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TITLE: Bottom trawling and oxygen minimum zone influences on continental slope benthic community structure off Vancouver Island (NE Pacific)

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ABSTRACT:

Understanding responses of benthic ecosystems to cumulative impacts of natural stressors, long-term ocean change and increasing resource exploitation is an emerging area of interest for marine ecologists and environmental managers. Few, if any, studies have quantitatively addressed cumulative effects in the deep sea. We report here on a study from the continental slope off Vancouver Island (Canada) in the northeast Pacific Ocean, where the Oxygen Minimum Zone impinges on seabed habitats that are subjected to widespread bottom trawling, primarily by the fishery for thornyhead (*Sebastolobus* spp.). We examined how the benthic megafauna in this area was influenced by varying levels of dissolved oxygen and trawling activity, along a depth gradient that was also likely to shape community composition. Continuous video and sonar records from two ROV surveys (50 linear km total; depth range 300–1400 m) respectively provided data on faunal attributes (composition, abundance and diversity) and the frequency of trawl door marks on the seabed. Faunal and trawl data were compiled in a geo-referenced database along with corresponding dissolved oxygen data, and pooled into 500 m segments for statistical analysis. Trawl mark occurrence peaked between 500 and 1100 m, corresponding to areas of slope subjected to hypoxia (<1.4 ml l⁻¹) and severe hypoxia (<0.5 ml l⁻¹). A combined total of 266,251 megafauna organisms from 87 taxa were enumerated in the two transects. Significant megafaunal assemblages according to depth, trawling intensity and bottom water dissolved oxygen concentration were identified by PERMANOVA analyses, with characterizing taxa identified for all three factors. Depth, dissolved oxygen and trawl mark density accounted for 21% to 52% of the variability in benthic community structure according to multiple regression (DISTLM) models. Species richness was highest at intermediate depths and in areas subject to intermediate levels of trawling, and higher under hypoxia than under severe hypoxia. These statistically significant trends demonstrate that the structuring influences of bottom trawling on deep-sea benthic communities can be observed even where communities are being shaped by strong environmental gradients.

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