

Northwest Atlantic Fisheries Organization



**Report of the NAFO Joint Fisheries Commission–Scientific Council
Working Group on Ecosystem Approach Framework to Fisheries Management
(WG-EAFFM)**

15–17 July 2015
Halifax, Nova Scotia, Canada

NAFO
Dartmouth, Nova Scotia, Canada
2015

Report of the NAFO Joint Fisheries Commission–Scientific Council Working Group on Ecosystem Approach Framework to Fisheries Management (WG-EAFFM)

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1. Opening

The meeting was called to order at 1000 hrs on 15 July 2015 by Andrew Kenny (EU). He offered apologies on behalf of the other co-Chair, Robert Day (Canada), who was unable to attend the meeting.

Representatives from Canada, Denmark (in respect of the Faroe Islands and Greenland) (DFG), European Union (EU), Iceland, Japan, Norway, the Russian Federation, and the USA were in attendance. The Scientific Council was represented by the SC Vice-Chair. Observers from Ecology Action Centre and World Wildlife Fund Canada were also in attendance (Annex 1).

2. Appointment of Rapporteur

The Fisheries Commission (FC) and Scientific Council (SC) Coordinators, Ricardo Federizon and Neil Campbell, were appointed as co-Rapporteurs.

3. Adoption of Agenda

With the addition under other matters of two items regarding the “Coral and Sponge Identification Guide – NAFO Area” for observers, and the review clause for Chapter 2 (Article 24) of the NCEM, the agenda was adopted (Annex 2).

4. Consideration of SC advice from 2015

The SC vice-Chair, Kathy Sosebee (USA) presented an overview of the SC response (formulated in June 2015) to the FC Requests for Advice (formulated in September 2014) on topics relevant to the agenda of this Working Group (WG) (Annex 3). The SC Response covers topics including Significant Adverse Impact (SAI) on Vulnerable Marine Ecosystem (VME) elements and species, impacts of removing candidate VME closures from survey design, impacts other than fishing in the NAFO Regulatory Area (NRA), and impacts of mid-water trawls on VME indicator species. Details of the SC advice are documented in SCS Doc. 15/12.

a) Development of work on Significant Adverse Impacts in support of workplan for assessment of bottom fisheries in 2016

The presiding Chair elaborated on the SAI advice (Annex 4). The WG was informed that the SC’s work plan for the assessment of bottom fishing activities by 2016 is progressing as scheduled, and development of a template for the assessment report is underway. An important addition to the template is a review of the current fisheries which summarises the spatial extent of the fisheries (see slides 5-6 in Annex 4). In its approach to assessing SAI, the first three of the FAO criteria (as defined in paragraph 18 of the 2009 FAO *International Guidelines for the Management of Deep-Sea Fisheries in the High Seas*) are being analysed, namely; intensity/severity of impact, spatial extent of impact, and sensitivity/vulnerability of ecosystem. The subsequent three criteria (recovery, function, and duration) relate to functionality of the ecosystem, rather than the impact of fishing on the structure of the benthic fauna and habitat. They will be addressed at a later stage.

The WG noted the preliminary nature of the work presented and thanked SC for the extensive effort which has gone into the assessment to date. It was noted that benthic fisheries for shellfish on the tail of the Bank were included in the preliminary assessment. It was agreed that these fisheries should be excluded from further analysis as NAFO has no management jurisdiction in this regard. It was also noted that mid-water trawl fisheries should not be included in the description or the analysis of bottom fisheries.

It was noted that 46% of the area of the fisheries closures (as referred to in NCEM Article 17.5) fall outside the footprint (as referred to in NCEM Article 16) and were therefore not at risk of SAI. The remaining 54% of the area of the fisheries closures (within the footprint), represents 6% of the footprint closed to bottom fishing to protect VME. Through a combination of analysing VMS data (2008–2014) and VME indicator species biomass for sponge, seapen and large gorgonian, the area of VME (outside current closures) likely to be impacted by bottom fishing can be estimated (see Table 1). It was noted that an impact on VME does not necessarily mean it is significant. For example if only 1% of the VME habitat has been impacted it would be assessed as not significant. For illustrative purposes, it was noted that under the EU Habitats Directive¹ some assessments of designated habitat features 25% of the area being impacted as the criteria to determine when the loss of habitat would result in a feature being in an ‘unfavourable’ state. If this approach were to be applied, the provisional assessment of area of VMEs potentially impacted by past activities for each of the assessed VME types fall below this value and the assessment would therefore conclude that there is no SAI to report. However, there could be SAI in the future and therefore possible management measures to minimize the risk of future SAI should be considered in the assessment. In addition, VMEs outside current closures could be under a potential risk of impact should fishing patterns change and in the absence of suitable mitigation measures. It was noted that findings presented (Annex 4 – Slide 13) are preliminary and did not pre-judge the ongoing assessment of SAI to be finalized in 2016.

Table 1. Area (km²) of VME inside and outside current fishery exclusion zones closures. “Cut-off” is the value of VME species biomass which distinguishes between areas of VME which are at potential risk of SAI *versus* areas of VME which have been subject to possible past or historic SAI. The “cut-off” values between the two conditions of at risk and past SAI are described and defined in SCS Doc. 14-23 and SCS Doc. 15-12.

	Sponges	%	Seapens	%	Coral	%	Notes
Total area of VME	22,439	100	6,983	100	3,725	100	
Total area of VME INSIDE Closed Area	8,042	36	1094	16	1,992	53	Not at risk of SAI
Total area of VME OUTSIDE Closed Area	14,397	64	5889	84	1,733	47	Total area of potential SAI
Area of VME OUTSIDE Closure, above “cut-off”	4,351	30	1,484	25	668	39	“historic” or “past” SAI
Area of VME OUTSIDE Closure, below “cut-off”	10,045	70	4,404	75	1,064	61	At present-day risk of SAI
Proportion of total VME subject to “historic” or “past” SAI	-	20	-	21	-	16	
Proportion of total VME at risk of present-day SAI	-	45	-	63	-	31	

It was felt that the understanding of the SAI analysis would be improved if SC were to compile, define and agree on terminology used in the reassessment of bottom fisheries, with particular emphasis on the definitions of SAI. It was further suggested that the evaluation of SAI would be improved if in addition to considering the VME areas derived from the kernel density analysis, biomass distributions of VME indicator taxa were also taken into account, e.g. assess the proportion of biomass within and outside current closures. In addition, it was suggested that the VME kernel density analysis polygon boundaries could be refined by taking into account current understanding of VME species distribution patterns in relation to environmental variables.

¹ Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:01992L0043-20070101>

b) Removal of closed areas from scientific surveys

The SC vice-Chair presented the work of SC and the Secretariat on the impacts of removing the closed areas from the survey design for relevant stock surveys. There has been limited progress; however, work is ongoing to quantify the overlap between VME protection areas and RV surveys. It was noted that removing these areas from the survey design could have implications for survey estimates. However, the WG urges SC to consider options to expedite the assessment process. Furthermore, it was suggested that the dialogue between the FC and SC Chairs on priorities and workload should take place at the earliest opportunity, with this task having increased priority.

c) Impact of activities other than fishing on fish stocks and biodiversity in the NRA

The SC vice-Chair presented the results of the literature review of potential impact from activities other than fishing on fish stocks and biodiversity in the NRA. It was noted that there was limited expertise currently available in the SC on many of these issues. It was recognized that NAFO is not the competent authority for the management of many of these activities. Prioritization of these other activities in terms of their likelihood of impacting upon fish stocks in the northwest Atlantic was mentioned as a possible way to reduce the scale of the work without any conclusion being reached on the way forward. One CP noted that in the SC's response oil and gas activities contained the biggest number of stressors, potential effects and risks; oil and gas activities are also explicitly mentioned as part of the Ecosystem Approach Roadmap (Fig. 1). It was also noted that in the northeast Atlantic, non-binding discussion between NEAFC, OSPAR, and the International Seabed Authority takes place, and that this could serve as a model for dialogue in the NAFO context.

On a related note, the Executive Secretary informed the WG that Canada has provided an extensive proposal regarding a mechanism for exchange of information to avoid overlapping and mitigate potential conflict between fisheries and hydrocarbon activity. This was recently circulated to Contracting Parties and Chairs.

d) Impacts of mid-water trawls on benthic VME indicator species

SC focused its response to this request on potential impacts of midwater trawling around seamounts, and advised that midwater trawls around seamounts have the potential to have bottom contact and therefore present a risk of causing SAI. This risk is lower than for a bottom trawl.

SC recommended that midwater trawl fisheries on seamounts report bycatch of all VME indicator species bycatch, regardless of the amount caught. This recommendation was endorsed by the WG. It was requested that at its future meeting(s) that the WG review any available information on bycatch resulting from this enhanced reporting requirement.

5. Consideration of NCEM Articles 17.1 - 17.3 (Seamounts)

At the 2014 Annual Meeting, FC referred the issue of exploratory fisheries in seamount areas to the WG for further consideration (FC Doc. 14/35).

It was noted that two CPs had operated fisheries in these areas over a long period. Current seamount closures in NAFO provide a level of protection identical to that provided by other areas outside the fishing footprint. Opinions within the WG as to the nature of the risk presented by midwater trawls to VME indicator species in NAFO varied. A range of possible ways to proceed was discussed including: *i.* to leave the current situation unchanged, *ii.* to remove the "seamount closures" from the CEM, recognizing that the protection they once provided is now applied to the entire NAFO Regulatory Area outside the footprint, or *iii.* to further control bottom fishing within the seamount areas, for example by removing the provision for exploratory bottom fisheries from Article 17. This third course of action was endorsed by the WG, as was a suggestion to develop a mid-water gear design, to be applied to seamount areas, and ensuring very minimal or no risk of bottom impacts (e.g. use of gear with no discs, bobbins, etc).

It was considered and agreed that it was not necessary to redefine midwater trawls as a bottom gear, but to recognize that midwater trawls in certain defined areas (seamounts) and fisheries (alfonsino) could contact the bottom (see Section 4d). A consensus formed that midwater trawl fisheries in seamounts should be subject to current gear provisions used for midwater trawls for redfish. With this agreement, the need for a definition of midwater trawling that would apply to seamount fisheries was also recognized.

Further, taking into account SC advice which highlighted the potential risk of SAI, the WG agreed to eliminate the provision for exploratory bottom fisheries in the NAFO seamount areas until 2020 when all VME provisions will be subject to review by FC.

6. Discussion of ongoing matters

a) Status of Candidate VME areas 13 and 14 (eastern Flemish Cap)

and

b) Status of Div. 30 Coral Closure

and

c) Significant concentrations of VME indicator species on Tail of the Bank (Div. 3N)

There was no new information or evidence to elaborate the assessment of these areas as reported in the previous meeting of this WG (FC-SC Doc. 14-03), however it was noted that data from a Canadian VME survey in 2015, as well as additional bottom trawl survey bycatch data from the EU-Spain survey, would be available to SC Working Group on Ecosystem Science and Assessment (WG-ESA) later in 2015. It was therefore requested that these topics be retained on the agenda for future discussion pending analysis of new data.

7. Implementation of the “Ecosystem Approach”

a) Review of the “Roadmap to an Ecosystem Approach”

The co-Chair of WG-ESA Mariano Koen-Alonso (Canada) presented a progress report on the work done by SC in further developing the Roadmap (Annex 5), focusing on those elements that SC considered advanced enough to start the discussion of their potential implications and avenues for implementation. These elements included (1) the definition of spatial scales considered relevant and practical for devising ecosystem-level summaries and management plans, (2) the delineation of Ecosystem Production Units (EPUs) that SC endorsed as candidate ecosystem-level management units for pilot implementations of EAF, and (3) the results from Ecosystem Production Potential models for some of these areas. These models provide estimates of Fisheries Production Potential that can serve as basis for developing “Total Catch Ceilings” (the maximum catch allowed across all species in an Ecosystem-level management unit).

The WG broadly welcomed this work, acknowledged that this being the first time these types of analyses have been presented at the WG, and indicated that more time was needed to reflect on them and further consider their management implications and potential mechanisms for implementation. The WG encouraged continued progress toward further developing these analyses and tools towards practical management applications to maintain momentum in this area.

The WG recognized that, as work on the implementation of the roadmap progresses, priorities and tasks may change over time. The WG updated the set of tasks and priorities to be progressed over the next year (Fig. 1). Updates reflect that the review of fishery closures was completed last year and the focus for 2015-2016 is the re-assessment of bottom fisheries.

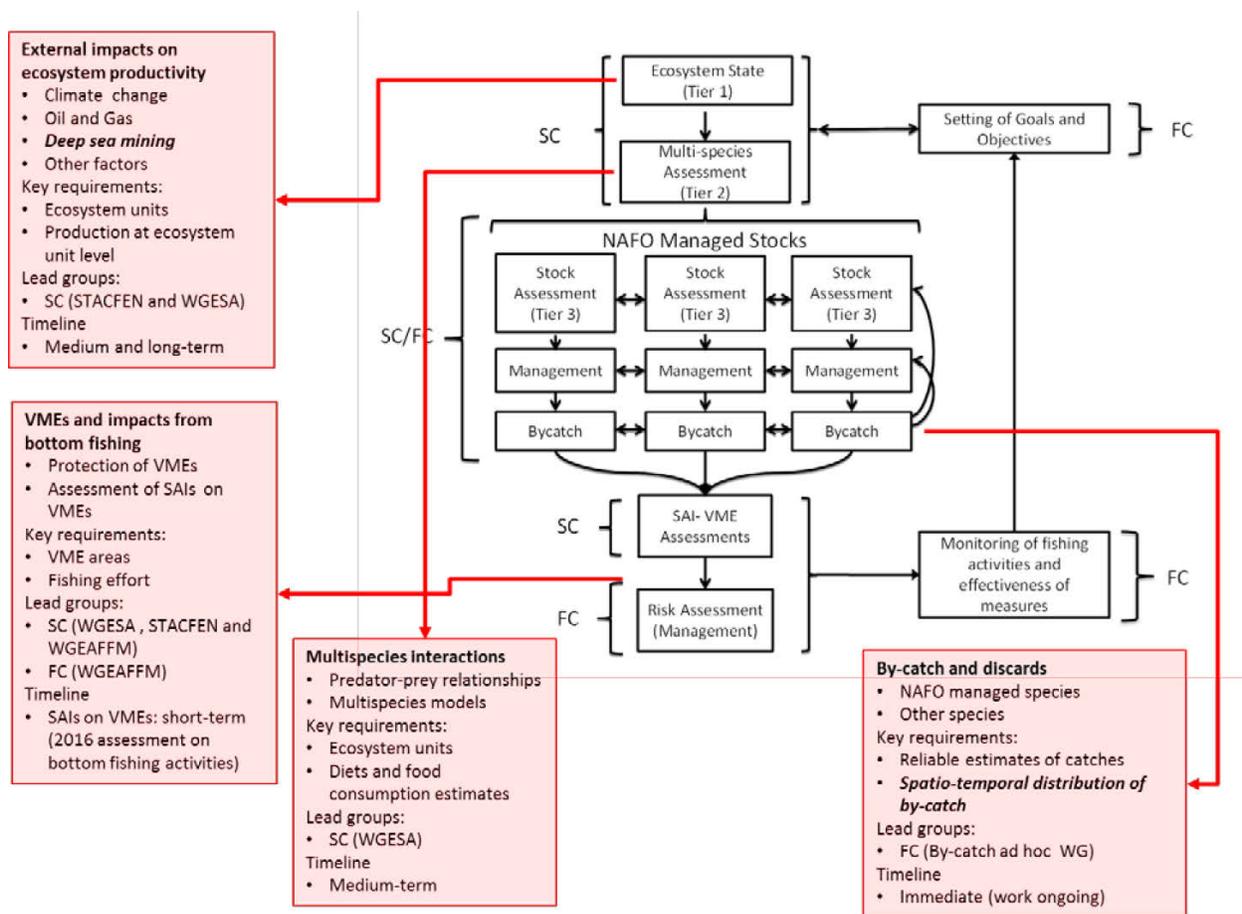


Fig. 1. Updated Workplan and Prioritization of the EAF Roadmap addressing other factors impacting the ecosystem (changes indicated in italic-bold text).

b) Addressing other factors impacting the ecosystem

The WG thanked SC for its thorough overview. It was recognized that if NAFO wishes to give further consideration to any of these issues, it will have to be in partnership with specific competent bodies. The list prepared by SC serves as a useful scoping document, and attempts could be made to prioritize these issues and identify relevant partners. To illustrate, it was noted that deep-sea mining exploration licenses are being issued at the mid-Atlantic ridge regions. Should interest expand to the NAFO Regulatory Area then engagement with the International Seabed Authority might be appropriate.

c) Future direction of FC-SC WG-EAFFM

Participants considered the future role of the WG. Noting the strong synergy between the *ad hoc* FC Working Group on Bycatch and Discards (WG-BDS), the work being carried out on bycatch in WG-ESA and the role of the FC-SC WG-EAFFM, it was felt that more effective coordination and integration of the outputs and discussion held by these two groups could be achieved so as to avoid duplication of effort. It was noted a similar discussion had taken place in the *ad hoc* WG-BDS which met immediately before this WG, it was therefore agreed to await the outcome of recommendations arising from that *ad hoc* group, as they met first.

8. Other matters

a) Coral and Sponge Identification Guide – NAFO Area

Progress by the Secretariat and members of WG-ESA on updating the Coral and Sponge Identification Guide in the NAFO Area to produce a single volume containing all NAFO's recognized VME Indicator Species was welcomed. Further areas for development, noting the US guides to bycatch species, the FAO Smartforms initiative and the WWF "app", were discussed.

b) Wording of NCEM Article 24

An outdated reference in Chapter II, Article 24 was noted. A recommendation was made to Fisheries Commission to update this Article and proposed a full review of the VME measures in 2020.

9. Recommendations to forward to the Fisheries Commission and Scientific Council

The Working Group **recommends**:

In relation to Progress of the Workplan on SAI in support of reassessment of bottom fisheries in 2016:

1. that Scientific Council should take into account the protection afforded to VME areas outside the NAFO fisheries footprint in the calculation of the VME area and biomass at risk of bottom fishing impact;
2. that Scientific Council refine VME kernel density analysis polygon boundaries, taking into account current understanding of distribution patterns in relation to environmental variables.

In relation to removal of closed areas from scientific surveys:

3. that Scientific Council considers options to expedite a risk assessment of trawl surveys impact on VME in closed areas, and the effect of excluding surveys from these areas on stock assessments.

In relation to activities other than fishing:

4. that Fisheries Commission request the General Council to identify other international organizations (e.g. International Maritime Organization, International Seabed Authority) with areas of mutual interest and instruct the Secretariat to explore the establishment of mechanisms for dialogue and engagement.

In relation to impacts of mid-water trawls on benthic VME indicator species and habitats:

5. that Fisheries Commission or STACTIC amend the NCEM to broaden the scope of application of the meaning of 'midwater trawl', as referred to in Article 13.2.f, to apply to midwater trawls in the seamount areas referred to in Article 17.

In relation to NCEM Articles 17.1 - 17.3 (Seamounts):

6. that Fisheries Commission revise Article 17 to remove the possibility of exploratory bottom fishing in seamount areas;
7. that Fisheries Commission revise NCEM to require reporting of all quantities of all VME indicator taxa catches (Annex I.E.VI), in seamount areas (Article 17) for instance through logbooks or observer reports.

In relation to Other matters:

- 8. that Scientific Council consider widening the scope of the NAFO coral and sponge identification guides to include other relevant species on seamounts.**
- 9. that Fisheries Commission revise Article 24 as follows:**

“The provisions of this Chapter shall be reviewed by the Fisheries Commission at its Annual Meeting no later than 2020”.

These recommendations will be presented to FC and SC at the 2015 Annual Meeting for consideration and adoption.

10. Adoption of the report

It was agreed that the text of the recommendations to Fisheries Commission and Scientific Council agreed in plenary was considered final. A first draft of the remainder of the report would be written up by the Secretariat and circulated firstly to the Chair and then to Contracting Parties in the days following the meeting.

11. Adjournment

The meeting was adjourned at 1100 hrs on 17 July 2015. The Chair thanked participants for their positive approach and engagement in the meeting, thanked the Secretariat for their support and hospitality, and wished participants a safe journey home.

Annex 1. List of Participants

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Annex 2. Agenda

1. Opening
2. Appointment of Rapporteur
3. Adoption of Agenda
4. Consideration of SC advice from 2015
 - a. Development of work on Significant Adverse Impacts in support of workplan for assessment of bottom fisheries in 2016
 - b. Removal of closed areas from scientific surveys
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 - c. Significant concentrations of VME indicator species on Tail of the Bank (Div. 3N)
7. Implementation of the "Ecosystem Approach"
 - a. Review of the "Roadmap to an Ecosystem Approach"
 - b. Addressing other factors impacting the ecosystem
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 - b. Wording of NCEM Article 24
9. Recommendations to forward to the Fisheries Commission and Scientific Council
10. Adoption of the report
11. Adjournment

Annex 3. Overview of the SC Responses to FC Requests

NAFO FC-SC WGEAFFM
15-17 July 2015, Halifax, NS

SC Responses to FC Requests

SC Vice-Chair

4 FC Requests

- #4. The Fisheries Commission requests the Scientific Council to continue to develop work on Significant Adverse Impacts in support of the reassessment of NAFO bottom fishing activities required in 2016, specifically an assessment of the risk associated with bottom fishing activities on known and predicted VME species and elements in the NRA. (WG-ESA Co-Chair Andy Kenny to elaborate)
- #5. FC requests that SC investigate the impacts of removing the closed areas from the survey design for relevant stock surveys.
- #11 As the first step in the assessment of such impacts and for the implementation of the priorities of the Ecosystem Roadmap, could the Scientific Council provide a literature survey that would indicate what the risks are to the fish stocks and ecosystems in the NAFO Regulatory Area by looking at comparable situations.
- #12 The Fisheries Commission requests the Scientific Council to evaluate the impact of mid-water trawls on VME indicator species in those instances when the gear makes contact with or is lost on the bottom.

FC Request # 5

Recognizing the work done in NAFO to prevent significant adverse impacts to vulnerable marine ecosystems, and the need for effective stock assessments; Further recognizing that modifications to survey designs occur on regular basis in fisheries surveys in many cases,
FC requests that SC investigate the impacts of removing the closed areas from the survey design for relevant stock surveys.

There was limited progress on this request from FC to investigate the impacts of removing the closed areas from the survey design for relevant stock surveys. A GIS analysis prepared by the Secretariat revealed that for Div. 3M, about 15% of the total stratified area overlaps with closed areas. Individual strata overlap ranged from 1% to 61%. Work is ongoing to quantify the overlap between VME protection areas and survey strata, as a first step in assessing the impact of excluding the closed areas from research survey design. Following this work, a comprehensive analysis of the time series of survey indices which include those strata overlapping closed areas will be required for various species.

FC Request # 11

The NAFO 2011 Performance Review Panel encouraged NAFO to consider whether activities other than fishing in the NAFO Convention Area may impact the stocks and fisheries for which NAFO is responsible as well as biodiversity in the NAFO Regulatory Area. Such activities might include oil exploration, shipping and recreational activities. Some work has been carried out as part of the ecosystem approach.
As the first step in the assessment of such impacts and for the implementation of the priorities of the Ecosystem Roadmap, could the Scientific Council provide a literature survey that would indicate what the risks are to the fish stocks and ecosystems in the NAFO Regulatory Area by looking at comparable situations.

Scientific Council outlined the anthropogenic activities other than fishing that are occurring or have the potential of occurring in the NAFO Convention area and listed possible stressors and their possible impact on fish stocks and the ecosystem.

Anthropogenic activity	Stressor	Potential effects	Risk to	
			Fish Stock / Fisheries	Ecosystem
Transportation	Ballast Water Exchange	Risk of introduction of pelagic organisms/larvae with alternative ballast water exchange zones in NAFO area	Fish Health and competition from aquatic invasive species (AIS).	Mostly studied for coastal zones
	Accidental events	Hydrocarbons Dispersants	Fish health; mortality and/or impacts on development. Fishery Disruptions (potential risk to fisheries)	Localized Habitat Disruption
	Ship Strikes	Risk of incidental mortality or injury to e.g. marine mammals and sea turtles	Low	Low
	Noise	Soundscape Modification	Unknown: Muffling of natural sounds and cues	Unknown: Ubiquitous
	Naval sonar	Marine mammals hearing loss, disorientation	Low	Possible alter marine mammals distribution

Anthropogenic activity	Stressor	Potential effects	Risk to		
			Fish Stock / Fisheries	Ecosystem	
Oil and gas exploration and exploitation	Drilling wastes	Smothering	Fish health; mortality and/or impacts on development.	Loss of Habitat and species diversity	
		Hydrocarbon/Heavy metal contamination, Increased O ₂ demands	Fishery Disruptions (potential risk to fisheries)		
	Produced water	Hydrocarbon / Heavy metal contamination / radionuclide contamination	Fish health; mortality and/or impacts on development.	Loss of Habitat and species diversity	
			Fishery Disruptions (potential risk to fisheries)		
	Seismic	Marine mammals – hearing loss, disorientation, mortality	Fish behaviour	Unknown long term effects on fish health; some evidence of non-lethal physiological changes in lab settings.	Unknown
			Catchability	Potential for short term displacement of fish aggregations.	
		Shellfish	Low catch rates in the short term (potential risk to fisheries).	Unknown	
			Benthos		Access to fishing grounds (potential risk to fisheries).
		Plankton			
Accidental events	Contamination, silt, smothering, Hydrocarbons, Dispersants	Fish health; mortality and/or impacts on development.	Changes in benthic and pelagic community structure, Mortality of sessile communities		
		Fishery Disruptions (potential risk to fisheries)			
	Structure	Increased habitat complexity in a contaminated environment	Fisheries exclusion zones (potential risk to fisheries)	Reef effect in a contaminated/affected area	
Structure (Mobile)	Ballast water, surface fouling	Fish Health and competition from AIS.	Reef effect in a contaminated/affected area		
		Fisheries exclusion zones (potential risk to fisheries)			

Anthropogenic activity	Stressor	Potential effects	Risk to	
			Fish Stock / Fisheries	Ecosystem
Mining	Crust on seamounts	Smothering	Fisheries exclusion zones (potential risk to fisheries)	Loss of Habitat and species diversity
	Placer mining	Seabed modification/ destruction	Fisheries exclusion zones (potential risk to fisheries)	Localized Habitat Disruption
	Nodule dredging	Seabed modification/ destruction	Fisheries exclusion zones (potential risk to fisheries)	Possible widespread Habitat Disruption
Litter	Sunken litter	Habitat modification, smothering	Low	Changes to Benthic community structure
	Ghost fishing	Mortality	Loss of Yield, Fouled gear	Unreported Mortality, Fish Entanglements
	Floating Debris	Ingestion by pelagic organisms and birds	Low	Long range, ubiquitous
	Contaminant Leaching	Endocrine Disruptors, Persistent Organic Pollutants	Fish Health	Long range, ubiquitous
	Accumulation in convergent zones	AIS vector	Competitor or predator to target species	Change in species diversity

Anthropogenic activity	Stressor	Potential effects	Risk to	
			Fish Stock/ Fisheries	Ecosystem
Microplastics	Pelagic substrate	Modification of microbial loop, increased sedimentation, Ingestion by organisms	Fish Health	Unknown
	Contaminant absorption and Leaching	Endocrine Disruptors, Persistent Organic Pollutants	Fish Health	Long range, ubiquitous
Cables Pipelines	Plowing, armouring	Habitat modification	Fisheries exclusion zones, fouled gear	Changes in species Assemblage Composition
	High voltage Alternating and Direct Current	Electro-magnetic fields	Fish Health, Interference with prey detection	Unknown
Defense activities	Sonar, dumping	Marine mammals hearing loss, disorientation	Gear fouling due to dumping	Redistribution of Marine Mammals, Reef effects
Dumping solid waste	Habitat modification/destruction Contaminants	Case specific	Fish Health	Loss of Habitat

FC Request # 12

The Fisheries Commission requests the Scientific Council to evaluate the impact of mid-water trawls on VME indicator species in those instances when the gear makes contact with or is lost on the bottom.

Midwater trawls (pelagic and semi-pelagic) can produce significant adverse impacts (SAI) on VME communities, as per information provided by the Scientific Council in 2010 and further addressed here. Such impacts are typically associated with: 1.) habitat destruction or direct contact with VMEs by the gear when it is fished near the seafloor and 2.) lost gear that becomes entangled in VMEs. Given the slow growth/reproductive rates that characterize VME-forming species, these impacts to VMEs can cumulatively result in Significant Adverse Impact (SAIs).

The definition of a midwater trawl is not described in the CEM except for Article 13 2 (f), the description for redfish midwater trawls. 'Bottom fishing activities' are described in Article 1 of the CEM as "bottom fishing activities where the fishing gear is likely to contact the seafloor during the normal course of fishing operations". Fishermen are able to deploy midwater trawls anywhere in the water column and studies have shown that midwater trawl fishing meets this definition. Inadvertent bottom contact can occur when fishing with midwater trawls on seamounts due to strong gyres associated with the topography of these geologic features and as a result of fishing midwater trawls close to the bottom.

The SC recommends that, midwater trawl fisheries on seamounts record all VME indicator bycatch, regardless of the amount caught.

Annex 4. Presentation on SC Advice pertaining to SAI

FC Request # 4

The Fisheries Commission requests the Scientific Council to continue to develop work on Significant Adverse Impacts in support of the reassessment of NAFO bottom fishing activities required in 2016, specifically an assessment of the risk associated with bottom fishing activities on known and predicted VME species and elements in the NRA.

1

SC Observations

1. The programme of work to deliver the assessment of bottom fishing activities by 2016 is progressing as intended.
2. Recent developments have included the design of a template for the assessment report, the start of the compilation of background ecological information, a description of the fisheries operating in the NRA, and
3. further advances on the approach to be used for assessing the risk of Significant Adverse Impacts on VMEs.

2

Progress towards Reassessment of Bottom Fishing Activities by 2016

- Template detailing content of the assessment report
- Compilation of general information
- Initial definition and characterization of fisheries
- Approach for assessing Significant Adverse Impacts (SAIs) on VMEs
- Preliminary analyses for some VME taxa
- Recommendations for refining the SAI method

3

Template for the assessment of Impacts of bottom fishing activities

Section 1: Introduction

Approach to the section: This section is intended to be a summary of the environmental and general ecosystem background; it is a brief introduction to the larger ecosystems where the VMEs are located.

Section 2: description of VME and VME elements

Approach to the section: This section is intended to be a summary of all VMEs and VME elements in the NRA. It should provide a concise summary of the types, and locations of VMEs and VME elements identified in the NRA. [already compiled as part of the review of fishery closures]

Section 3: Description of the Fisheries

Approach to the section: This section is intended to be a summary of all fisheries operating in the NRA, including their gear types, target species, areas of operation, etc. [New work]

Section 4: Impact Analysis

Approach to the section: This section is expected to be focused on likely impacts on VMEs and, whenever possible, to discriminate likely impacts by fisheries. Depending on how the work develops, this section could be merged with Section 5. [New work]

Section 5: Risk Assessment

Approach to the section: This section is intended to integrate the analysis of likely impacts (Section 4) in a framework compatible with standard risk assessment approaches that should allow identifying likely Significant Adverse Impacts (SAIs), as well as providing the basic blocks for potentially developing more comprehensive risk assessments if needed. Depending on how the work develops, this section could be merged with Section 4. [New work]

4

Description of Fisheries

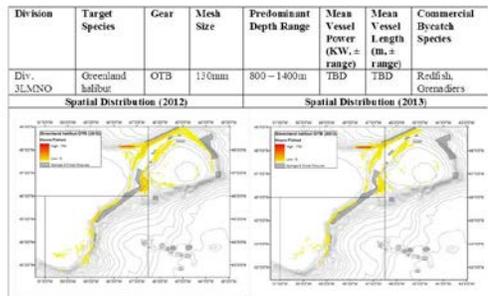
Operational fisheries initially identified for consideration in the Reassessment of Bottom Fishing Activities			
Fishery	Target Species	Main Area of Operation	Gear
Perlicia Redfish Fishery	Redfish	NAFO Div. 3F	Midwater otter trawl
Greenland Halibut Fishery	Greenland halibut	NAFO Divs 3LMN	Bottom otter trawl
3M Redfish Fishery	Redfish	NAFO Div. 3M	Bottom otter trawl
3M Shrimp Fishery	Shrimp	NAFO Div. 3M	Bottom otter trawl
<i>(in moratorium)</i>			
3M Travel Cod Fishery	Atlantic Cod	NAFO Div. 3M	Bottom otter trawl
3M Longline Cod Fishery	Atlantic Cod	NAFO Div. 3M	Longline
Sable Fishery	Sable	NAFO Div. 3NO	Bottom otter trawl
Yellowtail Rounder Fishery	Yellowtail Rounder	NAFO Div. 3N	Bottom otter trawl
Witch Rounder Fishery	Witch Rounder	NAFO Div. 3NO	Bottom otter trawl
<i>(re-opening in 2015)</i>		<i>(expected area)</i>	
3LN Redfish Fishery	Redfish	NAFO Divs 3LN	Bottom otter trawl
3LN Shrimp Fishery	Shrimp	NAFO Div. 3L	Bottom otter trawl
<i>(in moratorium)</i>			
White Hake Fishery	White hake	NAFO Divs 3NO	Bottom otter trawl
Squid Fishery	Shottfin squid	NAFO Subareas 3+4	Bottom and midwater otter trawl
		<i>(no directed fishing since 1999)</i>	
Alfonso Fishery	Splendid Neomusculina	NAFO Div. 5G (Corner Rise)	Midwater otter trawl
Snow Crab Fishery	Snow crab	NAFO Divs 3NO	Trawl
<i>(not managed by NAFO)</i>			
Arctic Surfclam Fishery	Arctic surfclam	NAFO Div. 3N	Hydraulic dredge
<i>(not managed by NAFO)</i>			

• A total of 16 operational fisheries have been identified – not all managed by NAFO

• VMS data is used to map their effort

5

Description of Fisheries



6

Approach for Assessing SAI

FAO 2009 assessment criteria

- i. the intensity or severity of the impact at the specific site being affected;
- ii. the spatial extent of the impact relative to the availability of the habitat type affected
- iii. the sensitivity/vulnerability of the ecosystem to the impact;
- iv. the ability of an ecosystem to recover from harm, and the rate of such recovery;
- v. the extent to which ecosystem functions may be altered by the impact; and
- vi. the timing and duration of the impact relative to the period in which a species needs the habitat during one or more of its life history stages

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SAI criteria

- ii. *the spatial extent of the impact relative to the availability of the habitat type affected*

Two considerations:

- i. Estimating SAI caused by past fishing activities – *determine area of impact which has likely occurred.*
- ii. Estimating risk of SAI by present and/or future fishing activities – *determine area at potential risk.*

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General Approach:

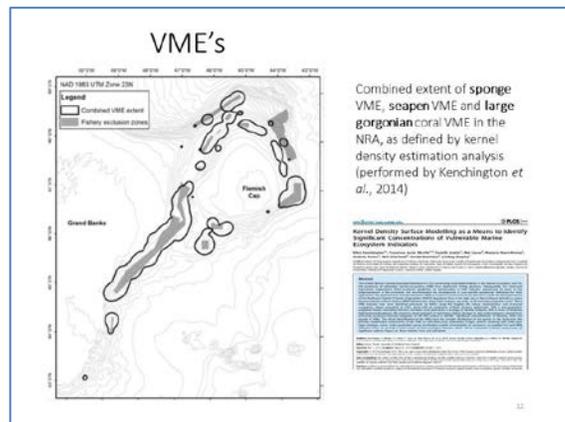
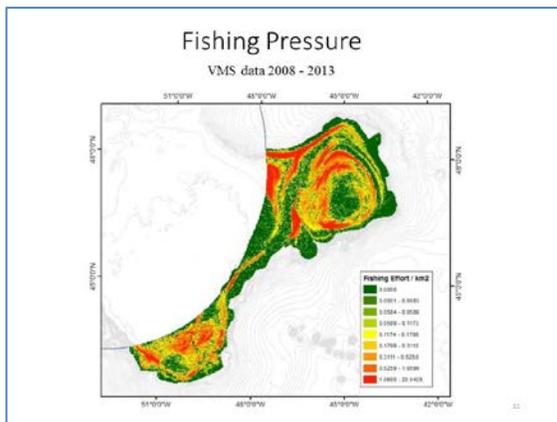
1. Analyse VMS data to generate a fishing activity/intensity layer (2008 – 2012)
2. Create biomass layers of VME species at the same spatial resolution (2000 – 2013)
3. Assess interaction/overlap between fishing activity and biomass layers.
 - Identify areas of possible past SAI and areas of potential risk present day SAI

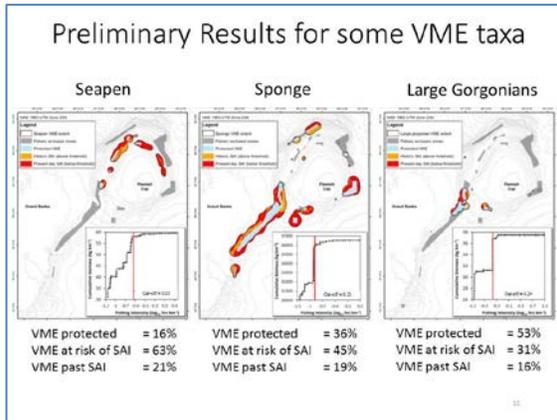
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Conceptual Approach to SAI

The diagram illustrates the conceptual approach to SAI. On the left, a graph shows 'Cumulative VME Biomass' on the y-axis and 'Fishing Intensity (effort/area)' on the x-axis. A curve rises steeply and then levels off. A vertical dashed line indicates a 'Cut-off in effort @ 95% of cumulative biomass'. A horizontal dashed line from this point on the curve meets the y-axis at '200t SAI'. Below the graph, text reads 'Evaluation of VME biomass observations inside areas at risk of SAI'. To the right, two maps of the study area are shown. The first map, 'Area at potential risk of SAI', shows a yellow area with a white cross and several red squares. The second map, 'Past SAI', shows a green area with a white cross and several red squares. Text to the right of the maps explains: 'Areas of low fishing intensity yielding high VME biomass – Potential risk of SAI' and 'Areas of high fishing intensity yielding low VME biomass – possible past SAI'.

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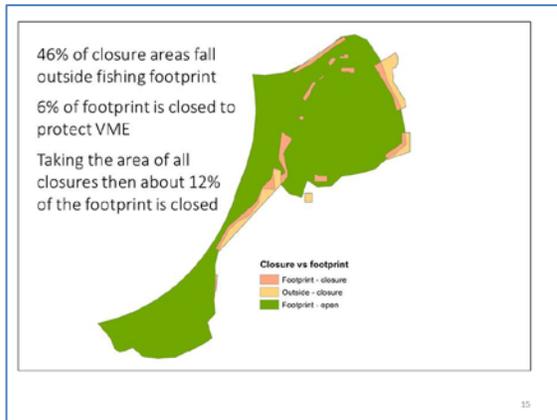




SC Recommendations

1. Further consider the role of environmental variables to define the fine scale features of VME boundaries (whenever possible).
2. Take into account the VME areas outside the NAFO fisheries footprint in the calculation of the VME area not exposed to risk of Significant Adverse Impacts.

Further thoughts to facilitate discussion.....!



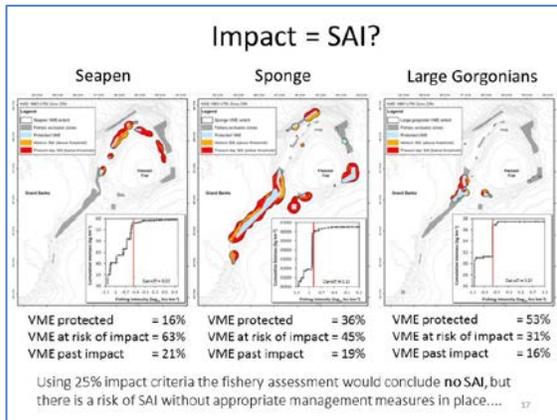
SAI criteria

ii. *the spatial extent of the impact relative to the availability of the habitat type affected*

Implies: not all VME habitat impacted = SAI?

It depends on how much VME habitat is impacted relative to the area of VME habitat available.

EU Habitats Directive uses a 25% impact cut-off to define when a habitat state becomes "unfavourable".



Annex 5. Progress Report on the “Roadmap”

NAFO FC-SC WGEAFFM
15-17 July 2015, Halifax, NS

Progress on the Roadmap towards implementing and Ecosystem Approach to Fisheries for NAFO

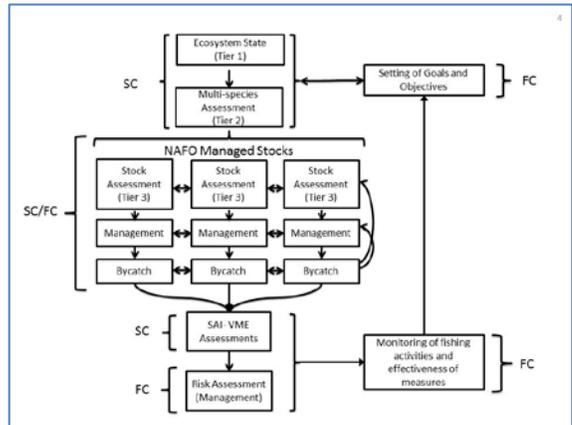
Mariano Koen-Alonso

Outline

- Context**
 - Development and Implementation of the Roadmap to EAF
 - Roadmap priorities identified by FC/SC WGEAFFM in July 2014 and endorsed by FC in September 2014.
- Process**
 - WGESA Meeting: 18-27 November 2014, Dartmouth
 - SC June Meeting: May 29 to June 12 2015, Halifax
- Topics**
 - Roadmap progress:
 - Ecosystem scales and candidate management areas
 - Fisheries Production Potential and Guidelines for Total Catch Ceilings.

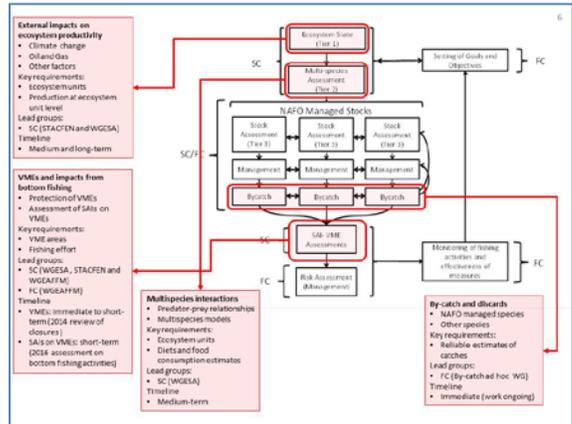
Main Roadmap features

- Core Roadmap premises are:
 - a) the approach is objective-driven,
 - b) it considers long-term ecosystem sustainability,
 - c) it is a place-based framework, and
 - d) trade-offs are explicitly addressed.
- Sustainability of exploitation is achieved through a 3-tier hierarchy:
 - Tier 1- ecosystem sustainability (total fisheries production; “TAC” at ecosystem level)
 - Tier 2- multispecies sustainability (multispecies assessments; trade-offs among fisheries)
 - Tier 3- stock sustainability (single species stock assessments; ensures that exploitation rates derived from Tiers 1 and 2 are consistent with stock characteristics).
- Integration of impacts of fisheries on benthic communities (e.g. VMEs)
 - Assessment of Significant Adverse Impact (SAIs) on VMEs by bottom fishing activities.
 - Analysis of fishing impacts on benthic ecosystems.



It is not that complicated: the Roadmap in 5 basic conceptual steps

1. Identify an Ecosystem level Management Area (only needs to be done once, after that only revisions)
2. Tier 1: Estimate fisheries production in area identified above and set a global TAC
3. Tier 2: Taking into account species interactions and other trade-offs, allocate the global TAC to individual stocks (stock TAC)
4. Tier 3: Verify at the single species level that the stock TAC is sustainable.
5. Identify benthic areas of special concern, and set up management measures to mitigate/avoid fishing impacts on these areas.



Ecoregion Analyses

- A series of ecoregion analyses has been carried out over the last several years.
- These analysis include regional studies (e.g. NL shelves, Flemish Cap, Scotian Shelf, Northeast US continental shelf), as well as an integrated analysis of the East coast of North America.
- These analysis included multiple data layers (e.g. bathymetry, water temperature, satellite derived chlorophyll and primary production, RV derived total fish biomass and diversity).
- On the basis of these studies, as well as expert opinion, and management considerations (e.g. existing NAFO division boundaries), a series of spatial scales and areas for ecosystem summaries and management were identified.

Spatial scales for ecosystem summaries and management

Spatial Scale	Name	Examples
"Large"	Bioregion	<ul style="list-style-type: none"> • NL shelves (2GHJ3KLNOP) • Flemish Cap (3M)
"Medium"	Ecosystem Production Unit (EPU)	<ul style="list-style-type: none"> • Northeast Newfoundland Shelf (2J3K) • Grand Bank (3LNO) • Flemish Cap (3M)
"Small"	Ecoregion	<ul style="list-style-type: none"> • North region of the Grand Bank (~3L) • Top of the bank in Flemish Cap • Slope areas

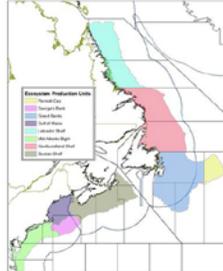
Large Scale: Bioregions



General operational description

Large geographical area characterized by distinct bathymetry, hydrography, and which contains one or more reasonably well defined (but still interconnected) major marine communities/food web systems.

Medium Scale: Ecosystem Production Unit

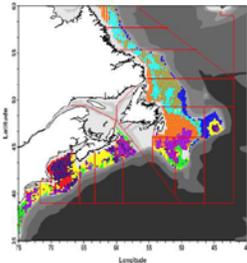


General operational description

Within a bioregion, a major geographical subunit characterized by distinct productivity and a reasonably well defined major marine community/food web system.

The ecosystem Production Unit (EPU) is the proposed scale for Ecosystem-level Management Areas.

Small Scale: Ecoregion



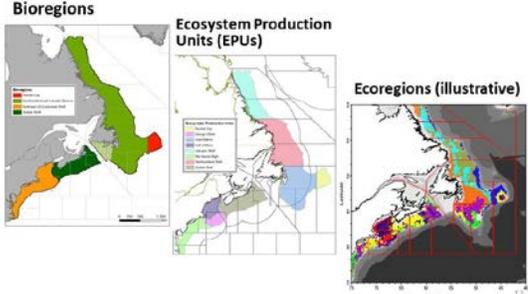
General operational description

Within an EPU, geographical area with consistent physical and biological characteristics. Often corresponds to a broadly defined seascape and/or major habitat type/class. It is within this spatial scales that more precise habitats can be identified (e.g. VMEs).

Precise boundaries at the ecoregion scale can vary with data availability; management at this scale would be better informed by "local" analyses.

Illustrative ecoregions from the integrated analysis of the East coast of North America

Spatial scales for ecosystem summaries and management



Bioregions

Ecosystem Production Units (EPUs)

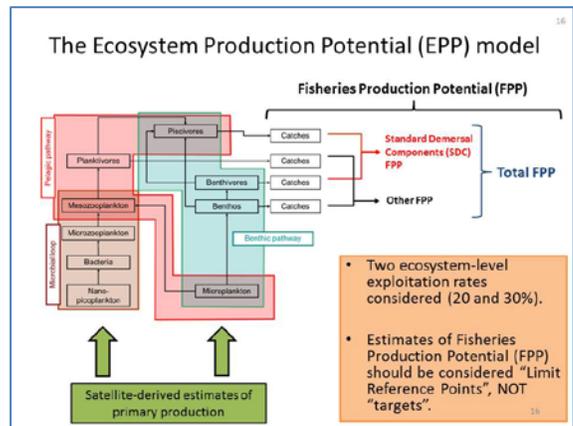
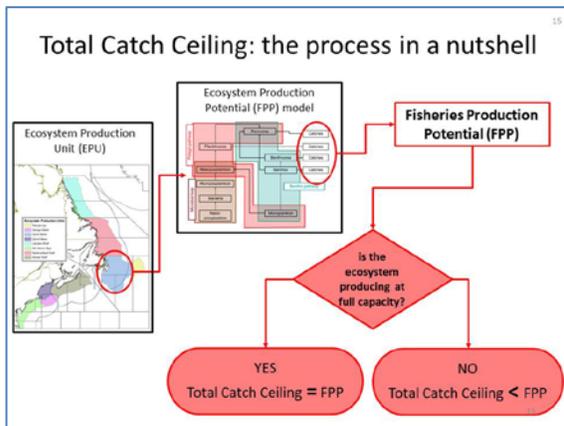
Ecoregions (illustrative)

Ecoregion Analyses: Summary

- Three nested levels of spatial organization were identified as relevant and useful for ecosystem summaries and management plans: **Bioregion**, **Ecosystem Production Unit (EPU)**, and **Ecoregion**.
- The EPU scale is proposed as the level for candidate ecosystem-level management units.
- Precise boundaries at the ecoregion scale can vary with data availability; management at this scale would be better informed by "local" analyses.

Ecosystem-level Management Areas and Total Catch Ceilings

- SC endorsed the Flemish Cap (NAFO Div. 3M), the Grand Bank (NAFO Divs 3LNO), and the Northeast Newfoundland Shelf (NAFO Divs 2J3K) EPUs as Ecosystem-level Management Areas for use in pilot implementations of EAF.
- Tier-1 of the Roadmap requires providing Total Catch Ceilings for defined Ecosystem-level Management Areas.
- In order to start the conversation on these aspects, a set of guidelines for "Total Catch Ceilings" for the above areas were developed.
- At this initial stage this is a "proof of concept". These guidelines are intended to help managers to begin assessing how current catch levels measure up to this additional management dimension, as well as stimulate the dialogue on how best to implement this new ecosystem-level limit reference point.



Fisheries Production Potential

- Total FPP densities were estimated around 2-3 tonne/km², with a general variability ranging around 1-5 tonne/km².
- These figures are remarkably consistent with Maximum Sustainable Yields (MSYs) from aggregate biomass production models for a suite of marine ecosystem, which were in the order of 1-5 tonne/km² (Bundy et al. 2012).
- When only Standard Demersal Components (SDCs) are considered, estimated FPP densities were around 0.6-1 tonne/km², while their variability ranged around 0.4-2 tonne/km².

From FPP estimates to Guidelines for Total Catch Ceilings

Considerations for "Total Catch Ceilings"

- FPP estimates represent a "best case scenario"
- If the ecosystem is *not* producing at full capacity, **FPP estimates** need to be **scaled down** to reflect current instead of maximum productivity state.

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Ecosystem Production State: Total biomass and P/B ratio

Flemish Cap (3M) EPU

- Total biomass is currently at or above the levels observed prior to the collapse in the early 1990s.
- Available data provides no indication of erosion in the current production capacity of this system.
- FPP estimates were considered a viable value for "Total Catch Ceiling"

Newfoundland Shelf (2J3K), Grand Bank (3LNO) EPUs

- Current total biomass in the NL Shelf and Grand Bank EPUs is in the order of 40-50% of pre-collapse levels.
- This indicates that the changes experienced by these systems eroded their production capacity, which remains impaired to this date.
- A **penalty factor of 50%** to account for ecosystem erosion was applied to the FPP estimates to generate "Total Catch Ceilings"

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Guidelines for Total Catch Ceilings

Guideline values for total catch ceilings for the NL Shelf (NAFO Divs 2J3K), Grand Bank (NAFO Divs 3LNO), and Flemish Cap (NAFO Div. 3M) Ecosystem Production Units (EPUs).

	Median Fisheries Production Potential (FPP) (thousand tonne/yr)				Median Total Nominal Landings (thousand tonne/yr)		
	Total FPP (20%)	Total FPP (30%)	SDC FPP (20%)	SDC FPP (30%)	1960-1979	1980-1989	1990-2012
NL Shelf (2J3K) 50% penalty	253	374	85	121	416	210	102
Grand Bank (3LNO) 50% penalty	357	534	117	171	446	304	119
Flemish Cap (3M)	129	192	43	62	42	34	53

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Total Catch Ceilings: we are already there

Guideline values for total catch ceilings for the NL Shelf (NAFO Divs 2J3K), Grand Bank (NAFO Divs 3LNO), and Flemish Cap (NAFO Div. 3M) Ecosystem Production Units (EPUs).

	Median Fisheries Production Potential (FPP) (thousand tonne/yr)		Median Total Nominal Landings (thousand tonne/yr)
	SDC FPP (20%)	SDC FPP (30%)	
NL Shelf (2J3K) 50% penalty	85	121	102
Grand Bank (3LNO) 50% penalty	117	171	119
Flemish Cap (3M)	43	62	53

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Total Catch Ceilings: Key observations

- Current fishing levels in these three EPUs are at the level of their estimated SDC "Total Catch Ceiling" ranges.
- This suggests that total catches in these ecosystems should not be increased; stock-specific TAC increases should be compensated by a decrease in another stock within the corresponding EPU.
- Total catches in the Flemish Cap currently are at their maximum level.
- The NL shelves ecosystems have the potential of doubling their current Total Catch levels if these systems are allowed to rebuild.

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