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Francois Carlotti, Marie-Paule Jouandet, Antoine Nowaczyk, Mireille Harmelin-Vivien. Mesozooplankton structure and functioning on shelf and oceanic waters of during the Kerguelen Bloom during the Keops2 survey (15 October – 20 November 2011). ICES/PICES 6th Zooplankton Production Symposium, May 2016, Bergen, Norway. hal-03006174

HAL Id: hal-03006174

<https://hal.science/hal-03006174>

Submitted on 8 Jan 2022

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ICES International Council for
the Exploration of the Sea
CIEM Conseil International pour
l'Exploration de la Mer



North Pacific Marine Science
Organisation (PICES)



INSTITUTE OF MARINE RESEARCH
HAVFORSKNINGSINSTITUTTET

Mesozooplankton structure and functioning during the onset of the Kerguelen phytoplankton bloom during the KEOPS2 survey (15 Oct. - 20 Nov. 2011)

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The KEOPS^(*) 2 survey combined :

- A large coverage of the eastern part of the shelf and the adjacent oceanic regions with 2 quasi-perpendicular transects oriented south to north (between 49°08 S and 46°50 S) and west to east (between 69°50 E and 74°60 E) aiming to document the spatial extension of the bloom and its coastal-off shore gradient,
- A pseudo-lagrangian survey located in a complex recirculation zone in a stationary meander of the Polar front nearly centered at the crossing of the 2 initial transects (Stations E1 to E5) in mid november.
- In addition, 8 stations were performed for 24 hour observations, distributed in key areas and particularly the reference station A3 above the Kerguelen plateau (already investigated during KEOPS1 cruise (Jan-Feb 2005) but in summer season- middle and bloom decline)

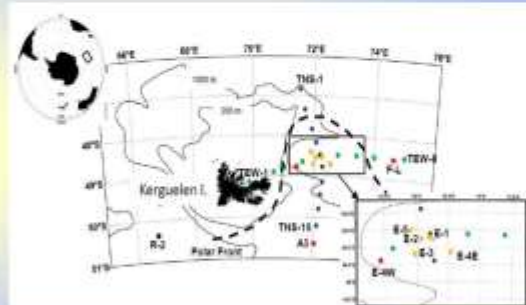


Figure (above) : Map of the KEOPS2 study area. The locations of the stations are marked by color dots. Blue indicates the stations of the North-South transect (TNS), green indicates the stations of the East-West transect (TEW), orange indicates the stations E located in the meander of the polar front (zoom panel). Red stands for other stations located in the fertilized region and black stands for the station located in the HNLC region.

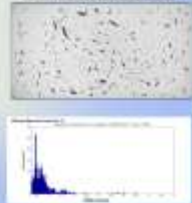
(*) Acknowledgment: The authors acknowledge the support of ANR program, INSU-CNRS LEFE CYBER program, and IPEV for the KEOPS2 project

Approach Sampling and Treatment

Zooplankton collection were conducted at 27 stations with a double Bongo nets (60 cm mouth diameter) fitted with 330mm mesh sizes mounted with filtering cod ends. Hauls were done from 250m depth to the surface at 0.5 ms⁻¹.



E4-E-night (1/32)



Abundances and biomasses were determined from fine size spectra delivered by the Zoscan digital imaging approach and the ZooProcess software. Organism size given by its equivalent circular diameter (ECD) was converted in biovolume assuming each organism as an ellipsoid. Biovolume-carbon ratio was used to deliver carbon biomasses. Taxonomic determination was made using a LEICA MZ6 dissecting microscope.

Results: zooplankton taxonomy

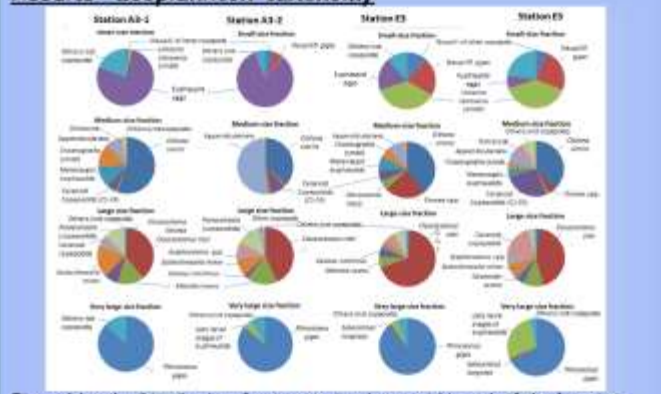


Figure (above) . Distribution of main taxa abundances within each of the four size fractions. Average distributions between day and night samples at stations A3-1, A3-2, E3 and E5. For each size fraction, the color labels for the different taxa are similar.

Results: zooplankton abundances and biomasses

Figure below : Top: Abundance (left) and biomasses values (right) ; Bottom : ratio abundance on biomasses (left) and zooplankton biomass values against the integrated Chl a in the mixed layer depth. For the different stations visited during KEOPS2 (right)

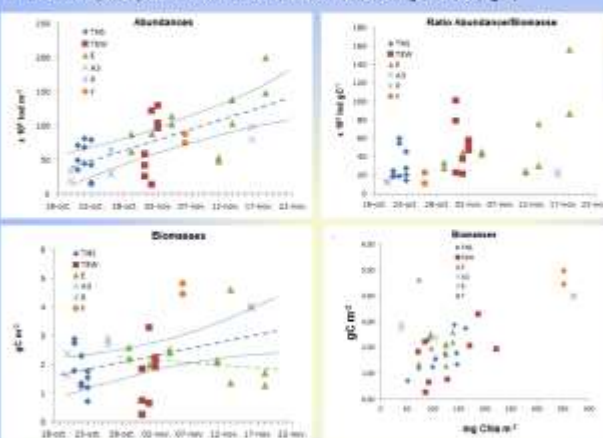
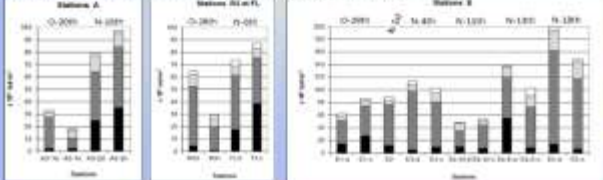


Figure (below) : Integrated 0-200m zooplankton biomass for different stations sampled during KEOPS2 with size fractions distributions. Size fractions: <500 µm: black; 500-1000 µm: dark grey; 1000-2000 µm: light grey; >2000 µm: white.



The zooplankton biomass stocks observed at the beginning of the KEOPS2 cruise were around 2 gC m⁻² both above the plateau and in oceanic waters.

Zooplankton biomasses in oceanic waters were maintained in average below 2 g C m⁻² over the study period, except in the Polar Front (FL) whereas zooplankton biomasses were around 4 gC m⁻² on the plateau at the end of the cruise.

Note the stronger increase in abundances in the oceanic waters (25 10³ to 160 10³ ind m⁻²) than on the plateau (25 10³ to 90 10³ ind m⁻²).

Results: Isotopic composition of size-fractionated zooplankton

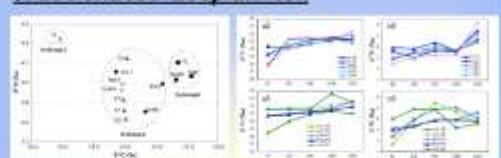


Figure (above): Left: Mean 13C and 15N values of zooplankton. Circles indicate the isotopic groups based on hierarchical analysis on stable isotope values; Right: Distribution of 13C and 15N values across zooplankton size-fractions for A3 and E stations

Taxonomic composition and stable isotope ratios of size-fractionated zooplankton indicated the strong domination of herbivores. The size structure and taxonomic distributions revealed a cumulative contribution of various larval stages of dominant copepods and euphausiids particularly in the oceanic waters, with clearly identifiable stages of progress during the Lagrangian survey.

Concluding remarks: By grouping observations of KEOPS1 and KEOPS2, zooplankton biomass in A3 doubled from mid-Oct. to mid-Nov. 2011, and further increased 2 to 3 fold higher between values of mid-Nov. 2011 and summer values (end of Jan. 2005). For the oceanic stations, the ratio of zooplankton biomass increase is of same order. For abundances observed at the end of KEOPS1 and the beginning of KEOPS2 the ratio is around 5 for the A3 station and 2 to 3 for the oceanic stations, and might be explained by a longer sustained reproduction period over summer above the plateau than in oceanic conditions.