The role of zooplankton in the flux of carbon at the NW Shelf of Spain

Kurt S. Tande and Elisabeth Halvorsen

Norges Fiskerihøgskole - Universitetet I Tromsø

1. The deliverables for partner 3b are as following:

1.1. Determination of mesozooplankton standing stocks, described as 3D pattern of mesozooplankton based on horisontal and vertical profiles over time by using SCANFISH MK II OPC and MOCNESS

1.2. Compatible estimates of mesozooplankton & herbivory

1.3. Intercalibration experiments and analysis

1.4. Mesozooplankton species and size category distribution

1.5. Grazing rates of mesozooplankton

1.6. Grazing model concept and data to modellers

Status scientific progress (12 mo)

1.1. Determination of mesozooplankton standing stocks, described as 3D pattern of mesozooplankton based on horisontal and vertical profiles over time by using SCANFISH MK II OPC and MOCNESS

Mesozooplankton abundace, biomass and distribution on ranges from small to mesoscale was determined to be monitored by Optical Plankton Counter (OPC) mounted on a SCANFISH MK II platform. This work has been undertaken during 1997 as a multipurpose investment at the laboratory. The system has been purchased by funds outside OMEX, but the project has contributed to the implementation prosess.

The system enable us to continously monitoring the temperature, salinity, fluorescense and particles from surface to 500 m of depth. Examples of primary data is taken from Balsfjorden, a North Norwegian fjord, and shows the tremendous potential such a system is providing (Fig. 1). From these basic data countours of concentrations of the above variables enable us to construct 3-D patterns in small and mesoscale ranges over confined periods of time.

A further step in data processing provides information on biomass (log body weight) and particle size distribution (biomass spectrum) for a range in particle size (Fig. 2). Examples from three different loacations demonstrate that a high latitude site as Balsfjorden deviate substantially from warm water environments. The actual particle spectrum can be calibrated by conventional zooplankton sampling followed by microscopic size determination.

The system is now up running, and was planned to contribute strongly to the field programme in OMEX II. Unfortunately, there is not space onboard RV “Darwin” for a group of three people which is needed to run the system, and we are therefore unable to adopt this sampling approach on the cruise.

The mesozooplankton sampling on the cruise in August 1998 will be covered by using MOCNESS with additional support from WP-2 nets.

1.2. Compatible estimates of mesozooplankton & herbivory

During the first 12 mo of the project, partner 3b has contributed to basic planning on two workshops and one separate meeting with colleagues at SOC. Partner 3 b contributed strongly to establish a mesozooplankton and sedimentation group at the meeting in Paris in November 1997, where the lines of communication were established. This enabled us to do the first stage planning, which was a prerequisite for success at the second meeting in Lisbon in April 1998.

The status of the plans for the cruise onboard RV "Darwin" are spelled out in details below:

Leg 1
The ship will stay by a drifting Argous buoy on-shelf, following a Lagrangian approach.

In order to describe the temporal evolution in the distribution of mesozooplankton, we will use the MOCNESS to sample from 3 depth intervals: 0-50 m, 50-100 m and 100-bottom. This will be done every six hours, every other day during the cruise. The content of each net will be fractionated into size categories of 2000-1000 μm, 1000-500 μm and 500-200 μm, and preserved in 4% buffered formaldehyde. Analyses of the samples will consist in scanning by a laboratory optical plankton counter (OPC). This gives the abundance of the animals in the different size fractions, as well as volume, which can be converted into biomass.

Preferably, one days session of MOCNESS sampling could be substituted by sampling with a triplicate WP-2 system, providing animals for gut fluorescence measurements, and estimates of abundance and biomass integrated for the upper 100 m. This would allow for comparison with the grazing rates obtained for the shelf edge area on Leg 2.
Additionally, this would allow intercalibration between the WP-2 and MOCNESS sampling systems.

Gut evacuation experiments will be carried out twice at noon and midnight. This involves sampling live animals with the WP-2, transferring them to 10 l carboys with FSW, and measuring gut fluorescence in subsamples taken out at short time intervals. This will be carried out in a constant temperature room (sea surface temperature).

If time allows, an incubation experiment will be carried out, where the functional response of the mesozooplankton to different concentrations of phytoplankton will be measured. This could be done if we encounter a phytoplankton bloom.

Leg 2
The ship will stay by a drifting Argous buoy off-shelf (in a filament), following a Lagrangian approach.

We are interested in the impact of mesozooplankton grazing in this shelf area, and will estimate grazing rates by measuring gut fluorescence. Every six hours mesozooplankton will be sampled (from 0-100 m) using a triplicate WP-2 system, providing animals for gut fluorescence measurements, and estimates of abundance and biomass. The content of each net will be fractionated into size categories of 2000-1000 μm, 1000-500 μm and 500-200 μm. Analysis for abundance will be made using an OPC (which also gives volume), whereas the samples for biomass will be filtered onto GF/C-filters and presented as μgC m^{-3}.

Ingestion rates will be estimated by measuring gut fluorescence from the collected samples, and taking into account the gut evacuation rate (method based on Morales *et al.*(1991) and Barquero *et al.* (in press)):

$I = G * k$

where k is an evacuation rate constant. This constant will be determined by measuring the decrease in gut fluorescence content of animals kept in FSW. If the difference in concentration of phytoplankton on the shelf (Leg 1) and off shelf (Leg 2) is substantial, gut evacuation experiments should be carried out on Leg 2 as well, since gut evacuation time may vary with food concentration.

Daily grazing impact of the mesozooplankton
The grazing rates obtained by the gut fluorescence method on Leg 2 will, combined with abundance and biomass data on the different size fractions, be incorporated into a model to estimate daily grazing impact of mesozooplankton in this shelf area (Dag Slagstad, SINTEF). Total integrated daily phytoplankton production and total integrated chlorophyll values for the selected depth interval (0-100 m) is also needed for this model.

The MOCNESS samples from Leg 1 provides abundance and biomass data on the different size fractions on the shelf, differentiated into 3 depth intervals. Integrating the two upper intervals (0-50 m and 50-100 m) allows for comparison with the WP-2 samples on Leg 2, which gives the same information integrated over the upper 100 m.

If there is no major difference between the composition of the mesozooplankton on shelf and at the shelf edge, the grazing rates obtained at the shelf edge could be interpolated and used for the entire area.
Selected samples from both legs should be analysed for taxonomical composition of the mesozooplankton.

1.3. Intercalibration experiments and analysis

Intercalibration experiments has been planned, and will be conducted well before the cruise. A scientist from SOC will visit UITØ where the basic methods and experiomental set-up will be tested in shipboard experiments close to Tromsø.

Plans for the coming 12-24 mo:

The partner will for the coming period continue with the ongoing work accoring to the below listed tasks. Most of these are already running, but emphasis will be place on 1.4 - 1.6. in the latter part of the next project period.

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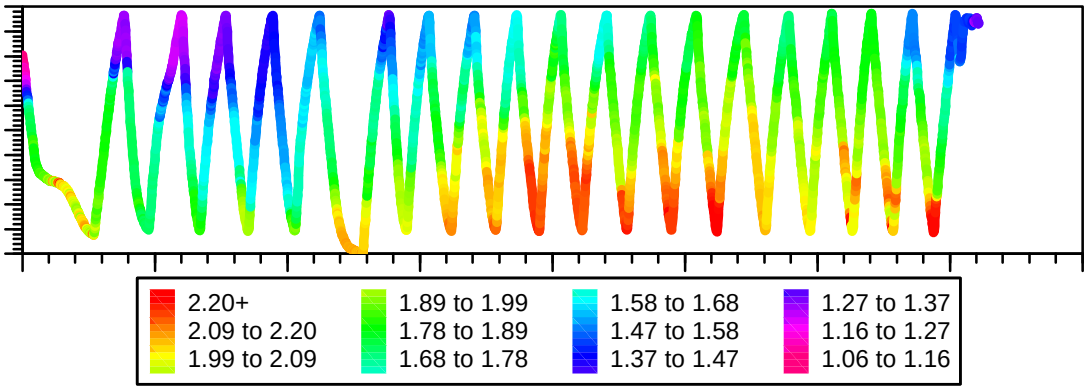
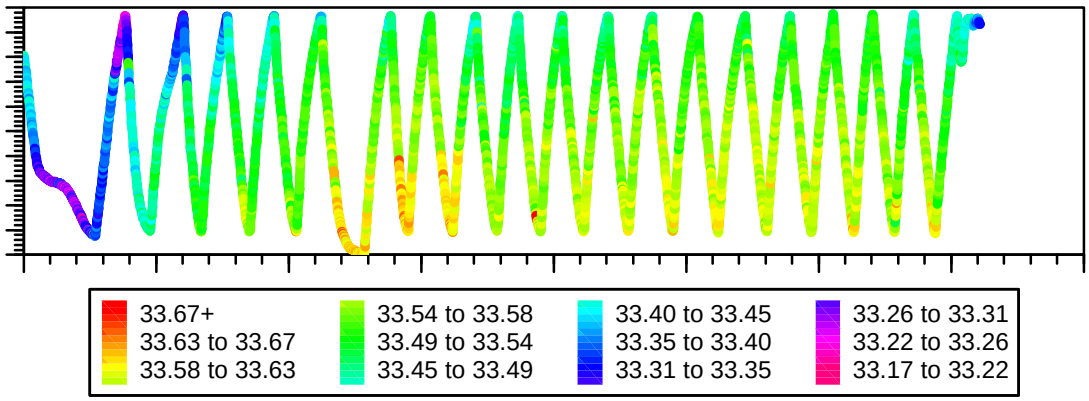
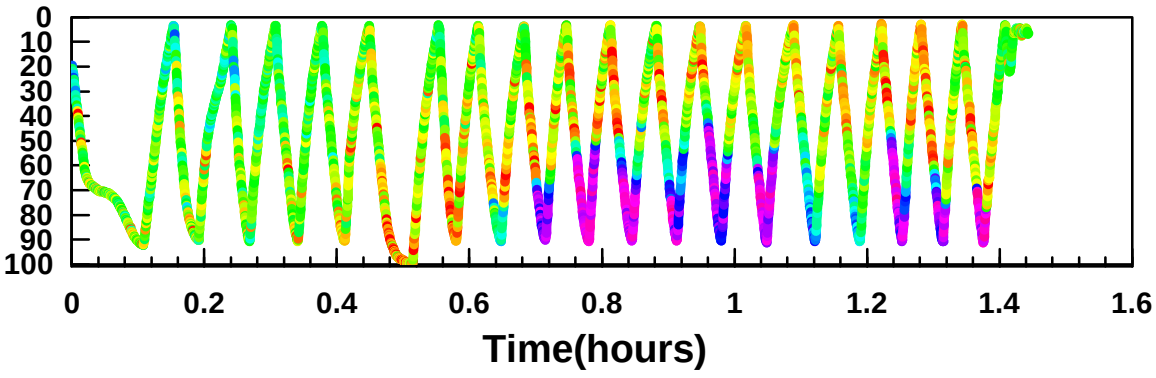
Temperature

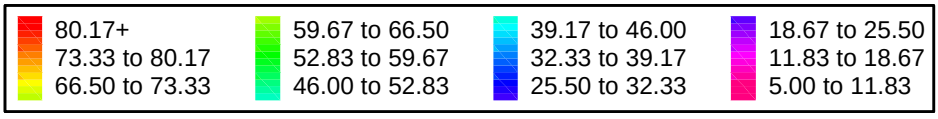


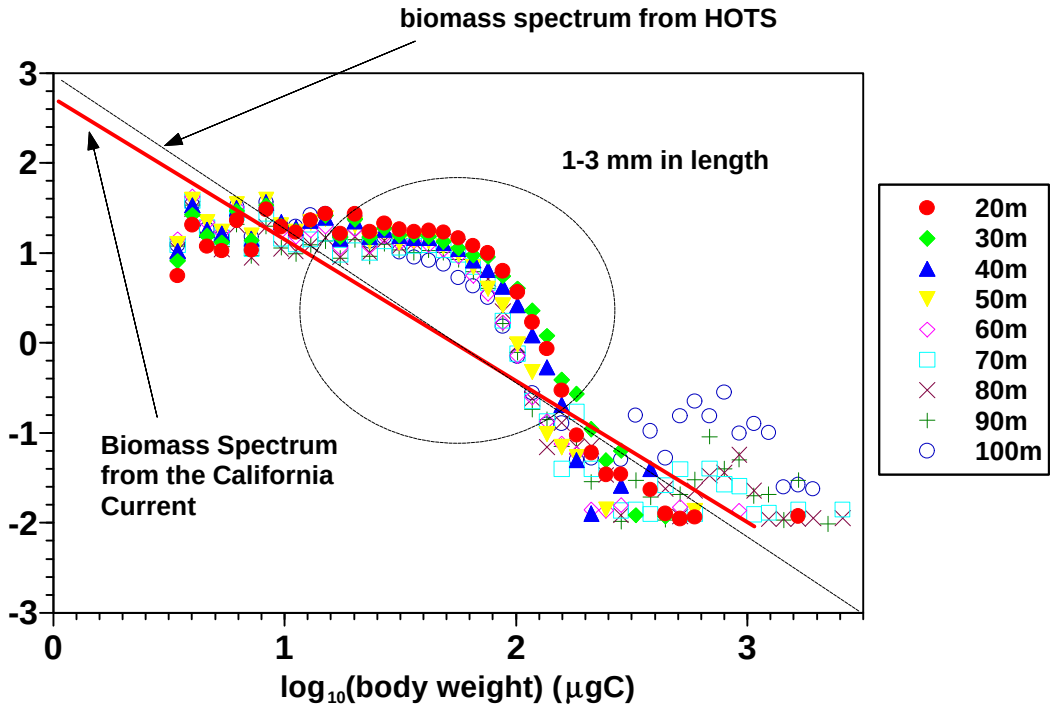
Salinity



Counts/s






biomass spectrum from HOTS
1-3 mm in length
Biomass Spectrum
from the California
Current
20m
30m
40m
50m
60m
70m
80m
90m
100m
3
2
1
0
-1
-2
-3
0
1
2
3
log10(body weight) (µgC)