



ASGEIR J. SØRENSEN

Professor at the Dept of Marine Technology, NTNU. In 2003-2012 he was key scientist in the Centre for Ships and Ocean Structures (CeSOS). He is currently acting as the Director of the Centre for Autonomous Marine Operations and Systems (NTNU

AMOS) at the Departments of Marine Technology and Engineering Cybernetics, NTNU. Sørensen has authored more than 190 scientific articles & book chapters. Sørensen has graduated more than 90 MSc and 18 PhD candidates. Sørensen is engaged in bringing fundamental research results into value creation by innovations and entrepreneurship. In 2002 Sørensen and 5 partners founded the company, Marine Cybernetics AS, acting as President and CEO until June 2010. In 2012 and 2015 Sørensen became a co-founder of the NTNU spin-off companies Ecotone AS and Eelume AS, respectively. Enabling technology for marine science is one of several research areas that Sørensen brings into research in the Arctic.

Photo: Thor Nielsen/NTNU CeSOS

KEY PAPERS

Berge, Renaud, Darnis, Cottier, Last, Gabrielsen, Johnsen, Seuthe, Weslawski, Leu, Moline, Nahrgang, Sørreide, Varpe, Lønne, Daase, Falk-Petersen. 2015. In the dark: A review of ecosystem processes during the Arctic polar night.

Progress in Oceanography. ISSN 0079-6611. doi: 10.1016/j.pocean.2015.08.005.

Berge, Daase, Renaud, Ambrose, Darnis, Last, Leu, Cohen, Johnsen, Moline, Cottier, Varpe, Shunatova, Balazy, Morata, Massabuau, Falk-Petersen, Kosobokova, Hoppe, Westawski, Kuklinski, Legezynska, Nikishina, Cusa, Kedra, Włodarska-Kowalczyk, Vogedes, Camus, Tran, Michaud, Gabrielsen, Granovitch, Gonchar, Krapp, Callesen. 2015. Unexpected levels of biological activity during the polar night offer new perspectives on a warming Arctic. *Current Biology* 25: 1-7.

Cohen, Berge, Moline, Sørensen, Last, Falk-Petersen, Renaud, Leu, Grenvald, Cottier, Cronin, Menze, Norgren, Varpe, Daase, Darnis, Johnsen. 2015. Is Ambient Light during the High Arctic Polar Night Sufficient to Act as a Visual Cue for Zooplankton? *PLoS ONE* 10(6): e0126247

Berge, Johnsen, Sørensen, Nilssen. 2015. Enabling technology for Arctic research. *Pan European Networks: Science and Technology Magazine* 15: 199-201.

Special Issue in *Polar Biology*, vol 38(1) 2015, with 10 research papers based on the polar night cruises in 2012 and 2013.

Guest editor Ole Jørgen Lønne (UNIS).

This exhibition is based upon the research project “Marine Night” led by UiT The Arctic University of Norway, and financed by the Norwegian Research Council (project number 226417/E10).

OTHER PROJECTS INCLUDED

- SiU (Technology Development for Marine Monitoring and Ocean Observation: An North America-Norway educational program). Project period 2009-2011, see www.norus-science.no
- Circadian rhythms and diel vertical migration of Arctic zooplankton (CircA). Project period 2012-2015, see www.mare-incognitum.no
- Arctic Ocean ecosystems - Applied technology, Biological interactions and Consequences in an era of abrupt climate change (Arctic ABC). Project period 2015-2019, see www.mare-incognitum.no
- UNIS MSc and PhD course AB334/834 “Underwater robotics and polar night biology” (led by Prof. Jørgen Berge, Geir Johnsen and Asgeir Sørensen).

PRODUCTION OF THE EXHIBITION, AND ON THIS FOLDER

Idea, text and design by Professor Jørgen Berge and Professor Geir Johnsen, text and design by Dr Anne Helene Tandberg, text by Professor Paul Renaud, photos by Geir Johnsen, design by Reibo.

ADDITION OF NEW RESEARCH FROM THE YEARS 2015-2016 FROM NTNU CEO AMOS

New enabling technology for polar night research with contribution from Profs. Asgeir J. Sørensen, Martin Ludvigsen, Jørgen Berge and Geir Johnsen. Music by BIIAS (funded by NTNU CeO AMOS). Photos by Geir Johnsen. New posters, videos and exhibition material from NTNU AMOS & AUR-LAB. Exhibition design by Marit O. Sørungård and graphic design by Elin S. Sandbakk. Text editing by Pernille Feilberg.

Cover design: Reibo. Graphic design: Elin S. Sandbakk/NTNU





Photo: Geir Johnsen/NTNU

THE POLAR NIGHT OF THE HIGH ARCTIC is most commonly conceived as a period when marine organisms reduce their activity levels commensurate with a primary production close to zero. Food web interactions and metabolic rates are thought to be at a minimum pending the return of the sun. Here we present new and compelling evidence of a system that is rather characterized by high activity and strong interactions, from the sea-surface, to the water-column and at the seafloor. We base our observations on regular surveys during the last seven winters around the archipelago of Svalbard at latitudes between 78-81°N. In contrast to a system that has entered a state of rest, we can document a system in which there is an end-to-end high production and turnover. Ultimately, this new understanding of life in the Arctic oceans during the polar night will have strong implications both for our perception of high latitude ecosystems and for development of management- and decision strategies for an area of the world receiving increasing economic and political attention.

The Mare Incognitum – ecological processes during the polar night initiative is a Norwegian led programme that comprises many large and small research projects with one common goal – to unravel the secrets of the Arctic Ocean during the polar night and winter, arguably the least known realm of the planet. The complex interactions between the biosphere, hydrosphere and cryosphere are central, yet poorly understood, features of the Arctic Ocean. Variability or change in one or more of these systems may lead to disproportionately large changes in the ecosystem. The rapid warming of the Arctic and loss of sea ice are two well-known examples of such a phenomenon, with the potential to affect most living organisms in the region, and, in fact, in ecosystems



Photo: Geir Johnsen/NTNU

throughout the world. Spatial and temporal changes in critical ecosystem processes, such as primary productivity, can alter pelagic community structure and function, with potential consequences for such ecosystem services as fisheries harvests and sequestration of atmospheric carbon in the deep-sea. However, such ecosystem effects resulting from climate change have been considered primarily from the perspective of the polar summer, while the polar winter has essentially remained a black box – a box that is rarely considered and less frequently opened.

This exhibition is based upon the recent discoveries and insights gained through the field campaigns carried out in Ny-Ålesund on Svalbard during the last seven winters. In January 2014 and 2015 the project organised more than 120 researchers and students combined – a total of more than 2000 researcher days – all with the same common goal: to explore the secrets of the polar night!

SEE MORE ON WWW.MARE-INCOGNITUM.NO

PARTNER INSTITUTIONS

UiT The Arctic University of Norway, NTNU - Norwegian University of Science and Technology, Akvaplan-niva, UNIS - University Centre in Svalbard, St Petersburg State University, Institute of Oceanology Polish Academy of Science, The Scottish Association for Marine Science, University of Delaware.

PRINCIPAL INVESTIGATORS



JØRGEN BERGE

Professor at the Institute of Arctic and Marine Biology at UiT The Arctic University of Norway and adjunct professor at the University Centre in Svalbard. Project leader of Mare Incognitum projects, and lead author on recent scientific papers and reviews

documenting both the new discoveries and the importance of polar night studies in general. Berge received his Doctoral degree in Tromsø in 2000, and has since 2002 had a main focus on marine systems on Svalbard. He has supervised 17 MSc and 6 PhD students, is currently supervisor for 5 PhD students, and has published >95 scientific papers in international journals. Berge is currently project leader on 5 projects funded by the Norwegian Research Council.

Photo: Karine Nigar Aarskog /UiT



GEIR JOHNSEN

Professor at the Dept of Biology, NTNU, adjunct professor at UNIS, and is one of the founding partners in a NTNU spin-off company Ecotone using new optical techniques for mapping and monitoring the marine environment. He has been at 1 year research

stays at University of California at Santa Barbara (1992-93) and at Curtin University, Perth, Australia (2010-11). Johnsen has supervised 37 MSc and 12 PhD students. Currently he advises 8 MSc and 5 PhD students, has published >100 papers in international journals and has been a co-editor for the books "Ecosystem Barents Sea" and "Phytoplankton pigments". Research areas: bio-optics, photosynthesis, pigment chemotaxonomy, underwater robotics and sensor development for in situ identification, mapping and monitoring of bio-geochemical objects of interest in the marine environment.

Photo: Åge Hojem/NTNU

