The relationship between cold-water corals and fish communities in the NE Atlantic

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Introduction:

Cold-water coral reefs form complex three-dimensional habitats, which are thought to act as refuge and nursery areas for fish (Buhl-Mortensen *et al*., 2010), along with harbouring a rich macro- and megafaunal community (Jonsson *et al*., 2004). Several studies (e.g. Soeffker *et al.*, 2011) have tried to determine the relationship between cold-water coral habitats and their importance to fish. So far these have lacked quantitative data estimating fish abundance or biomass per m^2, therefore preventing a comparison between data sets.

Aim:

to explore if there is a clear relation between fish abundance, fish biomass and cold-water coral structures.
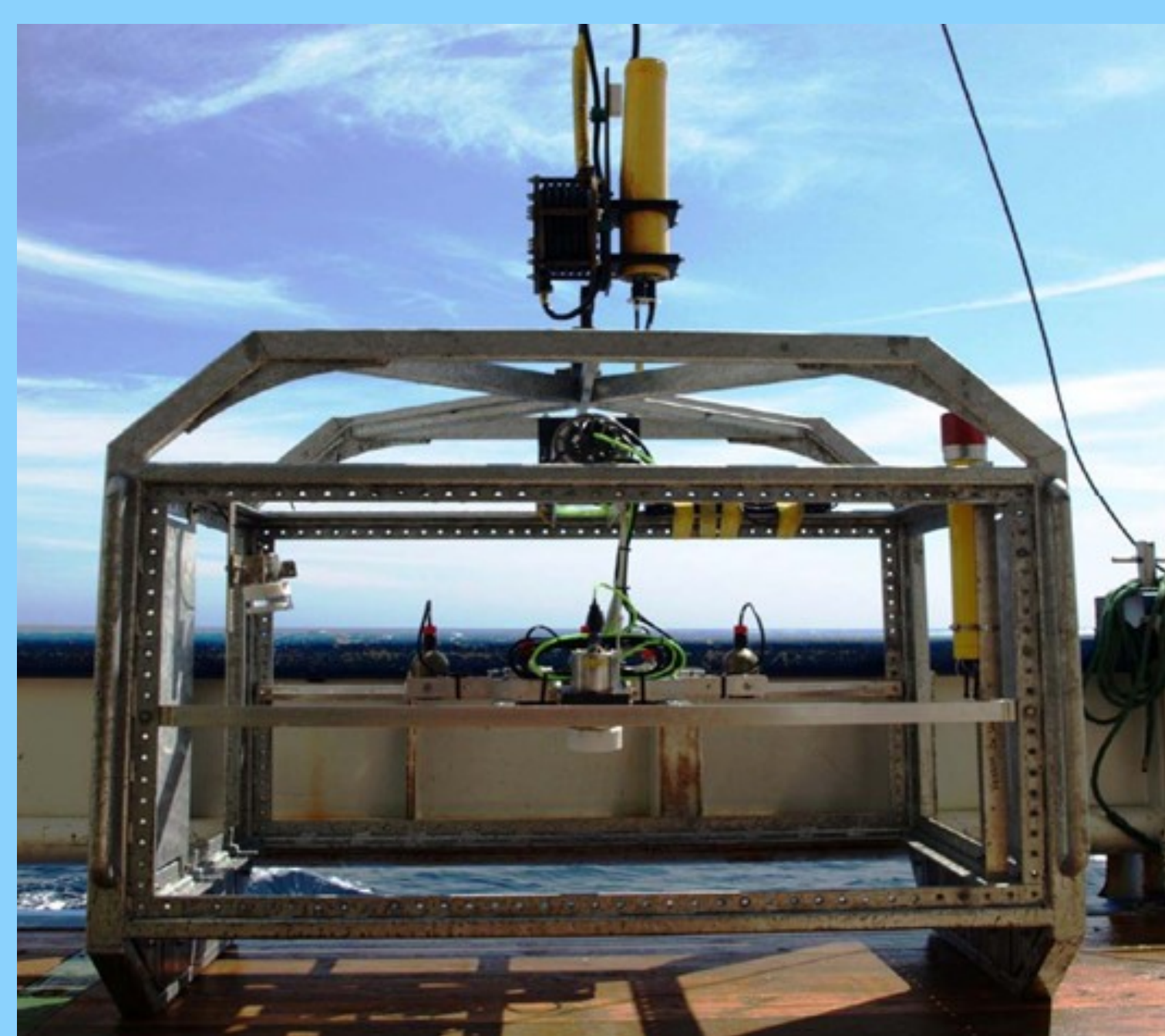
Methods:

Using a tethered video system with lasers (Fig. 1), 35 surveys were conducted at three different areas (7 Rockall Bank, 17 Hatton Bank, 11 Belgica Mound) recording over 36 hours of videos in total (Fig. 2). Water depth and position of the research vessel were recorded at one minute intervals. The area covered by the video was calculated per minute based on the position records of the research vessel and the average path width obtained from frame grabs. Coral framework cover (%) was calculated by measuring the covered area from still frame grabs every minute using ImageJ. Fish abundance (ind. ha^{-1}) was calculated for each fish species per minute. The length of the fish was measured with ImageJ by using the lasers as a reference. Fish length was converted into biomass (kg ha^{-1}) using length-weight relationships.

Fig.1. The tethered digital video camera system (Hopper Camera) with downward facing camera, light system and lasers.
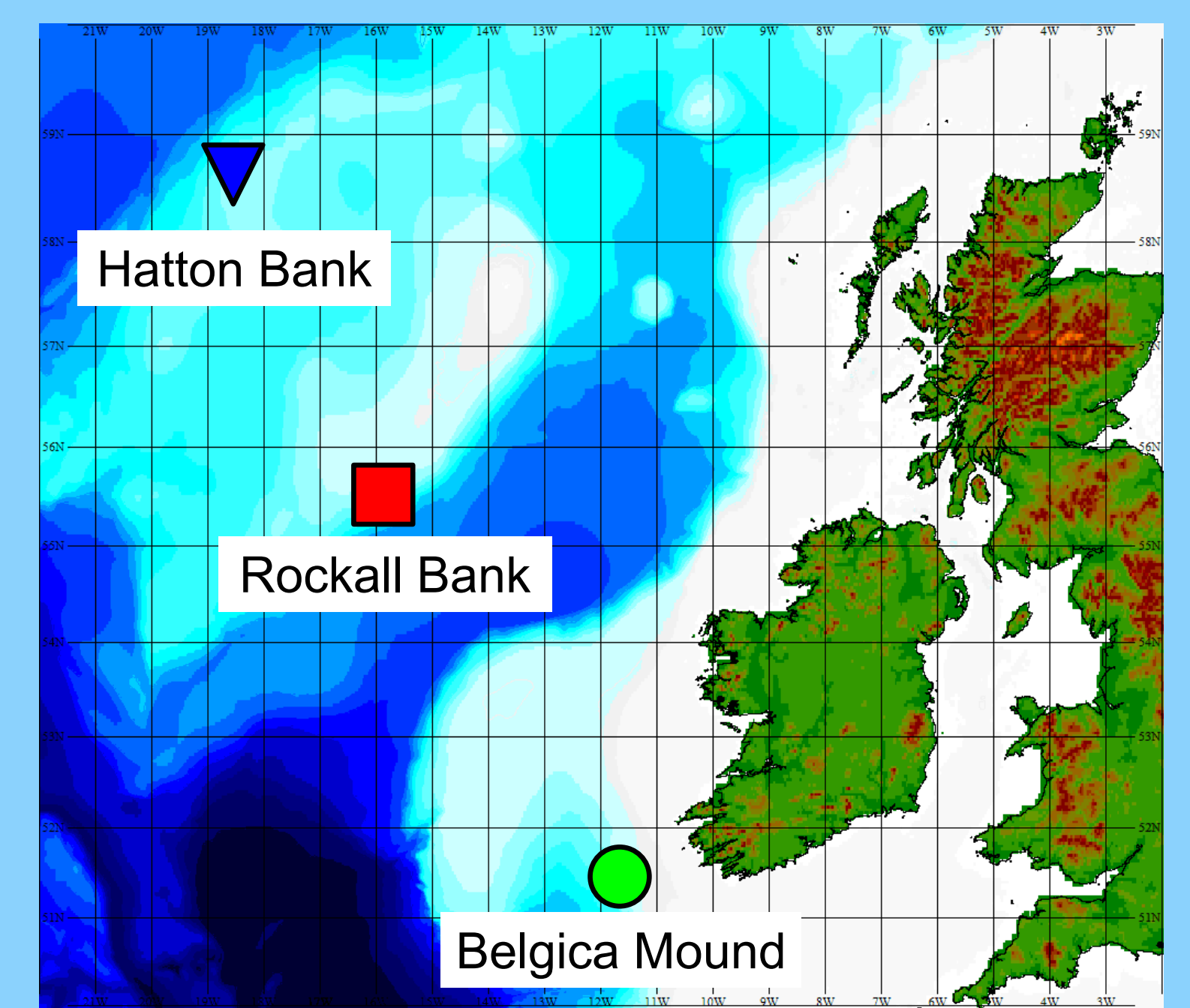
Study site:

Fig.2. Map of the study site in the Northeast Atlantic with the sampling regions indicated.

Results:

An area of nearly 12 ha were examined and 2361 fish recorded, belonging to 13 different species and 11 families. ANOSIM revealed a significant difference in the species abundance ($p < 0.01$) and biomass ($p < 0.01$) between the three regions (Fig. 3). The majority of the species found were present at all three regions. *Lepidion eques* was the most abundant species. *Helicolenus dactylopterus* was particularly abundant at Rockall Bank (Fig. 4). For all three regions fish abundance was higher in the coral compared to the non-coral framework patches, this was also true for fish biomass except for Hatton Bank (Fig. 5).
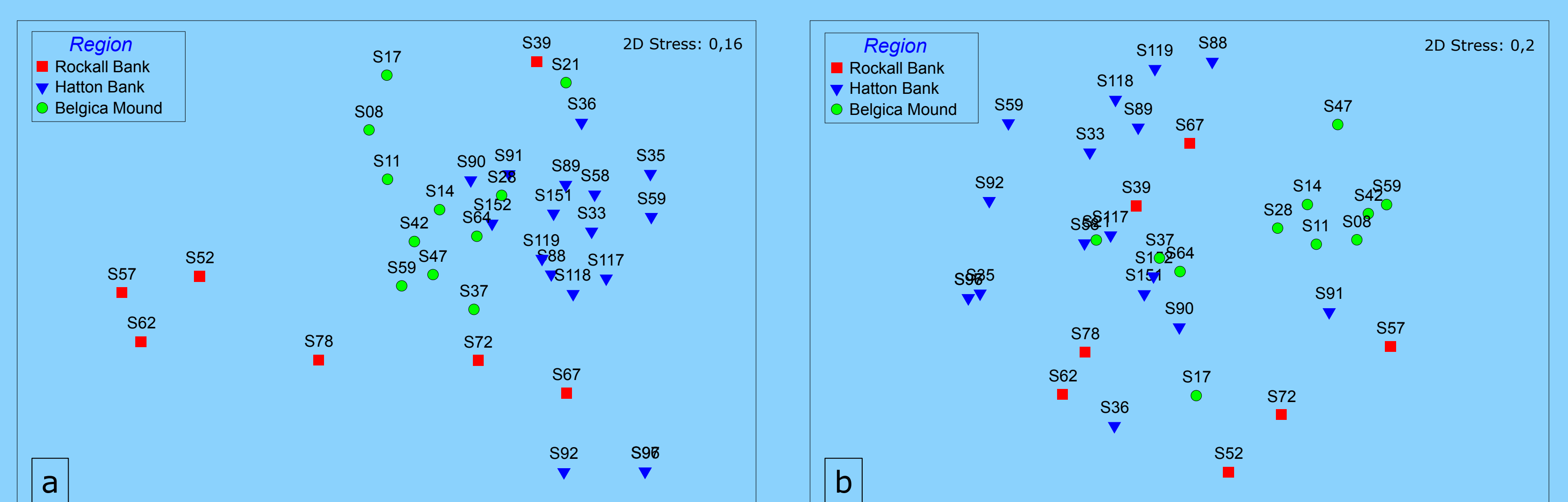
Fig. 3. MDS plot of 35 samples from the three study regions based on Bray-Curtis similarity matrix showing a difference in fish species abundance (a) and biomass (b) between the three regions.
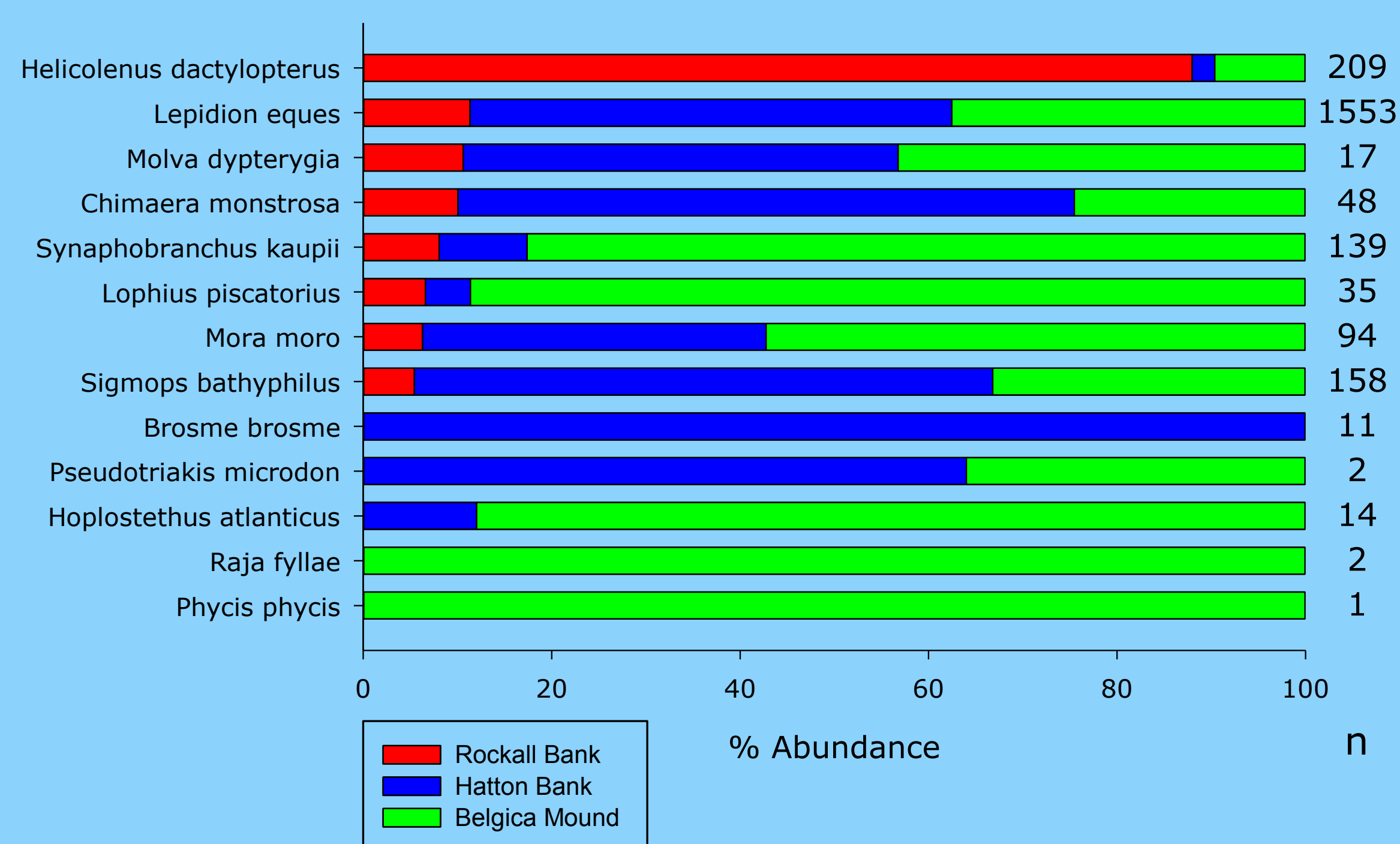
Fig. 4. Relative fish species abundance (%) of the three study regions.

Species	n
Helicolenus dactylopterus	209
Lepidion eques	1553
Molva dypterygia	17
Chimaera monstrosa	48
Synaphobranchus kaupii	139
Lophius piscatorius	35
Mora moro	94
Sigmops bathyphilus	158
Brosme brosme	11
Pseudotriakis microdon	2
Hoplostethus atlanticus	14
Raja fyllae	2
Phycis phycis	1

Conclusion:

Rockall Bank and Belgica Mound show a significant higher fish abundance and biomass at patches with coral compared to patches with no coral framework. Hatton Bank also shows a higher fish abundance if coral framework is present than if it is absent. However, at Hatton Bank fish biomass is higher when coral framework is absent than when it is present. The difference in fish abundance and biomass, at Hatton Bank compared to the other two areas, is possibly due to the absence of prominent topographic features (mounds) at Hatton Bank.
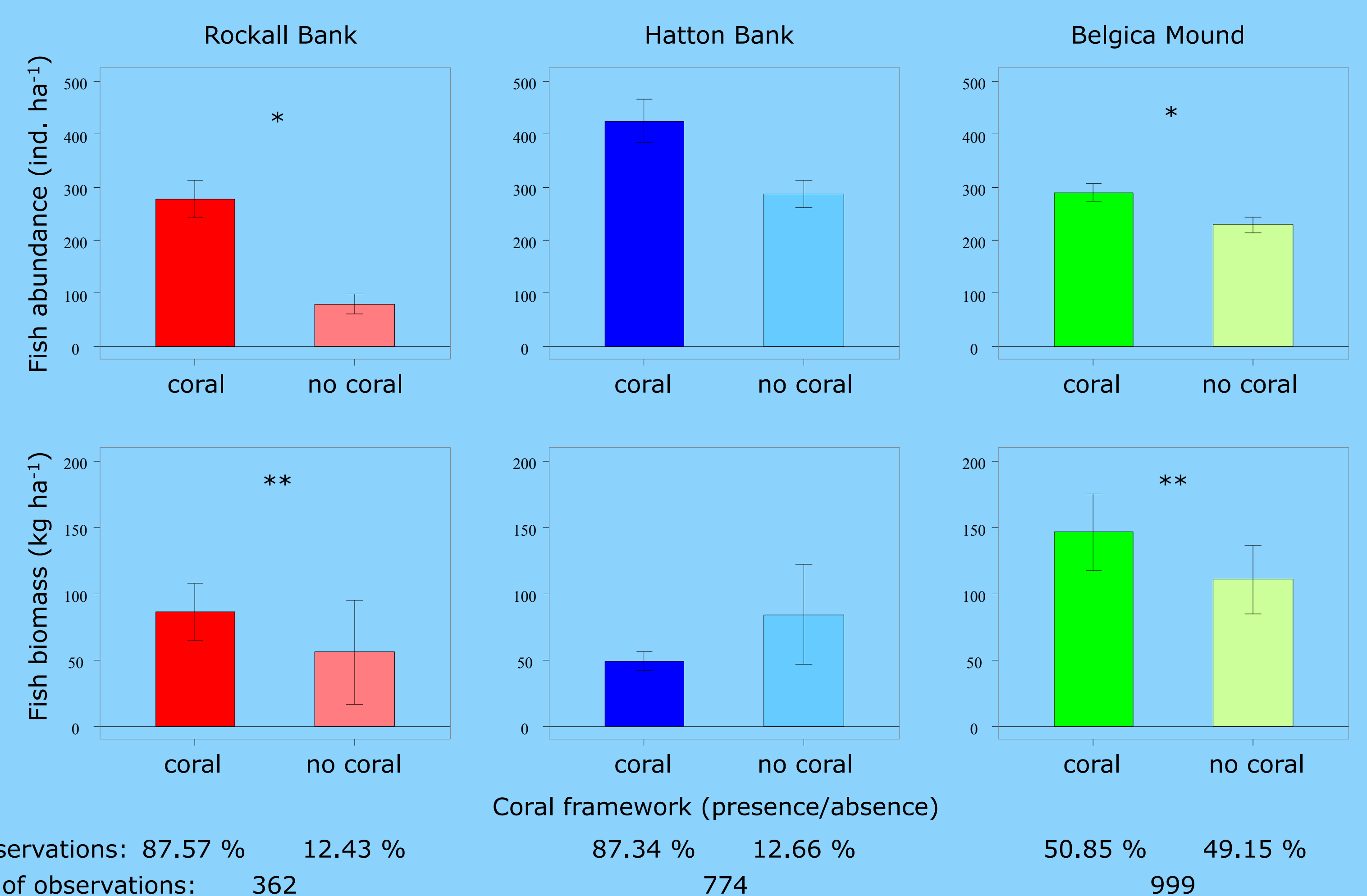
% of observations: 87.57 % 12.43 %   87.34 % 12.66 %   50.85 % 49.15 %
Number of observations: 362   774   999

Fig. 5. Fish abundance and biomass for coral and non-coral framework patches of the three regions; Error bars indicate ± 1 S.E.; * = $p < 0.05$, ** = $p < 0.01$ (Mann-Whitney U-Test).

References:

Buhl-Mortensen, L., Vanreusel, A., Gooday, A.J., Levin, L.A., Priede, I.G., Buhl-Mortensen, P., Gheerardyn, H., King, N.J., Raes, M., 2010. Biological structures as a source of habitat heterogeneity and biodiversity on the deep ocean margins. Marine Ecology-an Evolutionary Perspective 31 (1), 21-50.

Jonsson, L.G., Nilsson, P.G., Floruta, F., Lundalv, T., 2004. Distributional patterns of macro- and megafauna associated with a reef of the cold-water coral Lophelia pertusa on the Swedish west coast. Marine Ecology-Progress Series 284, 163-171.

Soeffker, M., Sloman, K.A., Hall-Spencer, J.M., 2011. In situ observations of fish associated with coral reefs off Ireland. Deep-Sea Research Part I Oceanographic Research Papers 58 (8), 818-825.