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Marine Matters

What's on the menu?
Feeding rates and selectivity of meroplankton larvae in the Western English Channel

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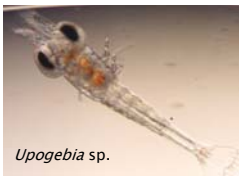
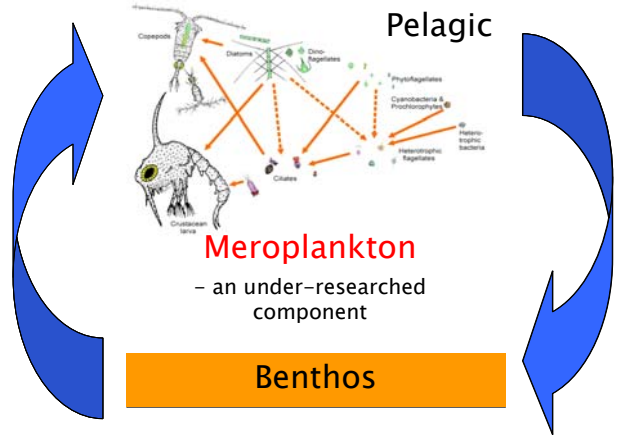


Introduction

Meroplankton, organisms that are planktonic for part of their life cycle, are an important component of the coastal marine food web during the reproductive season of benthic organisms. They may live in the plankton for several weeks, competing with holoplanktonic (permanent plankton) grazers, and in turn provide food sources for a variety of fish larvae and other organisms. In order for meroplankton larvae to survive, develop successfully and return to the benthos as juveniles, it is important for them to obtain a good source of nutrition in the earliest stages of life. It is thought that the larvae are omnivorous but few studies have characterised in situ feeding rates on natural assemblages together with the distribution and abundance measurements for the same organism. Even less is known about their feeding preferences in coastal waters of the North Atlantic.
Although phytoplankton has long been successfully used in the culture of bivalve larvae, in the field algal concentrations are often not enough to satisfy the metabolic requirements of bivalve larvae. Therefore other food sources must be important during a bivalve's planktonic life stage.

Aims

Experimentally quantify the impact of meroplankton in the pelagic foodweb of the Western English Channel and use molecular techniques to enhance meroplankton studies through:
1) Identification of meroplanktonic larvae and 2) Detection of prey in the gut content of larvae from feeding experiments and directly from the field.



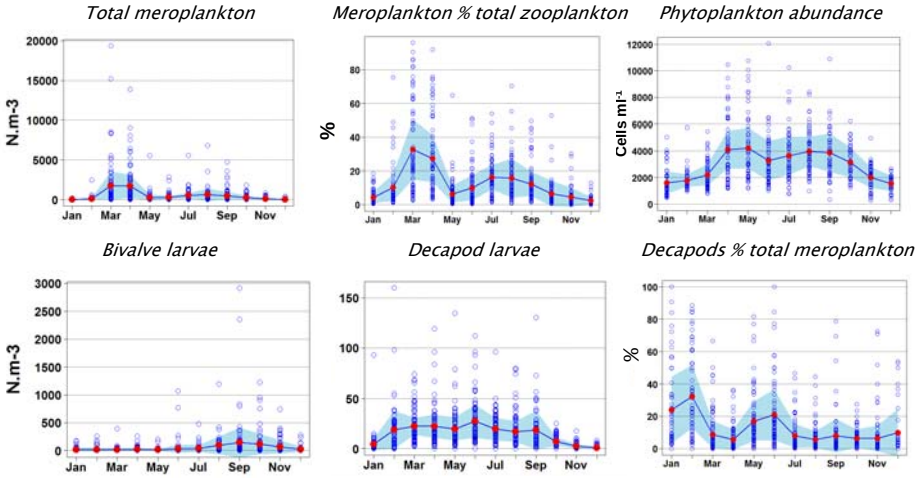
Feeding

As part of the Western Channel Observatory time series programme, we determined the temporal distribution of meroplankton larvae and the ingestion rates of decapod and bivalve larvae. Using 3 decapod genera, (*Necora* sp., *Liocarcinus* sp. and *Upogebia* sp.) and one bivalve known to be abundant at L4, we conducted a series of feeding experiments between May and November to determine larval ingestion rate on a natural mixed plankton assemblage.

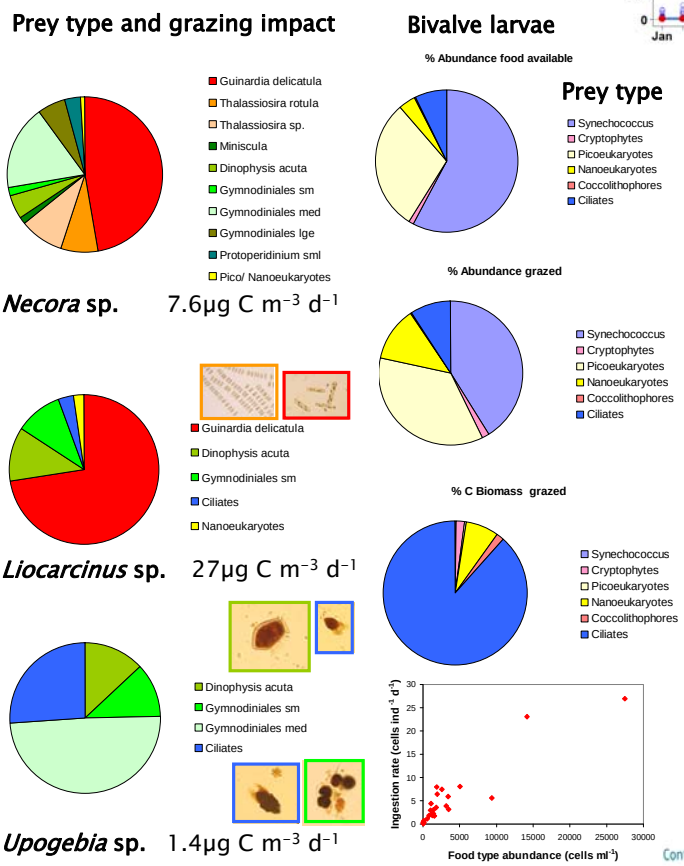
Results

We found that the decapod larvae, *Necora* and *Liocarcinus*, showed maximium ingestion rates for diatoms, whereas *Upogebia* did not ingest diatoms, but maximum ingestion rates were for dinoflagellates. Bivalves, which typically feed on smaller sized prey, showed highest ingestion rates for pico- and nanoeukaryotes. However, ciliates contributed significantly to the total carbon consumed daily.

Western Channel Observatory: 20 year averages (1988-2008)



Prey type and grazing impact



Molecular Aspects of Meroplankton Feeding

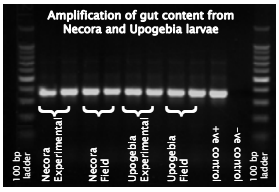
1) Identification of meroplanktonic larvae

Meroplankton larvae undergo large morphological changes between developmental phases leading to difficulties in identifying larval invertebrates in the plankton and associating them with their parent populations. As complimentary tools to classical identification PCR amplification of 18S rDNA and Cytochrome Oxidase I genes will be used to increase the level of identification. In particular larval bivalves are notoriously difficult, if not impossible, to identify to species level using traditional morphological techniques alone. Following bivalve feeding experiments larvae were pooled, sedated and DNA extracted. PCR amplification of a partial region of 18S rDNA gene was performed with universal eukaryotic primers (Holland et al., 1991). Currently a clone library is being prepared for each experiment such that the diversity of bivalve species present from October to March can be established and, where possible, the resolution of identification performed to genera or species level.

2) Detection of prey in the gut content of larvae

As part of this work we are developing a PCR-based method to further investigate feeding preferences of meroplankton species. Results from the feeding experiments are used to determine what the larvae are eating and PCR primers designed to the ingested prey. The PCR-based approach will be deployed to assess the prey ingested by meroplankton following the feeding experiments and on larvae taken directly from station L4. In this way a comparison can be made between prey ingested in the laboratory with prey ingested in the field.

Custom designed PCR primers to a partial region of the 18S rDNA gene have been designed to target *Thalassiosira spp.* and *Guinardia delicatula*. These primers have been successfully used on DNA extracted from *Necora* and *Upogebia* following the feeding experiments and from animals taken directly from the field. The primers do not amplify DNA from the predators. The amplicon is yet to be sequenced but the results indicate that *Necora* and *Upogebia* are eating *Thalassiosira* +/or *G.delicatula* in the laboratory and also in the field.



Summary

This is the first study of its kind to study impact of meroplankton larvae on the pelagic food web. Within the decapod larvae, *Necora* sp. demonstrated ability to feed on a wide variety of prey which could be an adaptation for obtaining food within a diverse and dispersed plankton community. *Upogebia* sp. and *Liocarcinus* sp. were found to be more selective. It is evident that ciliates, a non-algal component of the plankton, are important to the diet of bivalves. Molecular techniques are enabling us to enhance our resolution of species identification and to make a comparison of feeding preferences under laboratory conditions with feeding preferences in the field. This provides an increased understanding of the role meroplankton play in the pelagic environment and how feeding strategies affect the number of larval recruits returning to the seafloor.

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