

Assessing the effect of increased solar exposure on Arctic species' health using science and traditional ecological knowledge

Martinez-Levasseur, Laura^{1,2}, C. Furgal², M. Simard³, B. Dodge³, K. Acevedo-Whitehouse⁴, M. Birch-Machin⁵, M. Hammill⁶ and G. Burness¹

¹ Department of Biology, Trent University, Ontario, K9J 7B8; ² Department of Indigenous and Environmental studies, Trent University, Ontario, K9J 7B8; ³ Nunavik Research Centre, Makivik Corporation, Quebec, J0M 1C0; ⁴ Unit for Basic and Applied Microbiology, School of Natural Sciences, Autonomous University of Querétaro, 76230, México ⁵ Dermatological Sciences, Institute of Cellular Medicine, Newcastle University, NE2 4HH, UK; ⁶ Maurice Lamontagne Institute, Fisheries and Oceans Canada, Quebec, G5H 3Z4

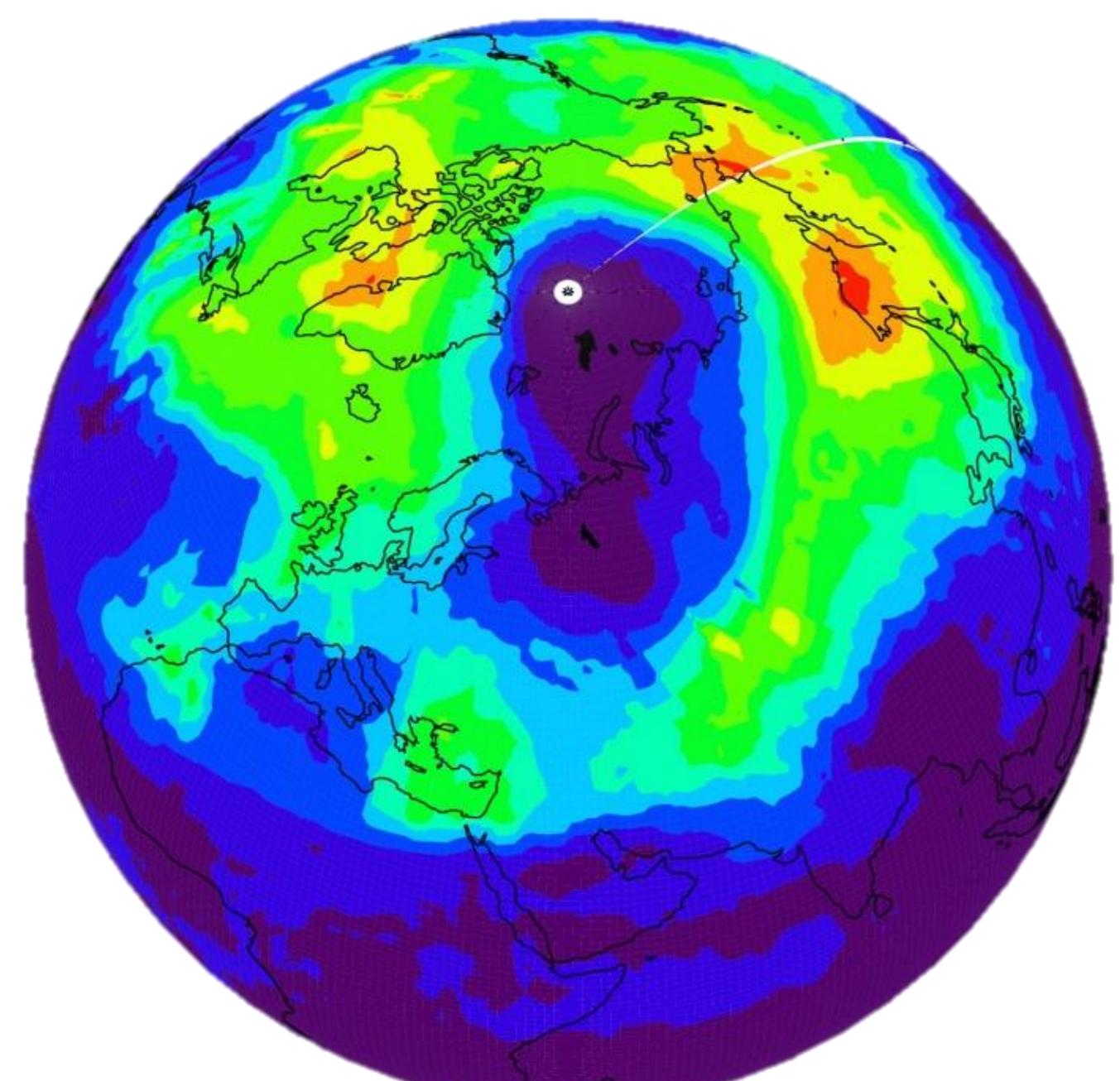
Introduction

Solar ultraviolet radiation (UV) negatively affect whales resulting in lesions commonly associated with severe sunburn in humans ⁽¹⁾

Like whales, walrus' skin is unprotected by fur. But, walrus spend extended periods of time out of the water, resulting in sun exposure far exceeding that of other marine mammals

Interestingly, skin ulcerative lesions of unknown aetiology have been recently recorded in Pacific walrus carcasses ⁽²⁾

If UV suppresses immunity in walrus, walrus' sensitivity to infectious pathogens may be increased. The decreased resistance to *Trichinella* associated with increased UV has been reported in laboratory ⁽³⁾



Thickness of the Arctic ozone layer, April 2011
© Ozone Monitoring Instrument, NIVR, FMI

Due to the unprecedented Arctic ozone loss recorded in 2011 ⁽⁴⁾, it is important to understand the extent of damage caused by UV in Arctic species, particularly those of economic, cultural and public health significance such as walrus.

Objective

Understand the effect of UV on walrus' health and answer the questions:

- 1) What is the extent of cellular & molecular damage on walrus caused by UV exposure?
- 2) How do individual variations in skin pigmentation, sex, and age influence sensitivity to UV-induced damage?
- 3) Is there an association between the prevalence of UV lesions and infectious parasites such as *Trichinella* ?

Methods

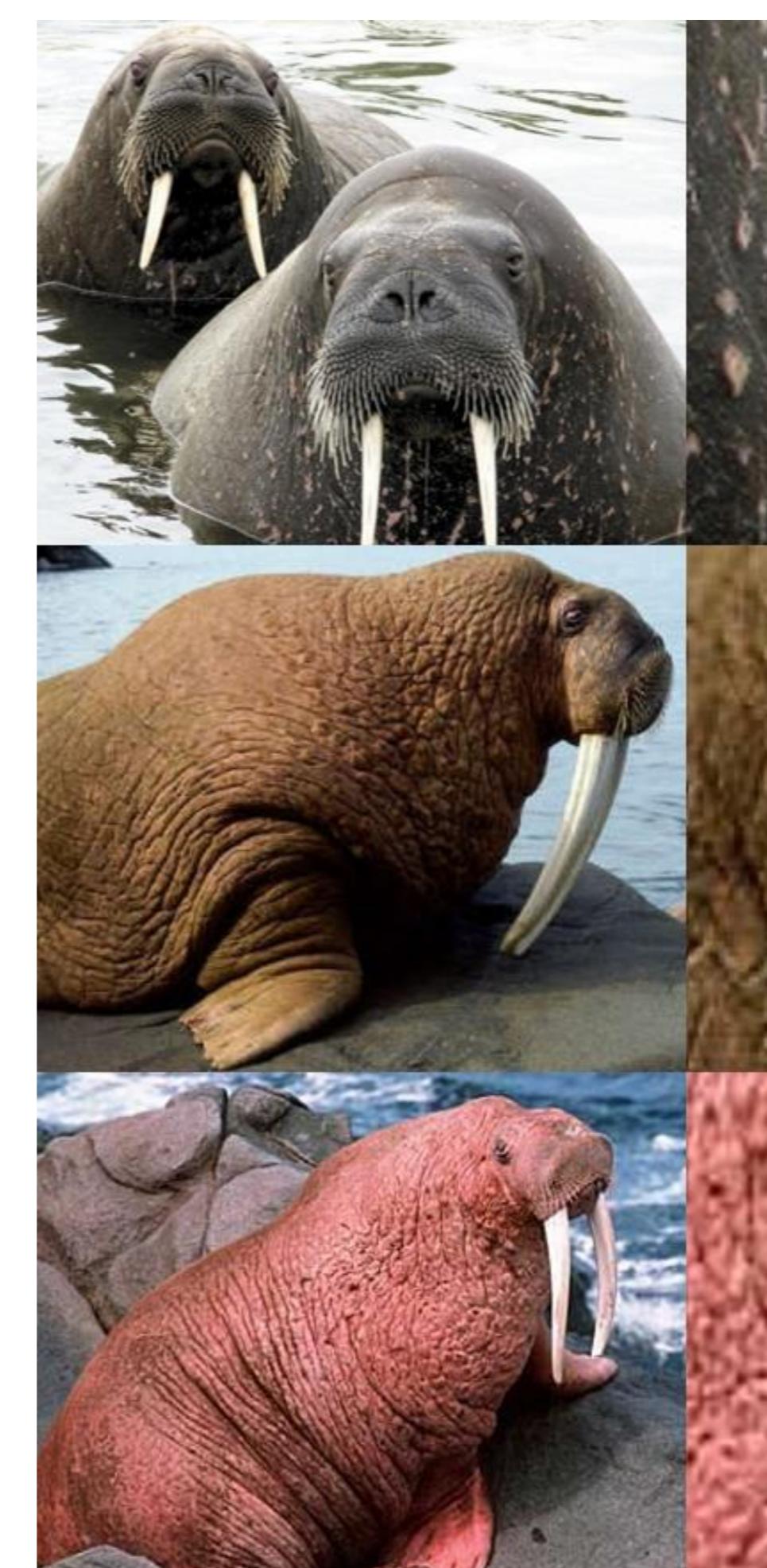
Multidisciplinary approach combining

Traditional Ecological Knowledge, TEK

Collection of knowledge from expert Indigenous hunters

Laboratory analyses

Collection of skin & mucus samples during subsistence walrus hunt



Different walrus skin colours.
Credits: nunatsiaqonline.ca, animalbackgrounds.com, seapics.com

- Using semi-directive interviews to document observed changes in walrus' health
- Using guides showing different levels of:
 - ✓ Walrus skin colours
 - ✓ sunburn lesions
 - ✓ eye cataracts

1st trip: 10-15 key experts, from Quaqtaq, Kangiqsualujjuaq, Ivujivik and Inukjuak (Nunavik, Quebec) were invited to participate

2nd trip: semi-directive interviews were conducted to document observed changes in walrus' health

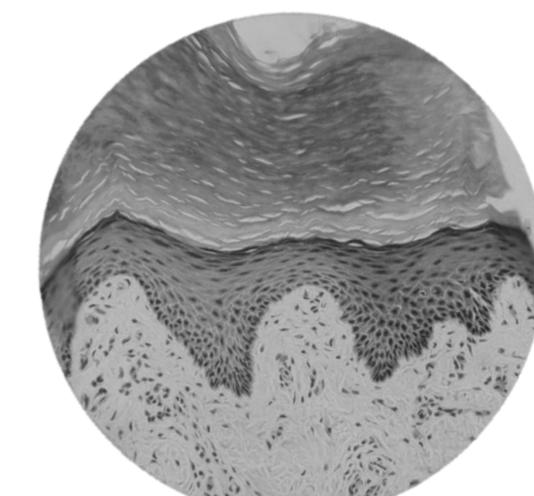
3rd trip: workshops will be organized to verify and validate the preliminary results

4th trip: final results will be returned to each community

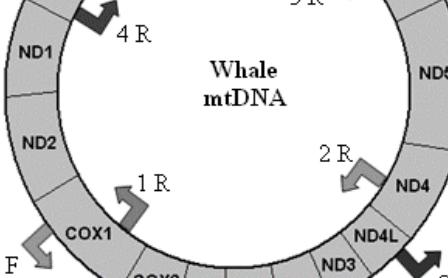


Subsistence Inuit walrus hunt, captain Johnny Oovaut, Quaqtaq, July 2013

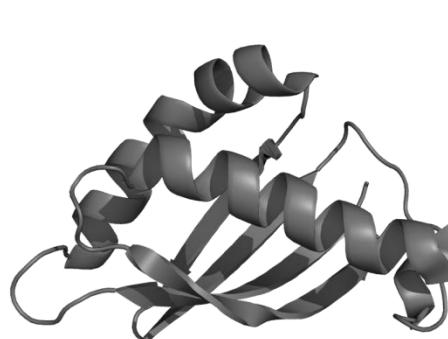
Histology
Skin sections to detect UV-induced cell damage



Genetic
Quantitative long-PCR assays to screen UV-induced mitochondrial DNA lesions



Immunology
Detection of immune proteins in mucus



Parasitology
Detection of *Trichinella*



This project is of interest and importance for both walrus ecology and public health as it can provide insights on walrus pathogenic infection that can affect higher trophic levels including Indigenous consumers

contact: lmartinez@trentu.ca

References: 1. Martinez-Levasseur LM et al. (2011) Proc. R. Soc. B 278, 1581-1586; 2. Garlich-Miller J et al. (2011) US Fish and Wildlife Service; 3. Goetsch W et al. (1994) Environ. Health Persp. 102(3), 298:301; Manney GL et al (2011) Nature. 478: 469-475

Acknowledgments:

Kangiqsualujjuaq, Quaqtaq, Ivujivik, Inukjuak & their Local Hunting Fishing & Trapping Associations, Northern Villages & Landholding Corporations; HEIC members, particularly K. Breton-Honeyman & V. Gelinas, for their guidance in working with Indigenous communities