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**New data on deep-water corals and large sponges from bottom trawl groundfish surveys in the NAFO Regulatory Area (Divs. 3LMNO): 2011-2013 period**

by

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New data on deep-water corals and sponges are presented based on Spanish/EU and Canadian bottom trawl groundfish surveys for the period 2011-2013 in order to make these data available to the NAFO WGESA and improve the mapping of sensitive species in the NAFO Regulatory area (Divs. 3LMNO). “Significant” catches (according to the NAFO definition from groundfish surveys) of deep-water corals and sponges are provided and mapped together with the areas closed in 2010. Most of the significant catches of sponges (78.6%) are inside of the closed areas, meanwhile for corals the results are different according to the group considered. For large gorgonians the 87.5% are outside, for sea pens the 75% and for all small gorgonians the significant catches recorded are outside of the closed areas.

**Introduction**

Between November 19<sup>th</sup> and 28<sup>th</sup> 2013 the sixth NAFO WGESA (formerly known as NAFO SC WGEAFM) meeting was held in Dartmouth (Canada). One of the terms of reference of the group was the *Update on identification and mapping of sensitive species and habitats in the NAFO area*. In order to make data available and improve the mapping of sensitive species in the NAFO area, new data on deep-water corals and sponges were presented based on Spanish/EU and Canadian bottom trawl groundfish surveys for the period 2011-2013.

During the years 2008 and 2009, the NAFO WGEAFM identified “significant” concentrations of corals and sponges in the NAFO Regulatory Area (Divs. 3LMNO) from groundfish trawl survey data. Significant concentrations of deep water corals were identified by a cumulative catch weight distribution method (NAFO, 2008) and quantitative spatial analysis method was used for sponges (Kenchington *et al.*, 2009; NAFO, 2009). During the 6<sup>th</sup> WGESA meeting quantitative spatial analysis method was applied for corals and it was carried out again for sponges with all the data available. From these analysis, new thresholds were selected for significant concentrations of coral and sponges as follows: 75 kg per tow for sponges, 0.6 kg per tow for large gorgonians, 0.15 kg per tow for small gorgonians; and 1.4 kg per tow for sea pens (NAFO 2013). Since the coral and sponge closures were put in place (NAFO 2010) new areas with significant concentrations have emerged outside of the closures.

## Material and Methods

Data used in this study come from four different bottom trawl groundfish surveys:

1. The Spanish 3NO Survey, carried out by the Instituto Español de Oceanografía (IEO), samples the Grand Bank of Newfoundland (NRA, Divs. 3NO) between 42 and 1462 m depth (González-Troncoso *et al.*, 2013).
2. The EU Flemish Cap Survey, carried out by the IEO together with the Instituto de Investigaciones Marinas (IIM) and IPIMAR (Portugal), samples all the Flemish Cap (NAFO Div. 3M), and currently a depth range between 132 and 1450 m (Casas and Gonzalez-Troncoso, 2013).
3. The Spanish Fletán Negro-3L Survey carried out by the IEO, samples the Div. 3L in the NRA between 112 and 1478 m depth (Román *et al.*, 2013).
4. DFO NL Multispecies Surveys (NRA Divs. 3LMNO), carried out by Fisheries and Oceans, Canada between 47 and 723 m (Gilkinson, 2013).

Surveys 1 to 3 were carried out between May and August for the period 2011-2013, using a random-stratified sampling design with standardized 30-minutes bottom trawls and vessel speed of 3 knots (surveys 1 and 3) and 3.5 knots (survey 2). The main objective of these surveys is the estimation of abundances and biomass indices of the main demersal species, and the demographic structure of their populations. Campelen 1800 bottom trawl gear was used in the Flemish Pass and the Grand Bank of Newfoundland (NRA Divs. 3LNO), whereas a Lofoten bottom trawl gear was used in the Flemish Cap (Div. 3M). Surveys 4 for the period 2011-2012 were carried out using a random-stratified sampling design with standardized 15-minutes bottom trawls and vessel speed of 3 knots. Campelen 1800 bottom trawl gear was used.

Deep water corals and sponges were weighted (in the case of massive sponge, catches were extrapolated from samples or estimated visually) and recorded by scientific staff on board, and some samples were preserved for posterior studies in laboratory.

In order to follow the same groups previously used by WGEAFM, deep water corals were grouped in large gorgonians (Alcyonacea), small gorgonians (Alcyonacea) and sea pens (Pennatulacea); and all the sponges were grouped together. Some data of the species of corals and sponges present in the area have been previously published (Wareham and Edinger, 2007; Wareham, 2009; Fuller, 2011; Murillo *et al.*, 2011a; Murillo *et al.*, 2012).

Data from the surveys undertaken in NAFO Regulatory Area (Divs. 3LMNO) during 2011-2013 period are analysed in this document. A total number of 1154 bottom trawls were studied from Spanish/EU surveys and 128 from Canadian surveys (only presence data is available). DFO NL Multispecies Surveys cover Divisions 3LNO and part of Division 3M, for this reason as well as only presence of sponge or coral data was available, only the Spanish/EU surveys that cover uniformly the entire study area in the NRA (Divs. 3LMNO) have been used for the calculation of the percentage of presence for the different groups of corals and sponges.

Distribution maps of presence and significant catches of sponges, large gorgonians, small gorgonians and sea pens following the new thresholds defined during the 6<sup>th</sup> WGESA (NAFO, 2013) are presented in this document, based on data from RV surveys. Location of the corals and sponge records was assigned to the start position of the survey fishing tows. The coordinates and weight of the significant catches are provided in Table 1.

All the geographical databases were plotted using the WGS 1984 web Mercator to avoid distorting

the data surfaces. Moreover, bathymetric curves were exported as shapefiles (ArcMap format) from GEBCO.

## Results

### Sponges

Sponges were recorded in 810 of the total tows (688 Spain/EU, that represents 59.61% of the Spanish/UE tows analyzed and 122 Canada), mainly in the Flemish Pass, Flemish Cap and slope of the Grand Bank and significant catches ( $\geq 75$  kg/tow) were found in 28 tows (Figure 1), most of them in the areas identified previously as sponge grounds composed of large sponges of the Families Geodiidae and Ancorinidae in the Divisions 3LMNO of the NRA (ICES, 2009; NAFO, 2009; Murillo *et al.*, 2012) that were closed in 2010.

Of the total 28 tows, only 6 are outside of the closed areas (Table 1) although they were very close to them, and the sponge catch of these tows was between 586 and 6655 kg with an average ( $\pm$  SD of the mean) of  $2997 \pm 2725$  kg. Significant catches inside the closed areas were  $572 \pm 762$  kg with the higher values up to 3444 kg in a tow in the south of Flemish Pass. Significant differences (Mann-Whitney U test, p value = 0.004) between the significant catch averages from both areas were found.

### Large gorgonians

Large gorgonians include the species *Acanthogorgia armata*, *Keratoisis* spp., *Paragorgia* spp. and *Paramuricea* spp. They were recorded in 54 tows (46 Spain/EU, that represents 4% of the Spanish/UE tows analyzed and 8 Canada) between 158 and 1409 m. Eight significant catches ( $\geq 0.6$  kg/tow) were found with an average of  $8.52 \pm 11.88$  kg. Only one of the eight significant catches was inside of the closed areas (Figure 2). Table 1 shows the significant catches outside of the closed areas.

### Small gorgonians

Small gorgonians include the species *Acanella arbuscula*, *Anthothela grandiflora* and *Radicipes gracilis*. They were recorded in 133 Spanish/UE tows (11.58% of the tows analysed), mostly in the slope of the Grand Bank, Flemish Cap and Flemish Pass between 500 and 1462 m. Two significant catches ( $\geq 0.15$  kg/tow) were found outside of the closed areas in the slope of the Grand Bank between 798 and 1397 m (Table 1 and Figure 3). Above mentioned significant catches were between 0.188 and 1.79 kg

### Sea pens

Sea pens were recorded in 402 tows (387 Spain/EU, that represents 33.54% of the Spanish/UE tows analyzed and 15 Canada). They showed a horseshoe distribution around Flemish Cap and along the slope of the Grand Bank. According to the 6<sup>th</sup> WGESA new thresholds, significant catches ( $\geq 1.4$  kg/tow) were found in 3 tows located in the southeast of Grand Bank next to the Coral Protection Zone closure in NAFO Div. 3O and the Flemish Pass (Table 1). Figure 4 shows the significant catches between 1.5 and 9.95 kg, as well as presence records.

## Discussion and conclusion

Significant catches of sponges for the new data analysed were found around the same areas that those obtained in 2009 (NAFO, 2009) and 2011 (Murillo *et al.*, 2011b) and only 6 of the 28 catches were found outside of the closed areas. The significant catches found outside the closed areas had significant higher values than the catches found inside, although some improvements and modifications of the closures could be done (Figure 5).

For large gorgonians, the most significant catches were recorded outside of the closed areas, and these areas should be refined in the future to incorporate these significant catches (one of 36.9 kg) in the closed areas. For small gorgonians the significant catches were localized in the south of Grand Bank outside of the closed areas. Three significant catches of sea pens were recorded outside of the closed areas, but in proximities of them (Figure 5). Significant catches in the northeast of Flemish Cap were not observed in contrast to the period 2008-2010 (Murillo *et al.*, 2011b).

The results of this study together with previous study (Murillo *et al.*, 2011b) and other data from the oncoming NEREIDA Project could be used in 2014 when the revision of the areas will be revisited (NAFO, 2012).

There is a general concern about the environmental impacts of science research on VMEs (OSPAR, 2008). Despite that the NAFO areas known to have VMEs generally are avoided by the groundfish surveys (E. Román, pers. comm.), some records of indicator species suggest that surveys could cause some degree of disturbance, particularly, in those areas less used by the commercial fishery. In such areas scientific activities, such as the traditional trawl methods presented here, could represent the main disturbance factor on sensitive habitats like VMEs. Brodie and Ollerhead (2012) examined the overlaid of the closed areas with the sampling strata used in trawl surveys of NAFO Divisions 3LMNO and identified 46 survey strata which intersect the closed areas and these closures represent approximately the 25% of the total measured area of affected strata. In order to solve the issue of whether to survey in a closed area or not, they provide several options to consider. We encourage more studies like that in order to establish sampling guidelines to prevent adverse effects on sensitive areas.

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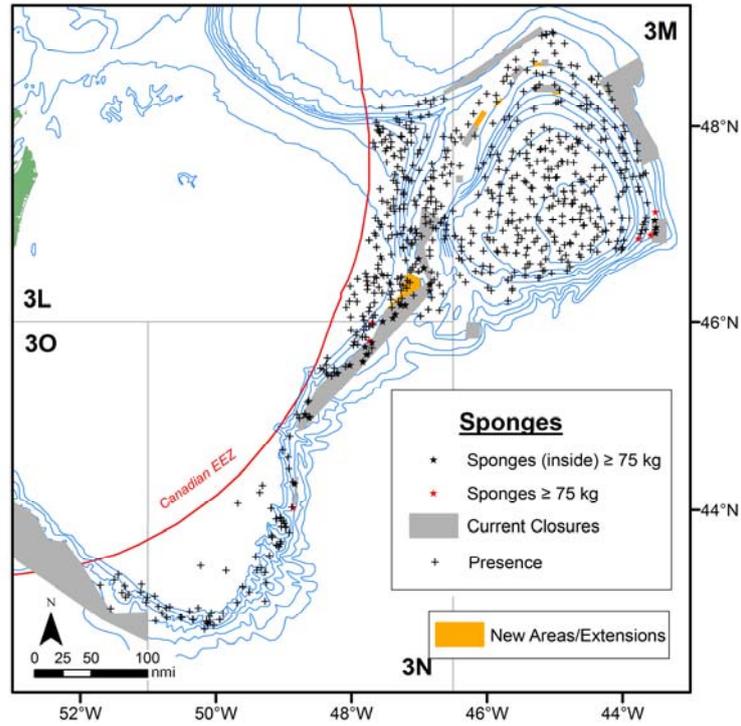
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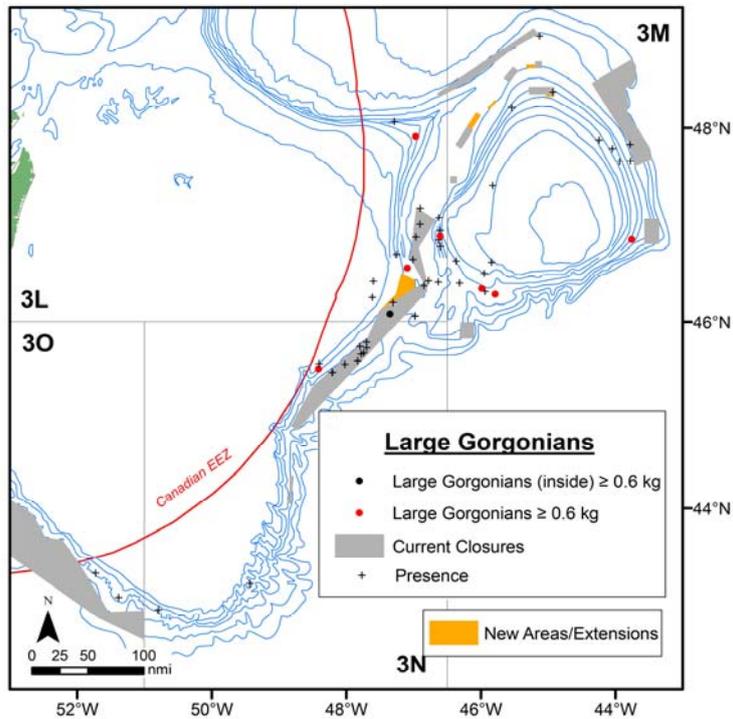
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**Table 1.-** Start positions of tows with corals and sponges catches above the threshold defined as significant catch (NAFO 2013) in the NRA (Divs. 3LMNO) outside of the closed areas with their corresponding weight in the period 2011-2013.

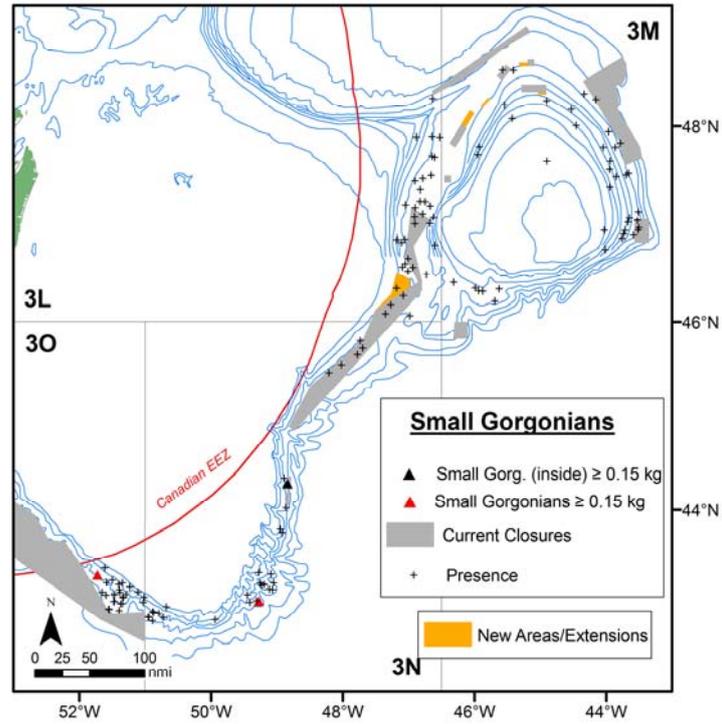
Country	Year	Start position		VME species	Weight (kg)
		Lat (N)	Lon (W)		
Spain/EU	2013	47° 08' 16.80''	43° 30' 29.88''	SPONGES ≥ 75 kg	6655.003
Spain/EU	2011	46° 53' 44.99''	43° 34' 50.41''		5691.200
Spain/EU	2013	46° 51' 25.20''	43° 45' 15.48''		3599.151
Spain/EU	2013	45° 59' 02.40''	47° 41' 45.60''		779.063
Spain/EU	2012	45° 47' 55.21''	47° 43' 47.39''		674.632
Spain/EU	2013	44° 01' 18.59''	48° 51' 20.41''		585.644
Spain/EU	2012	45° 30' 05.40''	48° 24' 34.20''	LARGE GORGONIANS ≥ 0.6 kg	36.900
Spain/EU	2012	46° 20' 50.39''	45° 59' 01.79''		9.330
Spain/EU	2013	46° 53' 16.80''	46° 36' 01.08''		8.560
Spain/EU	2013	46° 33' 51.59''	47° 05' 27.60''		5.298
Spain/EU	2013	46° 51' 25.20''	43° 45' 15.48''		2.700
Canada	2012	47° 54' 47.99''	46° 57' 54.00''		2.360
Spain/EU	2012	46° 17' 14.39''	45° 47' 04.20''	0.880	
Spain/EU	2013	43° 17' 36.60''	51° 43' 15.60''	SMALL GORGONIANS ≥ 0.15 kg	1.791
Spain/EU	2011	43° 00' 14.40''	49° 16' 15.60''		0.292
Spain/EU	2013	43° 17' 36.60''	51° 43' 15.60''	SEA PENS ≥ 1.4 kg	9.946
Spain/EU	2012	47° 11' 49.81''	46° 40' 10.20''		4.968
Canada	2011	43° 21' 36.00''	51° 43' 54.00''		1.500



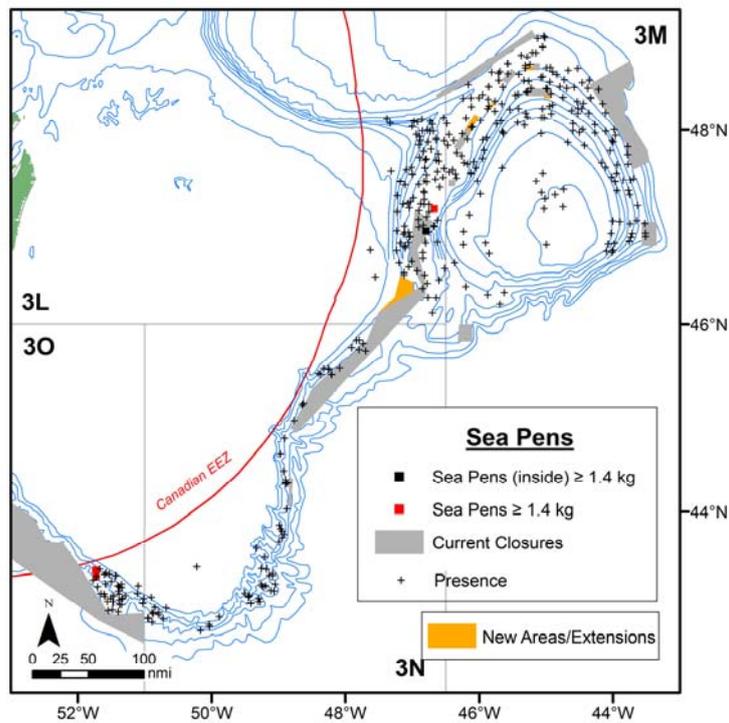
**Figure 1.-** Distribution of significant catches and presence of sponges in the study area (NAFO Divs. 3LMNO).



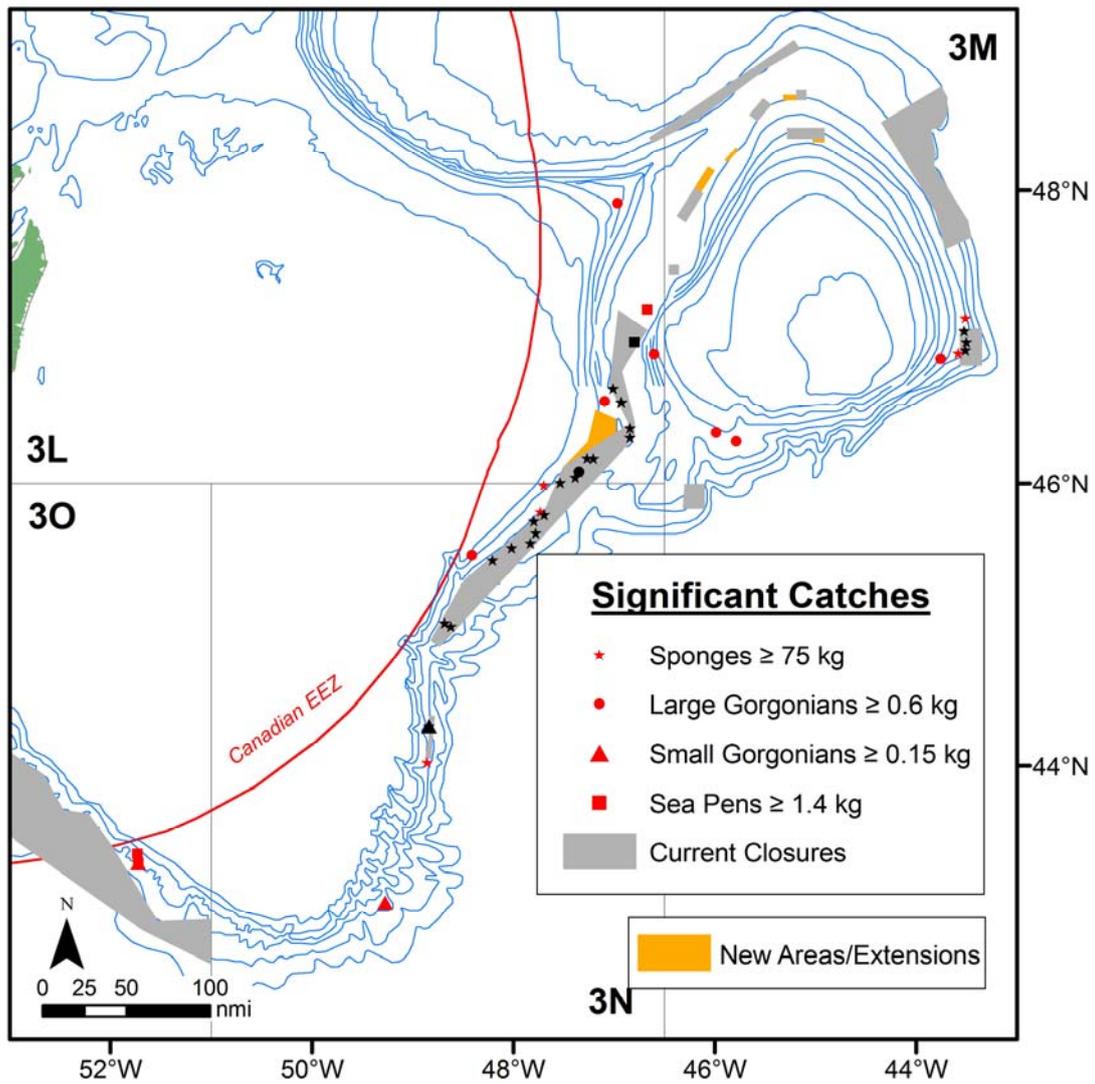
**Figure 2.-** Distribution of significant catches and presence of large gorgonians in the study area (NAFO Divs. 3LMNO).



**Figure 3.-** Distribution of significant catches and presence of small gorgonians in the study area (NAFO Divs. 3LMNO).



**Figure 4.-** Distribution of significant catches and presence of sea pens in the study area (NAFO Divs. 3LMNO).



**Figure 5.-** Distribution of significant catches of deep-water corals and sponges in the study area (NAFO Divs. 3LMNO). The location of all areas currently closed to protect significant concentrations of corals and sponges in the NRA (Divs. 3LMNO) are also indicated (NAFO 2012).