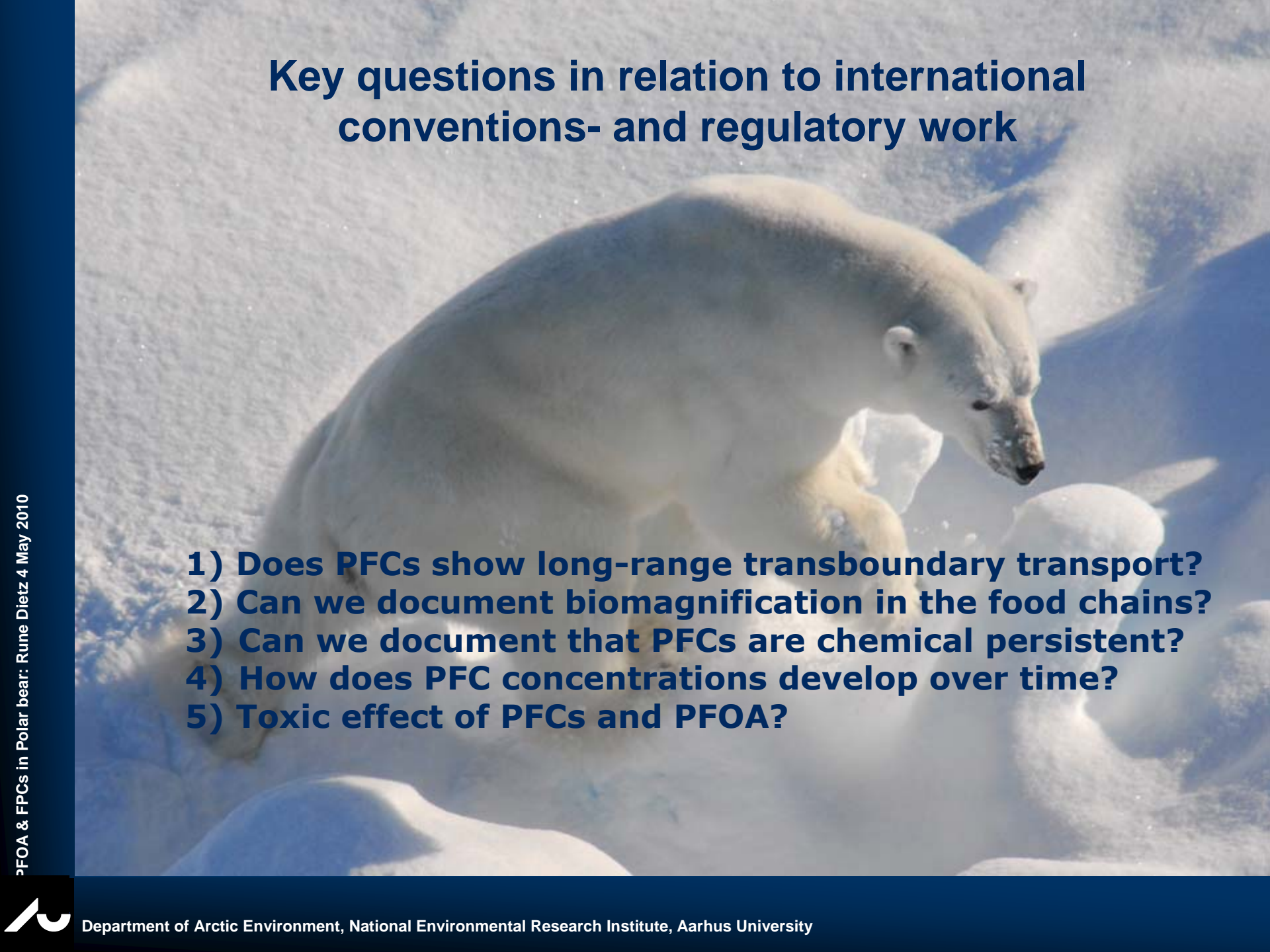


Monitoring results on PFOA in Arctic marine top predators with focus on polar bears

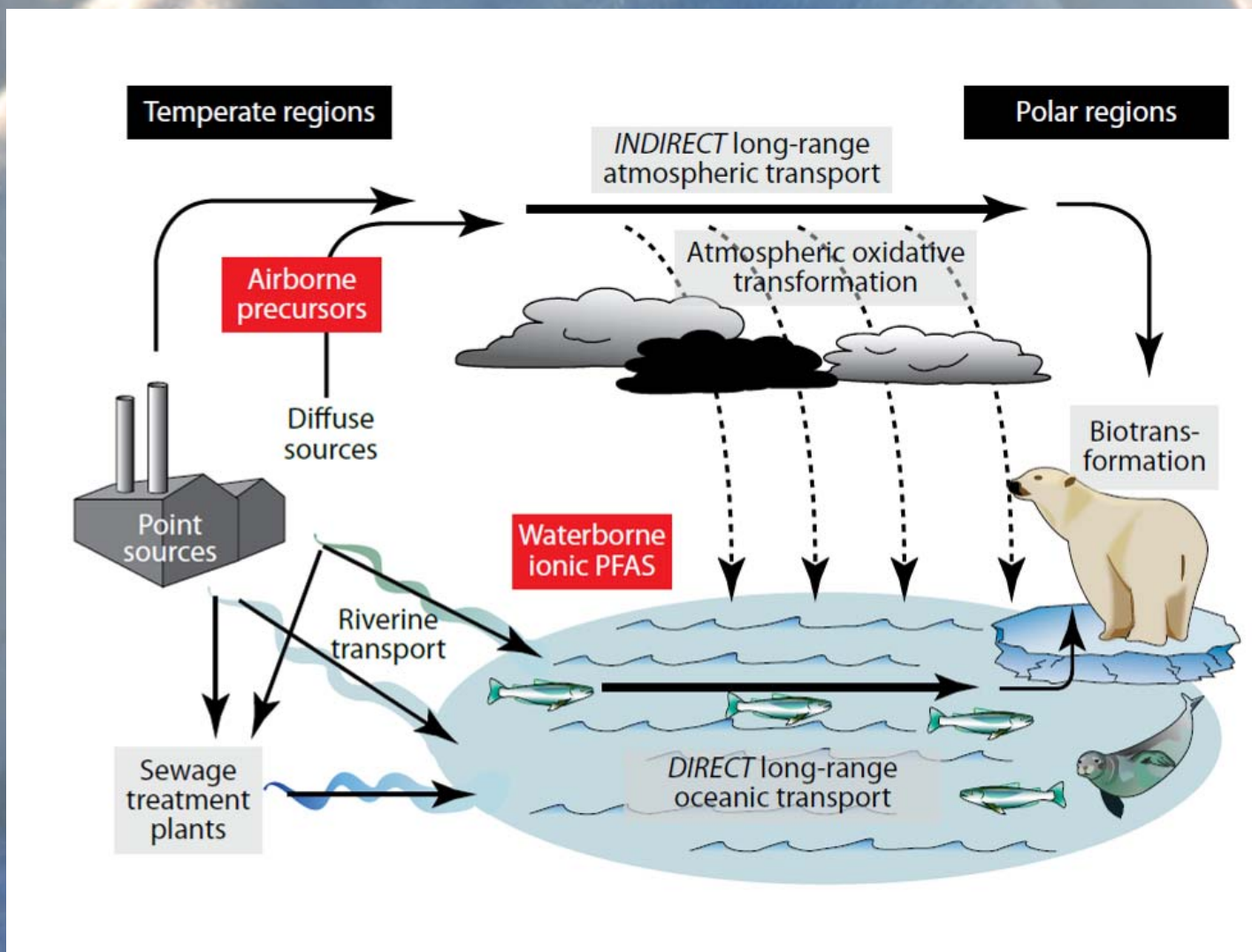


By:
Rune Dietz

Key questions in relation to international conventions- and regulatory work

- 
- A polar bear is shown in profile, walking across a vast, flat, and snowy landscape. The bear's fur is white, and its dark nose and eyes are visible. The ground is covered in snow and ice, with some darker patches visible. The background is a bright, hazy white, suggesting a snowy or icy environment.
- 1) Does PFCs show long-range transboundary transport?**
 - 2) Can we document biomagnification in the food chains?**
 - 3) Can we document that PFCs are chemical persistent?**
 - 4) How does PFC concentrations develop over time?**
 - 5) Toxic effect of PFCs and PFOA?**

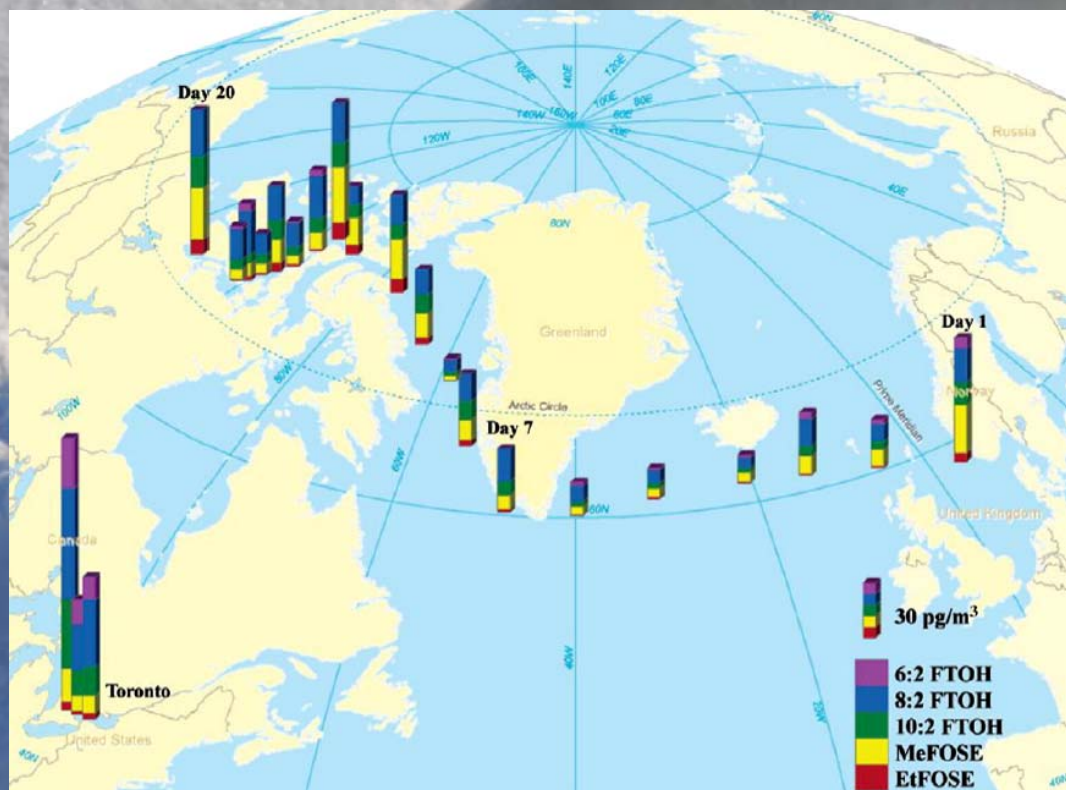
Pathways of PFCAs in the environment



AMAP 2009

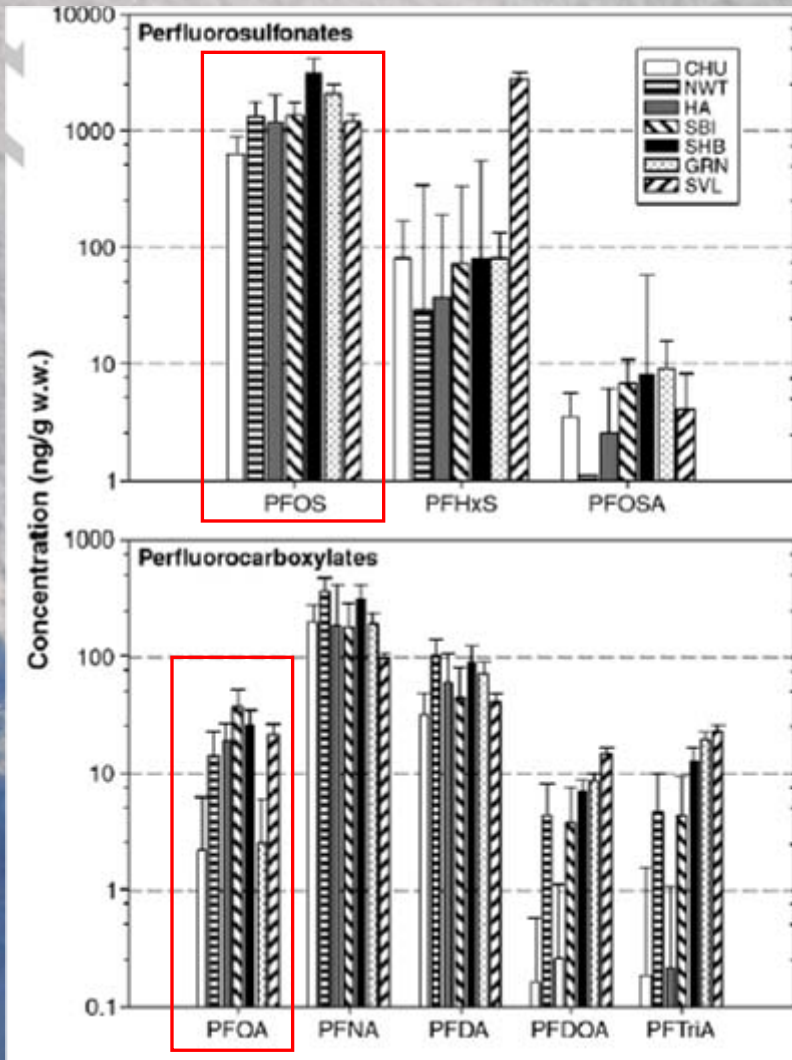
Geographical trends

Total air concentrations of individual FTOHs and FOSEs from North Atlantic and Canadian Archipelago

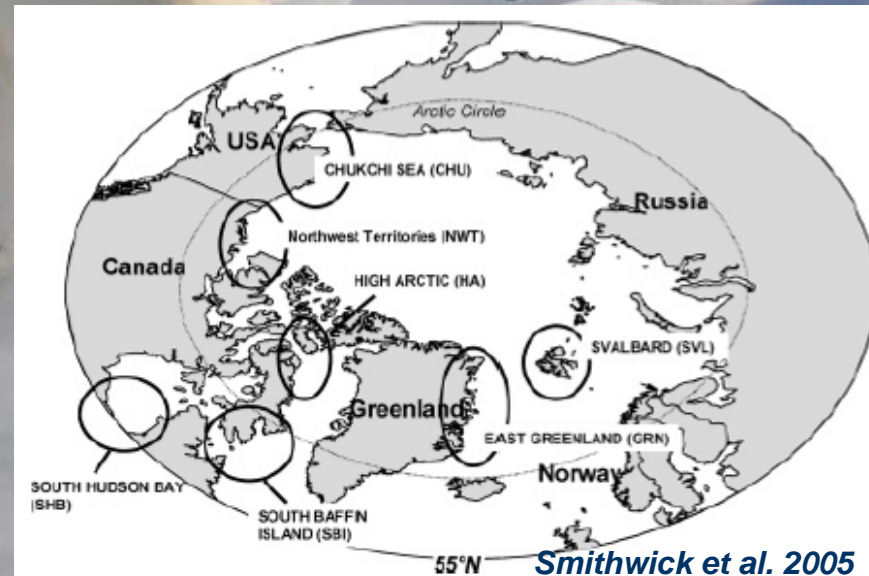


Schoeib et al. 2006

Geographical trends



PFC:	Min	Max	Max/Min
PFOS	729	2730	3.7
PFOA	2.4	36	15.0

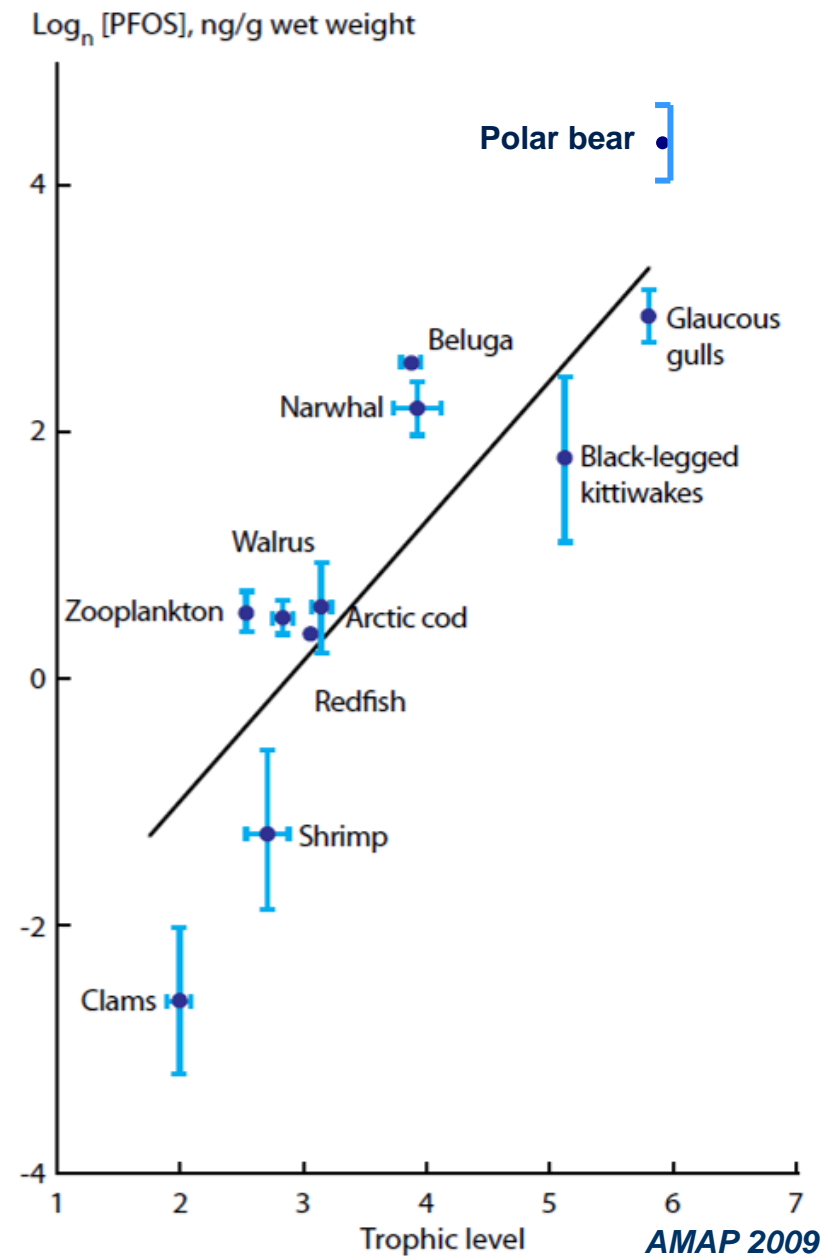


Smithwick et al. 2005

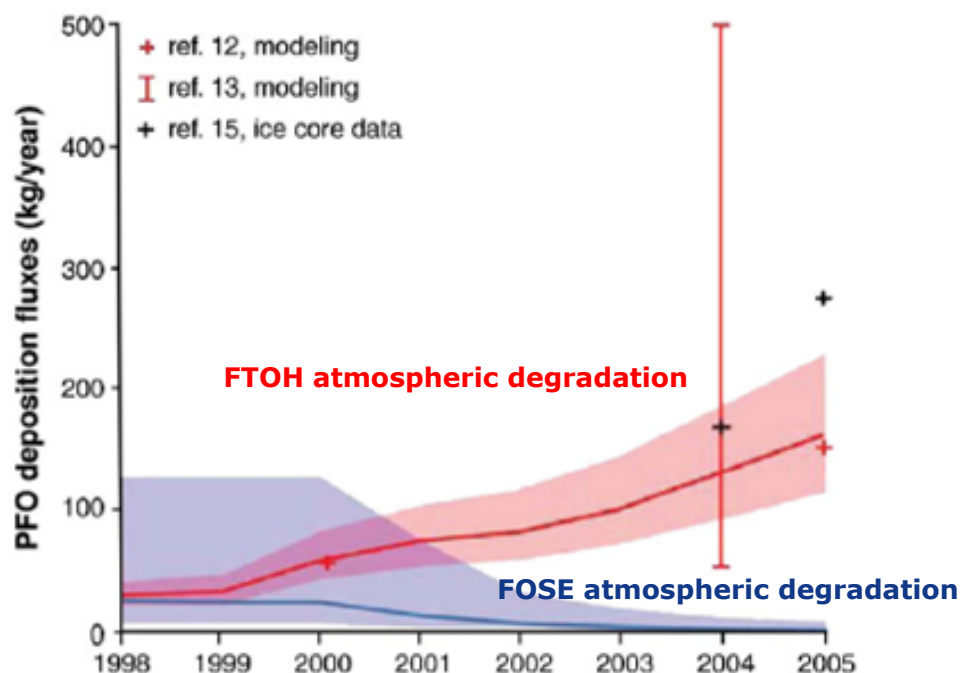
Biomagnification of PFCs in Arctic food chains

PFOS trophic biomagnification factor: $3.1 < \text{OHCs}$

**PFOA: Only biomagnifying between some species:
e.g. cod-beluga, seal-polar bear**

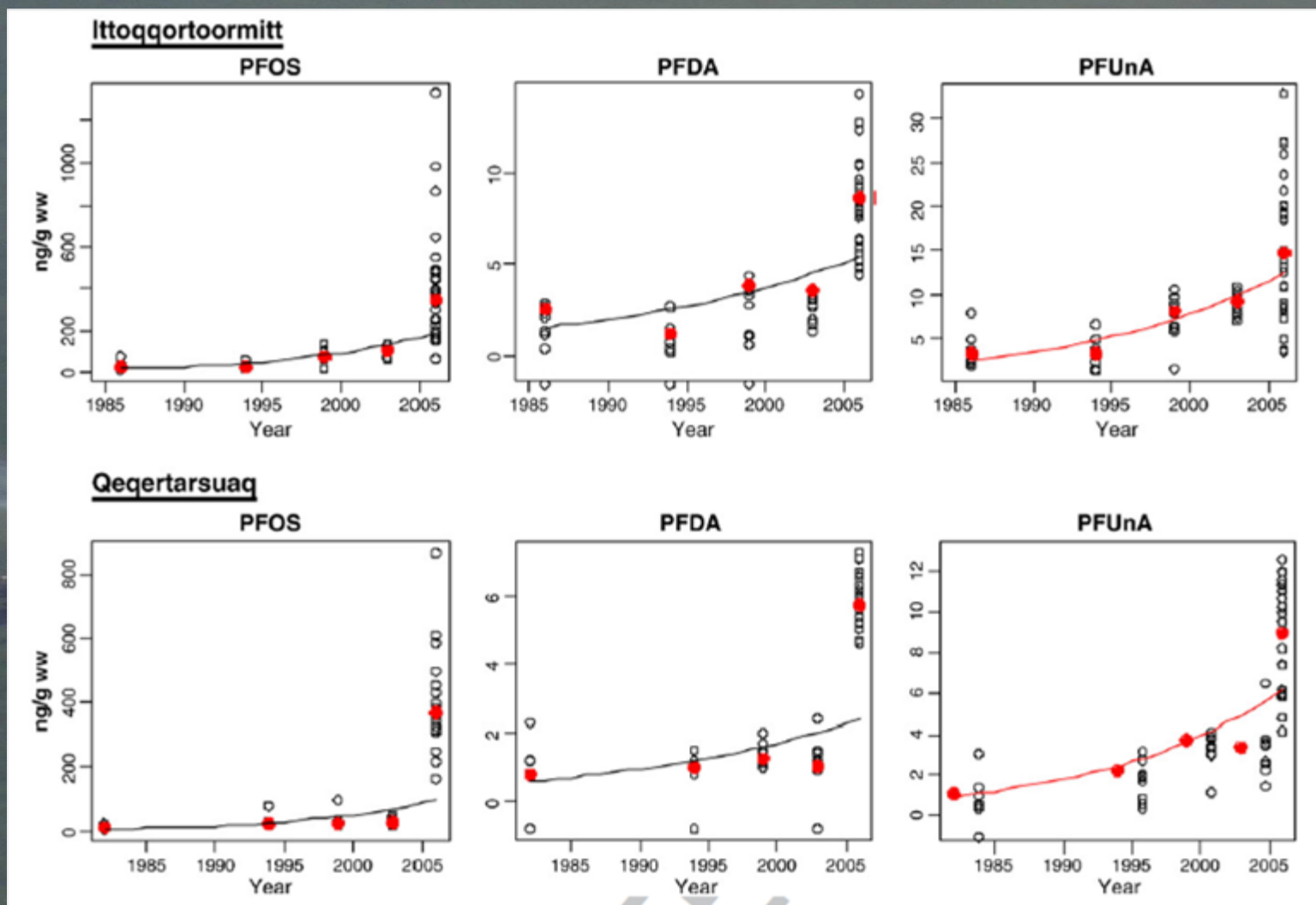


Modelled PFOA deposition fluxes to the Arctic over time



Schenker et al. 2008

Time trend of PFCs in Greenland ringed seals

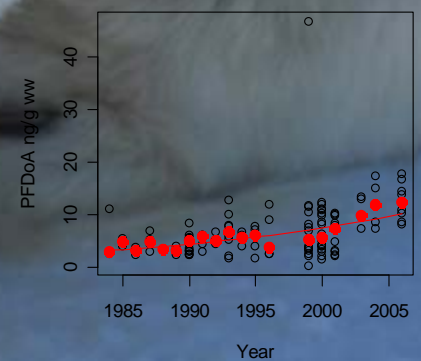
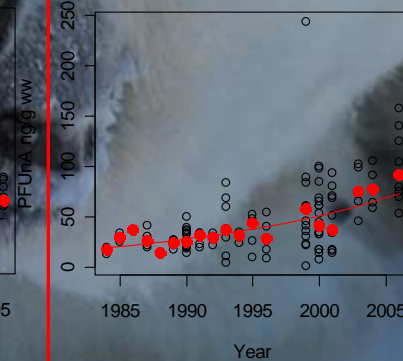
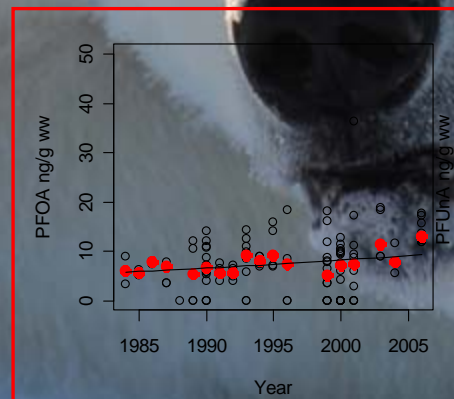
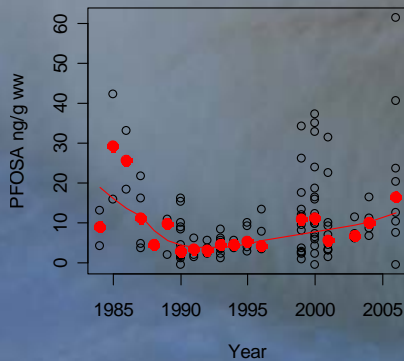
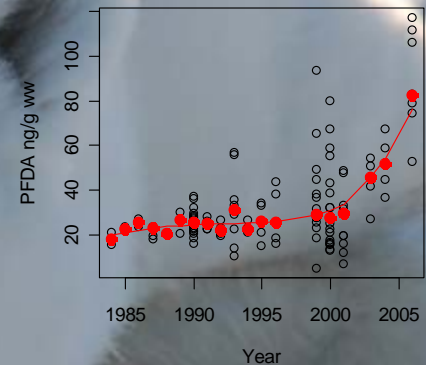
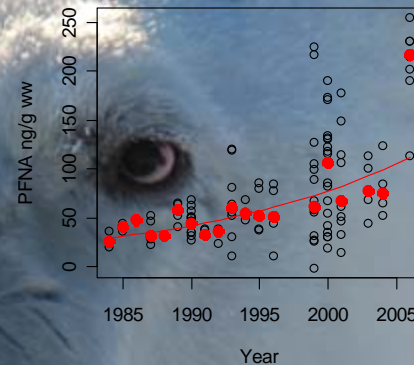
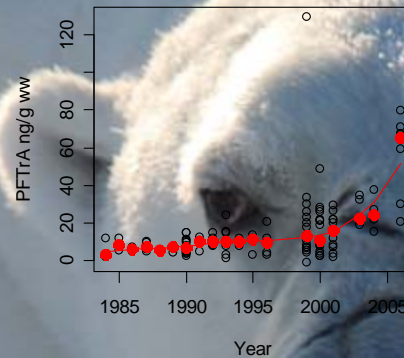
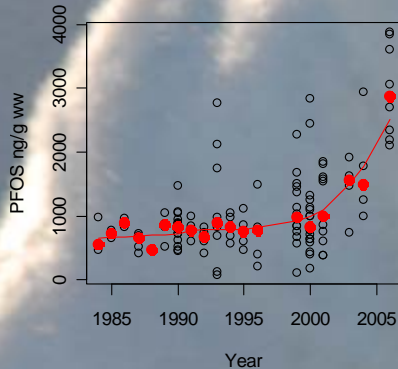


PFOA: Below detection limit in ringed seal

Bossie et al 2005, Riget et al. in prep

Time trend of PFCs (Perfluorinated compounds) in liver of juvenile East Greenland polar bears

*Log-linear regressions 7 out of 8 $P < 0.006$ with increases between 2.3 – 8.5%/year
LOESS smoother was better than linear model for PFOS, PFTrA, PFDA and PFOSA with
log-linear significant increases in 1990-2006 or 2000-2006 between 9.2 – 27.4%/year*

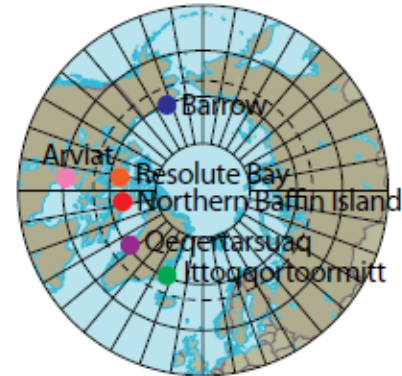
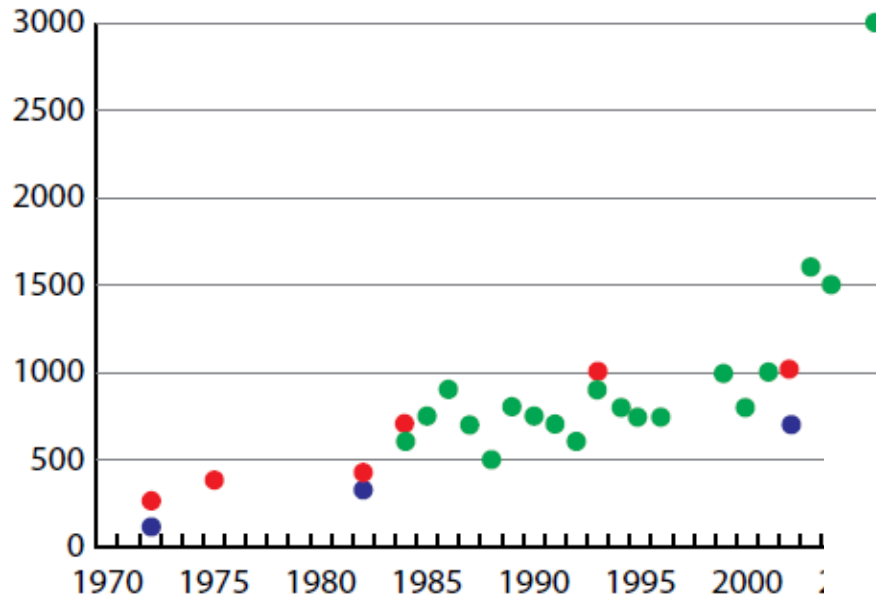


PFOA increases by 2.3 %/year

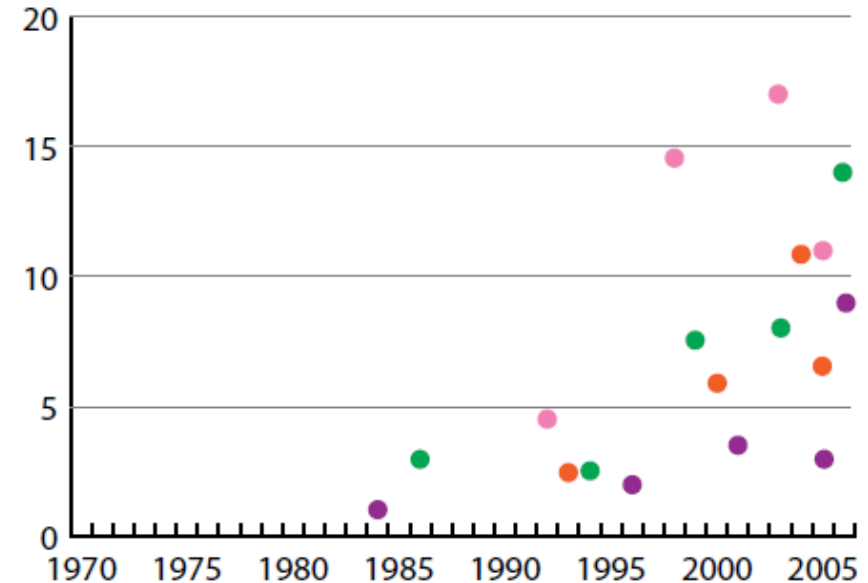
Dietz et al. 2008

Temporal trends of PFOS in marine mammals

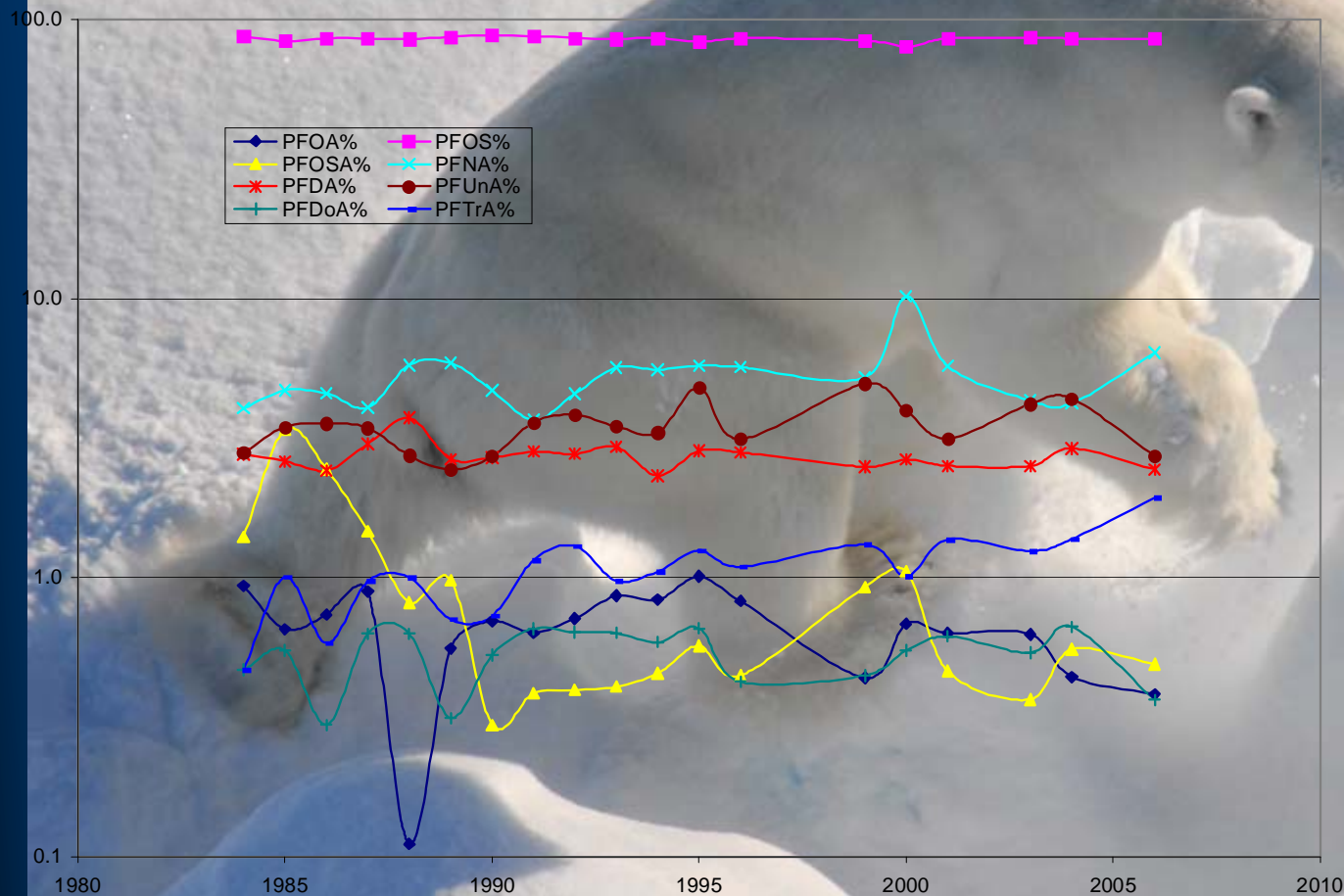
PFOS in polar bear liver, ng/g wet weight



PFUnA in ringed seal liver, ng/g wet weight

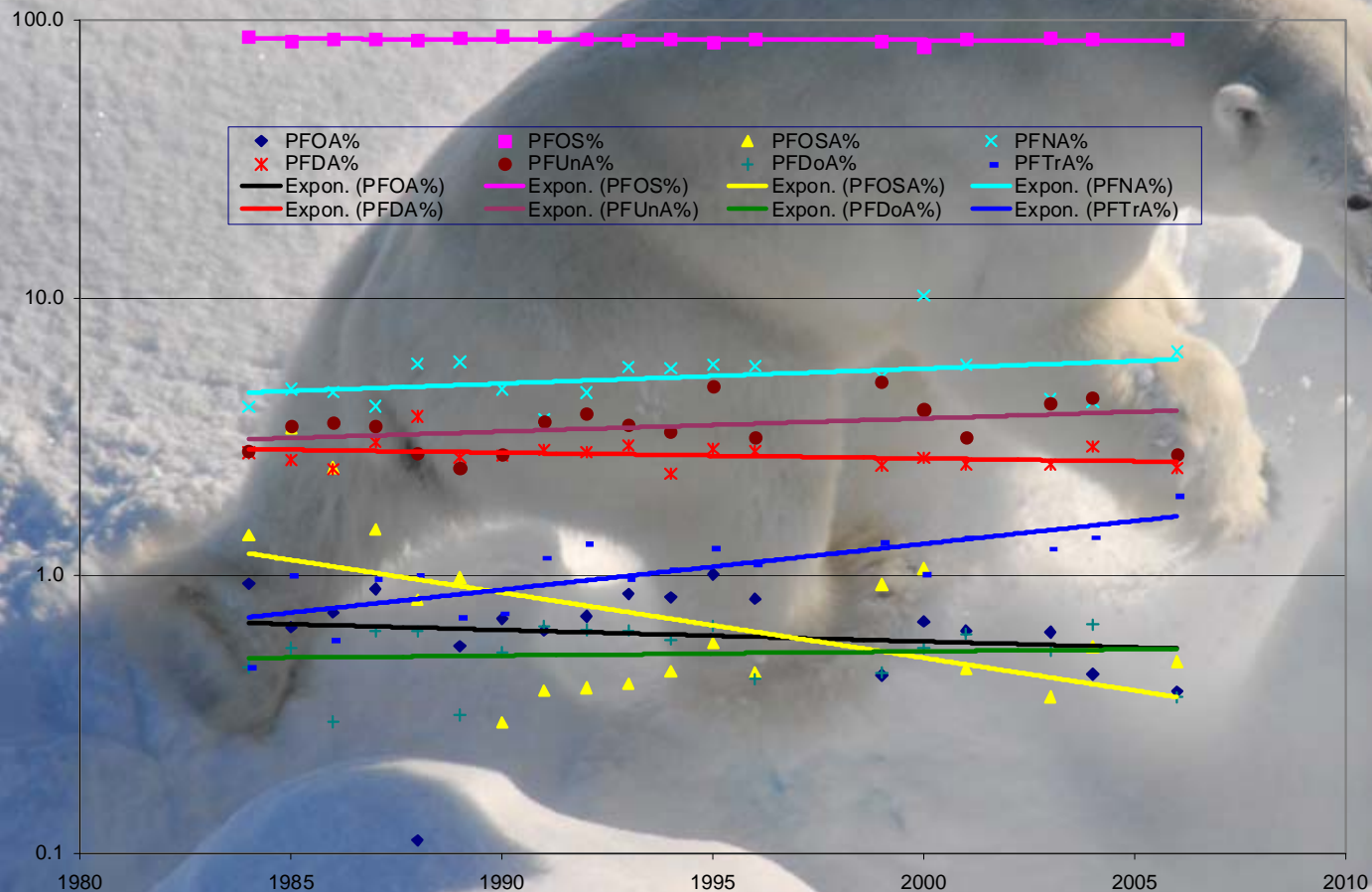


Percentual trends in PFCs of East Greenland polar bears



Dietz et al. 2008

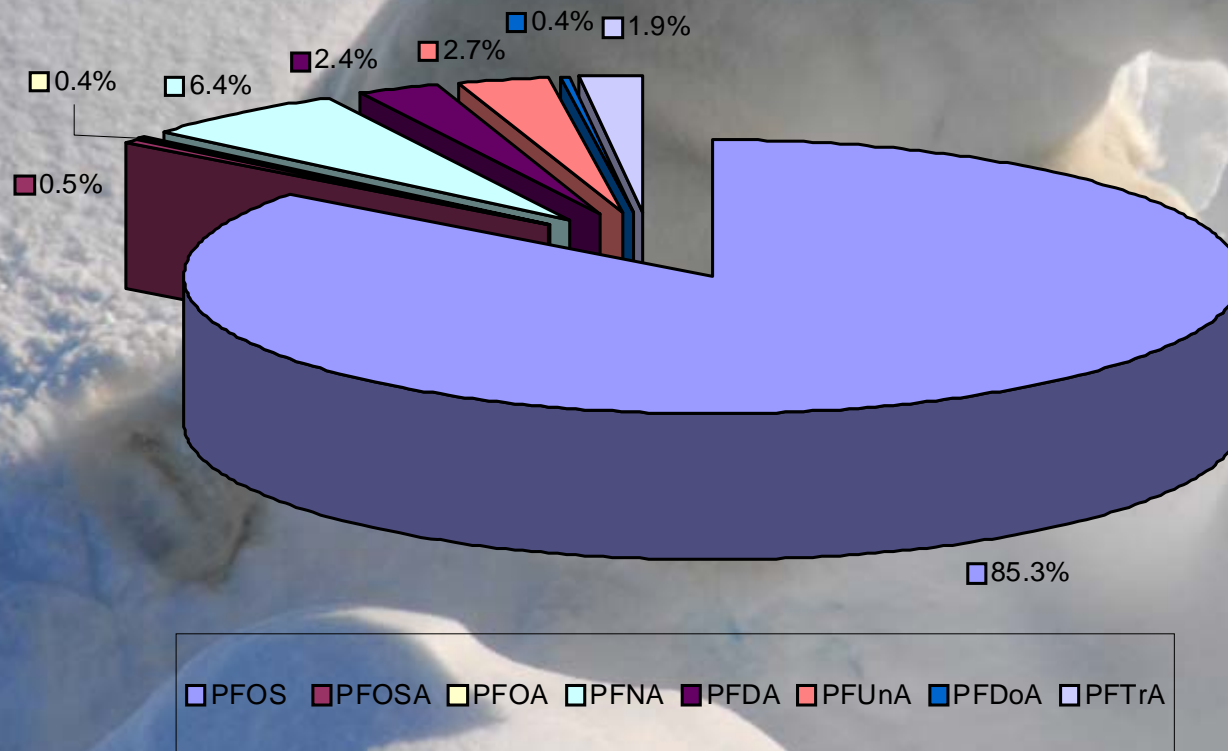
Percentual trends in PFCs of East Greenland polar bears



Dietz et al. 2008

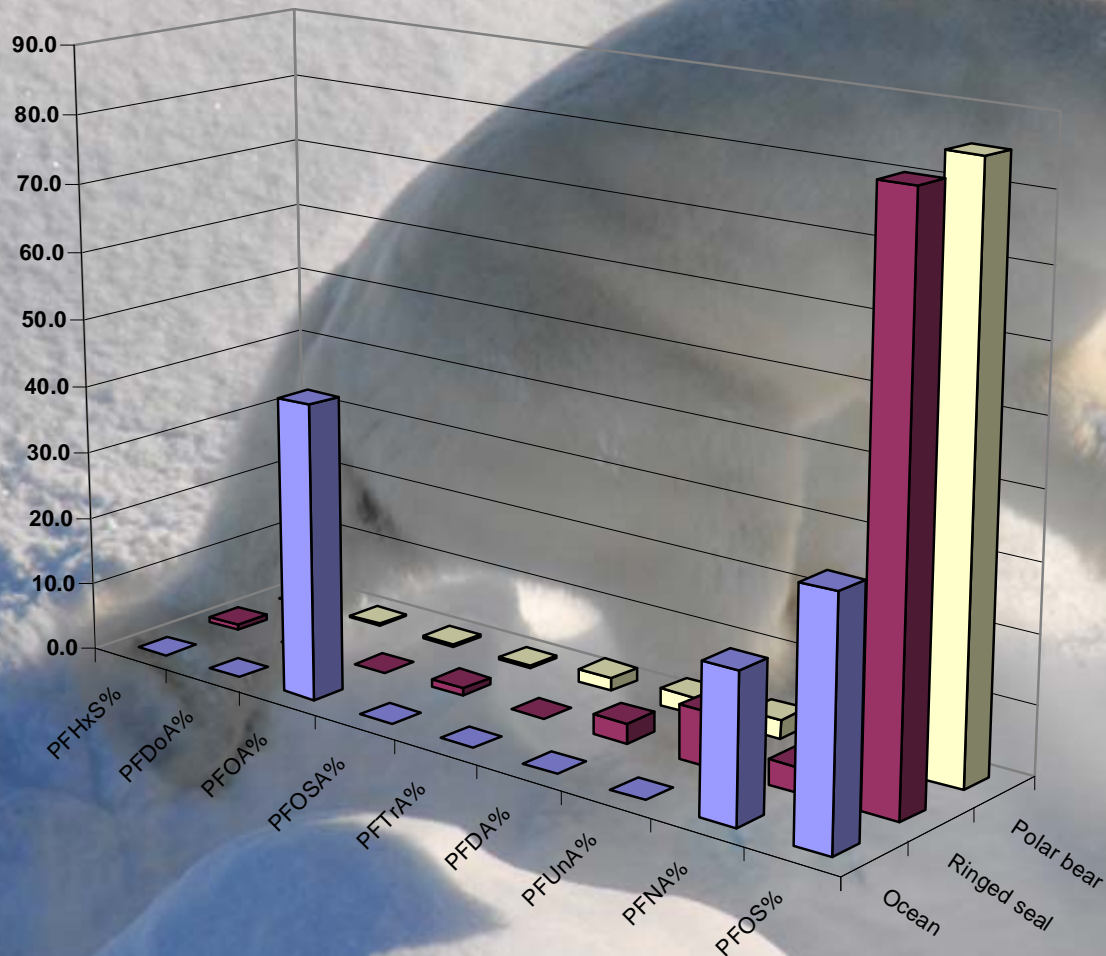
Percentual presence of PFCs in East Greenland polar bears

PFOA Canada: 3 % of PFCs



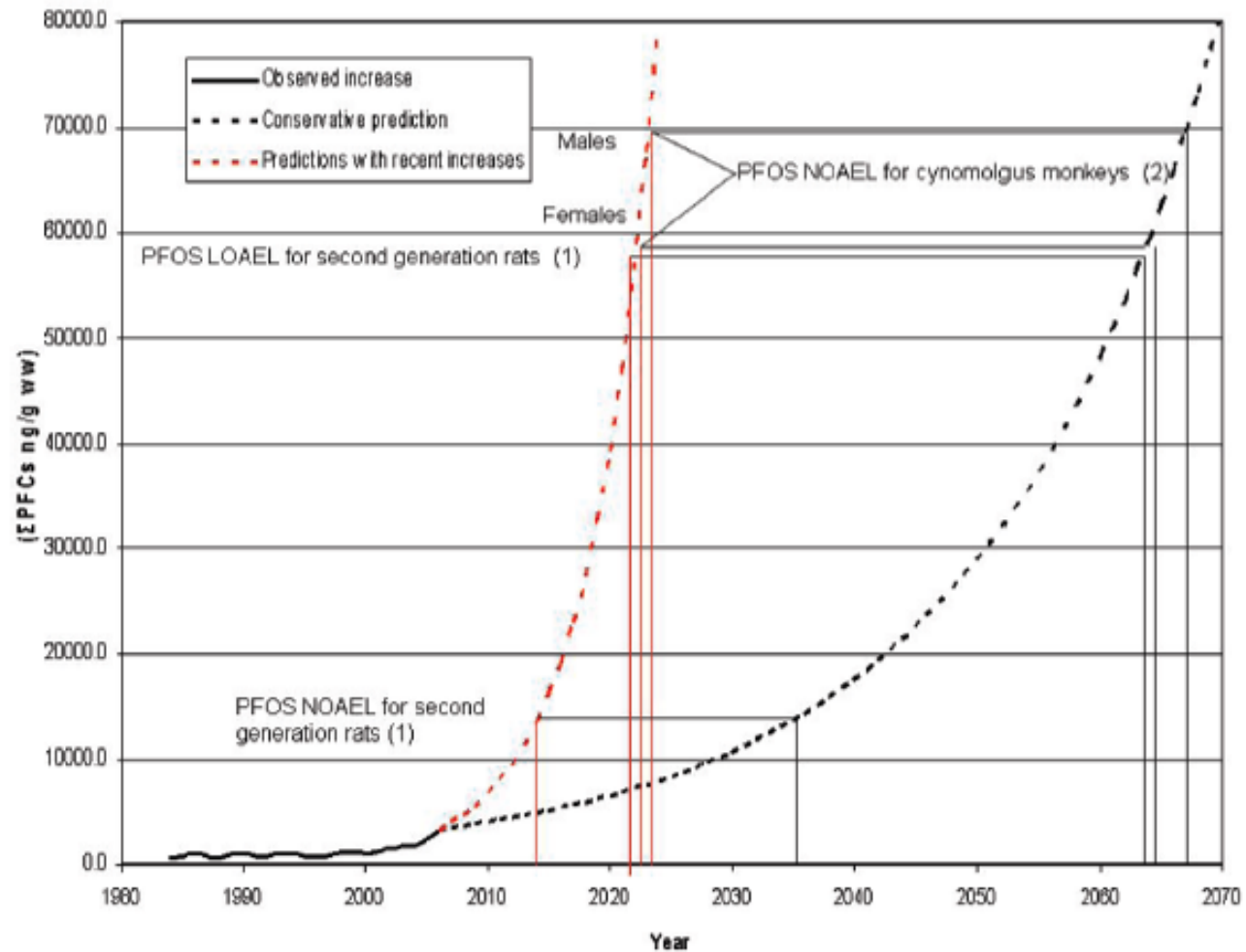
Dietz et al. 2008

Percentual presence of PFCs in within the food chain of the Greenland Sea



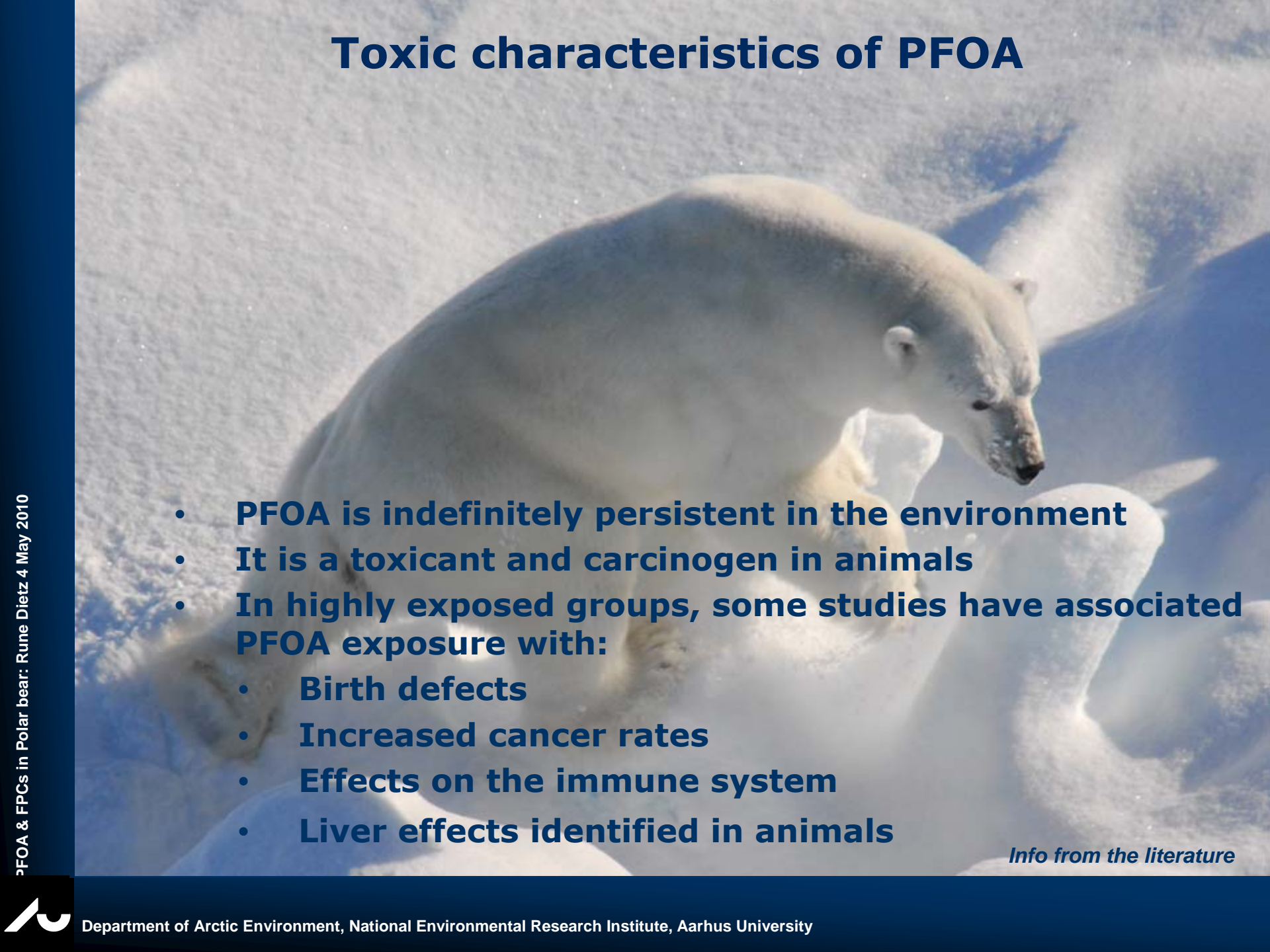
Dietz et al. 2008

Temporal trend of Σ PFCS in East Greenland polar bears



Dietz et al. 2008

Toxic characteristics of PFOA

- 
- A polar bear is shown in profile, walking across a vast, snowy, and icy landscape. The bear's fur is white, and its body is robust. The background consists of rolling snow-covered hills and ice formations under a bright sky.
- **PFOA is indefinitely persistent in the environment**
 - **It is a toxicant and carcinogen in animals**
 - **In highly exposed groups, some studies have associated PFOA exposure with:**
 - **Birth defects**
 - **Increased cancer rates**
 - **Effects on the immune system**
 - **Liver effects identified in animals**

Info from the literature

Conclusions

- **PFOA appears in remote areas such as the Arctic i.e. it shows long-range transport**
- **Geographical patterns can be observed for PFOA**
- **Biomagnification: $\text{PFOA} < \text{PFOS} < \text{OHCs/POPs}$**
- **PFOA constitutes 43% in the Ocean and 0.4-3% in a top carnivore such as the polar bear**
- **PFOA is showing a 2.3% increase per year**

Answers to the key questions in relation to international conventions- and regulatory work:

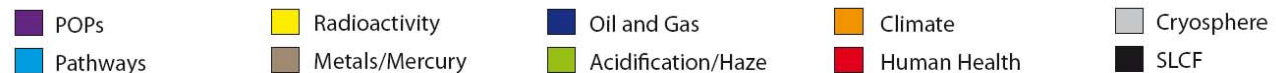
- 
- A polar bear is shown in profile, walking across a vast, flat, and snowy landscape. The bear's fur is white, and its dark nose and eyes are visible. The background is a bright, hazy white, suggesting a snowy or icy environment. The bear is positioned in the center-right of the frame, moving towards the right.
- 1) Does PFCs show long-range transboundary transport? **Yes**
 - 2) Can we document biomagnification in the food chains? **(Yes)**
 - 3) Can we document that PFCs are chemical persistent? **Yes**
 - 4) How does PFC concentrations develop over time? **Increase**
 - 5) Toxic effect of PFCs and PFOA? **Toxic**

Assessments ...

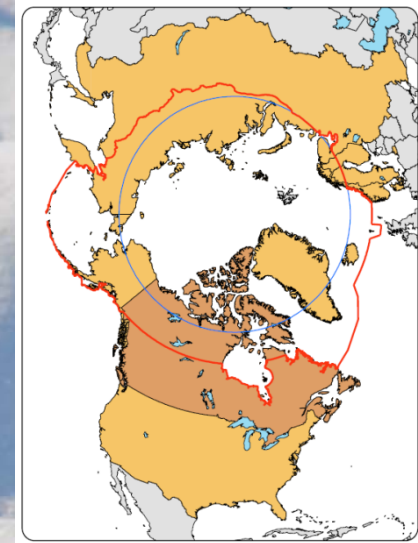
Layman's Style Overview Reports



Scientific Assessment Reports



AMAP and the Arctic Council



***AMAP provides information on:
The status of, and threats to, the Arctic environment,
Scientific advice on actions to be taken in order to support Arctic governments in
their efforts to take remedial and preventive actions relating to contaminants and
adverse effects of climate change".***

Acknowledgements

- **Commission for Scientific Research in Greenland**
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- **Prince Albert II Foundation**
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- **Greenland hunters**
- **Colleagues and Collaborators**