ICES CM 2014/3614 A:32

Jellyfish boost productivity

Our mesocosm experiment demonstrates how bottom-up influences due to nutrient recycling and excretion of organic carbon (DOC) by jellyfish can increase both primary and bacterial production in the pelagic.

Aino Hosia[1], Christina B Augustin[2], Julie Dinasquet[3], Jorun K Egge[4], Lena Granhag[5], Maria L Paulsen[4], Lasse Riemann[6], Janne-Markus Rintala[7], Outi Setälä[8], Julia Talvitie[9], Josefin Titelman[10]

Introduction and set-up

Jellyfish are known as voracious predators capable of initiating top-down trophic cascades (Fig. 1). However, bottom-up influences of jellyfish are much less studied. Adding senescent *Cyanea capillata* with negligible predatory impact to mesocosms containing the approximate *in situ* plankton community allowed us to isolate bottom-up effects of jellyfish.

The experiment was conducted at Espegrend marine biological station, Norway, 1-8 October 2011. We had 3 treatments with varying amounts of jellyfish per mesocosm (Fig. 2). During the 8 day experiment, we daily monitored primary and bacterial production rates, abundance and composition of the pelagic community across different trophic levels (Fig. 1), and environmental conditions such as nutrient concentrations and carbon parameters.

Multivariate statistics and generalized additive mixed models (GAMM) were applied to test whether jellyfish carbon (JellyC) concentration in the different mesocosms had an impact on the monitored variables.

No differences in abundances or community composition of mesozooplankton at the end of the experiment suggested negligible predatory impact and top-down effects by the jellyfish.

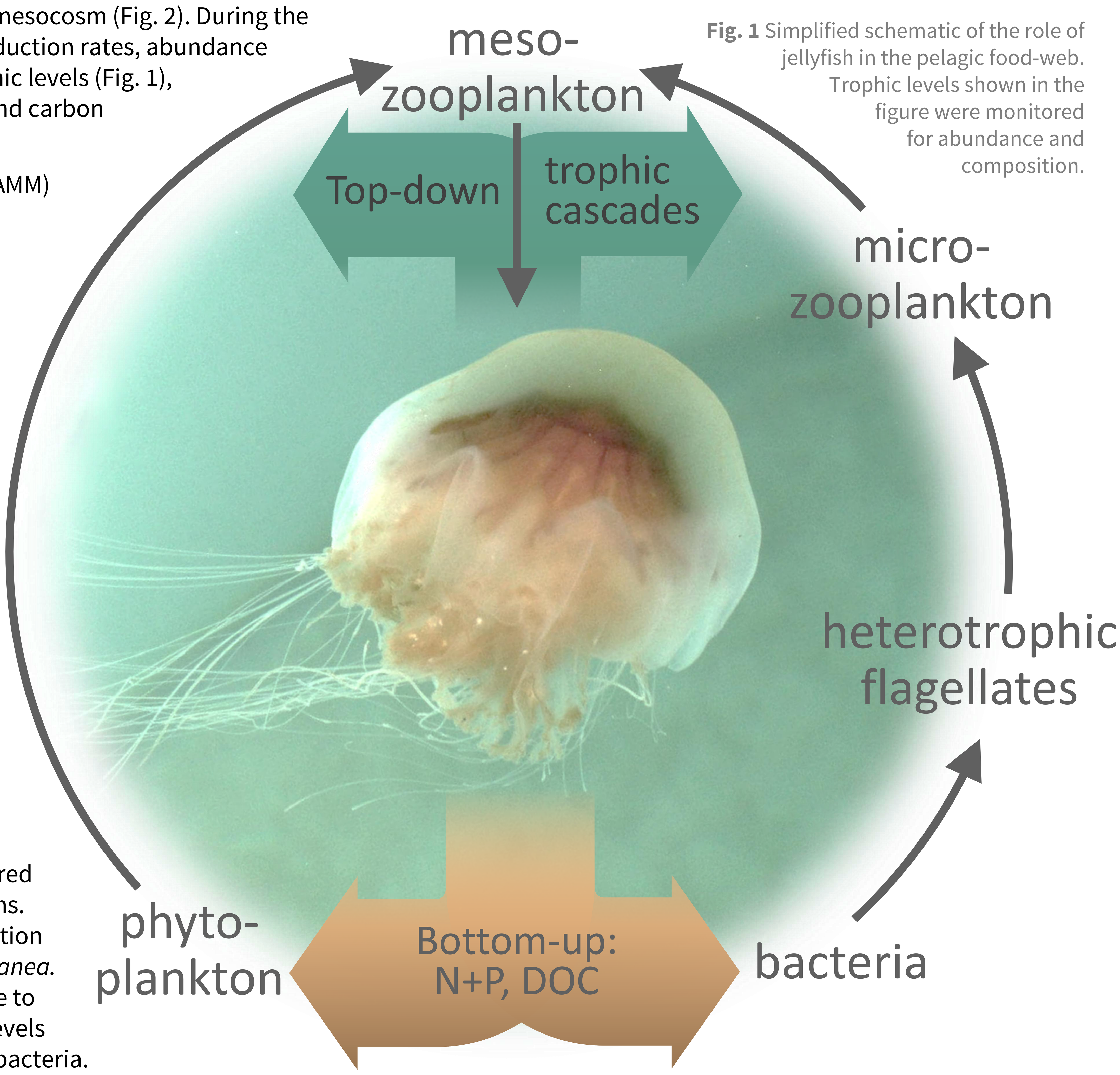
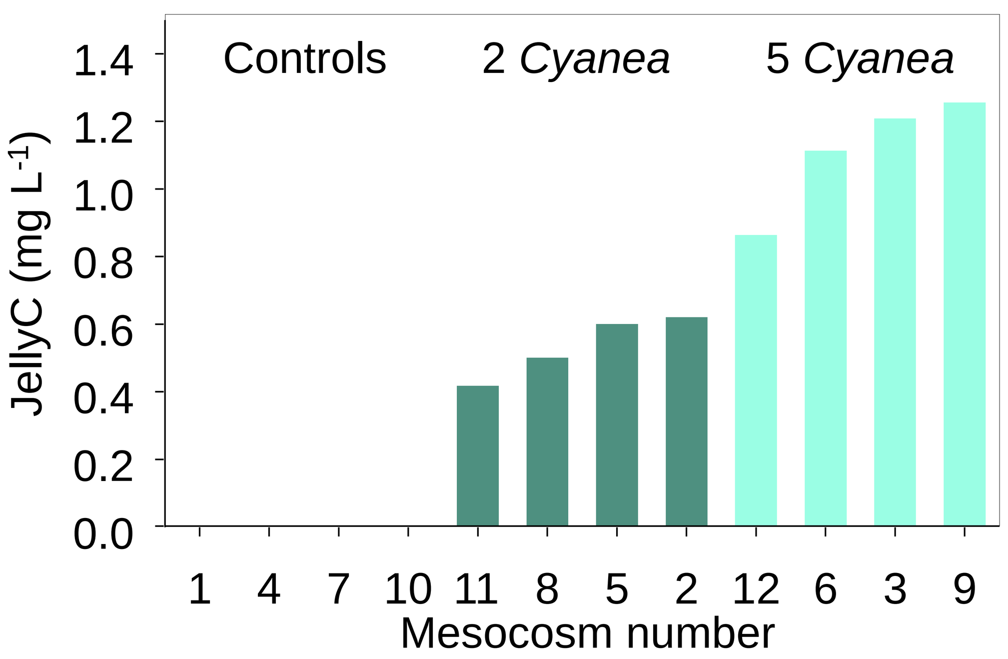


Fig. 1 Simplified schematic of the role of jellyfish in the pelagic food-web. Trophic levels shown in the figure were monitored for abundance and composition.

Fig. 2 Treatments and the concentration of jellyfish carbon (JellyC) in the mesocosms (carbon content converted from *Cyanea* diameters measured at the end of the experiment).

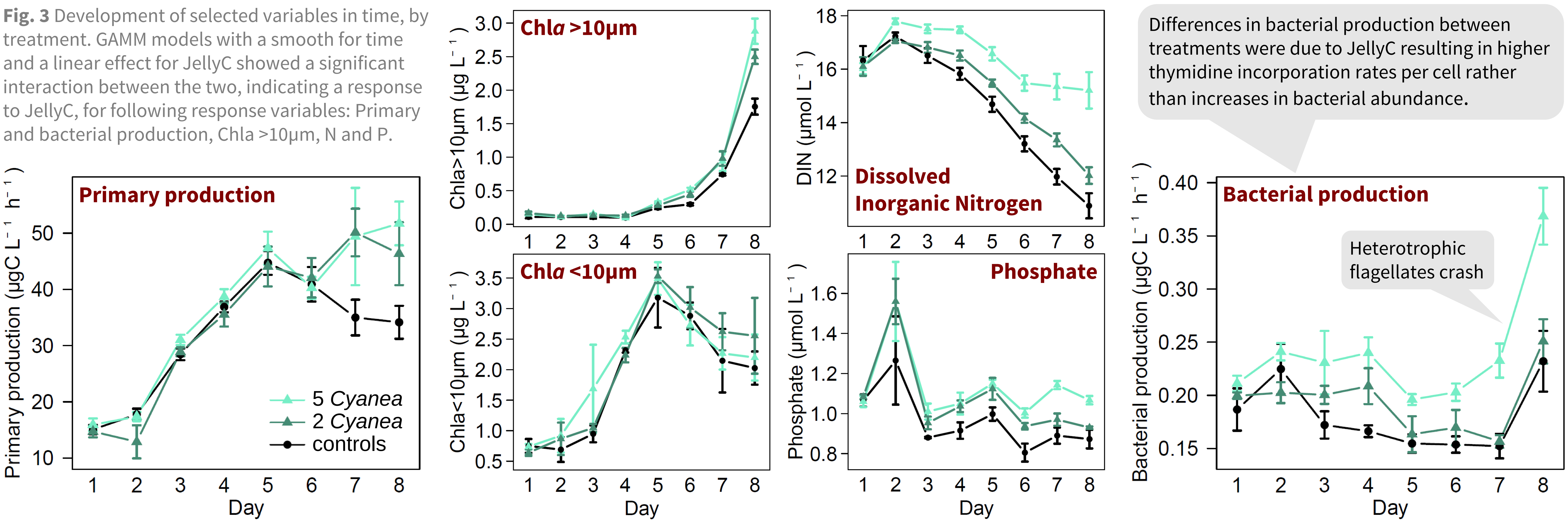


Outcome

JellyC had a positive impact on both primary and bacterial production (Fig. 3). The main effect on primary production occurred towards the end of the experiment and was mostly due to diatoms. This was also evident in the chl*a* concentrations. Primary production was probably increased by the regeneration of N and P by the *Cyanea*. Although differences in bacterial production were most likely due to release of organic matter by the jellyfish, no differences in DOC levels between treatments were seen, possibly due to rapid uptake by bacteria. Community composition of bacteria, phytoplankton and mesozooplankton all changed in time, but with no significant differences between treatments.

Fig. 3 Development of selected variables in time, by treatment. GAMM models with a smooth for time and a linear effect for JellyC showed a significant interaction between the two, indicating a response to JellyC, for following response variables: Primary and bacterial production, Chla >10µm, N and P.

Differences in bacterial production between treatments were due to JellyC resulting in higher thymidine incorporation rates per cell rather than increases in bacterial abundance.



Affiliations

[1] Institute of Marine Research, Norway. Present: University Museum of Bergen, The Natural History Collections, Norway , [2] Leibniz Institute for Baltic Sea Research Warnemünde, Germany. Present: University of Rostock, Germany, [3] University of Copenhagen, Denmark. Present: Scripps institution of oceanography, USA, [4] University of Bergen, Norway, [5] Chalmers University of Technology, Sweden, [6] University of Copenhagen, Denmark, [7] University of Helsinki, Finland, [8] Finnish Environment Institute, Finland, [9] University of Helsinki, Finland. Present: Aalto University, Finland, [10] University of Oslo, Norway

Contact aino.hosia@gmail.com

Acknowledgements

We would like to thank Agnes Aadnes and the rest of the staff at the Espegrend Marine Biological station for the facilities, and the many people at the Institute of Marine Research, University of Bergen and the SARS Centre, whose help was essential for the experiment.

UNIVERSITY OF BERGEN