The role of euphausiid fecal pellet in the carbon flux along the Eastern South Pacific and Antarctica.

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Introduction.

Zooplankton fecal pellet (FP) play an important role in the carbón cycle dynamics (Lampitt et al. 1990, Wassmann 1998, and Turner 2002). Their relevance have been reported since the 1970s, with the first studies carried out by sediment traps, which currently exceed 500 publications (Turner 2002). This information allowed the quantitative estimation of FP flux, highlighting its importance for particulate organic carbon (POC) export to the deep ocean (Smetacek 1980a; González 1992a & González et al. 1994).

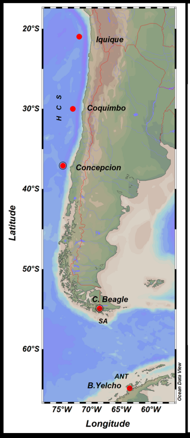

Figure 1. Red circles show the study areas.

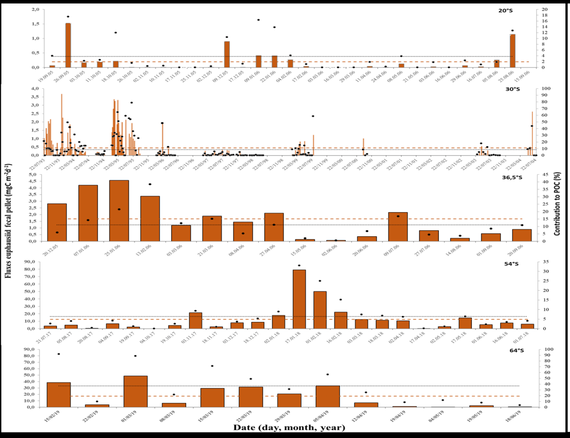

Figure 2. Carbon fluxes (in mgC $m^{-2}d^{-1}$; red bars) and contribution (%) of carbon euphausiid fecal pellet (CEFP) (black dots) in 5 study areas along the HCS off Chile, Subantarctic (SA) and Antarctic (ANT regions.

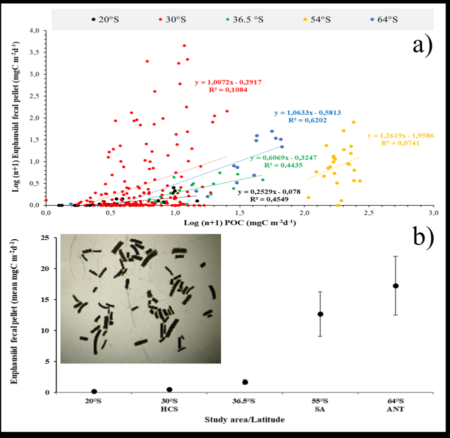

Figure 3. a) log-log of CEFP fluxes versus POC, dashed lines represent the regressions for each time series. b) average flux and standard error for each study site. PFE morphology is show in the top left photograph.

Material and method.

Samples were obtained from oceanic (SMT 230; Salzgitter electronic, Kiel) and coastal (PPS 3/3; Technicap) automatic sediment traps , at water depth between 200 and 2300 m. (Fig.1). Analyses were performed through an inverted phase contrast microscope (Zeiss, axiovert 200), using the method of Utermöhl (1958). CEFP were obtained following the methodology suggested by Menschel et al. (2019).

Results.

The average CEFP flux ranged between 0.2 -1.7 mgC m^2d^{-1} in the HCS (5-10% of the total POC) and between 12.6 -17.3 mgC m^2d^{-1} (6-36% of the POC) in the SA and ANT systems, respectively. The highest CEFP fluxes were recorded during the summer season with 12% for the SCH and 24% in the SA and ANT systems, while the lowest fluxes occurred in spring and autumn (HCS) corresponding to 4 and 7% of the average COP, respectively (Fig. 2). For the SA and ANT system, the lowest fluxes occurred during winter, representing ~3% of the POC. The impact of CEFPs to the COP in the all study area was highly variable, with the lowest correlations observed at 30°S (R^2=0.1) and 54°S (R^2=0.07), while the highest correlations were observed at 20°S (R^2=0.45), 36.5°S (R^2=0.44) and 64°S (R^2=0.62) (Fig.3).

Discussion/Conclusion.

The general trend of the average CEFP fluxes of each study area showed a latitudinal increase along the South Pacific, with maximum fluxes in the highly productive southernmost region of the HCS (36.5°S, Fig. 3b), especially during the summer period, when coastal upwelling intensifies and enhances productivity and carbon export. The CEFP fluxes increased significantly by up to an order of magnitude in SA and ANT regions, compared to the HCS. Similar trend in carbon flux was observed in the SA and ANT systems, where the highest fluxes occurred mainly during the most productive months such as summer and early autumn in the ANT system. Finally, euphausiid-FP showed a significant contribution to POC flux (>40% of total POC flux) and carbon export along the Chilean HCS and ANT regions (mainly in 20°S, 36.5°S and 64°S).

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