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Other Effective Area-based Conservation Measures (OECMs)
NAFO Sponge Area Bottom Fishing Closures (1-6)

NAFO Flemish Cap and Slopes of the Grand Bank Sponge VME areas 1-6

Prepared by the North Atlantic Fisheries Organization (NAFO) Scientific Council and Secretariat (www.nafo.int)

Abstract

The six areas described here are located in the northwest Atlantic in areas beyond national jurisdiction in the Northwest Atlantic Fisheries Organization (NAFO) Regulatory Area. They have been closed to bottom fishing activities by NAFO since 2010, with some subsequent adjustment to boundaries. Although the six bottom fisheries closures included are distinct from one another, they are also considered to be ecologically connected (Wang et al., 2024). As such, this document is comprised of a single OECM, with distinct OECM areas.

Deep-sea sponge grounds increase habitat complexity (Buhl-Mortensen et al., 2010; Tissot et al., 2006), enhance biodiversity (Beazley et al., 2013, 2015; Stratmann et al., 2024), providing important habitat for fish feeding and spawning (Amsler et al., 2009; Kenchington et al., 2013) in addition to improving water quality and benthic productivity functions (Pham et al., 2019). The structural characteristics, their slow growth rates, and high longevity (Klitgaard & Tendal, 2004) tend to make them sensitive and vulnerable to perturbations, particularly to the mechanical impacts of bottom fishing activities (Heifetz et al., 2009; ICES, 2009; Wassenberg et al., 2002), and they can take decades or longer to recover (if they recover at all) if they are removed or damaged (ICES, 2009). Deep-sea sponge grounds qualify as Vulnerable Marine Ecosystems in relation to high seas fisheries, according to Criteria developed by FAO in the International Guidelines for the Management of Deep-sea Fisheries in the High Seas (FAO, 2009)

The slopes of the Flemish Cap and Grand Banks of Newfoundland contain aggregations of large sponges (sponge fields) which constitute VMEs in international waters of the NAFO Regulatory Area (NRA). This area also includes all the current NAFO bottom fishery closures for protection of sponges. These areas currently protect > 60% of the known biomass of the large sponges in the fishing footprint of the NAFO Regulatory Area (NAFO, 2021).

Location

(Indicate the geographic location of the area, including co-ordinates if available. This should include a location map to be added to the 'Maps, Figures and Tables' *section. It should state if the area is within or outside national jurisdiction or straddling both.)*

Within its Regulatory Area, the Northwest Atlantic Fisheries Organization (NAFO) has identified 27 areas as being vulnerable to bottom contact gears and subsequently closed these areas to bottom fishing (Figure 1).

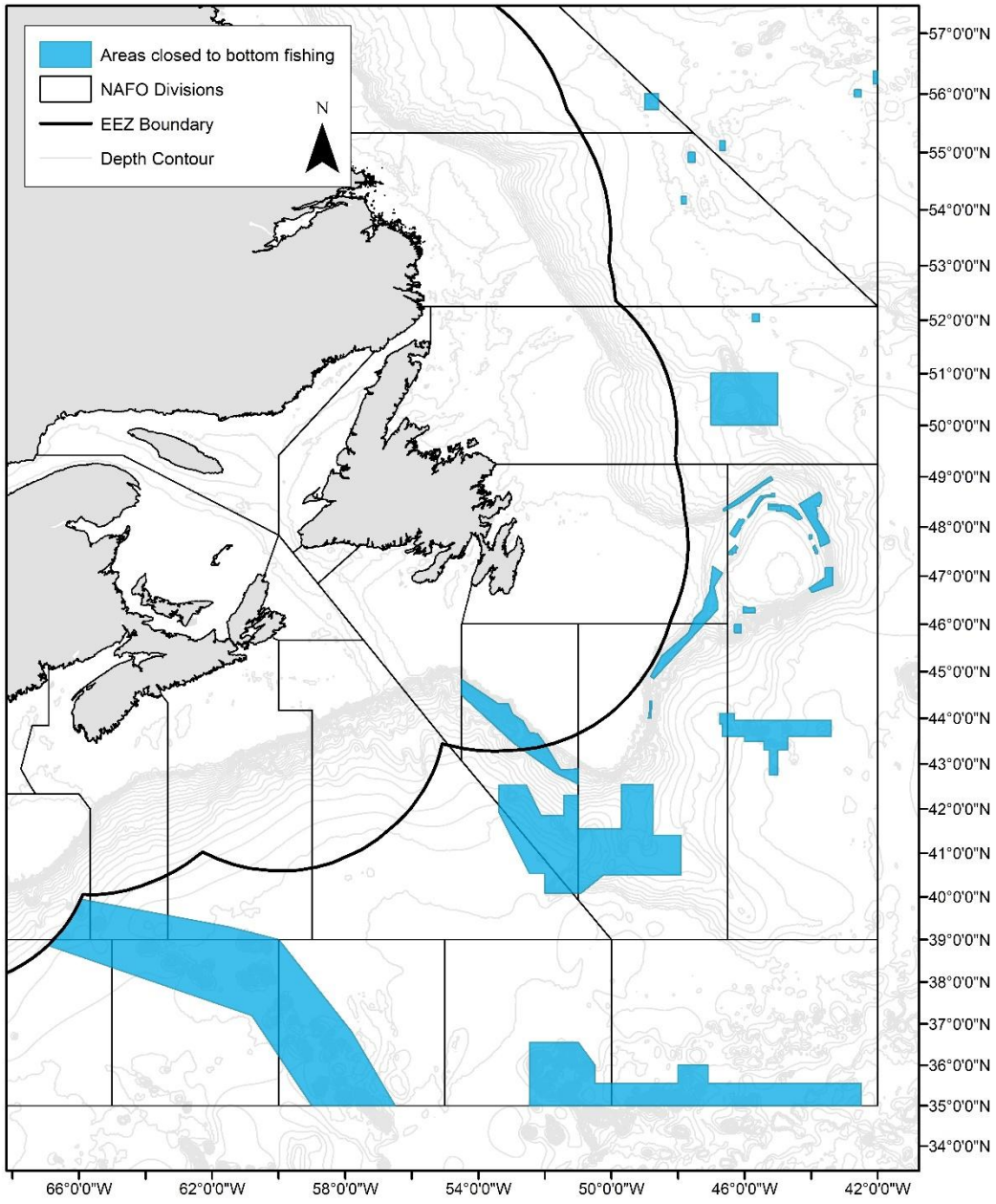

Figure 1. The 27 areas closed to bottom fishing within the NAFO Regulatory Area.

The NAFO VME sponge closures are located entirely within the NAFO Regulatory Area (NRA), they comprise VME closure Areas 1, 2, 3, 4, 5 and 6 as shown in Figure 2 below with coordinates given in Table 1.

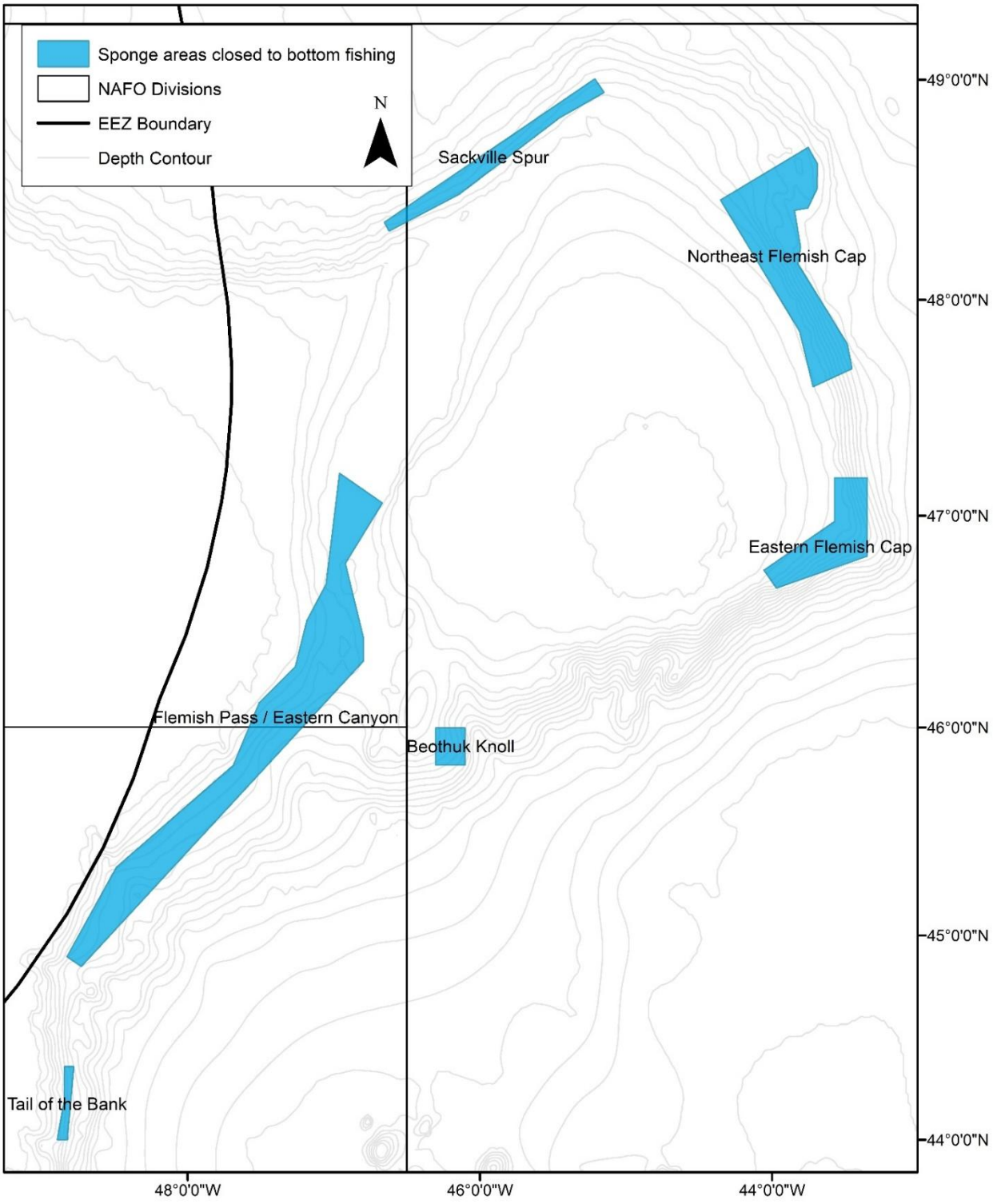

Figure 2. Polygons Delineating Vulnerable Marine Ecosystem Area Closures 1-6 Referenced in Article 17.3 of the NAFO CEM.

Table 1. Coordinates for the 6 NAFO sponge closures as of 2024 (NAFO, 2024).

	Description	Coordinate No.	Latitude	Longitude
1	Tail of the Bank	1.1	44° 02' 53.88" N	48° 49' 09.48" W
		1.2	44° 21' 31.32" N	48° 46' 48.00" W
		1.3	44° 21' 34.56" N	48° 50' 32.64" W
		1.4	44° 11' 48.12" N	48° 50' 32.64" W
		1.5	44° 02' 54.60" N	48° 52' 52.32" W
		1.6	44° 00' 01.12'' N	48° 53' 28.75'' W
		1.7	43° 59' 57.52'' N	48° 49' 26.47'' W
2	Flemish Pass/ Eastern Canyon	2.1	44° 50' 56.40" N	48° 43' 45.48" W
		2.2	46° 18' 54.72" N	46° 47' 51.72" W
		2.3	46° 25' 28.56" N	46° 47' 51.72" W
		2.4	46° 46' 32.16" N	46° 55' 14.52" W
		2.5	47° 03' 29.16" N	46° 40' 04.44" W
		2.6	47° 11' 47.04" N	46° 57' 38.16" W
		2.7	46° 40' 40.80" N	47° 03' 04.68" W
		2.8	46° 30' 22.20" N	47° 11' 02.93" W
		2.9	46° 17' 13.30" N	47° 15' 46.64" W
		2.10	46° 07' 01.56" N	47° 30' 36.36" W
		2.11	45°49' 06.24" N	47° 41' 17.88" W
		2.12	45° 19' 43.32" N	48° 29' 14.28" W
		2.13	44° 53' 47.40" N	48° 49' 32.52" W
3	Beothuk Knoll	3.1	45° 49' 10.20" N	46° 06' 02.52" W
		3.2	45° 59' 47.40" N	46° 06' 02.52" W
		3.3	45° 59' 47.40" N	46° 18' 08.28" W
		3.4	45° 49' 10.20" N	46° 18' 08.28" W
4	Eastern Flemish Cap	4.1	46° 44' 34.80" N	44° 03' 14.40" W
		4.2	46° 58' 19.20" N	43° 34' 16.32" W
		4.3	47° 10' 30.00" N	43° 34' 16.32" W
		4.4	47° 10' 30.00" N	43° 20' 51.72" W
		4.5	46° 48' 35.28" N	43° 20' 51.72" W
		4.6	46° 39' 36.00" N	43° 58' 08.40" W
5	Northeast Flemish Cap	5.1	47° 47' 46.00" N	43° 29' 07.00" W
		5.2	47° 40' 54.47" N	43° 27' 06.71" W
		5.3	47° 35' 57.48" N	43° 43' 09.12" W
		5.4	47° 51' 14.40" N	43° 48' 35.64" W
		5.5	48° 27' 19.44" N	44° 21' 07.92" W
		5.6	48° 41' 37.32" N	43° 45' 08.08" W
		5.7	48° 37' 13.00" N	43° 41' 24.00" W
		5.8	48° 30' 15.00" N	43° 41' 32.00" W
		5.9	48° 25' 08.00" N	43° 45' 20.00" W
		5.10	48° 24' 29.00" N	43° 50' 50.00" W
		5.11	48° 14' 20.00" N	43° 48' 19.00" W
		5.12	48° 09' 53.00" N	43° 49' 24.00" W
6	Sackville Spur	6.1	48° 18' 51.12" N	46° 37' 13.44" W
		6.2	48° 28' 51.24" N	46° 08' 33.72" W
		6.3	48° 49' 37.20" N	45° 27' 20.52" W
		6.4	48° 56' 30.12" N	45° 08' 59.99" W
		6.5	49° 00' 09.72" N	45° 12' 44.64" W
		6.6	48° 21' 12.24" N	46° 39' 11.16" W

Description of the area

(Identification of other effective area-based conservation measures should, to the extent possible, document the known biodiversity attributes (include the identification of the range of biodiversity attributes for which the site is considered important (e.g., communities of rare, threatened or endangered species, representative natural ecosystems, range restricted species, key biodiversity areas, areas providing critical ecosystem functions and services, areas for ecological connectivity), as well as, where relevant, cultural and/or spiritual values, of the area and the governance and management in place as a baseline for assessing effectiveness.)

The Flemish Cap is a plateau with a radius of approximately 200 km at the 500 m isobath, with a depth of less than 150 m at its centre. It is situated east of the Grand Banks of Newfoundland and separated from it by the approximately 1200-m-deep Flemish Pass. Bottom fishing managed by NAFO is restricted to the fishing footprint (otherwise known as the existing bottom fishing areas, see NAFO website under Footprint and Exploratory Fisheries) which also includes areas on the Grand Bank outside the Canadian EEZ known as the Nose and Tail of the Grand Bank (Figure 3).

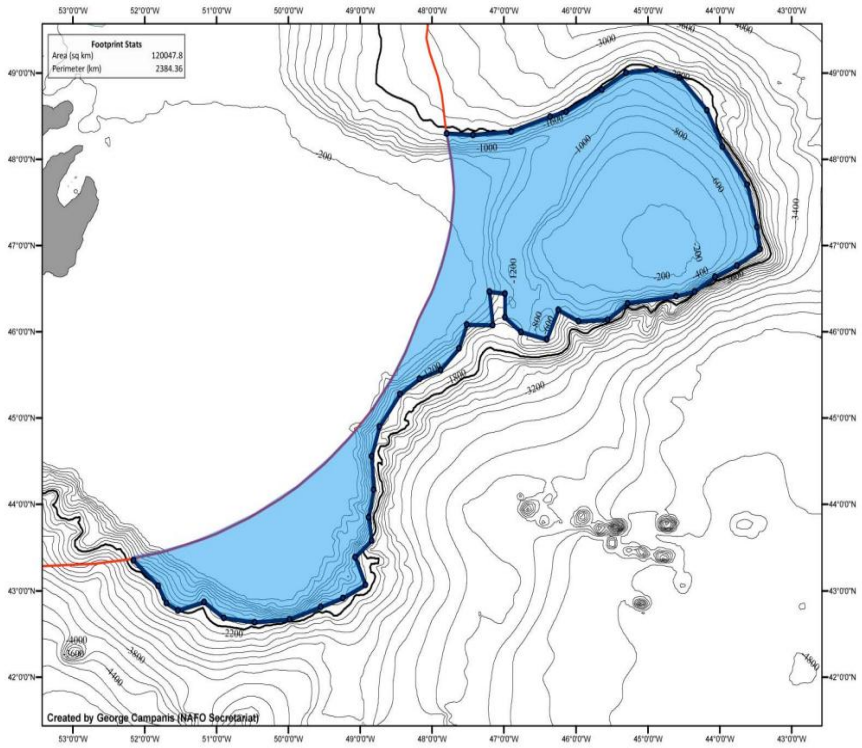

Figure 3. NAFO fishing footprint showing the boundary of the Canadian EEZ (red line) and the 2000m isobath in bold. (NAFO, 2009a)

The water mass around this area comprises mainly two sources: the Labrador Current Slope water, with temperatures between 3 and 4ºC and salinities between 34 and 35‰, flowing from the north and the North Atlantic Current water, with temperatures >4ºC and salinities >34.8‰, flowing from the south (Colbourne and Foote, 2000). At the Flemish Pass, the Labrador Current bifurcates with the major branch flowing southward to the south-eastern slope of the Grand Banks; meanwhile, the side branch circulates clockwise around Flemish Cap. Around the Tail of the Banks the Labrador Current and the Gulf Stream meet, giving rise to the North Atlantic Current (NAC) and the NAC front. The 3000 m isobath is often considered the offshore limit of the deep Labrador Current (Cuny et al., 2005).

NAFO is the competent international organisation for managing fisheries in the NAFO Regulatory Area in the North-West Atlantic Ocean for the listed fish species found in the yearly NAFO Conservation and Enforcement Measures on the NAFO website. Areas 1-6 that are closed to NAFO bottom fishing are located in the 3LMNO Divisions of the NAFO Regulatory Area (NRA) between 600 m and 2500 m depth. The 3LMNO Divisions include the main bottom-fishing grounds in international waters, with the highest concentration of fishing effort seen along the continental slope on the north-east side of the Flemish Cap and a smaller concentration along the southern end of the Flemish Pass and around the Tail of the Banks (NAFO, 2015)

EU and Canadian research vessel (RV) bottom-trawl surveys sample most of this area annually, but only down to 1500 m (Healey et al., 2012; Nogueira et al., 2017). The primary objective of these surveys is to produce abundance and biomass indices for the NAFO managed species, and to determine the demographic structure of their populations, although other scientific goals, such as the collection of information on the spatial and bathymetric distribution of megabenthic invertebrate species (such as large sponges), are also addressed.

Geodia spp. dominated sponge grounds form a linear band following depth contour on the continental slopes in the NRA. Six areas with significant sponge concentrations have been identified based on RV surveys (Kenchington et al., 2011; Murillo et al., 2019; NAFO, 2009): a band between 700 m and 1470 m depth on the north-east slope of the Grand Banks, between the Nose and the Tail of the Banks; the south-eastern corner of the Beothuk Knoll between 1000 and 1400 m depth; the south-eastern corner of the slope of Flemish Cap between 950 and 1330 m depth; the eastern slope of the Flemish Cap in a band from north to southeast between 1050 and 1350 m depth; and lastly, the north slope of the Flemish Cap and Flemish Pass in one area known as Sackville Spur, between 1250 m and 1450 m depth. Analyses of sponge spicules in sediment cores indicates that these sponge grounds have persisted in these areas for millennia (Murillo et al., 2016).

Species distribution models for sponge grounds have been developed for the area described (Kenchington et al., 2015, 2019; Knudby et al., 2013). The models have a spatial extent of the NRA (Divisions 3LMNO) to 2500 m depth and show prediction surfaces with clearly defined areas of high occurrence probability of sponge which predominantly coincide with the Sponge VME bottom fishery closures.

An increased level of biodiversity has been shown to occur in sponge grounds (Beazley et al., 2013, 2015; Murillo, Kenchington, Koen-Alonso, Guijarro, Kenchington, et al., 2020)_which provide significant functions important in delivering ecosystem heath and services, such as water quality and secondary production functions, both of which are important in maintaining healthy and resilient fish stocks (Kenchington et al., 2013; Maldonado et al., 2015; Meyer et al., 2019; Pham et al., 2019). For example, it has been estimated that sponge grounds (VMEs) in this region have the capacity to filter approximately 56,143 ± 15,047 million litres of seawater daily from the bottom waters encompassing an area of 135,056.82 km^2 of seafloor (Pham et al., 2019). This huge exchange of water is likely to make a significant contribution to the re-cycling of carbon (chemical energy) and nutrients, giving rise to elevated levels of secondary benthic production (Maldonado et al., 2015) including the potential associated benefits (via the provision of food, refugia and/or nursery grounds) for commercially targeted fish species in the region (Kenchington et al., 2013; Meyer et al., 2019)

Identify pressures and threats on biodiversity

(Inventory of known or reasonably foreseeable pressures and threats on biodiversity features, their nature, scale and source, and the range of societal and ecological values attached to the components.)

The primary threat to the biodiversity in the areas is from bottom fishing. A very low level of trap fishing for snow crab under Canadian regulation has occurred in Area 2 (DFO, 2023). There are pelagic fisheries in the area managed by ICCAT (www.iccat.int), including swordfish and tuna, but they are not conducted with bottom-fishing gear and management of salmon fisheries is by NASCO (www.nasco.int), which prohibits fishing for salmon beyond areas of fisheries jurisdiction of its members.

Bottom-contact fishing poses innumerable threats to sponge-dominated habitats (ICES, 2009). Direct impacts include removals, dislodgement and injury all of which result in limited or no recovery (ICES, 2009). Sponges have evolved a complicated interior aquiferous canal system which enables their

efficient filtering capacity. When sponges are captured in the trawl nets and brought to the surface, the aquiferous system is drained and air penetrates the chambers. Very few sponges can remove the air in the chambers which causes the sponges to float, with poor chance of survival (ICES, 2009). Smothering is the most prevalent indirect impact of bottom trawling (ICES, 2009). Repeated accumulation of sediments in the sponge aquiferous system, can lead to death or impairment.

Oil and gas activities in the Flemish Pass, as well as those on the wider Grand Banks, can pose additional threats to the species found in the described area (C-NLOPB, 2014; NAFO, 2015). Oil and gas activities could include disturbance and injury of mammals and seabirds by anthropogenic noise, oil spills and associated increase in vessel traffic. Exploration and development activities can impact VME indicator taxa when they overlap in the slope areas such as the Flemish Pass. Climate change and ocean acidification could pose a threat to the VMEs, although recent work has indicated that *Geodia* spp. may be resilient to projected temperature and salinity level changes (Wurz, 2022).

Data and information available on the fisheries and the ecosystem

(Describe the available data sources, e.g., distribution maps; fleets size and composition; fishing gears; target and non-target species; stock assessment; governance types; key stakeholders and participation processes; legal frames; management measures; compliance; catch; socio-economic parameters; biodiversity features of concern; ecosystem services (including food and livelihoods) and other relevant values affecting conservation; possible threats and pressures; existing MPAs (networks, seascapes) and other conservation measures. Provide details of the sources in the 'Relevant Databases' section)

All relevant information on NAFO fisheries and the ecosystem are publicly available at the NAFO website (www.nafo.int).

The NAFO Convention (NAFO, 2017) is the general legal framework for the organization, including participatory processes and is the basis for all NAFO compliance and enforcement measures.

Compliance and enforcement measures are updated annually and published on the NAFO website (NAFO CEM) as well as distributed to NAFO CPs in a printed format. Detailed information on NAFO fisheries is publicly available at the NAFO website through the yearly Compliance Review (https://www.nafo.int/Fisheries/Compliance) including number of vessels, fishing gear and catches.

The primary data sources on the distribution of the VME and activities potentially effecting it (fisheries oil and gas etc.), are from reports of NAFO Scientific Council and its various working groups, in particular Scientific Council Working Group on Ecosystem Science and Assessment. https://www.nafo.int/Library/.

Assessment of the areas against CBD Criteria

(Discuss the area in relation to each of the CBD Criteria and relate the best available science. Please note where there are significant information gaps)

A. Not a protected area

NAFO sponge VME bottom fishing closures (Areas 1, 2, 3, 4, 5, and 6) are not reported as MPAs.

B. Area is governed and managed

B.1 Geographically defined space

The NAFO sponge VME bottom fishing closures consist of 6 separate areas which are ecologically connected (Kenchington et al., 2019; Wang et al., 2020, 2024) and therefore should be considered collectively as a single OECM. The sponge closures have well defined spatial boundaries (NAFO, 2021) whose location and coordinates are outlined in Table 1 above.

B.2 Legitimate governance authorities

I. Governance has Legitimate Authority and is appropriate for achieving in situ conservation of biodiversity within the area.

NAFO is an international organization and the Convention on Cooperation in the Northwest Atlantic Fisheries (NAFO, 2017) specifies that NAFO has the mandate to regulate the following fishery resources in the NAFO Area; all fish, molluscs and crustaceans excluding: (i) sedentary species over which coastal States may exercise sovereign rights consistent with Article 77 of the 1982 United Nations Convention on the Law of the Sea; and (ii) in so far as they are managed under other international treaties, anadromous and catadromous stocks and highly migratory species listed in Annex I of the 1982 United Nations Convention on the Law of the Sea.. The general principles of the NAFO Convention include taking due account of the impact of fishing activities on other species and marine ecosystems and in doing so, adopt measures to minimize harmful impact on living resources and marine ecosystems as well as taking due account of the need to preserve marine biological diversity.

II. Governance by indigenous peoples and local communities is self-identified in accordance with national legislation and applicable international obligations.

All NAFO governance and management measures are based on the principles set out in the NAFO Convention (NAFO, 2017) Governance by indigenous peoples and local communities is the responsibility of the individual Contracting Parties within the framework of the NAFO Convention.

III. Governance reflects the equity considerations adopted in the CBD Convention.

The NAFO Convention stipulates in Article XXI – Relation to Other Agreements, that the Convention shall not alter the rights and obligations of Contracting Parties that arise from other Agreements compatible with the Convention and that do not affect the enjoyment by other Contracting Parties of their rights or the performance of their obligations under the Convention. For the purposes of equity considerations in the CBD Convention, these considerations would apply to those NAFO Contracting Parties that are members of the CBD.

IV. Governance may be by a single authority and/or organization or through collaboration among relevant authorities and provides the ability to address threats collectively.

NAFO is the international organization that has the legal mandate to manage bottom fishing activities in the NAFO Regulatory Area, See B2, I, above. Canada, as a coastal state exercises sovereign rights constituent with Article 77 of the United Nations Convention on the Law of the Sea of 10 December 1982, to manage crab fisheries on its continental shelf. A very low level of trap fishing for snow crab under Canadian regulation has occurred in Area 2 (DFO, 2023). The areas are subject to management of pelagic fisheries of tuna and tuna like species by ICCAT (www.iccat.int) which does include bottom fishing and management of salmon fisheries by NASCO (www.nasco.int), which prohibits fishing for salmon beyond areas of fisheries jurisdiction. Additional threats to the sponge grounds not under the jurisdiction of NAFO are mainly oil and gas activities, but direct threats are considered to be relatively low and highly localized compared to the potential direct threat arising from bottom fishing activities. Oil and gas activities are under the management of Canadian authorities as they take place on the Canadian continental shelf. NAFO receives regular updates from the Canadian authorities on any oil and gas activities taking place in the NAFO Regulatory Area.

B.3 Managed

I. Managed in ways that achieves or expects to achieve positive and sustained outcomes for the conservation of biological diversity.

The NAFO Scientific Council has advised the NAFO Commission that the primary threat to the VME in the areas 1-6 is from bottom fishing activities (NAFO, 2015). Bottom-contact fishing poses innumerable threats to sponge-dominated habitats (ICES, 2009). Direct impacts include removals, dislodgement and injury all of which result in limited or no recovery (ICES, 2009). Sponges have evolved a complicated interior aquiferous canal system which enables their efficient filtering capacity. When sponges are captured in the trawl nets and brought to the surface, the aquiferous system is drained and air penetrates the chambers. Very few sponges can remove the air in the chambers which causes the sponges to float, with poor chance of survival (ICES, 2009). Smothering is the most prevalent indirect impact of bottom trawling (ICES, 2009). Repeated accumulation of sediments in the sponge aquiferous system, can lead to death or impairment. By closing the sponge VME to bottom fishing activities NAFO is addressing the primary threat to the VMEs and preventing significant adverse impacts, leading to positive and sustained biodiversity benefits.

The deep-sea sponge grounds in these areas (Murillo et al., 2012) have persisted for millennia (Murillo et al., 2016) and qualify as VMEs in relation to high seas fisheries, according to International Guidelines for the Management of Deep-sea Fisheries in the High Seas developed by FAO (FAO, 2009). They are considered foundation species in that deep-sea sponge grounds (Maldonado et al., 2015) have a strong role in structuring benthic communities (Stratmann et al., 2024). They have been demonstrated to increase habitat complexity (Buhl-Mortensen et al., 2010; Tissot et al., 2006), enhance biodiversity (Beazley et al., 2015; Murillo et al., 2020), provide important habitat for fish feeding and spawning (Amsler et al., 2009; Kenchington et al., 2013), in addition to improving water quality and benthic productivity functions (Pham et al., 2019). Their structural characteristics of slow growth rates and great longevity (Klitgaard & Tendal, 2004) tend to make them sensitive and vulnerable to perturbations, particularly to the mechanical impacts arising from bottom fishing activities (Heifetz et al., 2009; Wassenberg et al., 2002). Accordingly, they can take decades or longer to recover (if they recover at all) following their removal or damage by bottom fishing activities.

The slopes of the Flemish Cap and Grand Banks of Newfoundland support the most important aggregations of large sponges (sponge fields) in the region, which constitute VMEs in international waters of the Northwest Atlantic Fisheries Organization (NAFO) Regulatory Area.

II. Relevant authorities and stakeholders are identified and involved in management.

NAFO is the international organization with a legal mandate to manage bottom fishing in the area for those species set out in the NAFO CEM. Stakeholders can participate in the NAFO management process through attendance as accredited observers (NGOs) at NAFO meetings, in both the Commission and Scientific Council, or in the capacity of members to NAFO Contracting Party delegations (these may include stakeholders such as industry representatives or NGOs). Canada, as a coastal state exercises sovereign rights constituent with Article 77 of the United Nations Convention on the Law of the Sea of 10 December 1982, to manage certain fisheries on its continental shelf. Canada is a member of NAFO.

III. A management system is in place that contributes to sustaining the in-situ conservation of biodiversity.

The NAFO Scientific Council has advised the NAFO Commission to close the sponge areas to bottom fishing to protect VMEs from possible significant adverse impact. In turn, the NAFO Commission has closed these areas to bottom fishing and has a management, control and enforcement system in place to monitor the closures.

IV. Management is consistent with the ecosystem approach with the ability to adapt to achieve expected biodiversity conservation outcomes, including long-term outcomes, and including the ability to manage a new threat.

The NAFO Conventions' General Principles include that NAFO Contracting Parties individually or collectively, as appropriate, shall apply the precautionary approach in accordance with Article 6 of the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks of 4 August 1995; take due account of the impact of fishing activities on other species and marine ecosystems and in doing so, adopt measures to minimize harmful impact on living resources and marine ecosystems; take due account of the need to preserve marine biological diversity (NAFO, 2017). The sponge bottom-fishing closures are an integral part of the NAFO SC work on furthering an ecosystem approach to fisheries.

Other threats operating in the region and in close proximity to the sponge VME which are not managed by (or under the jurisdiction of) NAFO, are oil and gas exploration and production activities (C-NLOPB, 2014; NAFO, 2015a) taking place on the Canadian continental shelf.

C. Achieves sustained and effective contribution to *in situ* conservation of biodiversity *(Produces long-term* in situ *biodiversity conservation outcomes)*

C.1 Effective

I. The area achieves, or is expected to achieve, positive and sustained outcomes for the in situ conservation of biodiversity.

Areas 1-6 are closed to bottom fishing to protect sponge VMEs The NAFO Scientific Council has advised the NAFO Commission that bottom fishing closures are the most effective measures to protect VMEs from potential significant adverse impacts arising from such fisheries in the NRA.

An increased level of biodiversity has been shown to occur in sponge grounds (Beazley et al., 2013, 2015; Murillo, Kenchington, Koen-Alonso, Guijarro, Sacau, et al., 2020; Stratmann et al., 2024) , which

provide significant functions important in delivering ecosystem heath and services, such as water quality and secondary production functions, both of which are important in maintaining healthy and resilient fish stocks (Kenchington et al., 2013; Maldonado et al., 2015; Meyer et al., 2019; Murillo, Weigel, et al., 2020; Pham et al., 2019) For example, it has been estimated that sponge grounds (VMEs) in this region have the capacity to filter approximately 56,143 ± 15,047 million litres of seawater daily from the bottom waters encompassing an area of 135,056.82 km^2 of seafloor (Pham et al., 2019) . This huge exchange of water is likely to make a significant contribution to the re-cycling of carbon (chemical energy) and nutrients, giving rise to elevated levels of secondary benthic production (Maldonado et al., 2015) including the potential associated benefits (via the provision of food, refugia and/or nursery grounds) for commercially targeted fish species in the region (Kenchington et al., 2013; Meyer et al., 2019).

II. Threats, existing or reasonably anticipated ones are addressed effectively by preventing, significantly reducing or eliminating them, and by restoring degraded ecosystems.

The bottom fishing closures in Areas 1-6 address the main threat to the sponge VMEs and are aimed at preventing serious adverse impacts of bottom fishing to these VMEs. The direct and indirect impacts of bottom-contact fishing on sponge-dominated habitats are severe, and episodic recruitment limits recovery potential. The methods adopted by NAFO prevent harm from such impacts.

III. Mechanisms, such as policy frameworks and regulations, are in place to recognize and respond to new threats.

NAFO is committed to work with other international organizations with competence to manage human activities in the NRA.

Full reviews of the status of bottom fishing closures to protect VMEs as well as the status of those VMEs in the NRA are conducted every 5 years. All NAFO bottom fishing closures have been subject to review by the Scientific Council in 2014 and 2021 to ensure they are effective in achieving their conservation aims (NAFO 2014 and 2021). The next full review of the NAFO VME and assessment of bottom fisheries is expected in 2027.

An MoU has been signed between the NAFO Secretariat, and the Secretariat of the Sargasso Sea Commission and outreach has been made to the International Seabed Authority (ISA) for exchange of information.

IV. To the extent relevant and possible, management inside and outside the other effective area-based conservation measure is integrated.

Parts of the sponge VME fishery closures extend beyond the boundary of the bottom fishing footprint in the NAFO Regulatory Area. In addition to the protection afforded by the fishery closures, any potential fishing activity adjacent to the closure outside of the footprint is prohibited without *a priori* an appropriate assessment being undertaken as part of an 'exploratory fishing protocol' (endorsed by the Scientific Council) and permission granted (see CEM Article 16).

C.2 Sustained over long-term

The other effective area-based conservation measures are in place for the long-term or are likely to be. 'Sustained' pertains to the continuity of governance and management and 'long-term' pertains to the biodiversity outcome.

Bottom fishing closures to protect sponge VME were first established in NAFO in 2009. Management measures are included in Article 17.3 of the NAFO Conservation and Enforcement Measures.

In 2012, 2014, 2015 and 2021 following advice from NAFO SC, revisions to the sponge VME closure boundaries were introduced, increasing the overall area and biomass of sponge protected in the NRA. The sponge VME closures already account for more than 60% of the total large-sponge biomass in the NRA (NAFO, 2021) and are amongst the most well protected VMEs in the NRA.

Current closures to bottom fishing activities are subject to review every 5 years. Previous reviews conducted in 2014 and 2021 verified the continued presence of sponge VME and their protection through sustained bottom fishery closure measures.

C.3 *In situ* conservation of biological diversity

Recognition of other effective area-based conservation measures is expected to include the identification of the range of biodiversity attributes for which the site is considered important (e.g., communities of rare, threatened or endangered species, representative natural ecosystems, range restricted species, key biodiversity areas, areas providing critical ecosystem functions and services, areas for ecological connectivity).

The deep-sea sponge grounds in Areas 1-6 qualify as Vulnerable Marine Ecosystems in relation to high seas fisheries, according to Criteria developed by FAO (FAO, 2009).

Recent research has improved the understanding of the ecological functions performed by VMEs and specifically Sponge VME in the NRA, including their value to humans (Maldonado et al., 2015; Murillo, Weigel, et al., 2020; Pham et al., 2019; Stratmann et al., 2024; Thurber et al., 2014). It has also been shown that an increased level of biodiversity occurs in sponge grounds (Beazley et al., 2013, 2015; Stratmann et al., 2024). The increased levels of biodiversity and specific functions associated with large sponge grounds gives rise to enhanced secondary production, and enhanced benthic-pelagic coupling of nutrients, including particulate and dissolved organic matter (Baldrighi et al., 2017). For example, it has been estimated that sponge grounds (VMEs) located in the Flemish Cap area of the northwest Atlantic, have the capacity to filter approximately 56,143 ± 15,047 million litres of seawater daily from the bottom waters encompassing an area of 135,056.82 km^2 of seafloor (Pham et al., 2019). This huge exchange of water is likely to make a significant contribution to the cycling of carbon (chemical energy) and nutrients, giving rise to elevated levels of secondary benthic production (Maldonado et al., 2015) including the potential associated benefits (via the provision of food, refugia and/or nursery grounds) for commercially targeted fish species in the region (Kenchington et al., 2013; Meyer et al., 2019)

The NAFO sponge VME closures consist of 6 separate fishery closures, which are in relatively close in spatial proximity to one another, are likely to be ecologically connected (Kenchington et al., 2013; Wang et al., 2024). The separate closures should therefore be considered as a single interconnected system which collectively serve to sustain significant regional populations of sponge at levels which maintain their essential functional processes of value to the wide ecosystem (Baco et al., 2016; Wang et al., 2024).

C.4 Information and monitoring

Identification of other effective area-based conservation measures should, to the extent possible, document the known biodiversity attributes, as well as, where relevant, cultural and/or spiritual values, of the area and the governance and management in place as a baseline for assessing effectiveness

I. Monitoring system informs management on the effectiveness of measures with respect to biodiversity, including the health of ecosystems.

The management measures adopted for the NRA sponge areas are based on a scientific description of the area by the NAFO Scientific Council and its Working Group on Ecosystem Science and Assessment (WG-ESA).

EU and Canadian research vessel (RV) bottom-trawl surveys sample most of the NAFO fishable area annually, but only down to 1500 m (Healey *et al.*, 2012; Nogueira *et al.*, 2017). The main objective of these surveys is to produce abundance and biomass indices for the main demersal species, and to determine the demographic structure of their populations, although other scientific goals, such as the collection of information on the spatial and bathymetric distribution of megabenthic invertebrate species (such as large sponges), are also addressed. All information from these surveys is available to NAFO Scientific Council.

Full reviews of the status of VME closures and VMEs in the NRA are conducted every 5 years. All NAFO bottom fishing closures have been subject to review by SC in 2014 and 2021 to ensure they are effective in achieving their conservation aims (NAFO, 2014 and 2020). The 2021 review concluded that overall protection status for large size sponge VME was "good", with management action recommended as "beneficial. The next full review of the NAFO VME bottom fishing closures is expected in 2027.

All control, monitoring and enforcement measures pertaining to fishing activities in the NAFO Regulatory Area are contained in the most recent NAFO CEM (NAFO CEM). These include recording of all catches, discards and live releases of all fish species caught as well as haul-by-haul data. All fishing vessels in the NRA are required to send VMS positioning information on an hourly basis, this information is used to verify that no bottom fishing operations are taking place within the closed areas.

II. Processes should be in place to evaluate the effectiveness of governance and management, including with respect to equity.

In regard to Areas 1-6 two processes to evaluate the effectiveness of governance and management are relevant. Firstly, NAFO Scientific Council undertakes a full scientific review of the status of VME closures and VMEs in the NRA every 5 years, the next review is scheduled for 2027. Secondly, Article XVIII of the NAFO Convention – Review, states that the Commission shall periodically initiate reviews and assessments of the adequacy of provisions of this Convention and, if necessary, propose means for strengthening their substance and methods of implementation in order to address any problems in attaining the objective of this Convention (NAFO, 2017). NAFO has undertaken two external performance reviews, to assess the Organization's performance regarding its mandate and objectives, defined in the NAFO Convention), the first one in 2010 and second one in 2018 (Performance Reviews).

***III.* General data of the area such as boundaries, aim and governance are available information.**

All information on the areas, boundaries, governance and management are publicly available on the NAFO website (www.nafo.int).

D. Associated ecosystem functions and services and cultural, spiritual, socio-economic and other locally relevant values (*Maintains ecosystem functions and services, and upholds locally relevant values*)

D.1 Ecosystem functions and services

I. Ecosystem functions and services are supported, including those of importance to indigenous peoples and local communities, for other effective area-based conservation measures concerning their territories, taking into account interactions and trade-offs among ecosystem functions and services, with a view to ensuring positive biodiversity outcomes and equity.

All NAFO governance and management measures are based on the principles set out in the NAFO Convention (NAFO, 2017). Relevant governance by indigenous peoples and local communities is the responsibility of the individual Contracting Parties within the framework of the Convention.

There has been increased efforts by the NAFO Scientific Council in assessing the ecosystem functions and services associated with VMEs within and in the adjacent areas of the NAFO fishing footprint. As described under C3 (above), sponge VME supports several important ecosystem functions especially those associated with nutrient recycling, and habitat provision which are essential in maintaining the high biodiversity associated with the sponge grounds (Murillo et al., 2020; Murillo, Weigel, et al., 2020; Pham et al., 2019; Stratmann et al., 2024). The provision of these functions is likely to have a positive benefit for the health, resilience and overall productivity of ecosystem (including fish), although the precise mechanisms by which this occurs is unclear and not certain.

II. Management to enhance one particular ecosystem function or service does not impact negatively on the sites overall biological diversity information.

The areas in question are closed to bottom fishing by commercial vessels, but research vessels are still able to conduct scientific activities within the areas.

D.2 Cultural, spiritual, socioeconomic and other locally relevant values

I. Governance and management measures identify, respect and uphold the cultural, spiritual, socioeconomic, and other locally relevant values of the area, where such values exist.

The fisheries in the NRA have important social and economic value for the coastal communities from where the fisheries are operated. All NAFO governance and management measures are based on the principles set out in the NAFO Convention (NAFO 2017). Governance by indigenous peoples and local communities is the responsibility of the individual Contracting Parties within the framework of the NAFO Convention.

However, the scientific community has gained much by investigating the nature of the unique habitats and species found in the NRA, resulting in a plethora of scientific papers, which has contributed greatly to the understanding of deep-sea conservation biology and the development of management measures to ensure the sustainability of both biodiversity and the fisheries in the region.

II. Governance and management measures respect and uphold the knowledge, practices and institutions that are fundamental for the in situ conservation of biodiversity.

All NAFO governance and management measures are based on the principles set out in the NAFO Convention (NAFO, 2017) including the following ones contained in Article III, (b) adopt measures based on the best scientific advice available to ensure that fishery resources are maintained at or restored to levels capable of producing maximum sustainable yield; (c) apply the precautionary

approach in accordance with Article 6 of the 1995 Agreement; (d) take due account of the impact of fishing activities on other species and marine ecosystems and in doing so, adopt measures to minimize harmful impact on living resources and marine ecosystems; (e) take due account of the need to preserve marine biological diversity;.

E. Assessing additional OECM properties (Optional)

Are there any potential overlapping fisheries management measures which would infer additional protection or governance for the features under consideration, e.g., a fishing footprint.

Areas outside the bottom fishing footprint in the NAFO Regulatory Area are protected, in that no directed bottom fishing activity is permitted outside the fishing footprint without *a priori* an appropriate assessment which is part of a 'exploratory fishing protocol' being undertaken (endorsed by the Scientific Council) and permission granted (see CEM Article 16). All the sponge closures extend, in part, into areas beyond the fishing footprint. In one case (Area 3), the entire sponge closure is located outside the fishing footprint.

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