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TITLE: Unravelling the versatile feeding and metabolic strategies of the cold-water ecosystem engineer *Spongosorites coralliophaga* (Stephens, 1915)

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ABSTRACT:

Sponges are often major players in the functioning of shallow-water ecosystems through their high biomass and high capacity in filter feeding. In comparison, little is known about the feeding and metabolic strategies of deep-sea sponges, although they can also form dense aggregations with high biomass. This situation hinders our understanding about how some sponge species thrive under the often food-limited conditions of the deep sea. In the present study we examined the feeding and metabolic strategies of 1) the massive demosponge *Spongosorites coralliophaga*, which was recently described as an important ecosystem engineer in cold-water coral reefs (CWCRs) and 2) the anthozoan *Parazoanthus anguicomus* and the ophiuroid *Ophiura ophiura*, i.e. two dominant epibionts on *S. coralliophaga*. All three benthic species have high density at CWCRs of the North-East Atlantic and knowing their feeding strategies facilitates future studies on carbon (C) and nitrogen (N) cycling at CWCRs. The on-board feeding experiments examined the processing of four isotopically-labelled food sources, namely ^{15}N -ammonium chloride, ^{13}C -glucose, $^{13}\text{C}/^{15}\text{N}$ -labelled microalgae, $^{13}\text{C}/^{15}\text{N}$ -labelled bacteria by *S. coralliophaga* and its symbiotic bacteria and the epibionts *P. anguicomus* and *O. ophiura* from the Mingulay reef complex and the Logachev mound (North-East Atlantic). There were no significant differences among the three species in terms of biomass-specific C and N assimilation rates; however, there were differences among *S. coralliophaga*, *P. anguicomus* and *O. ophiura* in how they processed the food sources and this maybe is linked to interspecific variability in metabolic needs. *S. coralliophaga* preferentially assimilated particulate organic N (PON) over particulate organic C (POC) while this was not the case for *P. anguicomus* and *O. ophiura*. We did not detect the ^{15}N tracer in the bacterial biomarker D-Alanine suggesting that the preferential assimilation of N over C in *S. coralliophaga* was mediated by sponge cells instead of the bacterial symbionts. *S. coralliophaga* assimilated C and N from all four food sources and this versatile feeding strategy was accompanied by an ability for de novo synthesis of essential and non-essential hydrolysable amino acids (HAAs). We suggest that the recorded feeding and metabolic flexibility of *S. coralliophaga* plays an important role in the survival of this massive sponge under food-limited conditions in the deep sea.

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