Trade-Offs: Fishing Opportunities and VME fishery closures

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Aim: To maximise the protection of VMEs whilst minimising the impact on fisheries

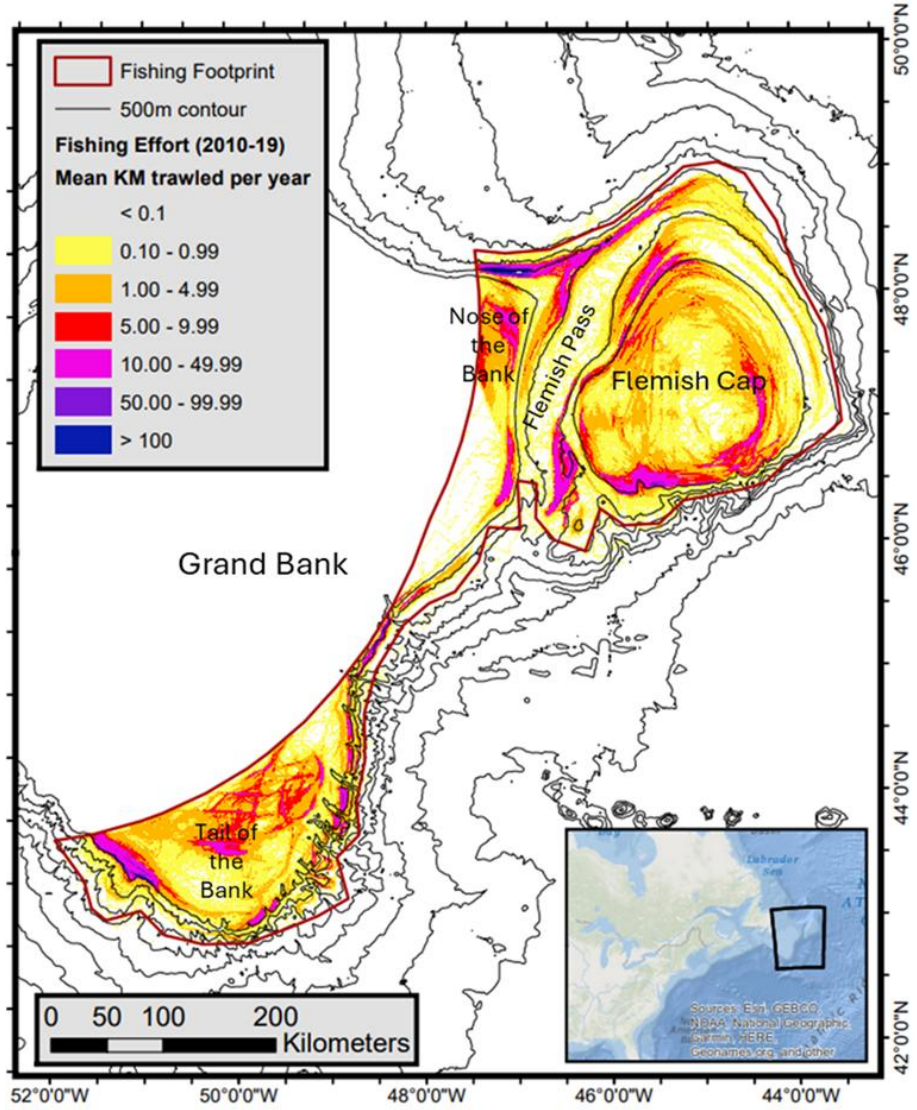
Approach

- **Fishing vessel activity**
  - Fishing vessel VMS data, logbook and catch data (preferably haul by haul)
- **Location of VMEs**
  - VME indicator species biomass and abundance data

Demonstrate a specific approach as used in NAFO

Fishing Vessel Activity

Fishing Effort



Maps of VMS fishing effort are very useful, but what about the proportion of the overall fishing effort and catches in specific areas.

Maps of *percentile* fishing effort can be more informative, especially in understanding how much area (or habitat) corresponds to a given level of fishing effort, which is important for assessing SAI.

Percentiles of Fishing Effort

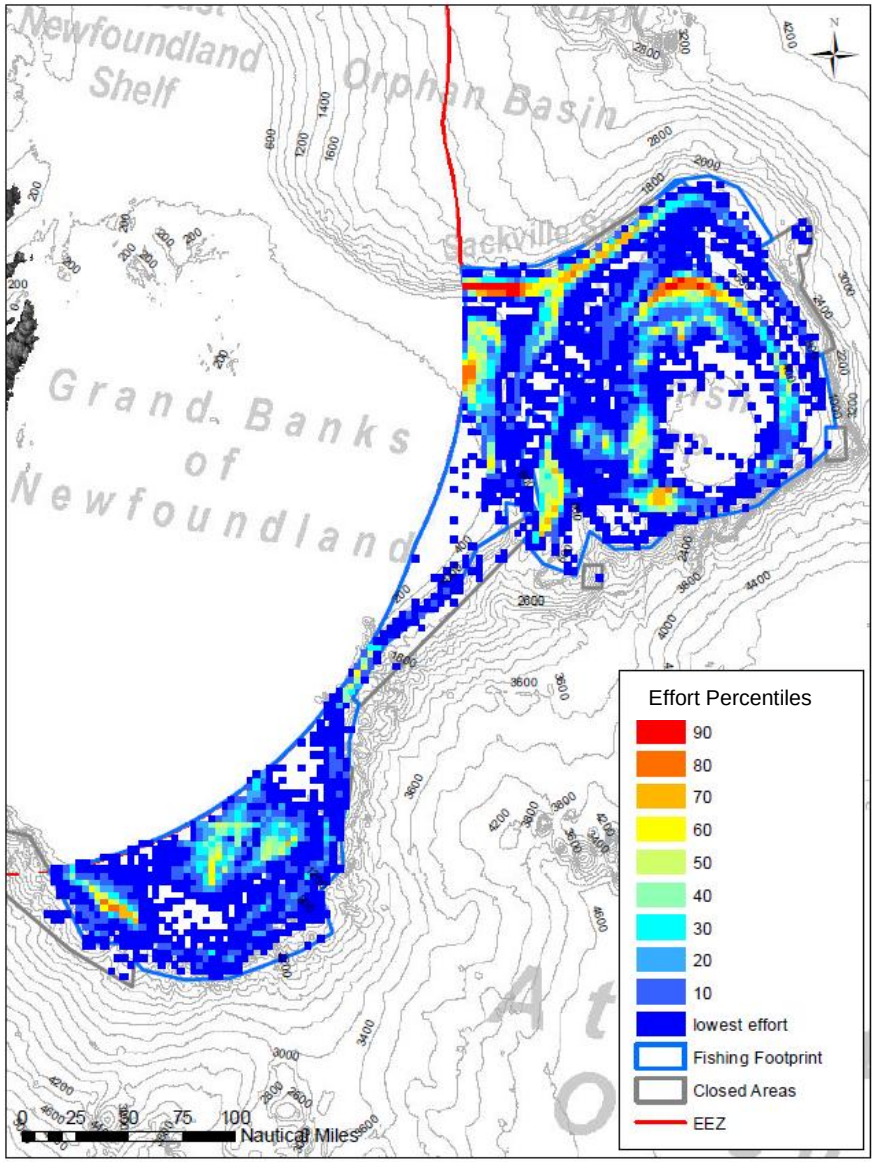
Ranked Cells

A total of 1,982 cells with pings ranging from 1 – 319 pings per cell

Cell	VMS Pings	lon	lat	%	Cumulative%
1	1	-50.50	42.76	0.005	0.00
2	1	-50.31	42.79	0.005	0.01
3	1	-51.35	42.82	0.005	0.01
.	.	.	.	.	.
.	.	.	.	.	.
1,161	4	-48.73	45.12	0.018	10.02
1,162	4	-48.39	45.48	0.018	10.04
.	.	.	.	.	.
.	.	.	.	.	.
1,531	9	-44.91	46.64	0.042	20.02
1,532	9	-46.67	46.81	0.042	20.06
.	.	.	.	.	.
.	.	.	.	.	.
1,975	235	-47.69	48.13	.	90.01
.	.	.	.	.	.
1,982	319	-47.61	48.14	1.471	100.00

0 - 10th Percentile Fishing Activity (1,161 cells) — Bottom 10%

90 - 100th Percentile Fishing Activity (8 cells) — Top 10%



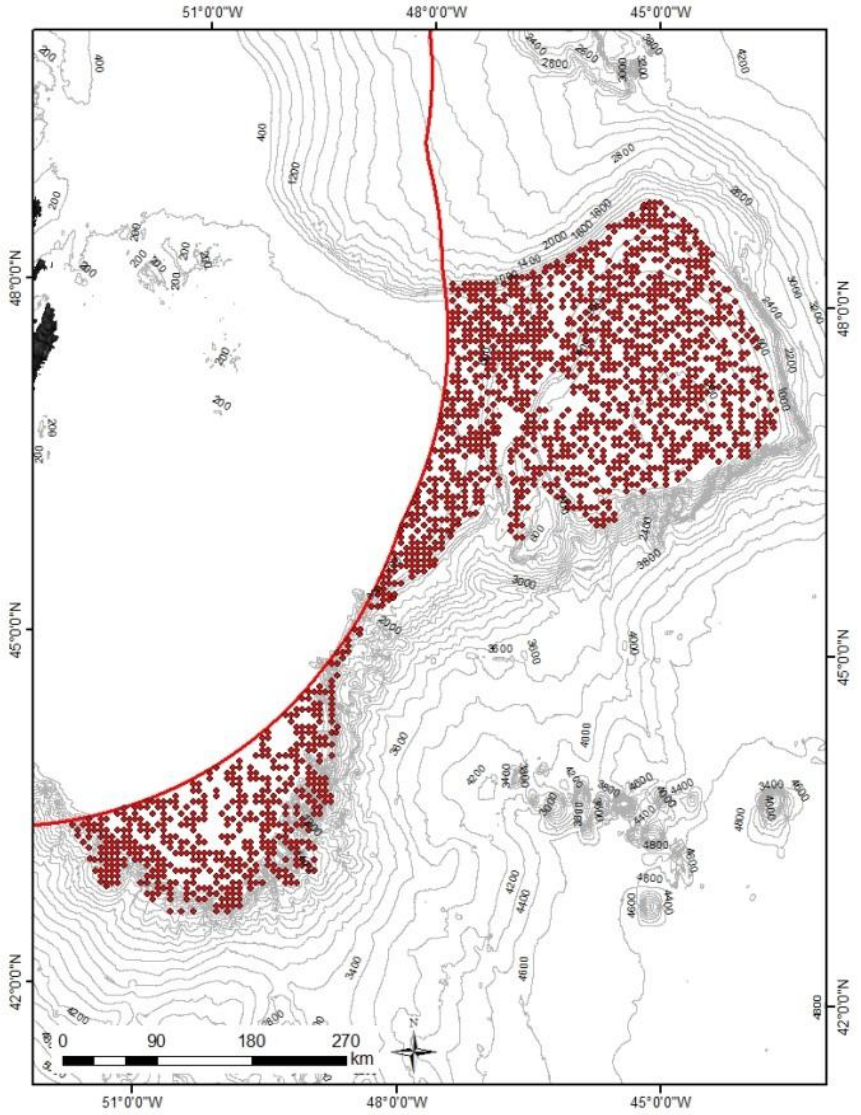
90 – 100th percentile (**top 10%** of all effort)	8	Cells
70 – 100th percentile (**top 30%** of all effort)	38	Cells
50 – 100th percentile (**top 50%** of all effort)	115	Cells
10 – 100th percentile (**top 90%** of all effort)	823	Cells
0 – 100th percentile (**100%** of all effort)	1982	Cells

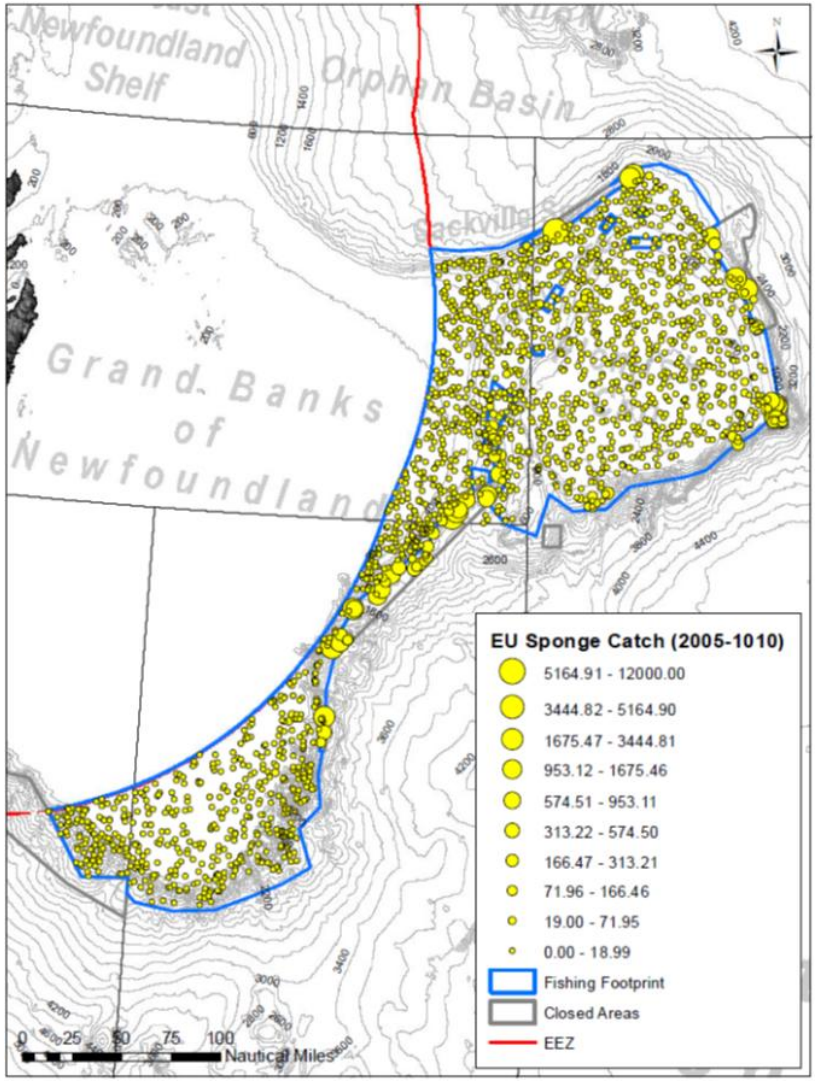
How important is this bottom 10 % of the total fishing effort in terms of the catch?

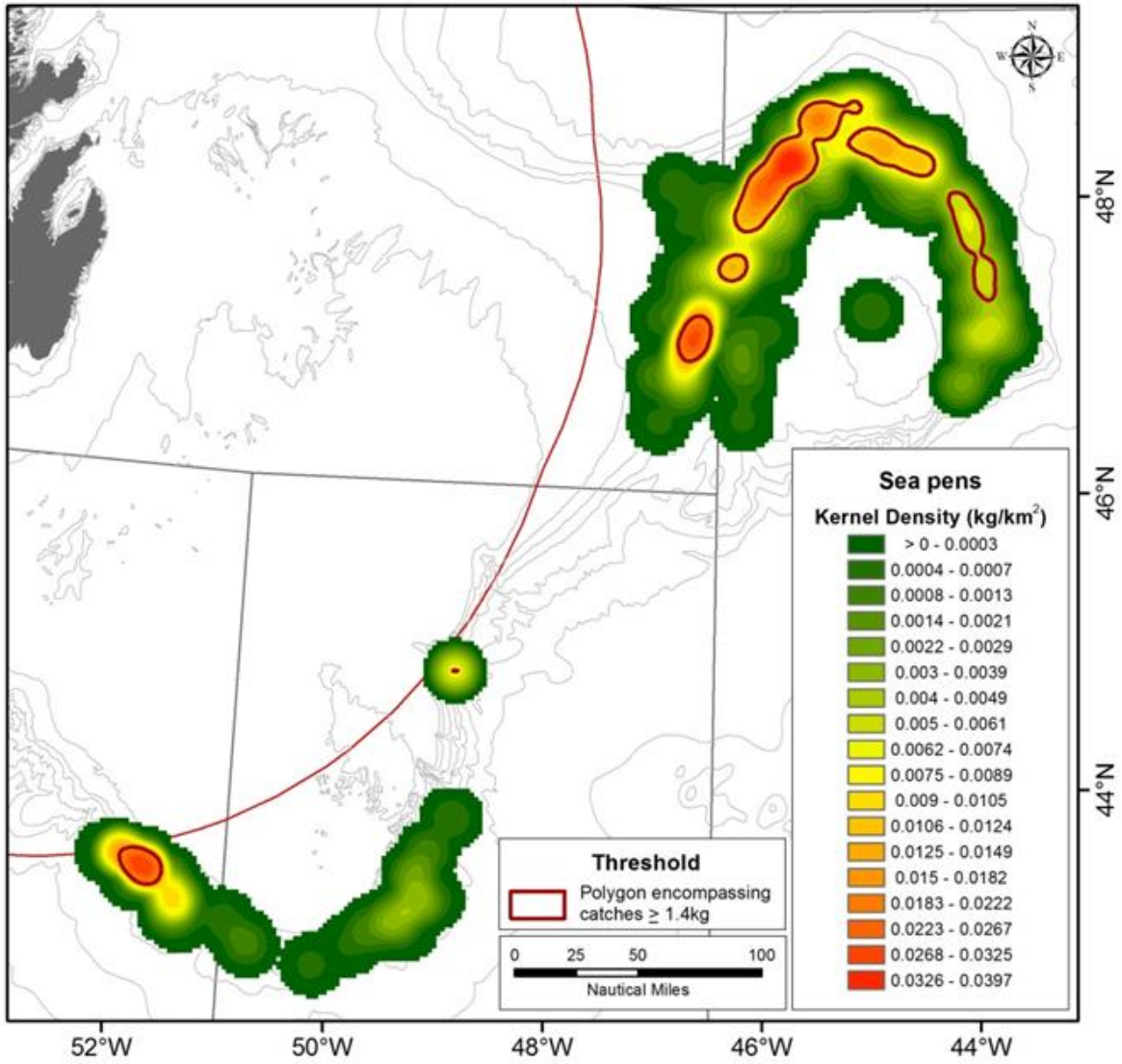
What risk to VME does this bottom 10% represent?

Location of VMEs

Trawl Samples VME indicator species biomass

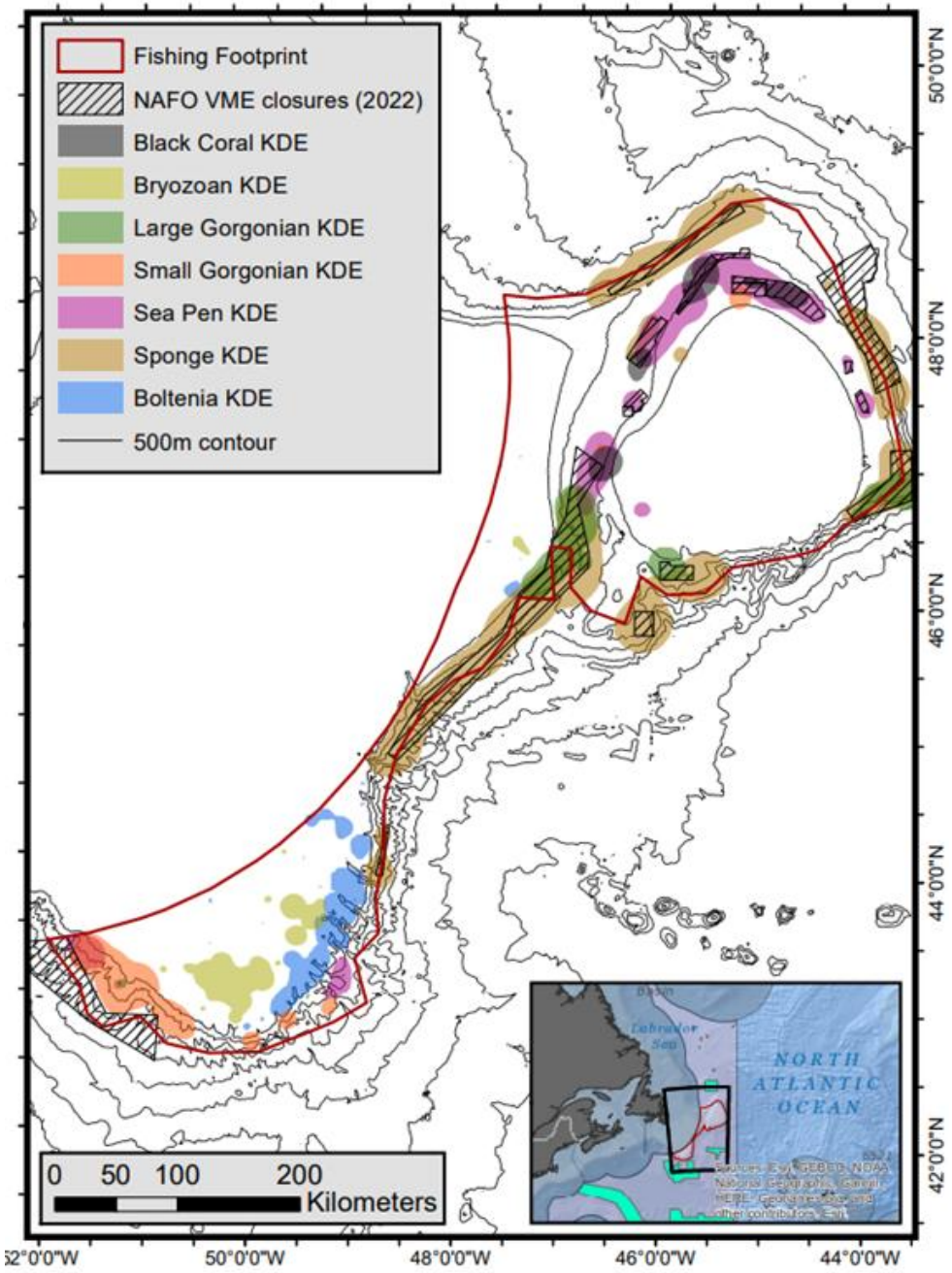


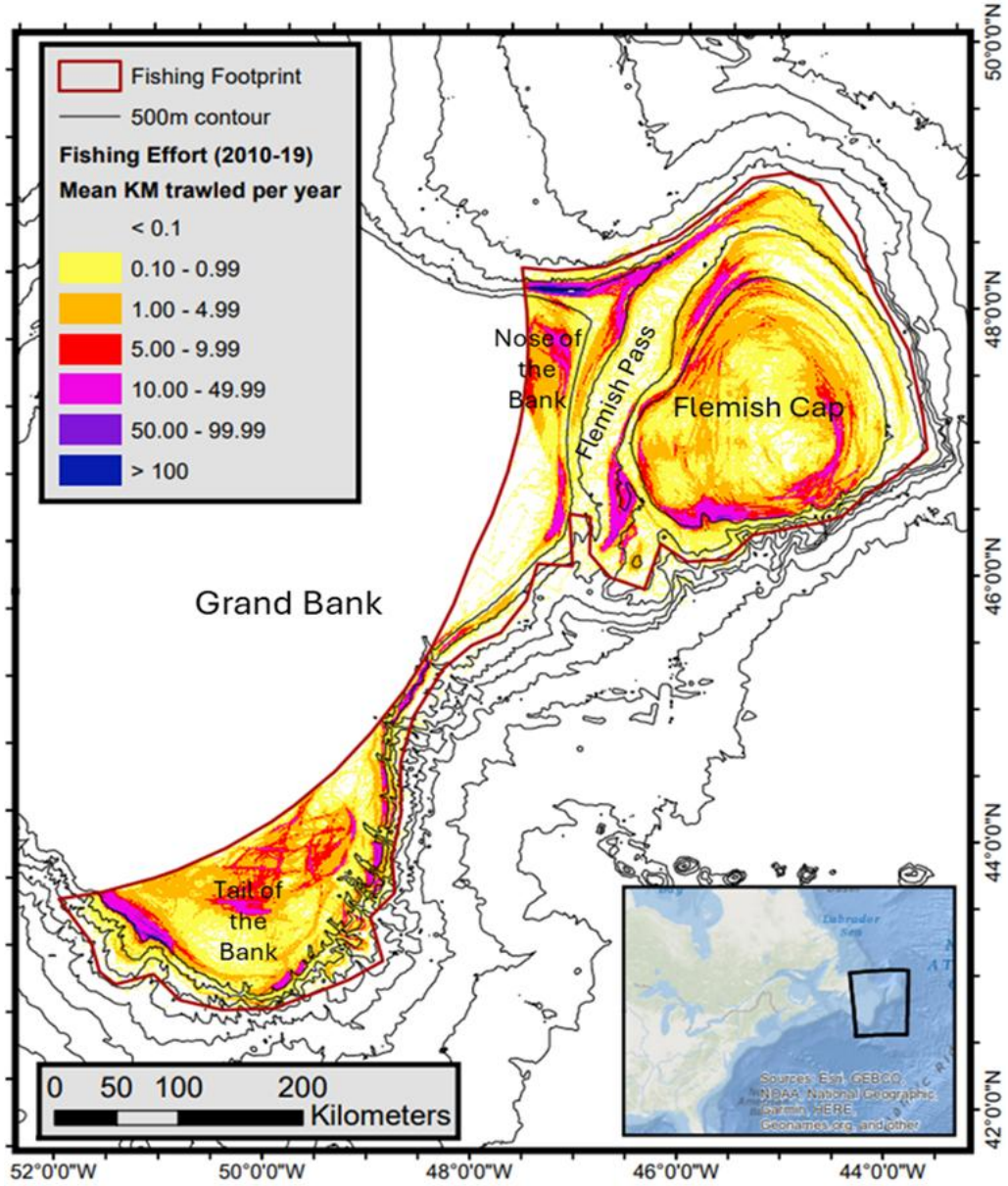


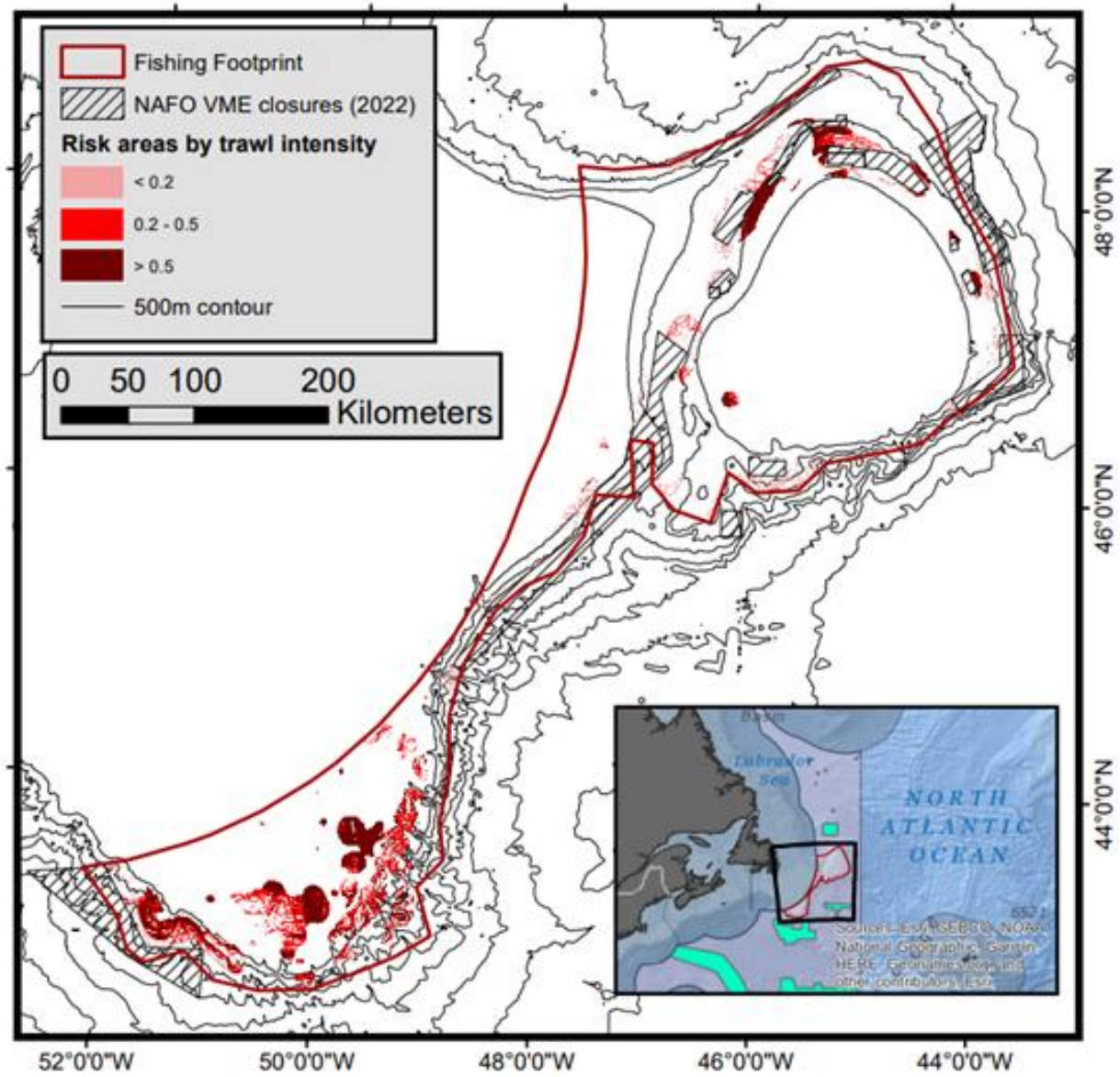


Applied KDE analysis to VME indicator species biomass data to identify “significant concentrations” and to define VME polygons.

Kenchington, E., Murillo, F. J., Lirette, C., Sacau, M., Koen-Alonso, M., Kenny, A., Ollerhead, N., Wareham, V., Beazley, L. (2014). Kernel Density surface modelling as a means to identify significant concentrations of Vulnerable Marine Ecosystem indicators. PLoS ONE 9(10): e109365. doi:10.1371/journal.pone.0109365


Fishing Footprint
NAFO VME closures (2022)
Black Coral KDE
Bryozoan KDE
Large Gorgonian KDE
Small Gorgonian KDE
Sea Pen KDE
Sponge KDE
Boltenia KDE
500m contour
0 50 100 200
Kilometers
50°0'0"N
48°0'0"N
46°0'0"N
44°0'0"N
42°0'0"N
52°0'0"W
50°0'0"W
48°0'0"W
46°0'0"W
44°0'0"W


Fishing Footprint
500m contour
Fishing Effort (2010-19)
Mean KM trawled per year
< 0.1
0.10 - 0.99
1.00 - 4.99
5.00 - 9.99
10.00 - 49.99
50.00 - 99.99
> 100
Nose of the Bank
Flemish Pass
Flemish Cap
Grand Bank
Tail of the Bank
0 50 100 200
Kilometers
50°0'0"N
48°0'0"N
46°0'0"N
44°0'0"N
42°0'0"N
52°0'0"W
50°0'0"W
48°0'0"W
46°0'0"W
44°0'0"W



Total combined VME polygon at "increasing risk of impact" to fishing. The area represents 16% of the total fishing footprint.

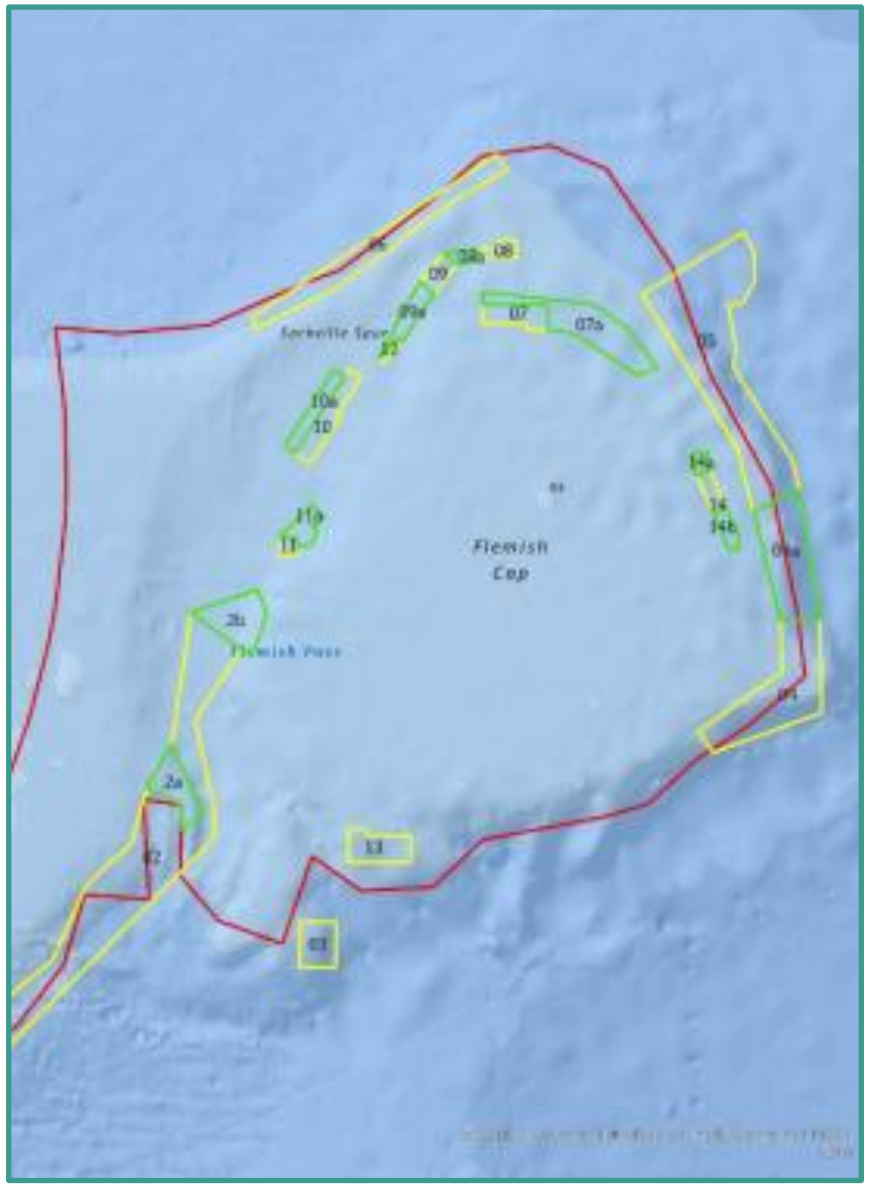
Effort in these areas is generally extremely low, equivalent to a trawling frequency of between 2 and 5 times per **decade**.

So, these areas are **unlikely** to be important fishing areas, but the risk of SAI is high due to the sensitivity of VMEs and their slow recovery potential.

Excluding bottom trawling from areas with a historic fishing intensity of less than 0.10 $km \cdot km^{-2} \cdot y^{-1}$ would increase the overall protected proportion of VME biomass by an average of 20 %

Management Options

- In 2021 NAFO investigated establishing several new closures and extending existing closures into these high-risk areas.
- This required a trade-off analysis between different closure options to maximise the protection of VMEs whilst minimising the impact on fisheries.



All figures refer to the reassessment of NAFO bottom fisheries conducted in 2021.

Percentage of Catch from VMEs (outside current closures)	All VMEs
Cod	
Catch current	5.75%
Catch current + proposals	5.72%
Difference	**-0.03%**
Greenland Halibut	
Catch current	39.13%
Catch current + proposals	37.82%
Difference	**-1.31%**
Redfish	
Catch current	21.21%
Catch current + proposals	20.56%
Difference	**-0.65%**

Additional VME biomass protected (%)
Black coral 52%
L. Gorgonian 2%
Sea Pen 31%
L. Sponge 3%

Conclusions

- Most of the proposed closures were accepted by the Commission with the exception of proposed closures for Small Gorgonians, Bryozoans and Sea-Squirts. These will be further evaluated in 2027, along with all VMEs.
- Long-time series high resolution VMS and catch data is helping to achieve the maximum protection of VMEs whilst minimising the impacts on the fishery.
- Further work is on-going to better assess the importance of VME closures, at a functional level, including their ecological connectivity, and the potential ecosystem level consequences of SAI.

Thank you for listening

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