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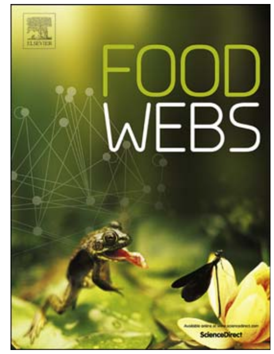

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Stable isotopes reveal insight into food web dynamics of a data-poor deep-sea island slope community

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Abstract

Deep-sea communities are subject to a growing number of extrinsic pressures, which threatens their structure and function. Here we use carbon and nitrogen stable isotopes to provide new insights into the community structure of a data-poor deep-sea island slope system, the Exuma Sound, The Bahamas. A total of 78 individuals from 16 species were captured between 462 m and 923 m, and exhibited a broad range of $\delta^{13}C$ (9.45‰) and $\delta^{15}N$ (6.94‰). At the individual-level, $\delta^{13}C$ decreased strongly with depth, indicative of shifting production sources, as well as potential shifts in community composition, and species-specific feeding strategies. $\delta^{15}N$ did not follow strong depth relationships, suggesting trophic level and depth are not tightly coupled across individuals. We observed ontogenetic enrichment in $\delta^{13}C$ and $\delta^{15}N$ for *Squalus cubensis* (Cuban dogfish) highlighting a shift to larger, higher trophic level prey through ontogeny. These data provide the first assessment of food-web structure in the Exuma Sound, and suggest inherent complexity associated with deep-sea island slope ecosystems. Such observations are needed to further our understanding and develop contemporary management plans for these systems.

Keywords: Stable isotope analysis; deep-water; ecosystem; primary production; feeding dynamics

1. Introduction

Deep-sea ecosystems are being increasingly exploited by a multitude of anthropogenic activities, such as commercial fishing and mining, which threatens their structure and function (Benn et al., 2010; Priede et al., 2010; Van Dover et al., 2011). The conservative life histories of many deep-sea taxa exacerbate exploitative effects, as many are unable to quickly rebound from population-based perturbations (Simpfendorfer and Kyne, 2009). Such effects are likely to drive changes in community composition, and structure, as seen in a number of coastal biomes (e.g. McCain et al., 2015; Möllman et al., 2015). Therefore a basic understanding of food-web dynamics is essential for predicting the broad-scale impacts of exploitation on deep-sea communities.

Stable isotope analysis (SIA) of carbon and nitrogen (referred to in delta notation as $\delta^{13}C$ and $\delta^{15}N$) has proven valuable in describing food-web structure and species interactions across marine, freshwater, and terrestrial biomes (Layman et al., 2011; Hussey et al., 2012; Rundel et al., 2012), and are becoming increasingly applied to deep-sea systems (Polunin et al., 2001; Pethybridge et al., 2012; Churchill et al., 2015; Shipley et al., In Press). Although the majority of isotopic food-web studies have focussed on shallow water systems, evidence suggests deep-sea