

Interactive comment on “Macrofauna community inside and outside of the Darwin Mounds SAC, NE Atlantic” by N. Serpetti et al.

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We thank the reviewer for the positive comments and for the effort on revising the manuscript. We followed all the changes suggested that have strongly improved the manuscript. Please see below for the details of our responses.

1. My major concern is that the study was conducted seven years after the bottom trawling has been closed in the Darwin Mound SAC. The baseline information on macrofaunal communities in the area is not presented in the manuscript. To understand the effect of bottom trawling, data needs to be collected before the impact, in disturbed communities and monitored after the impact. When material is collected seven years after the impact, it is not clear what is analysed. Seven years is a good time for complete (or almost complete) recovery of heavily disturbed deep-sea benthic

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communities, even abyssal, i.e. less dynamic (see results of the DISCOL experiment, summed up by Thiel, 2003).

Response: We agree that having the macrofauna baseline information at the same coordinates before the SAC establishment would be very interesting information. The Darwin Mounds coral reefs were discovered in 1998 during the AFEN surveys (Atlantic Frontier Environmental Network; Bett, 2001) and the only macrofauna data available in the Rockall Trough area before the Darwin Mounds SAC establishment are collected in the AFEN database (2000). However the samples were collected over a vast area, over a wide range of sediment types and depths and the sample processing was carried out with a coarser sieving mesh. For this reason the comparison made was only qualitative and across selected stations from the AFEN database, selecting comparable sampling stations in terms of distance, depth and sediment characteristics. The aim of our study is a preliminary attempt to assess the trawling impact on the macrofauna community comparing samples collected inside and outside the Darwin Mounds SAC and not to determine the macrofauna community changes before and after the SAC establishment. Moreover, we would like also to underline that the video analysis carried out during the cruise RRS James Cook cruise 060 in May–June 2011 showed that even if the closure of the Darwin Mounds to bottom trawling seems to be fairly well respected, the area still appears to be covered in mainly dead coral, especially the region towards the east, and overall there was little evidence of recovery (Huvenne, 2011). This is particularly interesting in relation to the findings of Thiel's (2003) and it could indicate that the Darwin Mounds SAC closure is not well respected as it seems and/or that the ecosystem recovery can follow different modalities depending on the type of impact. The DISCOL experiment carried out in the late 1980's and early 1990's was aimed to analyse the impact of mining on the ecosystem and the faunal recovery. The mining activity affects all faunal benthic size classes, and after seven years from the impact, even if with different modalities, all benthic size classes (mega-, macro- and meiofauna) were back near the baseline values. However, the trawling activity has a higher impact on the megafauna that could determine shifts of the size classes com-

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munity that affect the recovery time. These considerations definitely need to be added to our manuscript.

2. The ms by Serpetti et al. presents data on patterns of horizontal distribution of macrofaunal communities in the Darwin Mound area. There is no convincing evidence of any effect of trawling. All reported differences can be explained by patchiness and scale of benthic communities in the deep-sea (e.g. Budaeva et al., 2008). By the way, the distance between the two studies areas, inside and outside the SAC, remains unclear from the ms.

Response: Discovered in 1998, the Darwin Mounds were designated a SAC in 2004 after concerns about possible damage from hydrocarbon exploration and bottom trawling. The effect of trawling activity on benthic fauna has often been recorded and the evidence of the damage in the study area has been previously reported (Wheeler et al., 2005) and also monitored just before the SAC establishment (Davis et al., 2007). Macrofaunal patchiness could definitely be an issue for our comparison due to the spatial vicinity between the samples: the maximum distance between all the stations, both within and outside of the SAC is 18 km (as given in the material and methods section, page 16911, line 14). However in our study we are trying to underline the high similarity of the community composition between all the samples collected (between 57% to 71%). The small dissimilarity in terms of macrofauna community was driven by the distributions of a few rarer species. The major difference found between stations collected outside and within the SAC was driven by macrofaunal abundances. Similar results were found by Budaeva et al. (2008) showing high similarity between the samples and no differences in term of biodiversity. The main difference found between two macrofauna assemblages, identified by Budaeva et al., was determined by the rank order of the dominant species; however no significant differences were found in terms of total abundances across their sampling stations. As mentioned earlier, we compared our results with comparable sampling stations from the AFEN database: the maximum macrofaunal community similarity found between these selected stations with similar

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depth and sediment properties in the north-east of the Rockall Trough database was 40% (data not shown).

3. Data is lacking on the composition of macrofauna in the studied area. A list of recorded taxa is essential. Response: The list species has been added as supplementary material

4. The section Results needs to be re-written. It starts immediately with discussing observed differences before presenting actual results on community characteristics in the two areas. Response: Please see Response point 5)

Other comments were made in a form of sticky notes alongside the manuscript. Responses:

1) Pp. 16907, title: Abbreviation needs to be introduced. In the title better give the term in full. Response: The title is changed to "Macrofauna community inside and outside of the Darwin Mounds Special Area of Conservation, NE Atlantic"

2) Pp. 16909, line 14: Why switching to megafauna in comments about importance of macrofauna? Response: The sentence has been removed.

3) Pp. 16910, line 4: Communities or species? Response: Species

4) Pp. 16911, line 23: "High number of individuals" is not a sound argument to mix macro- and meiofauna in community analysis. The two size classes may have different horizontal distribution patterns and recovery rates (Thiel, 2003). One of the reasons is a lack of planktonic larvae in meiofauna species.

Response: Different distribution patterns and recovery rates between benthic size classes is related to their body-size, their interactions (predator/prey and competition) and trophic level. Within the same size class (e.g. macrofauna) different taxa can also have different rates of species replacement (e.g. higher for gastropods compared to polychaete and bivalves, (Rex and Etter, 2010)). More than a "definition" of which taxa is belonging to different size class, we analysed every taxa retained on a 250 μm mesh

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sieve including nematodes and copepods. The sentence has been rephrased as.
“We analysed all the taxa retained on 250 μ m including nematodes and copepods. However the specimens were not identified to species level and in the diversity calculations the nematode phylum was used as a single entity, whilst the copepod phylum was split into 3 orders, Calanoida, Cyclopoida and Harpacticoida.” Reference: Rex, M. A. and Etter, R. J.: Deep-Sea Biodiversity, Pattern and Scale. Harvard University Press, Cambridge, Massachusetts, London, England, 5, Beta diversity along depth gradients, pp. 171-198.

5) Pp. 16912, line 17: Results start with discussion! Please, present raw data first. Also, it would be better to present first data on fauna and after that on the sediment parameters.

Response: Statistical tests are generally part of the results. The results were split into two sections, univariate and multivariate analysis, based on the statistical tests. We re-structured the results (see below).

3 Results Brief general description of the macrofauna community (dominant taxa and species) has been added. 4.1 Macrofauna standing stock and diversity 4.2 Macrofauna community structure and composition 4.3 Sediment properties

6) Pp. 16913, line 1: This is discussion again in the Results section.

Response: The sentence has been rephrased. “Across all the taxonomic levels, significant differences in abundances between stations collected outside and within the SAC were found only for polychaetes ($p < 0.05$), crustaceans ($p < 0.01$) and nematodes ($p < 0.05$) (Fig. 3a).”

7) Pp. 16914, 17: The first two large paragraphs of the Discussion section are not a “discussion” of results, they would fit better in Introduction. Response: The paragraphs have been moved to the introduction.

8) Pp. 16916, line 18: Conventional size of mesh for macrofauna is

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0.5-0.3 mm (see Glossary in Ecosystems of the Deep Oceans (2003), and <http://en.wikipedia.org/wiki/Fauna>).

Response: Unfortunately there are many studies referring to “macrofaunal” community studies where different meshes have been used, mostly 0.5mm, 0.3mm and 0.25mm, (Gage & Bett 2005; Rex and Etter, 2010; Narayanaswamy et al. in press), but even coarser 20-30mm (Clark and Rowden, 2009) and 1mm (Kaiser and Spencer, 1996). Nowadays, most macrofaunal samples are washed on either a 0.3mm or 0.25mm mesh sieve.

9) Pp. 16919, line 6: Your data rather indicate patchiness and high variability in distribution pattern typical for this species (see Pipenburg and Juterzenka, 1994).

Response: This reference has been added to the manuscript. “Echinoderms, mostly consisting of *Ophiocten gracilis* species, were the only phylum that showed a higher percentage contribution of abundances inside the SAC sites compared to outside (Fig. 3b) indicating that this species might be particularly vulnerable to damage or disturbance by beam-trawling. However this aspect could also reflect the patchy distribution pattern typical of this species (Pipenburg and Juterzenka, 1994).” Reference: Piepenburg, D. and von Juterzenka, K.: Abundance, biomass and spatial distribution pattern of brittle stars (Echinodermata: Ophiuroidea) on the Kolbeinsey Ridge north of Iceland. Polar. Biol., 14: 185-194, 1994.

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