

Why monitor *Rangifer* Health?



What is Health?

- **World Health Organization definition of Health (1948)**

Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity

The English word "**health**" comes from the Old English word *hale*, meaning "wholeness, a being whole, sound or well".

Determinants of Health

Three interdependent fields as key determinants of an individual's health. These are:

- Lifestyle: the aggregation of personal decisions (i.e., over which the individual has control) that can be said to contribute to, or cause, illness or death;
- Environmental: all matters related to health external to the (human) body and over which the individual has little or not control
- Biomedical: all aspects of health, physical and mental, developed within the (human) body as influenced by genetic make-up.

What is *Rangifer* health?



Iceland, 2011

Measuring Health: Individual vs. Population

- Population health measures = census, recruitment, survival, mortality



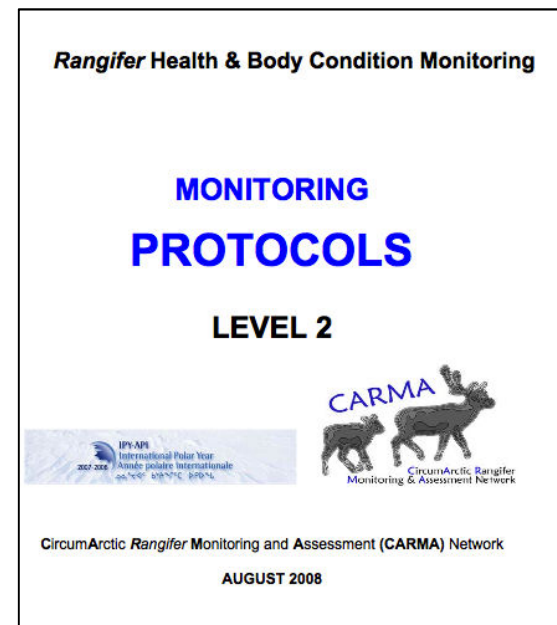
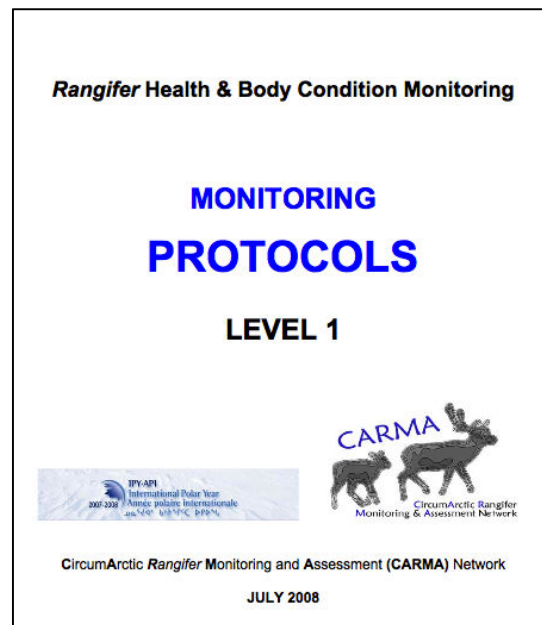
Dovrefjell, Norway

Population health is the sum of the individuals



Individual Health Measures

- CARMA IPY Research
 - Manuals and protocols on Monitoring
 - Standardized, differing levels of intensity



Details: CARMA website www.carmanetwork.com; Kutz et al., *Rangifer*, In press

Individual Health Measures

- Animal information
 - Age, sex
 - Body condition (fat and protein)
 - Body size
 - Pregnancy, calf at heel, lactation
- Infectious disease
 - Viruses (exposure)
 - Bacteria
 - Parasites
- Contaminants
- Stress?
- Genetic health – immune capacity?

Why collect/how do we use this information?

Glucocorticosteroid concentrations in feces and hair of captive caribou and reindeer following adrenocorticotrophic hormone challenge.

Ashley NT, Barboza PS, Macbeth BJ, Janz DM, Cattet MR, Booth RK, Wasser SK.

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Original Article

Linear enamel hypoplasia in caribou (*Rangifer tarandus groenlandicus*): A potential tool to assess population health[†]

Jessica P. Wu^{1,*}, Alasdair Veitch², Sylvia Checkley¹, Howard Dobson³, Susan J. Kutz¹

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Issue



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ORIGINAL PAPER

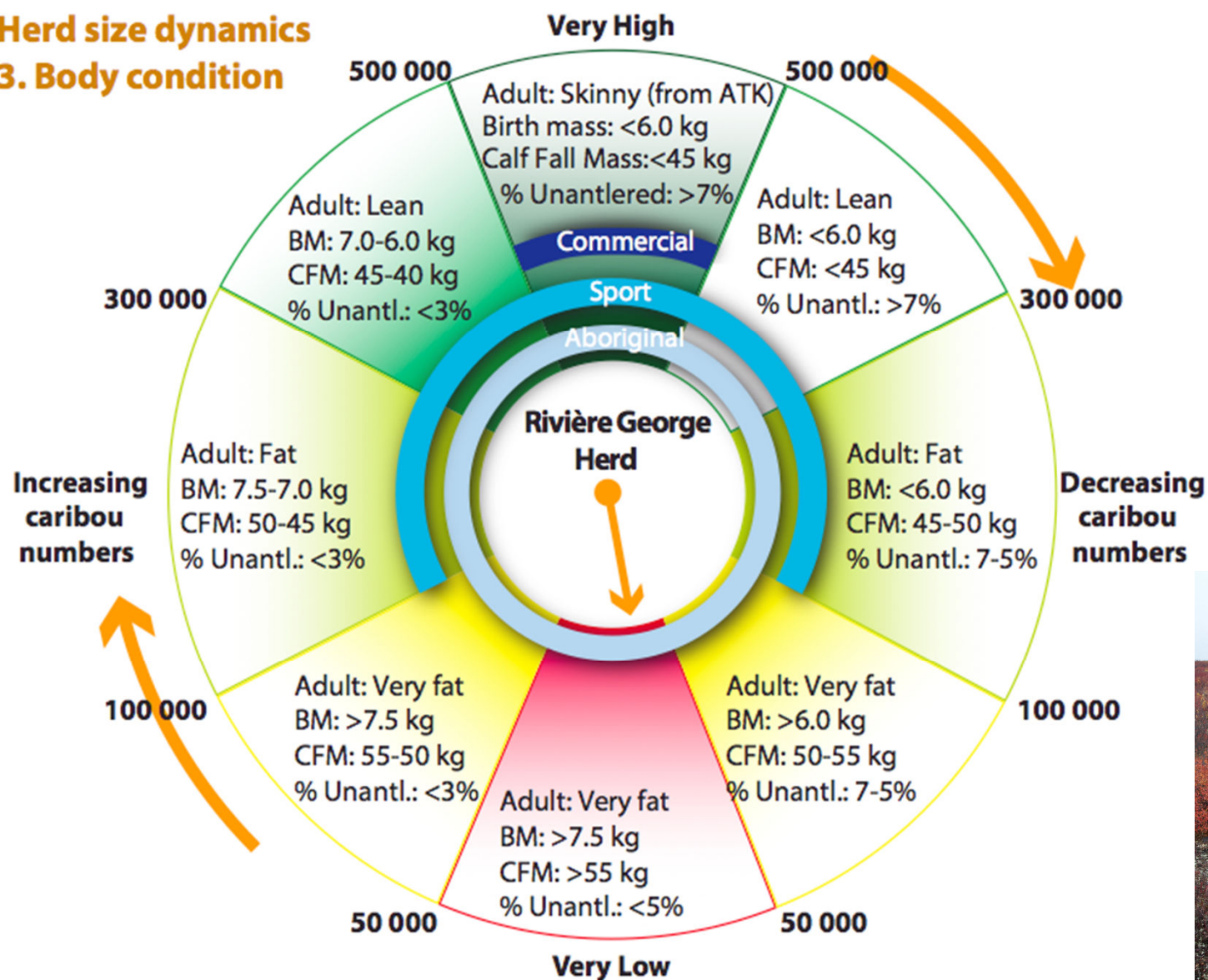
Low MHC *DRB* class II diversity in the mountain goat: past bottlenecks and possible role of pathogens and parasites

Julien Mainguy · Kirsty Worley · Steeve D. Côté ·
David W. Coltman

A new Management Framework: The caribou wheel

Herd size dynamics

3. Body condition





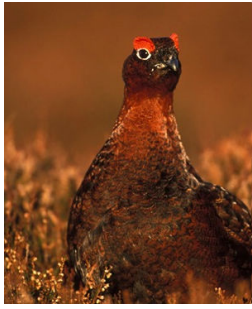
Why Monitor Infectious Disease?



Victoria Island, Canada

1. A role in population health

*“the role of disease in wildlife conservation
has probably been radically underestimated”
(Aldo Leopold, 1933)*



*Journal of Animal
Ecology* 1992,
61, 477–486

Regulation and stability of a free-living host–parasite system: *Trichostrongylus tenuis* in red grouse.

I. Monitoring and parasite reduction experiments

PETER J. HUDSON, DAVID NEWBORN and ANDREW
P. DOBSON*

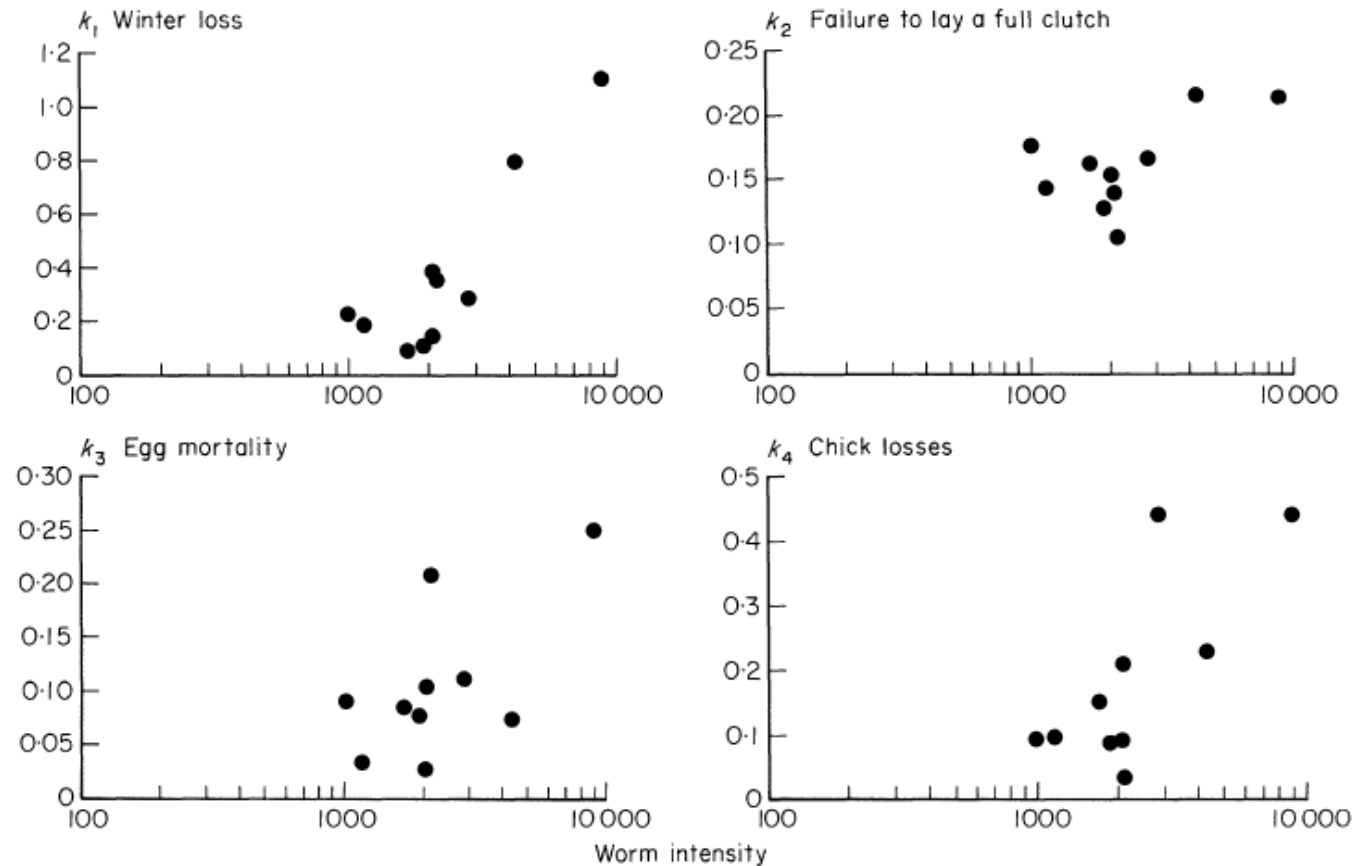


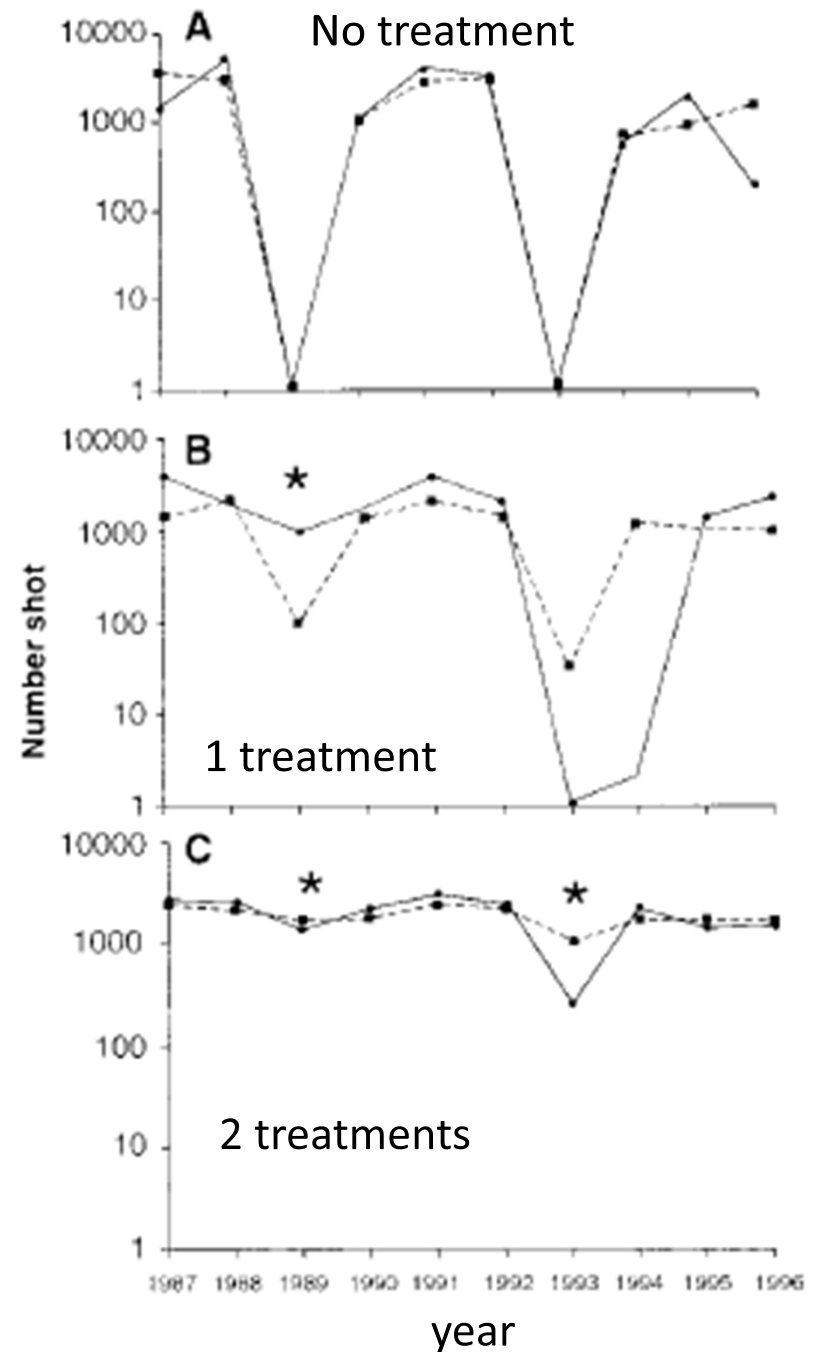
Fig. 5. The relationship between losses from the Gunnerside population and intensity of worm infection in breeding adult grouse. Winter loss, egg mortality and chick losses all show a positive correlation ($P < 0.05$) while failure to lay a full clutch shows a weak positive association ($0.1 > P > 0.05$).

Prevention of Population Cycles by Parasite Removal

Peter J. Hudson,* Andy P. Dobson, Dave Newborn

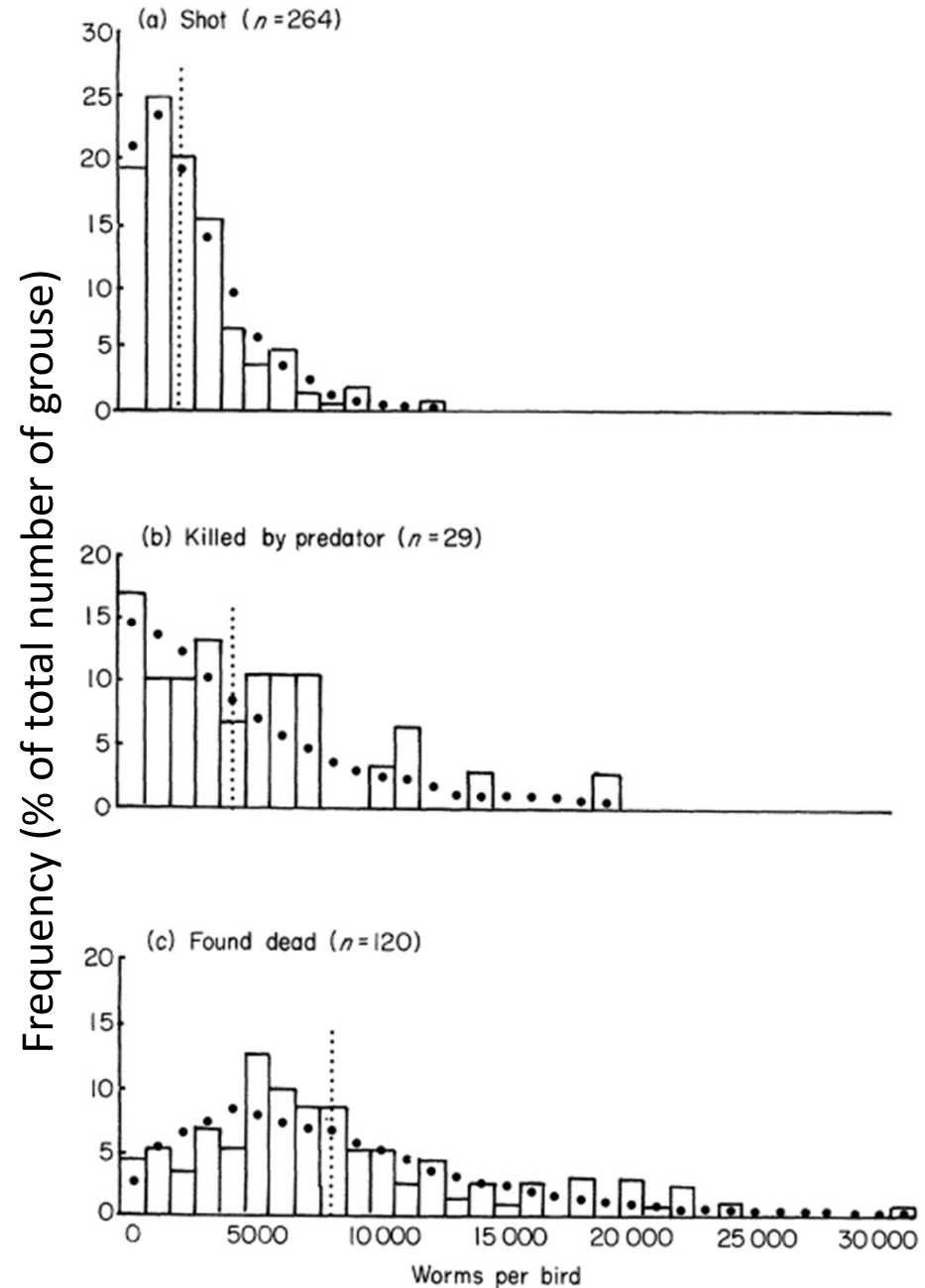
18 DECEMBER 1998 VOL 282 SCIENCE www.sciencemag.org

Each graph = two independent populations of grouse

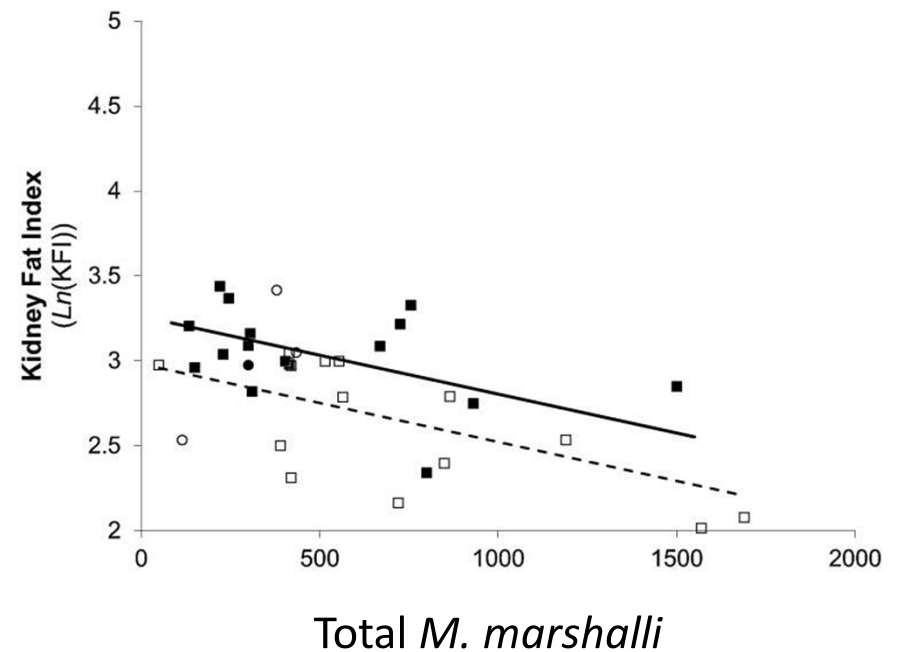
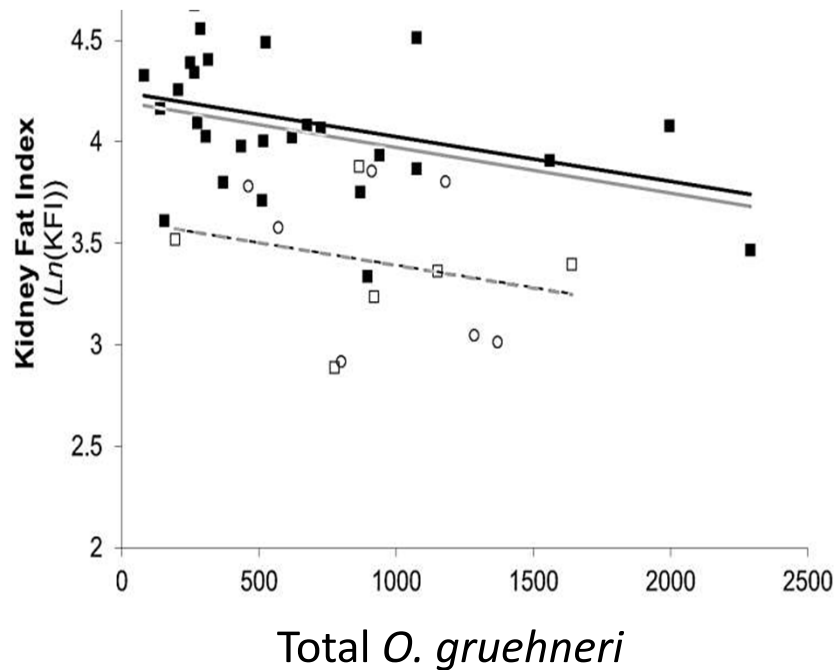


Parasite Intensity and Cause of Mortality

- Found dead and killed by predator have higher infection intensities



Greenland Caribou – Abomasal Parasites associated with poorer body condition (*J. Steele et al.*)



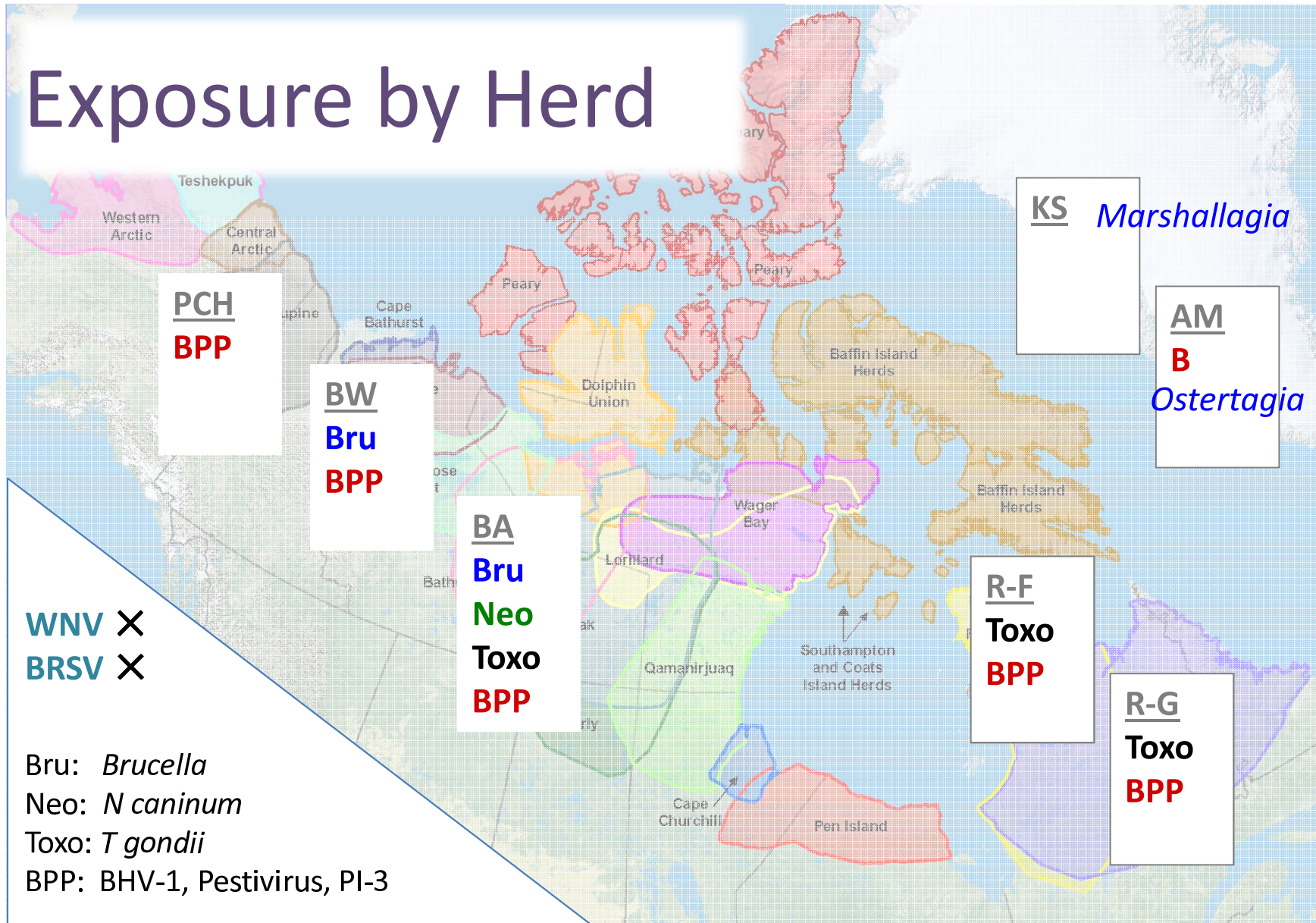
2. Infectious Disease and Food Safety



Greenland

3. Biodiversity and Invasive Species

Exposure by Herd

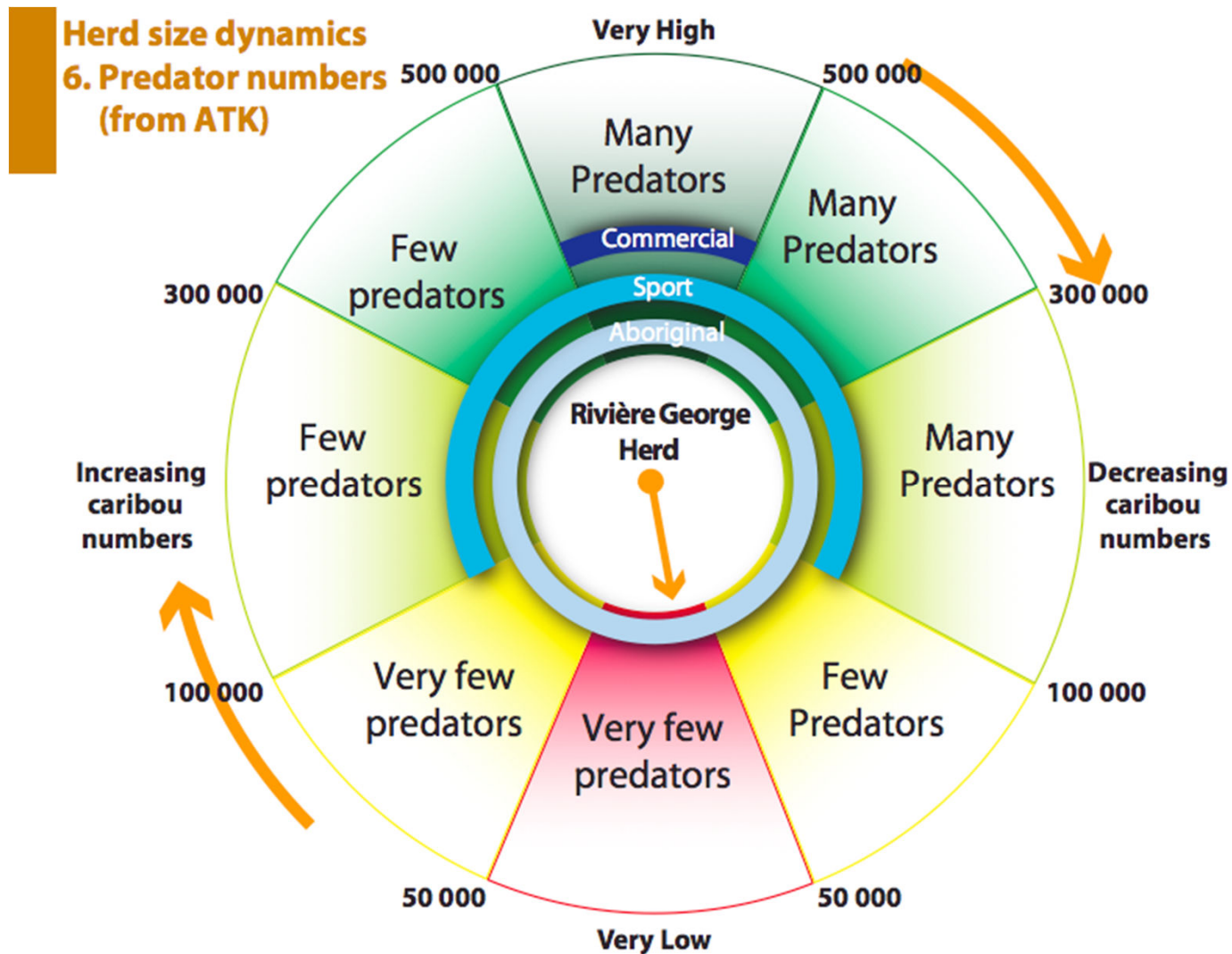


From Pat Curry, 2012



4. Can pathogens tell us something about population trajectories?

Pathogens = Predators?



Like Caribou, not all pathogens are created equally.... Which makes them so much more interesting!

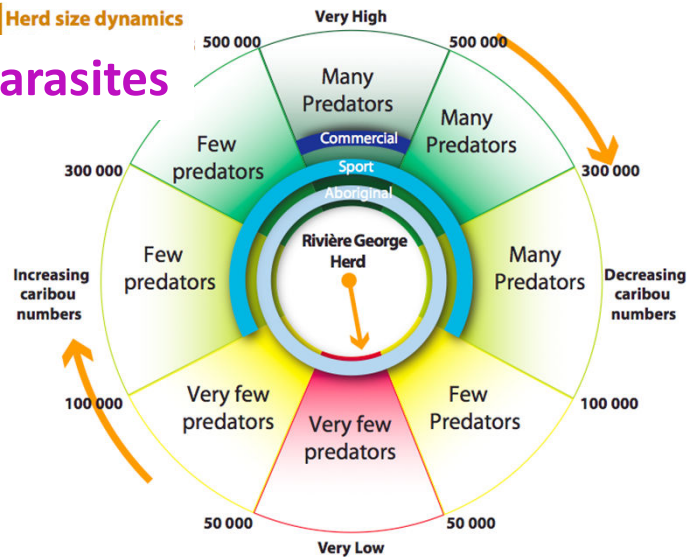


- *Ostertagia gruehneri*
- *Taenia hydatigena*
- *Hypoderma tarandi*
- *Toxoplasma gondii*

The caribou wheel and *Ostertagia gruehneri*

Herd size dynamics

Parasites



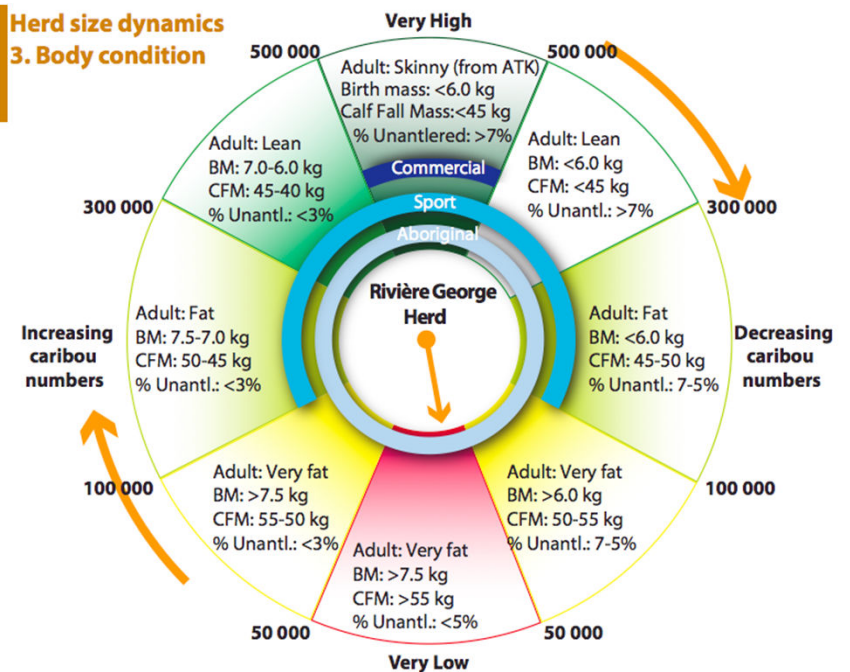
R. Feuilles 97%

R. George 60%

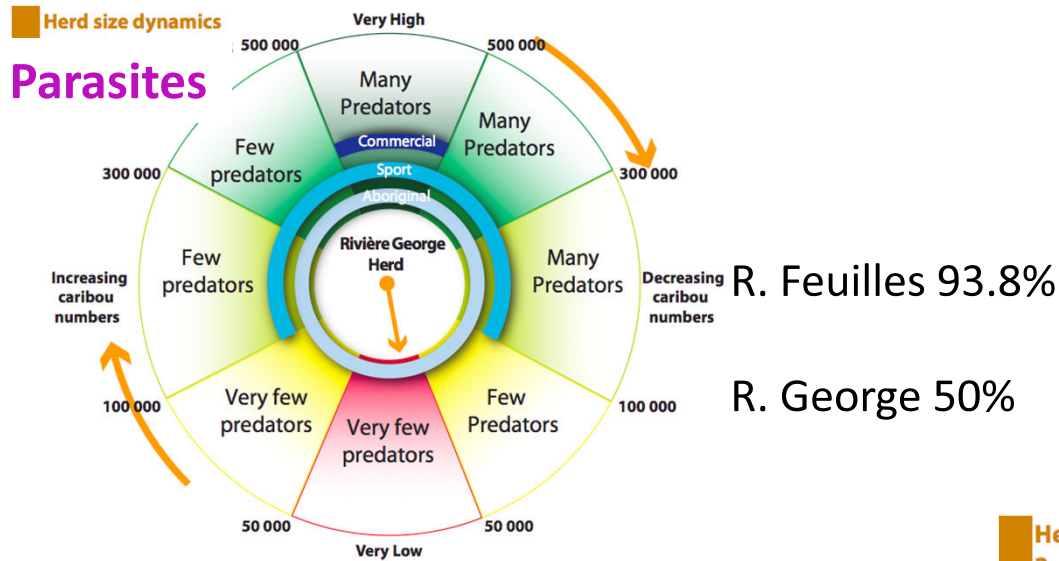


- Direct lifecycle, density dependent
 - Expect direct correlation, maybe 2 year time lag
 - Direct effect on body condition

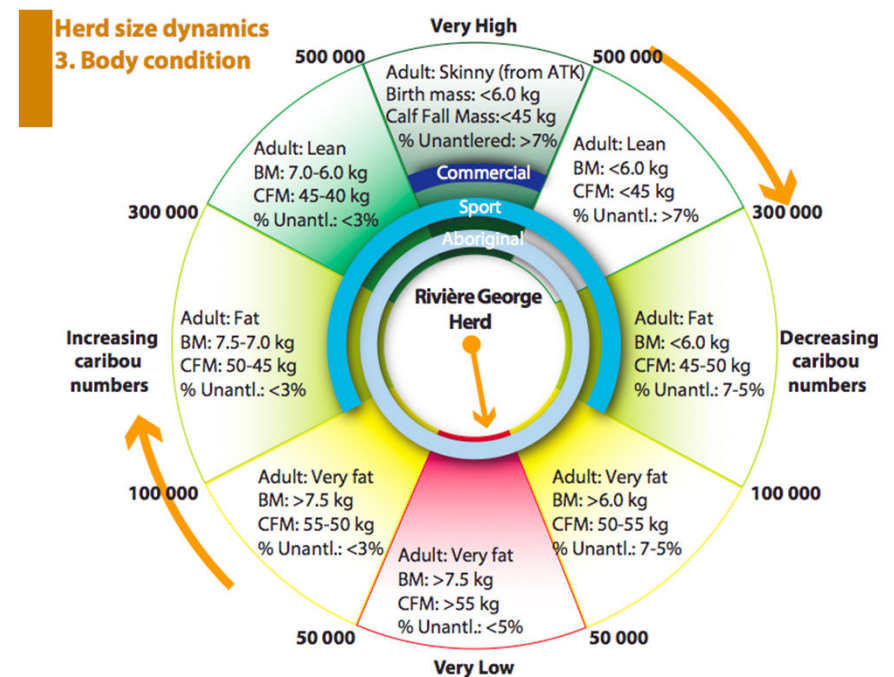
Herd size dynamics
3. Body condition



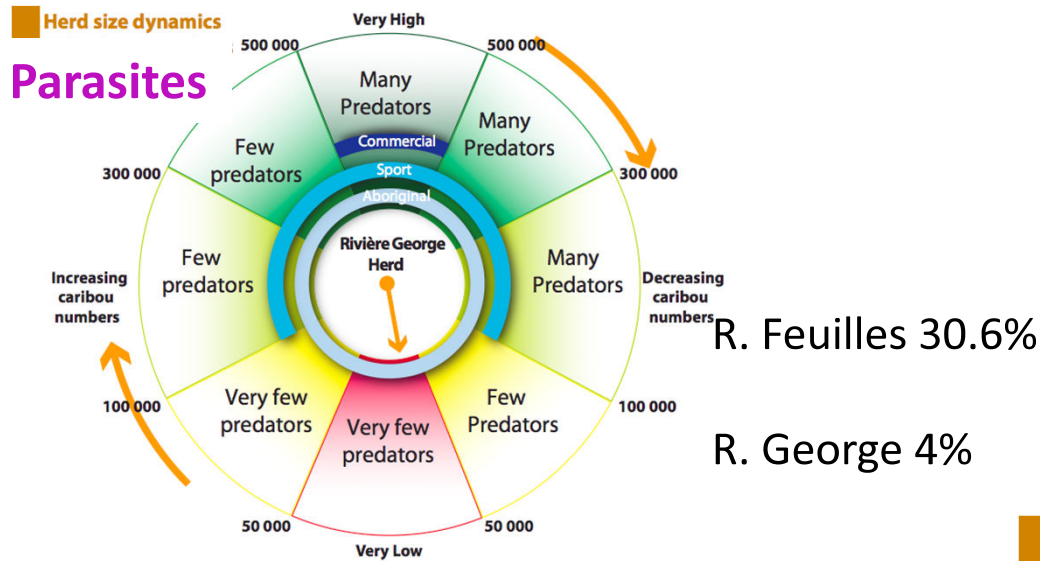
Warbles and Nose Bots



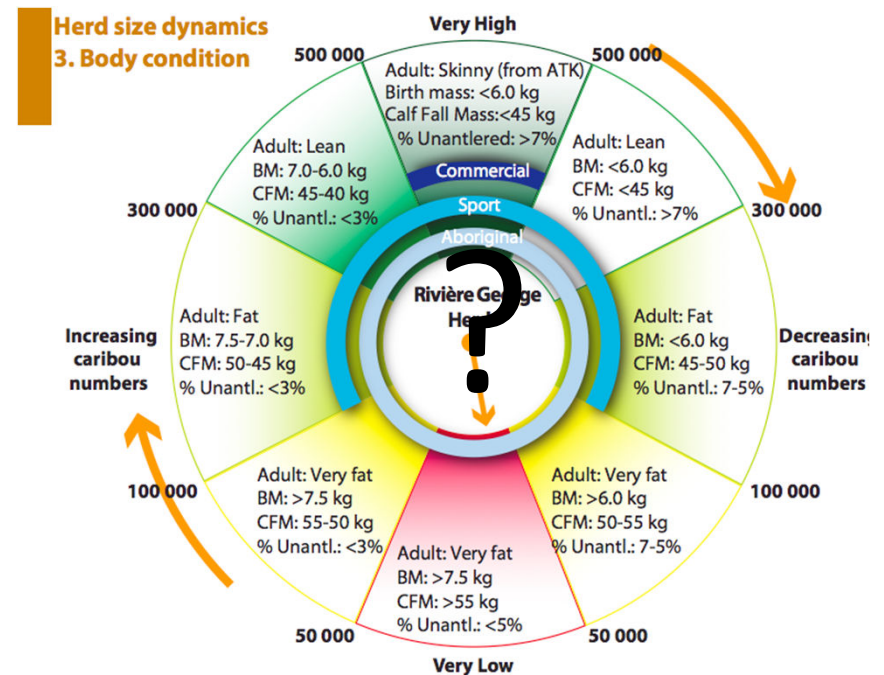
- Direct lifecycle
- Transmission - frequency dependent
 - Expect extended parasite abundance even as population density decreases – worse with small group sizes



Taenia sp. (liver and muscle cysts)



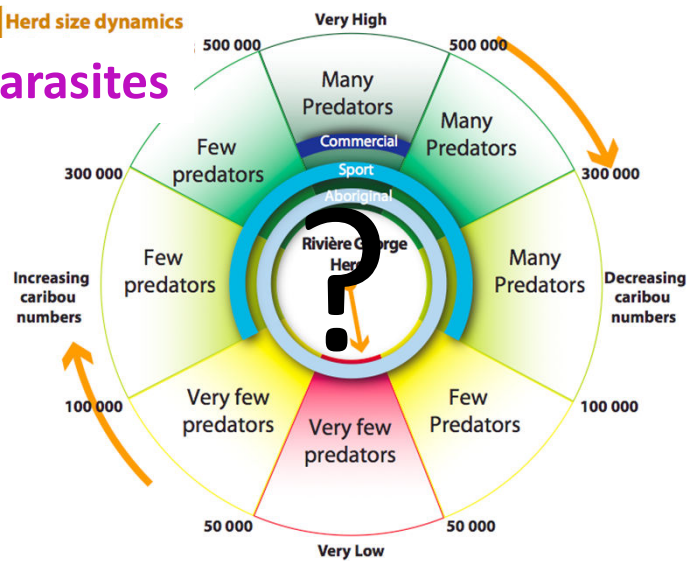
- Predator-Prey lifecycle
- Reflect functional ecosystem interactions (not just predator numbers)



Toxoplasma and *Neospora*: Protozoan tissue parasites

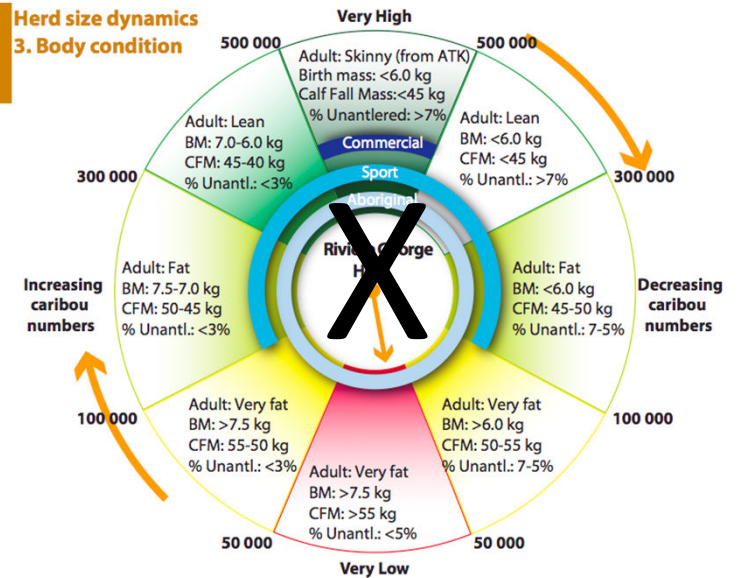
Herd size dynamics

Parasites

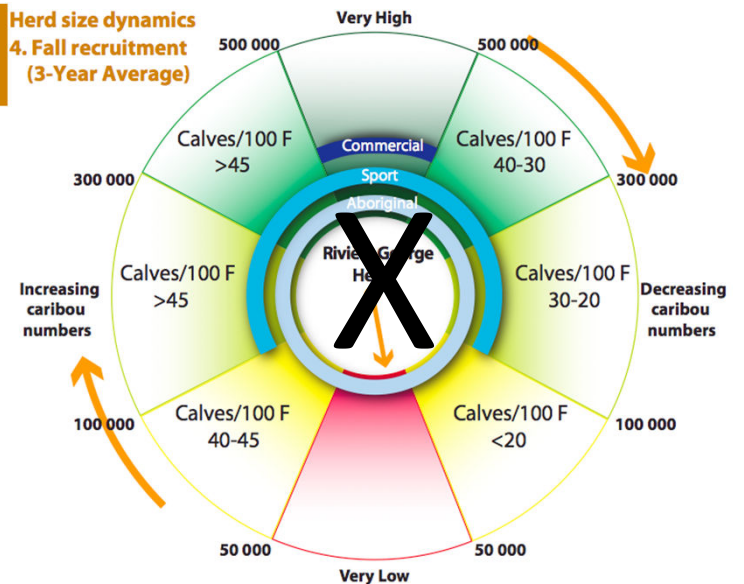


- Predator-prey, and vertical transmission
- Direct effect on fecundity – abortion, stillbirth, weak calves
- BNW – 37% in 1990s, 0% in 2008-9

Herd size dynamics 3. Body condition



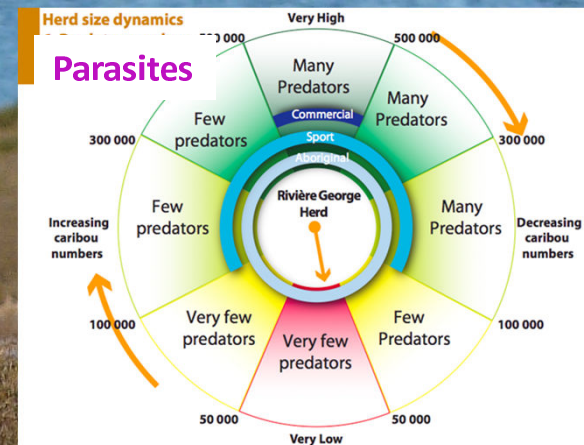
Herd size dynamics 4. Fall recruitment (3-Year Average)



Why Monitor *Rangifer* Health?

Sustainability, and Public and Ecosystem Health

- Body condition, Stress, Genetic health
- Pathogens
 - Population effects
 - Food Safety
 - Biodiversity and Ecosystem Health
- Population management



Integrating Health Into Herd Monitoring

- What is *Rangifer* Health for you?
- What information do you need?
- How will/could you use that information?
- How is collection of that information best implemented?

