

Scientific Paper:

J. Plankton Res. (2012) 0 (0): 1 - 14

Oxygen consumption of fecal pellets of doliolids (Tunicata, Thaliacea) and planktonic copepods (Crustacea, Copepoda)

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Abstract:

Zooplankton fecal pellets are a major component of the carbon cycle in the ocean. The goal of our study was to quantify oxygen consumption rates of fecal pellets of doliolids and copepods during initial degradation of fecal pellets in the water column. Fecal pellets were collected from gonozooids of the doliolid *Doliolletta gegenbauri* and adult females of the calanoid copepod *Eucalanus pileatus* feeding on the diatom *Thalassiosira weissflogii*, and the phytoflagellate *Isochrysis galbana*, and the latter on *T. weissflogii* only. Oxygen consumption of fecal pellets was quantified by applying non-invasive optical sensors, keeping the pellets continuously suspended in their experimental vessels. Oxygen consumption rates of pellets of doliolids and copepods ranged between 4 and 16 and 1 and 5 nmol O₂ mL⁻¹ h⁻¹, respectively. Average oxygen consumption rates were 212 pmol O₂ h⁻¹ for a doliolid pellet (range of 80 – 329 pmol O₂ h⁻¹) and 101 pmol O₂ h⁻¹ for copepod pellet (range of 50 – 211 pmol O₂ pellet⁻¹ h⁻¹). Variations in oxygen consumption were closely related to the type of pellets, and the abundance of pellet-associated heterotrophic prokaryotes. Average numbers of heterotrophic prokaryotes per doliolid pellet reached values of up to 3 × 10⁵, whereas prokaryotic numbers per copepod pellet approached 8 × 10⁴. Average cell volumes of pellet-associated heterotrophic prokaryotes were enhanced by a factor of 2 – 3 compared with those in the surrounding seawater. We estimated that approx. 2 % of the total organic carbon of a freshly egested doliolid pellet is oxidized by pellet-associated heterotrophic prokaryotes during the initial 4 h of pellet degradation. Our results underline the significance of heterotrophic prokaryotes rapidly colonizing and degrading zooplankton fecal pellets in the water column.

Key-words: fecal pellets, copepods, doliolids, heterotrophic prokaryotes, oxygen consumption rates, planar optodes, initial degradation of fecal pellets