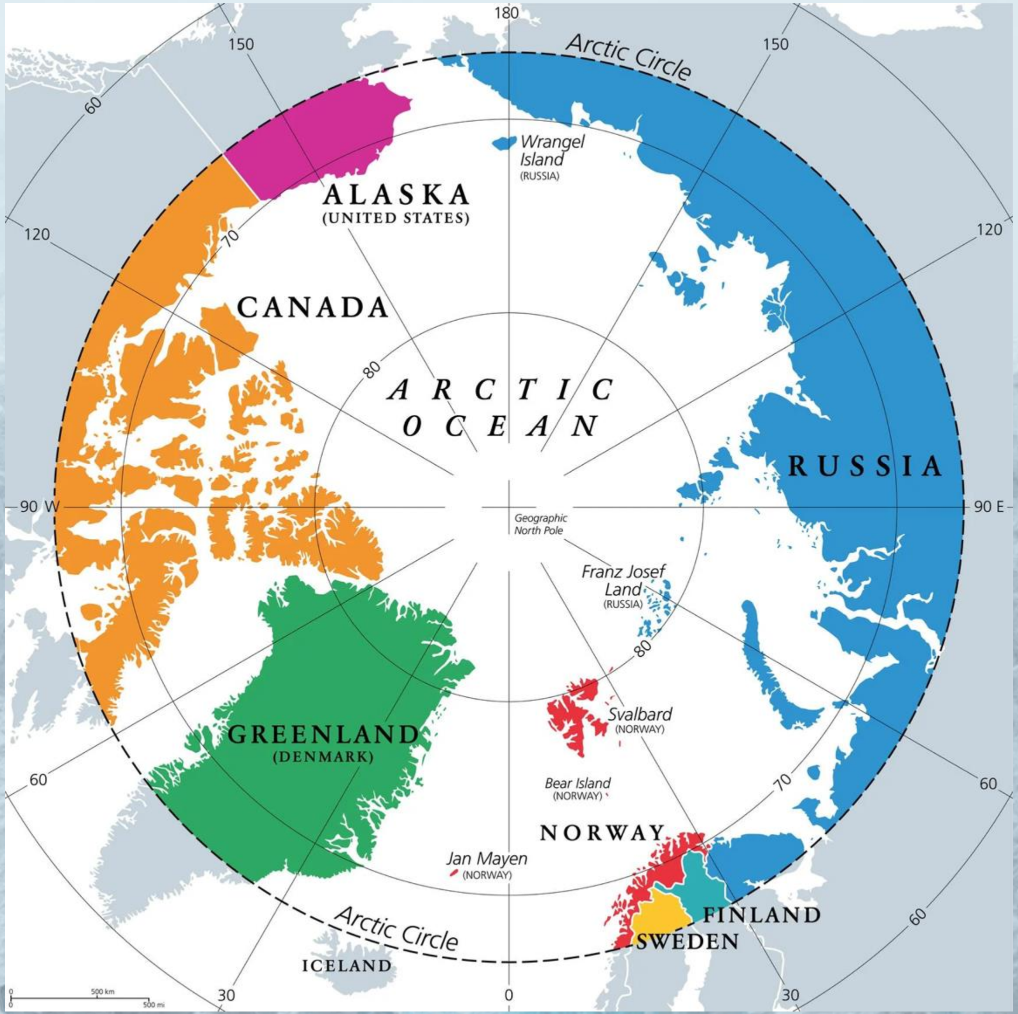
UiT
THE ARCTIC
UNIVERSITY
OF NORWAY

Environmental stressors and infectious diseases in the Arctic

Belgian One Health
Ecosystems in the balance

Brussels, January 22, 2025

Jacques Godfroid
Faculty of Biosciences, Fisheries and Economics
Department of Arctic Marine Biology



THE ARCTIC UNIVERSITY OF NORWAY • UIT •

Tromsø

Arctic Definition

High Arctic
Low Arctic
Sub Arctic

the Arctic Circle (66° 33′ 44″ North)
The Arctic Circle is the southernmost latitude in the Northern Hemisphere at which the sun can remain continuously above or below the horizon for 24 hours

10°C July isotherm
defined as being the area where the average temperature for the warmest month (July) is below 10°C / 50°F.

Arctic AHDR boundary
Arctic Human Development Report

Arctic EPPR boundary
The Emergency Prevention, Preparedness and Response

Arctic CAFF boundary
The Conservation of Arctic Flora and Fauna

Arctic AMAP boundary
The Arctic Monitoring and Assessment Programme

Arctic Tree line boundary
The northernmost latitude in the Northern Hemisphere where trees can grow; farther north, it is too cold all year round to sustain trees.

Source: GRID - Arendal, ADHR, EPPR Working Group, National Snow and Ice Data Centre, Boulder, CO, AMAP, CAFF

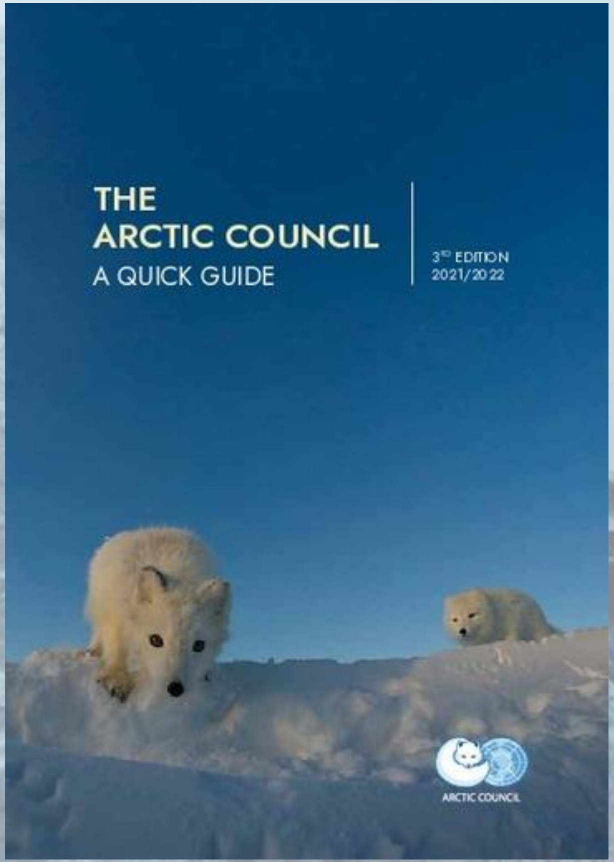
ARCTIC PORTAL
www.arcticportal.org

The Arctic Council

Is the leading intergovernmental forum promoting cooperation, coordination and interaction among the Arctic States, Arctic Indigenous Peoples and other Arctic inhabitants on common Arctic issues, in particular on issues of sustainable development and environmental protection in the Arctic. It was formally established in 1996.

All Arctic Council decisions and statements require consensus of the eight Arctic States.

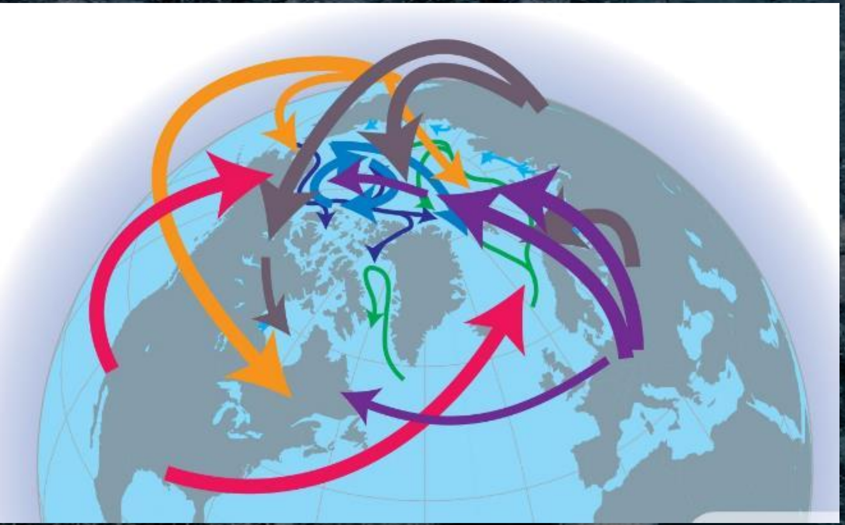
Six organizations representing Arctic Indigenous Peoples have status as Permanent Participants. This category was created to provide a means for active participation of the Arctic Indigenous Peoples within the Council.

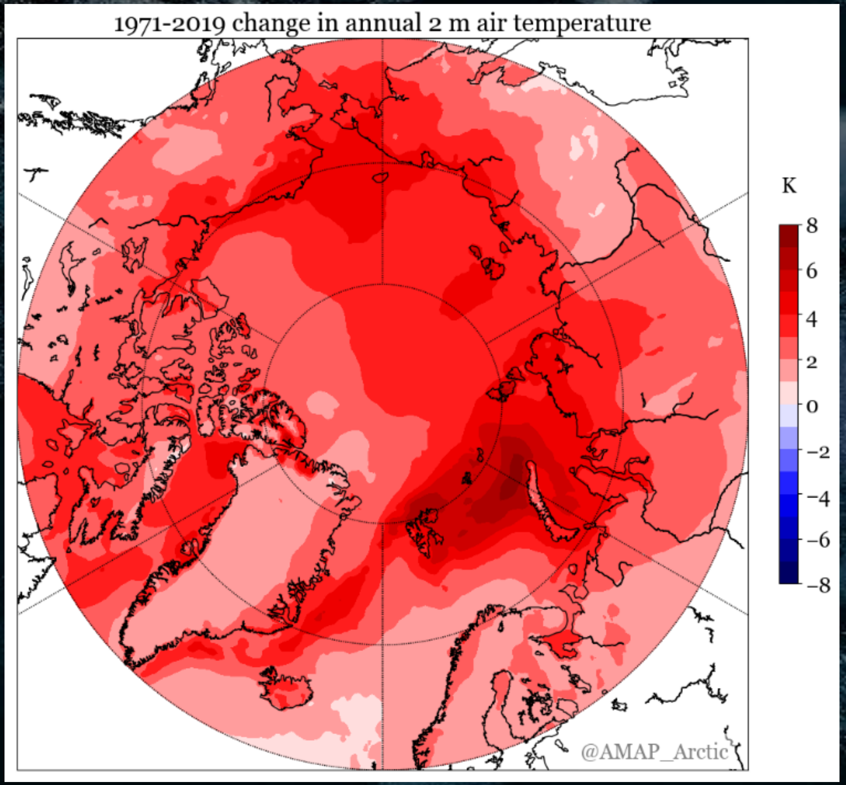


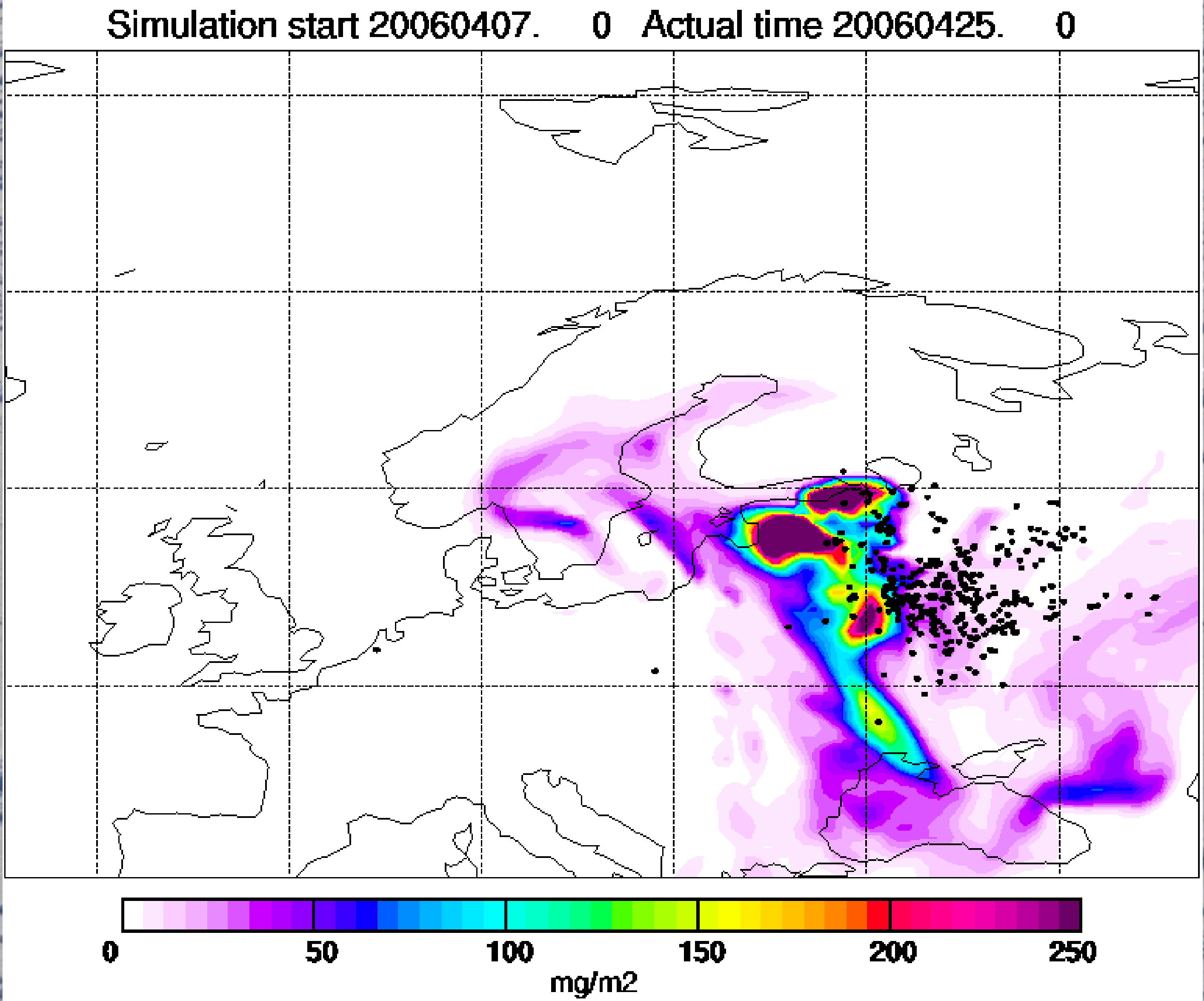
https://oaarchive.arctic-council.org/items/5b1cf319-c3d0-427a-b874-78ce0e32bba4

Why is this important?

- Arctic – the Canary bird of the globe
  - Arctic – the sensitive indicator
    - Transportation by air and sea
    - Magnification through food webs
  - Arctic Amplification
    - The Arctic warms 3 times faster than global average
    - Some of the fastest rates of ocean acidification
  - What happens in the Arctic affects the world



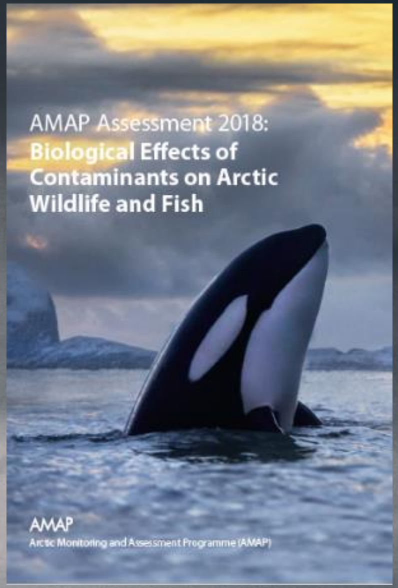




Eckhardt et al. 2007 Atmos Chem Phys 7: 4527-4536

https://acp.copernicus.org/articles/7/4527/2007/acp-7-4527-2007.pdf

AMAP Assessments show



That international and national pollution control activities have been effective at reducing the levels and ecosystem impacts of the chemicals they regulate

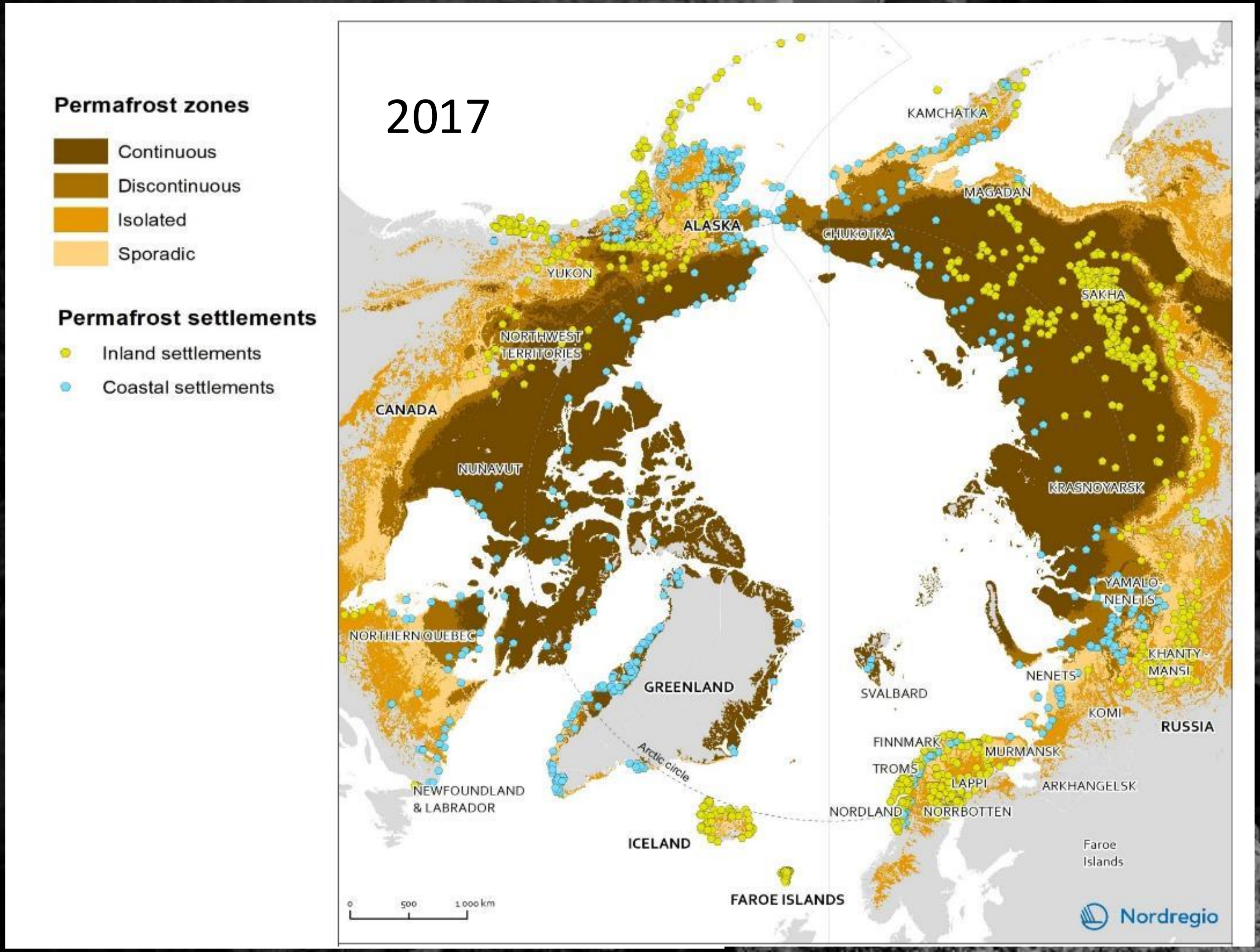
Arctic States have played a central role in this success story

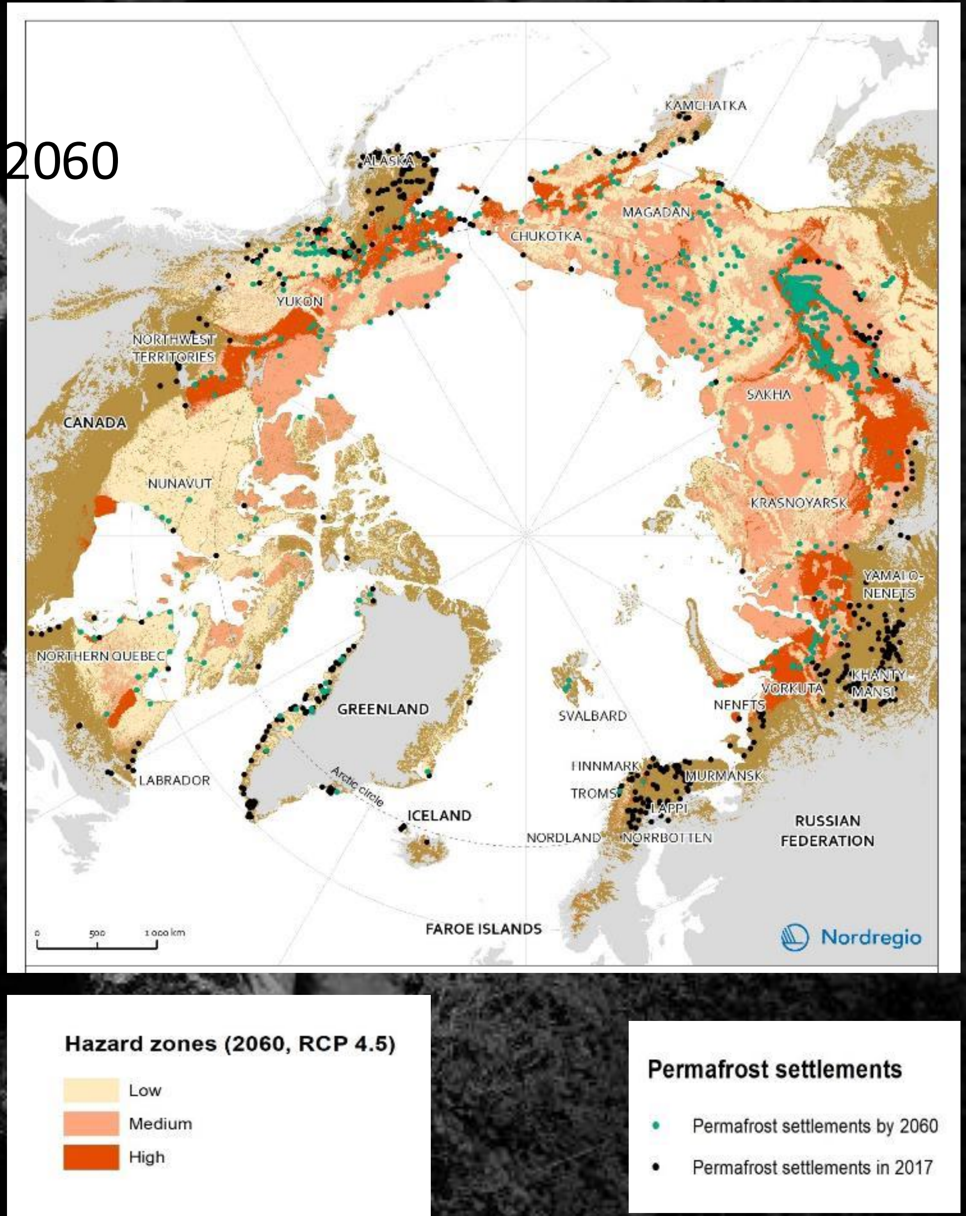
However

Pollution threats to the Arctic are continually evolving, new chemicals of emerging Arctic concern add to existing threats from chemicals such as mercury and POPs

Legacy chemicals and mercury continue to pose a significant concern for effects on the health of Arctic biota and ecosystems

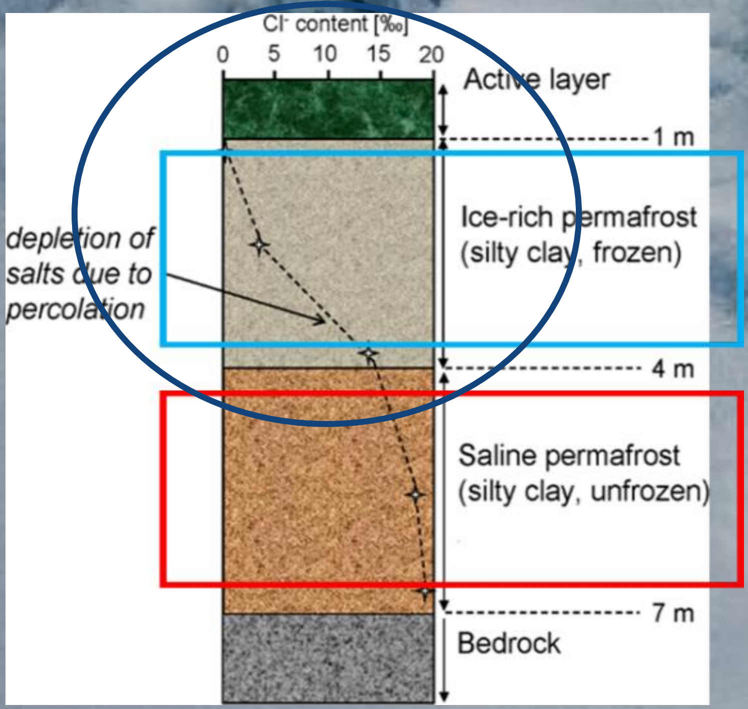
PERMAFROST THAW: SETTLEMENTS



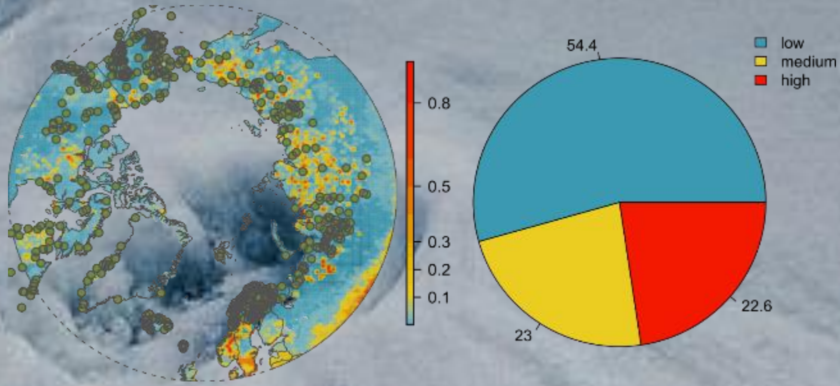


Ramage J et al, 2021. Population living on permafrost in the Arctic, *Population and Environment*, https://link.springer.com/article/10.1007/s11111-020-00370-6

PERMAFROST THAW: DRINKING WATER, FOOD

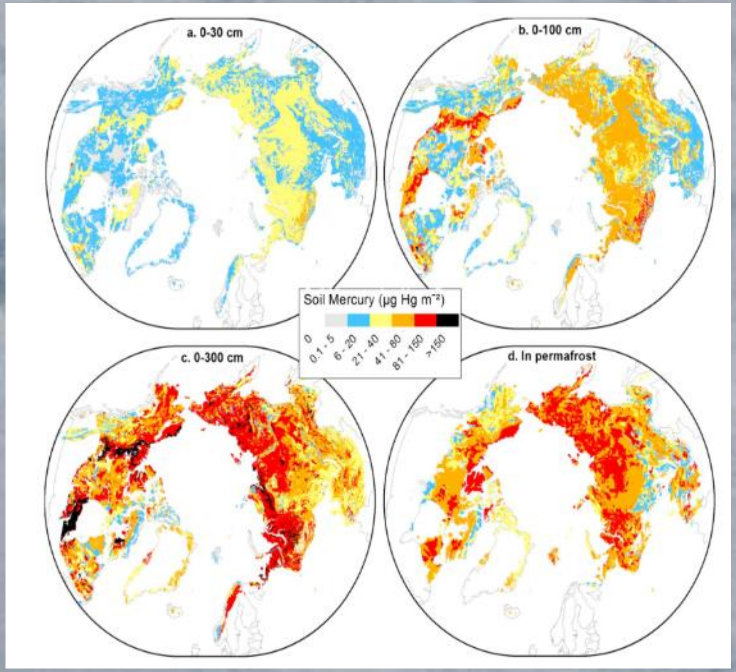


Drinking water, Greenland
Adapted from Foged and Ingeman-Nielsen, 2008



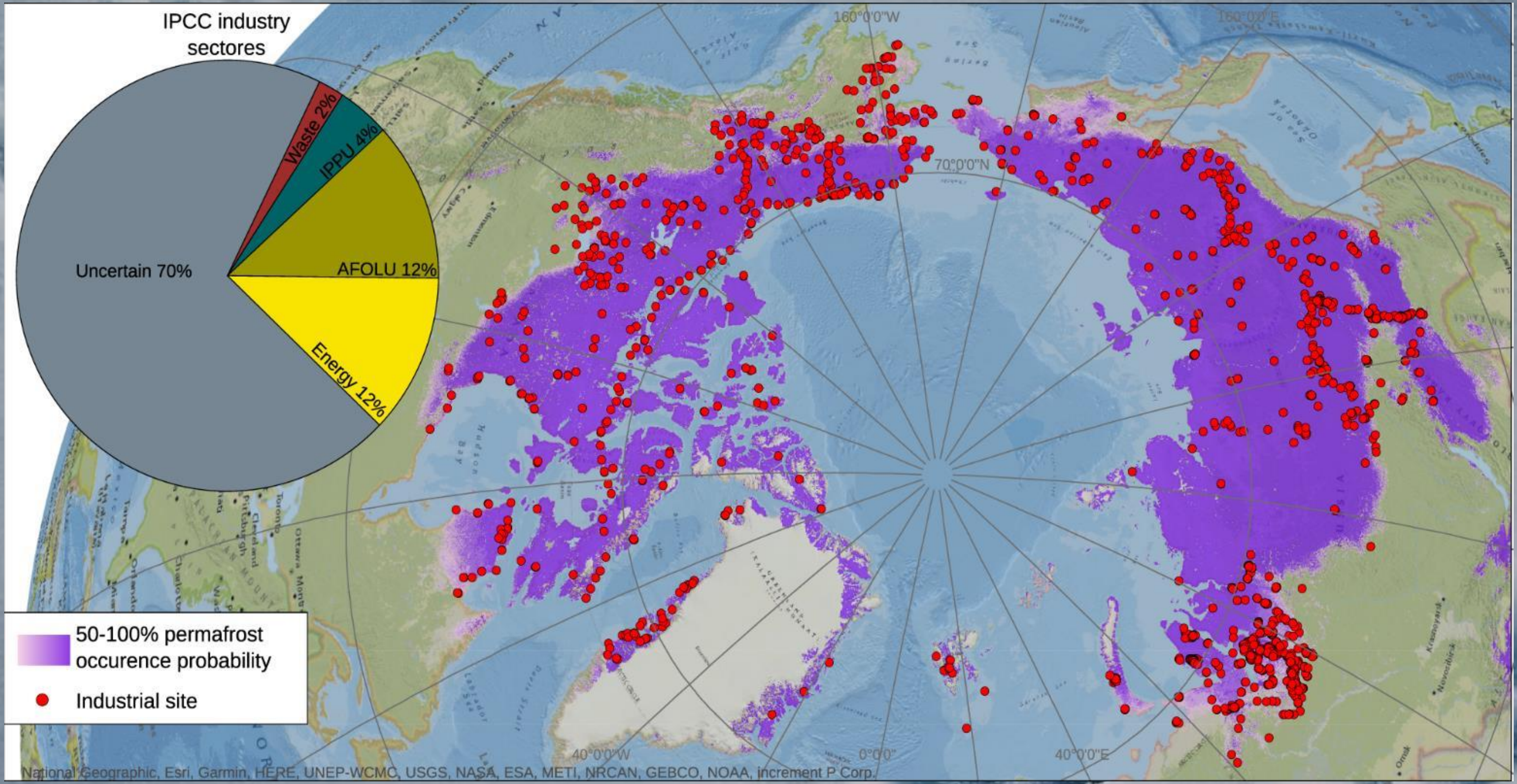
Mapping environmental suitability for anthrax reemergence in the Arctic

Stella et al, 2021
Stella et al, 2020

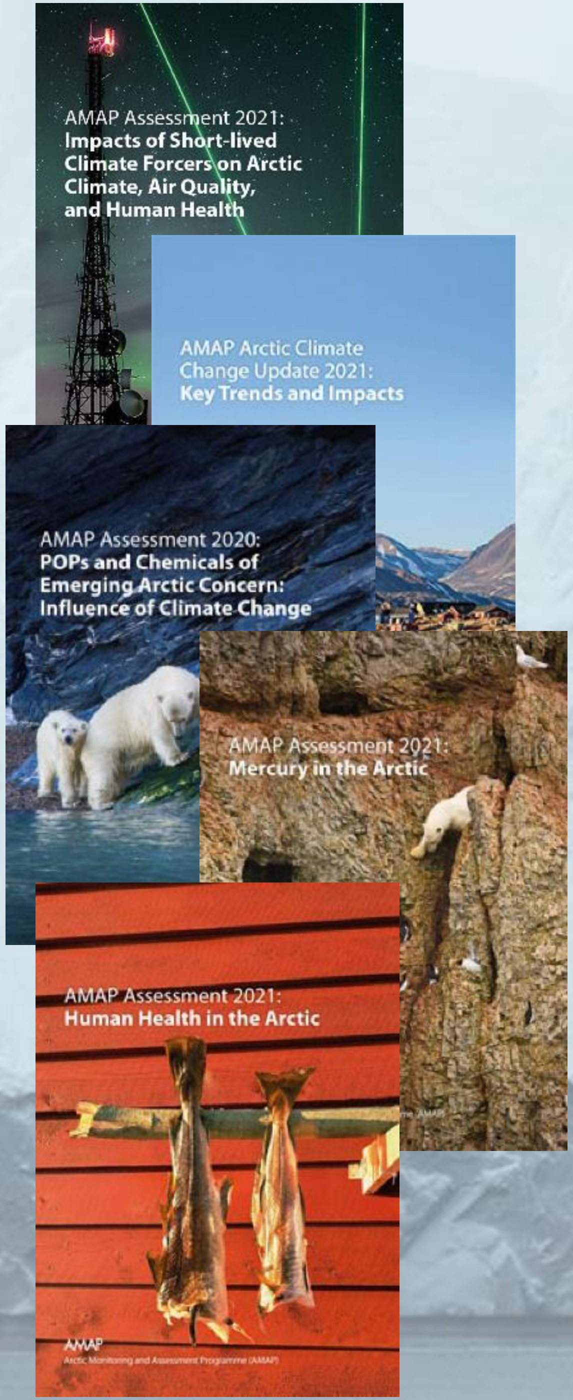


Mercury in soil
Schester et al., 2018

PERMAFROST THAW: CONTAMINATED SITES



Langer et al., Thawing permafrost poses environmental threat to thousands of sites with legacy industrial contamination, *Nature Communications*, 2023, 14:1721, https://doi.org/10.1038/s41467-023-37276.



AMAP

peer-reviewed scientific assessment reports

- Summaries for Policy Makers (SPM's)
- Monitoring programmes and guidelines (harmonization)
- Advice to the Arctic Council and Senior Arctic Officials
- Advice/data to international organs - IPCC, Stockholm, Minamata, Air Convention, WHO and others

My deepest thanks to
mario.acquarone@amap.no
Deputy Secretary

FUTURE PERSPECTIVES

Contaminants

Pathways and consequences for human health and ecosystems

Multiple stressors

Interactions of pollution and climate

A personal take on science and society

World view

By Christian Sonne

Join forces to counter Arctic pandemic threat

Emerging disease risk is the fourth component of a quadruple crisis brewing in the Arctic.

The Arctic is under stress, that much is known. Between 1979 and 2021, the region warmed four times faster than the global average, with effects – as yet poorly understood – on its ecology and ability to store carbon, on global sea levels and on wider ocean-circulation and weather patterns.

Add in the effects of biodiversity loss and pollution, and people often refer to a triple planetary crisis. I think we should actually be talking about a quadruple crisis. Since starting research in the Arctic in 1997, I have spent nearly all of my summers there, monitoring changes in pollution levels, habitats and food webs using a 'One Health' approach that integrates effects on wildlife, humans and ecosystems. And it's becoming clear that, as the Arctic warms, its environment degrades and human activities increase, new health threats are emerging. In particular, the Arctic is likely to become a hotbed for zoonotic diseases that spill over into humans from other animals. That threat was brought home to all of us by the COVID-19 pandemic. We need to take seriously the possibility that the next pandemic could come from the north.

Some 60% of emerging infectious diseases are zoonotic. Their emergence and spillover is in general highly interlinked with habitat degradation, biodiversity loss and food-web changes – all of which are present in the Arctic. But a warming Arctic harbours other risks. As sea ice thaws, 'forever chemicals' are increasingly being transported into Arctic environments. These include mercury, per- and polyfluoroalkyl substances and polychlorinated biphenyls, all known to modulate human and animal immune systems and increase vulnerability to respiratory infections. Invasive fish and whale species are also bringing in industrial chemicals and their own diseases.

The pathogens enter an environment in which some native species, such as polar bears (*Ursus maritimus*), have not been exposed to them, and so are at increased risk. The release of ancient microorganisms long frozen in ice and sediments as the landscape thaws adds to this danger: humans and other wildlife are likely to lack any immune defences against them.

These risk factors are set to increase. The first ice-free Arctic summers could come as early as the 2030s. The Arctic Ocean has huge potential for energy, fishery and tourism sectors, and is not subject to any global treaty regulating its exploitation. Further wildlife disturbance, pollution, overfishing and jurisdictional conflicts are the likely result.

The current perception is that the Arctic possesses relatively low microbial activity. Compared with temperate and tropical latitudes, many fewer resources are devoted to studying zoonoses in the Arctic, with sparse surveillance for emerging threats in most areas. This needs to change – taking account of human, animal and wider environmental perspectives.

> "Compared with temperate and tropical latitudes, many fewer resources are devoted to studying zoonoses in the Arctic."

When it comes to logistics, low-tech is high-tech in the Arctic. On the human side, Canadian researchers have already started taking samples from sewage and other sources that can easily be analysed for the presence of viral pathogens. This kind of approach should be combined with better access to community health care, clinical inspections and consultations with local doctors. A particular flash point is the handling and consumption of raw or dried animal meat in subsistence-hunting communities. Hygiene courses, meat inspection and better disease surveillance developed in partnership with those communities can help to both sustain food security and prevent spillover events.

On the wildlife side, long-term finance is needed for yearly and seasonal surveillance programmes. These schemes should collaborate with local communities using existing techniques that don't rely on technologies such as cryogenics and so are easy to use *in situ*. Such activities could be embedded into the ongoing Arctic Council monitoring and assessment programmes on pollution, biodiversity and climate change, as laid out in the council's 'One Arctic, One Health' project.

On the broader environmental front, efforts to reduce pollution, safeguard biodiversity and reduce greenhouse-gas emissions through international agreements play their part. Efforts spearheaded by various Arctic Council working groups, and other initiatives such as the ongoing negotiations for a United Nations-backed treaty on plastic pollution, show how intergovernmental and interdisciplinary collaboration across public health, biodiversity conservation, pollution and food security can help with achieving sustainability.

To make a true difference, there is need for a broader Arctic monitoring and assessment plan, underpinned by treaty, that combines surveillance of pollution and of disease. This is currently difficult to achieve through the Arctic Council, given the absence of Russia and Russian data since the country's invasion of Ukraine in 2022. A better opportunity to establish a holistic understanding and action plan might be afforded by the proposed pandemic-preparedness treaty, currently under negotiation at the World Health Organization. This could build on the efforts of almost 200 globally recognized One Health Networks, including those in the Arctic.

Action must be taken now. If it isn't, it will become more difficult to mitigate wildlife interactions and diagnose, treat and isolate people with an infection – and the risk of a future pandemic with an Arctic ground zero will only increase.

Christian Sonne is a professor in the Department of Ecoscience at Aarhus University in Roskilde, Denmark.
e-mail: cs@ecos.au.dk

Science of the Total Environment 957 (2024) 176869

Contents lists available at ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

Environmental stressors and zoonoses in the Arctic: Learning from the past to prepare for the future

Emilie Andersen-Ranberg [a,*], Ingebjørg H. Nymo [b,c], Pikka Jokelainen [d], Anastasia Emelyanova [e,f], Solveig Jore [g], Brian Laird [h], Rebecca K. Davidson [b], Sonja Ostertag [h], Emilie Bouchard [i,s], Freja Fagerholm [j], Kelly Skinner [h], Mario Acquarone [k], Morten Tryland [l], Rune Dietz [m], Khaled Abass [n,f], Arja Rautio [e,f], Sjúrður Hammer [o,p], Birgitta Evengård [j], Tomas Thierfelder [q], Raphaela Stimmelmayr [r], Emily Jenkins [s], Christian Sonne [m,*]

[a] University of Copenhagen, Faculty of Health and Medical Sciences, Department of Veterinary Clinical Sciences, Dyrlægevej 16, 1870 Frederiksberg, Denmark
[b] Norwegian Veterinary Institute, Holtveien 66, 9016 Tromsø, Norway
[c] Department of Arctic and Marine Biology, UiT - The Arctic University of Norway, Framstredet 39, Breivika, 9019 Tromsø, Norway
[d] Infectious Disease Preparedness, Statens Serum Institut, Artillerivej 5, 2300 Copenhagen, Denmark
[e] Thule Institute, University of Oulu, Paavo Havaksen tie 3, 90570 Oulu, Finland
[f] Research Unit of Biomedicine and Internal Medicine, Faculty of Medicine, University of Oulu, Paavo Havaksen tie 3 Linnanmaa, 90014, Finland
[g] Department of Zoonotic, Food & Waterborne Infections, Norwegian Institute of Public Health, Postbox 222 Skøyen, 0213 Oslo, Norway
[h] School of Public Health Sciences, University of Waterloo, 200 University Ave W, Waterloo, ON N2L 3G1, Canada
[i] Ecotoxicology and Wildlife Health Division, Environment and Climate Change Canada, St Hyacinthe J2T 1B3, Canada
[j] Department of Clinical Microbiology and the Arctic Center, Umeå University, Johan Bures Väg 5, 90187 Umeå, Sweden
[k] Arctic Monitoring and Assessment Programme, Hjalmar Johansens gate 14, 9007 Tromsø, Norway
[l] Department of Forestry and Wildlife Management, Inland Norway University of Applied Sciences, Anne Evenstads Veg 80, 2480 Koppang, Norway
[m] Aarhus University, Faculty of Technological Sciences, Department of Ecoscience, Frederiksborgvej 399, 4000 Roskilde, Denmark
[n] Department of Environmental Health Sciences, College of Health Sciences, University of Sharjah, postbox 27272, United Arab Emirates
[o] Faroese Environment Agency, Traðagøta 38, 165 Argir, Faroe Islands
[p] University of the Faroe Islands, Vestara Bryggja 15, 100 Tórshavn, Faroe Islands
[q] Department of Energy and Technology, Swedish University of Agricultural Sciences, postbox 75651, Uppsala, Sweden
[r] Department of Wildlife management, North Slope Borough, postbox 69, 99723 Utqiagvik, AK, USA
[s] Department of Veterinary Microbiology, University of Saskatchewan, 52 Campus Drive, Saskatoon S7N 5B4, Canada

HIGHLIGHTS

- Pollution, climate change and biodiversity loss aggravate zoonoses transmission in the Arctic.
- Zoonoses transmission is elevated for Arctic people in close contact with animals, organs and tissues.
- About three-quarters of all known human infectious diseases are zoonotic including Arctic ones.
- Health care and public health services are limited in remote circumarctic regions.
- There is a need to enhance awareness and manage Arctic zoonoses with pandemic potential.

GRAPHICAL ABSTRACT

Zoonotic diseases observed in the Arctic

Some environmental contaminants cause immunosuppression

PFAS/CV-19

Echinococcus

Hydatid disease

Toxoplasma gondii

Trichinella

Giardia

Micrococcus, Staphylococcus

Mycoplasma

Brucella spp.

Q-fever

Tularemia

CDV, PDV Calicivirus

Rabies

Influenza A

Origins of major human infectious diseases

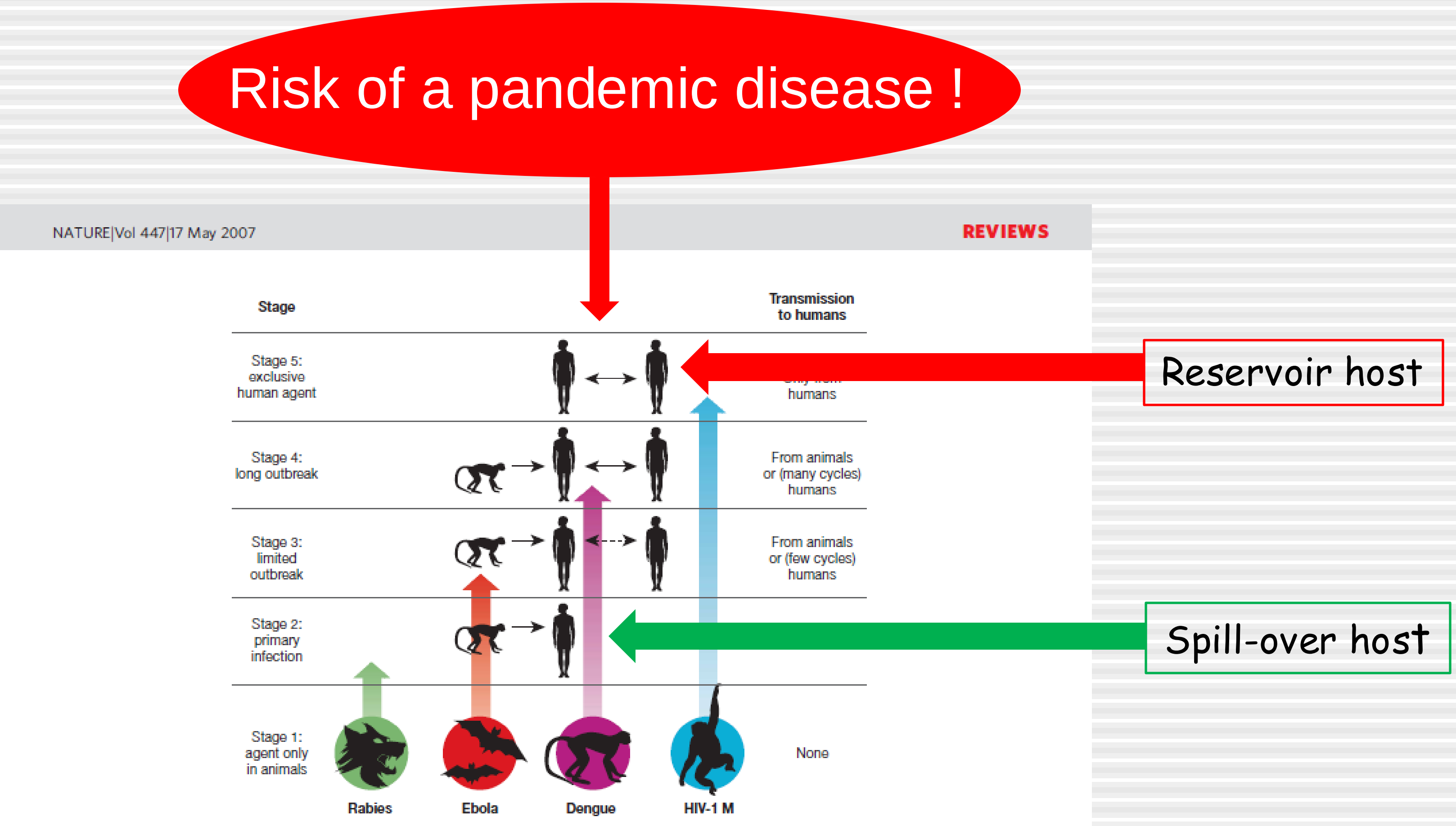


Figure 1 | Illustration of the five stages through which pathogens of animals evolve to cause diseases confined to humans. (See Box 1 for details.) The four agents depicted have reached different stages in the process, ranging from rabies (still acquired only from animals) to HIV-1 (now acquired only from humans).

Wolfe ND. et al. Nature Vol 447j17 May 2007
https://pmc.ncbi.nlm.nih.gov/articles/PMC7095142/

One Health – PPP (2010)

Comparative Immunology, Microbiology and Infectious Diseases 36 (2013) 241–248

Contents lists available at SciVerse ScienceDirect

Comparative Immunology, Microbiology and Infectious Diseases

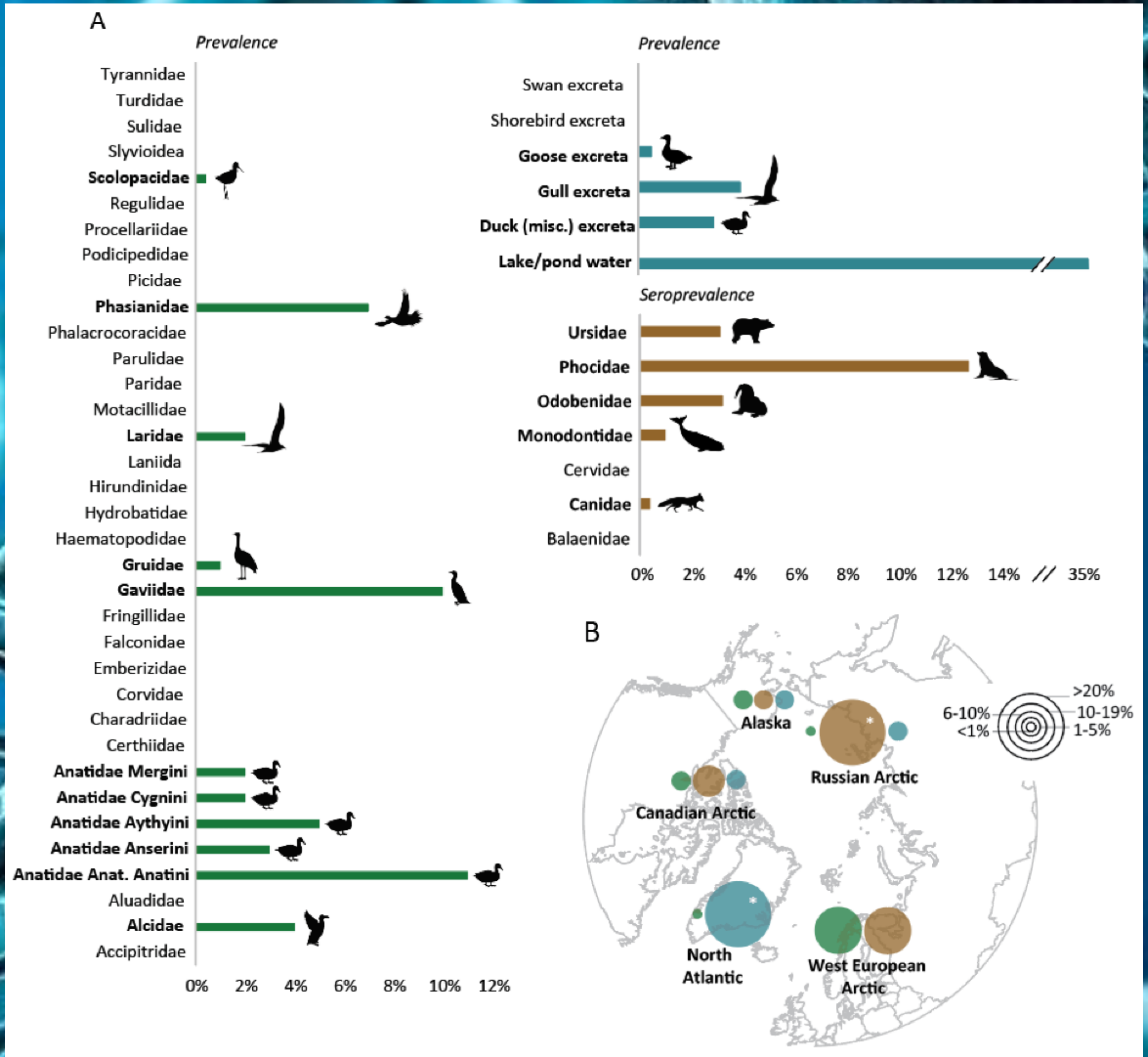
journal homepage: www.elsevier.com/locate/cimid

A "One Health" surveillance and control of brucellosis in developing countries: Moving away from improvisation

Jacques Godfroid[a,b,*], Sascha Al Dahouk[c,d], Georgios Pappas[e], Felix Roth[f], Gift Matope[g], John Muma[h], Tanguy Marcotty[i,b], Dirk Pfeiffer[j], Eystein Skjerve[k]

[a] *Department of Food Safety and Infection Biology, Norwegian School of Veterinary Science, Tromsø, Norway*
[b] *Department of Veterinary Tropical Diseases, Faculty of Veterinary Science, University of Pretoria, Onderstepoort, South Africa*
[c] *Federal Institute for Risk Assessment, Berlin, Germany*
[d] *RWTH Aachen University, Department of Internal Medicine III, Aachen, Germany*
[e] *Institute of Continuing Medical Education of Ioannina, Ioannina, Greece*
[f] *Swiss Tropical Institute, Basle, Switzerland*
[g] *Department of Paraclinical Veterinary Studies, University of Zimbabwe, Harare, Zimbabwe*
[h] *Department of Disease Control, University of Zambia, School of Veterinary Medicine, Lusaka, Zambia*
[i] *Institute of Tropical Medicine, Antwerp, Belgium*
[j] *Veterinary Epidemiology & Public Health Group, Department of Veterinary Clinical Sciences, Royal Veterinary College, London, UK*
[k] *Department of Food Safety and Infection Biology, Epicenter, Norwegian School of Veterinary Science, Oslo, Norway*

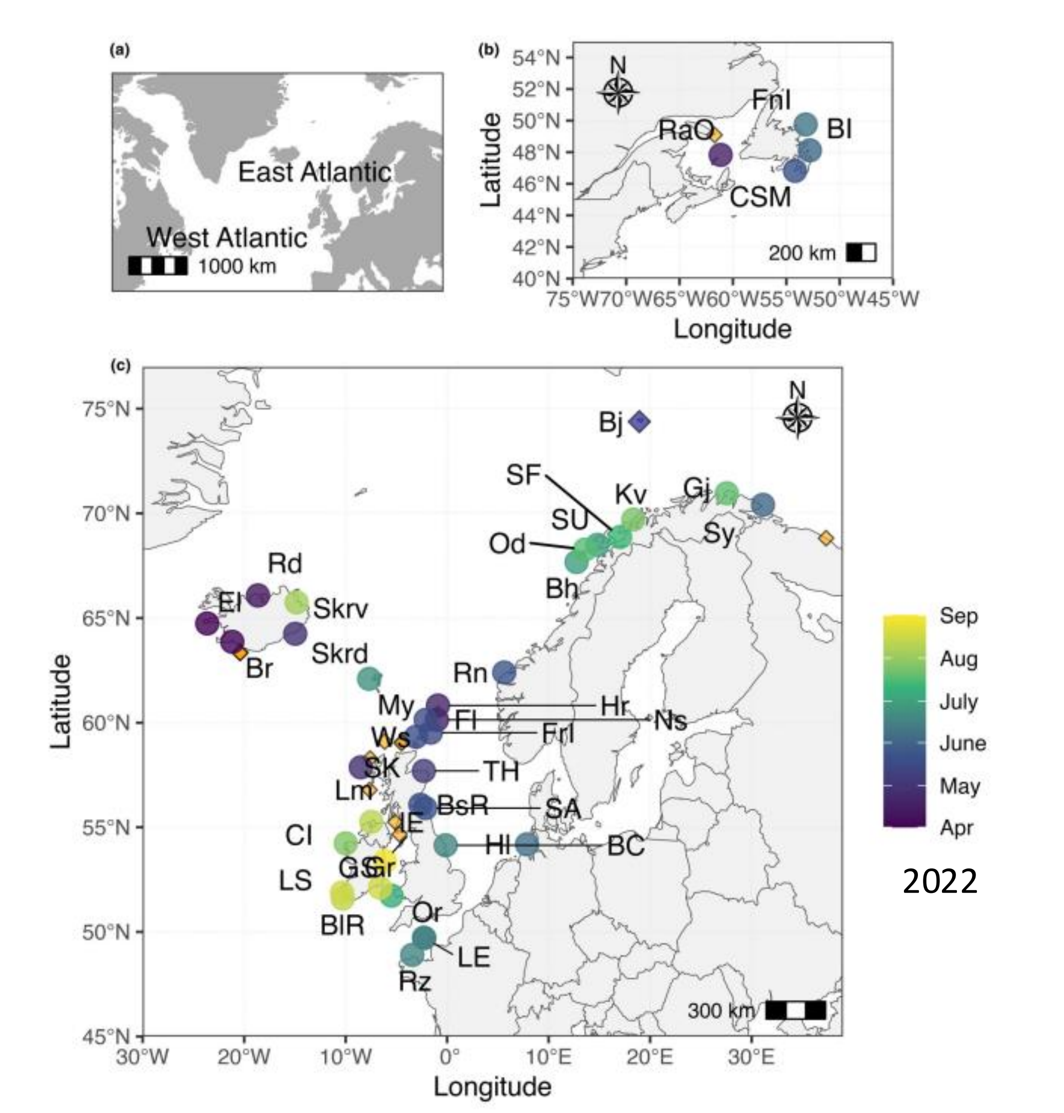
INFLUENZA A VIRUSES



Gass et al. Epidemiology and Ecology of Influenza A Viruses among Wildlife in the Arctic. Viruses 2022, 14, 1531. https://doi.org/10.3390/v14071531

HPAI in (H5N1) in Northern Gannets (*Morus bassanus*)

Lane et al. High pathogenicity avian influenza (H5N1) in Northern Gannets: Global spread, clinical signs, and demographic consequences. IBIS September 2023
https://onlinelibrary.wiley.com/doi/10.1111/ibi.13275

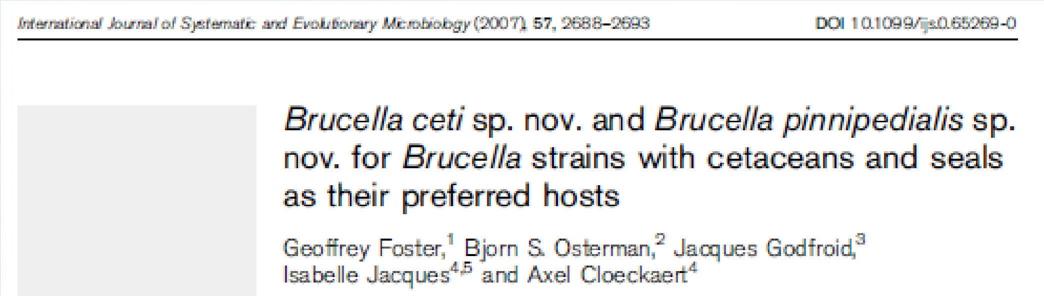


Brucella spp. infections in Marine Mammals

with special emphasis on Hooded Seals *(Cystophorus cristatata)*

Not Just Another Brucellosis Story !

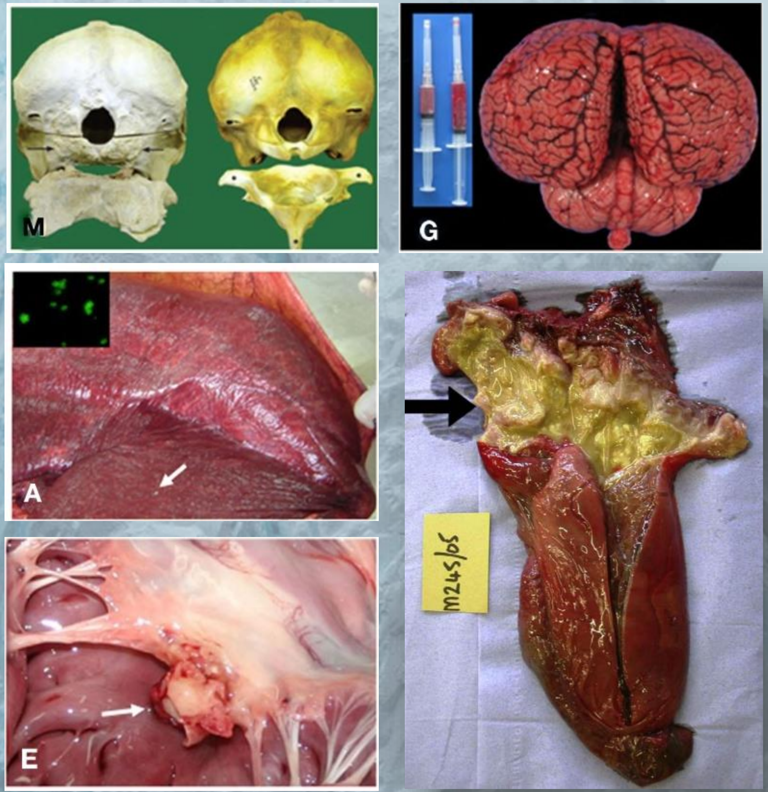
Marine mammal *Brucella species*


International Journal of Systematic and Evolutionary Microbiology (2007), 57, 2688–2693 DOI 10.1099/ijs.0.65269-0

Brucella ceti sp. nov. and *Brucella pinnipedialis* sp. nov. for *Brucella* strains with cetaceans and seals as their preferred hosts

Geoffrey Foster,[1] Bjorn S. Osterman,[2] Jacques Godfroid,[3] Isabelle Jacques[4,5] and Axel Cloeckaert[4]

Gross pathology to date only seen in cetaceans

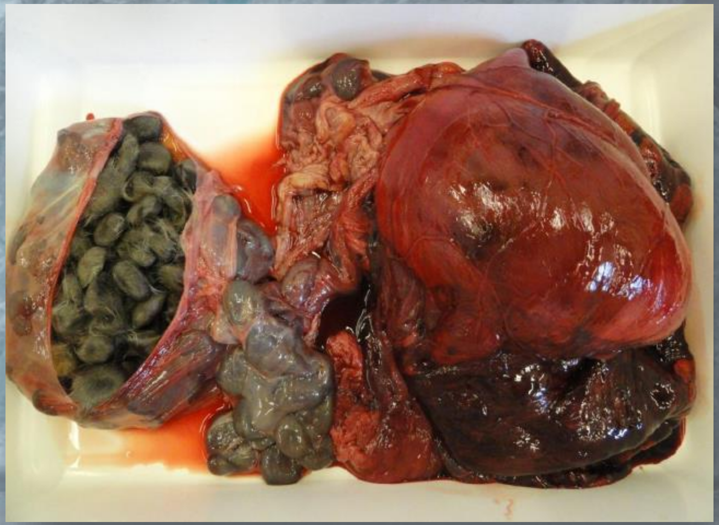


Guzmán-Verri *et al.* 2012. Brucellosis in cetaceans. Front Cell Infect Microbiol

The hooded seal

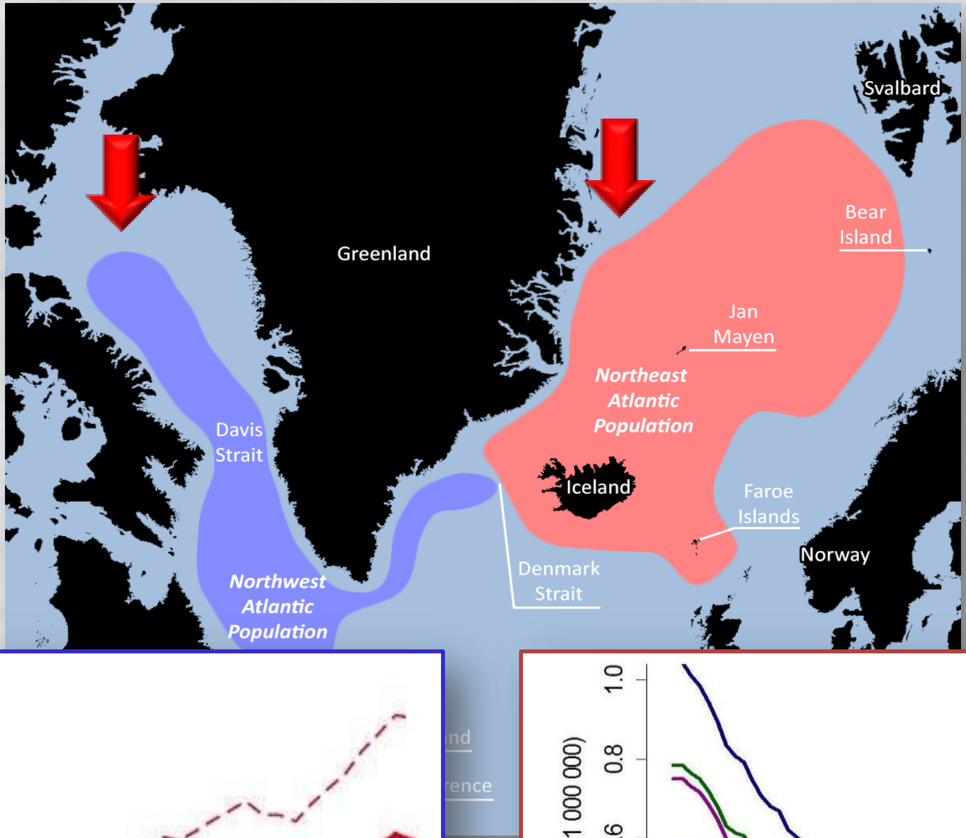
- Pelagic and migratory species
- 2.2 – 2.5 meters long, 200 – 300 kg
- Silver grey colour, irregular black spots, black face
- Characteristic nasal sac in males (“hood”)

Reproduction:
- Gives synchronized birth to a single pup in the spring
- Pups are approximately one meter long at birth and 25 kg
- Lactation: four days!

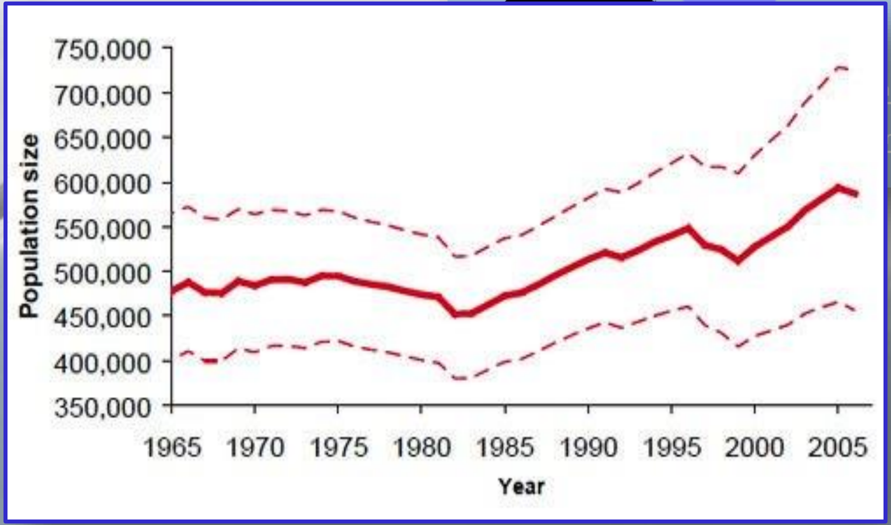


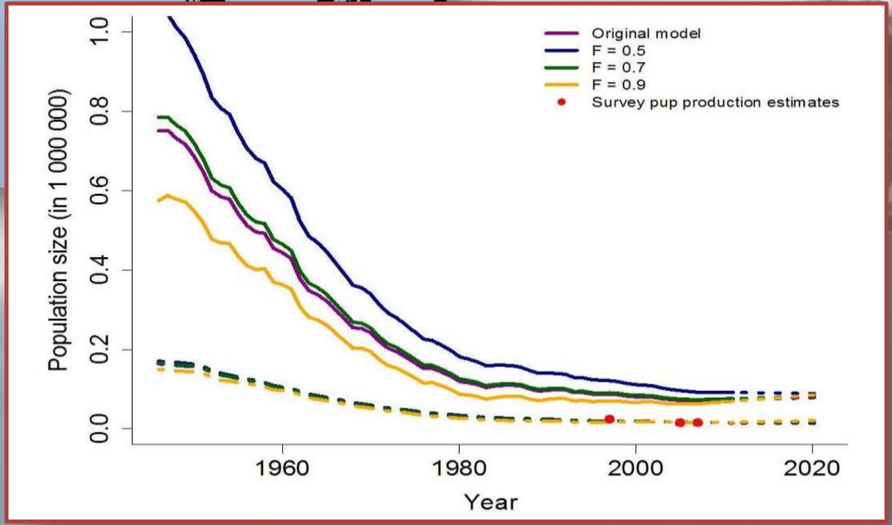
Hooded seal populations

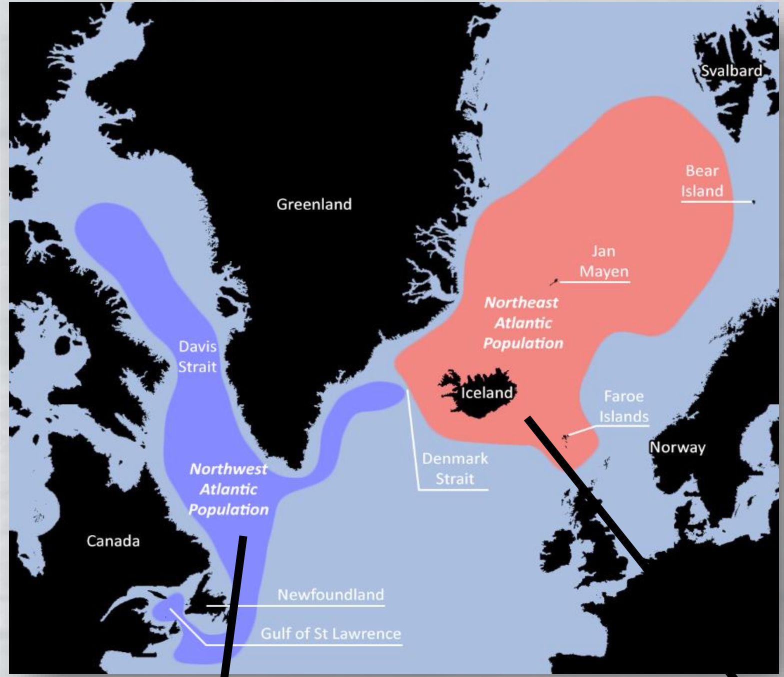
- The Northwest Atlantic population
- Increased since the 1980s
- Estimated population size in 2005; 593 500

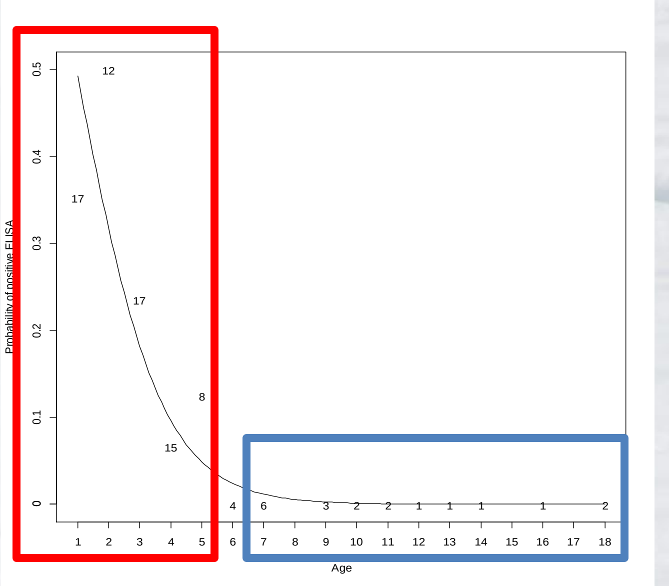


- The Northeast Atlantic population
- Estimated population size prior to 1940; 575 000
- Estimated population size in 2011; 85 000









5 %

31 – 35 %

38 %

No observed pathology…
Age-dependent serological and bacteriological pattern…
No indication of vertical transmission….

Not able to sustain the infection in the population

Are hooded seals the preferred hosts for *B. pinnipedialis* HS?

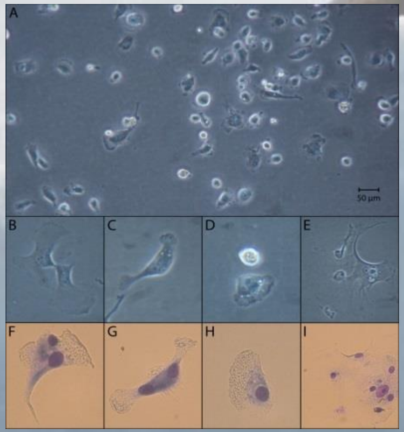
The hallmark of brucellosis is chronicity

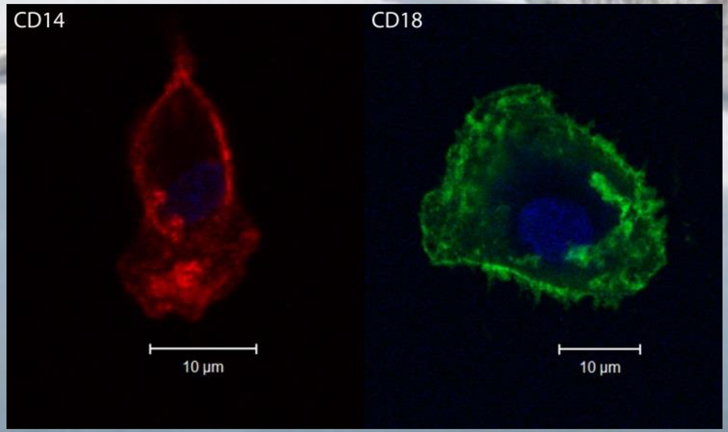
Assessed in gentamycine protection assays in macrophages

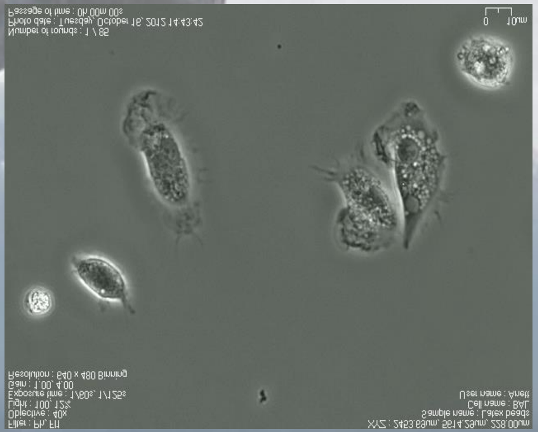
Alveolar macrophages, hooded seal

BAL performed on sacrificed hooded seals, 1 – 3 h post mortem
Alveolar macrophages identified by:

- Culture morphology
- Expression of membrane markers assessed by flow cytometry and immuncytochemistry
    - CD14
    - CD18
    - (MHC II, CD11c)
- Phagocytosis

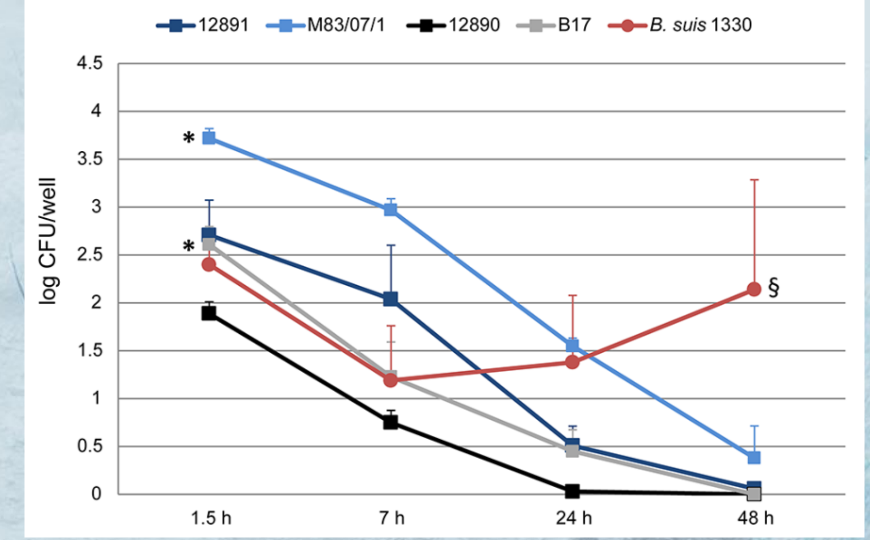






Alveolar macrophages, hooded seal

Alveolar macrophages



OPEN ACCESS Freely available online

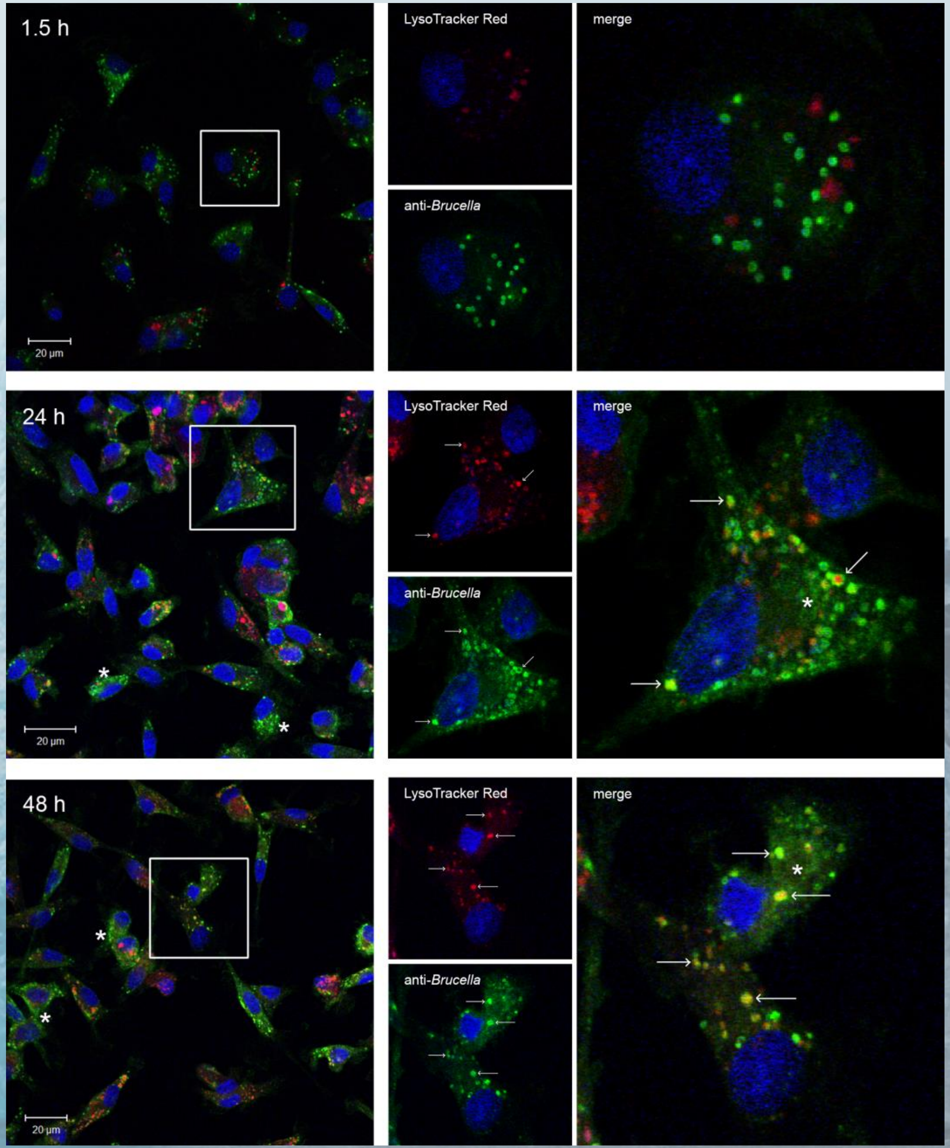
PLOS | ONE

Entry and Elimination of Marine Mammal *Brucella* spp. by Hooded Seal (*Cystophora cristata*) Alveolar Macrophages *In Vitro*

Anett K. Larsen[1,2*], Ingebjørg H. Nymo[1,2], Preben Boysen[3], Morten Tryland[1,2], Jacques Godfroid[1,2]

1 Section for Arctic Veterinary Medicine, Department of Food Safety and Infection Biology, Norwegian School of Veterinary Science, Tromsø, Norway, 2 Member of the Fram Centre, High North Research Centre for Climate and the Environment, Tromsø, Norway, 3 Section for Microbiology, Immunology, and Parasitology, Department of Food Safety and Infection Biology, Norwegian School of Veterinary Science, Oslo, Norway

https://pmc.ncbi.nlm.nih.gov/articles/PMC3869908/



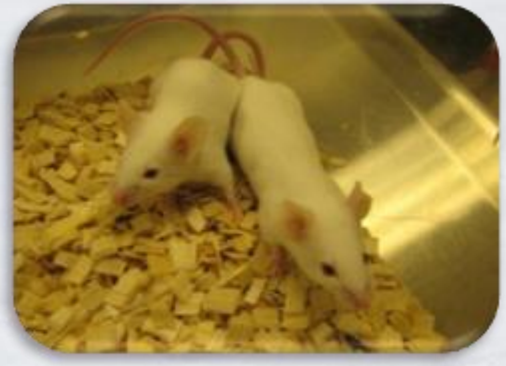
B. pinnipedialis + PCB 153 in the mouse model = Double trouble?

➡ Infection of mice with *B. pinnipedialis* while exposed to PCB 153

Infected with ~1x10^6 *Brucella* spp. intraperitoneally

PCB 153 in the food (4.08 µg/g food, ~0.49 µg/g bodyweight/day)

- Exposed to PCB 153
  - Infected with *B. pinnipedialis*
  - Infected with *B. suis*
  - Negative control
- Not exposed to PCB 153
  - Infected with *B. pinnipedialis*
  - Infected with *B. suis*
  - Negative control



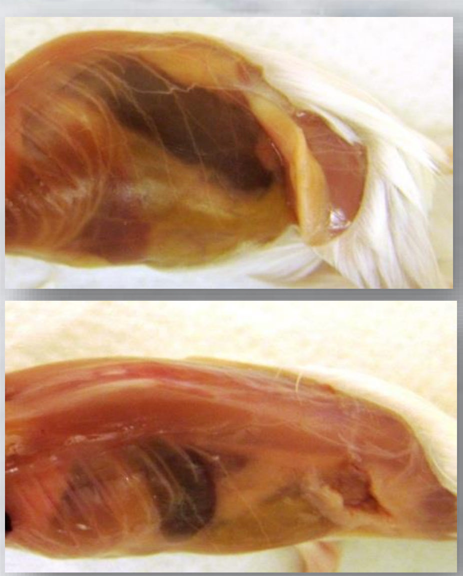
Nymo et al., CIMID 2014 https://doi.org/10.1016/j.cimid.2014.01.005

Photo: Birte Graeber, VI.

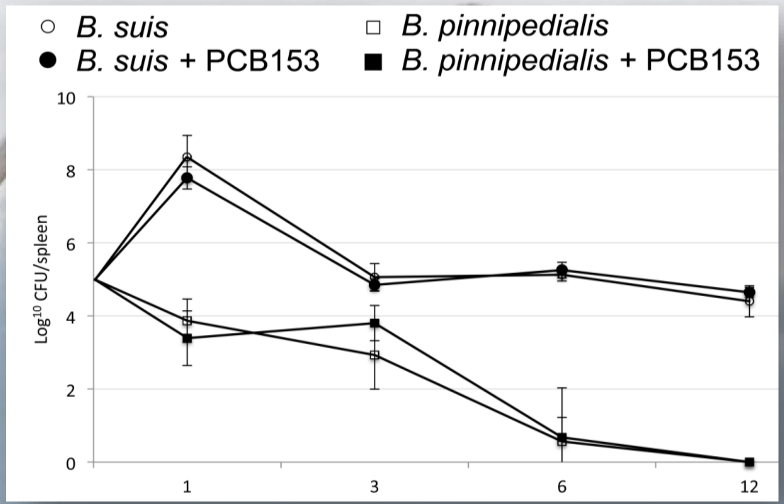
B. pinnipedialis + PCB 153 in the mouse model = Double trouble?

CFU spleen
- Typical pattern for *B. suis* 1330
- *B. pinnipedialis* showed a declining trend
- No effect of exposure to PCB 153

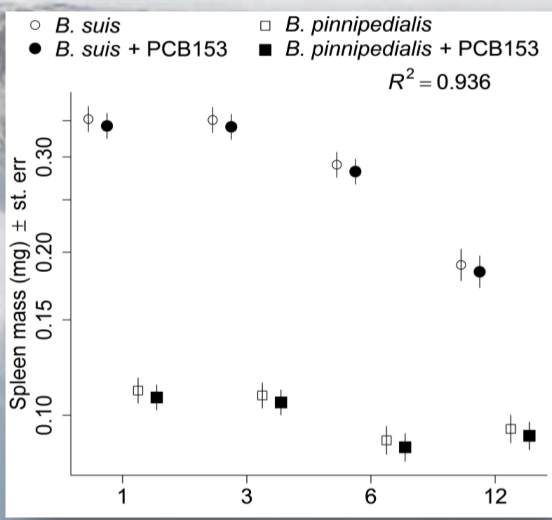
Spleen mass
- Typical pattern for *B. suis* 1330
- The mice infected with *B. pinnipedialis* had low spleen weights at all times pi
- No effect of exposure to PCB 153



Absence of significant inflammatory reaction or granulomas in the spleens of the *B. pinnipedialis* infected mice unexposed and exposed to PCB 153



Weeks pi

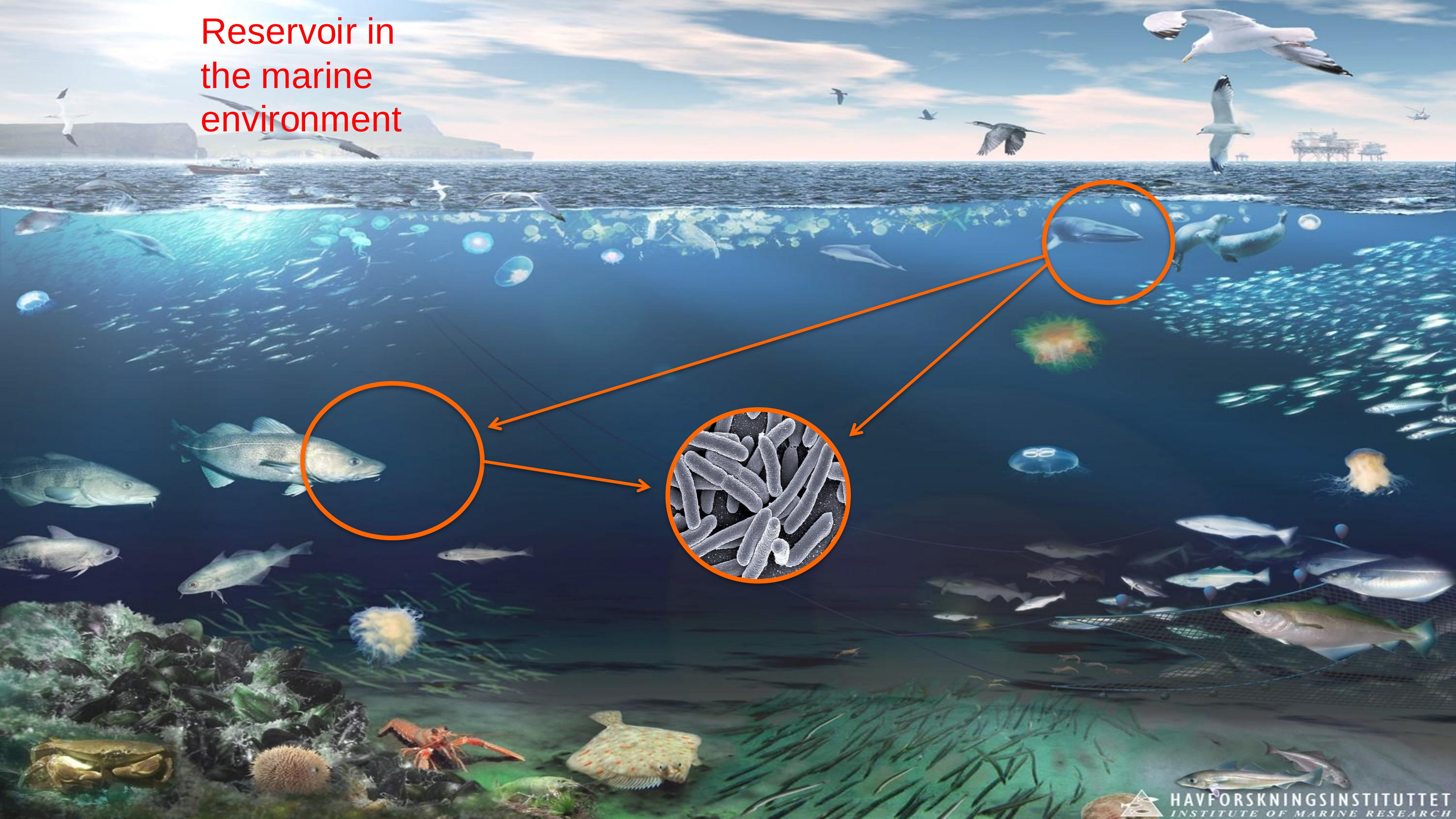


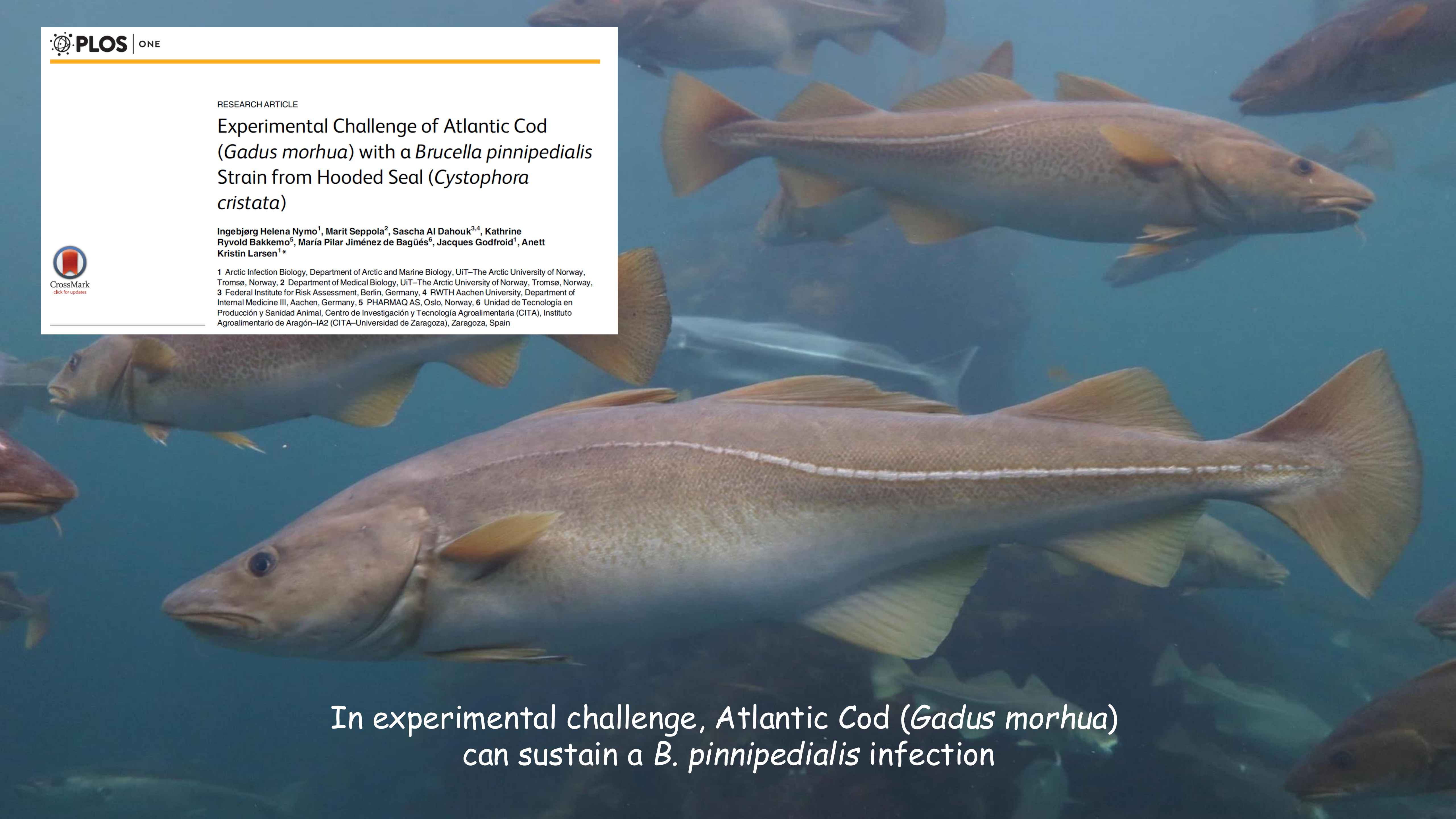
Weeks pi

Nymo et al., CIMID 2014 https://doi.org/10.1016/j.cimid.2014.01.005

Conclusions

Seals are not the preferred host for *B. pinnipedialis*, but rather a “dead-end” or spillover host being susceptible to infection derived from other sources in the marine environment


Reservoir in
the marine
environment
HAVFORSKNINGSINSTITUTTET
INSTITUTE OF MARINE RESEARCH



PLOS | ONE

RESEARCH ARTICLE

Experimental Challenge of Atlantic Cod (*Gadus morhua*) with a *Brucella pinnipedialis* Strain from Hooded Seal (*Cystophora cristata*)

Ingebjørg Helena Nymo[1], Marit Seppola[2], Sascha Al Dahouk[3,4], Kathrine Ryvold Bakkemo[5], María Pilar Jiménez de Bagüés[6], Jacques Godfroid[1], Anett Kristin Larsen[1]*

1 Arctic Infection Biology, Department of Arctic and Marine Biology, UiT–The Arctic University of Norway, Tromsø, Norway, 2 Department of Medical Biology, UiT–The Arctic University of Norway, Tromsø, Norway, 3 Federal Institute for Risk Assessment, Berlin, Germany, 4 RWTH Aachen University, Department of Internal Medicine III, Aachen, Germany, 5 PHARMAQ AS, Oslo, Norway, 6 Unidad de Tecnología en Producción y Sanidad Animal, Centro de Investigación y Tecnología Agroalimentaria (CITA), Instituto Agroalimentario de Aragón–IA2 (CITA–Universidad de Zaragoza), Zaragoza, Spain

In experimental challenge, Atlantic Cod (*Gadus morhua*) can sustain a *B. pinnipedialis* infection

In vivo infection

60 fish, 1 week,

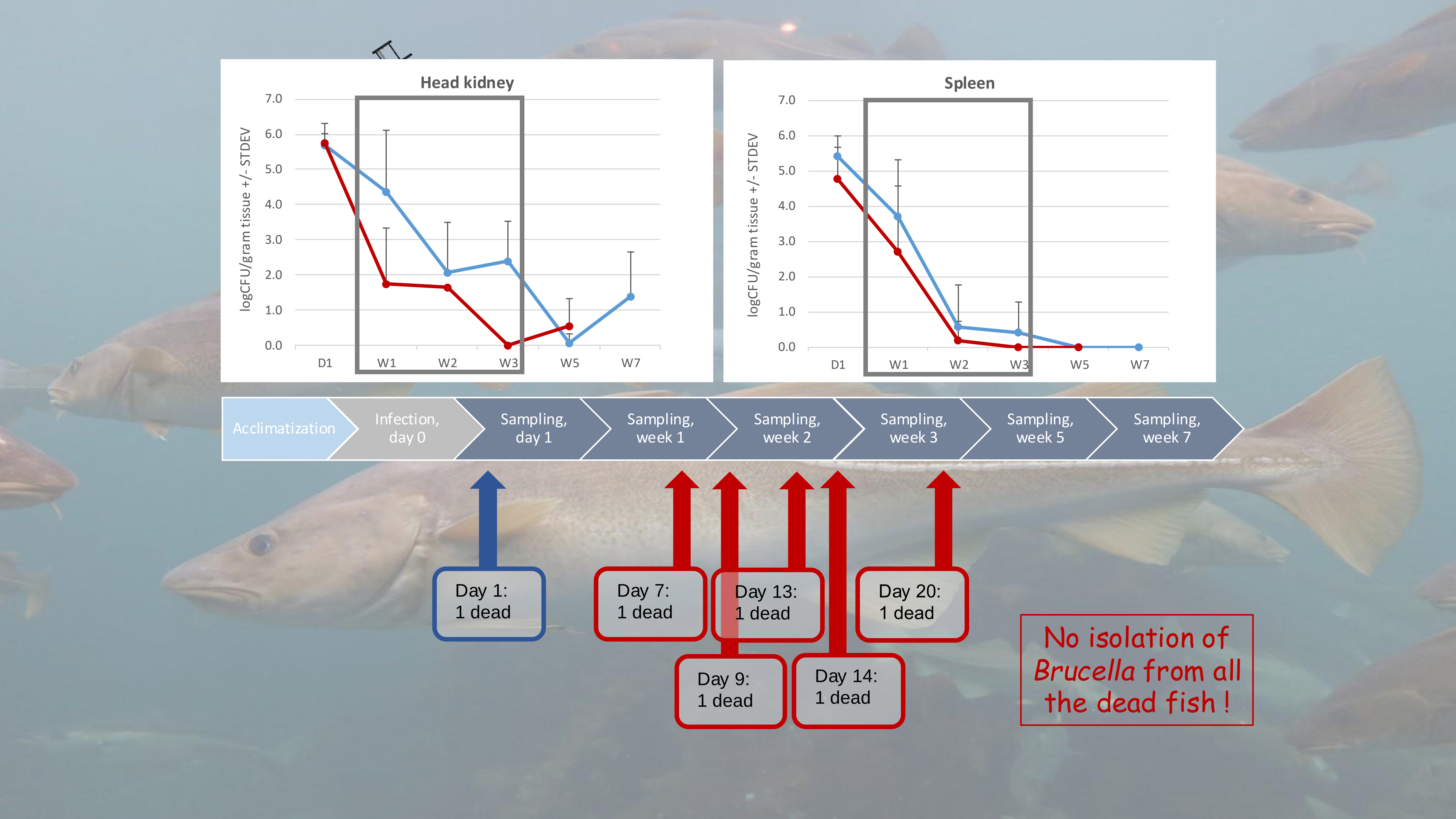
6 or 15 ° C

Feeding *ad libitum*

Acclimatization → Infection → Sampling day 1 → Sampling day 7 → Sampling day 14 → Sampling day 28

Analysis of:

- ✓ Bacterial colonization of organs
- ✓ Immunoglobulin response
- ✓ Cytokine genes expression


Head kidney
logCFU/gram tissue +/- STDEV
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
D1
W1
W2
W3
W5
W7
Spleen
logCFU/gram tissue +/- STDEV
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
D1
W1
W2
W3
W5
W7
Acclimatization
Infection, day 0
Sampling, day 1
Sampling, week 1
Sampling, week 2
Sampling, week 3
Sampling, week 5
Sampling, week 7
Day 1: 1 dead
Day 7: 1 dead
Day 13: 1 dead
Day 20: 1 dead
Day 9: 1 dead
Day 14: 1 dead
No isolation of *Brucella* from all the dead fish !

Naturally acquired human infection with *Brucella* species from marine mammals

- Had consumed raw shellfish
- Swam in the Pacific Ocean
- No contact with marine mammals
- Neurobrucellosis

- Consumed raw snapper
- Regular contact with uncooked fish bait
- No contact with marine mammals
- Spinal osteomyelitis

Human cases:
only sequence type (ST) 27

McDonald WL *et al.* (2006) Characterization of a *Brucella* sp. strain as a marine-mammal type despite isolation from a patient with spinal osteomyelitis in New Zealand. J Clin Microbiol 44: 4363-4370. Sohn AH *et al.* (2003) Human neurobrucellosis with intracerebral granuloma caused by a marine mammal *Brucella* spp. Emerg Infect Dis 9: 485-488.

RESEARCH ARTICLE

Characterisation of North American *Brucella* isolates from marine mammals

Adrian M. Whatmore[1]*, Claire Dawson[1], Jakub Muchowski[1], Lorraine L. Perrett[1], Emma Stubberfield[1], Mark Koylass[1], Geoffrey Foster[2], Nicholas J. Davison[2], Christine Quance[3], Inga F. Sidor[4¤a], Cara L. Field[4¤b], Judy St. Leger[5]

1 FAO/WHO Collaborating Centre for Brucellosis, OIE Brucellosis Reference Laboratory, Animal and Plant Health Agency, Addlestone, Surrey, United Kingdom, 2 Scottish Marine Animal Stranding Scheme, SRUC Veterinary Services, Drummondhill, Inverness, United Kingdom, 3 *Mycobacteria* and *Brucella* Section, National Veterinary Services Laboratories, USDA-APHIS, Ames, Iowa, United States of America, 4 Mystic Aquarium & Institute for Exploration, Mystic, CT, United States of America, 5 SeaWorld Parks and Entertainment, San Diego, CA, United States of America

The known host range of ST27 was extended with the identification of this ST from California sea lion samples.

DOI: 10.7589/JWD-D-23-00171

Journal of Wildlife Diseases, 60(4), 2024, pp. 860–873
© Wildlife Disease Association 2024

Surveillance for *Toxoplasma gondii*, *Brucella* spp., and *Chlamydia* spp. in Australian Fur Seal (*Arctocephalus pusillus doriferus*) Abortions

Brett R. Gardner,[1,7,8] Andrew Stent,[1] Rhys Bushell,[1] John P.Y. Arnould,[2] Rebecca McIntosh,[3] K.L.D. Tharaka D. Liyanage,[1] Aymeric Fromant,[4] Jonathan Botha,[5] Yonina H. Eizenberg,[2,4] O. Martins Olaogun,[6] Marc Marenda,[1] Michael Lynch,[7] and Jasmin Hufschmid[1]

[1] Melbourne Veterinary School, One Health Research Group, The University of Melbourne, Werribee Victoria 3030, Australia
[2] School of Life and Environmental Sciences, Deakin University, Burwood, Victoria 3125, Australia
[3] Conservation Department, Philip Island Nature Parks, Cowes, Victoria 3922, Australia
[4] Centre d'Etudes Biologiques de Chizé (CEBC), UMR 7372 CNRS-La Rochelle Université, 79360 Villiers-en-Bois, France
[5] Biosis Pty Ltd, 38 Bertie Street, Port Melbourne, Melbourne, Victoria 3207, Australia
[6] AsureQuality Diagnostics, 28 Mareno Road, Tullamarine, Victoria 3043, Australia
[7] Zoos Victoria, Parkville, Victoria 3052, Australia
[8] Corresponding author (email: gardner.b@unimelb.edu.au)

Documented uman brucellosis cases in the Arctic

ALASKA NATIVE TRIBAL HEALTH CONSORTIUM

Brucellosis: Answers to Frequently Asked Questions
Center for Climate and Health

Michael Brubaker MS, James Berner MD, Jay Butler MD, Michael Bradley DVM
CCH Bulletin No. 6, November 30, 2010

This bulletin describes brucellosis, an infectious disease caused by bacteria found in some land and sea mammals, including species that are important food resources. As climate change is providing new opportunities for the spread of infectious disease, ANTHC developed this bulletin to provide prevention guidelines and answer some commonly asked questions. The risk of infection from brucellosis is thought to be low, but it can be a serious illness. This information can help Alaska Natives reduce risk while continuing to enjoy a healthy, subsistence diet.

https://www.anthc.org/wp-content/uploads/2016/01/CCH-Bulletin-No-6-Brucellosis.pdf

Isolates of *Brucella suis* biovar 4 from animals and humans in Canada, 1982–1990

Lorry B. Forbes

Table 1. Summary of tissues from which *B. suis* biovar 4 was isolated[a]

Tissue	Gross lesion: Suppurative[b]	Gross lesion: Nonsuppurative	Gross lesion: Not described	Total	Species
Carpal joint	9	12	9	30	29 caribou, 1 muskox
Lymph nodes	2	28		30	7 caribou, 23 reindeer
Testicle	15	1	5	21	18 caribou, 2 reindeer, 1 muskox
Joints other than carpus	7	2	6	15	14 caribou, 1 human
Blood		10		10	All human
Subcutaneous abscess	9			9	All caribou
Mammary gland	4	3		7	6 reindeer, 1 caribou
Epididymis	4		1	5	All caribou
Abscessed muscle	3			3	All caribou
Liver	1		2	3	All caribou
Kidney	1			1	Caribou
Uterus			1	1	Caribou
Placenta		1		1	Caribou
Abscess of rumen wall	1			1	Caribou

[a]One hundred culture-positive cases of caribou, reindeer, muskox, and human origin. Some cases had more than one positive tissue
[b]Classed as suppurative if any of the following terms were used in describing the lesion: abscess, pus, purulent, suppurative

https://pmc.ncbi.nlm.nih.gov/articles/PMC1481085/pdf/canvetj00072-0048.pdf

Extended ecological niche ?

Only serological evidence – No *Brucella* spp. Isolation !

Tryland M., Derocher A. E., Wijg O., Godfroid J., 2001. *Brucella* antibodies in polar bears (*Ursus maritimus*) from Svalbard and the Barents sea. Journal of Wildlife Disease, 37: 523-531.

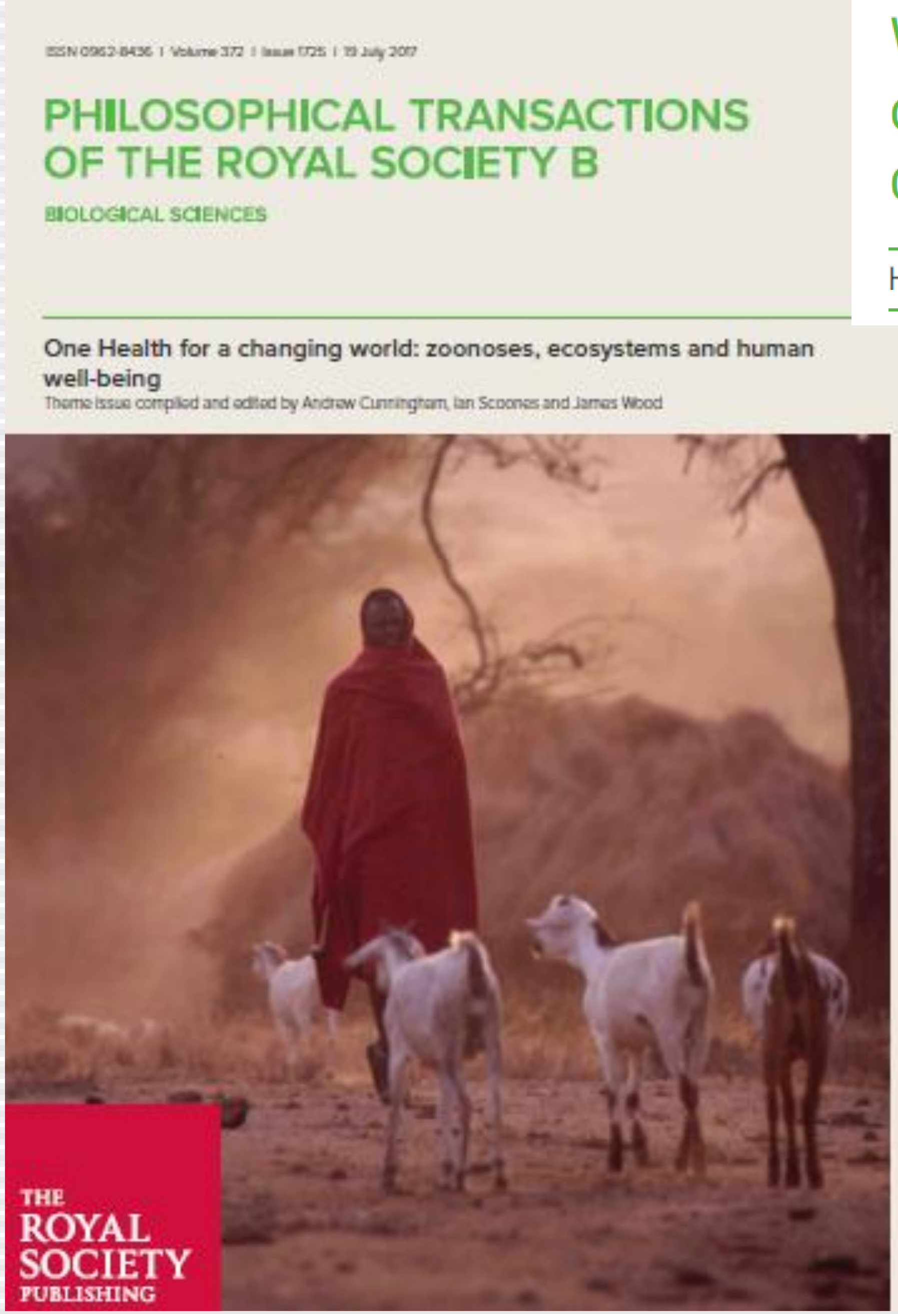
One Health Discourses / Narratives

- The first *discourse* offers a broad argument for a holistic, integrated approach: ecology, animals, people and diseases

- A second *discourse* focuses on the risks of emergence and spread of diseases

- The third *discourse* focuses on the potential economic benefits of implementing One Health approaches

- There is a marginalisation of alternative narratives rooted more in local ecological and disease contexts, and voiced by people living with, and responding to diseases



Views from many worlds: unsettling categories in interdisciplinary research on endemic zoonotic diseases

Hayley MacGregor and Linda Waldman

Thinking differently with and about animals and about species' boundaries could enable ways of addressing zoonotic diseases which have closer integration with people's own cultural norms

If we can bring this kind of knowledge into One Health debates, we find ourselves with a multiplicity of worldviews, where bounded categories such as human:animal and nature:culture cannot be assumed

Published in final edited form as:
Science. 2015 September 4; 349(6252): 1259504. doi:10.1126/science.1259504.

Why infectious disease research needs community ecology

Pieter T. J. Johnson[1,*], **Jacobus C. de Roode**[2], and **Andy Fenton**[3]
[1]Ecology and Evolutionary Biology University of Colorado Boulder CO 80309 USA
[2]Department of Biology Emory University Atlanta GA 30322 USA
[3]Institute of Integrative Biology University of Liverpool Liverpool L69 7ZB UK

Abstract

Infectious diseases often emerge from interactions among multiple species and across nested levels of biological organization. Threats as diverse as Ebola virus, human malaria, and bat white-nose syndrome illustrate the need for a mechanistic understanding of the ecological interactions underlying emerging infections. We describe how recent advances in community ecology can be adopted to address contemporary challenges in disease research. These analytical tools can identify the factors governing complex assemblages of multiple hosts, parasites, and vectors, and reveal how processes link across scales from individual hosts to regions. They can also determine the drivers of heterogeneities among individuals, species, and regions to aid targeting of control strategies. We provide examples where these principles have enhanced disease management and illustrate how they can be further extended.

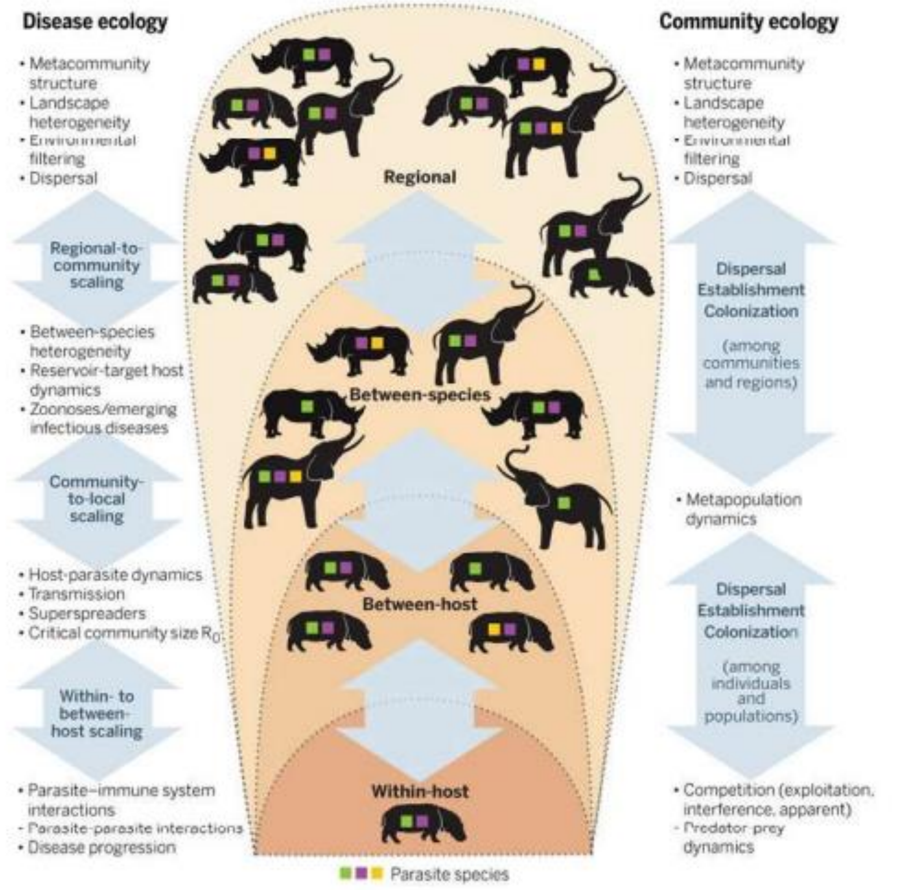


Fig. 2. Ecological hierarchies applied to host-parasite interactions and analogous processes in community ecology

The range of scales includes within-host ("parasite infracommunity," often dominated by parasite-parasite and parasite-immune system interactions); between-host ("parasite component community," population biology); among species ("parasite supracommunity," community ecology); and across regions (macroecology and disease biogeography). The different colored squares represent different parasite species; the text at the right and left highlights the relevant processes from community ecology and disease ecology, respectively. The potential importance for interactions and feedback across these scales represents an essential research frontier in the field of disease community ecology.

One of my brucellosis narrative…

Brucella suis biovar 4

Thank you