 1A inshore: Gillnet survey NPUE and CPUE +/-SE.

Division 1A - *Upernavik*

a) Catch history

Catches increased from the mid 1980s and peaked in 1998 at a level of 7 000 t. Landings then decreased sharply, but during the past 15 years, catch has gradually increased to a level between 7 500 and 9 000 t (Table 2.3.1 and Figure 2.3.1).

Table 2.3.1. Recent catches and advice ('000 t) are as follows:

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
1A Upernavik - TAC	9.5	9.6	9.7	9.5	8.5	8.5	9.9	10.0	9.5	9.3
1A Upernavik - Catch	6.3	7.4	6.8	7.5	9.0	7.6	8.5	7.7	7.3	
STACFIS Total	6.3	7.4	6.8	7.5	9.0	7.6	8.5	7.7	7.3	

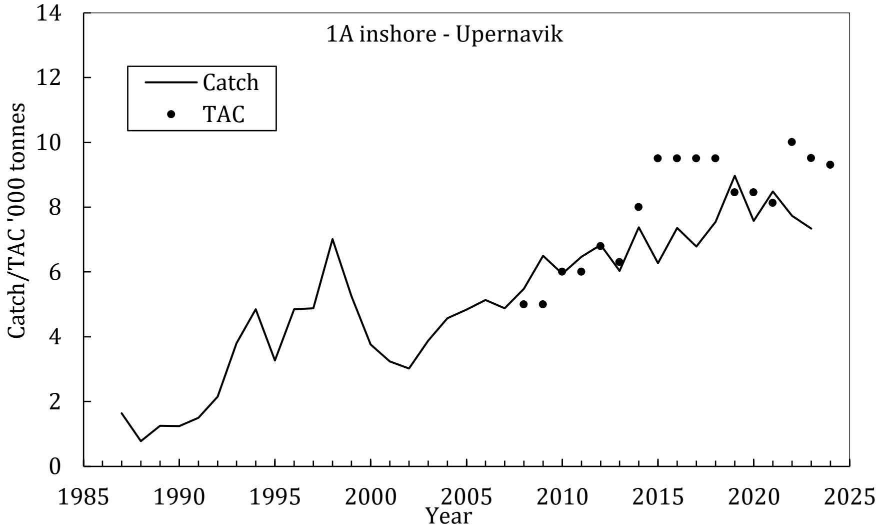


Figure 2.3.1. Greenland halibut in Division 1A inshore: Catches and TAC in t in Upernavik.

b) Data overview

i) Commercial fishery data

The mean length in the commercial landings decreased from 1993 to 1998. From 1999 to 2009, the mean length in the longline fishery remained constant, but has since then decreased further.

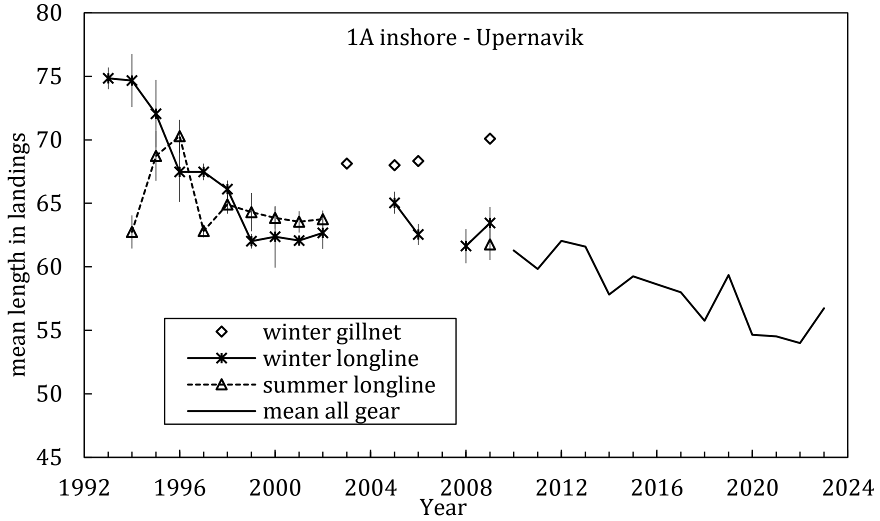


Figure. 2.3.2. Greenland halibut in Division 1A inshore: mean length in landings from longline fishery by season (summer and winter) and after 2010 overall mean taking account of fishing ground, season and gear.

CPUE indices from the commercial catch

CPUE based on logbooks gradually decreased from 2006. The CPUE based on factory landings data show an identical trend since 2012 (Figure 2.3.3).

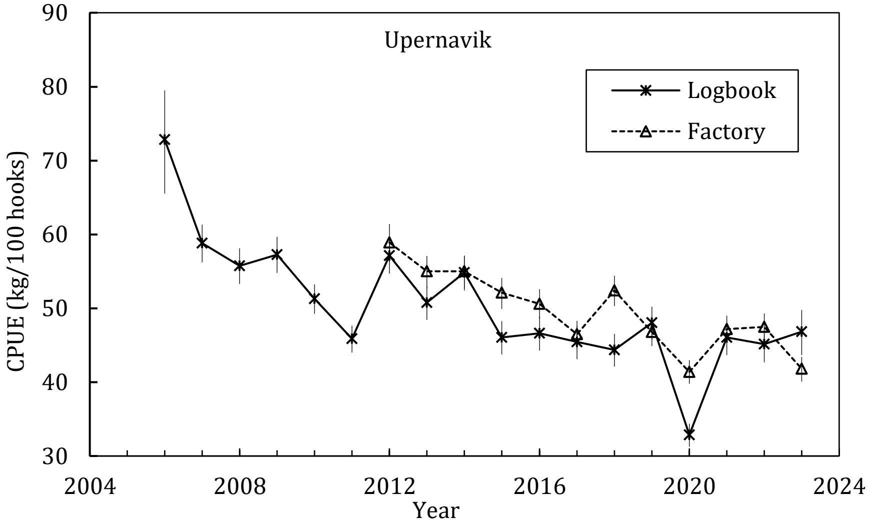


Figure. 2.3.3. Greenland halibut in Division 1A inshore: Commercial CPUE from logbooks (vessels) and factory data (vessels, boats and ice fishery) fishing in Upernavik.

The catch at age indicates a gradual shift towards younger Greenland halibut in the catches and that the fishery in 2023 was mainly based on ages 7 and 8 (Figure 2.3.4).

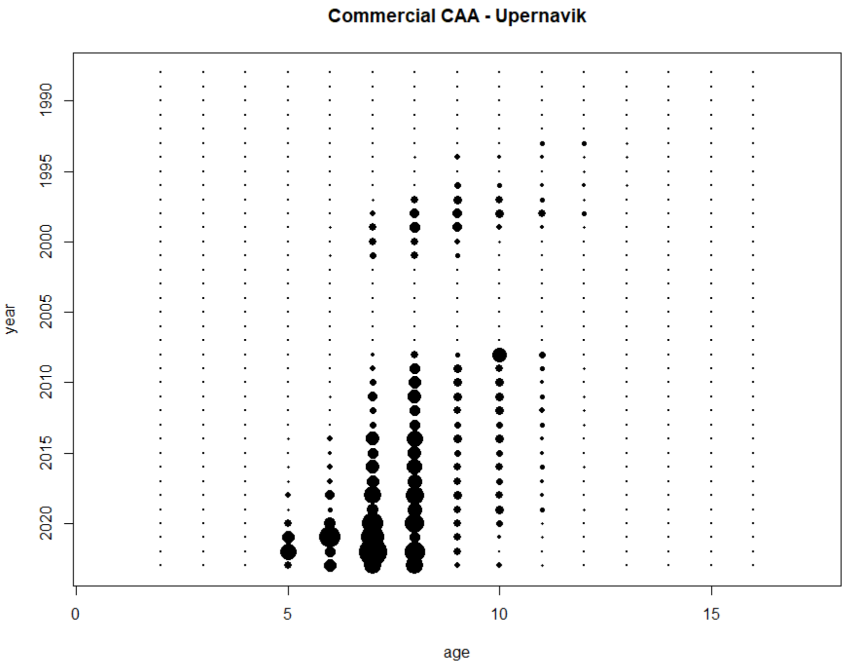


Figure. 2.3.4. Greenland halibut in Division 1A inshore: Upernavik commercial CAA.

ii) Research survey data

The Upernavik gillnet survey NPUE and CPUE increased in 2020 but has gradually decreased since then (Figure 2.3.4).

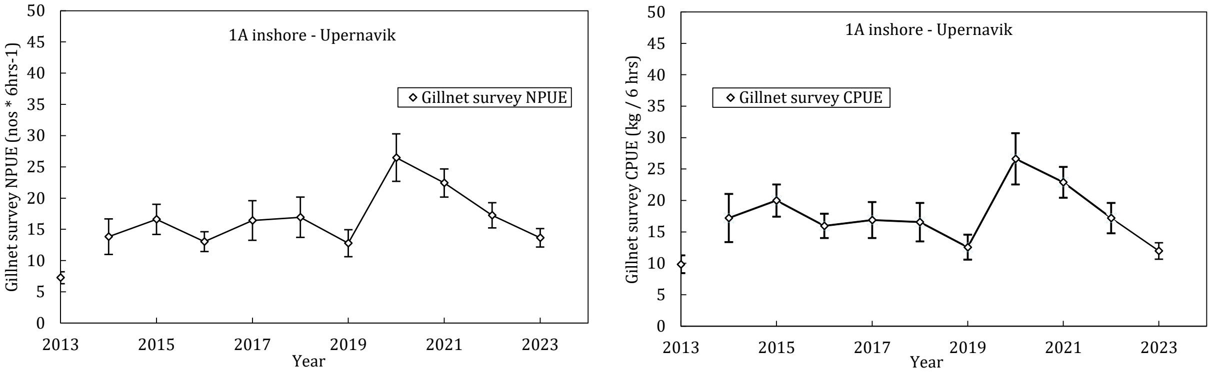


Figure 2.3.4. Greenland halibut in Division 1A inshore: gillnet survey NPUE (left) and CPUE (right) +/- SE.

c) Assessment results

Assessment: No analytical assessment was performed for any of the stocks.

Biomass: Unknown.

Fishing mortality: Unknown.

Recruitment: Unknown

d) State of the stock

Disko Bay:

The fishery has increased gradually over 4 decades, with signs of a decrease in the stock biomass in the most recent two decades. Although the commercial CPUEs have increased since 2017, the indices remain 17% below 2012 values. The mean size of the landed fish has decreased from 57 cm in 2010 to 51 cm in 2023 equivalent to a 32 % reduction in mean weight. After an increase in gillnet survey indices from 2017 to 2021, survey indices have quickly returned to around average levels. The trawl survey biomass indices are slightly higher in the recent two years.
The available data indicate that the fishery is currently based on incoming year classes ages 5, 7 and 8 and will be affected by variability in recruitment.

Uummannaq:
The commercial logbook CPUE has decreased by 44 % and the factory based CPUE has decreased by 58 % since 2012. The mean size of the landed fish have decreased from 60 cm in 2016 to 50 cm in 2023 equivalent to a 43 % reduction in mean weight. The fishery is mainly based on incoming year classes ages 5 and 6 in 2023. The stock shows signs of depletion.

Upernavik:

The commercial logbook CPUE has decreased by 18 % and the factory data based CPUE has decreased by 29 % since 2012. The mean size of the landed fish have decreased from 62 cm in 2013 to 57 cm in 2023 equivalent to a 23 % reduction in mean weight. The gillnet survey NPUE and CPUE increased relative to earlier levels in 2020 and 2021 but has decreased since then. The fishery is currently based on ages 7 and 8.

The gradual reduction in the size of the landed fish and minor decrease in CPUE could indicate a slow decrease of the stock.

These stocks will next be assessed in 2026.

e) Research recommendations

STACFIS **recommended** that *work continue on the surplus production model in a Bayesian framework or SPiCT continue.*

STATUS: ongoing work on SPiCT model development occurred and future work is expected.

STACFIS **recommends** *investigation of mesh size selectivity on abundance biomass indices in the gillnet survey.*

3. Demersal redfish and deep-sea redfish (*Sebastes* spp.) in Subarea 1

Interim Monitoring Report (SCR Doc. 24/013, 019, 025; SCS Doc. 24/14)

a) Introduction

There are two demersal redfish species of commercial importance in NAFO Subarea 1, golden redfish (*Sebastes norvegicus*) and demersal deep-sea redfish (*Sebastes mentella*). Connectivity to other redfish stocks off East Greenland, the Irminger Sea, the Newfoundland and Labrador Shelf and Iceland is unclear.

Fisheries and Catches: Both redfish species (*S. norvegicus* and *S. mentella*) are included as redfish in the catch statistics. The fishery targeting demersal redfish in Subarea 1 increased during the 1950s and peaked in 1962 at more than 60 000 t. Catches then decreased and have remained below 1 000 tons per year after 1986 with few exceptions. Recent catches of redfish in Subarea 1 (excluding beaked pelagic redfish) is a mixture of bycatch of recruits small enough to pass through the sorting grids in shrimp trawls and a by-catch in other fisheries (Figure 3.1).

Recent catches ('000 tons) are as follows:

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
TAC	1	1	1	1	0	0	0	0	0	0
STATLANT 21	0.19	0.16	0.23	0.19	0.10	0.21	0.36	0.26	0.33	
STACFIS	0.26	0.17	0.24	0.19	0.14	0.20	0.26	0.29	0.33	

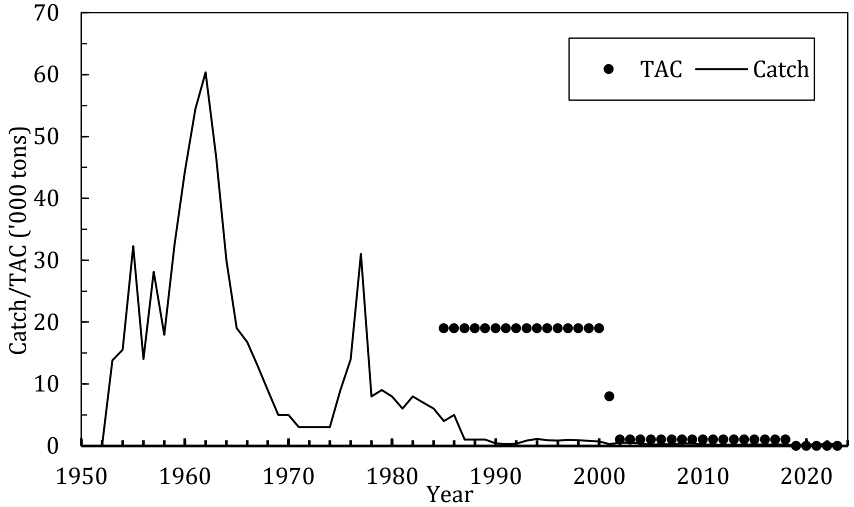


Figure 3.1. Demersal redfish in Subarea 1: catches and TAC.

b) Data Overview

i) Research survey data

There are 5 surveys of relevance for the stocks of demersal redfish in Subarea 1.

Golden redfish (*Sebastes norvegicus*)

The EU-Germany survey biomass index decreased in the 1980’s and was at a very low level in the 1990s (Figure 3.2). Increasing biomass indices of golden redfish were observed from 2005 to 2015, but the updated indices in 2016 and 2020 were at a lower level.

The Greenland shrimp and fish survey biomass index increased gradually from 2006 to 2016 and decreased thereafter. High indices in 2016 and 2019 were due to single hauls of large adult golden redfish (45-70 cm) that provided the majority of the total biomass estimate in those years. The EU-Germany survey and the Greenland shrimp and fish survey show similar overall trends with decreasing indices in the most recent decade (Figure 3.2). The Greenland deep-sea survey and the historic Greenland-Japan survey is less informative due to limited survey depth overlap with the depth distribution of Golden redfish.

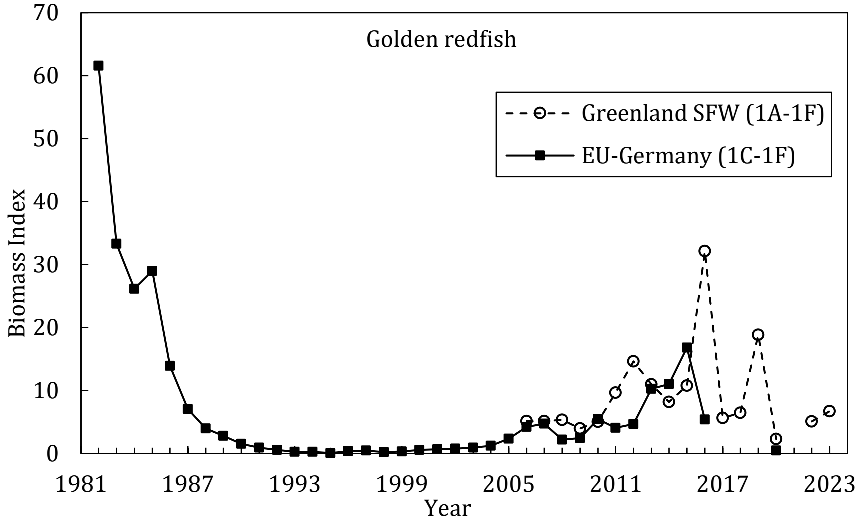


Figure 3.2. Golden redfish biomass indices in the EU-Germany survey and the Greenland shrimp and fish survey (no surveys in 2021).

Demersal deep-sea redfish (*Sebastes mentella*)

The Greenland-Japan survey (1BCD 400-1500m) biomass index gradually decreased from 1987 to 1995 (Figure 3.3). The Greenland deep-sea survey (1CD 400-1500m) had low biomass indices from 1997 to 2006 (Figure 3.3). After 2006, the Greenland deep-sea survey and the Greenland shrimp and fish survey biomass indices show similar increasing trends (Figure 3.3). Both surveys had decreasing biomass indices since 2013 (excluding outlier years in 2016 and 2023). The high 2016 biomass index in the Greenland shrimp and fish survey was caused by a single haul in Division 1D of adult deep-sea redfish between 25 and 40 cm and is not considered reflective of population trends. The EU-Germany survey is less informative due to limited survey depth overlap with the depth distribution of deep-sea redfish.

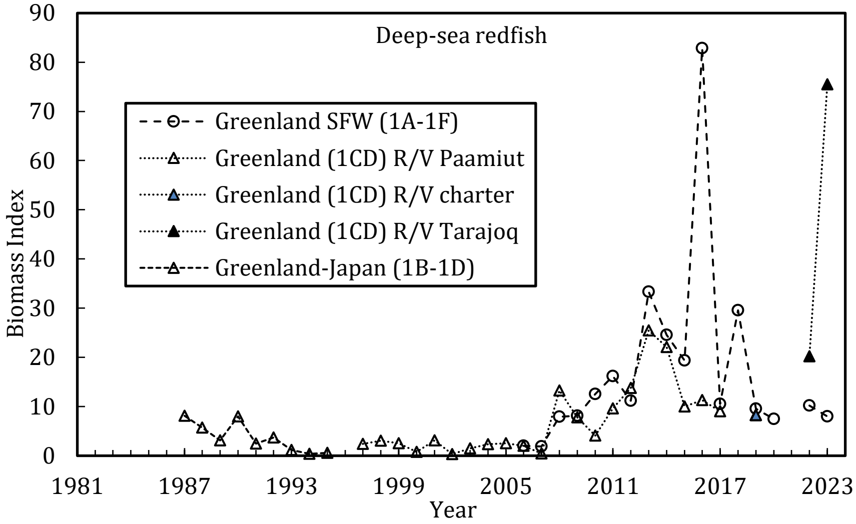


Figure 3.3. Demersal deep-sea redfish survey biomass from the Greenland shrimp and fish survey, the Greenland deep-sea survey and the Greenland-Japan survey.

Juvenile redfish (<17cm both species combined)

The EU-Germany survey regularly found juvenile redfish from 1984 to 2000. From 2001 to 2011, the abundance of juvenile redfish in the survey gradually decreased to a low level and from 2012 to 2015 no redfish less than 17 cm were identified in the survey (Figure 3.4). Recent recruitment is not comparable to past recruitment due to lack of historic separation of redfish species and recruits in the Greenland shrimp and fish.

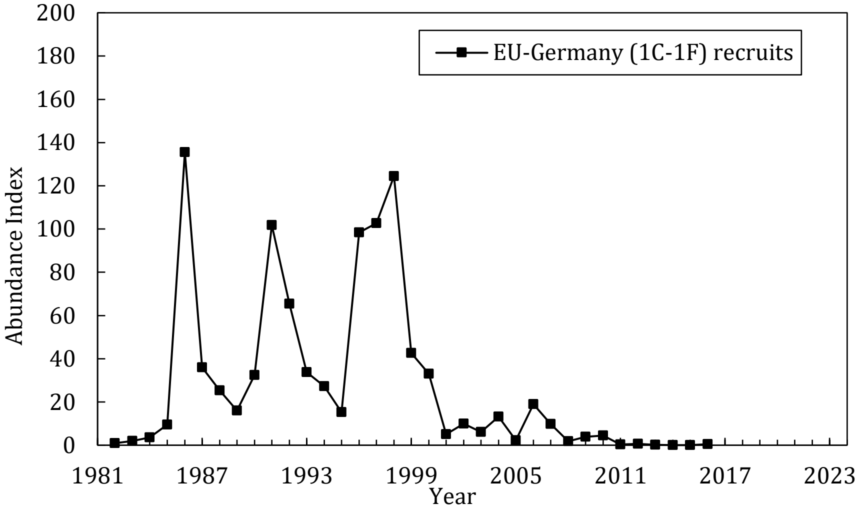


Figure 3.4. Juvenile redfish abundance indices for the EU-Germany survey (*Sebastes* spp. <17cm).

c) Conclusion

Golden redfish - *Sebastes norvegicus*

The stock was assessed in 2023 for the 2024-2026 period and current advice is “No directed fishery”. With the updated indices there is no basis for a reassessment. Recruitment has been at a low level from 2008-2018 and the biomass indices in the surveys remain low.

Deep-sea redfish - *Sebastes mentella*

The stock was assessed in 2023 for the 2024-2026 period and current advice is "No directed fishery". With the updated indices there is no basis for a reassessment. Recruitment has increased in the recent 5 years but was at a low level from 2008-2018 and the biomass indices in the surveys remain low.

This stock will next be assessed in 2023.

d) Research Recommendations

STACFIS **recommends** that *species composition and length-frequency distribution data from the Greenland shrimp and fish survey should be re-analysed to improve our understanding of recruitment for this stock*.

4. Wolffish in Subarea 1

Interim Monitoring Report (SCR Doc. 20/052, 24/019; SCS Doc. 23/14)

a) Introduction

Three species of wolffish are common in Greenland. Only Atlantic wolffish (*Anarhichas lupus*) and spotted wolffish (*Anarhichas minor*) are of commercial interest. Northern wolffish (*Anarhichas denticulatus*) is an unwanted discarded bycatch. Atlantic wolffish has a more southern distribution and seems more connected to the offshore banks and the coastal areas. Spotted wolffish can be found further north in West Greenland than Atlantic wolffish both in the fjords and offshore.

Fisheries and catches: Wolffish are primarily taken as bycatch in other fisheries. The commercial fishery for wolffish in West Greenland occurred from the 1950s to 1979 with catches of around 5 000 t per year (Figure 4.1). After 1980, the cod fishery gradually stopped in West Greenland and catches of wolffish also decreased during this period. To minimize by-catch in the shrimp fishery, offshore trawlers targeting shrimp have been equipped with 22mm grid separators since 2002 and inshore (Disko Bay) trawlers since 2011. Since 2015, reported catches have been at a lower level.

Recent nominal catches (000 tons) for Atlantic wolffish and spotted wolffish.

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Atlantic wolffish TAC	1.0	1.0	1.0	1.0	0	0	0	0	0	
Spotted wolffish TAC	1.0	1.0	1.0	1.0	0	0	0	0	0	
Combined wolffish TAC	2.0	2.0	2.0	2.0	0	0	0	0	0	
STATLANT 21	0.4	0.2	0.2	0.3	0.2	0.2	0.3	0.2	0.2	
STACFIS	0.4	0.2	0.2	0.3	0.2	0.2	0.3	0.2	0.2	

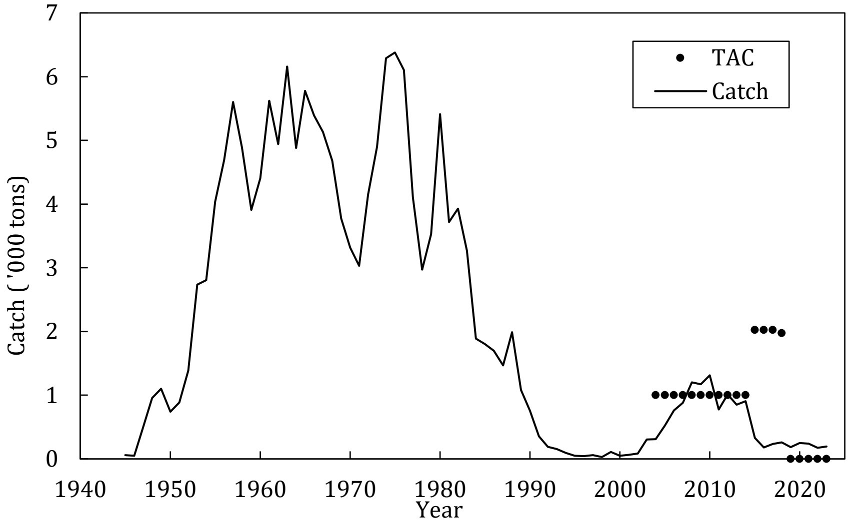


Figure 4.1. Wolffish in NAFO Subarea 1: Catches and TACs for Atlantic wolffish and spotted wolffish combined.

b) Data Overview

i) Research survey data

Indices for Atlantic wolffish and spotted wolffish are derived the EU-Germany survey and the Greenland shrimp and fish survey.

Atlantic wolffish:

The biomass index decreased substantially from 1982 to 1984 and continued to decrease until the late 1990's. Biomass was low from 1995 to 2015 (Figure 4.2). The EU-Germany abundance index of Atlantic wolffish was stable from 1982 to 2005 and then gradually decreased (Figure 4.2). However, the decrease may be related to a gradual reduction of the surveyed area. The Greenland Shrimp and fish survey biomass index slowly increased both before and after the gear change in 2005 (Figure 4.2) The abundance index has gradually increased throughout the time series (aside from the two outliers in 2005 and 2015) (Figure 4.2). The increasing abundance and biomass in the Greenland SFW survey has partly been observed in Divisions 1A-B, thus outside the EU-Germany survey area.

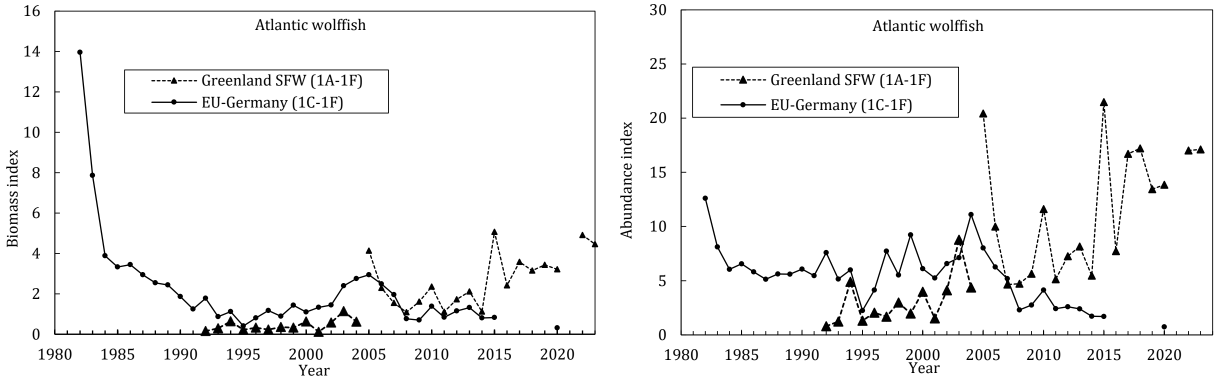


Figure. 4.2. Atlantic wolffish survey biomass index (left) and abundance index (right) from the surveys.

Spotted wolffish:

The EU-Germany survey biomass index decreased from 1982 to 1984 and remained at low levels during the 1990s (Figure 4.3). From 2004, the survey biomass increased, and the indices in 2013 to 2015 and 2020 were at the level observed at the beginning of the 1980s (Figure 4.3). The Greenland SFW survey biomass index was at low levels during the 1990s. Since 2010, survey biomass index has gradually increased although a decrease was observed in 2023 (Figure 4.3).

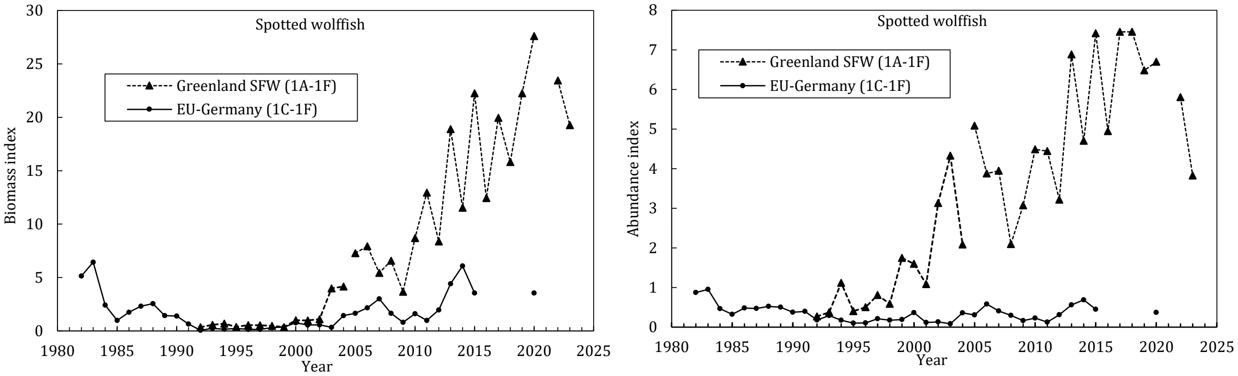


Figure. 4.3. Spotted wolffish survey biomass index (left) and abundance index (right) from the Greenland SFW and the EU-Germany survey.

c) Conclusion

Atlantic wolffish

The biomass index of the EU-Germany survey was below the long-term average in 2020. The survey biomass and abundance indices continue to increase in the Greenland Shrimp and fish survey. However, based on the updated indices there is no indication of any change in the stock.

Spotted wolffish

The biomass index decreased slightly in the Greenland shrimp and fish survey and the abundance also decreased slightly. Based on the updated indices there is no indication of any major change in the stock.

These stocks will next be assessed in 2026.

d) Research Recommendations

STACFIS **recommends** *investigation of fishing mortality and recruitment proxies*.

STOCKS ON THE FLEMISH CAP (NAFO DIVISION 3M)

Environmental Overview

The water masses characteristic of the Flemish Cap area are a mixture of Labrador Current Slope Water and North Atlantic Current water, generally warmer and saltier than the sub-polar Newfoundland Shelf waters with a temperature range of 3-4°C and salinities in the range of 34-34.75. The general circulation in the vicinity of the Flemish Cap consists of the offshore branch of the Labrador Current which flows through the Flemish Pass on the Grand Bank side and a jet that flows eastward north of the Cap and then southward east of the Cap. To the south, the Gulf Stream flows to the northeast to form the North Atlantic Current and influences waters around the southern areas of the Cap. In the absence of strong wind forcing the circulation over the central Flemish Cap is dominated by a topographically induced anti-cyclonic (clockwise) gyre. Variation in the abiotic environment influences the distribution and biological production of Newfoundland and Labrador Shelf and Slope waters where arctic, boreal and temperate species coexist. The elevated temperatures on the Flemish Cap result in relatively ice-free conditions that may allow longer phytoplankton growing seasons compared to the Grand Banks where cooler conditions prevail. The entrainment of nutrient-rich North Atlantic Current water around the Flemish Cap generally supports higher primary and secondary production compared with the adjacent shelf waters. The stability of this circulation pattern may also influence the retention of ichthyoplankton on the Grand Bank which may influence year-class strength of various fish and invertebrate species.

5. Golden redfish (*Sebastes norvegicus*) in Division 3M

Interim Monitoring Report (SCR Doc. 24/005; SCS Doc. 24/06, 07, 08, 11)

a) Introduction

There are three species of redfish that are commercially fished on Flemish Cap; deep-sea redfish (*Sebastes mentella*), golden redfish (*Sebastes norvegicus*) and Acadian redfish (*Sebastes fasciatus*). The term beaked redfish is used for *S. mentella* and *S. fasciatus* combined. Because of difficulties with identification and separation, all three species are reported together as 'redfish' in the commercial fishery. All stocks have both pelagic and demersal concentrations and long recruitment process to the bottom. Redfish species are long lived with slow growth.

The separation of the three species is made in the EU research survey. This requires extensive sampling effort by trained experts to examine internal features of individual redfish. The percentage per depth range of the three species in the EU Flemish Cap surveys was used to separate the Division 3M commercial catches into golden and beaked redfish. This method is also applied in assessments of beaked redfish.

i) Description of the fishery

Catches of golden redfish in Division 3M increased from 1 158 tonnes in 2006 to a peak of 7 662 tonnes in 2009. In 2010, catches decreased and remained relatively stable until 2014 between 2 000 and 3 000 tonnes. After 2014, catches decreased continuously to low levels over 2016 to 2023 (Figure 5.1). EU-Portugal, EU-Spain, the Russian Federation and EU-Estonia are responsible for the majority of the redfish landings over the last two decades.

Recent catches and TACs ('000 t) are as follows:

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
TAC[1]	6.7	7.0	7.0	10.5	10.5	8.6	8.4	10.9	11.2	17.5
STATLANT 21[1]	6.9	6.6	7.1	10.5	10.5	8.6	8.6	NA[3]	NA[3]	
STACFIS Total catch[1]	6.9	6.6	7.1	10.5	10.5	8.8	8.3	10.0	9.7	
STACFIS Catch[2]	1.7	0.4	0.3	0.1	0.3	0.1	0.1	0.6	0.3	

[1] TAC, STATLANT 21 and STACFIS Total catch refer to all three redfish species combined.

[2] STACFIS golden redfish catch estimate, based on golden redfish proportions on observed catch.

[3] NA - In 2022-2023, STATLANT 21 information is incomplete.

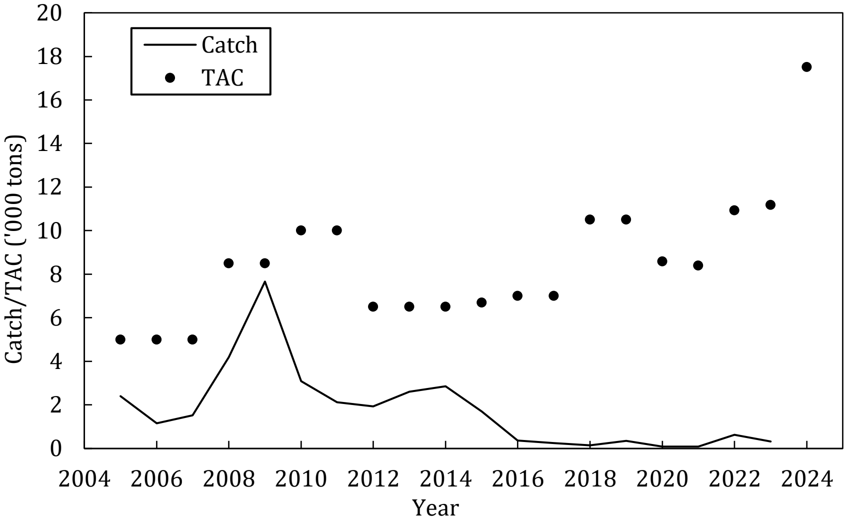


Figure 5.1. Golden redfish in Division 3M: Golden redfish catches and TACs of all three redfish species combined.

b) Data Overview

i) Research surveys

The 1988-2023 EU survey biomass and abundance indices for golden redfish are presented in Figure 5.2. Besides some sporadic small peaks, the survey stock abundance and biomass varied without trend at low levels since the beginning (1988) of the series until 2003. From 2004 to 2008 both abundance and biomass increased substantially due to recruitment. Since then, biomass and abundance have declined and in 2023 are at low levels. Survey results are noisy, with the characteristic variance of redfish indices, but broad trends show through the noise.

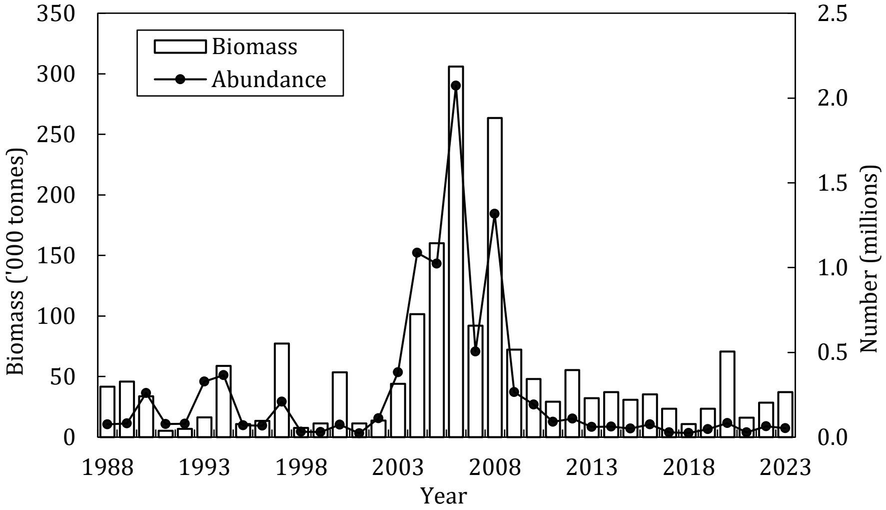


Figure 5.2. Golden redfish in Division 3M: EU biomass and abundance indices, 1988-2023.

c) Conclusions

The perception of the stock status has not changed.

Given the current status of the stock, it has not been considered appropriate to apply an assessment model or to give advice for golden redfish separately. Nevertheless, as in previous years, advice for golden redfish is given indirectly based on the Division 3M beaked redfish assessment (advice of 3M redfish applies the current percentage of golden redfish). Scientific Council will continue to monitor the golden redfish stock status and provide advice as part of the beaked redfish advice.

The next assessment of the stock is planned for when the dynamic of the stock changes.

6. Cod (*Gadus morhua*) in Division 3M (full assessment)

Full Assessment (SCS Doc. 24/06, 24/08, 24/10, 24/11; SCR Doc. SCR 24/05 and 24/16)

a) Introduction

The cod fishery on Flemish Cap has traditionally been a directed fishery by Portuguese trawlers and gillnetters, Spanish pair-trawlers and Faroese longliners. Cod has also been taken as bycatch in the directed redfish fishery by Portuguese trawlers. Estimated bycatch in the Division 3M shrimp fisheries is low.

The mean reported catch was 32 000 t from 1963 to 1979 with high inter annual variability. Reported catches declined after 1980, when a TAC of 13 000 t was established, but Scientific Council regularly expressed its concern about the reliability of some catches between 1963 and 1988. Alternative estimates of the annual total catch since 1988 were made available in 1995 (Figure 6.1), including non-reported catches and catches from non-Contracting Parties.

The fishery was under moratorium between 1999 and 2009. Annual bycatches between 2000 and 2005 were estimated to be below 60 t, increasing since then until the reopening of the fishery in 2010 with a TAC of 5 500 tons. Since 2013, catches have remained at the level of the TAC.

Recent catches ('000 tonnes) are as follow:

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
TAC	13.8	13.9	13.9	11.1	17.5	8.5	1.5	4.0	6.1	11.7
STATLANT 21	12.8	13.3	13.9	11.2	17.4	8.5	1.9	NA[1]	NA[1]	
STACFIS	13.8	14.0	13.9	11.5	17.5	8.5	2.1	4.0	6.2	

[1] NA - In 2022-2023, STATLANT 21 information is incomplete.

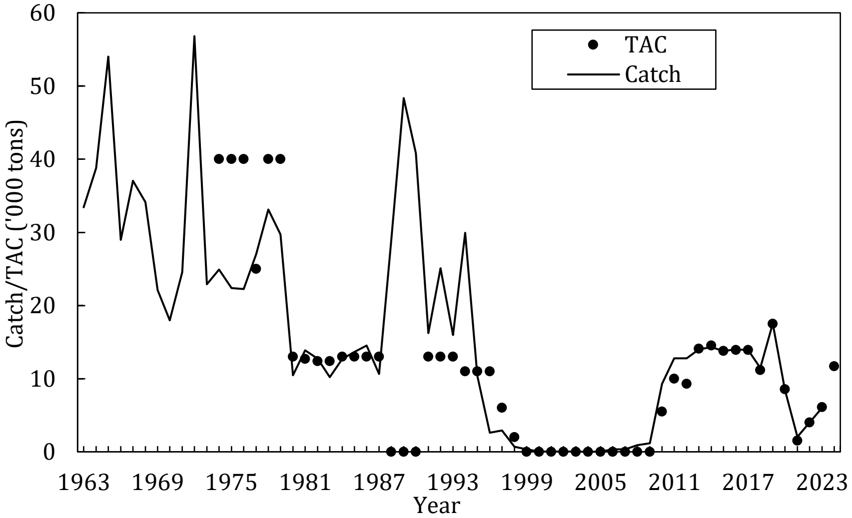


Figure 6.1. Cod in Division 3M: STACFIS catches and TAC.

a) Data Overview

i) Commercial Fisheries

In 2023 five countries fished cod in Division 3M: trawlers from EU-Portugal, EU-Spain, Norway and Russia and longliners from Faroes.

Length and age compositions from the commercial catches are available from 1972 to 2023 with the exception of the 2002 to 2005 period. In 2023 there were commercial length distributions from EU-Portugal, EU-Spain, Russia, Faroes and Norway. Given the low level of sampling at the Faroese survey, the samples were not considered to be representative of the total catch of the haul. For this reason, those samples were not considered, and consequently only the samples from the Faroese commercial vessels were used for the assessment (Figure 6.2). In 2023, the total commercial length distribution presents the mode around 54 cm. Since 2013, the commercial catch at age data has been generated using Age Length Keys (ALK) from the EU survey. In 2023, the ALK from the EU survey is not available, so the average of the last three years (2020-2022) was used. Since 2015, ages 5 to 8+ have been the most abundant in the catch.

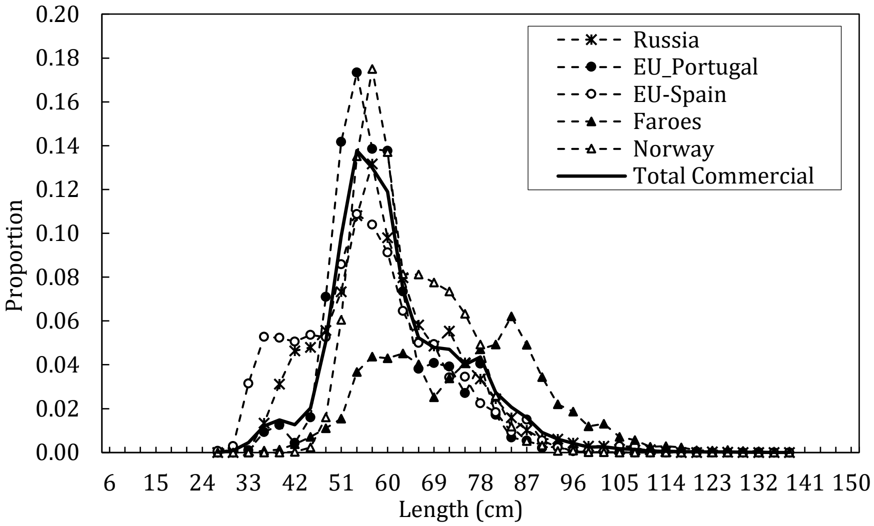


Figure 6.2. Cod in Division 3M: Length distribution of the commercial catches in 2023.

ii) Research surveys

Canadian survey. Canada conducted research surveys on Flemish Cap from 1978 to 1985 on board the R/V *Gadus Atlantica*, fishing with a lined Engels 145 otter trawl. The surveys were conducted annually in January-February covering depths between 130 and 728 m. From a high value in 1978, a general decrease in biomass and abundance can be seen until 1985, reaching the lowest level in 1982 (Figure 6.3).

EU survey. The EU Flemish Cap survey has been conducted since 1988 in summer with a *Lofoten* gear type. The survey indices showed a general decline in biomass going from a peak value in 1989 to the lowest observed level in 2003. Biomass index increased from 2004 to 2014 and decreased until 2019. The growth of several strong year classes over 2005 to 2012 contributed to the increase in the biomass. Abundance rapidly increased between 2005 and 2011, declined from 2012 to 2019. These low levels in 2019 were followed by a slight increase in both indices, which has become more pronounced in 2023. The difference in timing of the peaks in biomass and abundance over 2011-2018 is driven by the very large 2009 and 2010 year classes (Figure 6.3).

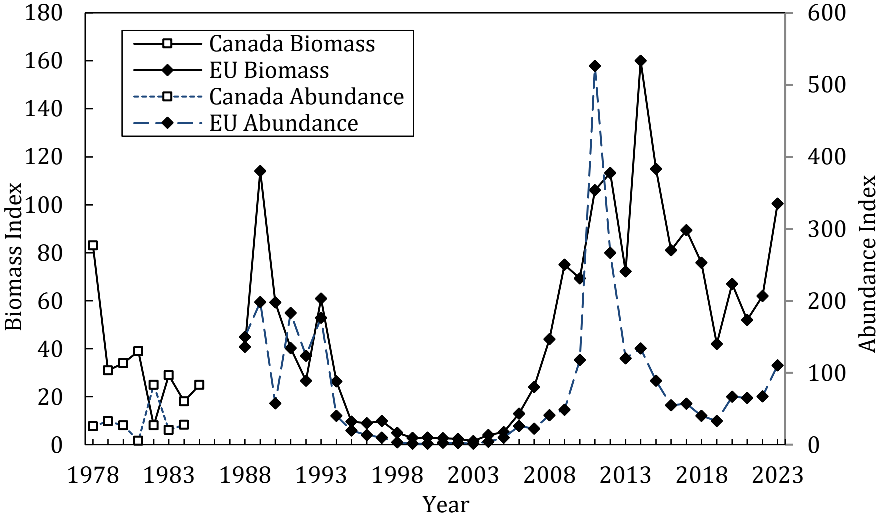


Figure 6.3. Cod in Division 3M: Survey abundance and biomass estimates from Canadian survey (1978-1985) and EU Flemish Cap survey (1988-2023).

iii) Recruitment

Three peaks in recruitment can be seen in 1982-1983, 1991-1992 and 2010-2012. Since 2019, recruitment has increased slightly after a period of 4 years with very low values, although in 2022 and 2023 recruitment was low (Figure 6.4).

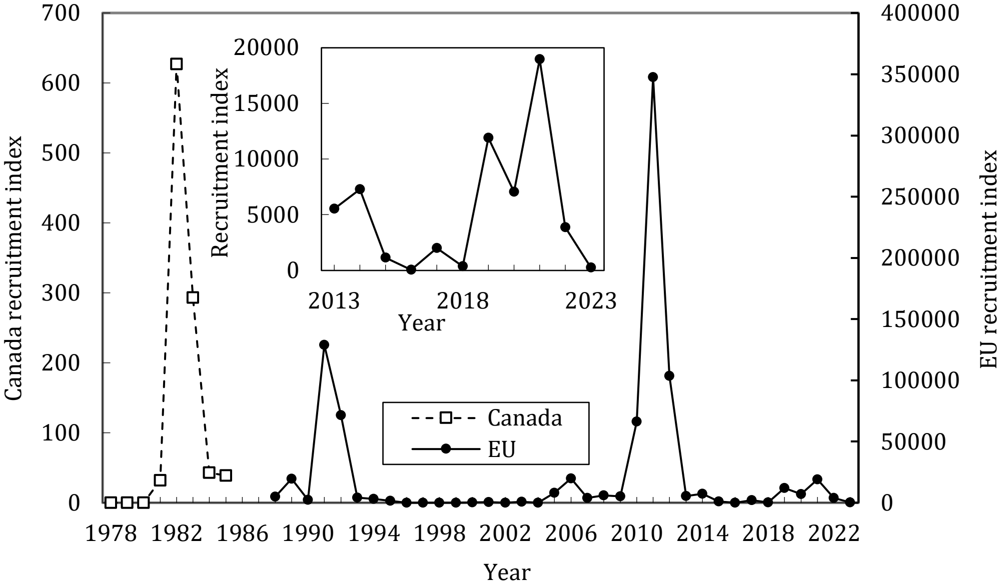


Figure 6.4. Cod in Division 3M: Number at age 1 in the Canadian survey (1978-1985) and EU survey (1988-2023). Inset plot depicts recruitment since 2013.

iv) Biological parameters

The 2023 age indices were derived from the average ALK from EU survey for the period 2020 to 2022. Mean weight-at-age in the stock and in the catch had been decreasing continuously since the reopening of the fishery, until 2017-2019. Since then, both remain more or less stable (Figures 6.5 and 6.6).

Maturity ogives are available from the EU Flemish Cap survey for almost all years between 1988 and 2022. These were modelled using a Bayesian framework with missing values replaced with interpolations from adjacent years. In 2023, the maturity ogive is not available, so the average of the last three years period was used. There was a continuous decline of the A50 (age at which 50% of fish are mature), going from above 5 years old in the late 1980s to just below 3 years old in 2002 and 2003. An upward trend is present in A50 from 2005 to 2016, remaining since then quite stable around 5 years old (Figure 6.7).

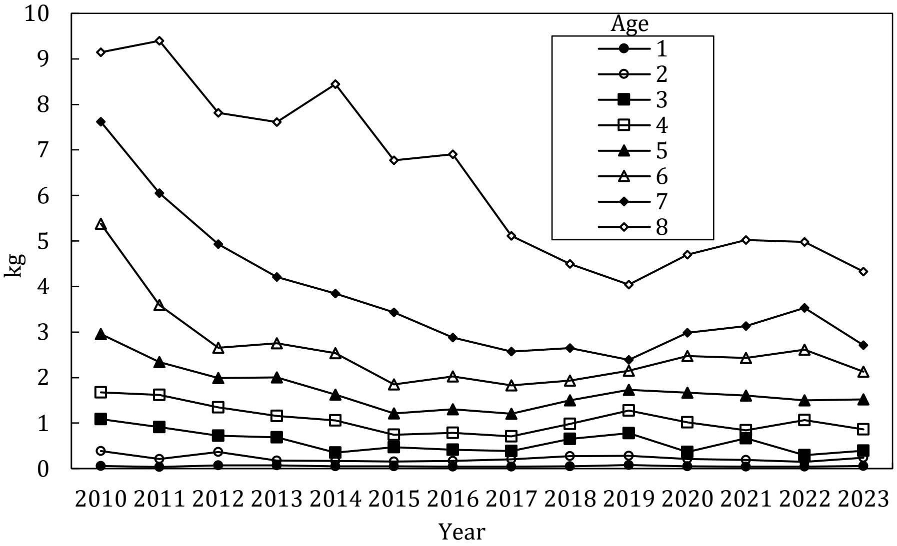


Figure 6.5. Cod in Division 3M: Mean weight-at-age in the stock for the 2010-2023 surveys.

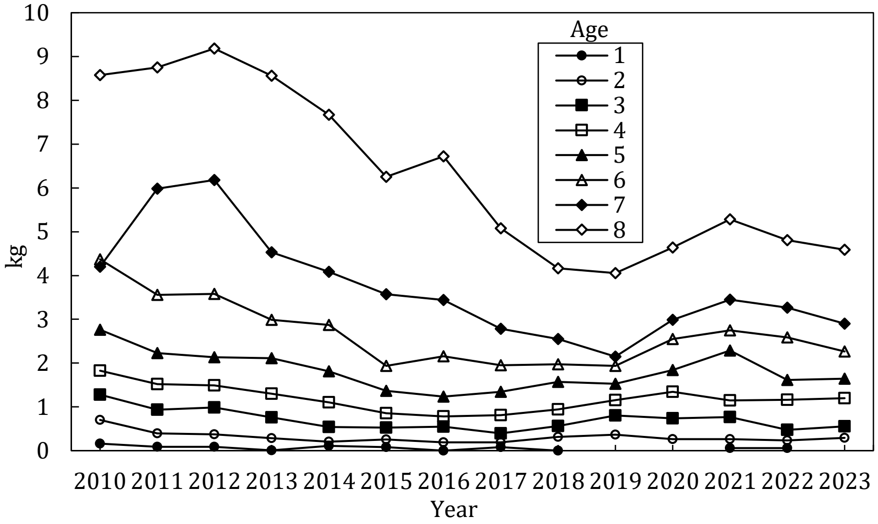


Figure 6.6. Cod in Division 3M: Mean weight-at-age in the catch for 2010-2023.

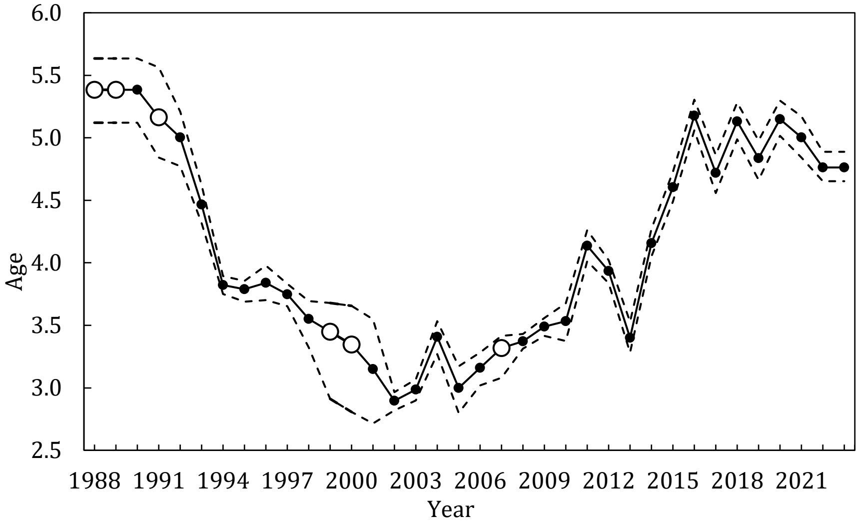


Figure 6.7. Cod in Division 3M: Age at 50% maturity (median and 90% confidence intervals) EU-Flemish Cap survey (1988-2023). Interpolated years are represented in white circles.

b) Estimation of Parameters

A Bayesian SCAA model, introduced at the 2018 benchmark, was used as the basis for the assessment of this stock with data from 1988 to 2023. Input data and settings are as follows:

Catch data: catch numbers and mean weight at age for 1988-2023, except for 2002-2005, for which only total catch is available. STACFIS estimates for total catch were used.

Tuning: numbers at age from EU Flemish Cap survey (1988-2023).

Ages: from 1 to 8+

Catchability analysis: dependent on stock size for age 1, estimated independently for ages 1 to 3 and for 4+ as a group.

Natural Mortality: M was set via a lognormal prior constant over years and variable through ages. Prior median is the same as last year assessment.

Additional priors: for recruitment in all the years, for the number-at-age for ages 2-8+ in the first year, for a year factor for F (f), for selectivity (rC), and for the natural mortality.

Likelihood components: for total catch, for catch numbers-at-age and numbers-at-age of the survey.

The model components are defined as follows:

Input data	Model component	Parameters
R 1988-2023	$LN\left(medrec, cvrec\right)$	*medrec*=45000, *cvrec*=10
N(1988,a), a=2-8+	Ages 2-7 $LN\left(median = medrec \times e^{-\sum_{age=1}^{a-1} M\left(age\right)+medFsurv\left(age\right)}, cv = cvsurv\right)$ Ages 8+ $LN\left(median = medrec \times \frac{e^{-\sum_{age=1}^{A-1}\left(M\left(age\right)+medFsurv\left(age\right)\right)}}{1-e^{-M\left(A+\right)+medFsurv\left(A+\right)}}, cv = cvsurv\right)$	*medFsurv*(1,…,7)={0.0001, 0.1, 0.5, 0.7, 0.7, 0.7, 0.7} *cvsurv*=10
f(y) y=1988-2023	Year 1988 $LN\left(median = medf\ ,\ cv = cvf\ \right)$ Years 1989-2023 $LN\left(median = AR(1)\, over\ f\ ,\ cv = cvf\ \right)$	*medf*=0.2, *cvf*=4
rC(y,a), a=2,8+ 1988-2023	Year 1988 $LN\left(median = medrC\left(a\right),\ cv = cvrC\left(a\right)\right)$ Years 1989-2023 $LN\left(median = last\ year\ rC,\ cv = cvrCcond\right)$	*medrC*(a)=c(0.01,0.3,0.6,0.9,1,1,1), *cvrC*(a)=c(4,4,4,4,4,4) *cvrCcond*=0.2
Total Catch 1988-2023	$LN\left(median = \sum_{age=1}^{A+} mu.C\left(y,age\right)wcatch\left(y,age\right),\ cv = cvcW\right)$ $mu.C\left(y,a\right) = N\left(y,a\right)\left(1-e^{-Z\left(y,a\right)}\right)\frac{F\left(y,a\right)}{Z\left(y,a\right)}$	*cvCW=0.077*
Catch Numbers at age, a=2,8+ 1988-2023	$LN\left(median = mu.C\left(y,a\right),\ cv = cv.C\right)$	*cv.C*=0.2
EU Survey Indices (I) 1988-2023	$I(y) \sim LN\left(median = \mu(y,a),\ cv = cvEU\right)$ $\mu(y,a) = q(a)\left(N(y,a)\frac{e^{-\alpha Z(y,a)} - e^{-\beta Z(y,a)}}{\left(\beta-\alpha\right)Z(y,a)}\right)^{\gamma(a)}$ $\gamma(a)\begin{cases}\sim N(\text{mean} = 1, \text{variance} = 0.25),\ if\ \ a = 1 \\ = 1,\ if\ a \geq 2\end{cases}$ $\log(q(a)) \sim N(\text{mean} = 0, \text{variance} = 5)$	I is the survey abundance index q is the survey catchability at age N is the stock abundance index *cvEU*=0.3 α = 0.5, β = 0.58 (survey made in July) Z is the total mortality
M	$M \sim LN(medM, cvM)$	*MedM*=c(1.26,0.65,0.44,0.35,0.30,0.27,0.24,0.24) *cvM*=0.15

c) Assessment Results

Total Biomass and Abundance: The median total abundance declined between 2012 and 2016 by 78%. In 2021 a steep increase is observed, declining since then. Median biomass also declined by 58% over 2012 to 2020, and remained quite stable for the last four years (Figure 6.8).

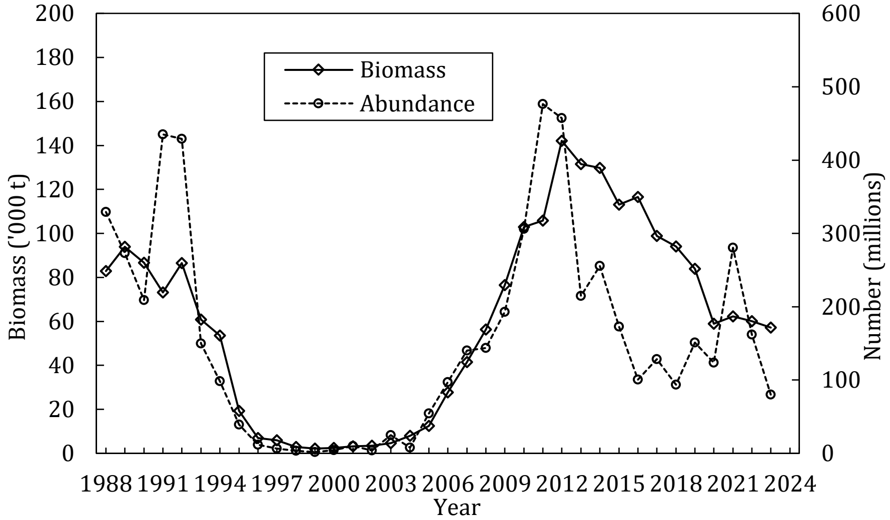


Figure 6.8. Cod in Division 3M: Biomass and Abundance estimates.

Spawning stock biomass: Estimated median SSB (Figure 6.9) increased from 2005 to 2017, decreased until 2021 and has since been stable. The probability of being below B_{lim} in 2024 is very low (<1%).

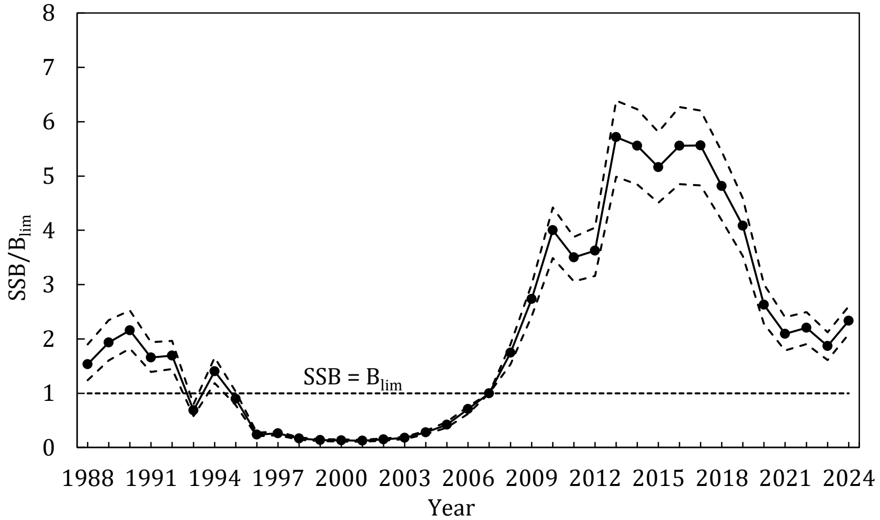


Figure 6.9. Cod in Division 3M: Median and 80% probability intervals SSB/*B$_{lim}$* estimates. The horizontal dashed line corresponds to SSB = *B$_{lim}$*.

Recruitment: Since 2013 the recruitment has oscillated around intermediate levels, much lower than those in 2011-2012 (Figure 6.10). In 2021, a good recruitment was observed, while in 2023 is at a very low level.

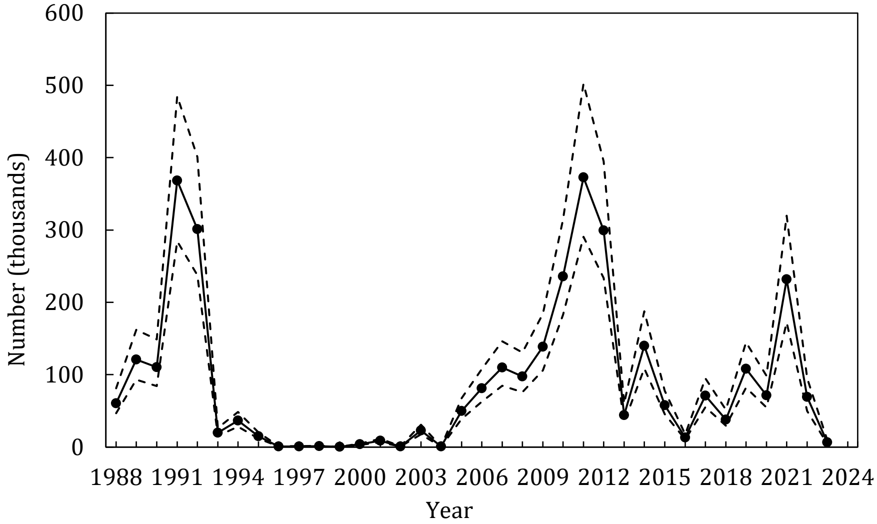


Figure 6.10. Cod in Division 3M: Recruitment (age 1) estimates and 80% probability.

Fishing mortality: *F* increased in 2010 with the re-opening of the fishery but remained below F_{lim}. In 2021, the minimum level of *F* since the re-opening was reached, increasing since then. In 2023 *F* is below F_{lim} with a high probability (Figure 6.11).

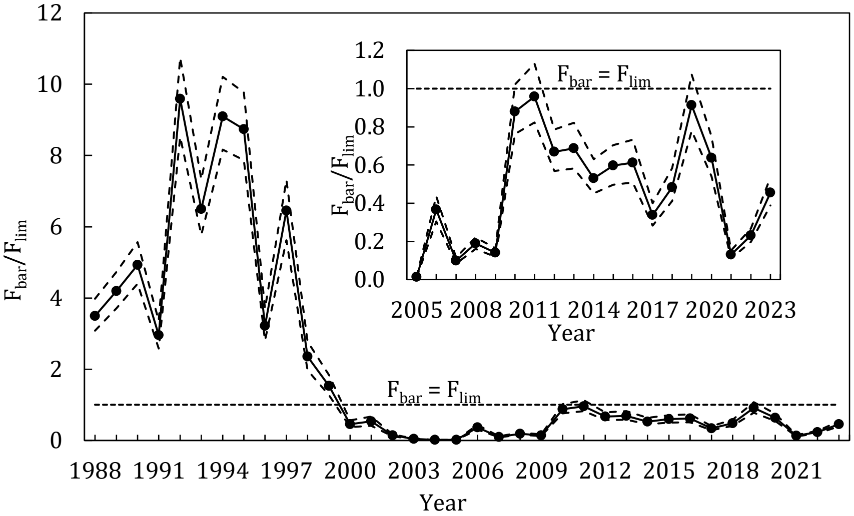


Figure 6.11. Cod in Division 3M: F_{bar} (ages 3-5) estimates and 80% probability intervals. The horizontal dashed line corresponds to $F = F_{lim}$. Inset plot, depicts F_{bar} since 2005.

Natural mortality: The posterior median of M by age estimated by the model was:

Age	1	2	3	4	5	6	7	8
Posterior	1.340	0.60	0.33	0.24	0.25	0.38	0.35	0.37

d) Retrospective analysis

A five-years retrospective analysis with the Bayesian model was conducted by eliminating successive years of catch and survey data. Figures 6.12 to 6.15 present the retrospective estimates for age 1 recruitment, total biomass, SSB and F_{bar} at ages 3-5.

Retrospective analysis shows revisions in the recruitment, mainly regarding the highest values of recruitment in the years 2009 to 2011 and 2021. These corrections lead to subsequent revisions in the total biomass and

SSB. No directional patterns in retrospective analysis are evident in recent years (Figures 6.12 to 6.14). There is very little evidence of a retrospective pattern in *F*, although the 2018 and 2019 values were revised downwards (Figure 6.15).

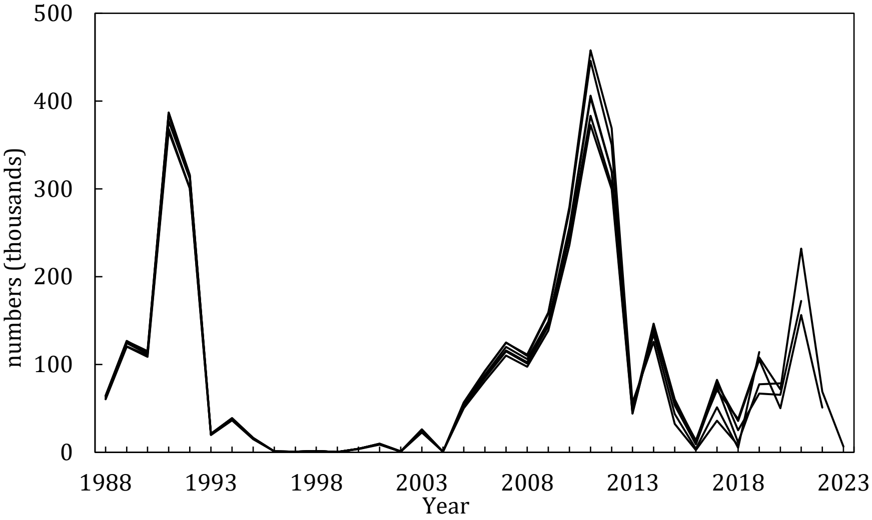


Figure 6.12. Cod in Division 3M: Retrospective results for recruitment.

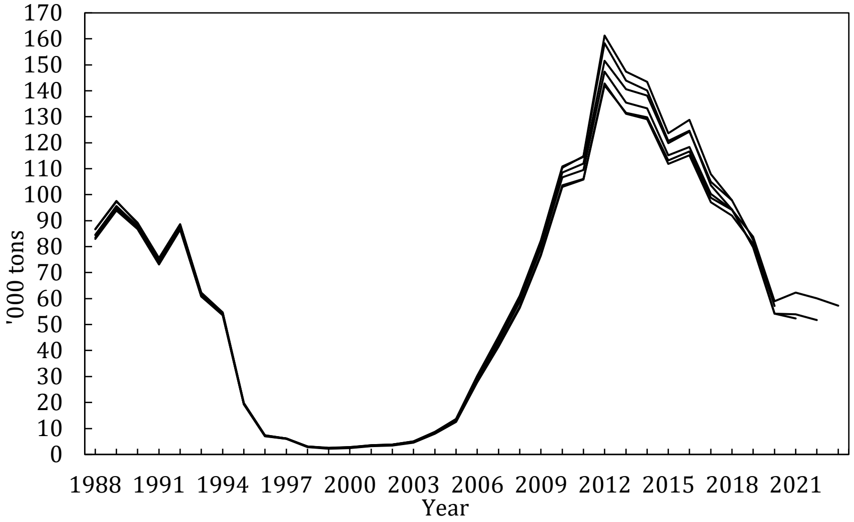


Figure 6.13. Cod in Division 3M: Retrospective results for total biomass.

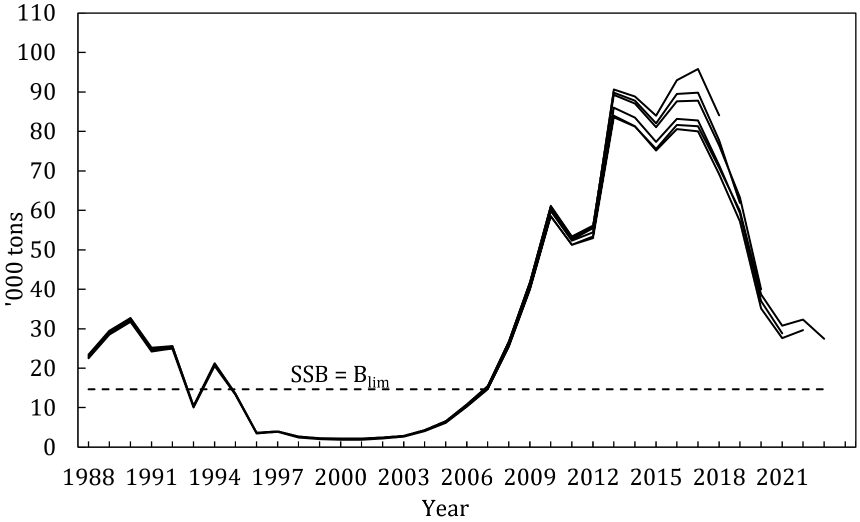


Figure 6.14. Cod in Division 3M: Retrospective results for SSB.

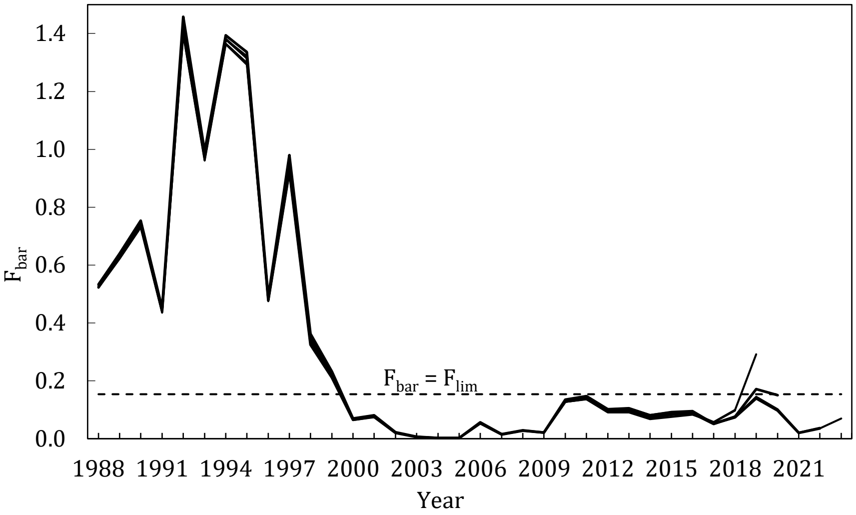


Figure 6.15. Cod in Division 3M: Retrospective results for average fishing mortality.

e) State of the stock

SSB declined rapidly since 2017 but has remained stable during the last 4 years and is estimated to be above *Blim*. Since 2013, recruitment has varied at intermediate levels but much lower than those observed in 2011-2012. In 2021, a good recruitment was observed, while in 2023 is at a very low level. Fishing mortality has remained below *Flim* since the fishery reopened in 2010. In 2021, the minimum level of *F* since the re-opening was reached, increasing since then. In 2023, *F* is below *Flim* with high probability.

f) Reference Points

Blim was set by SC as the 2007 SSB posterior distribution (median value = 14 632 tons) (Figure 6.16). *Flim* was set by SC as $F_{30\%SPR}$ calculated with the mean 2021-2023 input data as 0.153 (median value) (Figure 6.17).

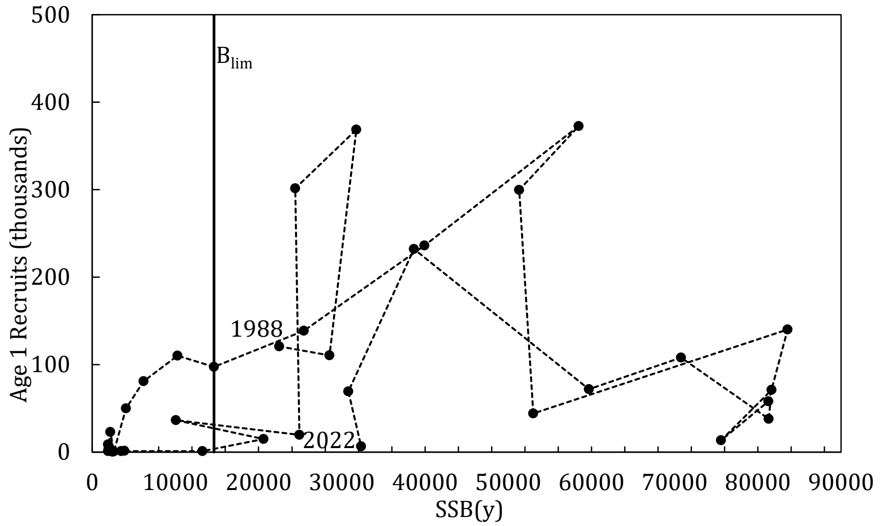


Figure 6.16. Cod in Division 3M: Stock-Recruitment age 1 (posterior medians) plot. B_{lim} is plotted in the graph.

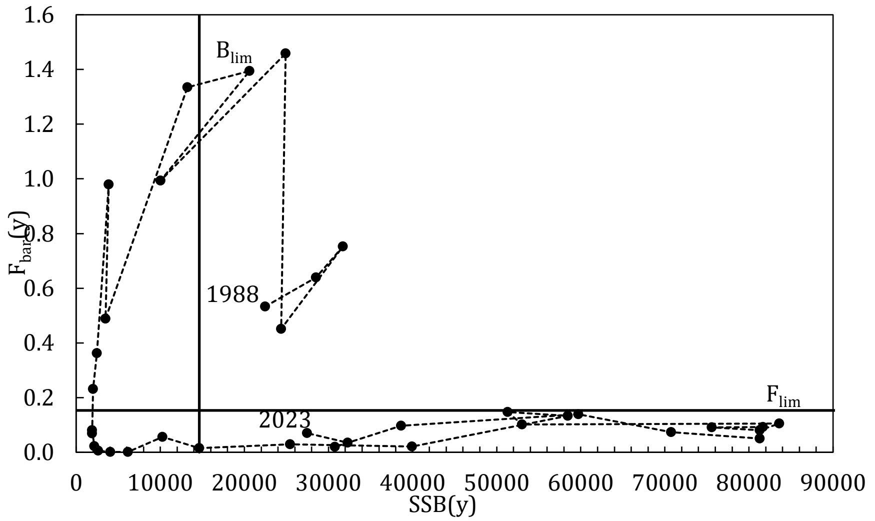


Figure 6.17. Cod in Division 3M: Stock- F_{bar} (3-5) (posterior medians) plot. B_{lim} and F_{lim} are plotted in the graph.

g) Stock projections

The same method as last year was used to calculate the projections and the risk. Two year stochastic projections were conducted. The variability in the input data is taken from the results of the Bayesian assessment. Input data for the projections are as follows:

Numbers aged 2 to 8+ in 2024: estimated from the assessment.

Recruitments for 2024-2027: Recruits per spawner were drawn randomly from 2020-2022.

Maturity ogive for 2024-2027: Mean of the last three years available (2020-2022) maturity ogive.

Natural mortality for 2024-2027: 2023 natural mortality from the assessment results.

Weight-at-age in stock and weight-at-age in catch for 2024-2027: Mean of the last three years (2021-2023) weight-at-age.

PR at age for 2024-2027: Mean of the last three years (2021-2023) PR.

F_{bar} *(ages 3-5)*: Eight scenarios were considered:

(Scenario 1) F_{bar}=0 (no catch).

(Scenario 2) F_{bar} =F_{sq} (median value = 0.042).

(Scenario 3) F_{bar}=1/2 F_{lim} (median value = 0.076).

(Scenario 4) F_{bar} =0.56 F_{lim} (median value = 0.086).

(Scenario 5) F_{bar}=F_{2024} (median value = 0.093).

(Scenario 6) F_{bar}=2/3 F_{lim} (median value = 0.102).

(Scenario 7) F_{bar}=3/4 F_{lim} (median value = 0.114).

(Scenario 8) F_{bar}= F_{lim} (median value = 0.153).

All scenarios assumed that the Yield for 2024 is the established TAC (11 708 t).

F_{bar} is the mean of the *F* at ages 3-5 and used as the indicator of overall fishing mortality; F_{sq} is the status quo *F* calculated as the mean of the last three years F_{bar} (2021-2023).

F_{bar} for this stock is calculated as mean F of ages 3-5, that were the most abundant ages in the catch in the past. But in recent years ages 5 to 8+ have been the most dominant so the appropriateness of the base case range of ages for calculating F_{bar} was explored. Although some differences in the value of F_{bar} can be seen in the results, the trend is the same so there was no reason to change the base case.

The results indicate that under all scenarios with $F_{bar} \leq F_{2024}$, total biomass during the projected years will increase, whereas the SSB is projected to increase in 2027 from 2024 with a probability higher than 50% under scenarios with $F_{bar} < 0.56\ F_{lim}$. The probability of SSB being below B_{lim} is very low (≤ 4%) in all the scenarios (Figures 6.18, 6.19 and 6.20; Tables 6.1 and 6.2).

Under all scenarios, the probability of F_{bar} exceeding F_{lim} is less than or equal to 10% in 2026.

Table 6.1. Medium-term projections.

	B		SSB		Yield
	Median and 80% CI				
F_{bar} = 0					
2024	69964	(61172 - 80992)	34191	(30581 - 37965)	11708
2025	71077	(58334 - 87704)	38180	(32789 - 44159)	0
2026	85529	(70215 - 108862)	54962	(47380 - 63261)	0
2027	97470	(75277 - 128007)	56346	(49099 - 64824)	
F_{bar} = F_{sq} (median = 0.042)					
2024	69964	(61172 - 80992)	34191	(30581 - 37965)	11708
2025	71077	(58334 - 87704)	38180	(32789 - 44159)	5580
2026	79679	(64255 - 102904)	49425	(42014 - 57552)	7112
2027	84088	(62475 - 114436)	44197	(36922 - 52632)	
F_{bar} = 1/2F_{lim} (median = 0.076)					
2024	69964	(61172 - 80992)	34191	(30581 - 37965)	11708
2025	71077	(58334 - 87704)	38180	(32789 - 44159)	9786
2026	75187	(59830 - 98431)	45287	(37898 - 53368)	11351
2027	74899	(53930 - 104982)	36282	(28988 - 44515)	
F_{bar} = 0.56 F_{lim} (median = 0.086)					
2024	69964	(61172 - 80992)	34191	(30581 - 37965)	11708
2025	71077	(58334 - 87704)	38180	(32789 - 44159)	10913
2026	73981	(58650 - 97233)	44158	(36816 - 52286)	12310
2027	72678	(51812 - 102907)	34312	(27034 - 42517)	
F_{bar} = F_{2024} (median = 0.093)					
2024	69964	(61172 - 80992)	34191	(30581 - 37965)	11708
2025	71077	(58334 - 87704)	38180	(32789 - 44159)	11613
2026	73231	(57914 - 96493)	43491	(36115 - 51656)	12820
2027	71372	(50559 - 101399)	33209	(25935 - 41462)	
F_{bar} = 2/3F_{lim} (median = 0.102)					
2024	69964	(61172 - 80992)	34191	(30581 - 37965)	11708
2025	71077	(58334 - 87704)	38180	(32789 - 44159)	12613
2026	72160	(56868 - 95434)	42483	(35219 - 50627)	13622
2027	69541	(48765 - 99338)	31548	(24214 - 39695)	
F_{bar} = 3/4F_{lim} (median = 0.114)					
2024	69964	(61172 - 80992)	34191	(30581 - 37965)	11708
2025	71077	(58334 - 87704)	38180	(32789 - 44159)	13949
2026	70731	(55473 - 94021)	41172	(33870 - 49383)	14558
2027	67180	(46452 - 96710)	29424	(22151 - 37537)	
F_{bar} = F_{lim} (median = 0.153)					
2024	69964	(61172 - 80992)	34191	(30581 - 37965)	11708
2025	71077	(58334 - 87704)	38180	(32789 - 44159)	17711
2026	66783	(51499 - 90043)	37545	(30323 - 45626)	16719
2027	60872	(40592 - 90361)	23935	(16734 - 32123)	

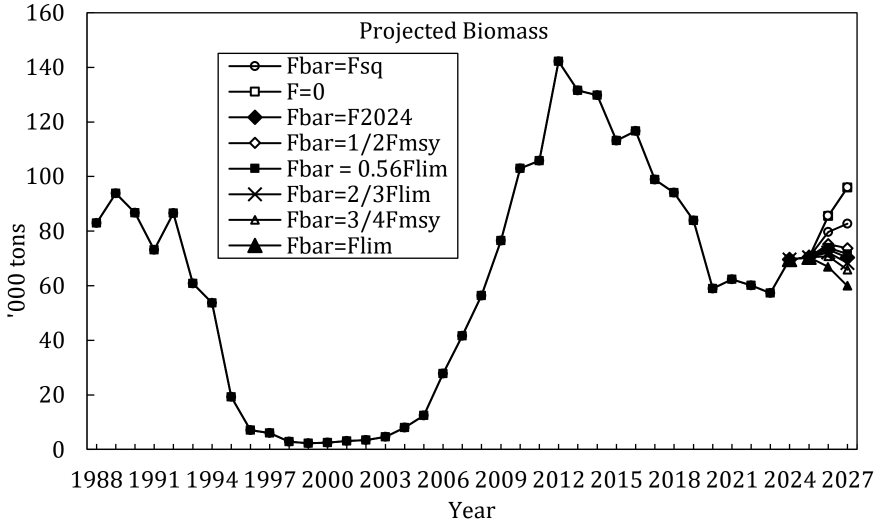


Figure 6.18. Cod in Division 3M: Projected Total Biomass under all the Scenarios.

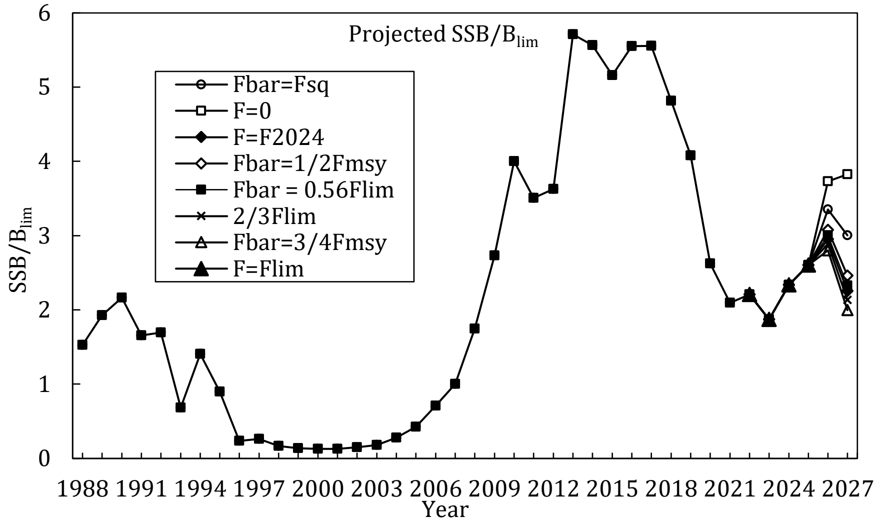


Figure 6.19. Cod in Division 3M: Projected SSB under all the Scenarios

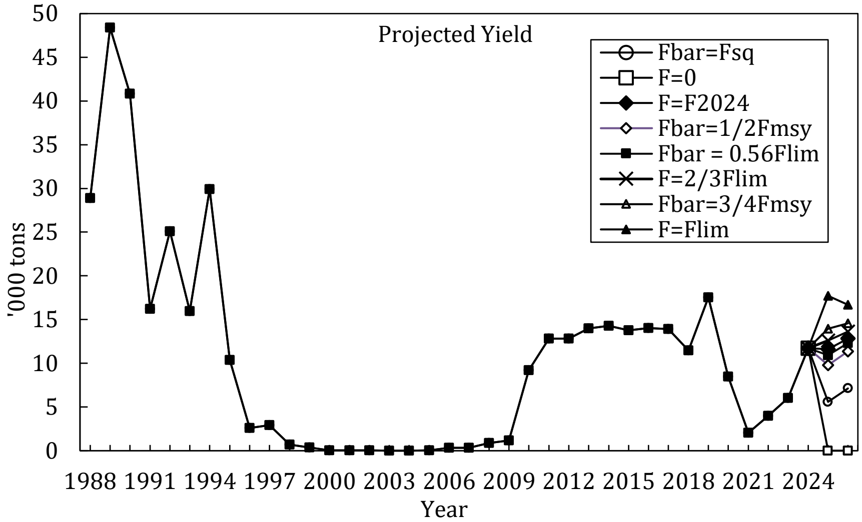


Figure 6.20. Cod in Division 3M: Projected removals under all the Scenarios.

Table 6.2 Projected yield (t) and the probability of SSB < B_{lim} and F_{bar} < F_{lim} and probability of stock growth (SSB_{2027} > SSB_{2024}) under projected F values.

		Yield			P(SSB < SSB_{lim})				P(F > F_{lim})			
		2024	2025	2026	2024	2025	2026	2027	2024	2025	2026	P(SSB27 > SSB24)
F =	0	11708	0	0	<1%	<1%	<1%	<1%	<1%	<1%	<1%	100%
F_{sq} =	0.042	11708	5580	7112	<1%	<1%	<1%	<1%	<1%	<1%	<1%	100%
1/2F_{lim} =	0.076	11708	9786	11351	<1%	<1%	<1%	<1%	<1%	<1%	<1%	66%
0.56 F_{lim}=	0.086	11708	10913	12310	<1%	<1%	<1%	<1%	<1%	<1%	<1%	50%
F_{2024} =	0.093	11708	11613	12820	<1%	<1%	<1%	<1%	<1%	<1%	<1%	41%
2/3F_{lim} =	0.102	11708	12613	13622	<1%	<1%	<1%	<1%	<1%	<1%	2%	29%
3/4F_{lim} =	0.114	11708	13949	14558	<1%	<1%	<1%	1%	<1%	2%	10%	18%
F_{lim} =	0.152	11708	17711	16719	<1%	<1%	<1%	4%	<1%	50%	50%	3%

h) Research recommendations

STACFIS **recommended** that *an age reader comparison exercise be conducted.*

STATUS: An age-readers Workshop was held in November 2017 in order to reconcile the differences among age-readers of this stock. Much progress in understanding where the differences between the commercial and survey ALKs come from was made but still needs more research to completely know the problem. No progress since then was made. STACFIS reiterates this recommendation.

STACFIS **encouraged** to *all Contracting Parties to provide length distribution samples from the commercial vessels fishing 3M cod*.

STATUS: STACFIS reiterates this recommendation.

STACFIS **recommended** that *the ALK and maturity ogive for this stock is provided annually.*

The next full assessment for this stock will be in 2026.

i) Special comments

Scientific Council proposes to conduct a full assessment of Atlantic cod in Division 3M every two years, since biological parameters and the stock status have remained quite stable in recent years. For this reason, this year Scientific Council is providing advice for this stock for the next two years.

7. Redfish (*Sebastes mentella* and *Sebastes fasciatus*) in Division 3M

Full Assessment (SCR Doc. 24/005, 024, 032; SCS Doc. 24/06, 07, 08, 11)

a) Introduction

There are three species of redfish that are commercially fished on Flemish Cap; deep-sea redfish (*Sebastes mentella*), golden redfish (*Sebastes marinus = S. norvegicus*) and Acadian redfish (*Sebastes fasciatus*). The term beaked redfish is used for *S. mentella* and *S. fasciatus* combined. Because of difficulties with identification and separation, all three species are reported together as 'redfish' in the commercial fishery. All stocks have both pelagic and demersal behaviour as well as a long recruitment process to the bottom, extending to lengths up to 30-32 cm. All redfish species are long lived with slow growth. Female sexual maturity is reached at a median length of 26.5 cm for Acadian redfish, 30.1 cm for deep-sea redfish and 33.8 cm for golden redfish.

b) Description of the fishery

The redfish fishery in Division 3M increased from 20 000 tons in 1985 to 81 000 tons in 1990, falling continuously since then until 1998-1999, when a minimum catch of around 1 000 tons was recorded as by-catch of the Greenland halibut fishery. This drop of the 3M redfish catches was related with the simultaneous decline of stock biomass and fishing effort deployed in this fishery during the first half of the 1990’s. In the 2000’s catches recorded a stepwise increase, from an average level of 3 000 tons (2000-2004) to 8 000 tons (2005-2017). In 2022 and 2023, the catches were 10 043 tons and 9 741 tons respectively. Since 2011 catches are associated with the changes in TACs. EU-Portugal, EU-Spain, the Russian Federation and EU-Estonia states are responsible for the bulk of the redfish landings over the last two decades.

Since the mid 2000’s, the fishery is a blend of by-catch from cod fishery (depths above 300m, a mixture of golden and beaked redfish), catch from bottom trawl directed fishery (depths between 300-700m, primarily beaked redfish), and by-catch again from Greenland halibut fishery (bellow 700m, 100% deep sea redfish).

For 2015 the annual STACFIS catch estimate was given by the Daily Catch Reports (DCRs) by country provided by the NAFO Secretariat. For 2016 catch was calculated using the CDAG Estimation Strategy (NAFO Regulatory Area Only). The 2017 to 2023 catch estimates were obtained with the application of the CESAG method. The 1989-2023 catch estimates from those different sources are accepted as the 3M redfish catches.

Recent TACs, catches are as follows -catch ('000 t) are as follows:

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
TAC	6.7	7.0	7.0	10.5	10.5	8.6	8.4	10.9	11.2	17.5
STATLANT 21[1]	6.9	6.6	7.1	10.5	10.5	8.6	8.6	NA[3]	NA[3]	
STACFIS Total catch [1]	6.9	6.6	7.1	10.5	10.6	8.8	8.3	10.0	9.7	
STACFIS Catch [2]	5.2	6.2	6.9	10.3	10.2	8.7	8.3	9.4	9.4	

[1] TAC, STATLANT 21 and STACFIS Total catch refer to all three redfish species combined.

[2] STACFIS beaked redfish catch estimate, based on beaked redfish proportions on observed catch.

[3] NA - In 2022-2023, STATLANT 21 information is incomplete.

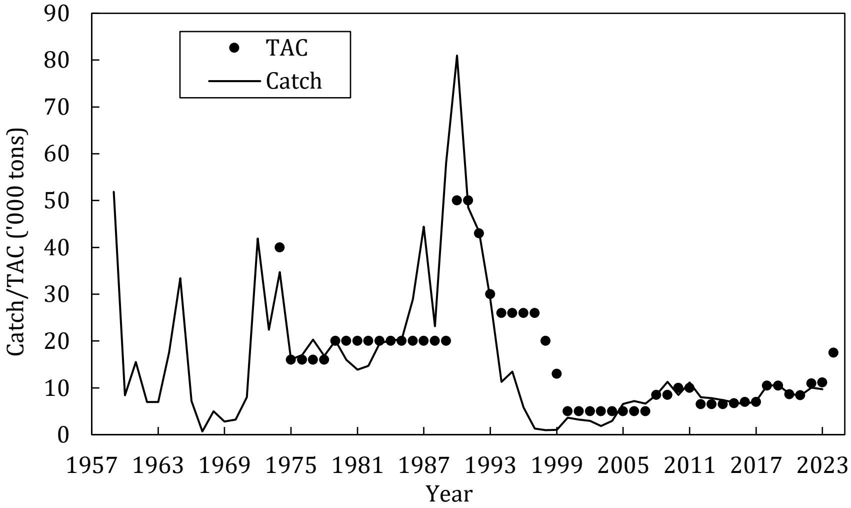


Figure 7.1. Redfish in Division 3M: total catches and TACs.

c) Input Data

The 3M redfish assessment is focused on beaked redfish, regarded as a management unit composed of two populations from two very similar species: the Flemish Cap *S. mentella* and *S. fasciatus*. The reason for this approach is the historical dominance of this group in the 3M redfish commercial catch. During the entire series of EU Flemish Cap surveys beaked redfish also represents the majority of redfish survey biomass (77%).

d) Commercial fishery and by-catch data

Sampling data. Portuguese beaked redfish length frequencies were applied to the beaked redfish catch of other bottom trawl fleets with the exception of the Russian, Spanish and Japanese fleets for the years where respective length sampling data are available. In 2023 Portuguese length frequencies were applied to other countries excluding Spain and Russia.

The available 1998-2023 3M beaked redfish commercial length weight relationships from the Portuguese commercial catch were used to compute the mean weights of all commercial catches and corresponding catch numbers at length.

Redfish by-catch in numbers at length for the Division 3M shrimp fishery is available for 1993-2004, based on data collected on Canadian and Norwegian vessels. No bycatch information were available from 2005 onwards when the fishery was very low and hence bycatch was assumed to be negligible, and a moratorium to the Division 3M shrimp fishery was in place from 2010-2019 and in 2022 onwards. The commercial and bycatch length frequencies were summed to establish the total removals at length. These were converted to removals at age using the EU survey *S. mentella* age length keys (ALK) from 1988-2017 and *S. mentella* + *S. fasciatus* ALKs from 2018-2022 with both sexes combined. Due to the lack of EU survey ALK for 2023, a 2020-2022 (3-years) combined ALK was applied both to commercial and survey length compositions. Annual length weight relationships derived from Portuguese commercial catch were used for determination of mean weights-at-age.

The 1999-2002 and 2005 cohorts dominated the overall catch in most years of the 2001-2012 period. The 2009-2011 cohorts are the most abundant in the catch between 2014 and 2016. Larger sizes corresponding to older ages, and 11 and 12 years old fish (from 2005-2006 cohorts) were the most abundant in the catch in 2017. However most abundant ages return to much younger redfish in 2018, with ages 6 and 7 (2012-2011 cohorts) being the most abundant in the catch. Since 2019, larger sizes in the catch correspond to fish aged 8+ years older (from cohorts as old as that of 2002) dominated catches. In 2023, the 2017 cohort (age 6) was the most abundant in the catches.

i) Research survey data

EU Flemish Cap bottom trawl survey

Survey biomass was calculated based on the abundance at length and annual length weight relationships from the EU bottom trawl survey for the period 1988-2023.

Age compositions for Division 3M beaked redfish EU survey stock and mature female stock from 1989 to 2023 were obtained using the EU survey *S. mentella* age length keys (ALK) from 1988-2017 and *S. mentella* + *S. fasciatus* ALKs from 2018-2022. A 2020-2022 combined ALK was applied for 2023, as explained above on the "commercial fishery and by-catch data" section. Mean weights-at-age in the stock were determined using the EU survey annual length weight relationships.

Gonads from Flemish Cap beaked redfish were collected since 1994 though not every year. Maturity at length ogives from 1994 were used in previous assessments. New maturity at length ogives were estimated based on microscopic inspection of histological sections of gonads collected throughout 16 years between 1994 and 2022. Maturity data were combined for both species within each year and fitted to a logistic function. For the years in between, where data was missing, curve parameters were estimated as the weighted average of the adjacent years where maturity ogives were available. The new maturity at length results were used in the present assessment. Due to the lack of EU survey maturity ogives for 2023, an average maturity ogive for the last three years (2020-2022) was applied to survey 2023 length composition.

Survey results. The survey stock abundance and biomass declined in the first years of the survey and remained low until 2003. A sequence of above average year classes (2001-2005), including the strongest of the survey series (2002), with high survival rates and coupled to a sudden but major increase of the size of the *S. fasciatus* component, lead the exploitable beaked redfish stock as a whole to a maximum in 2006. Both spawning stock and exploitable biomass were high in mid 2000s early 2010s. While the exploitable biomass index and abundance declining since 2012, spawning stock biomass (SSB) has remained high until 2017 (Figure 7.2). There has been very low recruitment at age four in most recent years with the exception of the 2016 year class which appears in 2020. The exploitable stock biomass index was declining until 2018 and has generally increased since then.

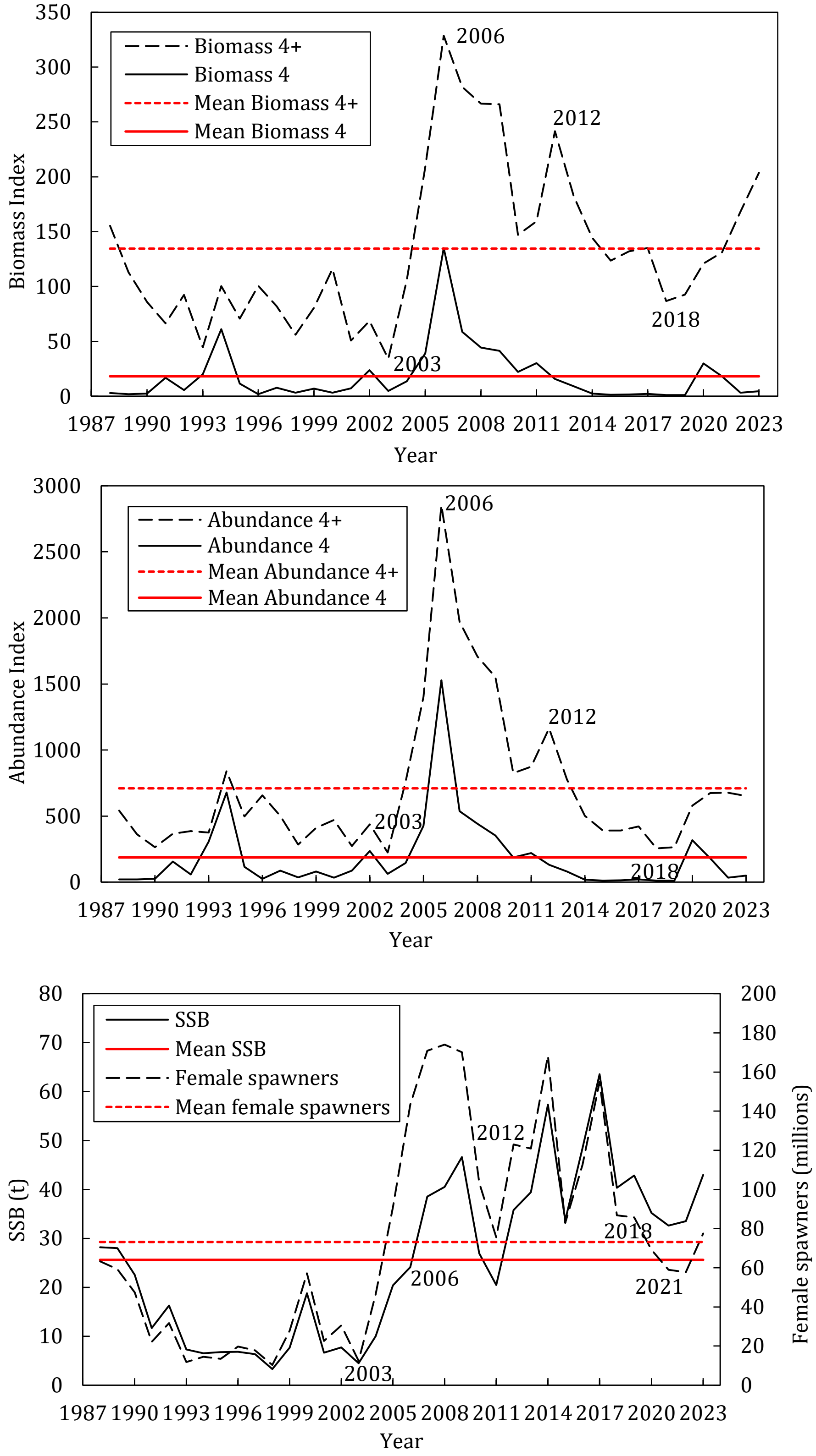


Figure 7.2. Beaked redfish in Division 3M: exploitable biomass, female spawning biomass/abundance and recruitment at age 4 abundance from EU surveys (1988-2023).

ii) Natural mortality

In this assessment, the sensitivity analysis carried out in the 2021 assessment was not performed. the Division 3M cod biomass has been stable in recent years and there is no reason to suspect that the predation on redfish has changed.

e) Estimation of Parameters

The Extended Survivors Analysis (XSA) was used to estimate stock size. The month of peak spawning (larval extrusion) for Division 3M *S. mentella* was taken to be February, and was used for the estimate of the proportion of fishing mortality and natural mortality before spawning. EU survey abundance at age was used for calibration. The XSA model specifications are the same as in the assessments since 2015, and are given below:

Catch data from 1989 to 2023, ages 4 to 19+

Fleets	**First year**	**Last year**	**First age**	**Last age**
EU summer survey (Div. 3M)	1989	2023	4	19+

Tapered time weighting not applied

Catchability independent of stock size for all ages

Catchability independent of age for all ages ≥16

Terminal year survivor estimates not shrunk towards a mean *F*

Oldest age survivor estimates not shrunk towards the mean *F* of previous ages

Minimum standard error for population estimates from the last true age of each cohort age = 0.5

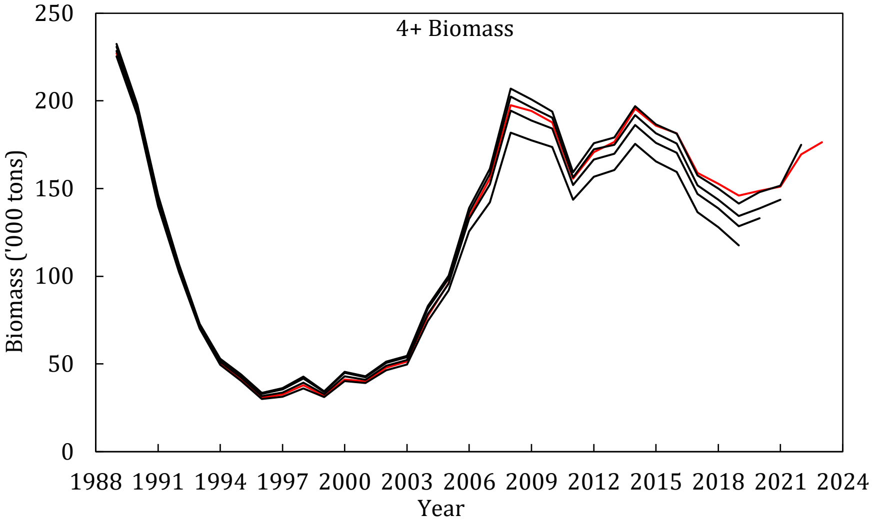
Before 2006, *M* remained at 0.1. The rationale to select the best options for natural mortality between 2006 and 2017 are thoroughly explained in the sensitivity analysis sections of previous assessments. A natural mortality of 0.4 was tuned to ages 4-6 between 2006 and 2010 and extended to all ages in 2009-2010 to reflect cod predation. Since then, natural mortality was assumed to be again an age independent parameter, and in 2011-2012 declined to 0.125, a level much closer to what is considered the magnitude of natural mortality on redfish stocks (0.1). However, from 2013-2014 the best fit to survey data implied again a marginal increase of *M* to 0.14. The best *M* option found since 2017 XSA assessments was a natural mortality of 0.1 from 2015 onwards. The 2023 XSA assessment was run with *M* in 2023 fixed at 0.10.

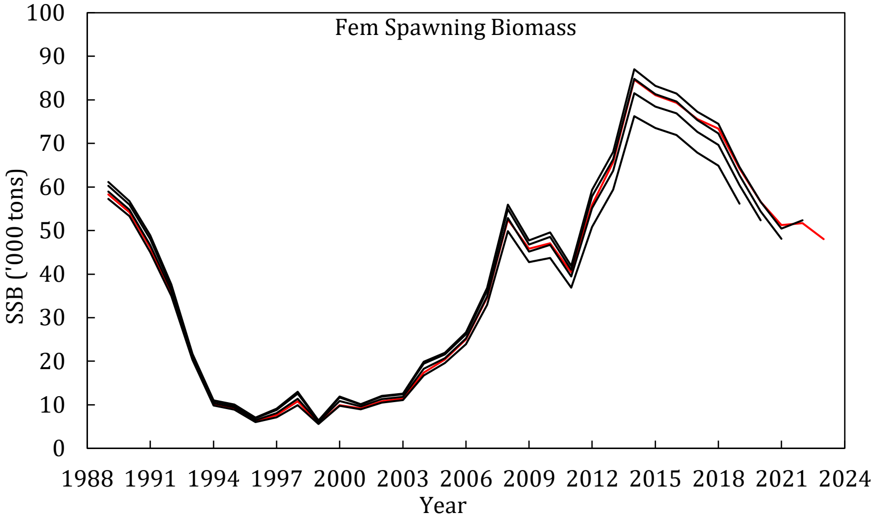
f) Assessment Results

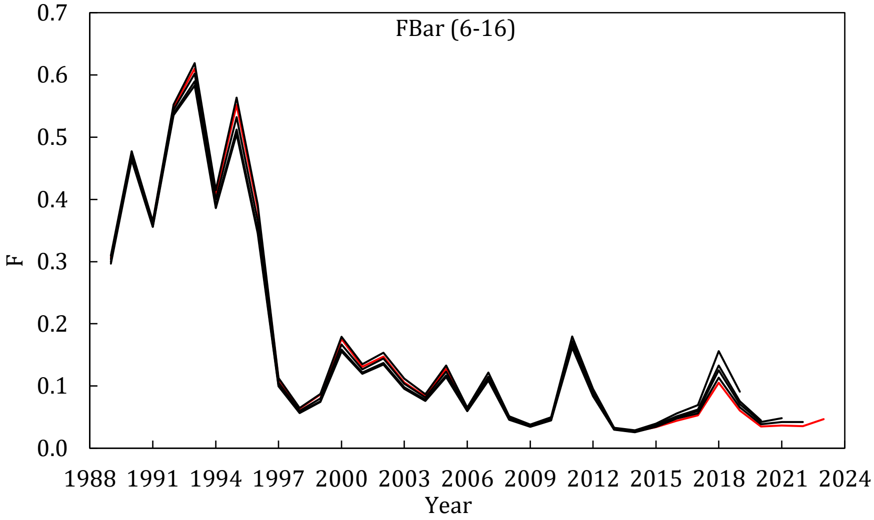
The 2024 XSA diagnostics were similar to past assessments: high variability associated with mean catchabilities and survivors, namely at younger ages, together with a similar patchwork of *log q age* residuals that remains with only small changes from its predecessors. However, in most recent years a clear annual pattern of positive residuals appears again, though not as high as previous time periods. The last two years show a decrease in the magnitude of the residuals.

A retrospective $\text{XSA}_{2023\text{-}2019}$ was carried to check patterns and magnitude of bias in the main results of recent assessments back in time (Figure 7.3).

The retrospective patterns of both exploitable and female spawning biomass show consistent underestimates except for the most recent year (2023). The retrospective pattern of the fishing mortality shows slight overestimates, but the magnitude is small.


4+ Biomass
Biomass ('000 tons)
0
50
100
150
200
250
1988
1991
1994
1997
2000
2003
2006
2009
2012
2015
2018
2021
2024
Year


Fem Spawning Biomass
SSB ('000 tons)
0
10
20
30
40
50
60
70
80
90
100
1988
1991
1994
1997
2000
2003
2006
2009
2012
2015
2018
2021
2024
Year


FBar (6-16)
F
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
1988
1991
1994
1997
2000
2003
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2021
2024
Year

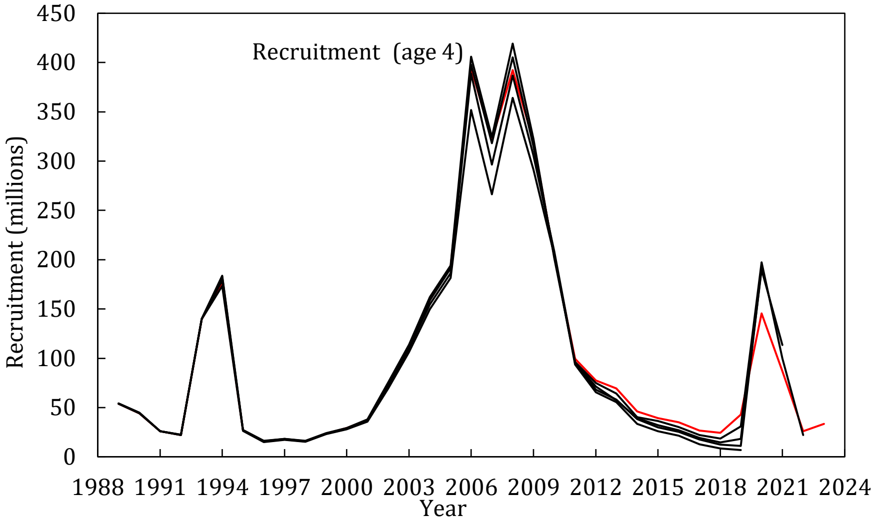

Figure 7.3. Beaked redfish in Division 3M: XSA retrospective analysis, last year 2023-2019: exploitable 4+ biomass, female spawning stock biomass, average fishing mortality (ages 6-16) and recruitment (age 4).

Taking into account the consistency of the present assessment with the previous ones, the XSA assessment was accepted.

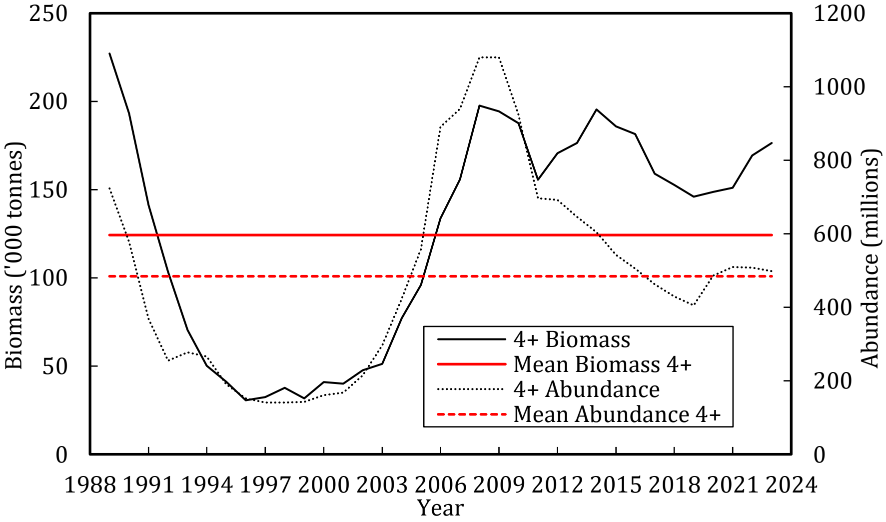

Figure 7.4. Beaked redfish in Division 3M: age 4+ biomass and age 4+ abundance from XSA.

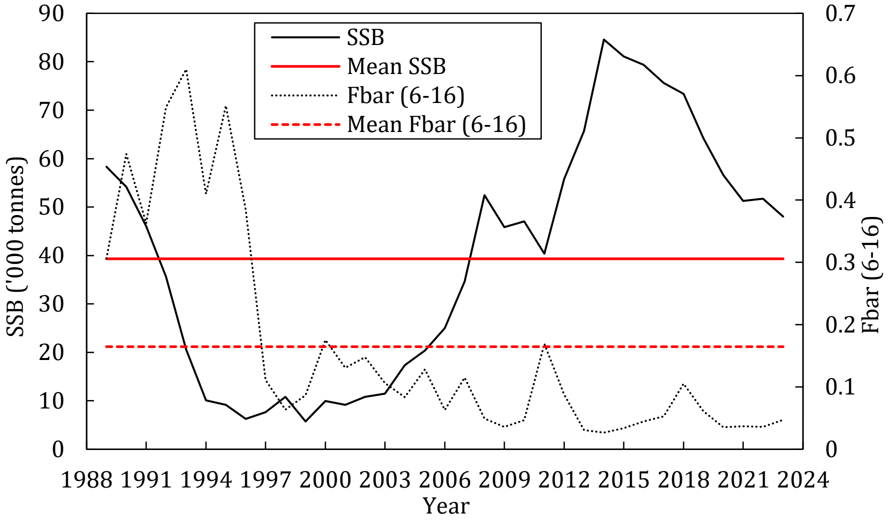

Figure 7.5. Beaked redfish in Division 3M: female spawning biomass and fishing mortality trends from XSA.

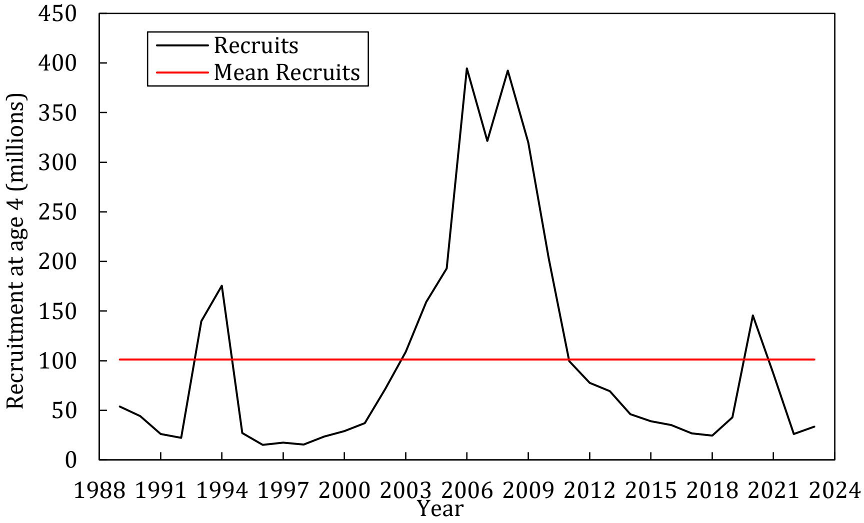

Figure 7.6. Beaked redfish in Division 3M: recruitment at age 4.

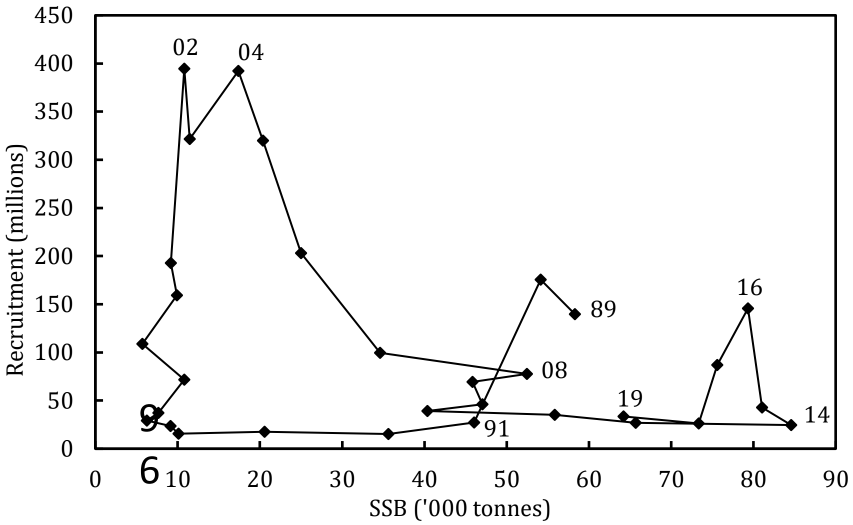

Figure 7.7. Beaked redfish in Division 3M: Stock/Recruitment plot (labels indicate age class).

Biomass and abundance (Figure 7.4): Biomass and abundance have increased since 2018, and in 2023 are above the means of their respective series.

Spawning stock biomass (Figure 7.5): SSB has declined since 2014, but in 2023 is still well above the long term mean.

Fishing Mortality (Figure 7.5): Current fishing mortality remains relatively low compared to the 1980s and 1990s.

Recruitment (Figures 7.6 and 7.7): After an extended period of declining recruitment, the recruitment (at age 4) estimate for 2020 and 2021 are above or at the mean while the 2022 and 2023 values are low.

State of the stock: SSB has declined since 2014, but in 2023 is still well above the long term mean. After an extended period of declining recruitment, the recruitment estimates for 2020 and 2021 are above or at the mean, while the 2022 and 2023 values are low. Fishing mortality remains relatively low compared to the 1980s and 1990s.

g) Yield per recruit analysis

In order to get proxies of $F_{0.1}$ and F_{max} in line with the most recent partial recruitment (*PR*) results, a new yield per recruit analysis (*ypr*) was performed.

The *PR* vector is given by the 2021-2023 average of the relative *F* at ages 4-18. *M*'s were kept at 0.10 through ages and years. All input weight at age and maturity at age vectors were averages from the most recent three years. In order to reduce the weight of the plus group on the final results, ages were virtually extended to age 29 with a plus group set at age 30. Mean weights and female maturity were kept constant and were the ones of the XSA 19 plus group.

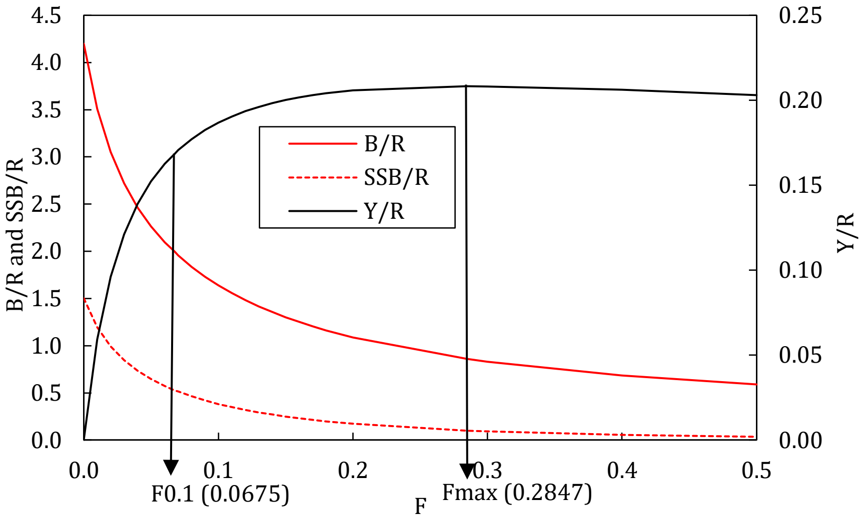

Figure 7.8. Beaked redfish in Division 3M: yield per recruit analysis at M=0.10 (2021-2023 average inputs)

The $F_{0.1}$ (0.0675) estimated by the 2024 *ypr* (Figure 7.8) was at the magnitude of the one estimated in the two last assessments (0.0635 in 2023; 0.0669 in 2021) and below the previous one of 2019 assessment (0.0911). F_{max} is estimated at 0.2846 (0.3899 in 2023; 0.2997 in 2021; 0.1883 in 2019 assessments). F_{max} is considered to be estimated with high uncertainty and therefore was not accepted. The $F_{0.1}$ value has been used for short term projections. $F_{0.1}$ and F_{max} are candidates for the 3M beaked redfish fishing mortality reference points that need to be confirmed in near future.

h) Short term projections

Short term (2025-2027) projections were carried out for spawning stock biomass (SSB) and catch, under most recent level of natural mortality (with an associated CV correspondent to an allowed variability of natural mortality between 0.08 and 0.12) and considering seven options for fishing mortality and catch levels as follows:

1. No fishing, F_0
2. $F_{0.1}$
3. $F_{statusquo}$
4. $F=M=0.1$
5. 1.25 TAC_{2024}
6. TAC_{2024}
7. 0.75 TAC_{2024}

Two sets of projections were done, one with $F_{statusquo}$ and another one assuming the *F* corresponding to the 2024 TAC, for the intermediate year of the projections.

Recruitment in 2024 was given by the geometric mean of the most recent recruitments (age 4 XSA, 2021-2023).

Stochastic projections of yield and female spawning stock biomass (SSB) under the seven *F* options started with abundance for ages 5 and older at the beginning of 2025. The coefficients of variation for population at age at the beginning of 2025 were set as the internal standard errors from XSA diagnostics. For 2025 and 2026, recruitment was randomly resampled with residuals from the geometric mean of 2021-2023 recruitments (age 4 XSA, 2021-2023). All other inputs at age are the last three year averages with associated errors at age.

Short term projections are summarized on Tables 7.1 and 7.2.

Table 7.1. Short term projections for female SSB (50%ile at the beginning of 2024, 90%ile, 50%ile and 10%ile at the beginning of 2025-2027), yield of beaked redfish predicted for 2025 and 2026 (50%ile) under several F options and TAC for all three redfish species, based on beaked redfish proportions on observed catch, $F_{statusquo}$ in the intermediate year of the projections.

F=0

Year	SSB Median and 80% CI	Yield	TAC
2024$_{deterministic}$	52117	13195	17503
2025	50199 (44661 - 59311)	0	0
2026	51014 (45564 - 59659)	0	0
2027	51356 (46045 - 59688)		

$F_{0.1}$=0.0675

Year	SSB Median and 80% CI	Yield	TAC
2024$_{deterministic}$	52117	13195	17503
2025	50199 (44661 - 59311)	21378	22445
2026	44603 (39919 - 51955)	18652	19584
2027	39608 (35681 - 45815)		

F=M=0.1

Year	SSB Median and 80% CI	Yield	TAC
2024$_{deterministic}$	52117	13195	17503
2025	50199 (44661 - 59311)	30659	32189
2026	41849 (37548 - 48711)	25087	26339
2027	35170 (31672 - 40488)		

F_{sq} = 0.0585

Year	SSB Median and 80% CI	Yield	TAC
2024$_{deterministic}$	52117	13195	17503
2025	50199 (44661 - 59311)	18689	19622
2026	45409 (40641 - 52891)	16599	17428
2027	40983 (36895 - 47412)		

1.25 TAC (F= 0.065675)

Year	SSB Median and 80% CI	Yield	TAC
2024$_{deterministic}$	52117	13195	17503
2025	50199 (44661 - 59311)	20839	21879
2026	44769 (40062 - 52137)	18247	19158
2027	39884 (35925 - 46117)		

TAC (F= 0.051797)

Year	SSB Median and 80% CI	Yield	TAC
2024$_{deterministic}$	52117	13195	17503
2025	50199 (44661 - 59311)	16671	17503
2026	45993 (41174 - 53600)	15007	15756
2027	42045 (37850 - 48636)		

0.75 TAC (F=0.038268)

Year	SSB Median and 80% CI	Yield	TAC
2024$_{deterministic}$	52117	13195	17503
2025	50199 (44661 - 59311)	12503	13127
2026	47251 (42261 - 55078)	11555	12131
2027	44292 (39825 - 51233)		

average beaked redfish proportion in the 2021-2023 3M redfish catch 0.952

Projection results indicate a 4% SSB decline from 2024 to 2025 (i.e., interim year under $F_{statusquo}$). Results for the seven projection scenarios show SSB declines of 1% (for F=0), 24% (for $F_{0.1}$), 33% (for F=M), 21% (for $F_{statusquo}$), 23% (for 1.25 TAC), 19% (TAC) and 15% (for 0.75 TAC) between 2025 and 2027 (Table 7.1; Figure 7.9).

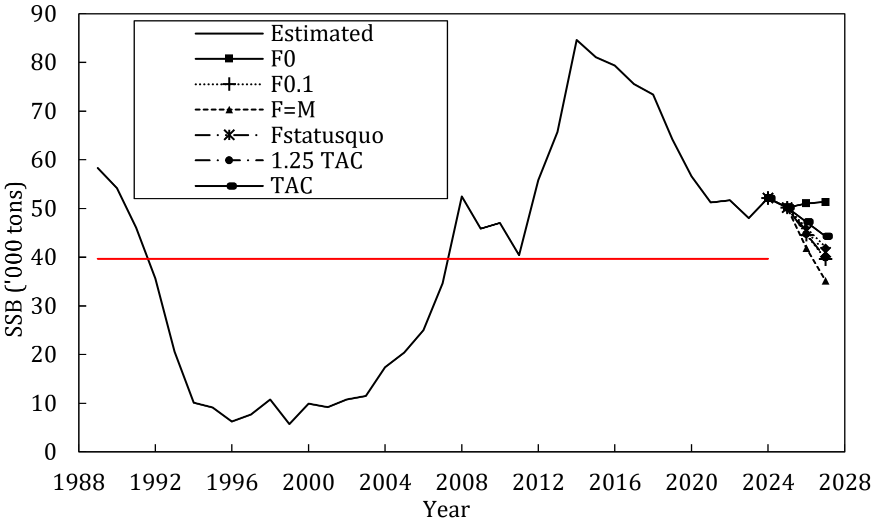

Figure 7.9. Beaked redfish in Division 3M: SSB trajectory (1989-2023) and 2024-2026 projections (50%ile) under several F options (interim year under $F_{statusquo}$)

	F=0	$F_{0.1}$	F=M	F_{sq}	1.25 TAC	TAC	0.75 TAC
P(SSB2025>SSB2024)	>10%	>10%	>10%	>10%	>10%	>10%	>10%
P(SSB2026>SSB2024)	>10%	<10%	<10%	>10%	>10%	>10%	>10%
P(SSB2027>SSB2024)	>10%	<10%	<10%	<10%	<10%	<10%	<10%

The probability of SSB at the beginning of 2027 being greater than it was at the beginning of 2024 is less than 10% in all scenarios, not taking in consideration the scenario F=0 (Table 7.1).

Table 7.2. Short term projections for female SSB (50%ile at the beginning of 2024, 90%ile, 50%ile and 10%ile at the beginning of 2025-2027), yield of beaked redfish predicted for 2025 and 2027 (50%ile) under several *F* options and TAC for all three redfish species, based on beaked redfish proportions on observed catch F_{TAC} in the intermediate year of the projections.

F=0

Year	SSB Median and 80% CI	Yield	TAC
$2024_{\text{deterministic}}$	52117	17503	17503
2025	47961 (42714 - 56635)	0	0
2026	48861 (43686 - 57065)	0	0
2027	49353 (44212 - 57395)		

$F_{0.1}$=0.0675

Year	SSB Median and 80% CI	Yield	TAC
$2024_{\text{deterministic}}$	52117	17503	17503
2025	47961 (42714 - 56635)	20498	21521
2026	42764 (38347 - 49877)	17831	18721
2027	38223 (34332 - 44124)		

F=M=0.1

Year	SSB Median and 80% CI	Yield	TAC
$2024_{\text{deterministic}}$	52117	17503	17503
2025	47961 (42714 - 56635)	29379	30846
2026	40154 (36071 - 46724)	24021	25220
2027	33951 (30549 - 39038)		

F_{sq} = 0.0585

Year	SSB Median and 80% CI	Yield	TAC
$2024_{\text{deterministic}}$	52117	17503	17503
2025	47961 (42714 - 56635)	17917	18811
2026	43531 (39018 - 50785)	15872	16664
2027	39509 (35470 - 45624)		

1.25 TAC (F= 0.068708)

Year	SSB Median and 80% CI	Yield	TAC
$2024_{\text{deterministic}}$	52117	17503	17503
2025	47961 (42714 - 56635)	20839	21879
2026	42663 (38259 - 49752)	18088	18990
2027	38056 (34176 - 43937)		

TAC (F= 0.05416)

Year	SSB Median and 80% CI	Yield	TAC
$2024_{\text{deterministic}}$	52117	17503	17503
2025	47961 (42714 - 56635)	16671	17503
2026	43888 (39345 - 51229)	14893	15636
2027	40160 (36040 - 46393)		

0.75 TAC (F=0.040047)

Year	SSB Median and 80% CI	Yield	TAC
$2024_{\text{deterministic}}$	52117	17503	17503
2025	47961 (42714 - 56635)	12503	13127
2026	45119 (40452 - 52695)	11486	12060
2027	42344 (37976 - 49021)		

average beaked redfish proportion in the 2021-2023 3M redfish catch 0.952

Projection results indicate an 8% SSB decline from 2024 to 2025 (i.e., interim year under F_{TAC}). Results for the seven projection scenarios show SSB declines of 4% (for *F*=0), 27% (for $F_{0.1}$), 35% (for *F*=*M*), 24% (for $F_{statusquo}$), 27% (for 1.25 TAC), 23% (TAC) and 19% (for 0.75 TAC) between 2025 and 2027 (Table 7.2; Figure 7.10).

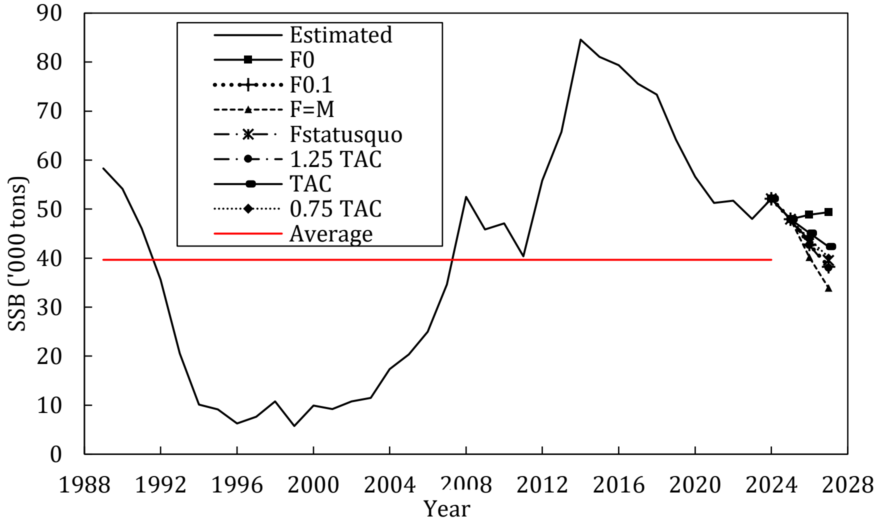

Figure 7.10. Beaked redfish in Division 3M: SSB trajectory (1989-2023) and 2024-2026 projections (50%ile) under several *F* options (interim year under F_{TAC}).

	F=0	$F_{0.1}$	*F=M*	F_{sq}	1.25 TAC	TAC	0.75 TAC
P(SSB_{2025}>SSB_{2024})	>10%	>10%	>10%	>10%	>10%	>10%	>10%
P(SSB_{2026}>SSB_{2024})	>10%	<10%	<10%	<10%	<10%	<10%	>10%
P(SSB_{2027}>SSB_{2024})	>10%	<10%	<10%	<10%	<10%	<10%	<10%

The probability of SSB at the beginning of 2027 being greater than it was at the beginning of 2024 is less than 10% in all scenarios, not taking in consideration the scenario *F*=0 (Table 7.2).

The potential yields estimated in the projections are lower than seen in the 2023 assessment, because of the retrospective pattern in the last assessment. With the exception of the *F*=0 scenario, in all projection scenarios the SSB is projected to decline, and to be at around the average for the assessment time-series (since the late 1980s) by 2027.

i) Reference Points

There are no accepted limit reference points for this stock.

j) Research recommendations

STACFIS **recommends** that *other assessment models, such as those used in mixed species redfish stocks, in the Gulf of St. Laurence (eg. in NAFO Subdivisions 4RST, 3Pn and 4Vn) and NAFO Subarea 0, should be explored.*

STACFIS **recommends** *exploring alternatives to the Medium-Term Stochastic Projections (Mterm) package for making projections.*

The next full assessment for this stock is planned to be in 2026.

8. American plaice (*Hippoglossoides platessoides*) in Division 3M

Interim Monitoring Report (SCR Doc. 23/024, 24/05; SCS Doc. 24/06, 11)

a) Introduction

The stock declined during the late 1980s and since 1996 there has been no directed fishing. Total estimated STACFIS/CESAG bycatch in 2023 was 104 tons (Figure 8.1).

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
TAC	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf
STATLANT 21	0.2	0.2	0.2	0.2	0.3	0.2	0.04	NA[1]	NA[1]	
STACFIS	0.3	0.2	0.2	0.2	0.3	0.2	0.1	0.1	0.1	

ndf No directed fishing.

[1] NA - In 2022-2023, STATLANT 21 information is incomplete.

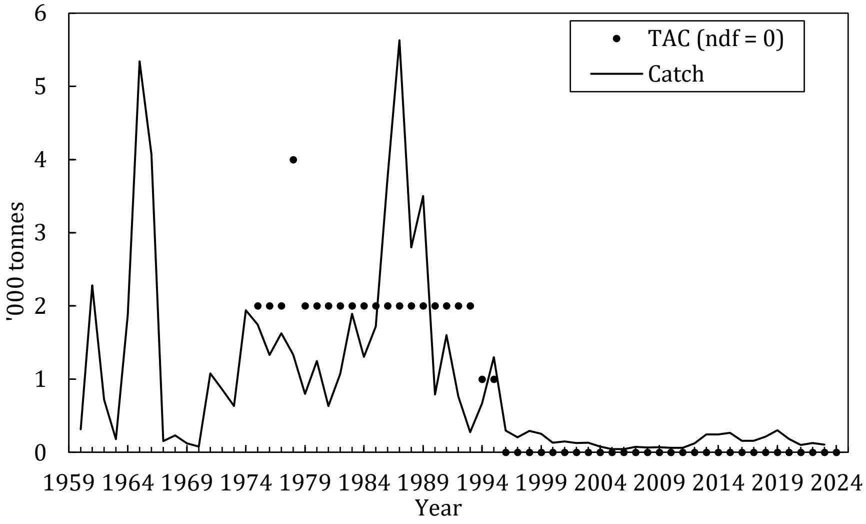

Figure 8.1. American plaice in Division 3M: STACFIS catches and TACs. No directed fishing is plotted as 0 TAC.

b) Data Overview

The EU bottom trawl survey on Flemish Cap was conducted during 2023. From 2017 to 2023 the biomass estimate has been relatively stable at levels observed in the mid 1990's, prior to the fishery closure (Figure 8.2).

All of the 1991 to 2005 year-classes are estimated to be weak. Since 2006 recruitment improved, particularly the 2006, 2012, 2015 and 2018 year classes (Figure 8.3).

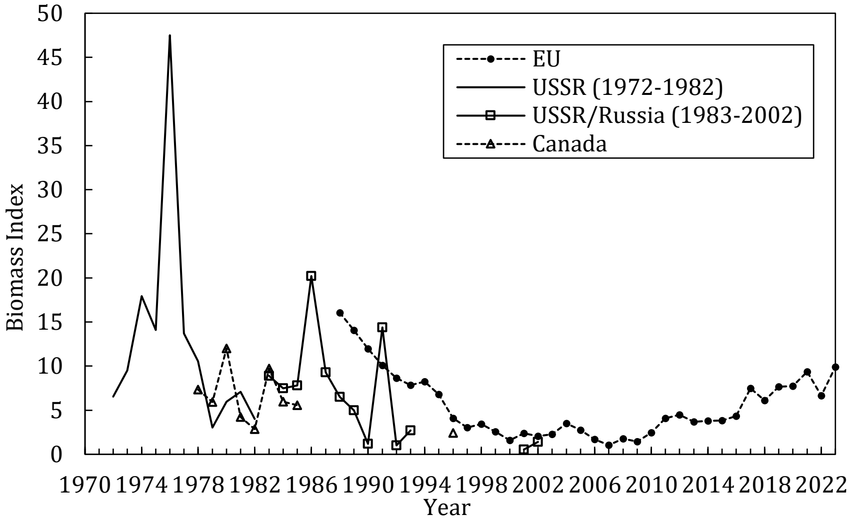

Figure 8.2. American plaice in Division 3M: trends in survey biomass indices. EU survey data prior to 2003 have been converted to *RV Vizconde Eza* equivalents.

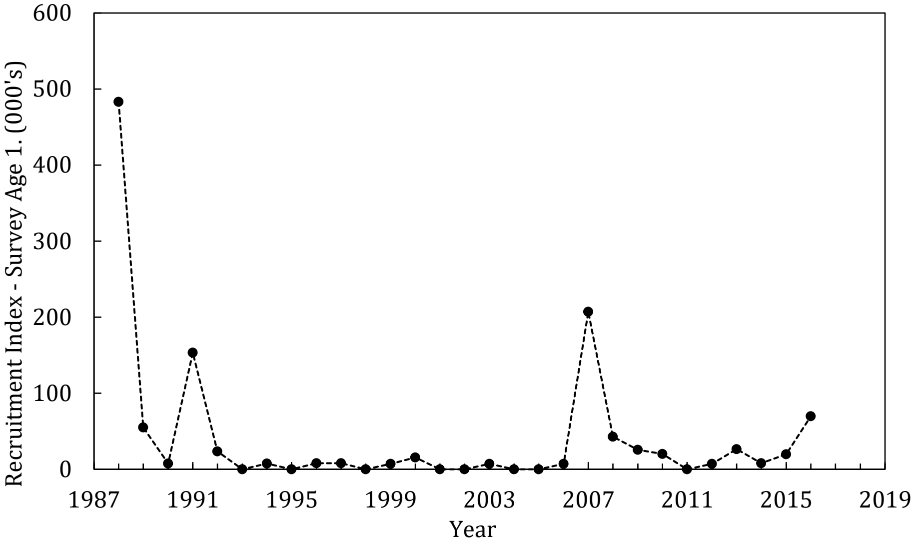

Figure 8.3. American plaice in Division 3M: Recruitment index, trends in survey age 1 abundance.

c) Conclusion

Catches since 1996 have been low, below 300 t, and although survey biomass has been gradually increasing with signs of improvement in recruitment since 2007 (2006 year-class was particularly strong), the stock remains at a relatively low level. The recent increase is not enough to change the perception of the stock status and the previous advice of no directed fishing is still valid.

d) Research Recommendations

STACFIS **recommends** that *other types of models should also be explored, and that the Division 3M American plaice stock is a candidate for an assessment benchmark together with the Division 3LNO American plaice stock or other flatfish stocks.*

STACFIS **recommends** *further investigation into whether current bycatch F levels are impeding stock recovery.*

The next full assessment for this stock is planned to be in 2026.

STOCKS ON THE GRAND BANKS (NAFO DIVISIONS 3LNO)

Environmental Overview

The water mass characteristic of the Grand Bank are typical of sub-polar waters, with the presence of a cold intermediate layer (CIL) formed during winter, which lasts throughout the year until the late fall. The CIL (defined as water <0°C) extends to the ocean bottom in the northern areas of 3LNO, covering the bottom with sub-zero temperatures. The CIL is a reliable index of ocean climate conditions in this area. Bottom temperatures are higher in southern regions of 3NO reaching 1 - 4°C, mainly due to atmospheric forcing and along the slopes of the banks below 200 m depth due to the presence of Labrador Slope Water. On the southern slopes of the Grand Bank in Division 3O bottom temperatures may reach 4 - 8°C due to the influence of warm slope water from the Gulf Stream. The general circulation in this region consists of the relatively strong offshore Labrador Current at the shelf break and a considerably weaker branch near the coast in the Avalon Channel. Currents over the banks are very weak and the variability often exceeds the mean flow.

9. Cod (*Gadus morhua*) in NAFO Divisions 3NO

Interim Monitoring Report (SCR Doc. 24/007, 036, 037; SCS Doc. 24/06, 08, 09, 10, 11)

a) Introduction

This stock has been under moratorium to directed fishing since February 1994. Total bycatch during the moratorium increased from 170 t in 1995, peaked at about 4 800 t in 2003 and has been between 300 t and 1 100 t since that time (Figure 9.1). The bycatch in 2023 was 329 t.

Recent TACs and catches ('000 tons) are as follows:

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
TAC	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf
STATLANT 21	0.5	0.5	0.6	0.4	0.5	0.3	0.3	NA[1]	NA[1]	
STACFIS	0.6	0.7	0.6	0.4	0.5	0.6	0.5	0.4	0.3	

ndf : No directed fishery

[1] NA - In 2022-2023, STATLANT 21 information is incomplete.

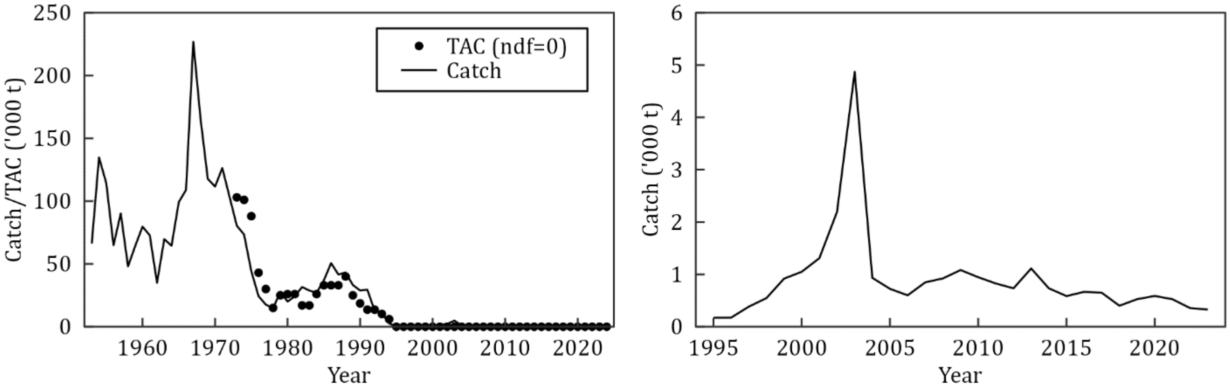

Figure 9.1. Cod in Divisions 3NO: total catches and TACs. Panel at right highlights catches during the moratorium on directed fishing.

b) Data Overview

Canadian bottom trawl surveys. The spring survey biomass index declined from 1984 to 1995 and has generally remained low since that time (Figure 9.2). There was an increase in biomass during 2011-2014 but indices have subsequently declined again, and the 2023 biomass indices were among the lowest in the time series. The trend in the autumn survey biomass index was similar to the spring series (Figure 9.2). There were no Canadian surveys in Divisions 3NO in spring 2020 and 2021 or Autumn 2021 and 2022. The 2022 spring and 2023 spring and autumn surveys were completed with new research vessels and a modified trawl. Analysis of comparative fishing data revealed that these data for Atlantic cod could be compared directly with existing data without the need to apply a conversion factor.

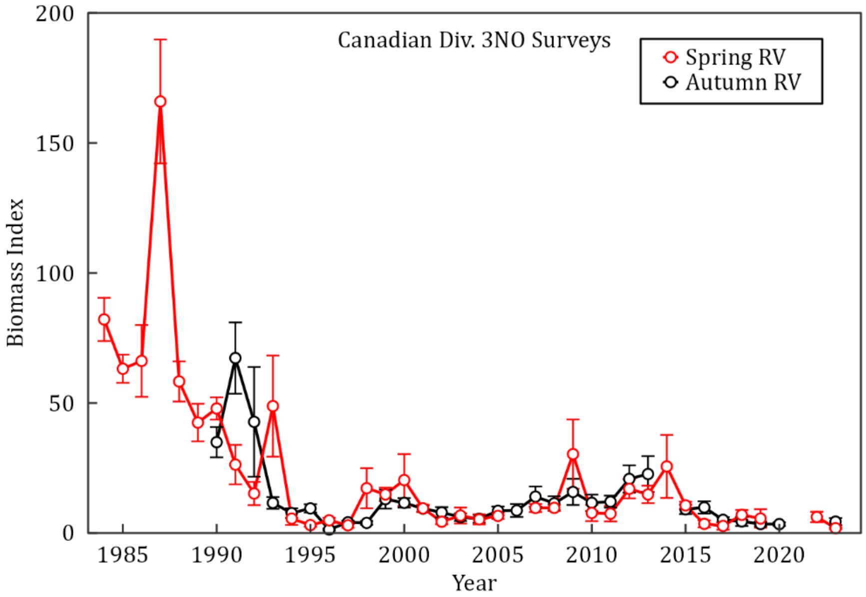

Figure 9.2. Cod in Divisions 3NO: survey biomass index (+ 1 sd) from Canadian spring and autumn research surveys.

EU-Spain Divisions 3NO surveys. The biomass index was relatively low and stable from 1997-2008 with the exception of 1998 and 2001 (Figure 9.3). There was a considerable increase in the index from 2008-2011, followed by a decline to 2013. In 2014, the index increased to the highest value in the time series but has continually decreased in subsequent years. There was no EU-Spain survey in Divisions 3NO in 2020 but the index remained low in the 2021 to 2023 surveys.

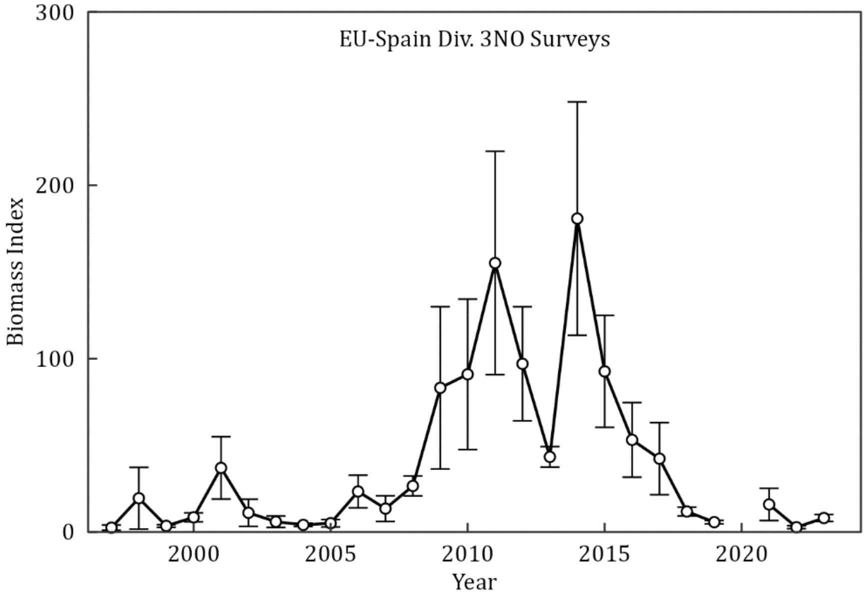

Figure 9.3. Cod in Divisions 3NO: survey biomass index (+ 1 sd) from EU-Spain Divisions 3NO surveys.

c) Conclusion

The most recent analytical assessment (2021) concluded that SSB was well below B_{lim} (60 000 t) in 2020. A lack of commercial sampling in 2020 prevented 2021 SSB from being estimated. Canadian RV surveys in 2023 remained among the lowest in the time series. The EU-Spain survey index remained low in 2023. Overall, the 2023 indices are not considered to indicate a significant change in the status of the stock.

The next full assessment of this stock was planned to be in 2024. However, until such time as a benchmark meeting has occurred or monitoring shows that conditions have changed, this stock will be monitored by interim monitoring reports.

10. Redfish (*Sebastes mentella* and *Sebastes fasciatus*) in Divisions 3L and 3N (full assessment)

Full Assessment (SCR Doc. 24/007, 008, 036, 037,048; SCS Doc. 24/06, 08, 09, 10, 11)

a) Introduction

There are two species of redfish in Divisions 3L and 3N, the deep-sea redfish (*Sebastes mentella*) and the Acadian redfish (*Sebastes fasciatus*) that have been commercially fished and reported collectively as redfish in fishery statistics. Both species, occurring in Division 3LN, are managed as a single stock and are thought to belong to a large Northwest Atlantic complex ranging from the Gulf of Maine to south of Baffin Island.

Fishery and catches: Between 1959 and 1960 reported catches dropped from 44 600 to 26 600 t, oscillating over the next 25 years (1960-1985) around an average level of 21 000 t. Catches increased to a 79 000 t high in 1987 and declined steadily to a 450 t minimum reached in 1996. The NAFO Fisheries Commission implemented a moratorium on directed fishing for this stock in 1998. Catches remained at relatively low levels (450-3 000 t) until 2009. The Commission endorsed the Scientific Council recommendations from 2011 onwards and catches steadily increased to 13 050 t in 2019, the highest level recorded since 1993. Since then, catches have been decreasing and have remained below the TAC. In 2023, total catch was estimated to be 8 212 t (Table 10.1; Figure 10.1).

Table 10.1. Recent catches and TACs ('000 t) of redfish in NAFO Divisions 3LN

	2015	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	2023	2024
TAC	10.4	10.4	14.2	14.2	18.1	18.1	18.1	18.1	18.1	18.1
STATLANT 21	10.2	8.5	11.8	11.3	13.1	11.7	11.8	NA[1]	NA[1]	
STACFIS	9.9	8.5	11.8	11.3	13.1	11.1	10.2	9.0	8.2	

[1]NA - In 2022-2023, STATLANT 21 information is incomplete.

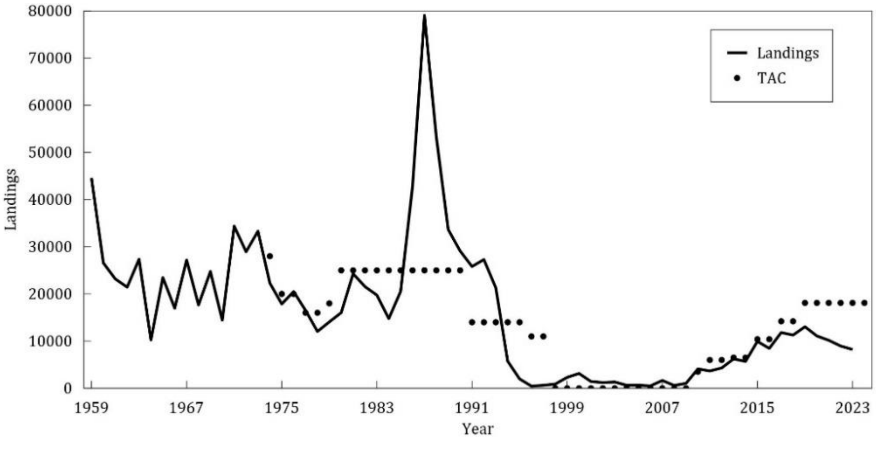

Figure 10.1. Redfish in Division 3LN: catches and TACs (No directed fishing is plotted as zero TAC)

b) Data Overview

i) Commercial fishery data

Most of the commercial length sampling data available for the 3LN redfish since 1990 comes from the Portuguese fisheries with data available from Spanish and Estonian fisheries since 2002 and 2008, respectively, as well as more limited data available from other countries. Commercial length frequency data has largely been absent from the Canadian fishery since 1991, with only sporadic sampling of often small sized fish.

ii) Research survey data

Canadian RV surveys

New vessel time series – Modified Campelen series.

Beginning in 2022, new survey vessels have been used to conduct the Canadian multi-species surveys. For redfish in NAFO Divisions 3LN, conversion factors that would allow data from the new vessels to extend existing time series data from the former primary research vessels (CCGS Wilfred Templeman and CCGS Alfred Needler) were only available for the Spring Teleost series. As a result, the spring Canadian Campelen series (1984-2019) and the autumn Canadian Campelen series (1990-2020) have ended.

Throughout the survey time series the CCGS Teleost was used to compliment or replace the primary vessels, with the assumption that catches were directly comparable. However, during the comparative fishing trials with the new vessels it was determined that the Teleost is not comparable for some species. Sensitivity analyses indicated that for redfish in Divisions 3LN, use of the Teleost in the autumn had minimal impact on indices, very little of the total biomass was represented in sets by this vessel in most year.

For the spring series, comparative fishing indicated that the Teleost is comparable to the new time series for redfish in Divisions 3LN. Years with complete/near-complete coverage with the Teleost (2016, 2018) have been removed from the 1984-2019 Campelen series, and included in a new spring time series which also includes the new survey series (modified Campelen).

Canadian stratified-random surveys that cover the entire stock area began in 1991. The survey was incomplete in spring 2006 and 2017, and autumn 2014. There was no spring survey in 3LN in 2021, or in fall in 2021 or 2022. The spring and fall surveys were complete in 3LN in 2023.

EU RV surveys

In 1995 EU-Spain started a stratified-random bottom trawl spring (May-June) survey in the NAFO Regulatory Area of Divisions 3NO. All strata within the NRA were covered every year following the standard stratification. Early surveys were completed to a depth of 732m and were extended to 1464 m in 1998. In 2003, this survey was extended northwards to include strata in Division 3L, but it has only been since 2006 that an adequate coverage of 3L has been accomplished in this survey. The EU-Spain survey was not completed in 3N in 2020 or 3L in 2020 - 2022.

Biomass indices

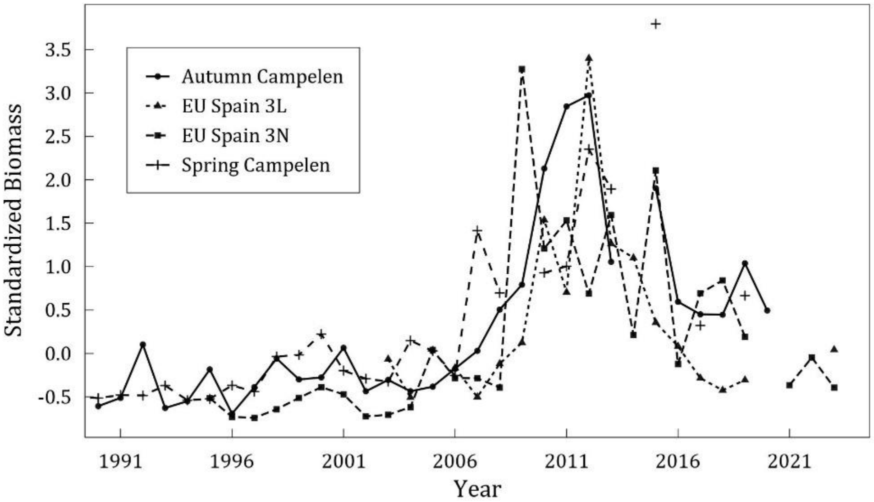

Figure 10.2. Redfish in Divisions 3LN: mean standardized survey biomass from the Canadian and EU-Spain RV surveys. Indices were normalized to its mean of 2003-2019.

Redfish bottom biomass from surveys in Divisions 3LN remained well below average level over the 1990's and early 2000's. By the mid-2000s, most indices began to show increases with each index peaking in the mid-2010s. Since the mid-2010s, there have been some conflicting signals between survey indices, however recent trends among different surveys are difficult to determine due to coverage gaps in recent years and a lack of appropriate conversion factors for the recent Canadian indices (Figure 10.2).

iii) Recruitment

Recruitment (abundance 15 -20 cm) has been below the long-term average since the mid-2010s in all surveys, with the exception of the 2023 EU-Spain survey in 3L (Figure 10.4).

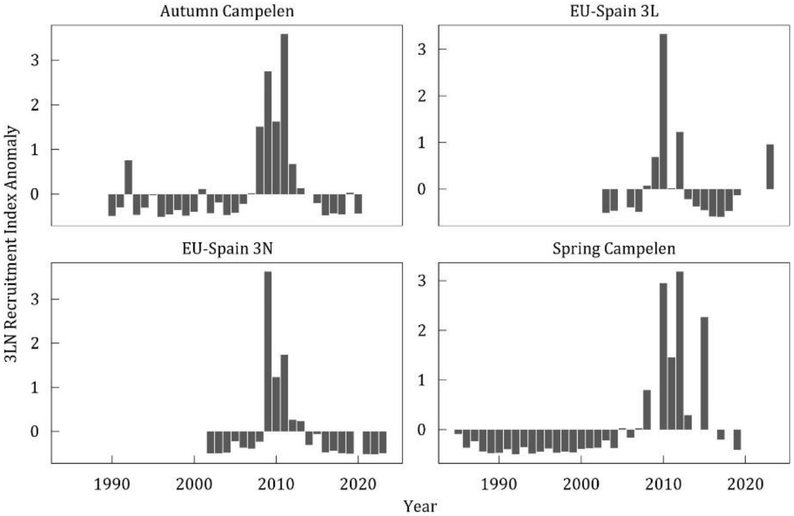

Figure 10.4. Recruitment index anomalies of 3LN redfish (15-20cm) from Canadian (DFO-NL) spring and autumn and EU-Spain 3L and 3N multispecies surveys.

c) Assessment Results

Biomass: A combined mean standardized biomass was calculated based on the series from the 3L and 3N EU-Spain, Canadian Fall Campelen and Spring Teleost standardized indices. The uncertainty estimates take into account the number of surveys available in any given year. The mean of the standardized survey biomass indices indicates that biomass has declined from timeseries highs in the mid-2010s, and B_{2023}/B_{lim} is estimated at 1.38. There is a 42% risk of the stock being below B_{lim} in 2023. Uncertainty in recent stock size remains high due to gaps in the survey series (Figure 10.6).

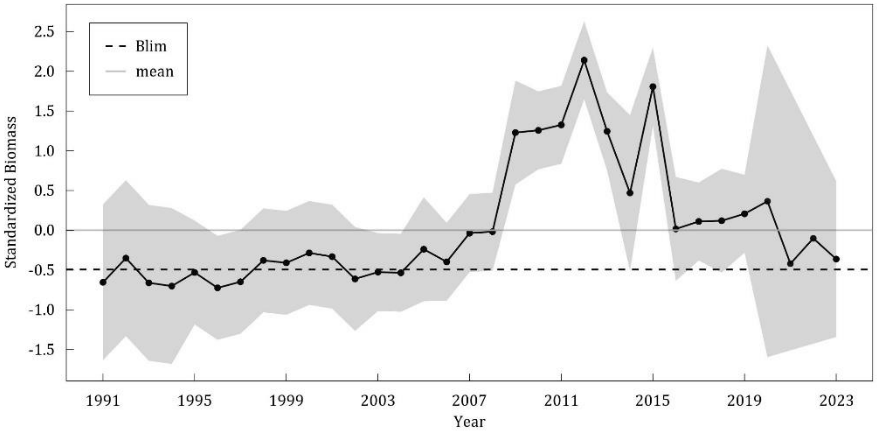

Figure 10.6. Redfish in Divisions 3LN: mean standardized survey biomass. Dashed line represents the average of the mean standardized survey biomass index from 1991-2005 (B_{rec}) and the solid grey line is the time series mean.

Fishing mortality: A fishing mortality proxy was derived as the ratio of the mean standardized catch to the mean standardized survey biomass, with values scaled between 0 and 1. Relative fishing mortality has been increasing in recent years, but remains well below the time series high seen in the early 1990's (Figure 10.5).

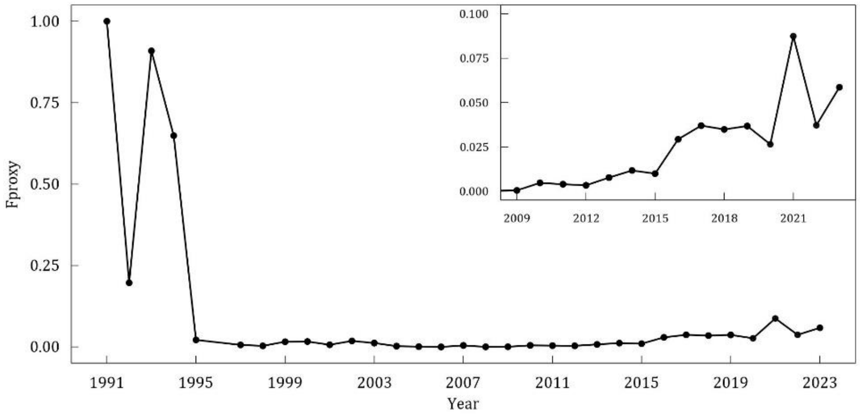

Figure 10.5. Redfish in Divisions 3LN: mean standardized catch/mean standardized survey biomass.

d) State of stock

The stock has decreased since 2015 and B_{2023}/B_{lim} is estimated at 1.38. There is a 42% risk of the stock being below B_{lim} in 2023. Recruitment (abundance 15 -20 cm) has been below the long-term average since the mid-2010s in all surveys, with the exception of the 2023 EU-Spain survey in 3L. Relative fishing mortality has been increasing in recent years, but remains well below the time series high seen in the early 1990's.

e) Reference points

A biomass reference point is derived from the combined standardized biomass index 3N EU-Spain, Canadian Fall Campelen and Spring Teleost (B_{lim}=B_{rec}) from the period 1991-2005. This period was chosen as it represented a time when stock biomass recovered from a prolonged low level.

f) Research recommendations

STACFIS **recommends** that *changes in maturity be explored for this stock*.

STACFIS **recommends** that *stock boundaries and definitions as well as synchronicity with adjacent stocks be explored for this stock*.

11. American plaice (*Hippoglossoides platessoides*) in Divisions 3LNO

Interim Monitoring Report (SCR Doc. 21/025, 032, 035, 24/007, 008, 036, 037; SCS Doc. 24/06, 08, 09, 11)

a) Introduction

American plaice supported large fisheries from the 1960s to the 1980s. However, due to the collapse of the stock in the early 1990s, there was no directed fishing in 1994 and a moratorium was put in place in 1995. Landings from by-catch increased until 2003, after which they began to decline. STACFIS agreed catches were 828 t in 2022 and 571 t in 2023 (Figure 11.1). American plaice are taken as by-catch mainly in the Canadian yellowtail flounder fishery, EU-Spain and EU-Portugal skate, redfish and Greenland halibut fisheries.

Recent catches and TACs ('000 tonnes) are as follows:

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
TAC	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf	ndf
STATLANT 21	1.1	1.0	1.1	0.9	1.2	1.1	0.9	NA[1]	NA[1]	
STACFIS	1.1[1]	1.7[1]	1.2	1.0	1.2	1.2	1.6	0.8	0.6	

ndf No directed fishing.

[1] NA - In 2022-2023, STATLANT 21 information is incomplete.

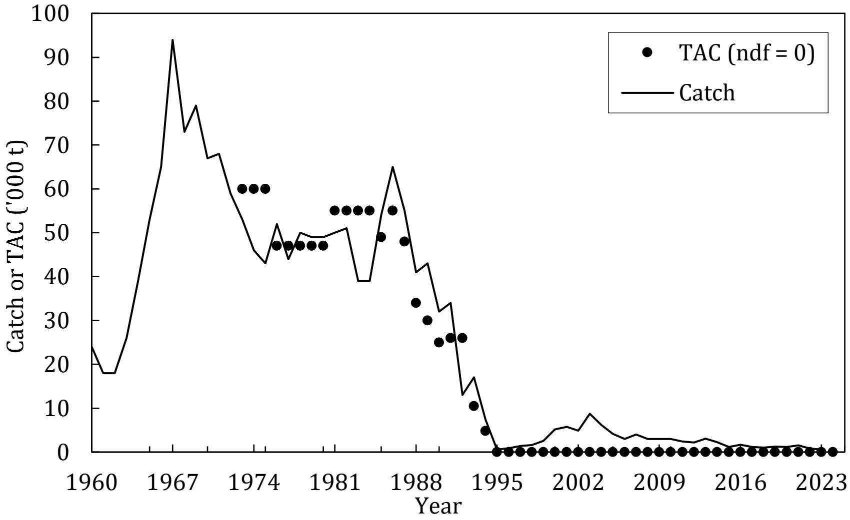

Figure 11.1. American plaice in Divisions 3LNO: estimated catches and TACs. No directed fishing is plotted as 0 TAC.

b) Data Overview

i) *Research Survey Data*

Canadian spring survey. Due to coverage issues in the Canadian spring survey, indices are not available from 2006, 2015, 2017, 2020, 2021 and 2022. Multiple vessels have been used to complete the Canadian spring survey. The 2023 survey was completed with the CCGS John Cabot using the modified Campelen trawl and the CCGS Teleost. Comparative fishing indicates these two vessels have equivalent catchability for American plaice in 3LNO in spring; this starts a new modified Campelen series including 2016 (survey completed by the CCGS Teleost) and for 2023 onwards.

The CCGS Wilfred Templeman and CCGS Alfred Needler are sister ships, with catches directly comparable with each other. While also previously assumed interchangeable with the CCGS Teleost, differences in trawl performance and conversion factors to the CCGS John Cabot reported during the CAN-NL comparative fishing program indicate differences in catchability for American plaice; indices from the CCGS Wilfred Templeman and CCGS Alfred Needler cannot be directly compared to those of the CCGS Teleost and CCGS John Cabot. For this report, survey indices from the 1983-2021 Campelen series are presented as previously reported (with the exception of 2016 which has been converted to the new series) with sensitivity analysis indicating overall survey trends were robust to mixing of CCGS Teleost, CCGS Alfred Needler and CCGS Wilfred Templeman in this period. However, this should be re-evaluated – including for size – and age-based indices – in the next assessment.

Biomass and abundance estimates declined during the late 1980s-early 1990s. Biomass indices generally increased from the mid-1990s to 2014 but declined sharply after that (Figure 11.2). The abundance index follows a similar trend. The 2023 survey abundance index is lower than the previous point (2016) in the modified Campelen series, while biomass is unchanged.

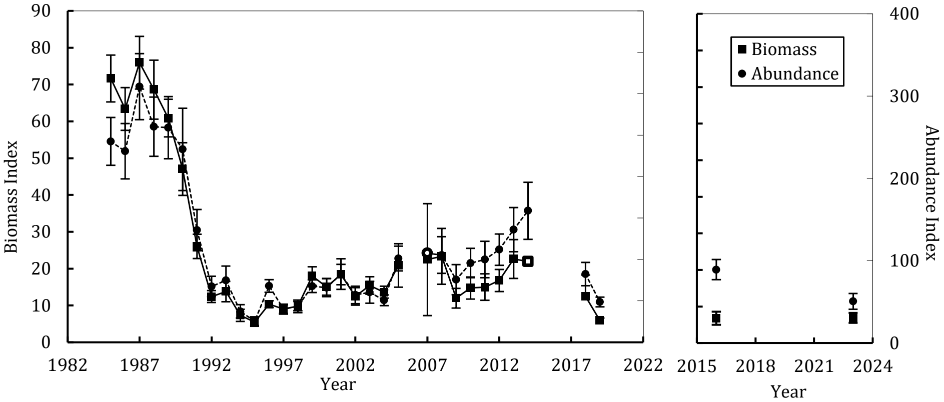

Figure 11.2. American plaice in Divisions 3LNO: biomass and abundance indices with approximate 95% confidence intervals from Canadian spring surveys during the Campelen series (left) and Modified Campelen (right). Open symbols represent years where CIs extend to negative values.

Canadian autumn survey. Autumn survey points for 2004 and 2014 are excluded due to incomplete coverage of Divisions 3L and 3NO, respectively. There was no autumn survey in Divisions 3LNO in 2021 to 2022. As with the spring, multiple vessels have been used to complete the Canadian fall survey, with indices presented here to 2020 as previously reported. Biomass and abundance indices (Figure 11.3) from the autumn survey declined rapidly from 1990 to the mid-1990s, and indices have generally been below average since. There was an increase in biomass to 2013 but this trend did not persist.

Comparative fishing data were insufficient to inform on conversion factors to the new survey vessels in fall for 3LNO American plaice, therefore a new survey series starts in 2023. The 2023 survey was completed with the CCGS John Cabot and CCGS Capt. Jacques Cartier and cannot be directly related to the earlier time series.

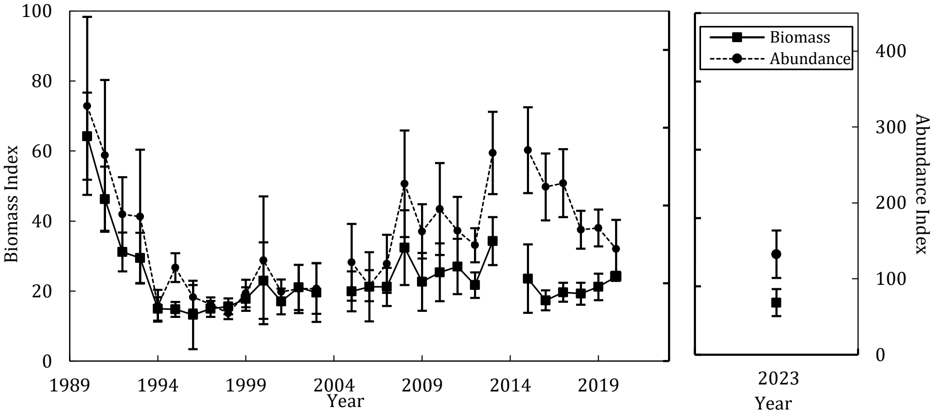

Figure 11.3. American plaice in Divisions 3LNO: biomass and abundance indices with approximate 95% confidence intervals from Canadian autumn surveys. In the first panel (left), data prior to 1996 are Campelen equivalents and since then are Campelen. In the second panel (right), data are modified Campelen units.

EU-Spain Divisions 3NO Survey. From 1998-2023, surveys have been conducted annually by EU-Spain in the Regulatory Area in Divisions 3NO. There was no survey in 3NO in 2020. The biomass and abundance indices varied without trend for most of the time series but then subsequently declined and have remained low since 2016 (Figure 11.4).

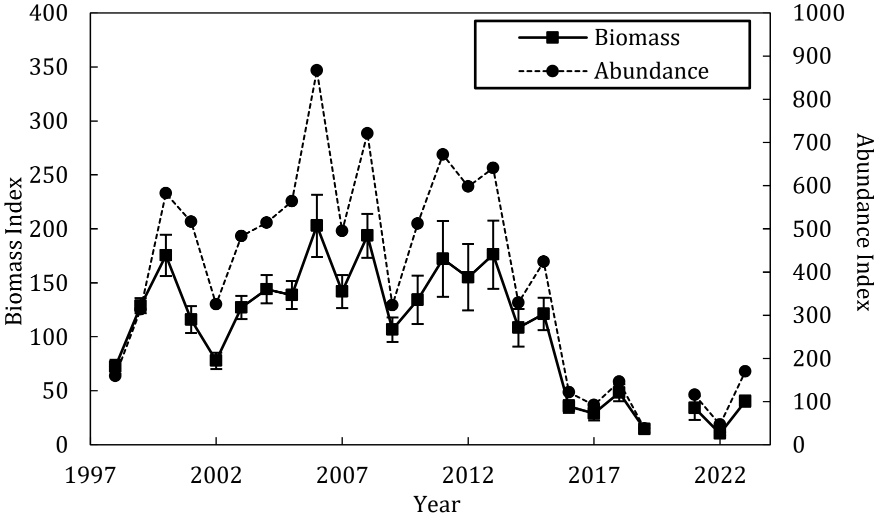

Figure 11.4. American plaice in Divisions 3LNO: biomass and abundance indices from the EU-Spain Divisions 3NO survey (data prior to 2001 are Campelen equivalents and since then are Campelen).

EU-Spain Division 3L Survey. Since 2003 surveys have been conducted annually by EU-Spain in the Regulatory Area in Division 3L. Surveys in 3L were not completed in 2005 or 2020 to 2022. The biomass and abundance indices increased from 2010 to 2015, and subsequently declined to 2019. Biomass in 2023 is similar to that observed from 2017 to 2019, while abundance indicates a continued decline and it is the lowest observed since 2013 (Figure 11.5).

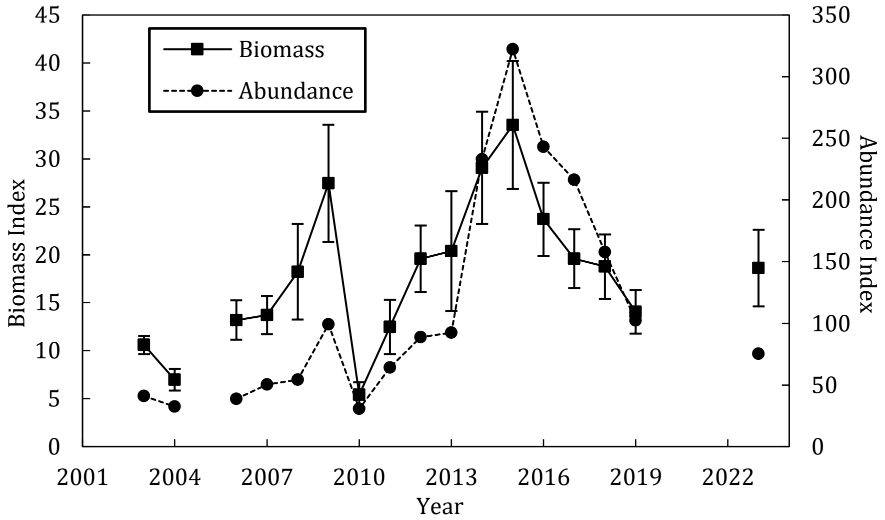

Figure 11.5. American plaice in Divisions 3LNO: biomass and abundance indices from the EU-Spain Division 3L survey.

c) Conclusion

The most recent Canadian surveys cannot be directly compared to previous series due to a lack of conversion factors. However, given the overall scale of recent Canadian indices, and with the continued low levels of American plaice reported in the EU-Spain surveys, there is nothing to indicate a change in the status of the stock since the 2021 assessment.

There will be no new assessment until monitoring shows that conditions have changed.

d) Research Recommendations

STACFIS **recommended** that *a benchmark be undertaken for this stock, including investigations be undertaken to reexamine which survey indices are included in the model.*

STACFIS **recommends** that *analyses be completed to update on bycatch of American plaice in the Yellowtail flounder fishery.*

STACFIS **recommends** that *investigations be undertaken to examine the impact of past vessel mixing in the Canadian surveys on length- and age-based indices.*

STACFIS **recommends** that *investigations be undertaken to compare ages obtained by current and former Canadian age readers.*

STATUS: Work is ongoing. This recommendation is reiterated.

12. Yellowtail flounder (*Limanda ferruginea*) in Divisions 3LNO

Interim Monitoring Report (SCR Doc. 24/007, 014, 037; SCS Doc. 24/06, 07, 08, 09)

a) Introduction

There was a moratorium on directed fishing from 1994 to 1997, and small catches were taken as by-catch in other fisheries. The fishery was re-opened in 1998 and catches increased from 4 400 t to 14 100 t in 2001 (Figure 12.1). Catches from 2001 to 2005 ranged from 11 000 t to 14 000 t. In many years from 2006 to 2018, catches were influenced by industry related factors, remained below the TAC, and in some years, were very low. From 2019 to 2022, catches were higher and ranged from 10 600 t to 14 800 t. In 2023, catches were again lower than the TAC, and at 3 213 t were the lowest observed since 2006.

Recent catches and TACs ('000 tons) are as follows:

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
TAC	17	17	17	17	17	17	17	20	20	15.6
STATLANT 21	6.9	6.8	9.1	8.6	12.5	14.4	14.7	NA[1]	NA[1]	
STACFIS	6.9	9.3	9.2	8.7	12.8	14.8	14.6	10.6	3.2	

[1] NA - In 2022-2023, STATLANT 21 information is incomplete.

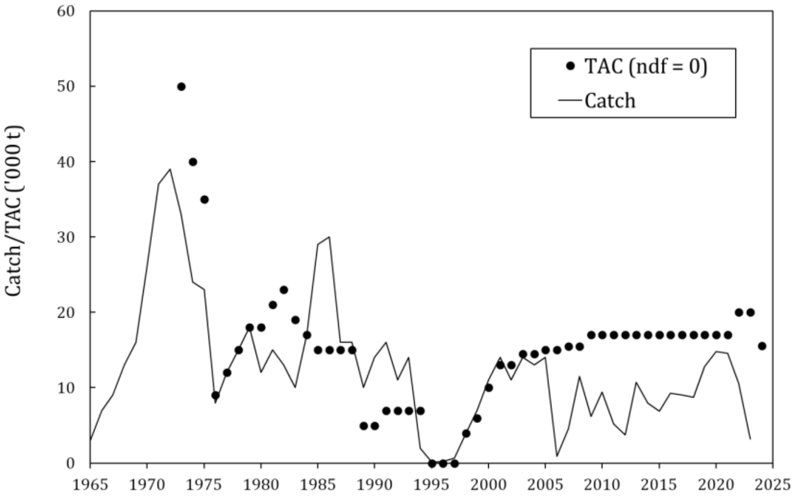

Figure 12.1. Yellowtail flounder in Divisions 3LNO: catches and TACs. No directed fishing is plotted as 0 TAC.

b) Data Overview

i) Research survey data

New vessel time series. Beginning in 2022, new survey vessels have been used to conduct the Canadian multi-species surveys. For yellowtail flounder in NAFO Divisions 3LNO, data from comparative fishing experiments were used to derive a length-based conversion factor to allow data from the new vessels to extend existing time series data from the former primary research vessels.

Occasionally throughout the survey time series the CCGS Teleost was used to compliment or replace the primary vessels, with the assumption that catches from the Teleost were directly comparable to those vessels. During the comparative fishing trials with the new vessels, however, it was determined that the Teleost is comparable to the new vessels, and not directly comparable to the Wilfred Templeman and Alfred Needler for some species. For yellowtail flounder in Divisions 3LNO, use of the Teleost in the spring and autumn surveys has little impact on the biomass index series as the Teleost sets are comparable to the new survey vessels and with conversion of the previous information, biomass indices have been constructed for both spring (from 1984) and autumn (from 1990).

Canadian stratified-random spring surveys (modified Campelen units). Although variable, the spring survey biomass index increased from 1995 to 2012 with a general decline thereafter. The 2006 and 2015 surveys did not cover the stock area and are not considered representative. The 2022 and 2023 survey biomass estimates have increased from the 2019 estimate (Figure 12.2).

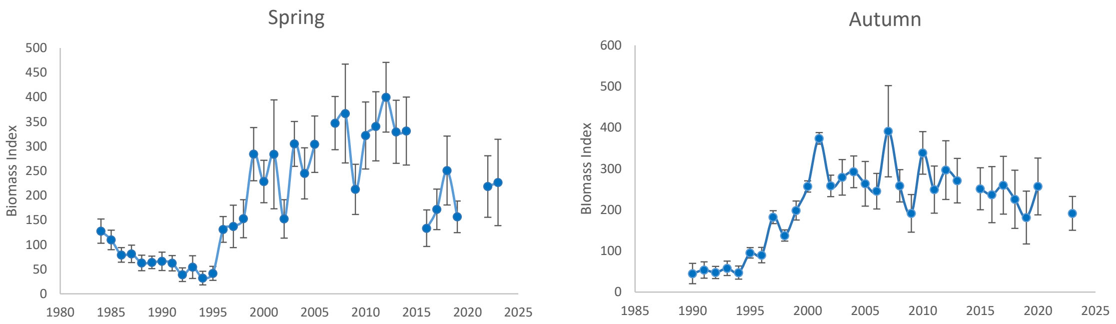

Figure 12.2. Yellowtail flounder in Divisions 3LNO: indices of biomass with approximately 95% confidence intervals, from Canadian spring and autumn surveys. Values are modified Campelen units or, prior to 2022, modified Campelen equivalent units. There were no surveys in Canadian autumn of 2014 or 2021, and there were no spring surveys conducted in 2020 or 2021 (error bars for autumn do not include error for the TEL sets).

Canadian stratified-random autumn surveys (modified Campelen units). The autumn survey biomass index for Divisions 3LNO increased steadily from the early-1990s to 2001, and although variable, it was relatively high (Figure 12.2), then has shown a slight decreasing trend from 2007-2023. The 2014 survey was incomplete due to problems with the research vessel, and results are not considered representative.

EU-Spain stratified-random spring surveys in the NAFO Regulatory Area of Divisions 3NO. The biomass index of yellowtail flounder increased sharply up to 1999 and remained relatively stable until 2013. Since then, biomass estimates declined to 2022 (second lowest in the time series) before increasing in 2023 (Figure 12.3). Trends are in general agreement with the Canadian series which covers the entire stock area.

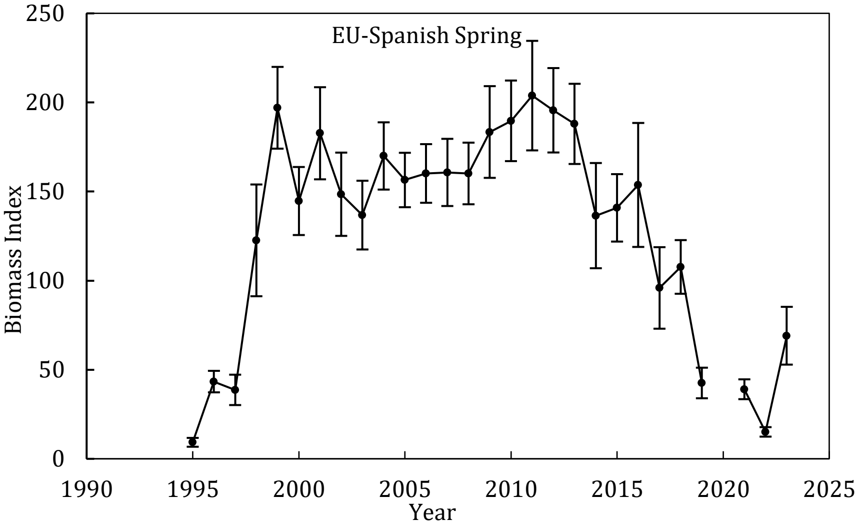

Figure 12.3. Yellowtail flounder in Divisions 3LNO: index of biomass from the EU-Spain spring surveys in the Regulatory Area of Divisions 3NO ±1SD. Values are Campelen units or, prior to 2001, Campelen equivalent units. There was no survey conducted in 2020.

Stock distribution. In all surveys, yellowtail flounder were most abundant in Divisions 3N, in strata on the Southeast Shoal and those immediately to the west (360, 361, 375 & 376), which straddle the Canadian 200 mile limit. Yellowtail flounder appeared to be more abundant in the Regulatory Area of Division 3N in the 1999-2023 surveys than from 1984-1995, and the stock has continued to occupy the northern portion of its range in Division 3L, similar to the mid-1980s when overall stock size was also relatively large. The vast majority of the stock is found in waters shallower than 93 m in both seasons.

Recruitment: Total numbers of juveniles (<22 cm) from spring and autumn surveys by Canada and spring surveys by EU-Spain are given in Figure 12.4 scaled to each series mean. Data from the modified Campelen spring and autumn time series were not available but will be included in future assessments. High catches of juveniles seen in the autumn of 2004 and 2005 were not evident in either the Canadian or EU-Spain spring series. No clear trend in recruitment is evident, although since 2007, the number of small fish in several Canadian surveys has been above average. The spring survey by EU-Spain has shown lower than average numbers of small fish since 2007, however in 2021, the number of small fish were higher than the mean. Given the absence of available recruitment (<22cm) information since 2020, recent recruitment in the complete stock area is unknown.

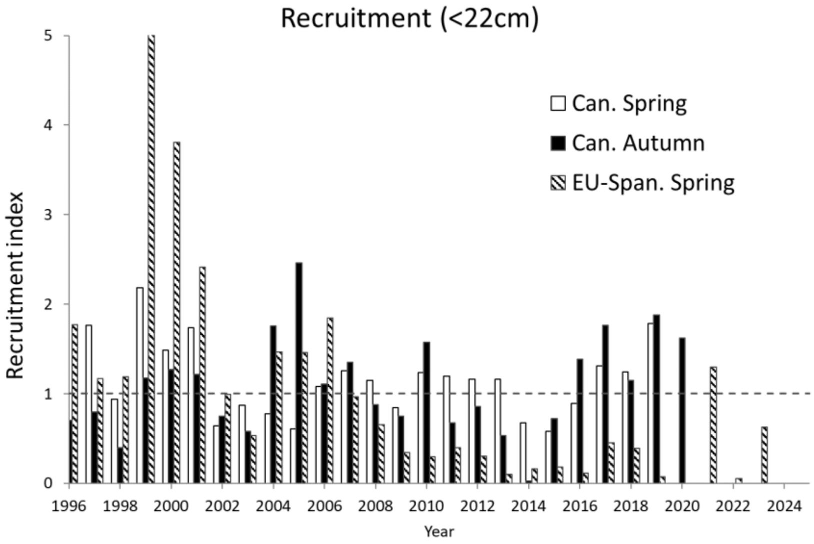

Figure 12.4. Yellowtail flounder in Divisions 3LNO: Juvenile abundance indices from spring and autumn surveys by Canada (Can.) and spring surveys by EU-Spain. Each series is scaled to its mean (horizontal line).

c) Conclusion

The most recent (2023) analytical assessment using a Bayesian stock production model concluded that the stock size steadily increased since 1994 and was 1.1 times B_{msy} (B_{msy}=91.1 t). There was very low risk (<1%) of the stock being below B_{msy} or F being above F_{msy}. Overall, the 2023 survey indices are not considered to indicate a significant change in the status of the stock.

The next full assessment of this stock is planned for 2025.

13. Witch Flounder (*Glyptocephalus cynoglossus*) in Divisions 3N and 3O

Full Assessment (SCR Doc. 24/007, 018, 036, 037; SCS Doc. 24/06, 08, 09, 11)

a) Introduction

From 1972 to 1984, reported catch of witch flounder in NAFO Divisions 3NO ranged from a high of about 9 200 tonnes (t) in 1972 to a low of about 2 400 t in 1980 and 1981 (Figure 13.1). Catches increased to around 9 000 t in the mid-1980s but then declined steadily to less than 1 200 t in 1995. A moratorium on directed fishing was imposed in 1995 and remained in effect until 2014. During the moratorium, bycatch averaged below 500 t. The NAFO Fisheries Commission reintroduced TACs in 2015. Not all Contracting Parties with quota resumed directed fishing for witch flounder until 2019, when participation in the fishery was more representative. Catch since 2015 has been below the TAC. In 2023, total catch was estimated to be 268 t.

Table 13.1 Recent catches and TACs ('000 t) of witch flounder in NAFO Divisions 3NO

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
TAC	1.0	2.2	2.2	1.1	1.2	1.2	1.2	1.2	1.3	1.4
STATLANT 21	0.4	0.6	0.6	0.7	0.9	0.6	0.6	NA[1]	NA[1]	
STACFIS	0.4	1.1	0.7	0.7	0.9	0.7	0.6	0.6	0.3	

[1] NA - In 2022-2023, STATLANT 21 information is incomplete.

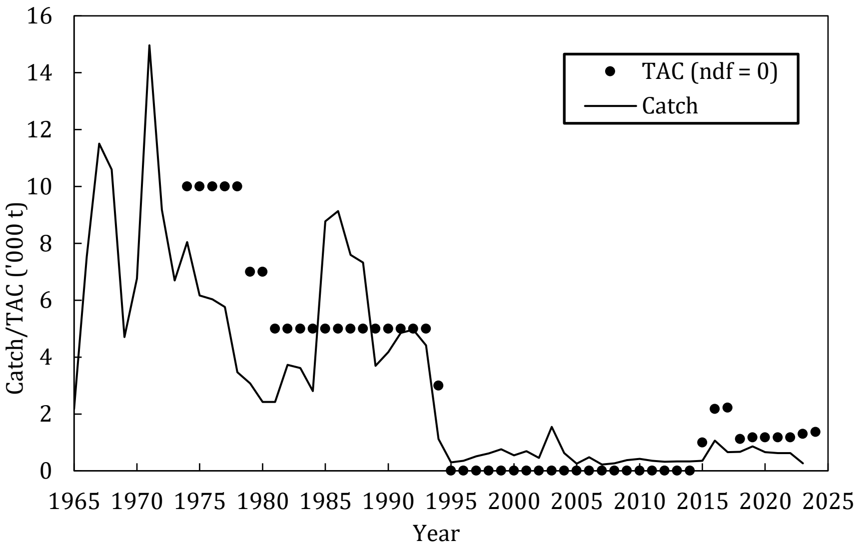

Figure 13.1. Witch flounder in Divisions 3NO (1960-2024): Catch and TAC ('000 tonnes).

b) Data Overview

i) Commercial fishery data

Length frequencies. Length frequencies were available from observer data for Canadian witch flounder directed and bycatch fisheries in NAFO Division 3O in 2022 and 2023. Canadian data indicated the catch and bycatch ranged between 30 and 55 cm with a mean length of ~40 cm (Figure 13.2). Length frequencies were available from bycatches in directed fisheries for redfish, Greenland halibut and skate by Spain, in 2023 (Figure 13.2). The Spanish data from Divisions 3NO indicated most of the witch flounder catch and bycatch was between 26 and 50 cm in length (Figure 13.2).

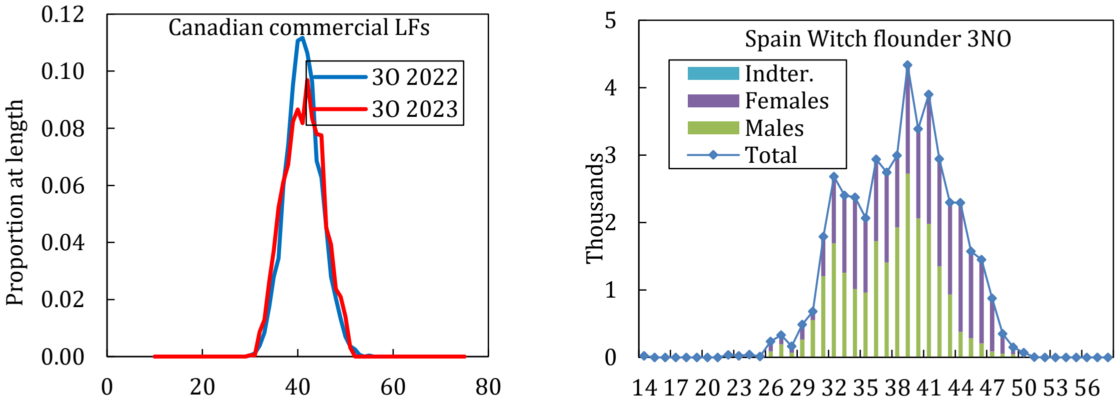

Figure 13.2. Witch flounder length frequency (cm) distributions for Canada (2022 and 2023) and Spain (2023) commercial bycatch and directed fisheries.

ii) Research survey data

New vessel time series – Modified Campelen series. Beginning in 2022, new survey vessels have been used to conduct the Canadian multi-species surveys. For witch flounder in NAFO Divisions 3NO, data from comparative fishing experiments were insufficient to provide conversion factors that would allow data from the new vessels to extend existing time series data from the former primary research vessels (CCGS Wilfred Templeman and CCGS Alfred Needler). As a result, the spring Canadian Campelen series (1984-2019) and the autumn Canadian Campelen series (1990-2020) have ended.

As well, occasionally throughout the survey time series the CCGS Teleost was used to compliment or replace the primary vessels, with the assumption that catches from the Teleost were directly comparable to those vessels. However, during the comparative fishing trials with the new vessels it was determined that the Teleost is comparable to the new vessels for witch flounder in Divisions 3NO, but not directly comparable to the Wilfred Templeman and Alfred Needler. For witch flounder in Divisions 3NO, use of the Teleost in the autumn surveys has little impact on this biomass index series as those survey sets were primarily in deep strata and very little of the total biomass was represented in those sets. For the spring series, since the Teleost sets are comparable to the new survey vessels, the years with complete/near-complete coverage with the Teleost (2014, 2016, 2018) have been removed from the 1984-2019 Campelen series, and included in a new spring time series which also includes the new survey series (modified Campelen).

Canadian spring RV surveys.

1984-2019 Campelen series. Due to substantial coverage deficiencies, values from 2006 are not presented. Due to COVID-19 restrictions and operational difficulties, respectively, the spring survey was not conducted in 2020 or 2021. The spring Campelen biomass index, although variable, had shown a general decreasing trend from 1985 to 1998, a general increasing trend from 1998 to 2003, and a general decreasing trend from 2003 to 2010. From 2010 to 2013 the index increased to values near the series high from 1987 (Figure 13.3). Biomass indices declined substantially from a high in 2013 to a value 51% of the time series average in 2015. Biomass indices remained relatively stable since 2015 (Figure 13.3).

2014-2023 Modified Campelen series. Biomass estimates from the modified Campelen series have been stable, but with wide error bars in some years (Figure 13.3).

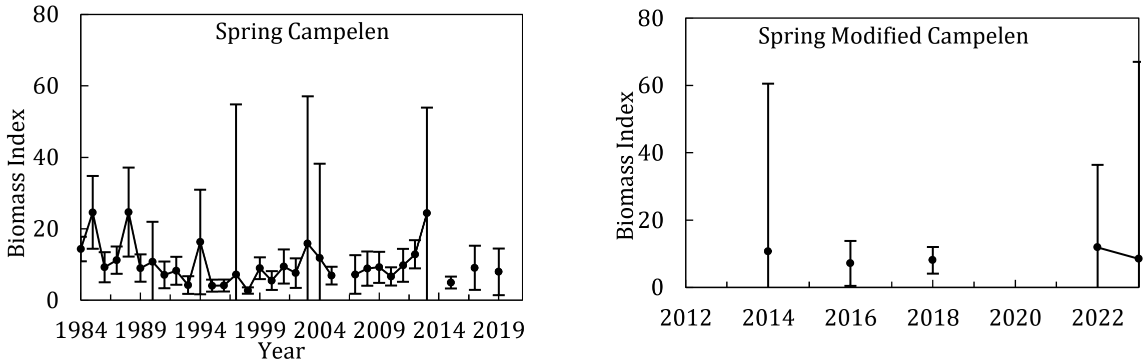

Figure 13.3. Witch flounder in NAFO Divisions 3NO: Left- survey biomass indices from Canadian Campelen spring surveys 1984-2019 (95% confidence limits are given) and right- the new survey index (2014-2023) with the Teleost and the Cabot (modified Campelen/equivalent units).

Canadian autumn RV surveys.

1990-2020 Campelen series. Due to operational difficulties, there were no 2014 or 2021 autumn surveys and, due to targeted comparative fishing exercises, there was no survey in autumn 2022. The biomass indices showed a general increasing trend from 1996 to 2009 but declined to 54% of the time series average in 2016 (Figure 13.4). Biomass indices increased slightly from 2016 to 2019, then decreased in 2020.

2023 Modified Campelen series. There was only one survey in autumn 2023 with the new vessel (no conversion factor available) (Figure 13.4).

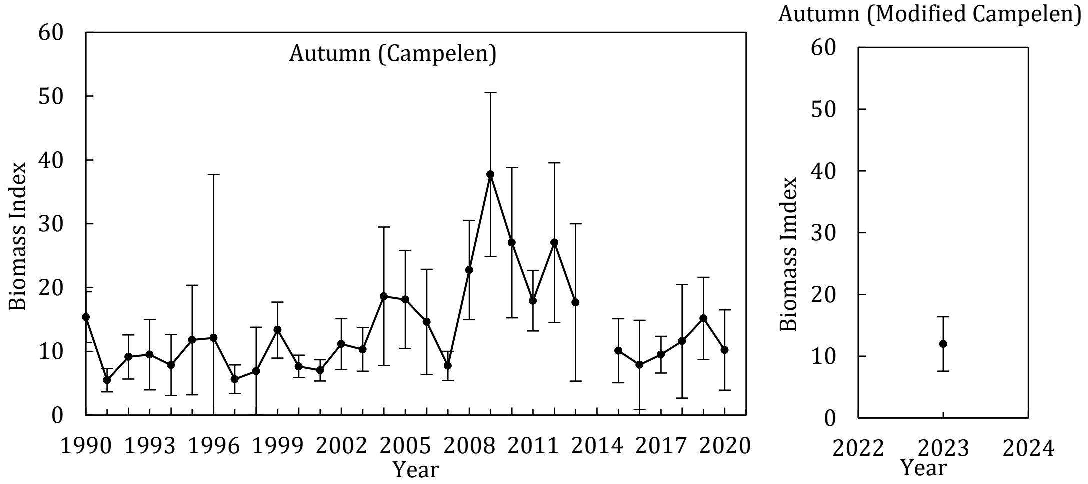

Figure 13.4. Witch flounder in Divisions 3NO: left plot is biomass indices from autumn Canadian surveys 1990-2019 (95% confidence limits are given; Campelen); right plot is biomass index from autumn Canadian survey (new vessel with modified Campelen; 2023 only).

EU-Spain RV spring survey. Surveys have been conducted annually from 1995 to 2023 by EU-Spain in the NAFO Regulatory Area in Divisions 3NO to a maximum depth of 1 450 m (since 1998). In 2001, the vessel (*Playa de Menduiña*) and survey gear (Pedreira) were replaced by the R/V *Vizconde de Eza* using a Campelen trawl. Data for witch flounder prior to 2001 have not been converted and therefore data from the two time series cannot be compared. In the Pedreira series, the biomass increased from 1995-2000 but declined in 2001. In the Campelen series, the biomass has been variable, but has shown a general decrease from 2004. No survey was conducted in 2020 (Figure 13.5).

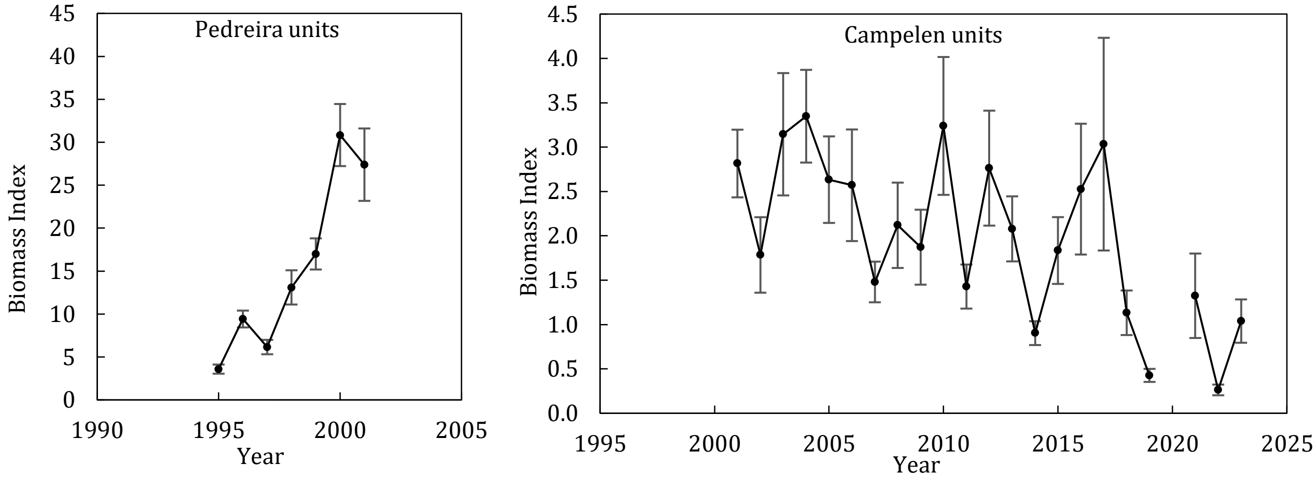

Figure 13.5. Witch flounder in Divisions 3NO: biomass indices from EU-Spanish Division 3NO spring surveys (± 1 standard deviation). Data from 1995-2001 are in Pedreira units; data from 2001-2023 are Campelen units. Both values are presented for 2001.

Abundance at length. Length frequencies of 30-50 cm fish increased from 2003 to 2005, decreased to pre-2002 levels from 2006 to 2007, and were then consistently higher from 2008 to 2014 (note there was no survey data collected in the fall of 2014, spring of 2020, or either season in 2021) with a mode generally within the mode of 40 cm (Figure 13.6). The increase in 30-50 cm fish is generally more pronounced in the fall survey data as opposed to the flatter distributions of the spring surveys. From 2015 to 2019, fish at this size mode were less prominent than seen in 2008 to 2014, although in fall 2020 this larger mode of fish increased.

There were a number of distinctive peaks in the 5-15 cm range (recruitment year classes) in surveys that were evident and could be followed through successive years. This included the periods from 2007-2009 and 2013-2014 in the Canadian spring series and from 2002-2004 and 2005-2006 in the Spanish spring series (Figure 13.6). In particular, a distinctive recruitment peak in the 10 cm range was evident in the 2017 Canadian autumn RV survey. Growth of this peak can be tracked through both Canadian spring and autumn surveys, and in 2019 these fish appear in a mode in the 21-26 cm range. Another strong peak of fish at about 5 cm is observed in the 2019 spring Canadian survey which is evident at 7-10 cm in size in the Canadian autumn survey. The 2020 fall autumn survey did not detect this recruitment peak, however, and there were no surveys that covered the stock area in 2021 (Figure 13.6). The 2019 Spanish spring survey had low levels of witch flounder at all sizes. For surveys in the most recent years, there were few fish seen under 21 cm with the exception of the spring and autumn surveys in 2023. These modified Campelen surveys are not directly comparable with the previous Campelen series, but they do indicate that fish at this size range were present.

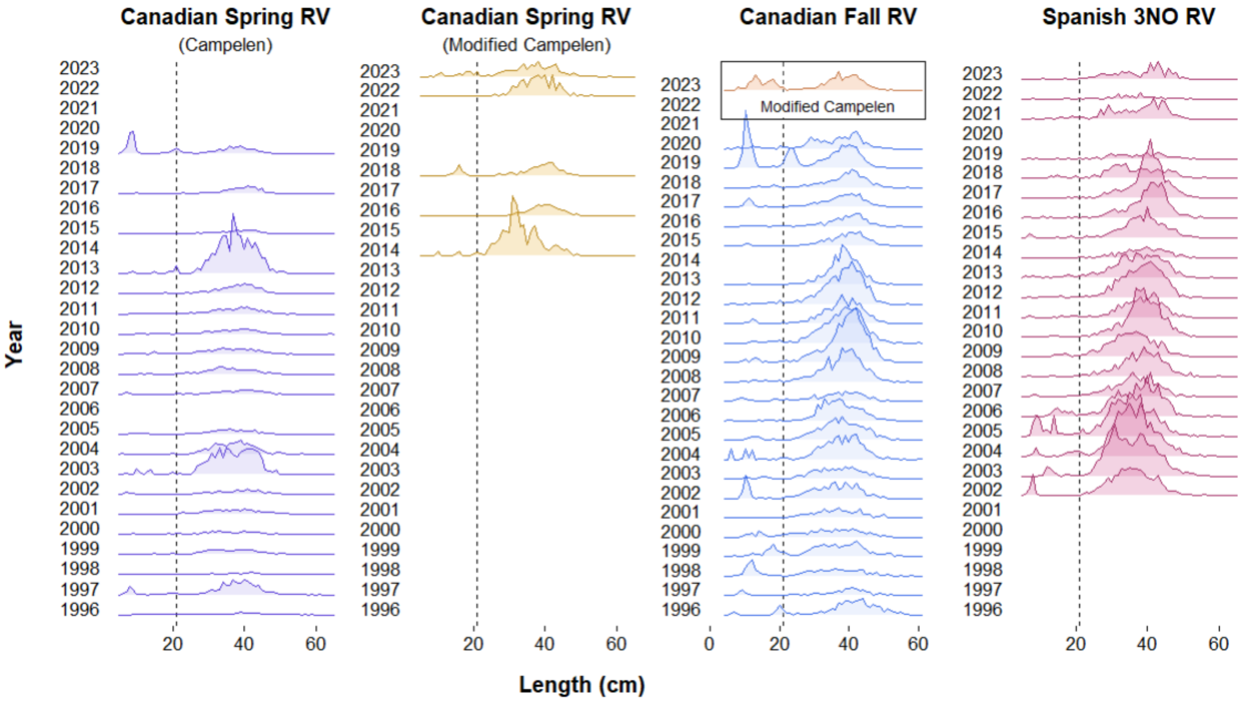

Figure 13.6. Length frequencies (abundance at length) of witch flounder from spring Canadian (1996-2019) Campelen and modified Campelen (2014, 2016, 2018, 2022-2023) series, autumn Canadian (1996 to 2020) Campelen and modified Campelen (2023) and Spanish (2002-2023) RV surveys in NAFO Divisions 3NO. No Canadian survey data was available in spring 2006, 2020, 2021 or autumn 2014, 2021, 2022. Vertical line represents the length at which fish are expected to be recruited to the population (21 cm).

Distribution. Analysis of distribution data from the surveys show that this stock is mainly distributed in Division 3O along the southwestern slopes of the Grand Bank. In most years the distribution is concentrated toward the slopes but in certain years, an increased percentage may be distributed in shallower water. A 2014 analysis of Canadian biomass proportions by depth aggregated across survey years (spring 1984-2014 and autumn 1990-2014) indicated that in Division 3N both spring and autumn biomass proportions were fairly evenly distributed over a depth range of 57-914 m while those in Division 3O were more restricted to a shallower depth range of 57-183m. Distributions of juvenile fish (less than 21 cm) were slightly more prevalent in shallower water during autumn surveys. It is possible however, that the juvenile distribution may be more related to the overall pattern of witch flounder being widespread in shallower waters during the post-spawning autumn period, although other stocks show a pattern of juvenile fish occupying shallow and/or inshore areas.

In years where all strata were surveyed to a depth of 1462 m in the autumn survey, generally less than 5% of the Divisions 3NO biomass was found in the deeper strata (731-1462 m).

c) Estimation of Parameters

A Schaefer surplus production model in a Bayesian framework was used for the assessment of this stock. The input data were catch from 1960-2023, Canadian spring Campelen survey series from 1984-1990, Canadian Campelen spring survey series from 1991-2019 (no 2006, 2014, 2016, or 2018), the Canadian autumn Campelen survey series from 1990-2020 (no 2014 or 2021), and the Canadian modified Campelen series 2014, 2016, 2018, 2022-2023. The model formulation was identical to the accepted formulation from the 2022 assessment.

The priors used in the model were:

Median initial population size (relative to carrying capacity)	Pin~dunif(0.5, 1)	uniform(0.5 to 1)
Intrinsic rate of natural increase	r ~ dlnorm(-1.763,3.252)	lognormal (mean, precision)
Carrying capacity	K~dlnorm(4.562,11.6)	lognormal (mean, precision)
Survey catchability	q =1/pq pq ~dgamma(1,1)	gamma(shape, rate)
Process error (sigma=standard deviation of process error in log-scale)	For 1960-2013 and 2017-2021 sigma ~ dunif(0,10) precision:isigma2= sigma^{-2} For 2014-2016 sigmadev <-sigma+1 precision: isigmadev2=sigmadev^{-2}	uniform(0 to 10)
Observation error (tau=variance of observation error in log-scale)	tau~dgamma(1,1) precision:itau2 = 1/tau	gamma(shape, rate)

d) Assessment Results

Recruitment: With the exception of the growth of the stock following improved recruitment in the late 1990s, it is unclear if the recruitment index (survey number of fish <21 cm; Figure 13.7) is representative. Nevertheless, the recruitment index in 2019 was the highest in the time series. The small fish did not appear in the 2020 Canadian autumn survey, however, and the recruitment index was again below average. The number of small fish in the Canadian modified Campelen survey was about average in 2014, lower than average in 2022, and above average in 2018 and 2023. Recent recruitment appears to be average.

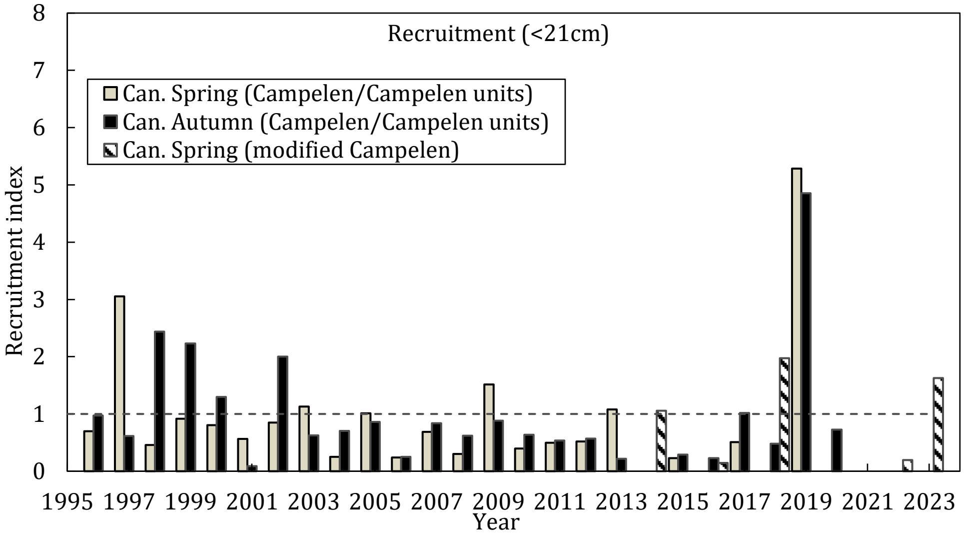

Figure 13.7. Recruitment index of witch flounder (<21cm) from spring and autumn Canadian RV surveys (Campelen) in NAFO Divisions 3NO 1996-2020 and spring Canadian modified Campelen (2014-2023). No survey data available in autumn 2014, 2021 or spring 2006, 2020, 2021.

Stock Production Model: The surplus production model results indicate that stock size decreased from the late 1960s to the late 1990s and then increased from 1999 to 2013. The decline from 2013 to 2015 was followed by a general increase. The model suggests that a maximum sustainable yield (*MSY*) of 3 715 (3 052 – 4 652) tonnes can be produced by total stock biomass of 60 730 (46 529 – 73 780) tonnes (B_{msy}) at a fishing mortality rate (F_{msy}) of 0.061 (0.047-0.087) (Figure 13.8).

Biomass: The analysis showed that relative population size (median B/B_{msy}) was below B_{lim} *(30%*B_{msy}*)* from 1993-1997 (Figure 13.8). Biomass at the beginning of 2024 is 48% of B_{msy} with a probability of being below B_{lim} of 11%.

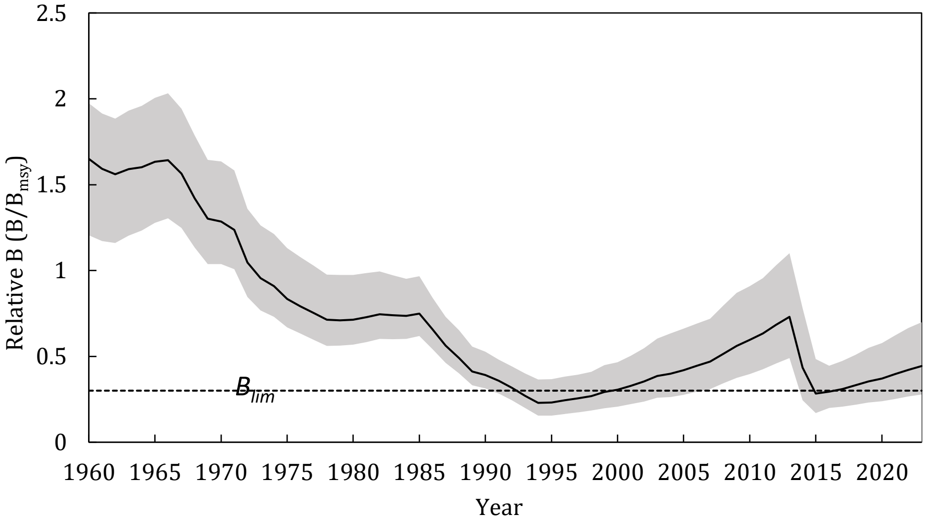

Figure 13.8. Witch flounder in Divisions 3NO. Median relative biomass (*Biomass/*B_{msy}) with 80% credible intervals from 1960-2023. The horizontal line is $B_{lim}=30\%B_{msy}$.

Fishing Mortality: Relative fishing mortality rate (median F/F_{msy}) was mostly above 1.0 from the late 1960s to the mid-1990s (Figure 13.9). *F* has been below F_{msy} since the moratorium implemented in 1995. Median *F* was estimated to be 16% of F_{msy} with a low probability (<1%) of being above F_{msy} in 2023.

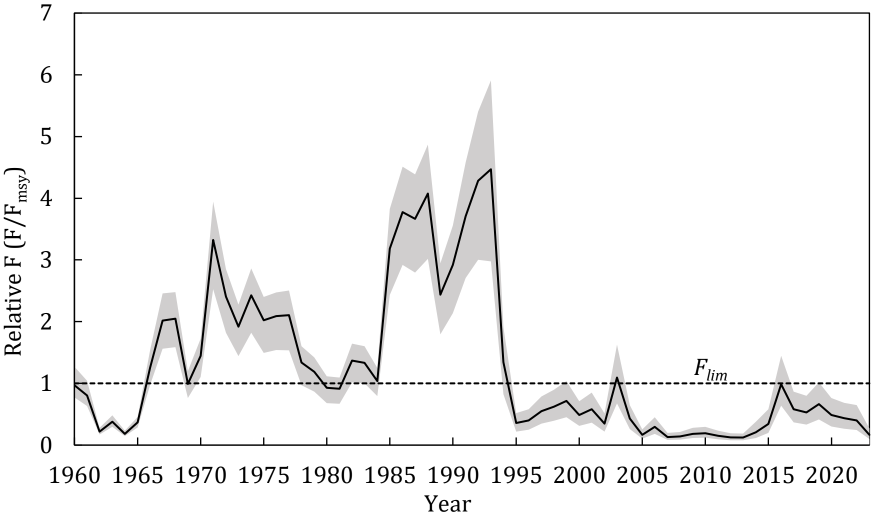

Figure 13.9. Witch flounder in Divisions 3NO. Median relative fishing mortality (F/F_{msy}) with 80% credible intervals from 1960-2023. The horizontal line is F_{lim}=F_{msy}.

e) State of the Stock

The stock has increased slightly since 2015 and is estimated at 48% B_{msy}. At the beginning of 2024, there is an 11% risk of the stock being below B_{lim} and less than 1% risk of F being above F_{lim}. Recent recruitment appears to be average.

f) Medium Term Considerations

The posterior distributions (13 500 samples) for r, K, sigma and biomass and the production model equation were used to project the population to 2027. Two scenarios were projected, one assumed that the catch in 2024 was equal to the TAC of 1 367 t, and the second assumed catch in 2024 was equal to the average catch in the last three years (505 t). These catch assumptions were then followed by constant fishing mortality for 2025 and 2026 at several levels of F ($F=0$, F_{2023}, 2/3 F_{msy}, 75% F_{msy}, 85% F_{msy} and F_{msy}).

The probability that $F > F_{lim}$ in 2024 is 14% at a catch of 1 367 t (10.5% for Catch$_{2024}$=505 t). The probability of F>F_{lim} in 2025 and 2026 ranged from 1 to 51% for the catch scenarios tested (Tables 13.2 and 13.3). The population is projected to grow under all scenarios (Figure 13.10) and the probability that the biomass in 2027 is greater than the biomass in 2024 is 61% or greater in all scenarios. The population is projected to remain below B_{msy} through to the beginning of 2027 for all levels of F examined with a probability of 90% or greater. The probability of projected biomass being below B_{lim} by 2027 was 4 to 11% in all catch scenarios examined and was 4 or 5% by 2027 in the F=0 scenarios, depending on the catch assumed in 2024.

Table 13.2. Medium-term projections for witch flounder under two scenarios: catch in 2024= TAC (1 367 t) and catch in 2024=average catch 2021-2023 (505 t). Projected yield (t) and the 10th, 50th and 90th percentiles of relative biomass B/B_{msy} are shown, for projected F values of $F=0$, F_{2023}, 2/3 F_{msy}, 75% F_{msy}, 85% F_{msy} and F_{msy}.

Projections with Catch in 2024= 1367 t (TAC)		
Year	Yield (t) median	Projected relative B (B/Bmsy) median (80% CL)
F0		
2025	0	0.50 (0.30, 0.82)
2026	0	0.55 (0.33, 0.90)
2027		0.59 (0.36, 0.98)
F Status quo (0.010)		
2025	301	0.50 (0.30, 0.82)
2026	324	0.54 (0.32, 0.89)
2027		0.58 (0.35, 0.97)
2/3 Fmsy (0.0407)		
2025	1240	0.50 (0.30, 0.82)
2026	1305	0.53 (0.31, 0.87)
2027		0.55 (0.32, 0.93)
75% Fmsy (0.0458)		
2025	1395	0.50 (0.30, 0.82)
2026	1461	0.52 (0.31, 0.87)
2027		0.55 (0.31, 0.92)
85% Fmsy (0.0519)		
2025	1581	0.50 (0.30, 0.82)
2026	1646	0.52 (0.30, 0.87)
2027		0.54 (0.31, 0.91)
Fmsy (0.0611)		
2025	1860	0.50 (0.30, 0.82)
2026	1920	0.51 (0.30, 0.86)
2027		0.53 (0.30, 0.90)

Projections with Catch in 2024= 505 t (avg 2020-2023)		
Year	Yield (t) median	Projected relative B (B/Bmsy) median (80% CL)
F0		
2025	0	0.52 (0.32, 0.84)
2026	0	0.56 (0.34, 0.92)
2027		0.61 (0.37, 1.00)
F Status quo (0.010)		
2025	516	0.52 (0.32, 0.84)
2026	555	0.56 (0.34, 0.91)
2027		0.60 (0.36, 0.98)
2/3 Fmsy (0.0407)		
2025	1275	0.52 (0.32, 0.84)
2026	1341	0.54 (0.32, 0.89)
2027		0.57 (0.33, 0.95)
75% Fmsy (0.0458)		
2025	1435	0.52 (0.32, 0.84)
2026	1501	0.54 (0.32, 0.89)
2027		0.56 (0.33, 0.94)
85% Fmsy (0.0519)		
2025	1626	0.52 (0.32, 0.84)
2026	1691	0.53 (0.32, 0.88)
2027		0.55 (0.32, 0.93)
Fmsy (0.0611)		
2025	1913	0.52 (0.32, 0.84)
2026	1972	0.53 (0.31, 0.88)
2027		0.54 (0.31, 0.92)

Table 13.3. Projected yield (t) and the risk of F>F_{lim}, B<B_{lim} and B<B_{msy} and probability of stock growth (B_{2027}>B_{2024}) under projected *F* values of *F=0*, F_{2023}, 2/3 F_{msy}, 75% F_{msy}, 85% F_{msy} and F_{msy}. Two scenarios are shown: catch in 2024=TAC (1 367t) and catch in 2024=average catch 2020-2023 (505 t).

C2024=505 t (avg 2020-2023)	Yield			P(F>F_{lim})			P(B<B_{lim})				P(B<B_{msy})				
	2024	2025	2026	2024	2025	2026	2024	2025	2026	2027	2024	2025	2026	2027	P(B_{2027}>B_{2024})
F0	505	0	0	<1%	<1%	<1%	11%	8%	6%	4%	97%	95%	93%	90%	0.76
F2023=0.0100	505	310	334	<1%	<1%	<1%	11%	8%	6%	4%	97%	95%	93%	91%	0.74
2/3 Fmsy = 0.0407	505	1275	1341	<1%	17%	18%	11%	8%	7%	7%	97%	95%	94%	92%	0.68
75% Fmsy = 0.0458	505	1435	1501	<1%	24%	26%	11%	8%	8%	7%	97%	95%	94%	92%	0.67
85% Fmsy = 0.0519	505	1626	1691	<1%	35%	36%	11%	8%	8%	8%	97%	95%	94%	92%	0.66
Fmsy= 0.0611	505	1913	1972	<1%	51%	51%	11%	8%	8%	9%	97%	95%	94%	93%	0.64

C2024=TAC (1367 t)	Yield			P(F>F_{lim})			P(B<B_{lim})				P(B<B_{msy})				
	2024	2025	2026	2024	2025	2026	2024	2025	2026	2027	2024	2025	2026	2027	P(B_{2027}>B_{2024})
F0	1367	0	0	26%	<1%	<1%	11%	10%	7%	5%	97%	96%	93%	91%	0.73
F2023=0.0100	1367	301	324	26%	<1%	<1%	11%	10%	7%	5%	97%	96%	94%	91%	0.72
2/3 Fmsy = 0.0407	1367	1240	1305	26%	17%	18%	11%	10%	9%	8%	97%	96%	94%	92%	0.65
75% Fmsy = 0.0458	1367	1395	1461	26%	25%	26%	11%	10%	9%	9%	97%	96%	94%	93%	0.65
85% Fmsy = 0.0519	1367	1581	1646	26%	35%	36%	11%	10%	10%	9%	97%	96%	94%	93%	0.63
Fmsy= 0.0611	1367	1860	1920	26%	51%	51%	11%	10%	10%	10%	97%	96%	94%	93%	0.61

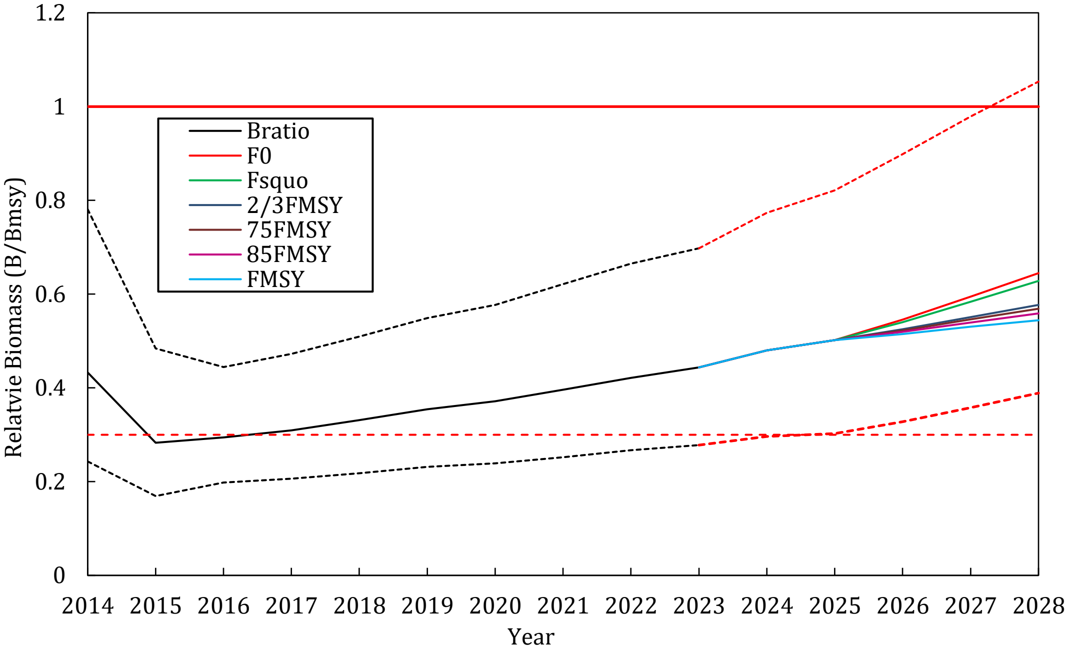

Figure 13.10. Witch flounder in Divisions 3NO: medium term projections of relative biomass (*B*/B_{msy}) at five levels of *F* (F=0, F_{2023}, 2/3 F_{msy}, 75% F_{msy} ,85% F_{msy} and F_{msy}). A catch of 1 367 t is assumed in 2024. The 10th and 90th credible intervals are included for the model results up to 2023 and for the projected period for the *F*=0 assumption.

g) Reference Points

Reference points are estimated from the surplus production model. Scientific Council considers that 30% B_{msy} is a suitable biomass limit reference point (B_{lim}) and F_{msy} a suitable fishing mortality limit reference point for stocks where a production model is used.

At present, the risk of the stock being below B_{lim} is 11% and above F_{lim} is less than 1% (Figure 13.11).

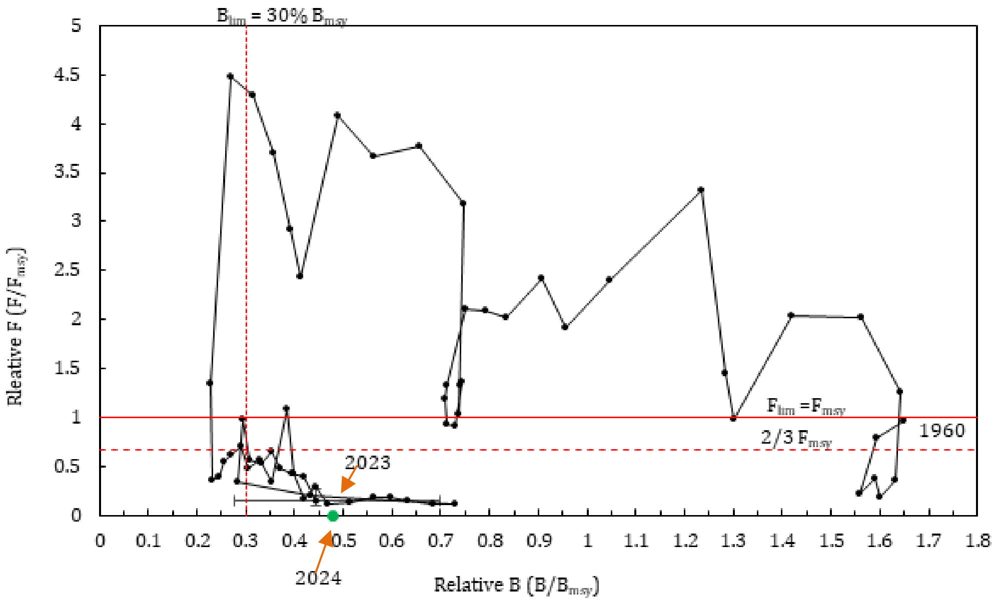

Figure 13.11. Witch flounder in Divisions 3NO: stock trajectory estimated in the surplus production analysis, under a precautionary approach framework.

The next assessment will be in 2026.

h) Research Recommendation

STACFIS **recommends** that *the Bayesian production model for this assessment be further explored in order to determine if adding the EU-Spain spring survey series (Pedreira and Campelen, either separately or if conversion is possible, a single time series) could be included as model inputs.*

14. Capelin (*Mallotus villosus*) in Divisions 3NO

Interim Monitoring Report (SCR 24/037 and SCS 24/08, 09)

a) Introduction

Fisheries and catches: The fishery for capelin started in 1971 and catches were high in the mid-1970s with a maximum catch of 132 000 t in 1975 (Figure 14.1). The stock has been under a moratorium to directed fishing since 1992. No catches have been reported from 1993 to 2013. Small catches (mostly discards) occurred from 2016 to 2020.

Recent catches and TACs (t) are as follows:

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Recommended TAC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Catch, t (STACFIS)	0	5	1	2	2	1	0	0	0	

na = no advice possible

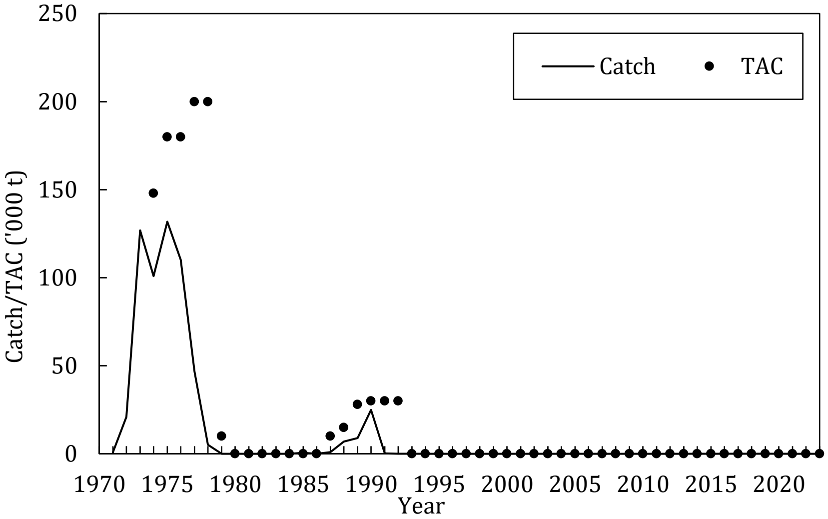

Figure 14.1. Capelin in Div. 3NO: catches and TACs.

b) Data Overview

i) Research survey data

Trawl acoustic surveys of capelin on the Grand Bank previously conducted by Russia and Canada on a regular basis have not been repeated since 1995. In recent years, STACFIS has repeatedly recommended the investigation of the capelin stock in Div. 3NO utilizing trawl-acoustic surveys to allow comparison with historical time series. However, this recommendation has not been acted upon. Available indicators of stock dynamics currently include the capelin biomass index from Canadian spring stratified-random bottom trawl surveys. This index varied greatly from 1995-2019 without any clear trend, however, three of the highest values have been observed in the most recent ten years of the time series (Figure 14.2). In 2016, the biomass indices declined to the historical minimum of 3.8 thousand tons. After increasing to 78.7 thousand tons in 2017, the index decreased to 45.7 thousand tons in 2018. In 2019, further decrease was indicated, to 17.3 thousand tons. Due to the COVID-19 pandemic, no data from spring surveys for 2020 and 2021 is available. The spring survey was incomplete in 2022 and in 2023 was carried out by a new vessel. Data were insufficient to estimate conversion factors for capelin in Div. 3NO, with the exception of Teleost spring which showed no significant difference in relative catchability.

Bottom-trawling is not a satisfactory basis for the assessment of a pelagic species, and the survey indices are only used to monitor for large-scale fluctuations. This utility is not considered to be impacted by the vessel change.

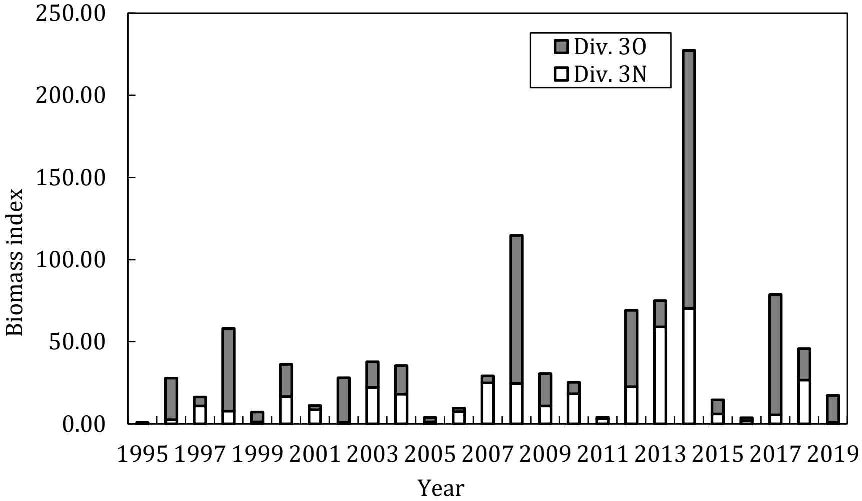

Figure 14.2. Capelin in Div. 3NO: survey biomass index (bottom trawl) from Canadian spring survey in 1995-2019.

Data from EU-Spain trawl surveys in Divs. 3NO for 1995-2023 are also available (Figure 14.3). Data from 1995-2000 are from the C/V "Playa de Menduíña", transformed to be comparable with the 2001-2023 R/V "Vizconde de Eza" data. It should be noted there is a gap in data for 2020, because of the pandemic.

Capelin biomass was at a maximum level in 2012 (151.4 thousand tons). During 2014-2017 biomass sharply declined from 85.5 thousand tons to 5.2 thousand tons. In 2018-2019, biomass rose to a level similar to that observed in the early 2000s (27.8-19.8 thousand tons). For 2022, a notable increase (up to 86.4 thousand tons) in biomass has been recorded, followed by a decrease to 11.4 thousand tons in 2023.

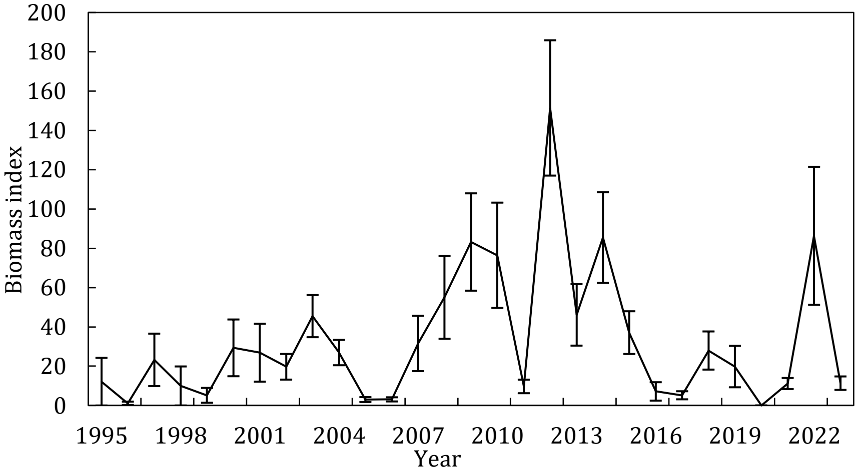

Figure 14.3. Biomass index and standard deviations of capelin (1995-2023) based on EU-Spain trawl 3NO surveys.

c) Conclusion

An acoustic survey series that terminated in 1994 indicated a stock at a low level. Biomass indices from bottom trawl surveys since that time have not indicated any change in stock status, although the validity of such surveys for monitoring the dynamics of pelagic species is questionable.

d) Research recommendations

STACFIS reiterates its **recommendation** *that initial investigations to evaluate the status of capelin in Div. 3NO should utilize trawl acoustic surveys to allow comparison with the historical time series.*

Commission has excluded the capelin from its triennial request for full assessment until surveys indicate a significant change in the state of the stock.

15. Redfish (*Sebastes mentella* and *Sebastes fasciatus*) in Division 3O

Interim Monitoring Report (SCR Doc. 22/044, 24/007, 036, 037; SCS Doc. 24/08, 09, 11)

a) Introduction

There are two species of redfish that have been commercially fished in Division 3O; the deep-sea redfish *(Sebastes mentella)* and the Acadian redfish *(Sebastes fasciatus*). The external characteristics are very similar, making them difficult to distinguish, and as a consequence, they are reported collectively as "redfish" in the commercial fishery statistics and RV surveys. Within Canada's fishery zone, redfish in Div. 3O have been under TAC regulation since 1974 and with a minimum size limit of 22 cm since 1995. Catch was only regulated by mesh size in the NRA of Div. 3O prior to the Fisheries Commission adopting a TAC in 2004. Initially, TAC was implemented at a level of 20 000 tons for 2005-2008 and has remained at that level. This TAC applies to the entire area of Division 3O.

Nominal catches have ranged between 3 000 tons and 35 000 tons since 1960, and have been below 10 000t since 2007. Catch in 2023 was 3 700 tons, the lowest since 1995 (Figure 15.1).

Recent catches and TACs ('000 tonnes) are as follows:

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
TAC	20	20	20	20	20	20	20	20	20	20
STATLANT 21	7.9	8.6	7.3	6.1	6.6	7.3	5.4	NA[1]	NA[1]	
STACFIS	8.4	9.0	7.5	6.1	6.5	7.3	5.6	3.9	3.7	

[1] NA - In 2022-2023, STATLANT 21 information is incomplete.

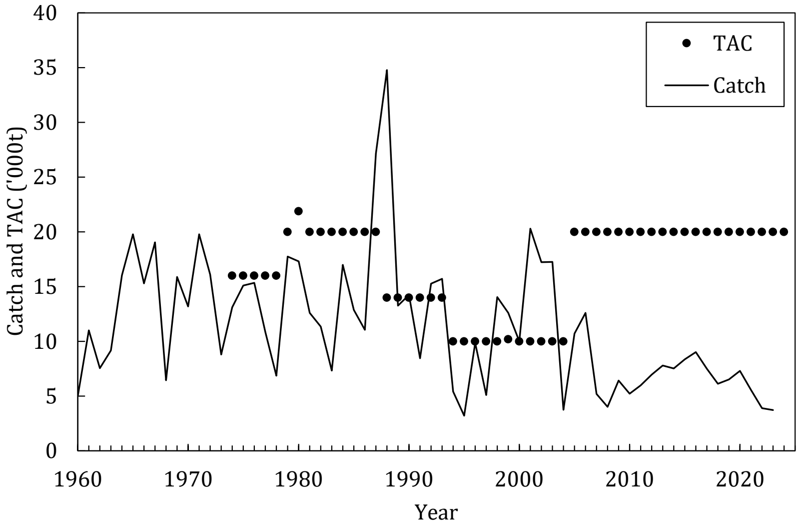

Figure 15.1. Redfish in Division 3O: Catches and TACs. TACs prior to 2004 were applied only to Canadian waters.

b) Data Overview

i) *Research survey data*

Survey data were available from Canadian stratified-random surveys during 1991-2019 in spring and 1991-2020 in autumn. There was no spring survey in 2006, 2020 or 2021. There were no autumn surveys conducted in Division 3O in 2014, 2021 or 2022. The 2022 and 2023 spring and 2023 autumn surveys in Div. 3O were completed with the new vessels CCGS *John Cabot* and CCGS Capt. Jacques Cartier which are not calibrated to the previous series, and are therefore presented as separate indices. Data were available from EU-Spain spring surveys conducted in the NAFO Regulatory Area (NRA) of Division 3O from 1997 to 2023, with the exception of 2020.

Results of bottom trawl surveys for redfish in Div. 3O have shown considerable variability, making it difficult to interpret interannual changes. However, trends across the survey series are consistent and show indices generally at or above the time-series mean during two periods: the mid to late 1990s, and during 2009 to 2015. All available surveys since 2018 have been below their long-term mean (Figure 15.2).

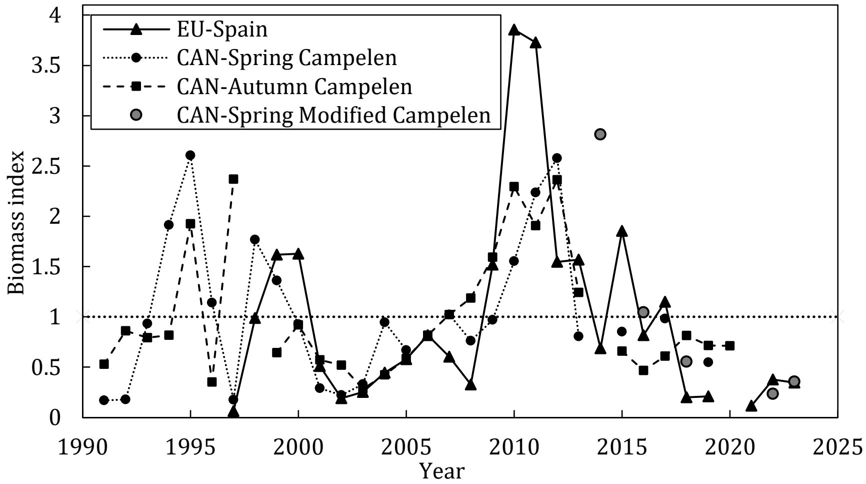

Figure 15.2. Redfish in Division 3O: Survey biomass indices from Canada and EU-Spain. Indices were normalized by dividing by their time-series means. The CAN-Autumn survey in 2023 is not presented as it is a single year of a new series.

c) Conclusion

Available survey indices indicate there has been no change in the perception of the status of this stock. Given a lack of conversion factors to the new vessels in the Canadian surveys, investigations into the limit reference point will need occur for the next assessment.

The next full assessment of the stock is scheduled for 2025.

d) Research Recommendations

STACFIS **recommend** that *for Redfish in Division 3O, work continue on developing an assessment model for the stock. Aging should be conducted for redfish sampled during select years to support model development.*

STACFIS **recommends** that *stock boundaries and definitions as well as synchronicity with adjacent stocks be explored.*

STACFIS **recommends** that *the reference point for this stock be reviewed at the 2028 assessment, or earlier if there are considerable advances in an analytical approach for this stock, or a significant change in available data or the understanding of stock dynamics.*

WIDELY DISTRIBUTED STOCKS: SUBAREA 2, SUBAREA 3 AND SUBAREA 4

Environmental Overview

The water mass characteristics of Newfoundland and Labrador Shelf are typical of sub-polar waters with a sub-surface temperature range of -1-2°C and salinities of 32-33.5. Labrador Slope Water flows southward along the shelf edge and into the Flemish Pass region, this water mass is generally warmer and saltier than the sub-polar shelf waters with a temperature range of 3-4°C and salinities in the range of 34-34.75. On average bottom temperatures remain < 0°C over most of the northern Grand Banks but increase to 1-4°C in southern regions and along the slopes of the banks below 200 m. North of the Grand Bank, in Division 3K, bottom temperatures are generally warmer (1-3°C) except for the shallow inshore regions where they are mainly <0°C. In the deeper waters of the Flemish Pass and across the Flemish Cap bottom temperatures generally range from 3-4°C. Throughout most of the year the cold, relatively fresh water overlying the shelf is separated from the warmer higher-density water of the continental slope region by a strong temperature and density front. This winter-formed water mass is generally referred to as the Cold Intermediate Layer (CIL) and is considered a robust index of ocean climate conditions. In general, shelf water masses undergo seasonal modification in their properties due to the seasonal cycles of air-sea heat flux, wind-forced mixing and ice formation and melt, leading to intense vertical and horizontal gradients particularly along the frontal boundaries separating the shelf and slope water masses.

Temperature and salinity conditions in the Scotian Shelf, Bay of Fundy and Gulf of Maine regions are determined by many processes: heat transfer between the ocean and atmosphere, inflow from the Gulf of St. Lawrence supplemented by flow from the Newfoundland Shelf, exchange with offshore slope waters, local mixing, freshwater runoff, direct precipitation and melting of sea-ice. The Nova Scotia Current is the dominant inflow, originating in the Gulf of St. Lawrence and entering the region through Cabot Strait. The Current, whose path is strongly affected by topography, has a general southwestward drift over the Scotian Shelf and continues into the Gulf of Maine where it contributes to the counter-clockwise mean circulation. The properties of shelf waters are modified by mixing with offshore waters from the continental slope. These offshore waters are generally of two types, Warm Slope Water, with temperatures in the range of 8-13°C and salinities from 34.7-35.6, and Labrador Slope Water, with temperatures from 3.5°C to 8°C and salinities from 34.3 to 35. Shelf water properties have large seasonal cycles, east-west and inshore-offshore gradients, and vary with depth.

16. Thorny skate (*Amblyraja radiata*) in Divisions 3LNO and Subdivision 3Ps

Full Assessment (SCR Doc. 24/007, 008, 037, 038; SCS Doc. 24/06, 08, 09, 11)

a) Introduction

Thorny skate in Subdivision 3Ps and Divisions 3LNO have a continuous distribution and are considered a single stock unit. A portion of the stock is managed by Canada and France (3Ps) and a portion is managed by NAFO (3LNO).

Catch History

Commercial catches of skates contain a mix of skate species. However, thorny skate dominates, comprising about 95% of skate species taken in Canadian and EU-Spain catches. Thus, the skate fishery on the Grand Banks can be considered a fishery for Thorny Skate. The TAC has been 7 000 t over the period 2013-2024. In Subdivision 3Ps, Canada established a TAC of 1 050 tons in 1997, which has not changed.

Catches from the NRA of Divisions 3LNO increased in the mid-1980s with the commencement of a directed fishery for thorny skate. The main participants in this new fishery were EU-Spain, EU-Portugal, USSR and the Republic of Korea. Catches from all countries in Divisions 3LNOPs over 1985-1991 averaged 17 058 t, with a peak of 28 408 t in 1991 (STATLANT 21). From 1992-1995, catches of thorny skate declined to an average of 7 554 t; however, there are substantial uncertainties concerning reported skate catches prior to 1996. Average STACFIS-agreed catch for Divisions 3LNO in 2019-2023 was 3 460 t and 429 t in Subdivision 3Ps. STACFIS catch in 2023 totaled 2 100 t for Divisions 3LNO and 16 t for Subdivision 3Ps (Figure 16.1).

Recent nominal catches and TACs (000 tons) in Divisions 3LNO and Subdivision 3Ps are as follows:

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Divs. 3LNO:										
TAC	7	7	7	7	7	7	7	7	7	7
STATLANT-21	3.3	3.5	4.2	0.1	3.7	4.0	4.0	NA[1]	NA[1]	
STACFIS	3.4	3.5	4.5	2.4	3.7	4.3	3.7	3.5	2.1	
Subdiv. 3Ps:										
TAC	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
STATLANT-21	0.2	0.7	0.6	1.1	0.9	0.8	0.7	0.2	<0.1	
Divs. 3LNOPs:										
STATLANT-21	3.6	4.1	4.8	2.3	4.6	4.8	4.7	NA[1]	NA[1]	
STACFIS	3.7	4.1	5.1	3.5	4.6	5.1	4.4	3.7	2.1	

[1] NA- In 2022-2023, STATLANT 21 information is incomplete for Divisions 3LNO..

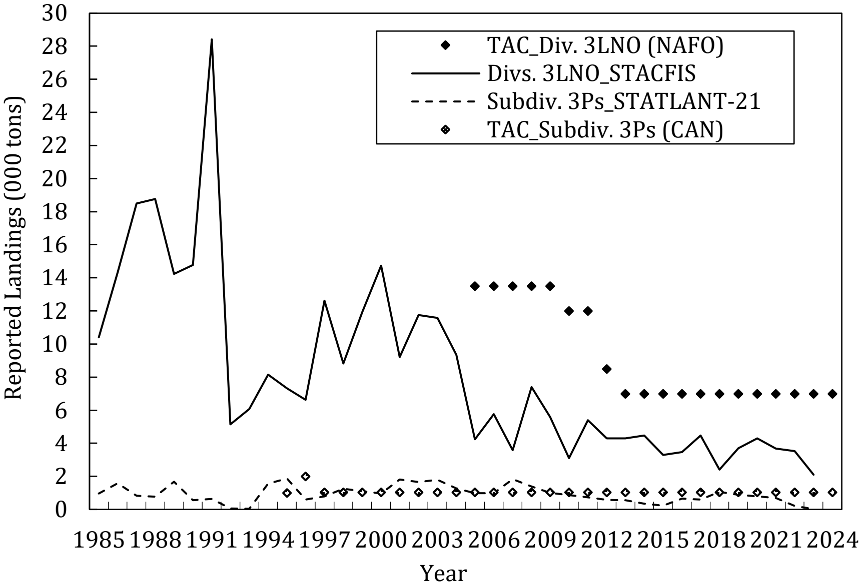

Figure 16.1. Thorny Skate in Divisions 3LNO and Subdivision 3Ps, 1985-2024: reported landings and TAC.

b) Data Overview

i) Commercial Fisheries

Thorny skates from either commercial or research survey catches are currently not aged.

Commercial length frequencies of skates were available for EU-Spain (2022-2023), EU-Portugal (2022-2023), Russia (2023) and Canada (2022).

In recent years, from skate-directed trawl fisheries (280 mm mesh) in the NRA of Divisions 3LNO over 2019-2023, EU-Spain reported 13-99 cm TL skates, with a small number of young-of-the-year (≤21 cm) caught in 2021-2022. In trawl fisheries targeting other species (130 mm mesh) in Divisions 3NO (NRA) over 2019-2023, EU-Portugal reported skate bycatch ranging from 26-90 cm TL, except for 14-100 cm TL in 2021. EU-Portugal did not sample Divisions 3LNO skate bycatch in 2020, while EU-Spain has not done so since 2009. Russian trawlers reported 15-95 cm skates in 2019-2020, and 31-85 cm skates in 2023. Canadian trawlers in the Divisions 3LN redfish (*Sebastes* sp.) fishery in 2019 caught 42-88 cm thorny skates. In 2019-2022, skates caught by Canadian trawlers in the Divisions 3LNO yellowtail flounder (*Limanda ferruginea*) fishery ranged between 23-96 cm. Canadian skate bycatch in Divisions 3LNO was not sampled in 2023.

No standardized commercial catch per unit effort (CPUE) exists for thorny skate.

ii) Research surveys

New vessel time series – Modified Campelen series. Beginning in 2022, new survey vessels have been used to conduct the Canadian multi-species surveys. For thorny skate in NAFO Divisions 3LNO and Subdivision 3Ps, data from comparative fishing experiments were insufficient to provide conversion factors for past primary research vessels CCGS Wilfred Templeman and CCGS Alfred Needler. As a result, the spring Canadian Campelen series (1984-2019) and the autumn Canadian Campelen series (1990-2020) have ended. For the spring series, conversion factors allow the CCGS Teleost sets in Divisions 3LNO to be converted to the new survey vessels using a length-based conversion, however data are insufficient to convert indices in Subdivision 3Ps.

Throughout the survey series the CCGS Teleost was used to compliment or replace the primary vessels, with the assumption that catches from the Teleost were directly comparable to those vessels. However, during the comparative fishing trials with the new vessels it was determined that the Teleost was not directly comparable to the Wilfred Templeman and Alfred Needler for some species. For thorny skate in Divisions 3LNO and Subdivision 3Ps, sensitivity analyses showed most years were not impacted by use of the Teleost, however spring surveys with complete/near-complete coverage by the Teleost (2014, 2016, 2018) have been removed from the 1984-2019 Campelen series.

Canadian spring surveys. 1984-2019 Campelen series. Stratified-random research surveys were conducted by Canada in Divisions 3LNO and Subdivision 3Ps in spring; using a Yankee 41.5 otter trawl in 1972-1982, an Engel 145 otter trawl in 1984-1995, and a Campelen 1800 shrimp trawl in 1996-2019. Subdivision 3Ps was not surveyed in 2006, nor was the deeper portion (>103 m) of Divisions 3NO in that year, due to mechanical difficulties on Canadian research vessels. In 2015 and 2017, several strata were not sampled in Division 3L, thus impacting biomass and abundance estimates of thorny skate. There were no spring surveys in Divisions 3LNO from 2020-2021.

Total survey biomass in Divisions 3LNOPs fluctuated, but remained stable at low levels from 2007 to 2019. Due to lack of comparable Canadian spring surveys in Divisions 3LNOPs since 2019 current status relative to B_{lim} cannot be determined (Figure 16.2).

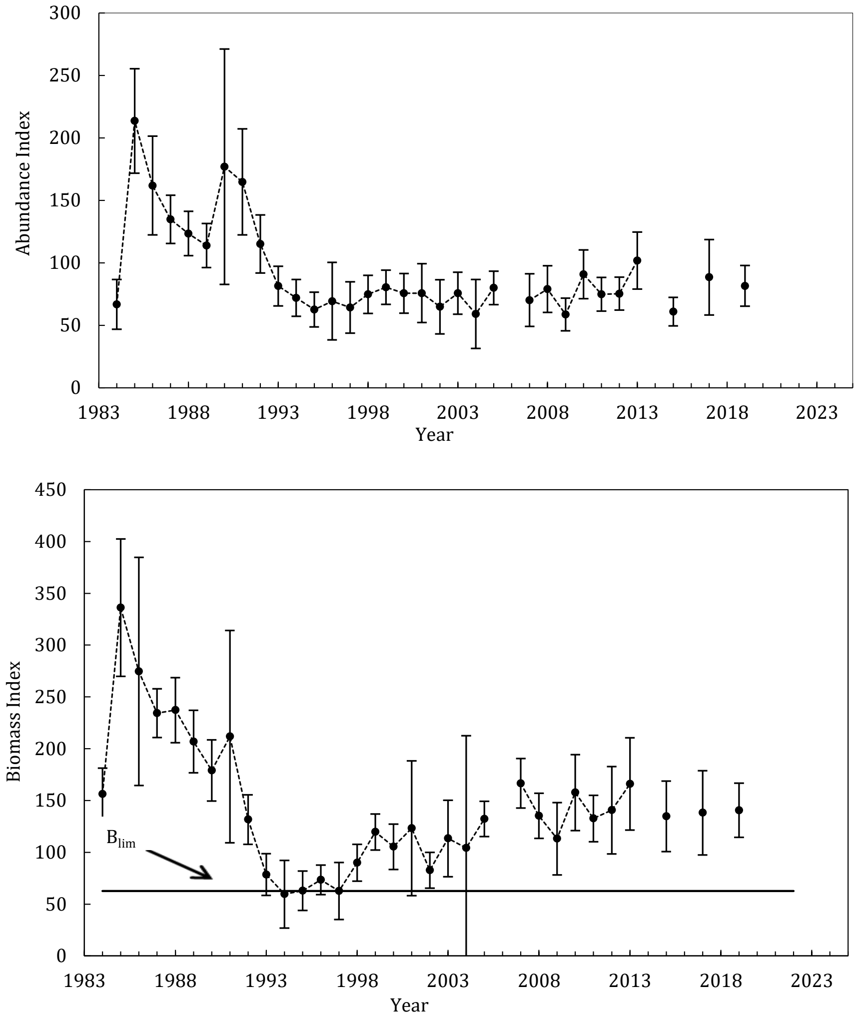

Figure 16.2. Thorny skate in Divisions 3LNOPs, 1984-2019: abundance (top panel) and biomass (bottom panel with B_{lim} shown [blue horizontal line]) indices from Canadian spring surveys. The survey in NAFO Division 3L was incomplete in 2015 and 2017. The surveys were partially completed on the Teleost in 2014, 2016 and 2018 and are not comparable. There were no spring surveys in Division 3LNO from 2019-2021.

Canadian autumn surveys. 1990-2020 Campelen series. Stratified-random research surveys have been conducted by Canada in Divisions 3LNO in the autumn, using an Engel 145 otter trawl in 1990-1994 and a Campelen 1800 shrimp trawl in 1995-2020, to depths of ~1 450 m. Due to operational difficulties there were no 2014 or 2021 autumn surveys and, due to targeted comparative fishing exercises, there was no survey in autumn 2022.

Autumn survey indices, similar to spring estimates, declined during the early 1990s. Catch rates have been stable at very low levels since 1995 (Figure 16.3). Biomass and abundance indices for the autumn 2020 survey were similar to those observed in 2019, but were highly uncertain. Autumn indices of abundance and biomass are, on average, higher than spring estimates. This is expected, because thorny skates are found deeper than the maximum depths surveyed in spring (~750 m), and are more deeply distributed during winter/spring.

Modified Campelen series. There has been one survey (in autumn 2023) with the new vessel, however no conversion factor available. The 2023 biomass estimate has high uncertainty (Figure 16.3).

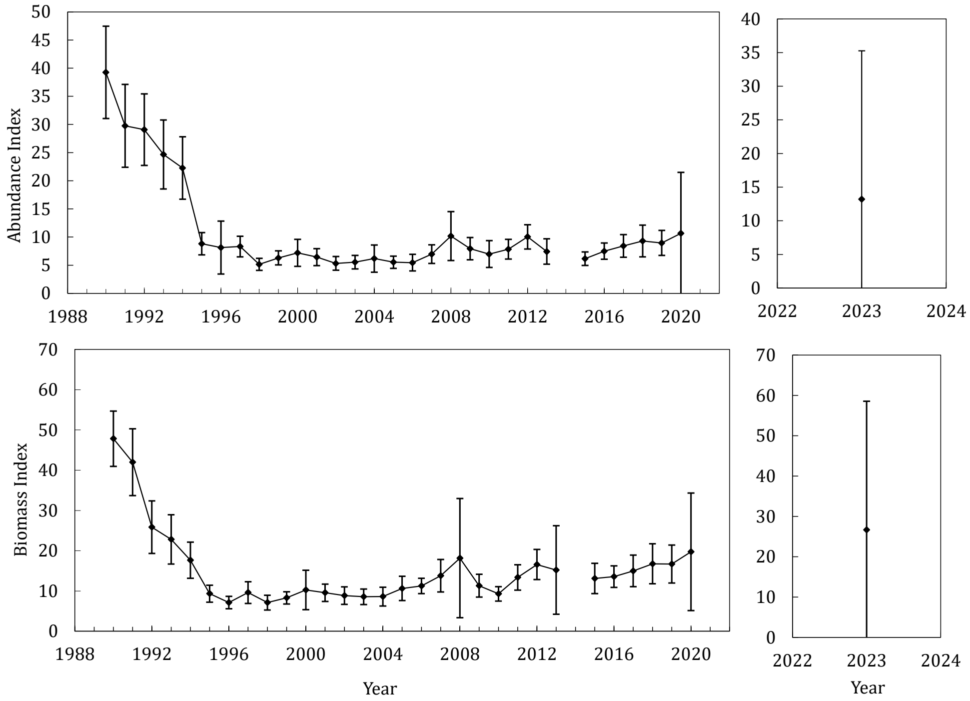

Figure 16.3. Thorny skate in Division 3LNOPs: 1990-2020: abundance (top panel) and biomass (bottom panel) indices from Canadian autumn surveys in Division 3LNO. The survey was not conducted in 2021 or 2022.

EU-Spain Divisions 3NO Survey. EU-Spain survey indices (Campelen or equivalent) are available for 1997-2023 (except for 2020). The survey only occurs in the NAFO Regulatory Area, thus not sampling the entire Divisions. The biomass trajectory from the EU-Spain surveys was similar to that of the Canadian spring surveys until 2006 (Figure 16.4). Since 2007, the two indices diverged with the Canadian survey remaining stable and the EU-Spain declining, reaching its lowest level in 2022.

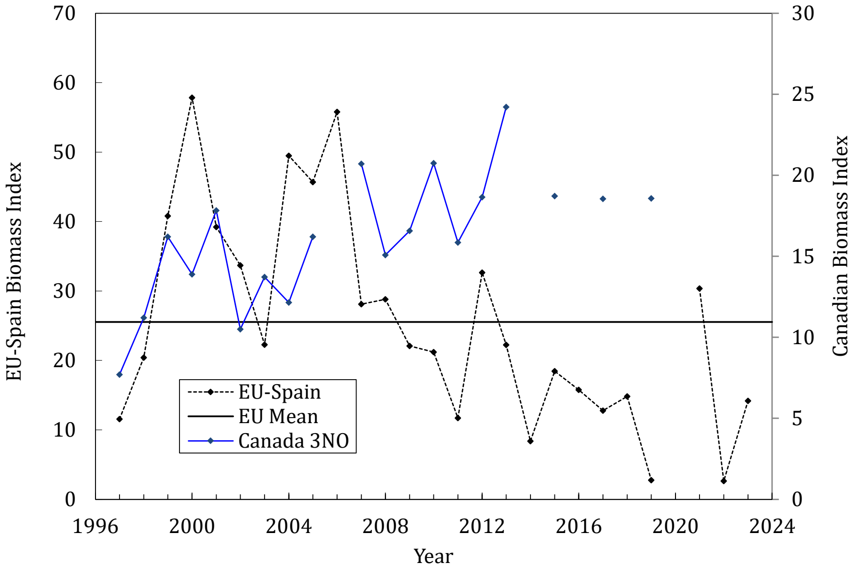

Figure 16.4. Thorny skate in Divisions 3NO: biomass indices from the EU-Spain survey and the Canadian spring survey (1997-2023). The Canadian spring surveys conducted in 2022 and 2023 are not comparable to the earlier time series.

EU-Spain Division 3L survey. EU-Spain survey indices (Campelen trawl) are available for 2003-2023 (excluding 2005/2020-2022). The survey only occurs in the NAFO Regulatory Area (Flemish Pass), thus not sampling the entire Division. Both the EU-Spain and Canadian autumn Division 3L biomass indices generally declined from 2007-2011, while the Canadian spring index was more variable during this period (Figure 16.5). The Canadian autumn biomass index followed an increasing trend since 2011, while the Canadian spring index fluctuated at lower levels (Figure 16.5). The EU-Spain index in 2023 is above the series average.

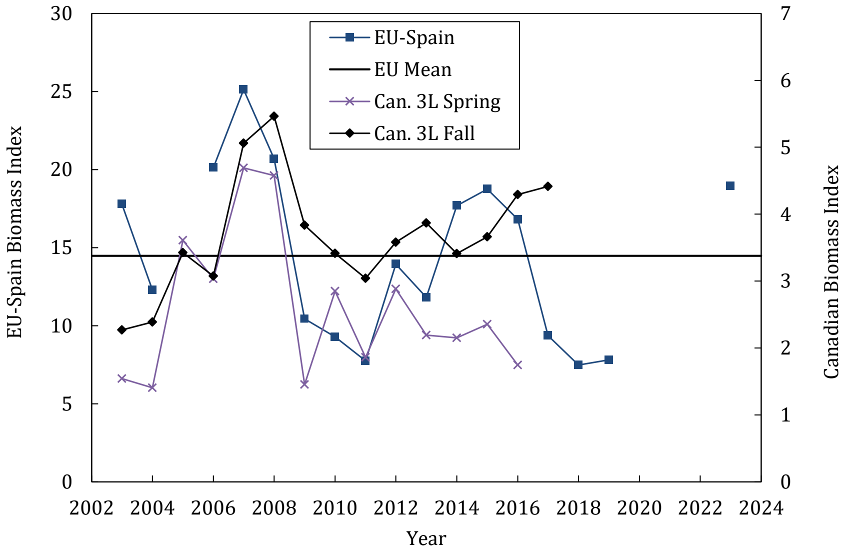

Figure 16.5. Thorny skate in Divisions 3LNOPs: Biomass indices from EU-Spain Division 3L survey and the Canadian spring and autumn surveys of Division 3L in 2003-2023. The Canadian spring and fall surveys conducted in 2022 and 2023 are not comparable to the earlier time series.

iii) Biological studies

The recruitment index (skate ≤ 21 cm TL) has been variable throughout the time series (Figure 16.6). Life history traits of late maturity, low fecundity and long reproductive cycles result in low intrinsic rates of increase, and impart low resilience to fishing mortality for this species. This series cannot be updated and a new series will begin in 2024.

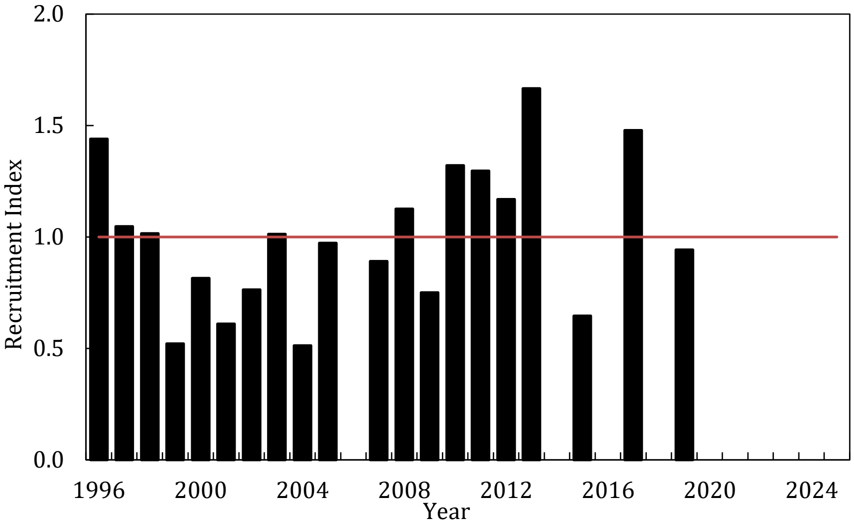

Figure 16.6. Thorny skate in Division 3LNOPs, 1996-2019: Standardized recruitment index for ≤21 cm TL males and females (combined) from Canadian Campelen spring surveys. Horizontal line depicts the standardized average recruitment for 1996-2019. The survey was incomplete in 2015 and 2017.

c) Estimation of Parameters

Relative *F* (STACFIS-agreed commercial landings/Canadian spring survey biomass) in Divisions 3LNO declined over the late-1990s, and was low in 2019. Relative fishing mortality in Subdivision 3Ps was also been low in 2019 (Figure 16.7). This series cannot be updated and a new series will begin in 2024.

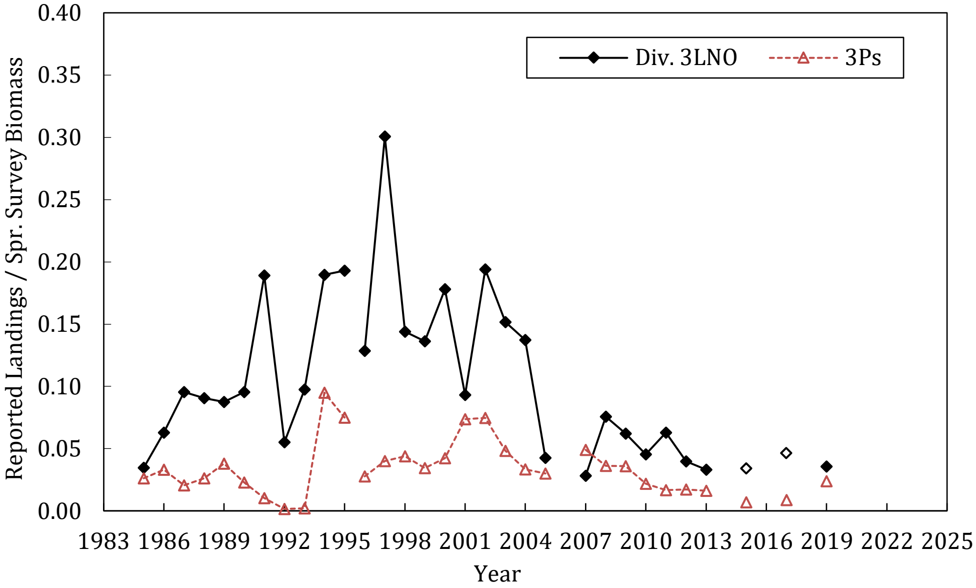

Figure 16.7. Thorny skate in Divisions 3LNO and Subdivision 3Ps, 1985-2019: estimates of Relative *F* from STACFIS-agreed commercial landings/Canadian spring survey biomass. The survey was incomplete in 2015 and 2017 (open diamonds).

d) Assessment Results

Assessment Results: No analytical assessment was performed.

The Canadian spring survey is considered the primary indicator of the status of this stock, due to its spatial and temporal coverage. However, current state of the stock is unknown due to the lack of Canadian spring surveys in 2020 and 2021 and new surveys that are not comparable to the old series.

Biomass: Biomass of this stock remained stable at low levels since 2007. Biomass since 2019 cannot be determined and/or is not comparable.

Fishing Mortality: Relative *F* (STACFIS-agreed commercial landings/Canadian spring survey biomass) in Divisions 3LNOPs declined since the mid-1990s, and was low in 2019. Current fishing mortality is unknown but catches in 2023 are the lowest reported.

Recruitment: Recruitment is currently unknown.

State of the Stock: The stock was above B_{lim} in 2019. No new survey information is available to determine stock status. However, due to the longevity of the species and the low level of catch in recent years, it is unlikely that there have been major changes to the state of the stock. Recruitment is currently unknown. Fishing mortality is currently unknown but thought to be low.

e) Reference Points

As a result of the lack of conversions factors, there is no longer an accepted reference point for this stock.

f) Research Recommendations

STACFIS **recommended** that *the EU-Spain 3L and 3NO surveys be combined into a single index and that a recruitment index be developed from the survey. STACFIS also recommends the addition of the Canadian Fall 3NO index to the EU-Canadian comparisons.*

STACFIS **recommended** that *further work be conducted on development of a quantitative stock model.*

STATUS: An Age-Structure Catch-at-Length model for NAFO 3LNOPs Thorny skate that is fitted to length-based survey indices and fishery total catch weight information was presented by Dr. Noel Cadigan at the June 2024 meeting. Further investigations of the application of this model are supported by STACFIS.

STACFIS reiterates the recommendation to conduct further work on the development of a quantitative stock model.

STACFIS **recommends** that *the stock structure of thorny skate in NAFO 3LNOPs be reevaluated to consider if this stock structure is valid or if NAFO 3LNO and Subdivision 3Ps should be considered as separate stock units.*

The next full assessment is planned for 2026.

17. White hake (*Urophycis tenuis*) in Divisions 3NO and Subdivision 3Ps

Interim Monitoring Report (SCR Doc. 24/007, 036, 037; SCS Doc. 24/09)

a) Introduction

Canada commenced a directed fishery for white hake in 1988 in Divisions 3NO and Subdivision 3Ps. All Canadian landings prior to 1988 were as bycatch in various groundfish fisheries. EU-Spain and EU-Portugal commenced a directed fishery in 2002, and Russia in 2003, in the NAFO Regulatory Area (NRA) of Divisions 3NO.

A TAC in Divisions 3NO for white hake was first implemented by Fisheries Commission in 2005 at 8 500 tons, and then reduced to 6 000 t for 2010-2011. The TAC in Divisions 3NO for 2012 was 5 000 t, and 1 000 t for 2013-2024. Canada has implemented a TAC of 500 t for Subdivision 3Ps for 2018-2024.

Landings peaked in 1987 at approximately 8 100 t (Figure 17.1). With the restriction of fishing by other countries to areas outside Canada's 200-mile limit in 1992, non-Canadian landings fell to zero. Landings were low in 1995-2001 (422 t average), then increased to 6 718 t in 2002 and 4 823 t in 2003, following recruitment of the large 1999 year-class. Catches increased to an average of 436 t in 2019-2023, and in 2023 was 493 t.

Commercial catches of white hake in Subdivision 3Ps were less variable than 3NO, averaging 1 114 t in 1985-1993, then decreasing to an average of 619 t in 1994-2002 (Figure 17.1). Subsequently, catches increased to an average of 1 174 t in 2004-2007, then decreased to a 263 t average in 2009-2023. Catch averaged 245 t over 2019-2023. Catch in 2023 was 178 t.

Recent reported landings and TACs (000 tons) in NAFO Division 3NO and Subdivision 3Ps are as follows:

	2015	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Div. 3NO:										
TAC	1	1	1	1	1	1	1[1]	1[1]	1[1]	1[1]
STATLANT-21	0.4	0.4	0.5	0.4	0.3	0.3	0.5	NA[2]	NA[2]	
STACFIS	0.5	0.4	0.5	0.4	0.3	0.3	0.5	0.5	0.5	
Subdiv. 3Ps:										
TAC				0.5	0.5	0.5	0.5	0.5	0.5	
STATLANT-21	0.3	0.4	0.3	0.3	0.3	0.2	0.1	0.1	0.2	

[1] May change in-season. See NAFO FC Doc. 19/01

[2] NA- In 2022 and 2023, STATLANT 21 information is incomplete for Divisions 3NO.

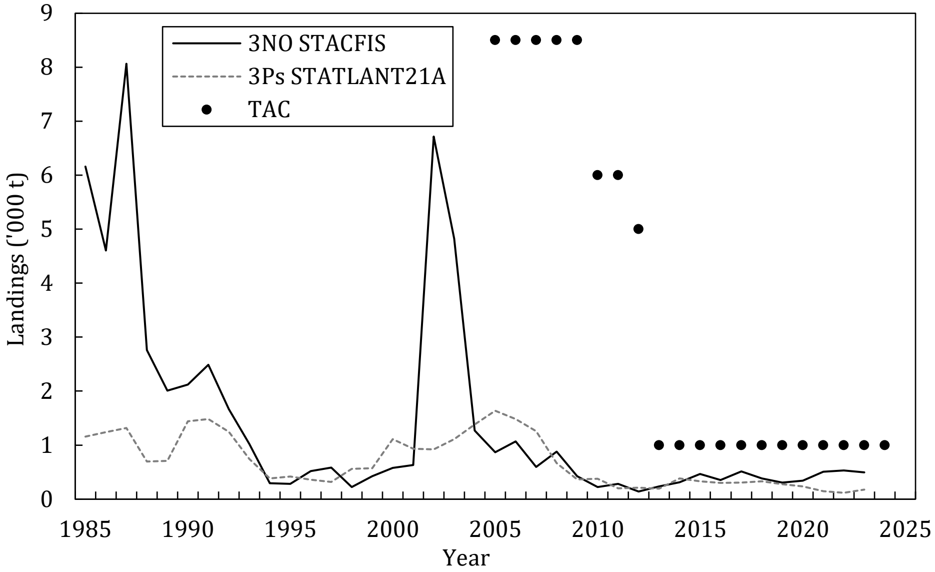

Figure 17.1. White hake in Divisions 3NO and Subdivision 3Ps: Total reported landings of white hake in the NRA of NAFO Division 3NO (STACFIS), and Subdivision 3Ps (STATLANT-21A). The Total Allowable Catch (TAC) in the NRA of Divisions 3NO is also indicated on this graph.

b) Input Data

i) Research Survey Data

New vessel time series – Modified Campelen series. Beginning in 2022, new survey vessels have been used to conduct the Canadian multi-species surveys. For white hake in NAFO Divisions 3NO and Subdivision 3Ps, data from comparative fishing experiments were insufficient to provide conversion factors that would allow data from the new vessels to extend existing time series data from the former primary research vessels (CCGS Wilfred Templeman and CCGS Alfred Needler). As a result, the spring Canadian Campelen series (1984-2019) and the autumn Canadian Campelen series (1990-2020) have ended.

Throughout the survey time series the CCGS Teleost was used to compliment or replace the primary vessels, with the assumption that catches were directly comparable. However, during the comparative fishing trials with the new vessels it was determined that the Teleost is comparable for some species. Sensitivity analyses indicated that for white hake in Divisions 3NO and Subdivision 3Ps, use of the Teleost in the autumn had minimal impact on indices, with most years were not impacted.

For the spring series, comparative fishing indicated that the Teleost is comparable to the new time series for white hake in Divisions 3NOPs. In Divisions 3NO, spring surveys 2014 and 2018 had a significant mixing of Teleost and Needler and are therefore not comparable to either the new or the old series and are no longer presented. The 2016 survey was carried out entirely on the Teleost and is included in a new spring time series which also includes the new survey series (modified Campelen).

Canadian stratified-random bottom trawl surveys. Data from spring research surveys in NAFO Divisions 3N, 3O and Subdivision 3Ps were available from 1972-2023 and from 1990-2023 in autumn. Canadian surveys were conducted using a Yankee 41.5 bottom trawl prior to 1984, an Engel 145 bottom trawl from 1984-1994 (fall)/1995(spring), and a Campelen 1800 trawl thereafter. The 2006 spring survey was incomplete, and there were no spring surveys in Divisions 3NO from 2020-2021. The autumn survey was incomplete in 2014 and did not occur in 2021 or 2022. Survey in 2022-2023 were on the new vessels. Data from autumn surveys in Divisions 3NO were available from 1990-2023; although this survey was not completed in 2014, or 2021-2022.

Abundance and biomass indices of white hake from the Canadian spring research surveys in Divisions 3NOPs are presented in Figure 17.2a. From 2007-2019, the population remained at a level similar to that previously observed in the Campelen time series for 1996-1998. The dominant feature of the white hake abundance time-series was the very large peak observed over 2000-2001. More recently, spring abundance of this species increased in 2011, but declined to relatively stable levels over 2012-2018. Biomass of this stock increased in 2000, generated by the very large 1999 year-class. Subsequently, the biomass index decreased until 2009, then increased to 2014, and has since remained relatively stable. Note that abundance of white hake increased in 2019. The new Modified Campelen series shows an increase in abundance between the two data points, though with a high degree of uncertainty in 2023. Biomass indices are similar between the two years of this index.

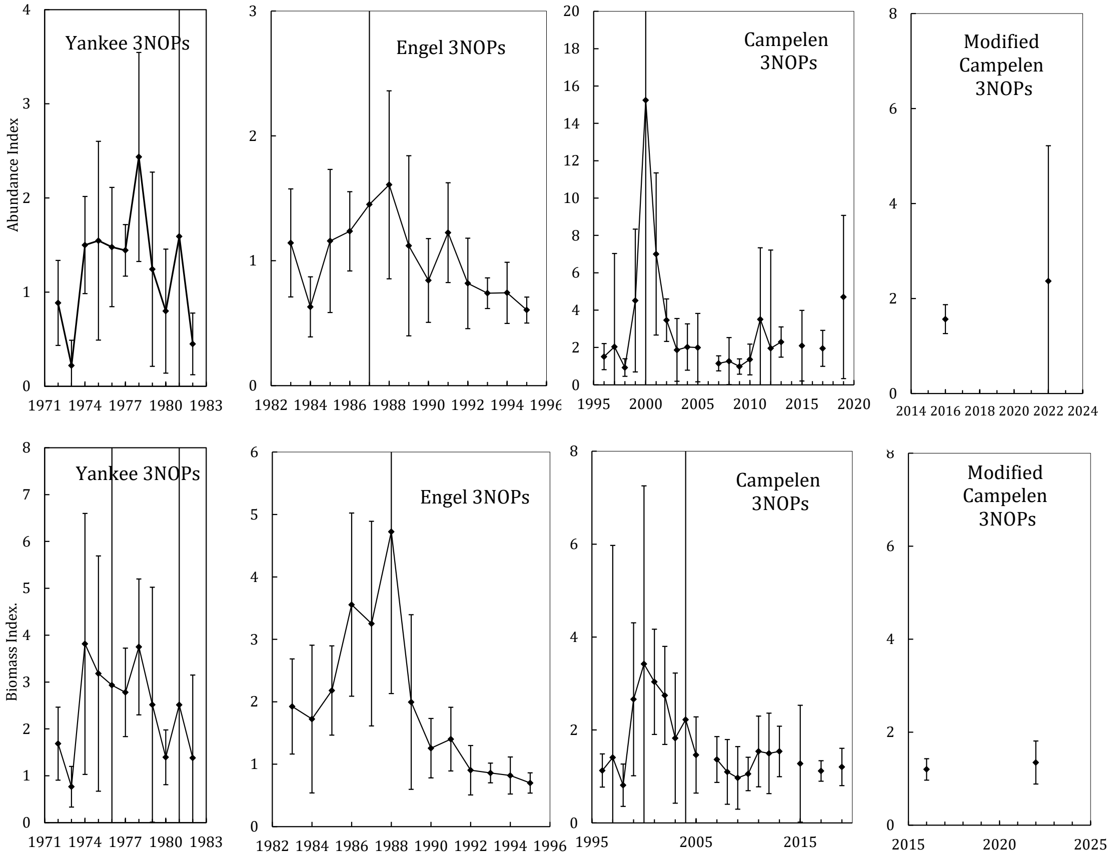

Figure 17.2a. White hake in Divisions 3NO and Subdivision 3Ps: abundance (top panels) and biomass (bottom panels) indices from Canadian spring research surveys, 1972-2019. Estimates from 2006 are not shown, since survey coverage in that year was incomplete. Estimates from 2014 and 2018 were from surveys that had combined Needler/Teleost sets and are not shown. Yankee, Engel, Campelen and Modified Campelen time series are not standardized, and thus are presented on separate panels. Error bars are 95% confidence limits. The bounds of the error bars in 1976, 1981, 1987, 2000, 2012, and 2015 and 2022 in some panels extend above/below the graph limits.

Canadian autumn surveys of Divisions 3NO have the peak in abundance represented by the very large 1999 year-class (Figure 17.2b). Autumn indices then declined to levels similar to those observed during 1996-1998 until 2010. In 2011-2013, both biomass and abundance appear to have slightly increased then declined over 2015-2018. This survey was not completed in 2014 or 2021-2022 and the 2023 value cannot be directly compared to any other series.

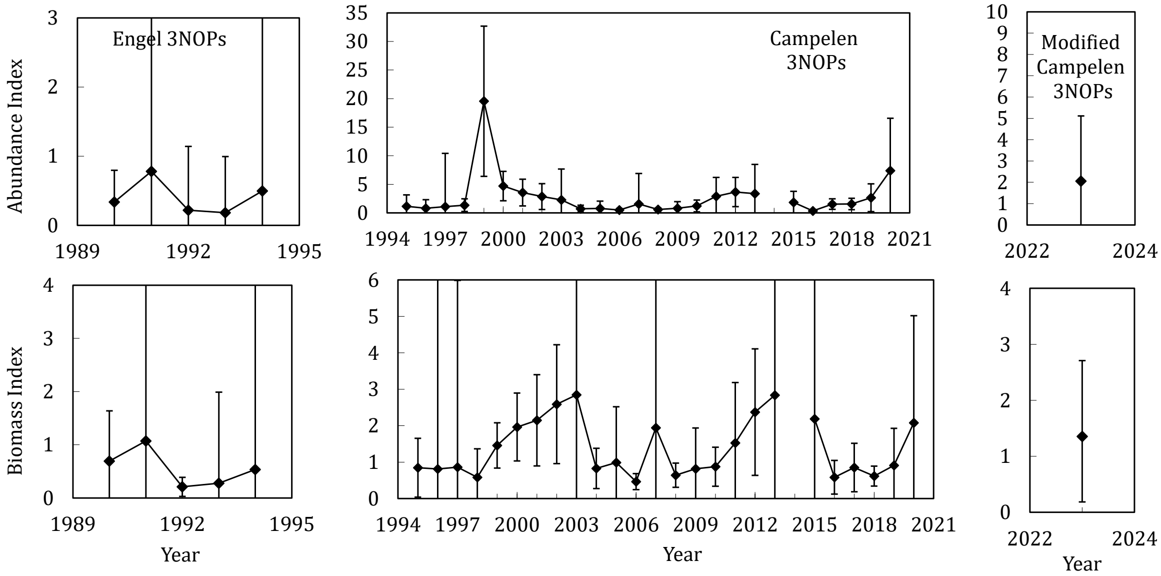

Figure 17.2b. White hake in Divisions 3NO: abundance (top panels) and biomass indices (bottom panels) from Canadian autumn surveys, 1990-2023. Engel (1990-1994), Campelen (1995-2020), and Modified Campelen in 2023; time series are not standardized. Estimates from 2014 are not shown, since survey coverage in that year was incomplete. Error bars are 95% confidence limits. The bounds of the error bars in 1990-1994, 2002-2009, 2013, 2015, 2019, 2020, and 2023 in some panels extend above/below the graph limits. This survey was not conducted in 2021 or 2022.

EU-Spanish stratified-random bottom trawl surveys in the NRA. EU-Spain biomass indices in the NAFO Regulatory Area (NRA) of Divisions 3NO were available for white hake from 2001 to 2023, although this survey was not conducted in 2020 due to COVID-19 (Figure 17.3). EU-Spain surveys were conducted with Campelen gear (similar to that used in Canadian surveys) in the spring to a depth of 1 400 m. This survey covers only 10% of the total stock area. The EU-Spain biomass index was highest in 2001, then declined to its lowest level in 2008 and has remained variable since then (Figure 17.3). The overall trend is similar to that of the Canadian spring survey index with a time lag.

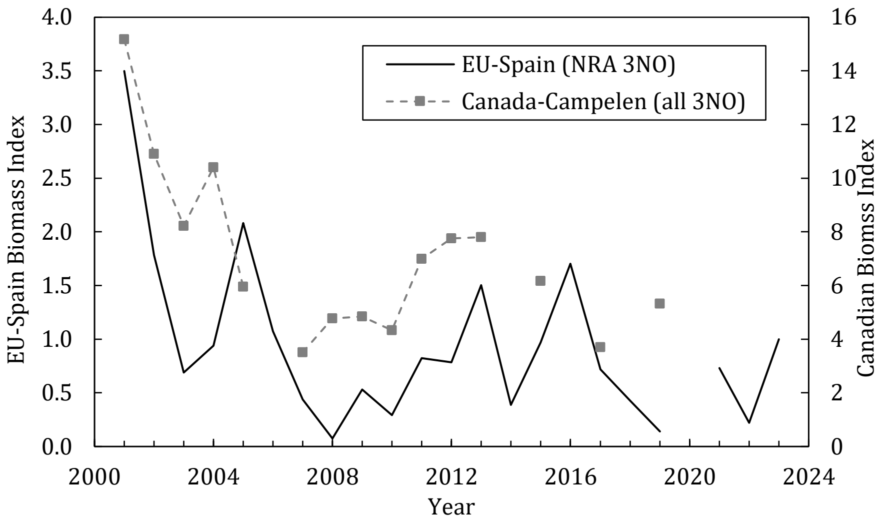

Figure 17.3. White hake in the NRA of Divisions 3NO: Biomass indices from EU-Spain Campelen spring surveys in 2001-2023 compared to Canadian spring survey indices in all of Divisions 3NO from 2001-2019. Estimates from 2006 Canadian survey are not shown, since survey coverage in that year was incomplete.

c) Conclusion

Based on current information there is no significant change in the status of this stock. However, there is increased uncertainty in current stock trends given recent survey challenges and a lack of complete conversion factors for the Canadian surveys. No large recruitments have been observed since 2000.

d) Research Recommendations

STACFIS **recommended** that *age determination should be conducted on otolith samples collected during annual Canadian surveys (1972-2019); thereby allowing age-based analyses of this population.*

Otoliths are being collected, and aging has begun. STACFIS reiterates this recommendation.

STACFIS **recommended** that s*urvey conversion factors between the Engel and Campelen gear be investigated for this stock.*

No progress. STACFIS reiterates this recommendation.

STACFIS **recommended** that *work continue on the development of population models and reference point proxies.*

Various formulations of a surplus production model were explored in a state-space (SPICT) and in a Bayesian framework, and work is continuing.

There will be no full assessment until interim monitoring shows a change in stock status.

18. Roughhead Grenadier (*Macrourus berglax*) in Subareas 2 and 3

Interim Monitoring Report (SCR Doc. 98/57,19/23;24/007, 008, 037, SCS Doc. 24/06, 08, 11; COM-SC CESAG-WP 24-01)

a) Introduction

This stock was last fully assessed in 2019. The stock structure of this species in the North Atlantic remains unclear because there is little information on the number of different populations that may exist and the relationships between them. Roughhead grenadier is distributed throughout NAFO Subareas 0 to 3 in depths between 300 and 2 000 m. However, for assessment purposes, NAFO Scientific Council considers the population of Subareas 2 and 3 as a single stock.

A substantial part of the grenadier catches in Subarea 3 previously reported as roundnose grenadier was actually roughhead grenadier. To correct the catch statistics, STACFIS revised and approved the roughhead grenadier catches from 1987 - 1997. In the period 2007-2012, catches for Subarea 2+3 roughhead grenadier were stable and averaged 900 tons. In the period 2013-2023, catches decreased to their lowest levels since 1987 and averaged around 400 tons (Figure 18.1). Most of the catches were taken in Divisions 3KLMN by the fleets of EU-Spain, Canada, EU-Portugal, Japan and Russia as bycatch in the Greenland halibut fishery. This stock is assessed by the Scientific Council but it is not managed by the NAFO Commission. There is no TAC for this stock.

Recent catches ('000 tons) are as follows:

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
STATLANT 21A	0.6	0.2	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.1
STACFIS	0.6	0.2	0.3	0.4	0.5	0.4	0.4	0.4	0.5	0.4

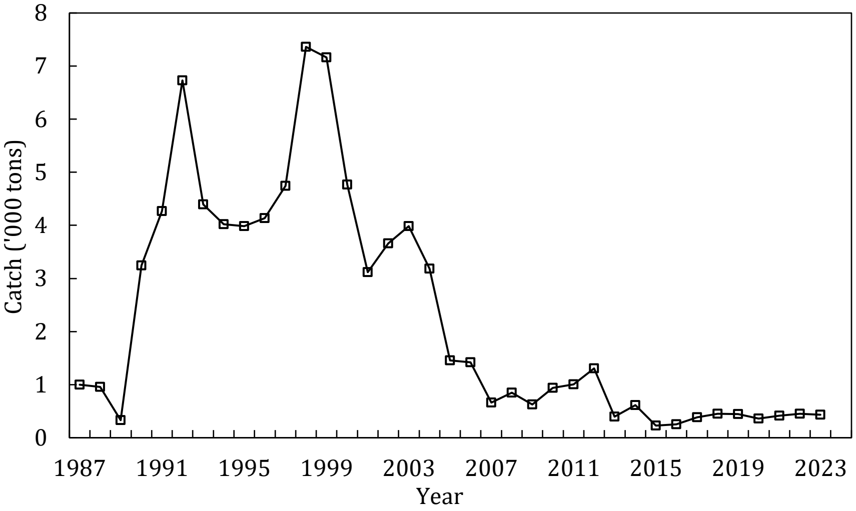

Figure 18.1. Roughhead grenadier in Subareas 2+3: STACFIS catches.

b) Data Overview

i) Surveys

There are no survey indices available covering the total distribution, in depth and area, of this stock. According to other information, this species predominately inhabits depths ranging from 800 to 1 500 m, therefore the best survey indicators of stock biomass are the series extending to 1 500 m depth as they cover the depth distribution of roughhead grenadier fairly well. Figure 18.2 presents the biomass indices for the following series extending to 1 500 m depth: Canadian fall 2J+3K Engel (1978-1994) and Canadian fall 2J+3K Campelen (1995-2023), EU-Spain 3NO (1997-2023), EU-Spain 3L (2006-2023) and EU Flemish Cap (to 1 400 m; 2004-2023). Survey coverage deficiencies within Divisions 2J+3K were such that the 2008, 2018, 2019 and 2021 indices from the Canadian fall Divisions 2J+3K surveys were not considered comparable to those of the other years and the survey was not carried out in 2022. In 2020, the EU 3NO survey was not carried out due to the pandemic situation and during 2020-2022 the EU 3L survey was not carried out due to the pandemic situation and other survey problems. The 2023 Canadian fall survey was carried out with a new vessel but the catchability between the old and new vessels was found to be comparable.

Survey biomass indices showed a general increasing trend in the period 1995-2004. During 2005-2019, the Canadian 2J+3K survey indices continued to increase whereas the other three time series showed a general decrease. During 2020-2023, there were multiple data gaps in the time series except for the Division 3M survey.

The only biomass indices available for 2021-2022 were from Divisions 3NO and Division 3M, both of which remained near their time series low in 2022, but increased in 2023.

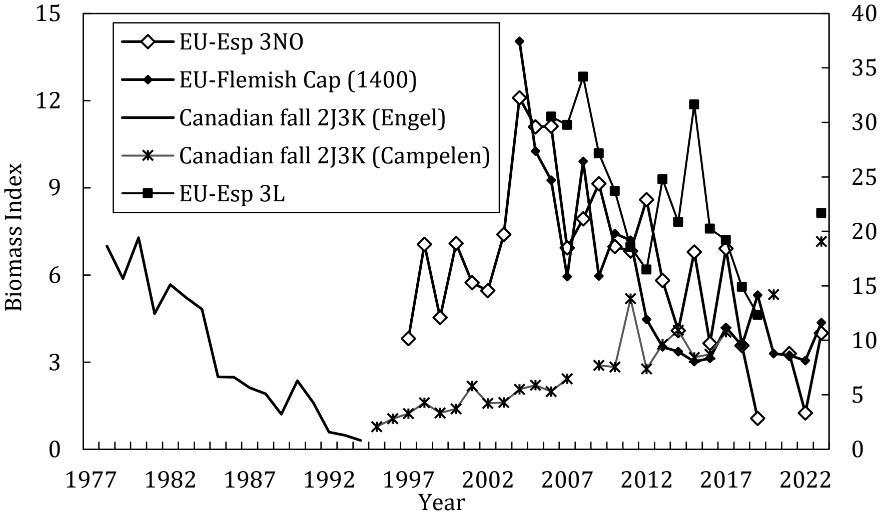

Figure 18.2. Roughhead grenadier in Subareas 2+3: Survey biomass indices.

The catch-biomass (C/B) ratios showed a clear declining trend from 1995-2005 and since then have been stable at low levels with the exception of the of the 3NO survey index in the year 2019 and 2022 (Figure 18.3). The C/B ratio of the Flemish Cap series shows a slightly increasing trend during 2019 - 2022. In 2023, both the Flemish Cap and Divisions 3NO biomass indices were generally low and similar to the values observed in recent years.

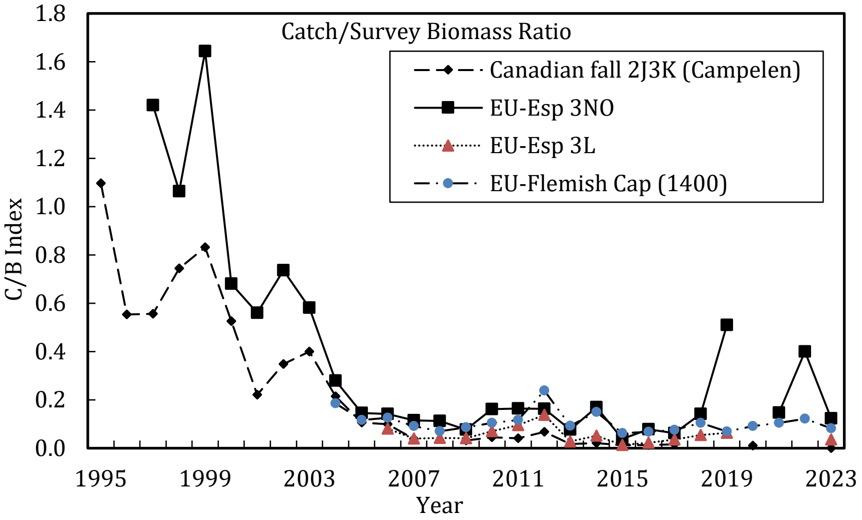

Figure 18.3. Roughhead grenadier in Subareas 2+3: catch/biomass indices based upon Canadian Autumn (Campelen series), EU-Spain Divisions 3NO, EU-Spain 3L and EU- Flemish Cap (to 1400 m depth) surveys.

c) Conclusion

The lack of survey indices in recent years limits our understanding of stock status since 2019, but the EU-Flemish Cap and EU-Spain Divisions 3NO biomass indices indicate that there was a general decrease over the past decade with the exception of the Canadian 2J3K survey, which contradicted this trend. Both the EU-Flemish Cap and EU-Spain Divisions 3NO indices showed some recovery in biomass compared to that observed in 2022. Fishing mortality indices have remained at low levels since 2005 with the exception of the 3NO survey indices in 2019 and 2022. The 2023 fishing mortality indices were close to the minimum of the series. Based on the biomass and fishing mortality indices for 2023, there is no change in the status of the stock.

This stock will be monitored in the future by interim monitoring reports until such time that conditions change to warrant a full assessment.

19. Greenland halibut (*Reinhardtius hippoglossoides*) in Subarea 2 + Divisions 3KLMNO

Interim Monitoring Report (SCS Doc. 24/09, 08, 11, 06; SCR Doc. 19/031, 24/007, 008, 005, 036, 037, 001REV2, 002REV2; FC Doc. 03-13, 10-12, 13-23, 16-20; COM Doc. 17-17)

a) Introduction

Fishery and Catches: TACs prior to 1995 were set autonomously by Canada; subsequent TACs have been established by NAFO Fisheries Commission (FC). Catches increased sharply in 1990 due to a developing fishery in the NAFO Regulatory Area in Divisions 3LMNO and continued at high levels during 1991-94. The catch was only 15 000 to 20 000 t per year in 1995 to 1998. The catch increased after 1998 and by 2001 was estimated to be 38 000 t, the highest since 1994. The estimated catch for 2002 was 34 000 t. The 2003 catch could not be precisely estimated, but was believed to be within the range of 32 000 t to 38 500 t. In 2003, a fifteen year rebuilding plan was implemented by Fisheries Commission for this stock. Though much lower than values of the early 2000s, estimated catch over 2004-2010 exceeded the TAC by considerable margins. TAC over-runs have ranged from 22%-64%, despite considerable reductions in effort. The STACFIS estimate of catch for 2010 was 26 170 t (64% over-run). In 2010, Fisheries Commission implemented a survey-based Management Procedure, which incorporates a harvest control rule (HCR) to generate annual TACs over at least 2011-2014, through which period the catch exceeded the TAC in every year. In 2013 Fisheries Commission extended the 2010 management approach to set the TACs for 2015–2017, but did not apply the HCR in 2017, rather setting the TAC equal to the 2016 TAC. TACs since 2018 have been based on the HCR adopted in 2017. Catches have closely tracked TACs since 2015. The TAC in 2023 was 15 156 t and 14 162 t were caught. The TAC for 2024 is 15 153 t (Figure 19.1).

Recent catches and TACs ('000 t) are as follows:

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
TAC	15.58	14.80	14.80	16.50	16.52	16.93	16.50	15.86	15.16	15.15
STATLANT 21	15.03	13.04	14.69	16.23	16.30	16.25	14.99	12.49	11.89	--
STACFIS	15.27	14.88	14.76	16.63	16.48	16.31	15.04	15.67	14.16	--

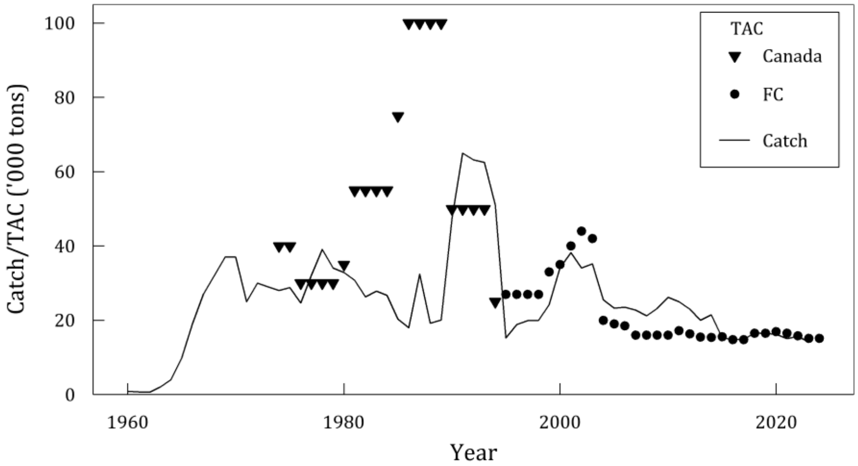

Figure 19.1. Greenland halibut in Subarea 2 + Divisions 3KLMNO: TACs and STACFIS catches.

b) Data Overview

Abundance and biomass indices were obtained from research vessel surveys conducted by Canada in Divisions 2+3KLNO (1978-2023), the EU in Division 3M (1988-2023), and EU-Spain in Divisions 3LNO (1995-2023). While indices are available for most years, some were excluded or unavailable due to coverage issues, interruptions from the COVID-19 pandemic, or the prioritization of comparative fishing experiments. The remaining years were analyzed to represent population trends from the various surveys.

For the Canadian autumn survey in Divisions 2J3K, data were available from 1996-2023; from the Canadian spring survey in Divisions 3LNO from 1996-2023; and for the Canadian autumn survey in Divisions 3LNO to 730 m from 1996-2023. The Canadian surveys were completed in 2023 with new research vessels and a modified trawl; however, the 2023 index from the Canadian spring survey of 3LNO is not shown due to the lack of a conversion factor. Conversion factors have been applied to the Canadian autumn surveys of 2J3K and 3LNO, and the effect of a bias in these factors have been tested under the latest management strategy evaluation simulations.

For the EU survey in Division 3M to 700 m, data are available from 1988-2023, and to 1400 m from 2004-2023; for the EU-Spain survey in Divisions 3NO from 1997-2023 and in 3L from 2003-2023.

i) Research survey data

STACFIS reiterated that most research vessel survey series providing information on the abundance of Greenland halibut are deficient in various ways and to varying degrees. Variation in divisional and depth coverage creates problems in comparing results from different years. A single survey series which covers the entire stock area is not available. A subset of standardized (depth and area) stratified random survey indices has been used to monitor trends in resource status, and are described below.

Canadian stratified-random autumn surveys in Divisions 2J and 3K: Abundance and biomass indices from the Canadian autumn survey of Divisions 2J3K have shown a series of increases and decreases since 1996 (Figure 19.2). The abundance index decreased between 1996-2005, increased between 2005-2011 and, following a decrease in 2012, the index has remained relatively low and stable. The biomass index has fluctuated since 1996, with local maxima around 1999, 2007 and 2014, and local minima around 2002, 2010 and 2017; the index has been relatively low since 2017, with a potential increase in 2021 towards the time-series mean.

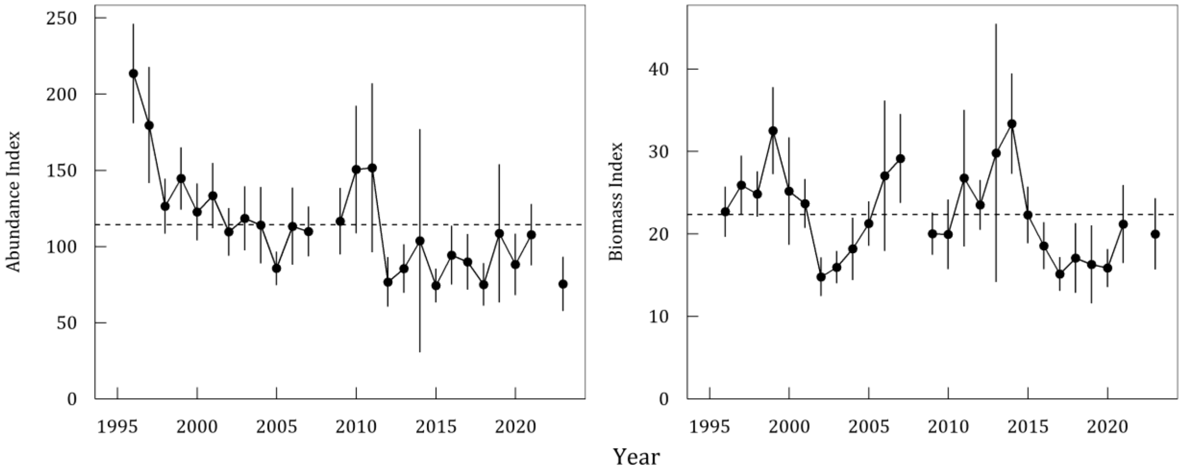

Figure 19.2. Greenland halibut in Subarea 2 + Divisions 3KLMNO: abundance (left) and biomass (right) indices (with 95% CI) from Canadian autumn surveys in Divisions 2J and 3K. The dotted line represents the time-series average.

Canadian stratified-random spring surveys in Divisions 3LNO: Abundance and biomass indices from the Canadian spring surveys in Divisions 3LNO (Figure 19.3) declined from relatively high values in the late 1990s and has been relatively low in most years thereafter. Abundance and biomass indices from 2018 and 2019 have increased from 2016 levels. Trends since 2019 are unknown due to recent survey interruptions and the lack of a conversion factor for this series.

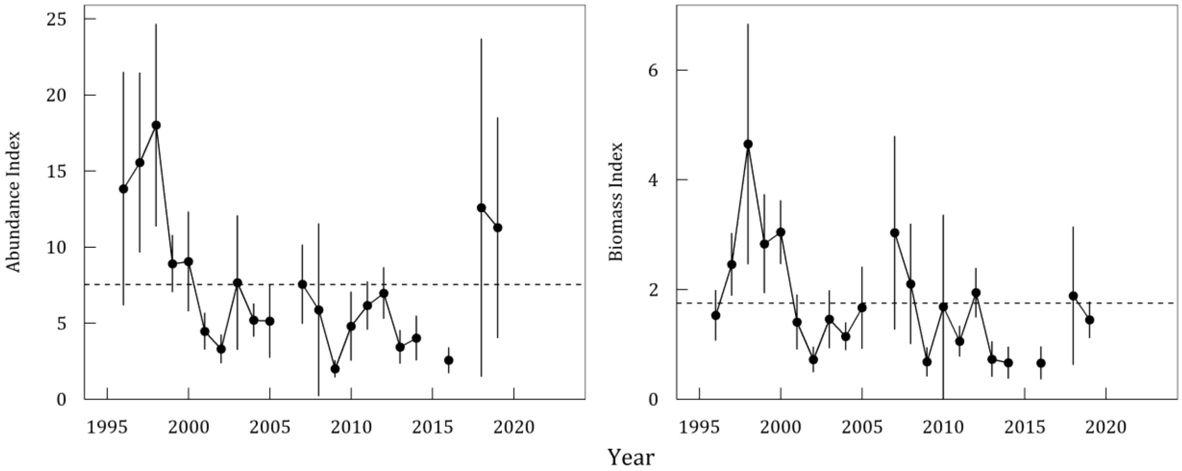

Figure 19.3. Greenland halibut in Subarea 2 + Divisions 3KLMNO: abundance (left) and biomass (right) indices (with 95% CI) from Canadian spring surveys in Divisions 3LNO. The dotted line represents the time-series average.

Canadian stratified-random autumn surveys in Divisions 3LNO: Time series of abundance and biomass were developed from the Canadian autumn surveys from 1996-2023 to a depth of 730 m. The abundance index from the Canadian autumn surveys in Divisions 3LNO (Figure 19.4) declined from relatively high values in the late 1990s then varied without trend until 2015 when the index began to increase. Like the abundance index, the biomass index increased between 2015-2020. Both the abundance and biomass indices appear to have decreased in 2023 to below-average levels.

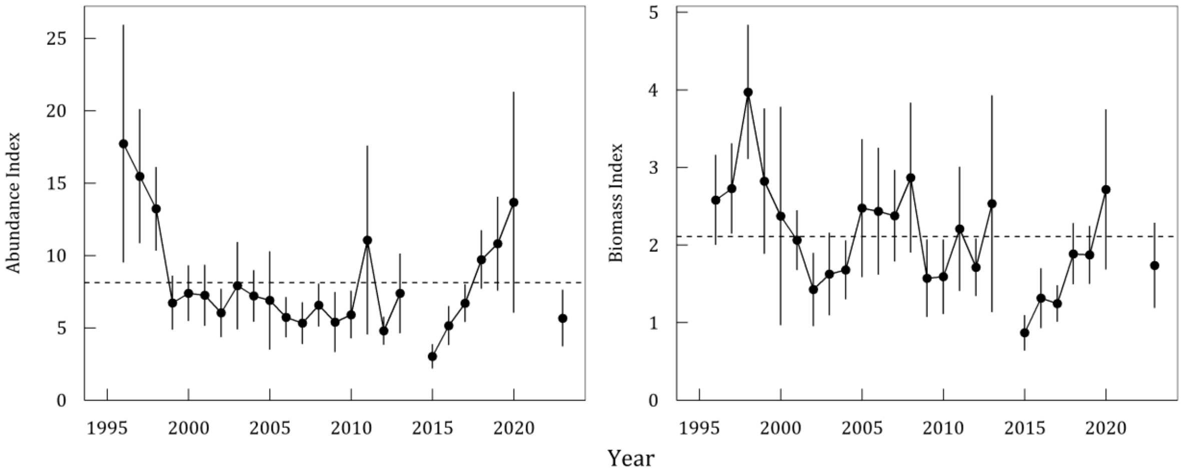

Figure 19.4. Greenland halibut in Subarea 2 + Divisions 3KLMNO: abundance (left) and biomass (right) indices (with 95% CI) from Canadian autumn surveys in Divisions 3LNO. The dotted line represents the time-series average.

EU stratified-random surveys in Divisions 3M (Flemish Cap): Surveys conducted by the EU in Division 3M during summer indicate that the Greenland halibut biomass index in depths to 730 m increased to a maximum value in 1998, after which the index declined to a time-series minimum in 2013 (Figure 19.5). This index has remained below the series average since 2010. The Flemish Cap survey was extended to cover depths down to 1460 m beginning in 2004, and this index has been relatively stable but more variable than the shallower series. The deep index was above the time-series average in 2023.

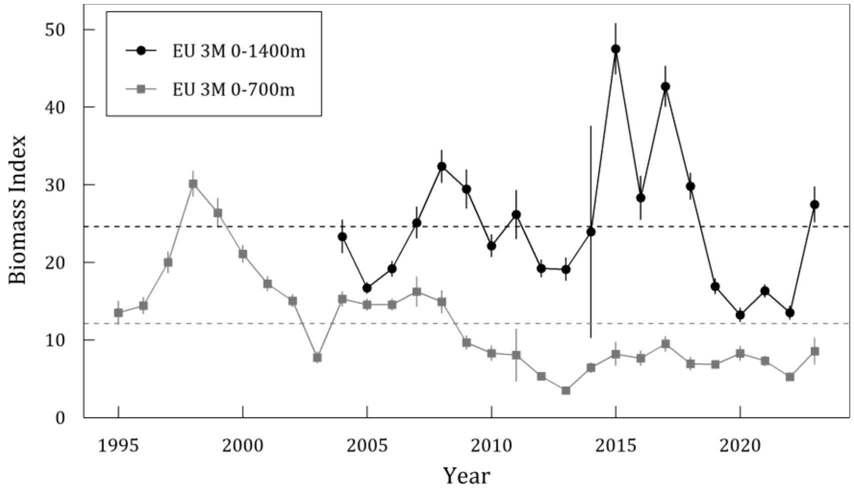

Figure 19.5. Greenland halibut in Subarea 2 + Divisions 3KLMNO: Biomass index (± 1 S.E.) from EU Flemish Cap surveys in Division 3M. Grey squares: biomass index for depths <730 m. Black circles: biomass index for all depths <1460 m. Dotted lines represent time-series averages.

EU-Spain stratified-random surveys in NAFO Regulatory Area of Divisions 3LNO: The biomass index for the survey of the NRA in Divisions 3NO generally declined over 1999 to 2006 but has generally increased since (Figure 19.6). Likewise, the biomass index for the survey of the NRA in Division 3L has generally increased since 2003.

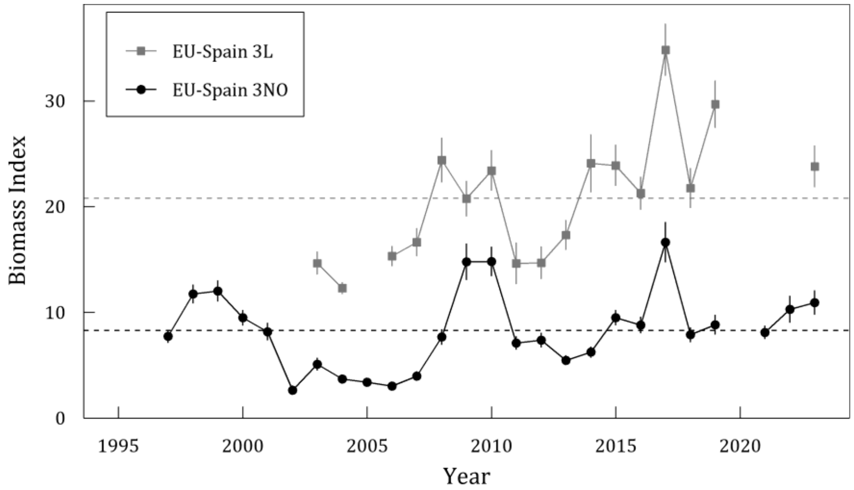

Figure 19.6. Greenland halibut in Subarea 2 + Divisions 3KLMNO: biomass index (±1 SE) from EU-Spain spring surveys in the NRA of Divisions 3NO and Division 3L. Dotted lines represent time-series averages.

Summary of research survey data trends.

These surveys provide coverage of the majority of the spatial distribution of the stock and the area from which the majority of catches are taken. Over 1995-2007, indices from the majority of the surveys generally provided a consistent signal in stock biomass (Figure 19.7). Results since 2007 show greater divergence which complicates interpretation of overall status; the overall trend since 2007 is unclear.

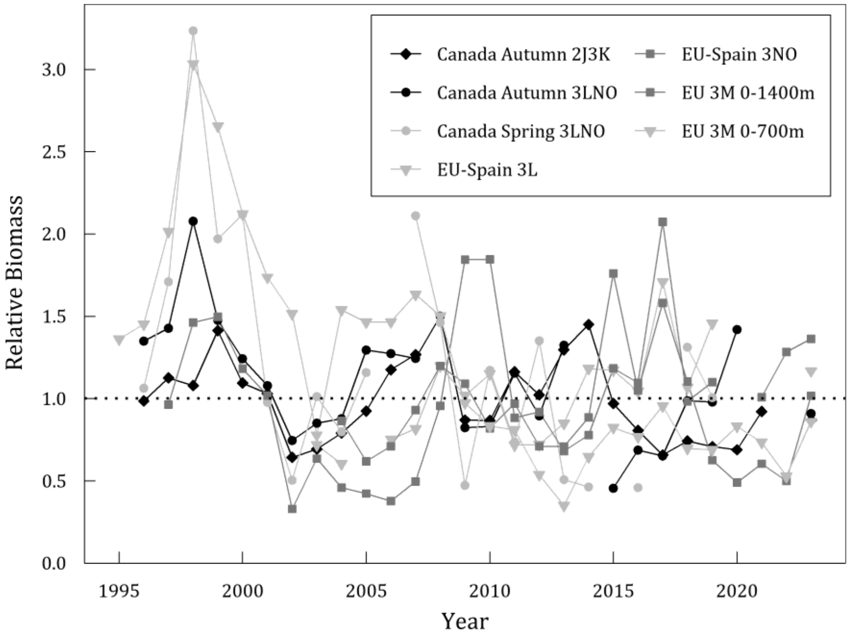

Figure 19.7. Greenland halibut in Subarea 2 + Divisions 3KLMNO: Relative biomass indices from Canadian autumn surveys in Divisions 2J3K, Canadian spring surveys in Divisions 3LNO, Canadian autumn surveys in Divisions 3LNO, EU survey of Division 3M, and EU-Spain surveys of the NRA of Divisions 3NO. Each series is scaled to its average and the average line is shown as thin dotted line.

Recruitment from surveys.

Abundance indices at age 4 from surveys were examined as a measure of recruitment. Year classes from all surveys were above average between 1993-1994 and below average between 2009-2013. After three very large year classes of 2000-2002 in the EU survey of Division 3M, abundance at age 4 fell below average for 12 years. There are some positive signals in recent years as estimates of the most recent year class (2015 to 2019) are near or above the time series average.

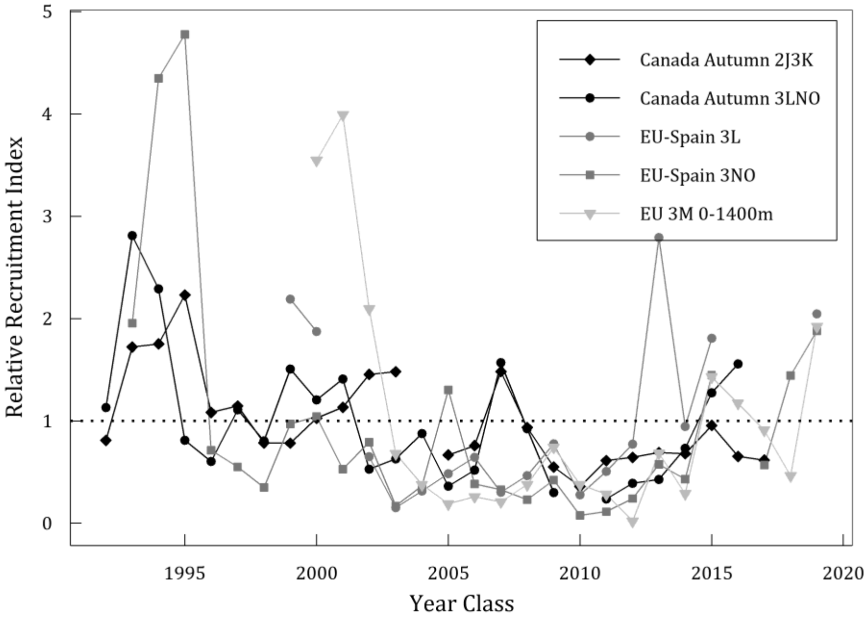

Figure 19.8. Greenland halibut in Subarea 2 + Divisions 3KLMNO: Relative recruitment indices from Canadian autumn surveys in Divisions 2J3K, Canadian spring surveys in Divisions 3LNO, EU survey of Division 3M and EU-Spain survey in Divisions 3LNO. Each series is scaled to its average, which is shown using a dotted line.

c) Conclusion

Biomass: Survey indices since 2007 are variable which complicates the interpretation of overall status. The five surveys that are used in the HCR show differing trends over this period. Since 2020, only two out of six available survey indices was above its time series mean.

Recruitment: Results of all surveys indicate that recruitment (age 4) has recently returned to average levels following a series of below average years.

State of the stock: Though divergent trends in the survey indices complicate interpretations of the state of the stock, the survey indices are not deviating significantly from expectations under the management procedure. Most survey indices are within the 95% probability envelopes from the base case SCAA (Figure 19.9) and revamped SSM simulations (Figure 19.10). The composite index suggests that the stock is stable and the most recent value is within the 80% probability envelope from both models.

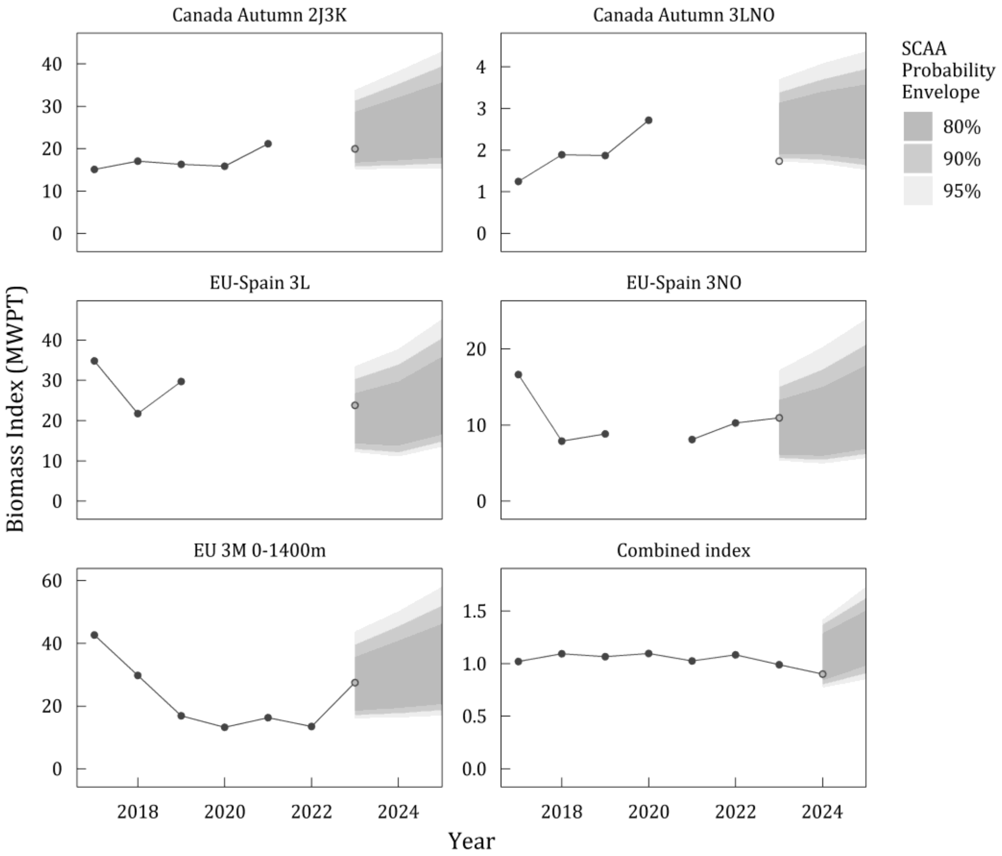

Figure 19.9. Greenland Halibut in Subarea 2 + Divisions 3KLMNO. Mean weight per tow from Canadian autumn surveys in Divisions 2J3K, Canadian spring surveys in Divisions 3LNO, Canadian autumn surveys in Divisions 3LNO, EU Flemish Cap surveys (to 1400m depth) in Division 3M and EU-Spain surveys in 3LNO. The figure also shows the combined index used in the target based component of the HCR. For the survey and combined indices, 80%, 90% and 95% probability envelopes from the SCAA base case simulation are shown. Index values observed from 2017 onward are shown using open circles.

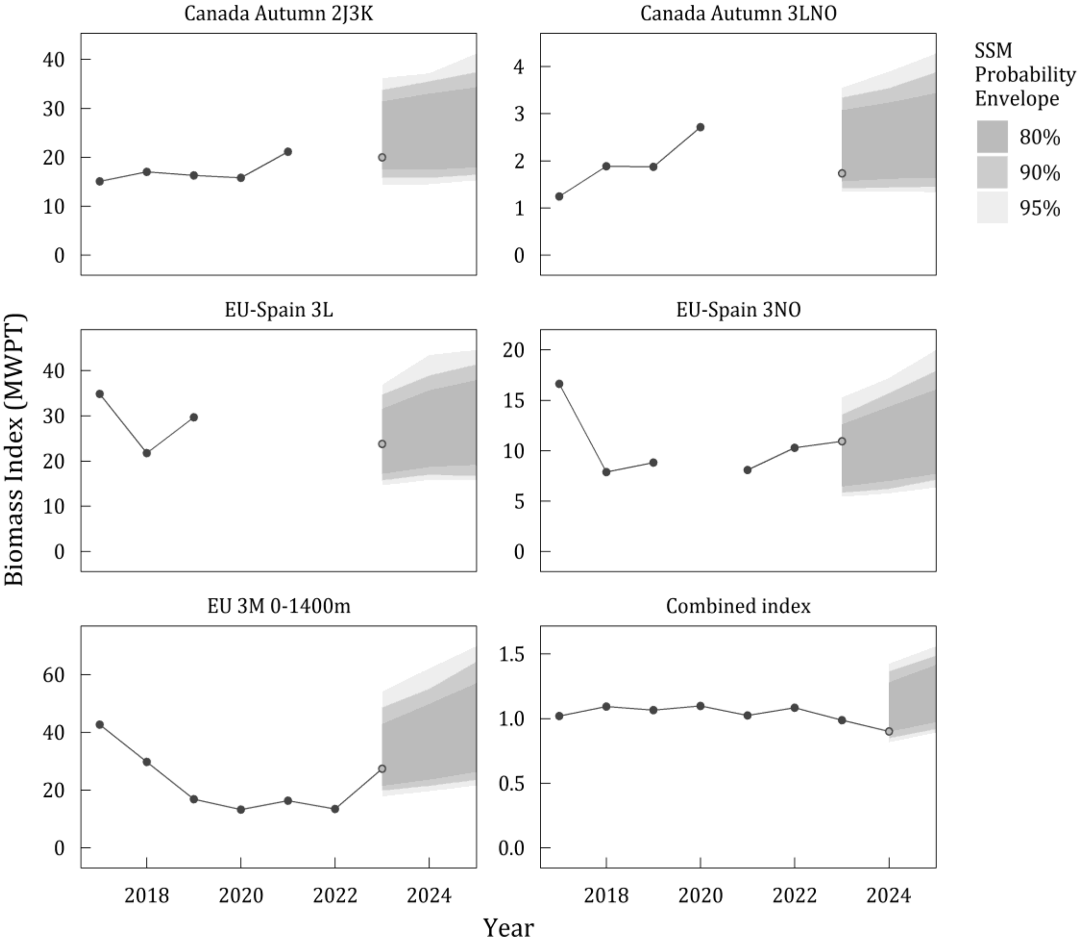

Figure 19.10. Greenland Halibut in Subarea 2 + Divisions 3KLMNO. Mean weight per tow from Canadian autumn surveys in Divisions 2J3K, Canadian spring surveys in Divisions 3LNO, Canadian autumn surveys in Divisions 3LNO, EU Flemish Cap surveys (to 1400m depth) in Division 3M and EU-Spain surveys in 3LNO. The figure also shows the combined index used in the target based component of the HCR. For the survey and combined indices, 80%, 90% and 95% probability envelopes from the SSM base case simulation are shown. Index values observed from 2017 onward are shown using open circles.

d) Research recommendation

The divergence in survey indices could be the result of movement of fish or because of transient age effects as a result of changing recruitment when different surveys cover differing age-ranges. STACFIS recommends that tagging and/or telemetry studies be undertaken to help elucidate movement of 2+3KLMNO Greenland halibut.

20. Northern shortfin squid (*Illex illecebrosus*) in Subareas 3+4

Deferred to the NAFO Annual Meeting in September 2024.

21. Splendid alfonsino (*Beryx splendens*) in Subarea 6

Interim Monitoring Report (SCR Doc. 15/06, 20/36; COM-SC CESAG-WP 24-01)

a) Introduction

Alfonsino is distributed over a wide area which may be composed of several populations. Alfonsino is an oceanic demersal species that forms distinct aggregations, at 300–950 m depth, on top of seamounts in the North Atlantic. The stock structure in NAFO Area is unknown. Until more complete data on stock structure is obtained it is considered that separate populations live on each seamount of Division 6G.

Most published growth studies suggest a maximum life span between 10 and 20 years. The observed variability in the maximum age and length depends on the geographic region. Sexual maturation was found to begin at age 2, with a mean length of 18 cm. By age 5–6 years, all individuals are mature at 25–30 cm fork length. On the Corner Rise Seamounts, alfonsino have been observed to spawn from May-June to August-September.

As a consequence of the species' association with seamounts, their life-history, and their aggregation behaviour, this species is easily overexploited and can only sustain low rates of exploitation.

b) Description of the Fishery

Historically, catches of alfonsino in the NAFO Regulatory Area (NRA) have been reported from Divisions 6E-H, although the bulk of those catches were made in the Corner Rise area Division 6G. The development of the Corner Rise fishery was initiated in 1976. Commercial aggregations of alfonsino on the Corner Rise have been found on three seamounts. Two of them named "Kükenthal" (also known as "Perspektivnaya") and "C-3" ("Vybornaya") are located in NRA. One more bank, named "Milne Edwards" ("Rezervnaya") is located in the Central Western Atlantic.

Russian vessels fished these areas during some periods between 1976 and 1999 using pelagic trawls. A directed commercial fishery has been conducted since 2005 by EU-Spanish vessels. Since 2006, virtually all the effort has been made in the Kükenthal seamount with pelagic trawl gear.

Fishery was closed in 2020 based on scientific advice that the stock was depleted.

c) Commercial fishery data

The Russian fishery started in 1976 with a catch of 10 200 t (Figure 21.1). Thereafter, the catches ranged between 10 and 3 500 t. There was no fishing effort from 1988-1993, 1998 and 2000 – 2003. From 2005 to 2019, an alfonsino-directed fishery in Kükenthal seamount was conducted by EU-Spanish vessels using pelagic trawl gear, where catches ranging between 1 to 1 187 t, with no fishery in 2008. In the 2020-2023 period, the fishery has been closed and alfonsino catches were zero (Table 21.1).

Table 21.1. Recent catches (tons), effort and CPUE (Kg/hr fished) for the alfonsino fishery on Kukenthal Peak.

Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Catch (t)	114	118	122	127	51	2	1	0	0	0	0
Effort (days on ground)	17	15	13	16	12	8	8	0	0	0	0
Effort (hours fished)	87	117	92	116	68	33	33	0	0	0	0
CPUE (Kg/hour)	1310	1009	1326	1095	750	61	42				
Effort (vessels)	1	2	2	1	1	1	1	0	0	0	0

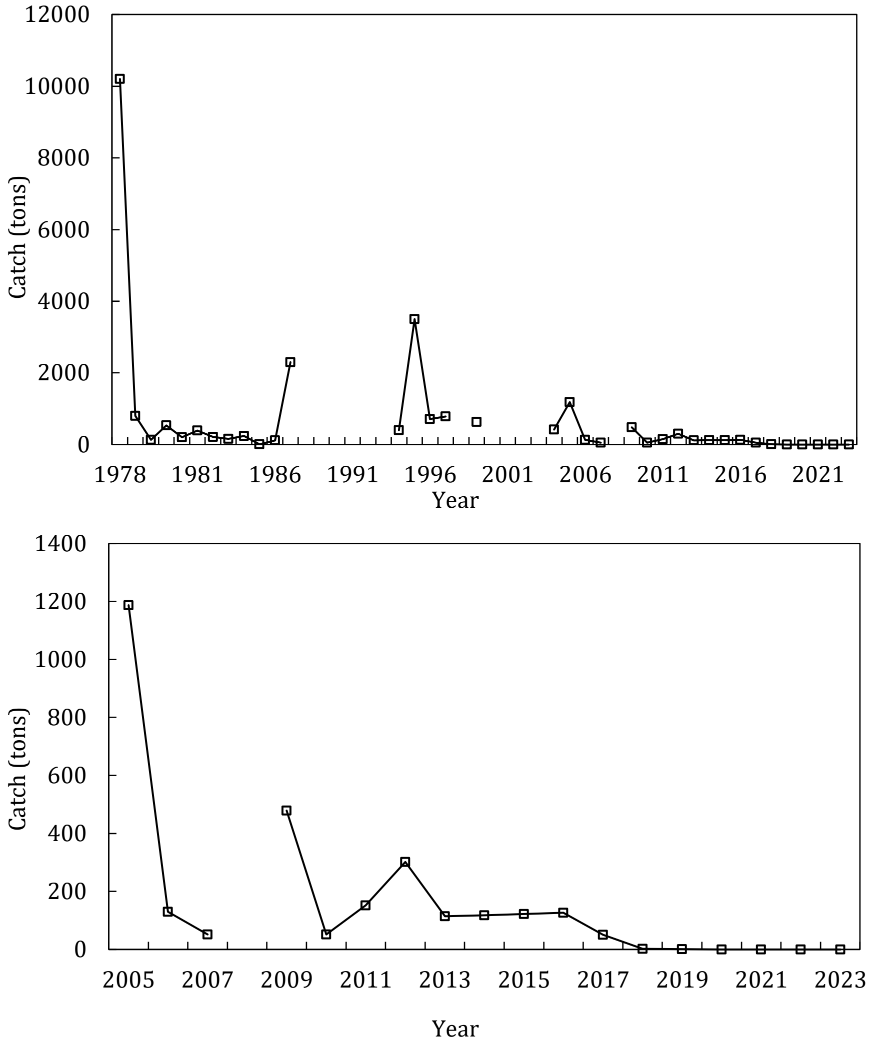

Figure 21.1. Alfonsino catches from Division 6G. Top panel illustrates the whole catch series (1978-2023) and bottom panel illustrates the catch series since 2005.

The available commercial length distributions in percentage by year (2007, 2009, 2012 and 2016-2019) are presented in Figure 21.2. It can be observed that in the period 2007-2018 these length distributions show a slight decrease in the mode over time. Catches in this period are in the 30-50 cm range with a mode around or bigger than 40 cm. The 2019 length distribution shows a smaller range with a mode around 38 cm.

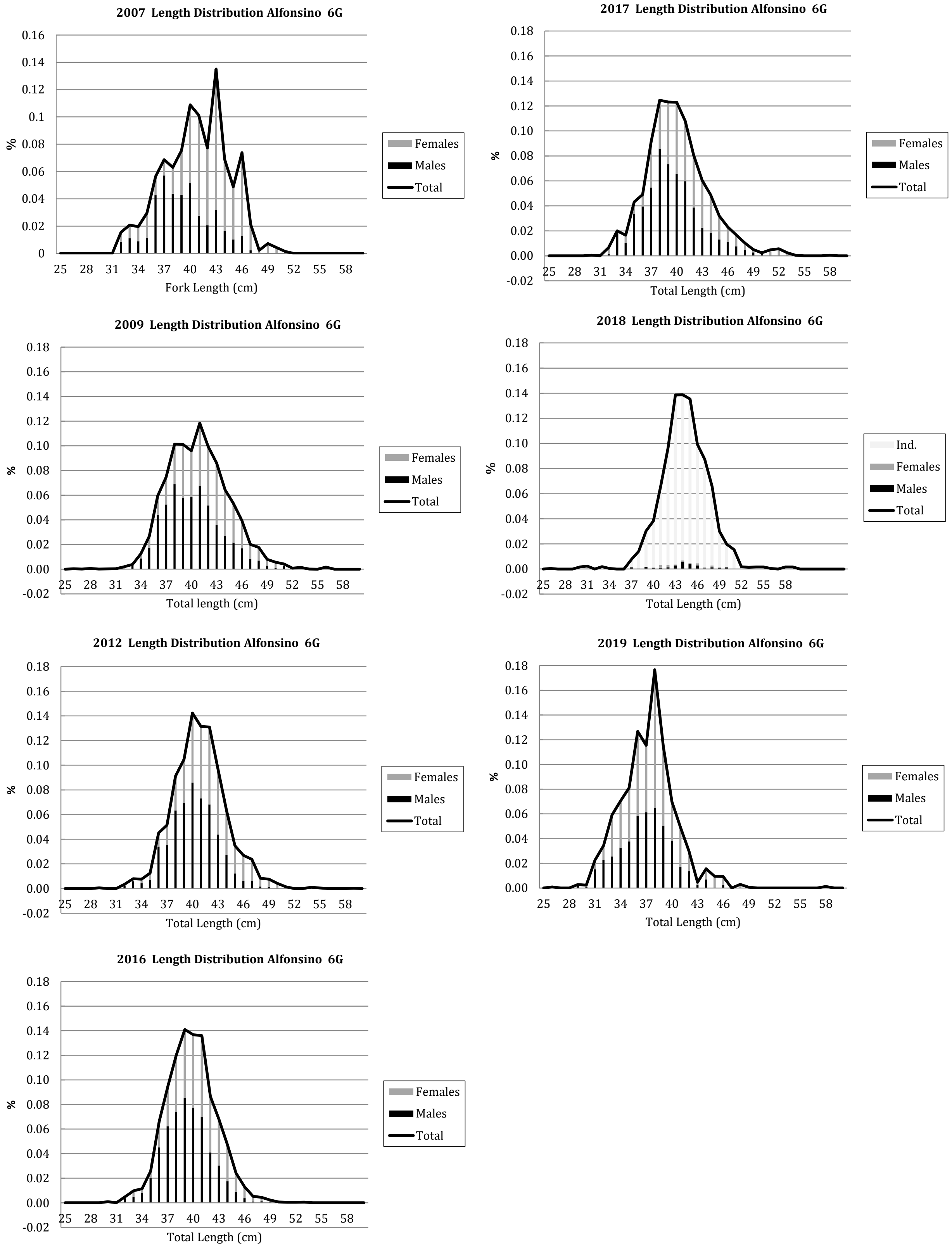

Figure 21.2. Length distributions of alfonsino catches from Division 6G.

d) Surveys

The only information available is the retrospective data from Russian research, exploratory and fishing cruises presented in 2015. This data covers the period ending in 1995. The alfonsino biomass estimated on Corner Rise with these data was around 11 000-12 000 t. It should be taken into consideration that the data with a time limitation of mainly 20-30 years were used for the calculations mentioned above. Based on this information, the greatest biomass of mature alfonsino (distribution depths of 400-950 m) was registered on the "Kükenthal" seamount. On the "C-3" and "Milne Edwards" seamounts, the biomass was much lower.

An acoustic survey plan to collect alfonsino data and estimate its biomass has been presented to the SC for discussion. The Scientific Council concluded that the presented acoustic survey plan could be appropriate to recollect fishery-independent information that can help the future evaluation of this stock.

e) Conclusion

No analytical or survey-based assessment were possible. The most recent assessment, in 2019, concluded that the stock appears to be depleted. There is no new information available to update the evaluation carried out in 2019 and ratified in the IMR of 2020. The fishery was closed during the 2020-2023 period.

f) Special comments

Periods of decline in catches have been observed several times in the past after several years of fishing. In the past, catches have increased after a period of low/no removals; however, it is unknown if this corresponded to stock recovery. In the absence of new data (eg. from an exploratory fishery or survey) there will be no basis to update the present assessment.

g) Research recommendations

Scientific Council **recommended** in 2019 that *fishery-independent information should be collected on this stock.* This is especially important given that the fishery has been closed since 2020, and there will not be CPUE or any other fishery-dependent or independent information to monitor whether there is any recovery. For this purpose, an acoustic survey plan was presented and discussed by the SC in 2021. The SC concluded that the presented acoustic survey plan could be appropriate to collect fishery-independent information that can help the future evaluation of this stock.

IV.OTHER MATTERS

1. FIRMS Classification for NAFO Stocks

STACFIS reiterates that the Stock Classification system is not intended as a means to convey the scientific advice to the Commission, and should not be used as such. Its purpose is to respond to a request by FIRMS to provide such a classification for their purposes. The category choices do not fully describe the status of some stocks. Scientific advice to the Commission is to be found in the Scientific Council report in the summary sheet for each stock.

Stock Size (incl. structure)	**Fishing Mortality**			
	None–Low	**Moderate**	**High**	**Unknown**
Virgin–Large		3LNO Yellowtail Flounder		
Intermediate		SA0+1 Northern shrimp[1] 3M Redfish[1] SA2+3KLMNO Greenland halibut 3M cod SA 0+1 (Offshore) Greenland halibut	East Greenland Northern shrimp	SA1 American Plaice SA1 Spotted Wolffish
Small	3NOPs White hake 3NO Witch flounder 3LN Redfish	3O Redfish		
Depleted	3M American plaice 3LNO American plaice 3NO Cod 3LNO Northern shrimp 3M Northern shrimp[2] 6G Alfonsino			SA1 Redfish SA1 Atlantic Wolffish
Unknown	SA2+3 Roughhead grenadier 3NO Capelin	1B-C Greenland halibut Inshore	1D Greenland halibut Inshore 1E-F Greenland halibut Inshore	SA3+4 Northern shortfin squid 3LNOPs Thorny skate Greenland halibut in Uummannaq Greenland halibut in Disko Bay Greenland halibut in Upernavik

[1] Fishing mortality may not be the main driver of biomass for Division 3M Shrimp and Redfish

[2] For many stocks, lack of surveys in recent years has impacted assessments.

2. Other Business

No other business was discussed.

V. ADJOURNMENT

The meeting was adjourned on 13 June 2024.

APPENDIX V. AGENDA – SCIENTIFIC COUNCIL MEETING, 31 MAY – 13 JUNE 2024

Scientific Council Meeting, 31 May -13 June 2024

I. Opening (Scientific Council Chair: Diana González-Troncoso)
  1. Appointment of Rapporteur
  2 Presentation and Report of Proxy Votes
  3. Adoption of Agenda
  4. Attendance of Observers
  5. Appointment of Designated Experts
  6. Plan of Work
  7. Housekeeping issues

II. Review of Scientific Council Recommendations in 2023

III. Fisheries Environment (STACFEN Chair: Miguel Caetano)
  1. Opening
  2. Appointment of Rapporteur
  3. Adoption of Agenda
  4. Review of Recommendations in 2023
  5. Invited speakers
  6. Department of Fisheries and Oceans Canada, Oceans Science Branch, Marine Environmental Data Section (MEDS) Report for 2023
  7. Review of the physical, biological and chemical environment in the NAFO Convention Area during 2023
  8. Formulation of recommendations based on environmental conditions during 2023
  9. Other Matters
    a) Work planning for Commission request #10 "Addressing the Impacts of Climate Change on NAFO Fisheries and Ecosystems"
  10. Adjournment

IV. Publications (STACPUB Chair: Rick Rideout)
  1. Opening
  2. Appointment of Rapporteur
  3. Adoption of Agenda
  4. Review of Recommendations in 2023
  5. Review of Publications
    a) Annual Summary
      i) Journal of Northwest Atlantic Fishery Science (JNAFS)
      ii) Scientific Council Studies
      iii) Scientific Council Reports
  6. Other Matters
    a) Deadlines for report drafting
  7. Adjournment

V. Research Coordination (STACREC Chair: Mark Simpson)
  1. Opening
  2. Appointment of Rapporteur
  3. Review of Recommendations in 2023
  4. Fishery Statistics
    a) Progress report on Secretariat activities in 2023/2024
      i) Presentation of catch estimates from the CESAG, daily catch reports and STATLANT 21A and 21B
  5. Research Activities
    a) Biological sampling

        - i) Report on activities in 2023/2024
        - ii) Report by National Representatives on commercial sampling conducted
        - iii) Report on data availability for stock assessments (by Designated Experts)
    - b) Biological surveys
        - i) Review of survey activities in 2023 and early 2024 (by National Representatives and Designated Experts)
        - ii) Surveys planned for 2024 and early 2025
    - c) Tagging activities
    - d) Other research activities
- 6. Review of SCR and SCS Documents
- 7. Other Matters
    - a) Update on Canadian survey comparative fishing and conversion factors for new vessels
    - b) Update on inshore tagging of Greenland Halibut in 0A

- 8. Adjournment

VI. Fisheries Science (STACFIS Chair: Martha Krohn)

- I. Opening
- II. General Review of Catches and Fishing Activity
- III. Stock Assessments
    1. Greenland halibut (*Reinhardtius hippoglossoides*) in SA 0+1 offshore (full assessment)
    2. Greenland halibut (*Reinhardtius hippoglossoides*) Div. 1A inshore Divs. 1BC inshore, Div. 1D inshore and Divs. 1EF inshore (full assessment)
    3. Demersal redfish and deep-sea redfish (*Sebastes* spp.) in SA 1 (monitor)
    4. Wolffish in SA 1 (monitor)
    5. Golden redfish (*Sebastes norvegicus* aka *S. marinus*) in Div. 3M (monitor)
    6. Cod (*Gadus morhua*) in Div. 3M (full assessment)
    7. Redfish (*Sebastes mentella* and *Sebastes fasciatus*) in Div. 3M (full assessment)
    8. American plaice (*Hippoglossoides platessoides*) in Div. 3M (monitor)
    9. Cod (*Gadus morhua*) in Divs. 3NO (monitor)
    10. Redfish (*Sebastes mentella* and *Sebastes fasciatus*) in Divs. 3L and 3N (full assessment)
    11. American plaice (*Hippoglossoides platessoides*) in Divs. 3LNO (monitor)
    12. Yellowtail flounder (*Limanda ferruginea*) in Divs. 3LNO (monitor)
    13. Witch flounder (*Glyptocephalus cynoglossus*) in Divs. 3NO (full assessment)
    14. Capelin (*Mallotus villosus*) in Divs. 3NO (monitor)
    15. Redfish (*Sebastes mentella* and *Sebastes fasciatus*) in Div. 3O (monitor)
    16. Thorny skate (*Amblyraja radiata*) in Divs. 3LNO and Subdiv. 3Ps(full assessment)
    17. White hake (*Urophycis tenuis*) in Divs. 3NO and Subdiv. 3Ps(monitor)
    18. Roughhead grenadier (*Macrourus berglax*) in SA 2 and 3 (monitor)
    19. Greenland halibut (*Reinhardtius hippoglossoides*) in SA 2 + Divs. 3KLMNO (in MSE process: monitor, COM requests #2 and 4a)
    20. Northern shortfin squid (*Illex illecebrosus*) in SA 3+4 (monitor)
    21. Splendid alfonsino (*Beryx splendens*) in SA 6 (monitor)

- IV. Other Matters
    - a) FIRMS Classification for NAFO Stocks
    - b) Other Business

- V. Adjournment

VII. Management Advice and Responses to Special Requests (See Annex 1)

1. Fisheries Commission (Annex 1)

   a) Request for Advice on TACs and Other Management Measures (request #1, Annex 1)

      For 2025
      - cod in Div. 3M
      - redfish in Div. 3LN

      For 2025 and 2026
      - redfish in Div. 3M
      - witch flounder in Div. 3NO
      - thorny skate in Div. 3LNO

      For 2025, 2026 and 2027
      - American plaice in Div. 3LNO

   b) Monitoring of Stocks for which Multi-year Advice was provided in 2022 or 2023 (request #1)
      - golden redfish in Div. 3M
      - American plaice in Div. 3M
      - cod in Divs. 3NO
      - yellowtail flounder in Divs. 3LNO
      - redfish in Divs. 3O
      - capelin in Divs. 3NO
      - alfonsino stocks in the NAFO Regulatory Area
      - roughhead grenadier in Subareas 2 and 3
      - white hake in Divs. 3NO and Subdiv. 3Ps
      - Northern shortfin squid in SA 3+4

   c) Special Requests for Management Advice

      i) Greenland halibut in Subarea 2 + Div 3KLMNO monitor, compute the TAC using the most recently agreed HCR and determine whether exceptional circumstances are occurring (request #2, Commission priority).

      ii) Continue to advance work on the 2+3KLMNO Greenland halibut MSE processes as per the approved 2024 workplan (request #3a, Commission priority).

      iii) Continue to advance work on the 3LN redfish MSE processes as per the approved 2024 workplan (request #3b, Commission priority).

      iv) Provide catch information in relation to 2TCI, including recent cumulative catch levels and a scoping of expected cumulative catch levels (request #4a).

      As practicable and taking into account Scientific Council capacity constraints, develop stock summary sheets for NAFO managed stocks that are evaluated using HCR or MSE processes (request #4b).

      v) Support the Secretariat in developing a centralized data repository using ArcGIS online to host the data and data-products for scientific advice (request #5a).

      vi) Continue working with WG-EAFFM towards developing operational objectives for the protection of VMEs and biodiversity in the NRA (request #5b).

      vii) Work towards the reassessment of VMEs and impact of bottom fisheries on VMEs for 2026 (request #5c).

      vii) Continue progression on the review of the NAFO PA Framework in accordance to the PAF review work plan approved in 2020 and revised in 2023 (request #6).

      ix) Update the 3-5 year work plan, (request #7, Commission priority).

        x) Include any new Canadian stock assessments for cod 2J3KL (Canada), witch flounder 2J3KL (Canada) as an annex to the SC's annual report (request #8).
        xi) Monitor and provide update on relevant research related to the potential impacts of activities other than fishing in the Convention Area, subject to the capacity of the Scientific Council (request #9).
        xii) Summarize the information it currently has available regarding the current and future impacts of climate change on NAFO-managed stocks, non-target species, and associated ecosystems; and identify any consequential data gaps, research needs and opportunities for productive research (request #10).

2. Coastal States
    a) Request by Denmark (Greenland) for Advice on Management in 2025 and 2026 (Annex 2)
        i) Greenland halibut SA 1 (inshore)
        ii) Monitoring of Stocks for which Multi-year Advice was provided in 2022 or 2023;
            - demersal redfish and deep-sea redfish (*Sebastes* spp.) in SA 1
            - wolffish in SA 1

    b) Request by Canada and Greenland for Advice on Management in 2024 and 2025 (Annex 2, Annex 3)
        i) Greenland Halibut, offshore.

VIII. Review of Future Meetings Arrangements
1. Scientific Council shrimp meeting, September 2024
2. Scientific Council, 23-27 September 2024
3. WG-ESA, 12-21 November 2024
4. Scientific Council, June 2025
5. Scientific Council (in conjunction with NIPAG), 2025
6. Scientific Council, Sep. 2025
7. WG-ESA, Nov. 2025
8. NAFO/ICES Joint Groups
    a) NIPAG
    b) WG-DEC
    c) WG-HARP

IX. Arrangements for Special Sessions

1. 11th International flatfish symposium
   Postponed from 2020, this will be held from 25 to 28 November 2024 in in Wageningen, the Netherlands. NAFO agreed to sponsor the symposium in 2020.
2. EAFM Symposium, 2025
   Subject to confirmation, this will be a NAFO/ICES/FAO symposium, and is planned to be held in Rome during March/April 2025.
3. Topics for future Special Sessions

X. Meeting Reports
1. Working Group on Ecosystem Science and Assessment (WG-ESA), 14-23 November 2023
2. Report from ICES-NAFO Working Group on Deepwater Ecosystems (WG-DEC), 25-29 March 2024
3. Meetings attended by the Secretariat

XI. Review of Scientific Council Working Procedures/Protocol
1. General Plan of Work for September 2024 Annual Meeting
2. Priority actions for Scientific Council from the Performance Review Panel WG (adopted by the NAFO Commission in September 2019)

XII. Other Matters

1. Designated Experts
2. Election of Chairs
3. Budget items
4. Other Business
    a) SC meeting format
    The efficiency WG asked all NAFO bodies to consider whether meetings should continue to be in hybrid format.
    b) SC workload discussions
    Report on the small group discussions with SC and Com. Chairs.

    c) Deadlines for submission of documents and data for SC meetings.

XIII. Adoption of Committee Reports

1. STACFEN
2. STACREC
3. STACPUB
4. STACFIS

XIV. Scientific Council Recommendations to Commission

XV. Adoption of Scientific Council Report

XVI. Adjournment

ANNEX 1. COMMISSION'S REQUEST FOR SCIENTIFIC ADVICE ON MANAGEMENT IN 2025 AND BEYOND OF CERTAIN STOCKS IN SUBAREAS 2, 3 AND 4 AND OTHER MATTERS

(from NAFO SCS Doc. 24/01)

Following a request from the Scientific Council, the Commission agreed that items 1, 2, 3 and 7 should be the priority for the June 2024 Scientific Council meeting subject to resources.

1. The Commission requests that the Scientific Council provide advice for the management of the fish stocks below according to the assessment frequency presented below. In keeping with the NAFO Precautionary Approach Framework (FC Doc. 04/18), the advice should be provided as a range of management options and a risk analysis for each option without a single TAC recommendation. The Commission will decide upon the acceptable risk level in the context of the entirety of the SC advice for each stock guided and as foreseen by the Precautionary Approach.

Yearly basis	Two-year basis	Three-year basis	Interim Monitoring Only
Cod in Div. 3M	Redfish in Div. 3M Thorny skate in Div. 3LNO Witch flounder in Div. 3NO Redfish in Div. 3LN White hake in Div. 3NO Yellowtail flounder in Div. 3LNO Northern shrimp 3LNO Northern shrimp in Div. 3M	American plaice in Div. 3LNO American plaice in Div. 3M Northern shortfin squid in SA 3+4 Redfish in Div. 3O Cod in Div. 3NO	SA 6 Alfonsino SA 2-3 Roughhead Grenadier Capelin in 3NO

Advice should be provided using the guidance provided in **Annexes A or B as appropriate**, or using the predetermined Harvest Control Rules in the cases where they exist (currently Greenland halibut 2+3KLMNO). For 3M shrimp supplementary advice in terms of fishing-days could also be considered as appropriate.

To implement this schedule of assessments, the Scientific Council is requested to conduct a full assessment of these stocks as follows:

- In 2024, advice should be provided for 2025 for: Cod in Div. 3M and Redfish in Div. 3LN.
- In 2024, advice should be provided for 2025 and 2026 for: Redfish in Div. 3M, Thorny skate in Div. 3LNO, Witch flounder in Div. 3NO and Northern shrimp in 3M.
    - With respect to Northern shrimp in Div. 3M, Scientific Council is requested to provide its advice to the Commission prior to the 2024 Annual Meeting based on the survey data up to and including 2024.
- In 2024, advice should be provided for 2025, 2026 and 2027 for: American plaice in Div. 3LNO.

The Commission also requests the Scientific Council to continue to monitor the status of all other stocks annually and, should a significant change be observed in stock status (e.g. from surveys) or in bycatch in other fisheries, provide updated advice as appropriate.

2. The Commission requests the Scientific Council to monitor the status of Greenland halibut in Subarea 2 + Div 3KLMNO annually to compute the TAC using the most recently agreed HCR and determine whether exceptional circumstances are occurring. If exceptional circumstances are occurring, the exceptional circumstances protocol will provide guidance on what steps should be taken.

3. The Commission requests that Scientific Council continue to advance work on the 2+3KLMNO Greenland halibut and 3LN redfish MSE processes during 2023-2024, as per the approved 2024 workplan [COM-SC RBMS-WP 23-06 (Rev. 3)]:

    a. For the Greenland Halibut MSE: test Candidate Management Procedures (CMP) performance against established management objectives and initial discussions on exceptional circumstances protocol.
    b. For the 3LN Redfish MSE: (1) review and finalize Operating Models, (2) review any further work on performance statistics; (3) select the CMP(s) for RBMS consideration and potential testing against established management objectives.

4. The Commission requests that the Scientific Council continue to work on tiers 1 and 2 of the Roadmap, specifically to:
    a. Annually provide catch information in relation to 2TCI, including recent cumulative catch levels and a scoping of expected cumulative catch levels;
    b. As practicable and taking into account Scientific Council capacity constraints, develop stock summary sheets for NAFO managed stocks that are evaluated using HCR or MSE processes.

5. In relation to the habitat impact assessment component of the Roadmap (VME and SAI analyses), the Commission requests that Scientific Council:
    a. Support the Secretariat in developing a centralized data repository using ArcGIS online to host the data and data-products for scientific advice;
    b. Continue working with WG-EAFFM towards developing operational objectives for the protection of VMEs and biodiversity in the NRA; and
    c. Work towards the reassessment of VMEs and impact of bottom fisheries on VMEs for 2026.

6. The Commission requests Scientific Council to continue progression on the review of the NAFO PA Framework in accordance to the PAF review work plan approved in 2020 and revised in 2023 (NAFO COM-SC RBMS-WP 23-19 (Revised)), specifically to undertake testing of the Provisional Draft PA Framework (COM-SC RBMS-WP 23-20 (Revised)).

7. The Commission requests Scientific Council to update the 3-5 year work plan, which reflects requests arising from the 2023 Annual Meeting, other multi-year stock assessments and other scientific inquiries already planned for the near future. The work plan should identify what resources are necessary to successfully address these issues, gaps in current resources to meet those needs and proposed prioritization by the Scientific Council of upcoming work based on those gaps.

8. The Commission requests that any new Canadian stock assessments for Cod 2J3KL and Witch flounder 2J3KL, and any new ICES stock assessments for Pelagic *Sebastes mentella* (ICES Divisions V, XII and XIV; NAFO 1) be included as an annex to the Scientific Council's annual report.

9. The Commission requests the SC to monitor and provide regular updates on relevant research related to the potential impacts of activities other than fishing in the Convention Area, subject to the capacity of the Scientific Council.

10. The Commission requests that the Scientific Council at its 2024 meeting: summarize the information it currently has available regarding the current and future impacts of climate change on NAFO-managed stocks, non-target species, and associated ecosystems; and identify any consequential data gaps, research needs and opportunities for productive research.

ANNEX A: Guidance for providing advice on Stocks Assessed with an Analytical Model

The Commission request the Scientific Council to consider the following in assessing and projecting future stock levels for those stocks listed above. These evaluations should provide the information necessary for the Fisheries Commission to consider the balance between risks and yield levels, in determining its management of these stocks:

1. For stocks assessed with a production model, the advice should include updated time series of:

- Catch and TAC of recent years
- Catch to relative biomass
- Relative Biomass
- Relative Fishing mortality
- Stock trajectory against reference points
- And any information the Scientific Council deems appropriate.

Stochastic short-term projections (3 years) should be performed with the following constant fishing mortality levels as appropriate:

- For stocks opened to direct fishing: 2/3 F_{msy}, 3/4 F_{msy}, 85% F_{msy}, 90% F_{msy},95% F_{msy}, F_{msy} 0.75 X $F_{status\ quo}$, $F_{status\ qu}$,1.25 X Status quo, F=0; TAC Status quo, 85% TAC Status quo, 90% TAC Status quo, 95% TAC Status quo
- For stocks under a moratorium to direct fishing: $F_{status\ quo}$, F = 0.

The first year of the projection should assume a catch equal to the agreed TAC for that year. In instances where Scientific Council expects catches to be significantly different from the agreed TAC, an additional projection could be provided based on the best available catch estimation.

Results from stochastic short-term projection should include:

- The 10%, 50% and 90% percentiles of the yield, total biomass, spawning stock biomass and exploitable biomass for each year of the projections
- The risks of stock population parameters increasing above or falling below available biomass and fishing mortality reference points. The table indicated below should guide the Scientific Council in presenting the short-term projections.

				Limit reference points														
				$P(F>F_{lim})$			$P(B<B_{lim})$				$P(F>F_{msy})$			$P(B<B_{msy})$				P(B2026 > B2024)
F in 2025 and following years	Yield 2024 (50%)	Yield 2025 (50%)	Yield 2026 (50%)	2024	2025	2026	2024	2025	2026		2024	2025	2026	2024	2025	2026		
2/3 Fmsy	t	t	t	%	%	%	%	%	%		%	%	%	%	%	%		%
3/4 Fmsy	t	t	t	%	%	%	%	%	%		%	%	%	%	%	%		%
85% Fmsy	t	t	t	%	%	%	%	%	%		%	%	%	%	%	%		%
90% Fmsy	t	t	t															
95% Fmsy	t	t	t															
Fmsy	t	t	t	%	%	%	%	%	%		%	%	%	%	%	%		%
0.75 X Fstatus quo	t	t	t	%	%	%	%	%	%		%	%	%	%	%	%		%
Fstatus quo	t	t	t	%	%	%	%	%	%		%	%	%	%	%	%		%
1.25 X Status quo	t	t	t	%	%	%	%	%	%		%	%	%	%	%	%		%
F=0	t	t	t	%	%	%	%	%	%		%	%	%	%	%	%		%
TAC Status quo																		
85% TAC Status quo																		
90% TAC Status quo																		
95% TAC Status quo																		

2. For stock assessed with an age-structured model, information should be provided on stock size, spawning stock sizes, recruitment prospects, historical fishing mortality. Graphs and/or tables should be provided for all of the following for the longest time-period possible:
   - historical yield and fishing mortality;
   - spawning stock biomass and recruitment levels;
   - Stock trajectory against reference points

And any information the Scientific Council deems appropriate

Stochastic short-term projections (3 years) should be performed with the following constant fishing mortality levels as appropriate:

- For stocks opened to direct fishing: $F_{0.1}$, F_{max}, 2/3 F_{max}, 3/4 F_{max}, 85% F_{max}, 75% $F_{status\ quo}$, $F_{status\ quo}$, 125% $F_{status\ quo}$,
- For stocks under a moratorium to direct fishing: $F_{status\ quo}$, F = 0.
  The first year of the projection should assume a catch equal to the agreed TAC for that year.

Results from stochastic short-term projection should include:

- The 10%, 50% and 90% percentiles of the yield, total biomass, spawning stock biomass and exploitable biomass for each year of the projections
- The risks of stock population parameters increasing above or falling below available biomass and fishing mortality reference points. The table indicated below should guide the Scientific Council in presenting the short-term projections.

				Limit reference points														
				P(F>F_{lim})			P(B<B_{lim})				P(F>F0.1)			P(F>F_{max})				P(B2026> B2024)
F in 2025 and following years*	Yield 2024	Yield 2025	Yield 2026	2024	2025	2026	2024	2025	2026		2024	2025	2026	2024	2025	2026		
F0.1	t	t	t	%	%	%	%	%	%		%	%	%	%	%	%		%
F_{max}	t	t	t	%	%	%	%	%	%		%	%	%	%	%	%		%
66% F_{max}	t	t	t	%	%	%	%	%	%		%	%	%	%	%	%		%
75% F_{max}	t	t	t	%	%	%	%	%	%		%	%	%	%	%	%		%
85% F_{max}	t	t	t	%	%	%	%	%	%		%	%	%	%	%	%		%
0.75 X F_{2018}	t	t	t	%	%	%	%	%	%		%	%	%	%	%	%		%
F_{2018}	t	t	t	%	%	%	%	%	%		%	%	%	%	%	%		%
1.25 X F_{2018}	t	t	t	%	%	%	%	%	%		%	%	%	%	%	%		%

ANNEX B. Guidance for providing advice on Stocks Assessed without a Population Model

For those resources for which only general biological and/or catch data are available, few standard criteria exist on which to base advice. The stock status should be evaluated in the context of management requirements for long-term sustainability and the advice provided should be consistent with the precautionary approach.

The following graphs should be presented, for one or several surveys, for the longest time-period possible:

a. time trends of survey abundance estimates
b. an age or size range chosen to represent the spawning population
c. an age or size-range chosen to represent the exploited population
d. recruitment proxy or index for an age or size-range chosen to represent the recruiting population.
e. fishing mortality proxy, such as the ratio of reported commercial catches to a measure of the exploited population.
f. Stock trajectory against reference points

And any information the Scientific Council deems appropriate.

ANNEX 2. DENMARK (ON BEHALF OF GREENLAND) REQUESTS FOR SCIENTIFIC ADVICE ON MANAGEMENT IN 2025 AND BEYOND OF CERTAIN STOCKS IN SUBAREA 0 AND 1

(from SCS Doc. 24/03)

Denmark (on behalf of Greenland) Coastal State Request for Scientific Advice – 2025

Denmark (on behalf of Greenland) hereby requests for scientific advice on management in 2025 of certain stocks in NAFO Subareas 0 and 1. Denmark (on behalf of Greenland) requests the Scientific Council for advice on the following species:

1. Golden Redfish and Demersal Deep-Sea Redfish

Advice on Golden redfish (*Sebastes marinus*) and demersal deep-sea redfish (*Sebastes mentella*) in Subarea 1 was in June 2023 given for 2024-2026. The Scientific Council is requested to continue its monitoring of the above stocks and provide updated advice as appropriate in the event of significant changes in stock levels.

2. Atlantic Wolffish and Spotted Wolffish

Advice on Atlantic Wolffish (*Anarhichas lupus*) and Spotted Wolffish (*Anarhichas minor*) in Subarea 1 was in June 2023 given for 2024-2026. The Scientific Council is requested to continue its monitoring of the above stocks and provide updated advice as appropriate in the event of significant changes in stock levels.

3. Greenland Halibut, Offshore

Advice on Greenland Halibut, Offshore in Subareas 0 and 1 was in 2022 given for 2023 and 2024. Denmark (on behalf of Greenland) requests the Scientific Council to provide updated advice on appropriate TAC levels for 2025 to 2026.

4. Greenland Halibut, Inshore, West Greenland

Advice on the inshore stocks of Greenland Halibut in Subarea 1 was in 2022 given for 2023-2024. Denmark (on behalf of Greenland) requests the Scientific Council to provide advice on appropriate TAC levels for 2025 to 2026. If appropriate, Denmark (on behalf of Greenland) would request the Scientific Council to use an MSY-approach.

5. Northern Shrimp, West Greenland

Subject to the concurrence of Canada as regards to Subareas 0 and 1, Denmark (on behalf of Greenland) requests the Scientific Council before December 2024 to provide advice on the scientific basis for management of Northern Shrimp (Pandalus borealis) in Subareas 0 and 1 in 2025 in line with Greenland's stated management objective of maintaining a mortality risk of no more than 35% in the first year prediction and to provide a catch option table ranging with 5,000 t increments. Future catch options should be provided for as many years as data allows for.

6. Northern Shrimp, East Greenland

Furthermore, the Scientific Council is in cooperation with ICES requested to provide advice on the scientific basis for management of Northern Shrimp (*Pandalus borealis*) in Denmark Strait and adjacent waters east of southern Greenland in 2025 and for as many years ahead as data allows for.

ANNEX 3. REQUESTS FROM CANADA FOR COASTAL STATE ADVICE IN 2025

(from SCS Doc. 24/04)

Canada would like to submit its request to the Scientific Council for advice on the following species:

1. Greenland halibut (Subarea 0 + 1 (offshore))

The Scientific Council is requested to provide an overall assessment of status and trends in the total stock area throughout its range and to specifically advise on TAC levels for 2025 and 2026. The stock status should be evaluated in the context of management requirements for long-term sustainability and the advice provided should be consistent with NAFO's Precautionary Approach Framework.

It is noted that at this time only general biological advice and/or catch data are available, and few standard criteria exist on which to base advice. Canada encourages the Scientific Council to continue to explore a model-based approach to bridge survey time series (i.e. data from the RV Paamiut and RV Tarajoq), and opportunities to develop risk-based advice in the future, noting that data conditions do not allow for such advice at this time.

2. Northern shrimp (Subarea 1 and Division 0A)

Canada requests that the Scientific Council consider the following options in assessing and projecting future stock levels for Northern shrimp (*Pandalus borealis*) in Subarea 1 and Division 0A:

The status of the stock should be determined and risk-based advice provided for catch options corresponding to Z_{msy} in 5,000t increments with forecasts for 2025 to 2027 (inclusive). These options should be evaluated in relation to Canada's Harvest Strategy (2022 revised version attached) and NAFO's Precautionary Approach Framework.

Presentation of the results should include graphs and/or tables related to the following:

- Historical and current yield, biomass relative to B_{msy}, total mortality relative to Z_{msy}, and recruitment (or proxy) levels for the longest time period possible;
- Total mortality (Z) and fishable biomass for a range of projected catch options (as noted above) for the years 2025 to 2027. Projections should include both catch options and a range of effective cod predation biomass levels considered appropriate by the Scientific Council. Results should include risk analyses of falling below: B_{msy}, 80% B_{msy} and B_{lim} (30% B_{msy}), and of being above Z_{msy} based on the 3-year projections, consistent with the Harvest Decision Rules in Canada's Harvest Strategy; and
- Total area fished for the longest time period possible.

Please provide the advice relative to Canada's Harvest Strategy as part of the formal advice (i.e., grey box in the advice summary sheet).

PROVISIONAL TIMETABLE

Scientific Council Meeting, 31 May -13 June 2024

Date	Time	Schedule
31 May (Friday)	0900	Registration, network connection
	0900-0930	SC Executive
	1000-1030	SC Opening
	1100-1200	STACFIS (Catch WG report, status of documentation, interim monitoring reports)
	1200-1300	Break
	1300-1800	STACFIS/STACFEN
01 June (Saturday)	0900-1200	STACFEN
	1300-1800	Scientific Council/STACFIS
	1830-2030	Scientific Council Reception/event
02 June (Sunday)	No meetings	
03 June (Monday)	0900-1200	STACPUB
	1300-1800	STACREC
04 June (Tuesday)	0900-1800	STACFIS/SC
05 June (Wednesday)	0900-1200	STACFIS/SC
	1300-1800	STACFIS/SC
06 June (Thursday)	0900-1800	STACFIS/SC
07 June (Friday)	0900-1800	STACFIS/SC
08 June (Saturday)	0900-1800	STACFIS Reports
09 June (Sunday)	No meetings	
10 June (Monday)	0830	Scientific Council Executive
	0900-1800	Scientific Council (Standing Committee Reports)
11 June (Tuesday)	0900-1800	Scientific Council
12 June (Wednesday)	0900-1800	Scientific Council
13 June (Thursday)	0900-1800	Scientific Council (advice and adoption of reports)

APPENDIX VI. EXPERTS FOR PRELIMINARY ASSESSMENT OF CERTAIN STOCKS

Designated Experts for 2024:

From the Science Branch, Northwest Atlantic Fisheries Centre, Department of Fisheries and Oceans, St. John's, Newfoundland & Labrador, Canada

Cod in Div. 3NO	Rick Rideout	rick.rideout@dfo-mpo.gc.ca
Redfish Div. 3O	Laura Wheeland	laura.wheeland@dfo-mpo.gc.ca
Redfish Div. 3LN	Andrea Perreault	andrea.perreault@dfo-mpo.gc.ca
American Plaice in Div. 3LNO	Laura Wheeland	laura.wheeland@dfo-mpo.gc.ca
Witch flounder in Div. 3NO	Dawn Maddock Parsons	dawn.parsons@dfo-mpo.gc.ca
Yellowtail flounder in Div. 3LNO	Dawn Maddock Parsons	dawn.parsons@dfo-mpo.gc.ca
Greenland halibut in SA 2+3KLMNO	Paul Regular	paul.regular@dfo-mpo.gc.ca
Northern shrimp in Div. 3LNO	Nicolas Le Corre	nicolas.lecorre@dfo-mpo.gc.ca
Ecosystem Designated Expert 3LNO	Robert Deering	robert.deering@dfo-mpo.gc.ca

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

Roughhead grenadier in SA 2+3	Fernando González-Costas	fernando.gonzalez@ieo.csic.es
Splendid alfonsino in Subarea 6	Fernando González-Costas	fernando.gonzalez@ieo.csic.es
Cod in Div. 3M	Irene Garrido Fernández	irene.garrido@ieo.csic.es
Northern Shrimp in Div. 3M	José Miguel Casas Sánchez	mikel.casas@ieo.csic.es
Ecosystem Designated Expert 3M	Diana González-Troncoso	diana.gonzalez@ieo.csic.es

From the Instituto Nacional de Recursos Biológicos (INRB/IPMA), Lisbon, Portugal

American plaice in Div. 3M	Ricardo Alpoim	ralpoim@ipma.pt
Golden redfish in Div. 3M	Ricardo Alpoim	ralpoim@ipma.pt
Redfish in Div. 3M	Ricardo Alpoim	ralpoim@ipma.pt

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White hake in Div. 3NO	Katherine Sosebee	katherine.sosebee@noaa.gov

APPENDIX VII. LIST OF SCR AND SCS DOCUMENTS

SCR Documents			
Serial No.	**Doc. No.**	**Author(s)**	**Title**
N7492	SCR Doc. 24/001REV2	RA Rademeyer and DS Butterworth	Results for Greenland Halibut Candidate Management Procedure Trials for the final SCAA Reference Set trials
N7496	SCR Doc. 24/002REV2	Paul M. Regular, Divya Varkey, Nick Gullage, Rajeev Kumar	Review and Update of the State-Space Management Strategy Evaluation for Greenland Halibut in NAFO Subarea 2 and Divisions 3KLMNO with mseSurv
N7497	SCR Doc. 24/003	RA Rademeyer , P M Regular and DS Butterworth	Comparing Results for the proposed revised Greenland Halibut Candidate Management Procedure for the final SCAA and SSM Robustness trials
N7500	SCR Doc. 24/004	Fernando González-Costas, Diana González-Troncoso and Irene Garrido	Flemish Cap cod biological parameters
N7501	SCR Doc. 24/005	Diana González-Troncoso, Jose Miguel Casas Sánchez, Irene Garrido, Esther Román and Raimundo Blanco	Results from Bottom Trawl Survey on Flemish Cap of June-July 2023
N7505	SCR Doc. 24/006	John Mortensen	Report on hydrographic conditions off West Greenland June 2023
N7506	SCR Doc. 24/007	Irene Garrido, Diana González-Troncoso, Fernando González-Costas, Esther Román and Lupe Ramilo	Results of the Spanish survey in NAFO Divisions 3NO
N7508	SCR Doc. 24/008	E. Román-Marcote, I. Garrido and G. Ramilo	Results for the Spanish Survey in the NAFO Regulatory Area of Division 3L for the period 2003-2023
N7511	SCR Doc. 24/009	Daniel G. Boyce	Addressing the impacts of climate variability and change on NAFO fisheries
N7513	SCR Doc. 24/010	F. Cyr, J. Coyne, P. S. Galbraith, C. Layton, D. Hebert	Environmental and Physical Oceanographic Conditions on the Eastern Canadian shelves (NAFO Sub-areas 2, 3 and 4) during 2023
N7514	SCR Doc. 24/011	D. Bélanger, G. Maillet, P. Pepin	Biogeochemical oceanographic conditions in the Northwest Atlantic (NAFO subareas 2-3-4) during 2023
N7515	SCR Doc. 24/012	Frédéric Cyr and David Bélanger	Environmental indices for NAFO subareas 0 to 4 in support of the Standing Committee on Fisheries Science (STACFIS) – 2023 update
N7517	SCR Doc. 24/013	Adriana Nogueira, Daniel Estévez-Barcia	Results for Greenland halibut survey in NAFO Divisions 1C-1D for the period 1997-2017, 2019 and 2022-2023
N7518	SCR Doc. 24/014	Igor Yashayaev	2023 Oceanographic Conditions in the Labrador Sea in the Context of Seasonal, Interannual and Multidecadal Changes
N7520	SCR Doc. 24/015	Jenny Chiu	Inventory of Environmental Data in the NAFO Convention Area - Report 2023
N7521	SCR Doc. 24/016	Irene Garrido, Diana González-Troncoso, Fernando González-Costas	Assessment of the Cod Stock in NAFO Division 3M-DRAFT REV
N7522	SCR Doc. 24/017	Nick Gullage, Rajeev Kumar, Divya Varkey	Analysis of Stock-Recruitment Relationships for NAFO Div. 3M Cod in Preparation for MSE Simulations
N7523	SCR Doc. 24/018	D. Maddock Parsons, K. Skanes and R. Rideout	An assessment of the Witch flounder resource in NAFO Divisions 3NO
N7524	SCR Doc. 24/019	Rasmus Nygaard and Adriana Nogueira	Biomass and Abundance of Demersal Fish Stocks off West and East Greenland estimated from the Greenland

			Institute of Natural resources (GINR) Shrimp and Fish Survey (SFW), 1990-2020, and 2022-2023.
N7525	SCR Doc. 24/020	Casper W.Berg and Adriana Nogueira	Combined index for Greenland halibut in Sub 0+1 offshore DRAFT
N7526	SCR Doc. 24/021	Adriana Nogueira , Casper W. Berg and Jesper Boje	Applying a stochastic surplus production model (SPiCT) for Greenland halibut in 0+1 offshore DRAFT
N7527	SCR Doc. 24/022	A. Nogueira and K.J. Hedges	Assessment of the Greenland Halibut Stock Component in NAFO Subarea 0 + 1 (Offshore)
N7529	SCR Doc. 24/023	K.J. Hedges	Report on Greenland halibut (Reinhardtius hippoglossoides) caught during the 2023 trawl survey in Subarea 0
N7530	SCR Doc. 24/024	P. Gonçalves, A. Ávila de Melo and R. Alpoim	Input data for the assessment of beaked redfish (S. mentella and S. fasciatus) in NAFO Division 3M
N7531	SCR Doc. 24/025	Rasmus Nygaard, Søren L. Post, Anja Retzel, Karl Zinglersen, Lars Heilmann, Sofie R. Jeremiassen, Signe Jeremiassen, Louise Mølgaard and Jørgen Sethsen.	Biomass and Abundance of Demersal Fish Stocks in the Nuuk fjord and Ameralik fjord derived from The GINR Shrimp and fish inshore (SFI) survey
N7532	SCR Doc. 24/026	Rasmus Nygaard, Henrik Christiansen & Inuk Petersen	Trawl and gillnet survey results from Disko Bay, NAFO Division 1A inshore
N7533	SCR Doc. 24/027	Rasmus Nygaard	Commercial data for the Greenland halibut fishery in the Upernavik area
N7534	SCR Doc. 24/028	Rasmus Nygaard, Henrik Christiansen & Inuk Petersen	Survey results from the Upernavik gillnet survey, NAFO Division 1A inshore
N7535	SCR Doc. 24/029	Rasmus Nygaard, Henrik Christiansen & Inuk Petersen	Survey results from the Uummannaq gillnet survey in NAFO Division 1A inshore
N7536	SCR Doc. 24/030	Paula Fratantoni	Hydrographic Conditions on the Northeast United States Continental Shelf in 2023 – NAFO Subareas 5 and 6
N7537	SCR Doc. 24/031	Rasmus Nygaard	Disko Bay - Commercial data for the Greenland halibut.
N7538	SCR Doc. 24/032	R. Alpoim, P. Gonçalves, A. Ávila de Melo, F. Saborido-Rey, M. Fabeiro , Sonia Rábade, D. González-Troncoso, F. González-Costas and M. Pochtar	An update assessment of beaked redfish (S. mentella and S. fasciatus) in NAFO Division 3M
N7539	SCR Doc. 24/033	RA Rademeyer	The effect of excluding EU 3L survey from the proposed Greenland halibut MP's TAC computations
N7540	SCR Doc. 24/034	Rasmus Nygaard, Henrik Christiansen & Inuk Petersen	Commercial data for the Greenland halibut fishery in Uummannaq
N7541	SCR Doc. 24/035	Rasmus Nygaard, Inuk Petersen, Henrik Christiansen, and Adriana Nogueira	Applying a stochastic surplus production model (SPiCT) to the Greenland halibut stock in the Upernavik area
N7542	SCR Doc. 24/036	R.M. Rideout, L. Wheeland, K. Skanes	Temporal And Spatial Coverage Of Canadian (Newfoundland And Labrador Region) Spring And Autumn Multi-Species RV Bottom Trawl Surveys, With An Emphasis On Surveys Conducted In 2023
N7543	SCR Doc. 24/037	L. Wheeland, A. Perreault, R.M. Rideout, K.R. Skanes, N. Le Corre, S. Trueman, P.M. Regular, M.R. Simpson, D. Maddock Parsons, F. Hatefi, A.T. Adamack	Application of Conversion Factors in the Canadian (Newfoundland And Labrador Region) Spring And Autumn Multi-Species RV Bottom Trawl Surveys

N7544	SCR Doc. 24/038	K. Sosebee, M.R. Simpson, and C.M. Miri	Assessment of Thorny Skate (Amblyraja radiata Donovan, 1808) in NAFO Divisions 3LNO and Subdivision 3Ps
N7545	SCR Doc. 24/039	Katherine Sosebee, Nancy McHugh, Dave McElroy, and Julie Nieland	United States groundfish survey coverage in NAFO Subareas 4-7 from 2014-2023 with a focus on comparison among surveys.
N7546	SCR Doc. 24/040	Quang C. Huynh, Kevin J. Hedges	Exploring spatiotemporal models for abundance indices from two gears in the absence of comparative fishing
N7547	SCR Doc. 24/041	Luis Ridao Cruz	Results of the longline survey on NAFO Division 3M
N7549	SCR Doc. 24/042	M. Ringuette, E. Devred, K. Azetsu-Scott, E. Head, C.-E. Gabriel, and S. Clay	Optical, Chemical, and Biological Oceanographic Conditions in the Labrador Sea from summer 2019 and 2023
N7550	SCR Doc. 24/043	Rajeev Kumar, Divya Varkey, and Nick Gullage	Management Strategy Evaluation (MSE) of Div. 3M Cod in support of NAFO Precautionary Approach Framework (NAFO-PAF)
N7551	SCR Doc. 24/044	Mariano Koen-Alonso and Hannah Munro	Catch levels for the scoping of the ecosystem sustainability of catches in 2024-2025
N7552	SCR Doc. 24/045	Rajeev Kumar, Divya Varkey, and Nick Gullage	Management Strategy Evaluation (MSE) of cod in NAFO Div. 3M to test the proposed NAFO Precautionary Approach Framework (NAFO-PAF)
N7553	SCR Doc. 24/046	Abalo-Morla, S., Palas Otero, S., Román-Marcote, E., Durán Muñoz, P., Pérez, P., Sacau, M.	Preliminary results on seabed litter distribution on Flemish Cap (Div. 3M), Flemish Pass (Div. 3L) and Grand Banks of Newfoundland (Divs. 3NO)
N7554	SCR Doc. 24/047	Durán Muñoz, P., Abalo-Morla, S., Palas, S. and Sacau, M.	Preliminary results from a desk-based study on activities other than fishing in the NRA: Interactions between oil and gas activities, deep-sea fisheries and VMEs - NEREIDA Task 3

SCS Documents			
Serial No.	**Doc. No.**	**Author**	**Title**
N7491	SCS Doc. 24/01	NAFO	The Commission's Request for Scientific Advice on Management in 2025 and Beyond of Certain Stocks in Subareas 2, 3 and 4 and Other Matters
N7493	SCS Doc. 24/02	NAFO	Report of the Scientific Council Intersessional Meeting, 09-11 January 2024
N7494	SCS Doc. 24/03	Denmark (in respect of Faroe Islands and Greenland)	Denmark (on behalf of Greenland) Coastal State Request for Scientific Advice – 2025
N7495	SCS Doc. 24/04	Canada	Canada's Request to NAFO Scientific Council for Coastal State Advice – 2025
N7498	SCS Doc. 24/05	NAFO	Report of the NAFO Precautionary Approach Working Group (PA-WG), 04 April 2024
N7502	SCS Doc. 24/06	K. Fomin and M. Pochtar	Russian Research Report for 2023
N7503	SCS Doc. 24/07	Japan Fisheries Research and Education Agency	National Research Report of Japan (2024)
N7504	SCS Doc. 24/08	F. González-Costas, G. Ramilo, E. Román, J. Lorenzo, D. González-Troncoso, M. Sacau, P. Duran, J. L. del Rio, R. Blanco and I. Garrido.	Spanish Research Report for 2023
N7509	SCS Doc. 24/09	Katherine Skanes and Mark Simpson	Canadian Research Report for 2023
N7510	SCS Doc. 24/10	Luis Ridao Cruz	Faroese Research Report 2023
N7512	SCS Doc. 24/11	J. Vargas, R. Alpoim and P. Gonçalves	Portuguese Research Report 2023
N7516	SCS Doc. 24/12	K.A. Sosebee	United States Research Report for 2023
N7519	SCS Doc. 24/13	NAFO	PA-WG Report May 2024
N7528	SCS Doc. 24/14	Adriana Nogueira, Henrik Christiansen, and Ramus Nygaard	Denmark/Greenland Research Report for 2023
N7548	SCS Doc. 24/15	H. O. Fock and C. Stransky	German Research Report for 2023

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