Dataset name: **Meso– and micro–zooplankton process studies**

|  |  |
| --- | --- |
| Parameters: | * **gut evacuation rates of mesozooplankton** * **mesozooplankton grazing rates on natural prey assemblages** * **microzooplankton grazing rates** |

PROJECT TITLE: **MOBYDICK**

Oceanographic cruise: **MOBYDICK**

Start date: **18/02/2018**

End date: **27/03/2018**

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Geographic information: **Indian sector of the Southern Ocean**

Latitude: **49.5°S – 52.5°S**

Longitude: **67,0°E – 74.5°E**

Parameter supervisor: **Delegrange Alice**

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# OPERATIONS

## Sampling device(s)

Vertical tows of WP2 plankton nets at 200 m depth – 10 minutes duration. Sampling was carried during daytime except for station M4\_2.

Natural microzooplankton and phytoplankton assemblages were obtained from rosette bottles deployed in surface layers (30 m depth).

## List of stations sampled

**Microzooplankton grazing** on phytoplankton communities was estimated via dilution experiments. A total of 8 experiments were carried out and corresponding to the following stations and cast number for niskin bottles

|  |  |  |
| --- | --- | --- |
| **Stations** | **CTD cast #** | **Rosette bottles #** |
| M1\_1 | 039 | 19-20-21 |
| M2\_1 | 006 | 19-20 |
| M2\_2 | 028 | 17-18-19 |
| M2\_3 | 50 | 19-20-21 |
| M3\_1 | 022 | 18-19-20 |
| M3\_3 | 59 | 17-18-19 |
| M4\_1 | 012 | 18-19-20 |
| M4\_2 | 045 | 19-20-21 |

For **mesozooplankton grazing on natural prey assemblages**, a total of 8 experiments were carried out using *Calanus simillimus* for most of the experiments and *Metridia gerlachei* (for the experiment carried out at M1).

* 1 experiment was carried out at station M1 at night time (M1\_1) – corresponding plankton net cast number = WP2\_4
* 3 experiments were done at station M2 (1st, 2nd and 3rd visit) at daytime – station code M2\_1, M2\_2 and M2\_3 – corresponding plankton net cast number = WP2\_4
* 2 experiments were done at station M3 (1st and 3rd visit) at daytime – station code M3\_1 and M3\_3 – corresponding plankton nets cast numbers were WP2\_1 and WP2\_4, respectively.
* 2 experiments were done at station M4 (1st and 2nd visit). Experiment M4\_1 was done during daytime whereas experiment M4\_2 was done during night time. Corresponding plankton nets cast numbers were WP2\_4 and WP2\_5

**Gut evacuation rates of dominant zooplankton species** were evaluated 4 times during the Mobydick cruise. Organisms were collected at night at station M2 (1st and 3rd visit) and M4 (1st and 2nd visit) – station codes were M2\_1, M2\_3, M4\_1 and M4\_2.

# INSTRUMENTS

Instrument Type: **Trilogy**

Manufacturer: **Turner Designs**

Model: N/A

Instrument Features / Calibration: see below (§ 3.2).

# DESCRIPTION of PARAMETERS

## Measurement details

**Microzooplankton grazing** estimations followed the dilution method of Landry & Hasset (1982) with dilution levels set in triplicates at 10-25-50-75 and 100% of whole seawater (*i.e.* natural seawater sieved on 200 µm after collection). After incubation, all bottles were sampled for chlorophyll *a* by filtration through polycarbonate filters thus leading to 4 phytoplankton size fractions (see Grattepanche *et al.,* 2011):

* CT = 0.2 µm to 200 µm
* C1 = 5 to 200 µm
* C2 = 5 to 10 µm
* C3 = 10 to 200 µm

At laboratory, analyses of chlorophyll *a* concentrations will allow to assess changes over the 24 h incubation period and will be used to calculate the instantaneous phytoplankton growth (*k*, d−1), assuming an exponential increase and grazing related mortality (*g*, d−1; Landry and Hassett 1982). The coefficients *k* and *g* will be determined from the best fit of the linear model linking apparent phytoplankton growth (*μ*) versus the fraction of whole seawater. Microzooplankton grazing pressure (*Pµ*; %Chl *a* standing stock d–1) will be calculated following *Pµ*= *Iµ*/Co, where *Iµ* is the daily consumption of Chl *a* by microzooplankton (µg Chl *a* L–1 d–1) and calculated as *Iµ* = *Cm* x *g*. *Cm* is the mean Chl *a* concentration throughout the incubation (µg Chla L-1), defined from Frost (1972).

**Mesozooplankton grazing** estimations followed the protocol of Vincent & Hartmann (2001). At the beginning and end of each incubation, all bottles (3 controls and 3 to 6 bottles containing copepods) were sampled for:

* total Chl *a* (GF/F filters),
* phytoplankton taxonomy (100 mL seawater preserved with acid lugol at 2% final concentration,
* microzooplankton taxonomy (500 mL seawater preserved with acid lugol at 2%),
* incubated copepods which were retrieved on 200 µm mesh sieve and preserved in formalin (4%),
* Fecal pellets produced during the incubation (directly filtered by gravity onto GF/A or GF/F filters).

At laboratory, changes in chlorophyll *a* / phytoplankton concentrations over the course of the incubation will allow to estimate apparent phytoplankton growth rates in control bottles (*k*, h–1). Copepod grazing rates (*g*, d–1) as well as clearance rates (*F*, mL ind–1 d–1) and ingestion rates (µg Chl *a*, µgC or number of prey ingested ind–1 d–1) will be estimated from changes in prey concentration over time in bottles containing copepods. Other parameters will be derived from taxonomic analyses of prey assemblages (phyto– and micro–zooplankton counts) and concern copepod selectivity (*e.g.* Ivlev index, Ivlev, 1961) as well as feeding target (*e.g.* Meunier *et al.,* 2018).

Incubated copepods will be measured and staged so as to address the initial incubation conditions. Biometry could also be related to respiration rates (Mayzaud *et al.,* 2002) and compared to actual rates measured onboard by S. Blain.

The **number of fecal pellets** produced over the course of experiments will be estimated from image system analyses of the filters (on a section, sub-section or a given diameter of the filter). Fecal pellets will be measured (length, width and biovolume) and counted to estimate the fecal pellet production rate as the number of fecal pellets produced (FP ind–1 d–1) or volume of particulate matter egested per day (µm3 ind–1 d–1).

**Evacuation rates** will be estimated from zooplankton species/groups/size fraction using time series frozen samples (from 10 to 90 min) after collection. The method is the same as for gut content and corresponds to 1) an extraction of pigments in acetone and 2) the measure of chlorophyll *a* gut content (ng Chl *a* ind–1). The decline in individual gut content over time (from 10 to 90 min) will be fitted with a negative exponential model (*e.g.* Mayzaud *et al.,* 2002) to estimate gut evacuation rate (h–1).

Ingestion rates (ng Chl *a* ind–1 d–1) will then be estimated from the product of gut content and gut evacuation rate following Bautista & Harris (1992).

## Analytical procedure

Chlorophyll a and pheopigments will be estimated by fluorimetry following Lorenzen (1966). Collected samples (filters or organisms) has been flash frozen (liquid nitrogen) and stored at -80°C onboard. In the laboratory, samples (filters or a defined number of copepods) will be extracted overnight in 90% acetone, and fluorescence values converted to pigment concentrations (chlorophyll a and pheopigments, µg L−1) using a standard chlorophyll *a* solution (*Anacystis nidulans*, Sigma).

## Units

|  |  |
| --- | --- |
| * Microzooplankton grazing rates | g d–1 |
| * Microzooplankton grazing pressure | % standing stocks consumed d–1 |
| * Mesozooplankton grazing rates | g d–1 |
| * Mesozooplankton grazing pressure | % standing stocks consumed d–1 |
| * Phytoplankton instantaneous growth rates (for < 200 µm natural prey assemblages) | d–1 |
| * Clearance rates of dominant copepods[[1]](#footnote-1) | mL ind–1 d–1 |
| * Ingestion rates of dominant copepods | µg C ind–1 d–1 |
| * Gut clearance rate constants of dominant copepods | h–1 |
| * Gut clearance rate constants of size fractions | h–1 |
| * Fecal pellet production of dominant copepods | FP ind–1 d–1 |
| * Fecal pellet biometry and biovolumes | µm3 |

## Sensor precision

N/A

## Post-cruise data analysis/treatment required

N/A

## Estimated Date of Delivery

Microzooplankton grazing: February 2019

Mesozooplankton grazing/clearance rates/Fecal pelets: July 2019

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1. Dominant copepods: *Calanus simillimus* and *Metridia gerlachei* [↑](#footnote-ref-1)