Table iv.1. Color scheme for the Ecological Features of the ecosystem summary sheet and the corresponding criteria for assignment to each category for the status and trends. Contributing elements time series should be standardized to zero mean and unit standard deviation relative to an appropriate reference period.

	Ecological Features	
	Status	**Trend**
Green	The state over the last 5 years is consistent with conditions observed/estimated during high productivity/high resilience periods. (mean > 0.5 SD)	The trend over the last 5 years indicates consistent improving of the state/condition. (trend > 1 SD/5 y or >20% increase in state)
Yellow	The state over the last 5 years is consistent with conditions observed/estimated during average productivity/average resilience periods.	The trend over the last 5 years does not indicate any consistent change of the state/condition.
Red	The state over the last 5 years is consistent with conditions observed/estimated during low productivity/low resilience periods. (mean < -0.5 SD)	The trend over the last 5 years indicates consistent deterioration of the state/condition. (trend < -1 SD/5 y or >-20% decline in state)
Grey	Unknown - insufficient data to assess or assessment pending.	Unknown - insufficient data to assess or assessment pending.

Table iv.2. Color scheme for the Management Measures of the ecosystem summary sheet and the corresponding criteria for assignment to each category for the status and trends.

	Management Measures	
	Status	**Trend**
Green	Good. Current management measures are delivering the desired results.	Good. Management measures over the last 5 years are improving conditions; moving towards/maintaining the desired results.
Yellow	Uncertain. Current management measures appear to have limited ability to deliver the desired results.	Uncertain. Management measures over the last 5 years are not improving conditions; no clear movement towards achieving the desired results.
Red	Poor. Current management measures appear insufficient to deliver the expected results or no management measure is in place.	Poor. Management measures over the last 5 years are not effective or no management measure is in place; conditions are moving away/deteriorating from the desired results.
Grey	Unknown - insufficient data to assess or assessment pending.	Unknown - insufficient data to assess or assessment pending.

Flemish Cap (3M) Ecosystem Summary Sheet

The Flemish Cap (3M) EPU is currently experiencing normal productivity conditions, with total biomass around the long-term level. VME protection in this EPU has improved between 2019 and 2021 with three out of five VME types well protected. Overall catch levels are consistent with current ecosystem productivity and the avoidance of high risk of ecosystem overfishing.

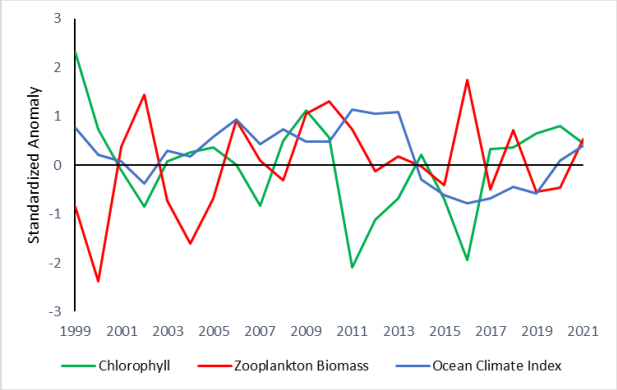
ECOLOGICAL FEATURES					
Convention Principle					**Comment**
A	Ecosystem status and trends (long-term sustainability)		Status (S)	Trend (T)	Summary of multiple trends/state
	1	Physical Environment			Ocean climate index at normal conditions in 2020-2021, after a 5 year period below normal (2015-2019). Clear increasing trend over the last 5 years, from below normal conditions to normal.
	2	Primary Productivity			Chlorophyll at normal level in 2021, after being above normal in 2019-2020. Indices show no clear trend.
	3	Secondary Productivity			Zooplankton biomass generally oscillating within the normal range in 2019-2021. Indices are dominated by cyclic changes with no clear trend.
	4	Fish productivity			Total biomass returned to average levels, after a peak in biomass in 2004-2010 driven by redfish recruitment. Shellfish remains low since the decline in shrimp. Average weight of individuals by functional group in the survey returned to normal range after increases between 2010 and 2017.
	5	Community composition			Community composition has remained relatively stable since 2010.
B	Ecosystem productivity level and functioning		S	T	Summary of multiple trends/state
	1	Current Fisheries Production Potential			Total biomass returned to average levels, after a peak in biomass in 2004-2010 driven by redfish recruitment.
	2	Status of key forage components			Reduced levels of shrimp and juvenile redfish. Trophic interactions between these species and cod are important mechanisms regulating the dynamics of all these species.
	3	Signals of food web disruption			Diet composition appears generally stable over the last decade (since the decline in shrimp). Stomach content weights have been above normal since 2014. However levels are now declining back to normal levels.
E	State of biological diversity		S	T	Summary of multiple trends/state
	1	Status of VMEs			Area and biomass of VMEs are considered to be at similar levels since the start of their assessments. Differences in estimates in the 2016-2021 period are due to improvements in the evaluation methods and availability of data.
	2	Status of non-commercial species			Based on 28 non-commercial species selected from the EU survey, 60% of the species have been above 20% of their historical maximum in 2012-2021. This indicator has

					decreased from around 80% in 2004-2009, but remains above the 40% level observed in 1992-2002.
MANAGEMENT MEASURES					
Convention Principle					**Comment**
C/D	Apply Precautionary Principle		S	T	Summary of metrics on level of management action
	1	Aggregate catches and risk of ecosystem overfishing (2TCI ecosystem reference point)			All catches have been below 2TCI since 1995. Piscivore catches are below 1 TCI in 2021, after been between 1 and 2 TCI during 2011-2020.
	2	Multispecies and/or environmental interactions			A multispecies model with cod, shrimp and redfish has been developed for this EPU. However, it has yet to be incorporated into scientific advice. No explicit consideration of species interactions and/or environmental drivers are currently being used.
	3	Production potential of single species			66% of NAFO managed stocks (four out of six) are in condition of supporting fisheries; some stocks have declining trends.
D/E	Minimize harmful impacts of fishing on ecosystems		S	T	Summary of metrics on level of management action
	1	Level of protection of VMEs			Three out of five VME types with good level of protection, with the exception being sea pens and small gorgonians. Protection has improved between 2019 and 2022. Fishing with bottom contacting gears does not intrude in closed areas.
	2	Level of protection of exploited species			Ecosystem reference point to inform on ecosystem overfishing (2TCI) has been adopted. LRPs or HCRs are available for 50% of managed stocks.
D/F	Assess significance of incidental mortality in fishing operations		S	T	Summary of metrics on level of management action
	1	Discard level across fisheries			Total discards in 3M showed a significant increase (>10-fold) between 2019 and 2021. While the greatest tonnage occurs in the Greenland halibut fishery, increases are observed in other fisheries. In terms of percentage of total catch from a fishery, the reported discards relative to total catch in the 2016-2021 was less or equal to 5% for the main fisheries (cod, redfish and Greenland halibut). Reporting of discards in minor fisheries is highly variable.
	2	Incidental catch of depleted and/or protected species, or other species of conservation interest			By catch of American plaice is a concern for the rebuilding of this stock. Incidental catch of Greenland sharks during 2016-2021 showed increases, going from values at or below 15 t in 2016-2019 to around 24 t in 2020-2021. Special protection measures for this species are in place.

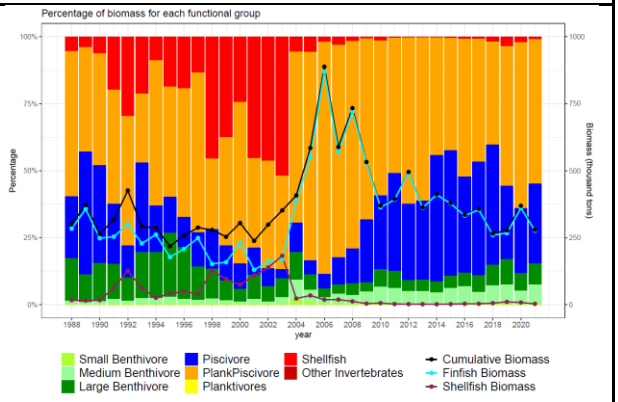
OTHER CONSIDERATIONS (outside mandate of NAFO Convention)					
Human Activities other than fisheries			S	T	Comment
	1	Oil and gas activities			As of 2022, there is intense exploration activities along the Flemish Pass. The total area for 3KLMNO of licenses[3] has increased 16.3-fold from 2014 to 2021. There have been 12 reported incidents between 2015 and 2022 in the Grand Bank, with an oil spill extending into the NRA in 2019. There is anticipated development of the Bay du Nord oil field in the Flemish Pass. This project overlaps with VME areas, a VME closure, and fishing grounds. It is expected, based on current exploration leases and development projections, that oil and gas exploration activities will continue to increase in the NRA.
	2	Pollution			There is no information of the occurrence of litter in 3M. Data has been collected in the EU surveys but has yet to be analyzed. Standardized protocols for litter data collection have been implemented in the EU surveys.
Fisheries not managed by NAFO			S	T	Comment
		Non-NAFO fisheries (coastal states and other RFMOs)			Swordfish and tuna fisheries operate in this EPU under ICCAT jurisdiction.
		Level of protection of VMEs (coastal states and other RFMOs)			Not applicable.

[3] License types: Exploration, Significant Discovery and Production

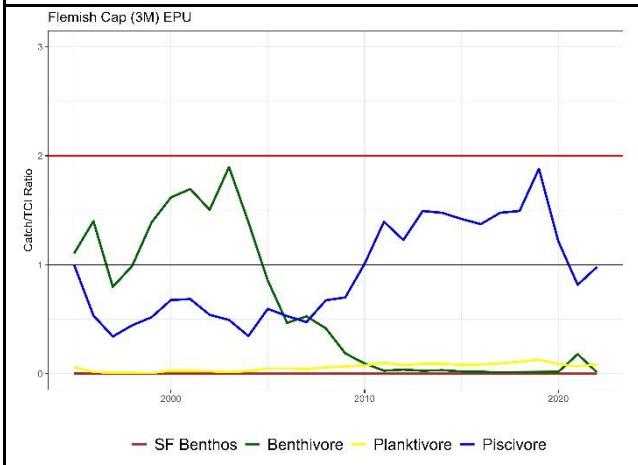
PHYSICAL ENVIRONMENT AND LOWER TROPHIC LEVELS



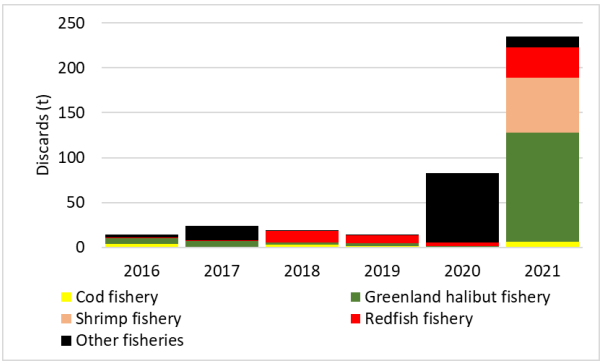
FISH COMMUNITY COMPOSITION AND BIOMASS



ECOSYSTEM AGGREGATE CATCHES



DISCARDS



Selected indicators to illustrate the 3M EPU status. Upper left-hand panel shows anomalies of the 3M subset of the NL Climate Index, chlorophyll-a, and zooplankton biomass index. Upper-right panel shows the relative composition of the fish community by functional groups from EU 3M survey. Lower left-hand panel shows the nominal total catch by functional guilds scaled relative to the corresponding Total Catch Index (TCI: black line; 2TCI: red line). The lower-right panel shows the tonnage of discards (total weight of all species) in each fishery from NAFO haul-by-haul catch reports.

ECOLOGICAL FEATURES

Ecosystem Status and Trends

Ocean climate index is at normal conditions in 2020-2021, after a 5 year period below normal (2015-2019). Clear increasing trend over the last 5 years, from below normal to normal conditions. Chlorophyll-a was at normal level in 2021, after being above normal in 2019-2020, this index has been stable at or above normal since 2017. Zooplankton biomass generally oscillating within the normal range in 2019-2021; this index has been dominated by cyclic changes with no clear trend.

Total fish biomass from the EU survey has been stable through all the period analyzed, despite values above normal in 2004-2009. Fishes have increased their dominance in the community since 2004, with a low proportion of shellfish in the ecosystem. The piscivore functional group experienced low biomass in late 1990s and beginning of 2000s, but since 2009 the level is at or above the level of the beginning of the series.

Average weight of individuals by functional group in the survey returned to normal range after increases between 2010 and 2017.

Ecosystem productivity level and functioning

The Flemish Cap (3M) EPU is experiencing normal productivity conditions. Total biomass returned to average levels, after a peak in biomass in 2004-2010 driven by redfish recruitment. In terms of key forage species, reduced levels of shrimp and juvenile redfish have been observed in this EPU since 2009. Trophic interactions between these species and cod are important processes regulating the dynamics of these species. Diet composition appears generally stable over the last decade (since the decline in shrimp) and stomach content weights have been above normal since 2014, but have been returning to normal levels in recent years.

State of biological diversity

Biological diversity is a multi-faceted concept. Out of its many dimensions, assessment of its state is being limited to Vulnerable Marine Ecosystems (VMEs) and the number of non-commercial fish species considered depleted until more comprehensive approaches can be developed. Although identification and delineation of VMEs is being done, it is difficult to assess their status given the absence of a defined baseline and the unquantified impacts from historical fishing activities. In this context, area and biomass of VMEs are considered to be at similar levels since the start of their assessments in 2016. Differences in estimates in the 2016-2021 period are due to improvements in the evaluation methods and data. Based on 28 non-commercial species selected from the EU survey, 60% of the species have been above 20% of their historical maximum in 2012-2021. This indicator has decreased from around 80% in 2004-2009, but remains above the 40% level observed in 1992-2002.

MANAGEMENT MEASURES

Precautionary Principles

The NAFO Roadmap addresses sustainability of fishing at three nested levels of ecosystem organization: ecosystem, multispecies and stock levels. At the present time, only considerations at the ecosystem and stock levels are in place. A multispecies models for cod, redfish, and shrimp with potential application for management advice has been developed but not yet used. Catches for all functional guilds have been below the 2TCI ecosystem reference point since 1995, indicating that overall catches have been generally consistent with current ecosystem productivity and the prevention of ecosystem overfishing. Catches of piscivores have been between 1 and 2 TCI during 2011-2020 but declined below TCI in 2021. Among NAFO managed stocks, 66% (four out of six) are in condition of supporting fisheries, but some stocks are showing declining trends. Impacts of either species interactions or environmental drivers are not currently being considered in the provision of advice or management.

Minimize harmful impacts of fishing on ecosystems

Minimization of harmful impacts of fishing on benthic communities has been focused on the protection of VMEs. Many coral and sponge VMEs in the Flemish Cap are currently protected with dedicated closures. Closures protect 94% of sponge VME, 59% of sea pen VME, 95% of large gorgonian coral VME, and 76% of black coral VME biomass, but only 8% of small gorgonians VME biomass is currently protected in this EPU.

At the ecosystem level, Total Catch Indices (TCI) for functional guilds in this EPU have been developed and an ecosystem reference point (2TCI) has been adopted to inform on the risk of ecosystem overfishing. At the stock level, 50% of managed stocks have LRPs or HCRs, although some LRPs are based on survey indices. A multispecies model with cod, shrimp and redfish has been developed for this EPU. However, it has yet to be used in management. At this time, there are no multispecies assessments in place to inform on trade-offs among fisheries.

Assess significance of incidental mortality in fishing operations

Total discards showed a significant increase (>10-fold) between 2019 and 2021, going from ~13 t to ~235 t. While the greatest tonnage occurs in the Greenland halibut fishery, increases are observed in all fisheries. In terms of percentage of total catch from a fishery, the reported discards relative to total catch in the 2016-2021 was less or equal to 5% for the main fisheries (cod, redfish and Greenland halibut). Reporting of discards in minor fisheries (e.g. roundnose grenadier, witch flounder) are highly variable and with many reporting no discards.

Incidental catch of Greenland sharks during 2016-2021 also showed increases, going from values at or below 15 t in 2016-2019 to around 24 t in 2020-2021. Special protection measures for this species are in place.

OTHER CONSIDERATIONS

Human activities other than fishing

As of 2022, there is intense exploration activities along the Flemish Pass. The total area for 3KLMNO of licenses[4] has increased 16.3-fold from 2014 to 2021. There have been 12 reported incidents between 2015 and 2022 in the Grand Bank, with an oil spill extending into the NRA in 2019. There is anticipated future development of the Bay du Nord oil field in the Flemish Pass. This project overlaps with VME areas, a VME closure (Area 10, Northwest Flemish Cap), and fishing grounds. It is expected, based on current exploration leases and development projections, that oil and gas exploration activities will continue to increase in the NRA.

There is no information of the occurrence of litter in 3M. Data has been collected in the EU surveys but has yet to be analyzed. Standardized protocols for litter data collection have been implemented in the EU surveys.

Fisheries not managed by NAFO

Swordfish and tuna fisheries operate in this EPU under ICCAT jurisdiction.

References

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[4] License types: Exploration, Significant Discovery and Production