Polar bear health – interactions between diet, gut microbiota and parasites

Supervisors

Main supervisor: Doctor Sarah Perkins (Cardiff University)
Co-supervisor: Professor Robbie McDonald (University of Exeter)
Co-supervisor: Professor Melissa Mckinney (

Dr. Melissa McKinney
Assistant Professor/ Joint Position Center of Environmental Sciences and Engineering
Department of Natural Resources and the Environment
University of Connecticut, USA
U-4087, 1376 Storrs Road
Storrs, CT 06269-4087

)
Co-supervisor: Dr. Heidi Hauffe (

?Fondazione Edmund Mach di San Michele all'Adige
Via E. Mach, 1 38010 S. Michele all'Adige (TN) - ITALY

)

Project enquiries - Email: perkinss@cardiff.ac.uk **Contact number:** +44 (0) 07581 667823

Host Institution: Cardiff University

Project description

Of the 19 sub-populations of polar bear which inhabit the ice-covered waters of the circumpolar Arctic, eight are in decline and seven lack the sufficient data required to determine a population status (IUCN/SSC Polar Bear Specialist Group, 2009). In response to the current and forecasted population statistics polar bears are listed as a threatened species under the U.S. Endangered Species Act (2008), with disease being noted as an important listing criterion needing to be addressed in future conservation efforts. Knowledge of parasitic agents within free-ranging polar bears is very limited, which is of concern, considering that climatic and anthropogenic stressors may impact exposure rates between polar bears and novel pathogens. Warming climates provoke the northern range expansion of parasites and their associated host species. In addition, changes in geographic distribution of polar bears due to anthropogenic stressors is altering the type of food sources foraged (for example bowhead whale carcass piles and domestic waste), increasing risks of parasite spill-over via trophic transmission and also by increased contact with land-based wildlife and domestic animals in arctic communities. Domestic dogs, for example, were implicated as the infection source of the 1998 and 2002

phocine distemper virus (PDV) epizootic, which killed approx. 40,000 seals in the UK. Importantly, PDV antibodies have also been found in polar bears. Domestic dogs are known to host a large diversity of 'novel arctic' parasite species, which was the rationale for the implementation of annex II to the Environmental Protocol (Conservation of Antarctic Fauna and Flora) which required all dogs to be removed from Antarctica by April 1994.

Climate change-driven dietary shifts may not only alter parasitism, but profoundly alter gut microbial homeostasis. Our recent work has shown strong links between the gut microbiota composition and the presence of parasitic helminths. As such, elucidating the nature of the three-way interaction between diet, parasitism and gut microbiota is essential for polar bear health. Illumina next-generation 16S ribosomal RNA (rRNA) gene sequencing will be used to profile the gut microbial community and identify pathogenic species. Parasite microscopy will be conducted to quantify faecal parasite egg loads, whilst stable isotope analysis will investigate dietary shits. This proposal will provide an inter-disciplinary insight into diet, gut microbiota and parasites within a flagship species for climate change.

References

Cattet M. R., Duignan P. J., House C. A., and Aubin D. J. S. (2004) Antibodies to canine distemper and phocine distemper viruses in polar bears from the Canadian Arctic. Journal of Wildlife Diseases, 40: 338-342

IUCN/SSC Polar Bear Specialist Group (2009) Circumpolar studies of polar bears [Online]. Available at: http://pbsg.npolar.no/en/meetings/press-releases/15-Copenhagen.html