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Development of ARCtic Biological INDicators for the impact assessment of (new) human activities: the ARCIND Project

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Introduction

Arctic sea routes are opening up for maritime transport due to sea ice retreat. 13% of undiscovered oil resources and 30% of undiscovered gas resources on the planet are estimated to be located in the Arctic. Arctic oil and gas exploration poses special environmental challenges to the industry due to special conditions in the Arctic. Potential for oil spill and chemical release Oil & Gas (OG) exploration and exploitation and shipping (S) in the Arctic might increase in the future due to the general increase in activity.

Knowledge concerning impacts of OG & S activities on the Arctic ecosystem is scarce [a]. Measuring contaminant concentrations and effects in benthic organisms can form an important tool for assessing and monitoring potential impacts of these activities on marine Arctic ecosystems.

Bioindicators

Monitoring tools for the assessment of human impacts on marine Arctic ecosystems are needed to help make decisions on activities and processes used.

The seafloor of the polar oceans is a sink for hydrophobic and persistent chemicals [b].

Benthic organisms are highly relevant in the Arctic ecosystem due to their crucial role in nutrients recycling and food webs. They are in direct contact with sediment and relatively immobile, and are therefore better reflecting local conditions. Polar benthic organisms can grow old and have a low metabolic capacity which may enhance accumulation of chemicals. Benthic organisms may therefore form a relevant bio-indicator to be used as monitoring and assessment tool.

Research goal

This PhD project (2013-2016) aims to develop a signalling system based on biological indicators for the prediction, assessment and reduction of potential impacts emerging from economic activities in the Arctic.

Research question

What drives the uptake of chemicals related to human activities, such as OG & S, by Arctic benthic species and what are potential sub-lethal effects after chronic exposure? Do these effects differ under changing conditions?

Macoma balthica.

Astarte borealis.

Nephtys sp.

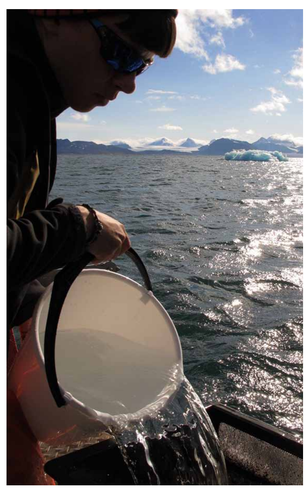
Pectinaria sp.

Research approach

Identification and selection of chemicals related to OG & S in the Arctic that show persistence and/or bioaccumulation.

Tracking causal relationships between exposure of selected chemicals and measurable or potential harm in Arctic benthic species, in the laboratory and where possible in the field. Identifying primary factors governing these relationships (e.g. temperature, food availability, seasonality).

Research location: Svalbard and the Barents Sea.



Collection of benthic species at Kongsfjorden, Svalbard (July 2013).

Expected output

- Inventories of chemical release profiles associated with OG & S in the Arctic.
- Demonstrated links between chemical release and exposure in Arctic benthic species.
- Validated dose-response relations for different chemicals and Arctic benthic species.
- Selection of established benthic bioindicators to be used as assessment and monitoring tools, including the development of criteria for selecting and validating these bioindicators using field data.

Value of this project

Bioindicators can be applied as assessment and monitoring tools in standards and guidelines for sustainable developments in the Arctic. This can be a valuable tool for governments in decision making processes and for industry in planning and constructing operations and showing the efficacy of mitigation measures.

Acknowledgements

Statoil and Wageningen UR – project 3P@Sea-Sustainable Arctic developments for funding this project.

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