

Spatio-temporal variability in metabolism of the Antarctic pelagic tunicate *Salpa thompsoni*

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Introduction

Salpa thompsoni is a numerous pelagic tunicate important ecologically and biochemically. Currently, observational studies describing metabolism of *S. thompsoni* are limited

Aims of the study:

- provide respiration rates of two salp forms
- identify main sources of salp respiration rates variability
- qualitatively assess the relationship between the salp metabolism and plankton community dynamics

Findings

- Strong positive relationships between respiration rates and individual salp body mass (Fig. 2 left panel), while mass-specific respiration rates were almost independent of the body mass (Fig. 2, right panel)
- The main causes of large variability in the mass-specific respiration rate of *Salpa thompsoni* were threefold: (a) salp density in respirometers (Fig. 3); (b) the circadian rhythm in the physiology and behavior of salps (Fig. 4); and (c) respiration rates correlated to spatial variability of the surrounding pelagic environment
- Respiration costs of *Salpa thompsoni* accounted for 16% and 14% of body carbon content in oozoids and blastozoids, respectively
- Average daily metabolic rates of *Salpa thompsoni* calculated for $C_w=3$ gWW.L⁻¹, irrespective of the individual body mass, were 79.5 and 41.5 $\mu\text{g O}_2 \cdot \text{gWW}^{-1} \cdot \text{h}^{-1}$ in oozoids and blastozoids, respectively

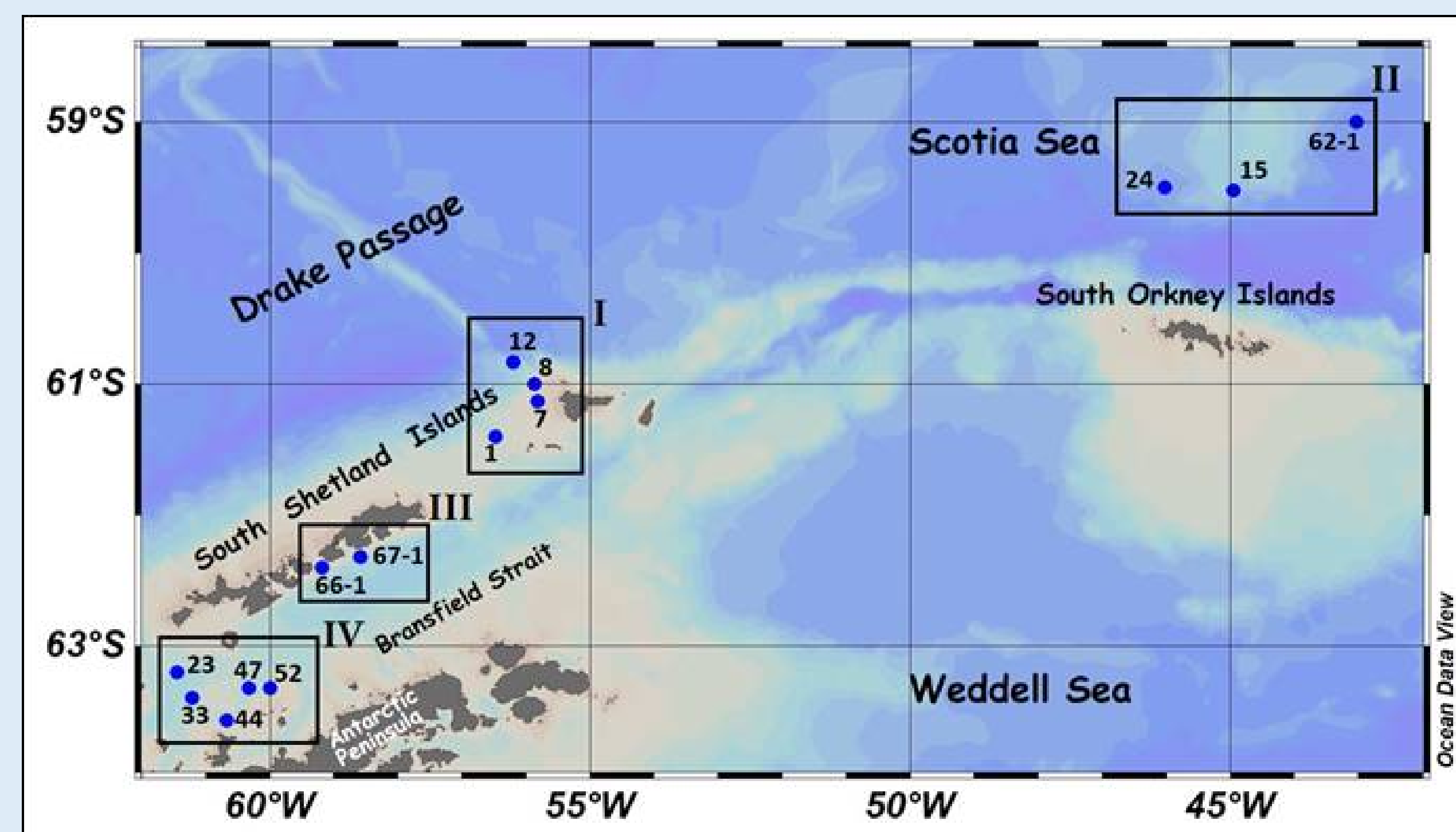


Fig. 1: Station positions of *Salpa thompsoni* respiration rate measurements during 1998 near the Elephant Island (I), north of the South Orkney Islands (II) and in the vicinity of the King George Island (III), and during 2002 in the Bransfield Strait (IV)

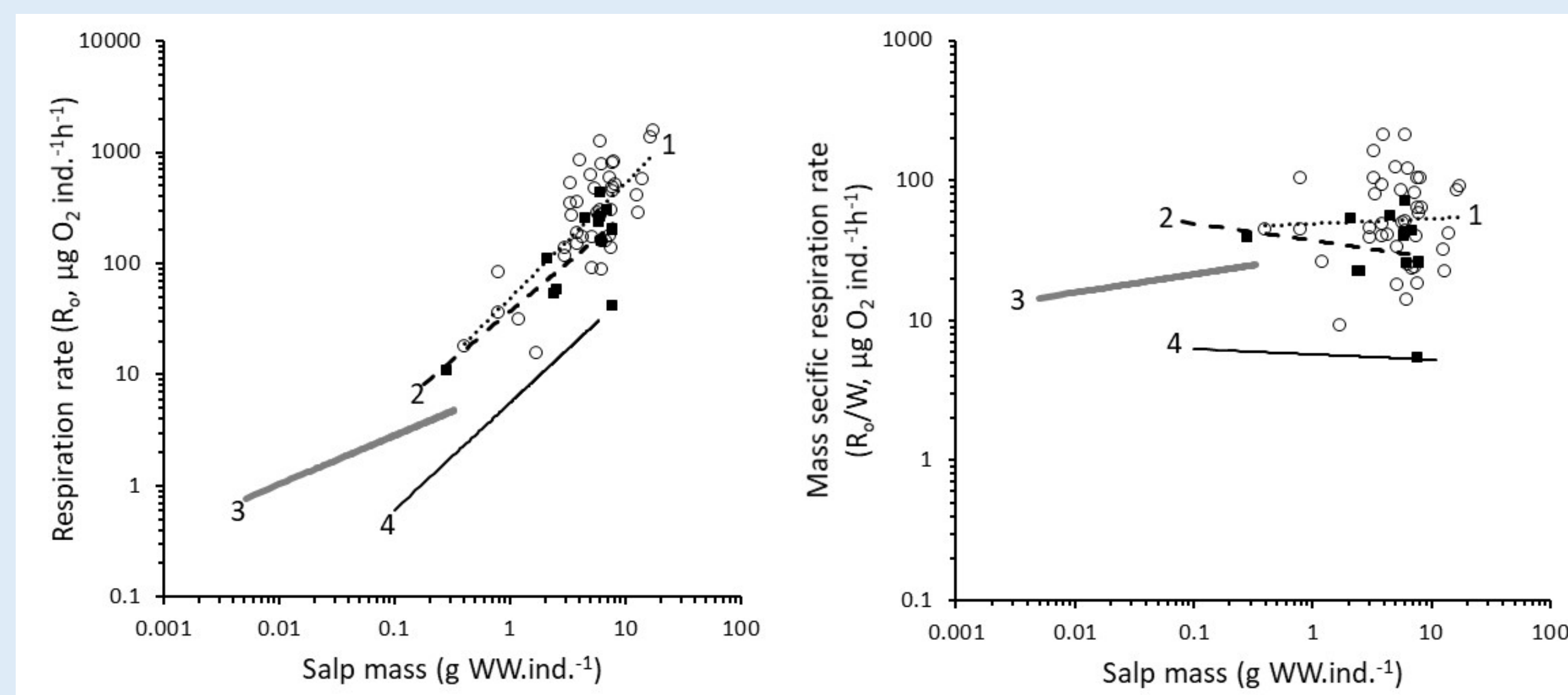


Fig. 2: Respiration rates (left panel) and mass-specific respiration rates (right panel) of salps. [Rates are adjusted to 3°C and $C_w=3$ gWW.L⁻¹]. 1 and 2: this study, *Salpa thompsoni* oozoids (open circles) and blastozoids (filled squares); 3: Pavlova (1975), oozoids of two Mediterranean salps; 4: Ikeda (1974), tropical salp oozoids and blastozoids

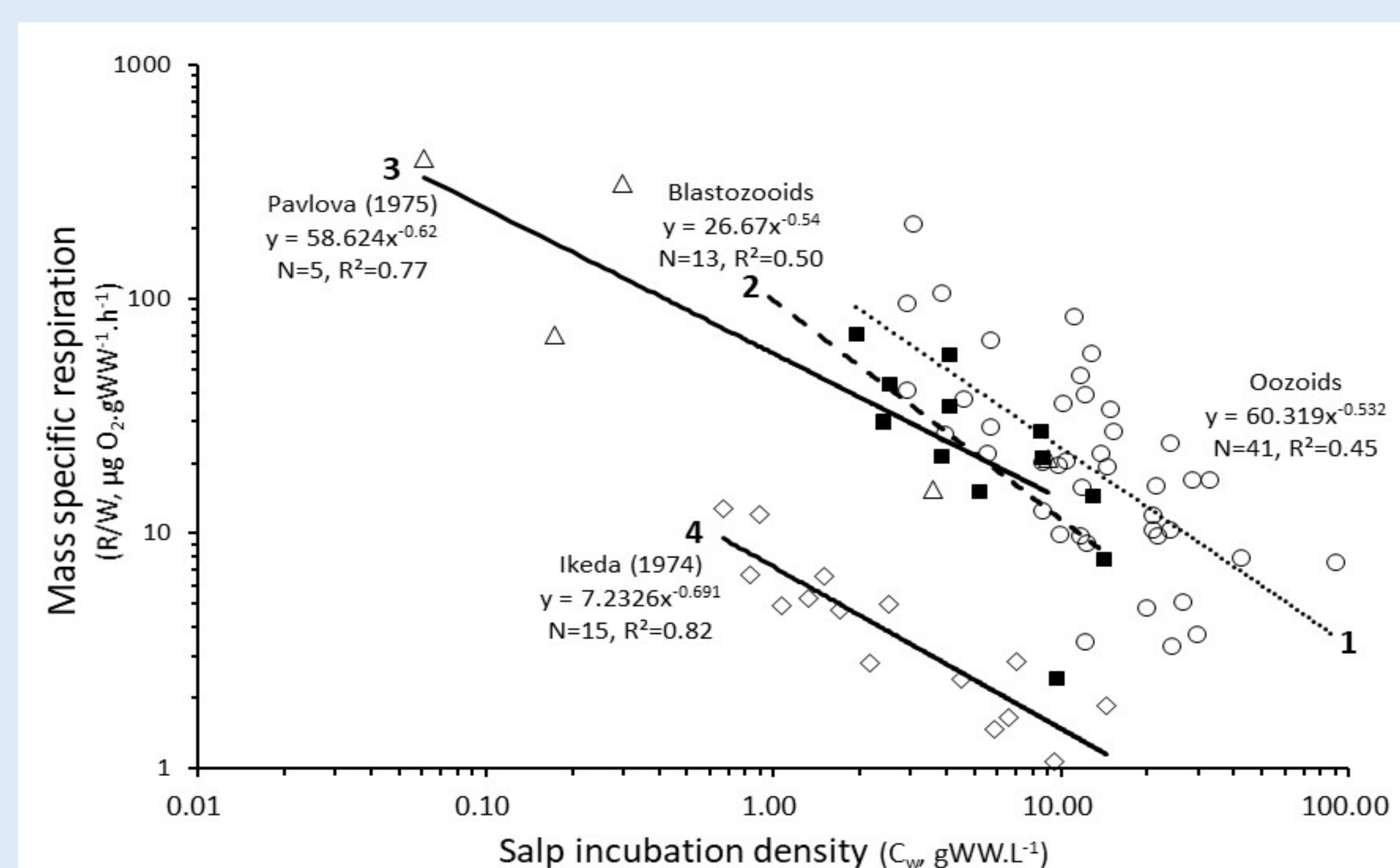


Fig. 3: Mass specific respiration rates (R/W , $\mu\text{g O}_2 \cdot \text{gWW}^{-1} \cdot \text{h}^{-1}$) of salps against the salp incubation density (C_w gWW.L⁻¹) in respirometers at 3°C: 1 – this study, oozoids, open circles; 2 – this study, blastozoids, filled squares; 3 – Pavlova (1975), open triangles; 4 – Ikeda (1974), open diamonds.

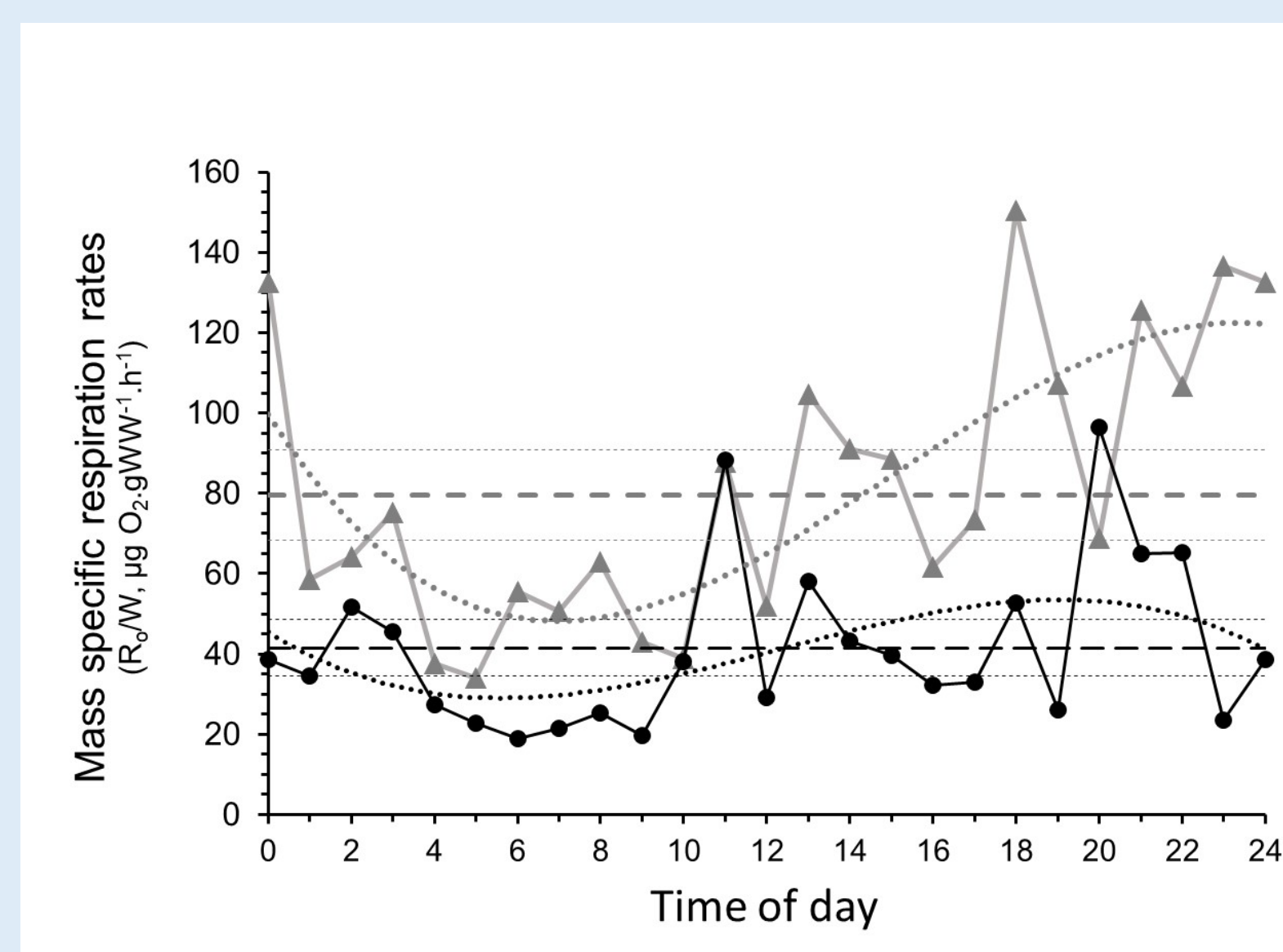


Fig. 4: Circadian rhythm of mass-specific respiration rates in the oozoids (1) and blastozoids (2) of *Salpa thompsoni*. Dotted lines are polynomial trends of the sixth degree; dash-dot lines are the daily average for each form and dashed lines represent the 90% confidence intervals of the average daily values

Methods

- R/V *Ernst Krenkel*, March-May, 1998 & R/V *Gorizont*, March 2002 (Fig. 1)
- Total of 55 respiration rate experiments (43 during 1998 and 12 during 2002) of *Salpa thompsoni* were performed.
- 42 experiments with 89 oozoids (total length 22-100 mm) and 13 experiments with 45 blastozoids (total length 42-85.3 mm)
- Salp respiration rates were measured using a polarographic oximeter equipped with oxygen (Clark-type) and temperature sensors designed and manufactured by the Ocean MNTK MGI NASU

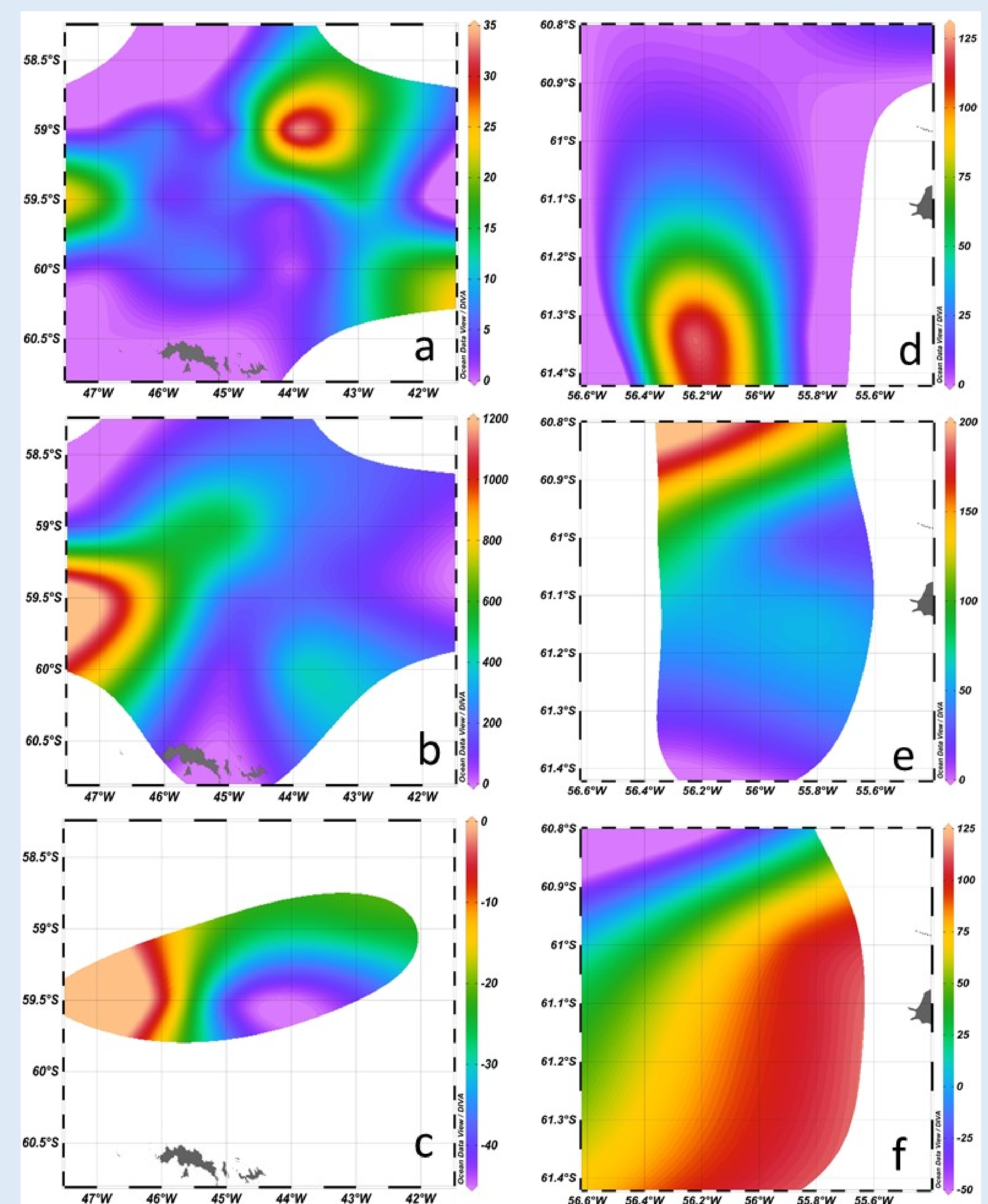


Fig. 5: *Salpa thompsoni* metabolic rate values as a function of the food availability in the 0-100 m layer during March 1998. Left panels: north of the South Orkney Islands (II), right panels: in the vicinity of the Elephant Island (I). (a), (d) biomass of salps ($\text{gWW} \cdot \text{m}^{-3}$); (b), (e) distributions of the phytoplankton biomass ($\text{mgWW} \cdot \text{m}^{-3}$); (c), (f) the spatial variability of the salp metabolic rates as deviation (in %) from the statistical norm

- North of the South Orkney Islands (Fig. 5 a-c), in areas where salps had low to modest densities and phytoplankton concentrations were high, salp metabolic performance was close to the statistical norm. However, if phytoplankton concentrations were low, salps usually metabolically modestly or heavily underperformed
- Near the Elephant Island (Fig. 5 d-f), in the area of a heavy control of the phytoplankton by very high salp concentrations, salp population metabolically performed well above the norm. Oceanography appear to play more prominent role and a latent high salp development may persist under their heavy grazing control of the phytoplankton standing stock



Literature cited

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