EURO-BASIN
BASIN SCALE ANALYSIS, SYNTHESIS AND INTEGRATION

SEVENTH FRAMEWORK PROGRAMME THEME 6 Environment

Collaborative project (Large-scale Integrating Project)

Project no: 246 933

Project Acronym: EURO-BASIN

Project title: European Basin-scale Analysis, Synthesis and Integration

Deliverable 1.3.3 Report and delivery of consolidate historical data on abundance of key zooplankton species (*C. finmarchicus*, *C. hyperboreus*, *Oithona* and Oncaea) over decadal time scales for the North Atlantic

Contributors: Torkel Gissel Nielsen

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Actual submission date: 20.02.2013
Organisation name of the lead contractor of this deliverable: UniHB, Stéphane Pesant

Start date of project: 31.12.2010 Duration: 48 months
Project Coordinator: Michael St John, DTU Aqua

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Dissemination Level		
PU	Public	
PP	Restricted to other programme participants (including the Commission)	x
RE	Restricted to a group specified by the consortium (including the Commission)	
CO	Confidential, only for members of the consortium (including the Commission)	

Deliverable 1.3 Report and delivery of consolidated historical data is a contribution to **Task 1.3.3: Consolidate historical data on abundance of key zooplankton species (*C. finmarchicus*, *C. hyperboreus*, *Oithona* and *Oncaea*) over decadal time scales for the North Atlantic**

Executive Summary:

Data about zooplankton abundances were collected in Disko Bay and Godthåbs fjorden off Greenland by the research group of Professor Torkel Gissel Nielsen in corporation with the Greenland Climate Research Centre. Field studies and laboratory experiments were conducted to gain knowledge about interactions among climate, oceanography and plankton succession.

The investigation in Disko bay focused on sea ice dependent timing of the spring bloom in relation to the appearance of the key grazers the Calanus in the surface layer. In the laboratory the response of the three Calanus species to temperature changes were tested. These experiments showed that the Atlantic C. finmarchicus in contrast the two arctic species would benefit from temperature increase within the predicted future range.

An intensive, seasonal study in a branch of the Godthåbsfjord-system showed a plankton community which was completely different from the one in Disko bay. Here Calanus had a minor role in the zooplankton community. The inshore population of Atlantic cod had significant breeding here and their larvae would therefore depend on other copepod species than Calanus for successful feeding and survival.

The present data sets will help EURO-BASIN in addressing important aspects of the phenology of the understudied non-Calanus copepods, Metridia, Oithona, Oncaea and Microsetella and made a thorough evaluation of their role for the feeding and growth of cod larvae. The comparison of plankton successions from the two areas with other datasets from EURO-BASIN will lead to new understanding of the key bio-physical linkages at the bottom of the trophic chain, and contributed valuable information for evaluating the consequences of a future warmer climate in the North Atlantic.

Relevance to the project & potential policy impact:

The aim of data archaeology tasks (T1.3.x) is for EURO-BASIN partners to harmonise their data and archive them at PANGAEA, bringing them into Open Access so that the broader scientific community can benefit from integrated, quality-checked datasets. Each of the data archaeology task (T1.3.x) is relevant to research activities in other Work Packages (see Table below). The present deliverable is directly relevant to research activities in Work Package 4 "Trophic Flows".

Data Archaeology (WP1)	Data Analysis
T1.3.1 (literature review)	WP2 Biological Pump
T1.3.2 (sample re-analysis)	WP3 Biogeography
T1.3.3 (rescue)	WP4 Trophic Flows
T1.3.4 (rescue)	
T1.3.5 (sample re-analysis)	
T1.3.6 (rescue)	WP5 Living Resources
T1.3.7 (data re-analysis)	
T1.3.8 (data re-analysis)	

The main outcome of these data archaeology tasks (T1.3.x) is the publication of a special issue in the open-access, peer-reviewed journal Earth System Science Data, as a mean to disseminate the work to the scientific community. EURO-BASIN modeling activities can already benefit from a recent ESSD special issue about Global distributions of Plankton Functional Types (http://www.earth-syst-sci-data-discuss.net/special_issue9.html). Complementary to that special issue, EURO-BASIN will publish an important compilation of data about biogeochemical rates mediated by plankton, biogeography of key plankton species, and estimates of the size, structure, biomass and diet of key fish stocks in the North Atlantic Ocean. The special issue will be published in 2013, following a progressive submission/review process of 10 months, starting in March. The present deliverable will directly contribute to the EURO-BASIN special issue in ESSD, as part of the paper entitled "Biogeography of key mesozooplankton species in the North Atlantic, by manual counting methods".

Report:

The data originated from studies performed in the North Atlantic in the vicinity of Greenland, investigating mesozooplankton abundance and growth in relation to phytoplankton blooms. One study area was located in the Disko Bay off Qeqertarsuaq, western Greenland. Due to land connected sea ice coverage during winter, 2 sampling sites were combined. At the first site in winter (21 February to 23 March 2008), sampling was conducted through a hole in the ice at ca. 65 to 160 m depth approximately 0.5 nautical mile (n mile) south of Qeqertarsuaq (69° 14' N, 53° 29' W). In spring and summer (9 April to 18 July), sampling was done at a monitoring station 1 n mile south from Qeqertarsuaq (69° 14' N, 53° 23' W) at 300 m depth, onboard RV 'Porsild' (Arctic station, University of Copenhagen) and 'Maja S' (Finn Steffens, Qeqertarsuaq). Sampling was carried out between 10:00 and 17:00 h. During sampling from the ice, mesozooplankton was collected using a modified WP-2 net (45 µm) equipped with a closing mechanism (Hydrobios). Samples were collected in 3 depth strata (0– 50, 50–100, and 100–150 m). During ship-based sampling, mesozooplankton was collected with a multinet (50 µm) equipped with a flow meter (Multinet, Hydrobios type midi), and 2 additional depth strata (150– 200 and 200–250 m) were included. In addition to the seasonal study one diurnal investigation with sampling every 6 h was conducted from 29 April at 12:00 h to 30 April 30 at 12:00 h. Samples were immediately preserved in buffered formalin (5% final concentration) for later analyses. Biomass values of the different copepod species were calculated based on measurements of prosome length, and length/weight relationships. The specific aim was to investigate the succession and fate of the spring diatom bloom in Disko Bay, with emphasis on evaluating the role of sedimentation versus grazing impact by the *Calanus* dominated zooplankton community study site (for more details see also Swalethrop et al, 2011; Dünnweber et al., 2010). One key result of this study was that C. finmarchicus and C. glacialis ascended to the surface layer at the onset of the spring phytoplankton bloom, followed by C. hyperboreus 2 weeks later (Figure 1). C. finmarchicus spawning occurred during the bloom and postbloom period, partially fueled by wax esters. C. glacialis commenced spawning before the bloom, yet it was greatly stimulated when food became available. However, feeding and reproduction was terminated after the main bloom despite the presence of food. In terms of feeding, this was also the strategy for C. hyperboreus. Between pre-bloom and post-bloom, C. finmarchicus showed an increase in carbon, nitrogen, and phospholipid content but a decrease in total lipid content. This was likely the result of protein synthesis, oocyte maturation, and spawning fueled by wax esters and by feeding. C. glacialis showed a similar pattern, although with an

increasing total lipid content from pre-bloom to post-bloom, and an increasing wax ester and decreasing phospholipid content after reproduction was terminated. C. hyperboreus showed greatly increased content of carbon, nitrogen, and all lipid classes between the pre- and post-bloom periods. Hence, C. finmarchicus commenced feeding and spawning at the onset of the bloom and continued throughout the remaining study period. Both C. glacialis and C. hyperboreus females refueled their storage lipids (wax esters) during the bloom and post-bloom period, suggesting that they may spawn in an additional year.

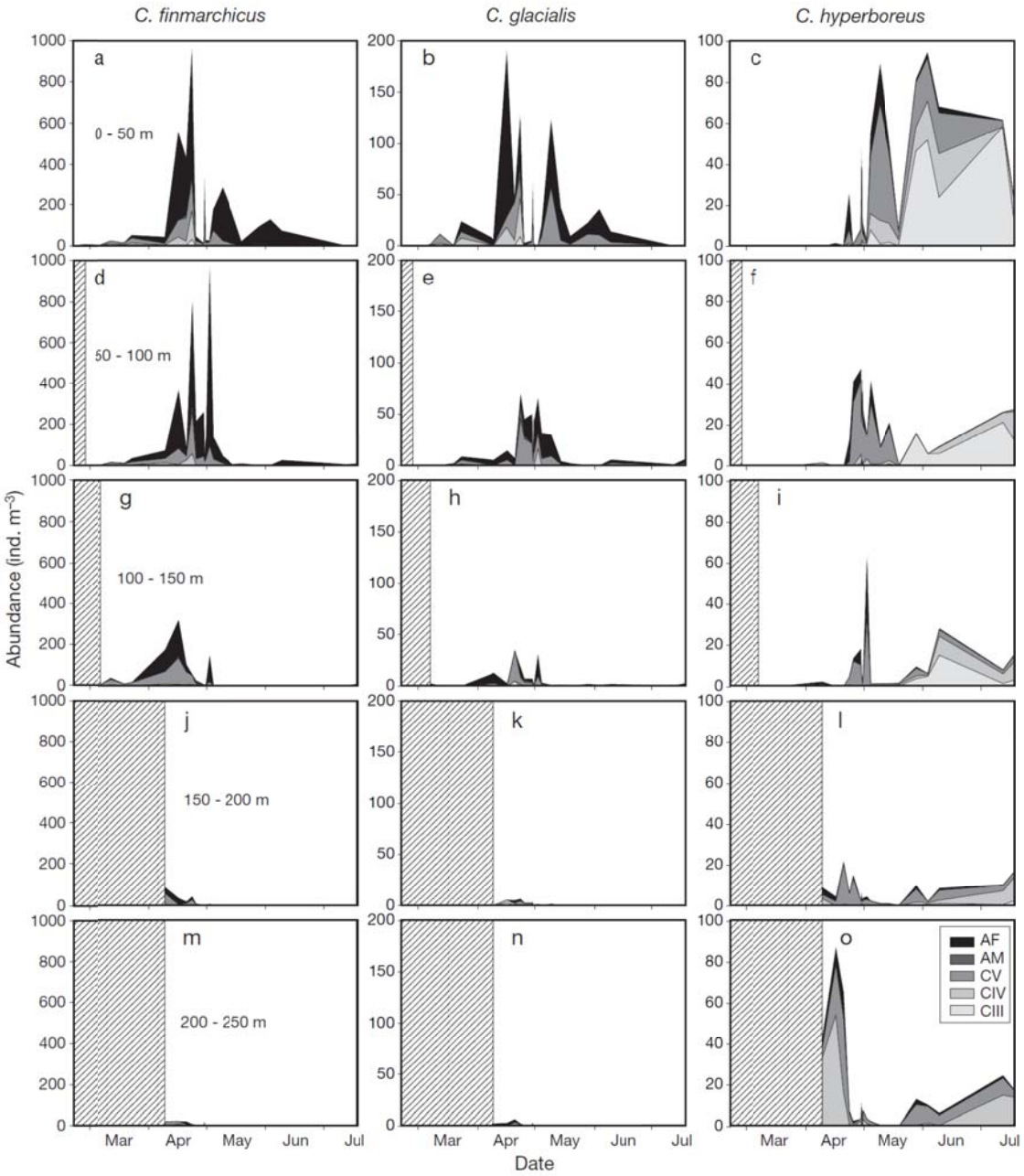

Figure 1: Calanus finmarchicus, C. glacialis, and C. hyperboreus. Abundance of copepodite stages III (CIII), IV (CIV), V (CV), adult males (AM), and adult females (AF) at depth intervals (a–c) 0–

50 m, (d–f) 50–100 m, (g–i) 100–150 m, (j–l) 150–200 m, and (m–o) 200–250 m. Note that sampling began on 21 February, while at 50–100, 100–150, and 150 – 250 m, sampling was not initiated before 27 February, 7 March, and 9 April, respectively (hatched area). Note the diurnal migration in the upper layers between 25 April and 2 May and the different scales on the y-axes

The 2nd study area was located in the in Kapisigdlit an inner fjord branch of the Godthåbsfjord system, West Greenland. A modified fishing boat "Lille Masik" was used for most of the sampling, except on June 17th-18th where R/V Dana (National Institute for Aquatic Resources, Denmark) was used. Sampling was done every 7-10 days in the period (n=15) with an extended diurnal sampling program once a month (n=6). Copepods were sampled throughout the study in 50 m depth intervals from 250 m depth to the surface using a mini Hydrobios multi-net. The nets were hauled by a with a speed of 10 m s^{-1}. Samples were preserved in buffered formalin (4% final concentration). Sampling was approximately carried out at 6 pm local time. On monthly 24 hour program (n=6) additional sampling was done at 12 pm, 6 am, 12 am. This study focused on the phenology of the major groups of copepode the two large lipid rich genera *Calanus* and *Metridia* and the smaller egg carrying *Microsetella*, *Oncaea* and *Oithona* in relation to the oceanographic settings and the succession of the plankton community in general.

Our investigation showed that the composition of the zooplankton community expected to sustain the cod recruitment is very different for the lipid rich *Calanus* communities known form other areas with strong cod populations. Highlights of the findings are in particular a novel understanding and description of the phenology of several understudied copepod genera important for the trophic dynamics in fjord systems, *Metridia* (Kjellerup et al. in prep), *Oithona* (Zamora-Terol et al. submitted), *Oncaea* and *Microsetalla* (Koski et. al submitted)and the evaluation of their role for cod larvae feeding and growth. One paper (Riisgaard et al. submitted) analyses the seasonal succession and regulation of the protozooplankton in the fjord branch, a food web component that in general have received little attention. The seasonal cycle of Arctic plankton are highly impacted by climate changes through reduction of sea ice cover and freshening of the surface water. Recently, protozooplankton (ciliates and dinoflagellates) has been documented to play a key role in high latitude pelagic ecosystems.

These data sets focusing on investigation along the Greenland coast and do not cover the entire North Atlantic but the data set are unique with respect to their temporal resolution in zooplankton

PANGAEA Data Archiving & Publication PDI-3119

EuroBASIN - Task 1.3.3 Consolidate historical data on abundance of key zooplankton species

Details

Type:	Task	Status:	Open
Priority:	Major	Resolution:	Unresolved

Description

Responsible: DTU-AQUA
Start: Month 4; End Month 16.

Consolidate historical data on abundance of key zooplankton species (C. finmarchicus, C. hyperboreus, Oithona and Oncaea) over decadal time scales for the North Atlantic. Sources: traditional net sampling [supports T4.1]

Attachments

Activity log - Kapisigdlit 2010.xlsx	69 kB	2012-10-12 13:25
Basin Data input oktober 2012.docx	21 kB	2012-10-12 13:43
Biomass sample information - Disko Bay 2008.xls	31 kB	2012-10-12 13:22
Mesozooplankton data - Disko Bay 2008.xls	6.73 MB	2012-10-12 13:22
Mesozooplankton data - Kapisigdlit 2010.xlsx	3.21 MB	2012-10-12 13:25
Net log - Kapisigdlit 2010.xlsx	50 kB	2012-10-12 13:25

Activity

All | Comments | Work Log | History | Activity

Stephane Pesant added a comment - 2012-09-07 12:48
UPDATE from 18 months report:

The organization of historical data for West Greenland zooplankton has started and D1.3 is delayed by 6 months.

Stephane Pesant added a comment - 2012-10-12 12:52
Hi Rasmus,
In case it was not clear, you can upload datasets by following the link in this email.
Once in the ticket system, you go to "More Actions" and select Attach Files.
Cheers,
Stéphane

Rasmus Swalethorp added a comment - 2012-10-12 13:22
Mesozooplankton seasonal study from february to july in Disko Bay, West Greenland

Rasmus Swalethorp added a comment - 2012-10-12 13:25
Mesozooplankton seasonal study in Kapisigdlit, a fjord branch in the Godthåbsfjord system, West Greenland

Janine Felden added a comment - 2013-02-14 17:26
Hi Rasmus,

I have started to work on the data set from Disko Bay. As you know PANGAEA is a geo- and time referenced data base and thus we prefer to get as precise as possible information about the sample location (Lat, Long) and time. Of course we are also interested in other metadata.

Therefore, I am wondering if you can complete the information about coordinates and if possible time in the "Biomass sample information - Disko Bay 2008". If available you could also add information about the sampling and from which cruises exactly the individual samples originated. Metadata about the cruises would be nice but are not obligate. Can you please let me know also know if I have read your file correctly that the samples from one specific dates originated from the same CTD cast?

Thanks for your help,
Best wishes
Janine

Janine Felden added a comment - 2013-02-15 17:29
Hi Rasmus,

during the preparation of the data set for the import. I was struggling the column "Subsample" in the "Mesozooplankton data - Disko Bay 2008" file. Can you please specify what this is? Furthermore, I assume the lenght give in the table have the unit µm, correct?

Best regards,

Janine

People

Assignee:
Janine Felden

Reporter:
Rasmus Swalethorp

Watching (4)

Dates

Due:
2012-11-01

Created:
2012-09-07 12:47

Updated:
2013-02-15 17:29

abundances and diversity. Furthermore, the data can be linked directly to environmental data which had been generated in simultaneously in the two study areas. In the future and the framework of EuroBasin more data will become available strengthen further our understanding of how the base of the marine pelagic food web will be impacted and change in a future warner ocean

References:

Dünweber M, Swalethorp R, Kjellerup S, Nielsen TG, EF Møller, M Hjort, K Arendt & K Tönnesson (2010) Fate of the spring diatom bloom in Disko Bay, western Greenland. Mar Ecol Prog Ser. 419: 11-29.

Swalethorp R, Kjellerup S, Dünweber M, Nielsen TG, Møller EF, Rysgaard S, and BW Hansen (2011). Production of Calanus finmarchicus, C. glacialis and C. hyperboreus in Disko Bay, western Greenland, with emphasis on life strategy. Mar Ecol Prog Ser: 429:125-144

Zamora-Terol, S. Nielsen TG & Saiz E (in press) Plankton community structure and role of Oithona similis on the western coast of Greenland during the winter-spring transition . Mar Ecol Prog Ser