Changes in metabolomic profiles are related to differences in contaminants and diet in polar bears and ringed seals from Hudson Bay and the High Arctic

A.D. Morris,^{1,2} R.J. Letcher,^{1,3} M. Houde,⁴ D. Muir,⁵ T. Brown,⁶ A. Rand,³ M. Dyck,⁷ D. Blair¹

Environment and Environnement et Climate Change Canada Changement climatique Canada

Crown-Indigenous Relations Relations Couronne-Autochtones and Northern Affairs Canada et Affaires du Nord Canada

Fisheries and Oceans Pêches et Océans Canada Canada *



1. Environment and Climate Change Canada (ECCC, Ottawa, ON), 2. Northern Contaminants Program (Crown Indigenous Relations and Northern Affairs Canada, Gatineau, QC), 3. Carleton University (Ottawa, ON), 4. ECCC (Montréal, QC), 5. ECCC (Burlington, ON), 6. Fisheries and Oceans Canada (Vancouver, BC), 7. Nunavut Department of the Environment (Igloolik, NU)



Contaminant and Metabolite Analyses

Sample Collections

	<u>Polar bears</u>		Ringed seals		
	WHB	Baffin Bay	WHB	Lancaster Sound	
Year	2015	2015	2015	2016	-
Month	Sept-Oct	Oct-Dec	Oct	May-June	
Age	6.5 ± 3.9	In process	$\textbf{6.6} \pm \textbf{7.1}$	$\textbf{7.8} \pm \textbf{7.1}$	0
n	15	15	15	13	
Adult males	6	7	2	5	
Adult females	4	1	6	4	
Subadults	5	7	7	4	
δ ¹³ C (‰)	-18.9 ± 0.739	-17.9 ± 0.398	-21.1 ± 1.16	-19.2 ± 0.683	
δ ¹⁵ N (‰)	18.9 ± 1.82	20.2 ± 0.605	16.3 ± 0.471	17.6 ± 0.677	
	Year Month Age n Adult males Adult females Subadults δ^{13} C (‰) δ^{15} N (‰)	Polar WHB Year 2015 Month Sept-Oct Age 6.5 ± 3.9 n 15 Adult males 6 Adult females 4 Subadults 15 δ^{13} C(%) 18.9 ± 0.739 δ^{15} N(%) 18.9 ± 1.82	Polar bears WHB Baffin Bay Year 2015 2015 Month Sept-Oct Oct-Dec Age 6.5 ± 3.9 In process n 15 15 Adult males 6 7 Adult females 4 1 Subadults 5 7 δ ¹³ C (%o) -18.9 ± 0.739 -17.9 ± 0.398 δ ¹⁵ N (%o) 18.9 ± 1.82 20.2 ± 0.605	Polar bears Rin WHB Baffin Bay WHB Year 2015 2015 Month Sept-Oct Oct-Dec Oct Age 6.5 \pm 3.9 In process 6.6 \pm 7.1 n 15 15 15 Adult males 6 7 2 Adult females 4 1 6 Subadults 5 7 7 δ^{13} C (%) 18.9 \pm 0.32 \pm 0.2 \pm 0.32 \pm	Polar bears R WHB Baffin Bay WHB Lancaster Sound Year 2015 2015 2015 2016 Month Sept-Oct Oct-Dec Oct May-June Age 6.5 ± 3.9 In process 6.6 ± 7.1 7.8 ± 7.1 n 15 15 15 13 Adult males 6 7 2 5 Adult females 4 1 6 4 Subadults 5 7 7 4 δ^{13} C(‰) 18.9 ± 0.739 17.9 ± 0.398 21.1 ± 1.6 -19.2 ± 0.637

Polar bears were sampled by hunters from Rankin Inlet, Whale Cove, Arviat, Chesterfield Inlet, Pond Inlet, Clyde River and Qikiqtarjuaq Ringed seals were sampled by hunters from Arviat and Resolute Bay





Polar bear issue samp



- Fatty acids were assessed in adipose/blubber
- Stable isotopes ($\delta^{15}N$, $\delta^{13}C$) assessed in muscle
- Contaminants and fatty acids were analyzed at the National Wildlife Research Centre (ECCC, Ottawa, ON) with some ringed seal analysis at the Canada Centre for Inland Waters (ECCC, Burlington, ON)
- Metabolomic analyses were performed in at SGS AXYS (Sidney, BC)
- Statistics were executed using Metaboanalyst v.4.0, SYSTAT and Sigmaplot
- Stable isotopes were measured at the GLIER (University of Windsor)
- All methods have been validated and published^{3,4,5,6}



High Arctic animals have stronger marine δ^{13} C values and











- greater trophic position ($\delta^{15}N$) than WHB
- Omega-3 fatty acids were enriched in High Arctic animals, while saturated FAs and omega-6 FAs were enriched in WHB
- Nutrient dynamics and diet are different between inland Hudson Bay, and the open Ocean
- Hudson Bay animals have broader carbon signatures which could be due to the large catchment of the bay and/or a more diverse diet with increasing numbers of North Atlantic species

Contaminants in Polar Bears and Ringed Seals



Relationships Between Metabolites, Diet and Contaminants in Polar Bears

