

Project information

Project title

Urban development, shipping and tourism impacts on marine ecosystem in Tromsø. Investigation of cocktail effects using bivalves as sentinel species.

Year

2018-2019

Project leader

Perrine Geraudie

Geographical localization of the research project in decimal degrees (max 5 per project, ex. 70,662°N and 23,707°E)

69°38'56" N and 18°57'18" E

Participants

Dr. Pernilla Carlsson, Dr. Ian Allan (NIVA)

Pr. C. Porte, A. Gilabert, IDAEA-CSIC, Spain

Dr. Nicholas Warner, NILU

Dr. Helene Guyon-Thomas, Marine Breitwieser, LIENSs, La Rochelle, France

Pr. A. Arukwe, Dr. V. Jaspers, NTNU

T. Vasskog, UiT

Xabier Lecube, University of Basque Country, Ehu,

Flagship

Hazardous Substances

Funding Source

Theme 3 of the program but also relevant for themes 1, 2 and 4.

Summary of Results

During the first phase of the project the experimental study has been carried out in order to evaluate the toxicity and (sub)cellular effects of a range of selected environmental compounds. For that the *ex-vivo* tissue explant method which was successfully established on Icelandic scallops (Project funded by Hazardous substances flagship in 2016, Geraudie et al., in prep), has been developed and characterized on the blue mussels, *Mytilus edulis*. This species constitutes one of the most used invertebrate model in marine ecotoxicology, and is the main species inhabiting the coastal ecosystem around Tromsø. It has also been

observed as North as around Svalbard archipelago. This *ex-vivo* methodology will constitute basic knowledge to study the cocktail effects of the environmental contaminants released in Tromsø due to human activities. During the experimental study, a master student, Cesare Guercia, from CSIC, Barcelona, Spain, has been working in the Akvaplan's laboratory under the supervision of Dr. Perrine Geraudie, for 8 weeks between April and June 2018. During this time, he successfully achieved the validation of the experimental conditions (culture media, exposure time, temperature) have been characterized as 1 mL of L15 medium with 1% antibiotic, 48 hours exposure and 5 degrees incubation under slight agitation. The results shown more than 80% viability of the explants during the first 72 hours that is excellent compare to literature (Gerbron et al., 2010; Eide et al., 2016) and will ensure a really good quality of the cells during the exposure time with contaminants. Due to the good viability obtained during the optimization, the exposure time has been set up to 24 hour precincubation (to let the cells recovered from cutting) followed by a 48 hour chemical exposure. This is what demonstrated in previous studies to provide the most robust results (Gerbron et al., 2014, Eide et al., 2015).

Then the explant tissues made from the digestive gland of blue mussels have been exposed to a selection of relevant compounds. A range of concentrations has been chosen in order to study the sub lethal effects for the molecular toxicology assessment that will be undertaken in spring 2019 at NTNU. Between April and June 2019, a master student Dora Bjevov, who got Erasmus grant in Italy, will be assessing the molecular toxicology at NTNU, supervised by Dr. Veerle Jaspers, and Pr. Augustine Arukwe. During a meeting we had in October 2018 at NTNU, we had discussed the preliminary results obtained for cell viability and we selected the relevant genes for assessing endocrine impacts. Due to the chemical properties of the chemicals the focus will be made on immunotoxicity and reprotoxixity as target physiological functions which could be impacted. This will provide new findings about biological impacts and mechanisms of actions of key emerging compounds released through human activities in sub-Arctic region. The sampling will take place in November 2018 and June 2019 in order to take in consideration the impacts of seasonal variation on contaminant release.

The preliminary results obtained so far indicated the great potential of using *ex-vivo* explant tissue culture of digestive gland in two different bivalve species to investigate human activity impacts on coastal ecosystem.

PhD: Alejandra Gilaber and Marine Breitwieser

Master students: Cesare Guercia, Dora Bjevov

For the Management

The investigation of cocktail effects is crucial to evaluate the overall health of an ecosystem, as the organisms inhabiting anthropogenic habitats are exposed simultaneously to a complex mixture of chemicals. It is thus crucial to develop methodologies which ensure the characterization of the mixture effects on coastal population. Due to urbanization of the North, increasing human activities will lead to larger amount of chemical mixture released in the environment potentially impacting exposed organisms. It is important to both study and communicate about direct impacts of human activities and industrialization of the North on coastal ecosystem. The outreach activities help to develop positive impacts on environment by conducting concrete actions to reduce the impacts of anthropogenic activities targeted in our project.

Published Results/Planned Publications

Geraudie et al., 2018: "Molecular isolation and characterization of the kisspeptin system, KISS and GPR54 genes in roach *Rutilus rutilus*."

Breitwieser et al., 2018: "Spatial and temporal impacts of the Skjervøy harbor diesel spill on native population of blue mussels: a sub-Arctic case study."

Planned publications: Gilabert et al. to be submitted. "Characterization of the lipid profile of the cold-water scallop, *Chlamys islandica*, a model organism of the Arctic and Subarctic seas"

Geraudie et al., "Molecular expression of key genes involved in the reproduction of Icelandic scallops, modern tools to assess endocrine disrupting compounds in invertebrates".

Geraudie et al., "Development and validation of micro-scale experimental tools in bivalves: use of digestive and reproductive tissue to assess biomarker effects of single and mixture of environmental contaminants."

An abstract will be send to the international SETAC conference (The society of Environmental Toxicology and Chemistry), hosted in Helsinki (26-30 May 2019) with putative title:" The use of tissue explant culturing as an *ex vivo* tool to investigate sub-individual toxicology in bivalve."

Communicated Results

The project has been presented during the bachelor and master student course AT333/AT833 at UNIS in summer 2018. The course is entitled: "Petroleum in the Arctic: environmental, technological and social challenges".

The project and preliminary results obtained will be also presented to the public through a conference at Polaria, during the anniversary jubilee on the 27th of November 2018.

Finally a seminar will be done in January (the date is not settled yet), during the annual Arctic Frontier's conference, to young students from local high school, in collaboration with Arctic Frontiers Young.

The project has also been involved in different outreach activities (Fritt Fram, Forskningsdagene, Arctic Frontiers science for kids) through another project funded by the Fram centre Program Coast and Fjord.

The project has been connected to 3 projects, 2 international and one national. More sampling effort could then be conducted, more experimental works on different population of bivalves following a latitude gradient will increase the knowledge on sensitivity of Arctic bivalves compared to southern population.

This project benefits from strong links and interactions through an ongoing outreach project funded from the Kyst og Fjord program of the Fram Centre, in order to communicate about the project with the public through seminar and different activities involving kids in collaboration with Polaria and Vitensenteret and national outreach programs (Fritt Fram, Forskningsdagene).

Budget in accordance to results

The project mainly relies on the funding from the Fram Centre so the success of the project was strongly dependent on the Fram Centre funding.

Could results from the project be subject for any commercial utilization

No

Conclusions

- a. The project management has been fully respected in term of money used and activities conducted in 2018. All the experimental studies planned have been done, and the biomarker analysis will be assessed in 2019. The fieldwork will be carry out at the end of the year and in spring/summer 2019.
- b. A new ex vivo explant tissue culture has been successfully developed in one of the main used ecotoxicological models of bivalves, the blue mussel, *Mytilus edulis*, and the scallop, *Chlamys islandica*. Moreover, the investigation in parallel of the same experimentation on the same species but two different population from the Arctic versus the temperate region of the world will bring more knowledge on the highly debated sensitivity specificity of blue mussels in relation to latitude.