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Squishy but not useless for energy balance: Energetic value of gelatinous zooplankton from the Salish Sea and adjacent waters

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Introduction

- Gelatinous and soft-bodied zooplankton (GZ) are traditionally considered as ‘trophic dead ends’ (Hansson & Norman 1995)
- Due to their low energy contents per wet weight, GZ have been named ‘green tea of the sea’ (Hamilton 2016)
- There is growing awareness of the importance of GZ in marine food webs (Hays et al. 2018) and for various other non-energetic purposes (Thiebot & McInnes 2020)
- Database listing elemental composition, organic and energy contents of various taxa is scattered, incomplete, and superficial in many cases
- We aim at the establishment of a comprehensive region-wide database compiling these data for a wide range of GZ species to inform energy-based food web models

Methods

- For best describing the nutritional value of food items, a combination of several proxies is recommended (Chen & Li 2017; Machovsky-Capuska & Raubenheimer 2020)
- More than 1000 specimens from 33 GZ species were collected on 10 cruises between 2014 and 2019 in the Salish Sea and adjacent waters (Figs. 1 and 2)
- Samples have been collected with Bongo and dip nets, Multinet, and pelagic trawl (Fig. 3)
- Specimens were sized and frozen on board and freeze-dried in the laboratory
- Elemental composition (C, N) was determined in elemental analyser
- Organic content measurement is based on dry matter (500 °C, 24 h)
- Energy content was estimated via published conversion factors (Platt et al. 1969; Schneider 1988) and based on bomb-calorimetry

Results

- Only a set of net types with different mesh sizes allows for huge species sampling variety in near and offshore areas in the present study
- Marked and partly statistically significant differences in organic content and C/N ratio among classes (Figs. 4 and 5) were identified
- Both depend highly on sampled size range (Fig. 6, e.g. Aequorea sp.) and development stage composition (Fig. 7, e.g. Salpa aspera)
- Energy contents vary between < 0.1 and 22.8 kJ g DW⁻¹ depended on class and method used (Fig. 8)
- Energy contents resulting from bomb-calorimetry are always low compared with conversion-used values
- Organic content / energy content pattern (based on Platt et al. 1969) highly similar to other GZ, but lower than values published for crustaceans (Fig. 9)

Discussion

- ‘Hidden diversity’ in GZ in terms of organic and energy contents and elemental composition, which needs to be considered when used in food web models
- Size- and development stage dependency are considerable
- Bomb-calorimetry failed to confirm energy contents based on conversion factors; questioning either technique or validity of used conversions
- Species-level diversity is even bigger, but not shown here for clarity reasons
- Even if GZ have low energy content compared to crustaceans, GZ and taxonomic variety should not be neglected in nutritional studies

Future Research

- Continuation of sample analyses from cruises in 2020 is planned
- Seasonality, various tissues, parasites, and further life cycle stages are not considered yet
- Analysis of phosphorus, vitamin, and micronutrient contents is recommended
- Other gelatinous species of e.g. siphonophores, polychaetes, and radiolarians need to be analysed