Contamination in the Arctic

- Challenges in Arctic Environmental Research

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Environmental contaminants are chemical compounds that may be harmful to organisms even at low levels. They are not easily broken down in the ecosystem, they may be transported over long distances and they become more concentrated higher up in the food chain. The levels of persistent organic pollutants (POPs) and heavy metals in Arctic animals, vary substantially.

For over a decade, the Norwegian Polar Institute has studied contamination in Arctic animals from Svalbard, Jan Mayen, and – in Russia – Franz Josef Land, Novaya Zemlya and the coast of the Kola Peninsula. It is a challenging task to measure persistent organic contaminants and assess the biological effects of these contaminants in Arctic wildlife. Not only do contaminant levels differ between species, but the levels are also dependent upon the individual's nutritional status and the animal's capacity to metabolize contaminants. For example, contaminant concentrations in blood are influenced by a recent meal, but also by the body condition of the animal. In contrast, contaminants stored in the fat may give a more long-term history of contamination, as this is less affected by the recent diet. When animals have enough food, they do not need to use their fat reserves. But in periods when food is scarce, they will be more exposed to pollutants stored in their own fat reserves. Also, mothers transfer contaminants to their offspring through mother's milk, which is rich in fat.

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Alarming effects

There are large differences in contaminant concentration between species due to diet and the ability to metabolize contaminants. For example, whales accumulate many more different kinds of contaminants, and often in higher quantities, than polar bears – except for PCBs. This is directly related to the fact that polar bears are very efficient in metabolizing most contaminants. However, polar bears in the Norwegian Arctic are more exposed to contamination than their counterparts in Alaska and north Canada. In the Norwegian Arctic, a higher number of pseudo-hermaphrodites, i.e. individuals with genital characteristics resembling both sexes, have been found. This is thought to be due to POPs, mainly PCBs, as these compounds have a severe impact on animals' immune and hormone system and their reproduction abilities.

There are other new compounds that may also have severe effects on Arctic ecosystems. One example is polybrominated flame retardants (PBDEs). Used in television sets, computers, the interior of cars and textiles, these may prove to be a serious threat in the future. Studies have shown that PBDEs do not seem to accumulate in polar bears, whereas this is not the case in seals, seabirds and white whales. So, both contaminant concentrations and patterns differ substantially between whales and bears, not only due to differences in their diet, but also due to a more efficient contaminant metabolism in bears.

Challenges for polar research

In coming years, the challenge for Norwegian polar research will be to improve the methods used for monitoring Arctic animals. We also need to increase experimental studies as well as continue to study the animals in the field. A methodology for monitoring effects of contaminants should be developed and applied to several Arctic mammal and bird species. Based on effect studies, potential risks to populations will be assessed. Additionally, there is a need to improve screening for new contaminants as well as their metabolites (the end-product contaminants take as a result of metabolism).

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www.npolar.no
Postmottak@npolar.no
tel. +47 77 75 05 00
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