Project information

Project title
COPOL II: Contaminants in Polar Regions
Year
2011/2012
Project leader
Geir Wing Gabrielsen, NPI
Participants
Project leaders:

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Participants:
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Project leaders:

Flagship

Hazardous substances, Theme: Animal health and ecosystem

Funding Source
Fram Centre, internal

Summary of Results

In 2010-2011 there was again formation of winter ice in Kongsfjorden, through the sampling campaign in 2011 we can address the influence of winter sea ice on the contaminant profiles observed in species of zooplankton.

Sea ice has the potential to influence contaminant concentrations and profiles by reducing volatilization of contaminant compounds from sea water to air. The samples collected in 2011 from open waters, the ice edge as well as within the ice pack will provide information on the degree of influence of the ice on zooplankton contamination.

Samples of pelagic and sympagic species of zooplankton from the Svalbard region were collected for contaminant (persistent organic pollutants, heavy metals and radionuclides) and stable isotope analyses on two cruises (in April/May and July). A total of 7 stations were sampled (see map). In April/May on the ICE-cruise three stations, one by the ice edge on the shelf break, and two within the ice over deep waters. In July on the MOSJ/COPOL-cruise four stations were sampled, the station Kb3 and V10 from the Kongsfjorden transect, one in Rjipfjorden and one within the ice over deep waters. Except from the station in Rjipfjorden all stations were mainly dominated by Atlantic type water masses, which is similar to the previous years sampled. The collected material includes species specific samples of these species: *Calanus hyperboreus*, *Calanus finmarchicus*, arrow worms, *Gammarus wilkitzkii*, polar cod (Boregadus saida), *Metridia longa*, *Themisto abyssorrum*, *T. libelulla*, krill, *Clione limasina*, *Limasina helisina.*

The 2011 sampling campaign has given us the chance to follow up some of the questions regarding the effect of sea ice on the contaminant concentrations and profiles found in different species of zooplankton. Additionally, the sampling campaign in 2011 has extended the time series of contaminant concentrations in different species of zooplankton, which is important since there was formation of winter ice in Kongsfjorden in 2010-2011.

In 2011 sampling of samples was prioritized, the analytical work (contaminants and stable isotopes) has already begun and will be completed in 2012.

Published Results/Planned Publications

No publications have been produced based on the 2010 to 2012 data. Publications based on this data are planned. One master thesis (Ida Egge) was produced in the COPOL project in 2011.
Based on samples from the 2007 to 2009 several publications have been published:

Vieweg I, Hop H, Brey T, Hubner S, Ambrose WGJ, Locke WL, Gabrielsen GW. 2012. Persistent organic pollutants in four bivalve species from Svalbard waters. *Environ Pollut* 161:134-142.
Renaud PE, Tessmann M, Evenset A, Christensen GN. 2011. Benthic food-we structure of an Arctic fjord (Kongsfjorden, Svalbard). *Mar Biol Res* 7:13-26.
Hallanger IG, Warner NA, Ruus A, Evenset A, Christensen GN, Herzke D, Gabrielsen GW, Borgå K. 2011. Seasonality in contaminant accumulation in Arctic marine pelagic food webs using trophic magnification factor as a measure of bioaccumulation. *Environ Toxicol Chem* 30:1026-1035.
Hallanger IG, Ruus A, Warner NA, Herzke D, Evenset A, Schoyen M, Gabrielsen GW, Borga K. 2011. Differences between Arctic and Atlantic fjord systems on bioaccumulation of persistent organic pollutants in zooplankton from Svalbard. *Sci Total Environ* 409:2783-2795.
Hallanger IG, Ruus A, Warner NA, Evenset A, Herzke D, Heimstad ES, Gabrielsen GW, Borgå K. 2011. Influence of sampling period, geography, species and diet on bioaccumulation of halogenated organic contaminants in Arctic marine zooplankton. *Environ Toxicol Chem* 30:77-87.
Warner NA, Evenset A, Christensen G, Gabrielsen GW, Borga K, Leknes H. 2010. Volatile Siloxanes in the European Arctic: Assessment of Sources and Spatial Distribution. *Environ Sci Technol* 44:7705-7710.

Communicated Results

**Scientific presentations in 2011:**

Hallanger IG, Ruus A., Warner NA., Evenset A., Gabrielsen GW, Borgå K, 2011, "Influence of climate and biomagnifications in species of Arctic zooplankton", Chemistry and Climate, Fram Centre, workshop, Tromsø 3-4 oktober.

Warner NA, Hallanger IG, Ruus A, Evenset A., Gabrielsen GW, Borgå K, 2011, "Factors of Change: Using Trophic Magnification Factors (TMFs) to assess changes in POP bioaccumulation in Arctic food webs" Chemistry and Climate workshop, Fram Centre workshop, Tromsø, 3-4 October.

Evenset, A., Borgå, K., Warner, N.A., Ruus, A., Hallanger, I.,Christensen, G.N., Heimstad, E., Gabrielsen, G.W, 2011, "COPOL: The effects of climate change on contaminant flow in polar marine ecosystems." Chemistry and climate workshop, Tromsø 3 – 4. October.

Bustnes, J.O. 2011, "Impacts of Climate and Feeding Conditions on the Annual Accumulation of Persistent Organic Pollutants in a Common Terrestrial Raptor". Chemistry and climate workshop, Tromsø 3 – 4. October.

Warner NA, Hallanger IG, Ruus A, Evenset A., Gabrielsen GW, Borgå K, 2011, "The COPOL Project: Contaminants in a Changing Arctic", IPY wrap-up conference, Tromsø, April 12-13.

Bustnes, J.O. 2011, "Impacts of persistent organic pollutants in seabirds under different stress regimes. March 2011, Chizé, Frankrike.

Bustnes, J.O. 2011, "When bad things occur simultaneously; monitoring multiple stressors in northern ecosystems". Seminar om Naturovervåning FRAM senteret 27 Okt 2011

Gabrielsen, G.W. Effekter av miljøgifter på sjøfugler og marine pattedyr. MOSJ møte i Tromsø, april 2011.

Gabrielsen, G.W. Persistent organic pollutants and their effects on Arctic animals. Stockholm University, May 2011.

Gabrielsen, G.W. Contaminants in the Arctic. Norsk-russisk-polsk Symposium på Svalbard, September 2011.

Gabrielsen, G.W. Pollutants and their effects on Arctic seabirds. NKV Symposium in Helsinki, Finland, Oktober 2011.

Gabrielsen, G.W. The Kongsfjorden system. Ny-Ålesund Symposium, November 2011.

**Popular science**

Blom, K. & G.W. Gabrielsen. 2011. Sjøfuglene i Arktis. Cappelen Damm, 67 pp.

Helgason, L.B., Routti, H., Gabrielsen, G.W. & E. Jørgensen. 2011. Seasonal emaciation potentiates the toxicity of persistent organic contaminants in arctic animals. Polar Research in Tromsø 2010: 4-5.

Gabrielsen, G.W., Hallanger, I.G., Ruus, A., Evenset, A., Christensen, G., Bustnes, J.O., Heimstad, E., Warner, N., Øverjordet, I.B., & K. Borgå. 2011. Contaminants in Polar Regions-COPOL.In; Polaråret 2007-2008. Det norske bidraget. Page 130-133.

Gabrielsen, G.W., Hallanger, I.G., Ruus, A., Evenset, A., Christensen, G., Bustnes, J.O., Heimstad, E., Warner, N., Øverjordet,

I.B., & K. Borgå. 2011. Contaminants in Polar Regions-COPOL. In; International Polar year 2007-2008. The Norwegian contribution. Page 130-133.

Gabrielsen, G.W. & D. Herzke. 2011. Miljøgifter i hverdagen. Nordlys; side 3 den 27 september.

Hallanger IG. 2011, "Ung miljøforsker i IPY", IPY, Internasjonale polaråret:Sluttkonferanse for Polaråret, Tromsø

Hallanger IG, 2011, "Results depending on the eyes that see", ARCTOS fagdag.

**Posters:**

Hallanger IG, Ruus A, Warner NA, Evenset A, Herzke D, Gabrielsen GW, Borgå K,2011, "Does Climate Change and Seasons have an Influence the Accumulation of Contaminants in Arctic Marine Pelagic Food Webs?", AMAP: The Arctic as a messenger for global processes; Climate change and Pollution, Mai, København, Danmark

Hallanger IG, Ruus A, Warner NA, Evenset A, Herzke D, Gabrielsen GW, Borgå K,2011, "Seasonal Variation in Accumulation of Contaminants in Arctic Marine Food Webs", IPY: Internasjonale polaråret, Sluttkonferanse for Polaråret, April, Tromsø, Norge

Hallanger IG, Warner NA, Ruus A, Evenset A, Herzke D, Heimstad ES, GabrielsenGW, Borgå K 2010, "Influence of Seasonality and Climate Change on Bioaccumulation of Organic Contaminants in Arctic Marine Pelagic Food Webs" IPY: Internasjonale polaråret, Oslo Science Conference, Juni, Oslo, Norge

Gwynn JP, Zaborska A, Gäfvert T, Christensen G, Gabrielsen GW & Evenset A (2009) Po-210 and Pb-210 in Arctic seabird species. International Topical Conference on Po and Radioactive Pb isotopes, 26-28 October 2009, Seville, Spain.

Gwynn JP, Gabrielsen GW, Jæger I & Lind B (2008). Bioaccumulation of Po-210 and Pb-210 in Arctic seabirds. In: International Conference on Radioecology & Environmental Radioactivity, Strand P, Brown J, Jølle T, eds., Bergen 2008. Posters proceedings, part 1. Østerås: Norwegian Radiation Protection Authority, 2008: 101-104.

Anita Evenset, Ingeborg Hallanger, Paul Renaud, Michael Tessmann, Nicholas Warner, Guttorm Christensen, Anders Ruus, Katrine Borgå, Geir Wing Gabrielsen. "Persistent Organic Pollutants in Benthic Communities in Svalbard: Seasonal and spatial trends", AMAP-Conference København (The Arctic as a messenger for global processes. Climate change and pollution)

Interdisciplinary Cooperation

There has been inter-disciplinary cooperation between marine ecology, chemistry and ecotoxicology participants in the COPOL project. COPOL has greatly benefitted from cooperation between these disciplines. Having biologists and chemists working together enhances the understanding on how contaminants behave within the abiotic and biotic environment.

Budget in accordance to results

The funding from the Fram Centre, together with the internal founding, enabled the project to participate on two cruises in the Svalbard area in order to follow up the COPOL work which started in 2007. This gave us a chance to follow up some of the questions regarding the effect of sea ice on the contaminant concentrations and profiles found in different species of zooplankton. Further the time trends in contaminant concentrations in different species of zooplankton was extended with an additional year which is important since there was formation of winter ice in Kongsfjorden in 2010-2011. Analysis of the 2011 samples has already begun and will be completed in 2012.

Could results from the project be subject for any commercial utilization

No

Conclusions

**a) Indicate future research and/or perspectives which the project results have led to**

The samples collected in 2011 will be analysed for contaminants and stable isotopes. These data will be used to investigate the influence of ice on contaminant burdens in species of zooplankton. Comparison of the 2011 data (winter sea ice present) will be compared to earlier sampled years (2007-2009; no winter sea ice) will provide information on the role of sea ice on concentrations of contaminants in zooplankton.

An application for the continuation of the COPOL project (COPOL 2) has been submitted to the Norwegian Research Council in the autumn of 2011.

There is a need for more knowledge on:

- The association between the contaminant concentrations measured in sea water and zooplankton to the contaminant concentrations measured in terrestrial melt water from snow and glaciers.
- The seasonality of contaminant accumulation in different species of zooplankton. Seasonality has been observed in fjord systems, however is this a commonly encountered phenomenon in the Arctic or is it due to fjord specific characterisation and confounding factors within fjords?

- The uptake of contaminants in different species of zooplankton as a consequence of their different feeding regimes.
- The influence of sea ice on contaminant composition found within pelagic species of zooplankton
- The presence of sea ice influences the volatilization of contaminants from seawater to air, but to what extent will this be reflected in zooplankton?

**b) List and describe new methods or techniques that have been developed during the project or that the project has revealed a need for**

No new methods of techniques have been developed during the project.