The 5Rs and Best Practice in Wild Terrestrial Mammal Research





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Wild Terrestrial Mammal Research: What is a 'Wild' Animal?

- Two types of animals:
  - Domestic(ated)
  - Wild
- Two types of wild animals:
  - Free-ranging
  - Captive
- 'Hybrids':
  - Semi-domestic(ated) reindeer…



Outline

- The 5Rs
  - *Wild animals are different from domestic/laboratory animals*
- Best Practice Guidelines, Standard Operating Procedures
  - *Know what you are doing*
- Research on Research
  - *What happens days/weeks/years down the road?*

The 5Rs of Wildlife Experiments

- Replace
- Reduce
- Refine
- The 4th R: Reality (Life in the woods is different)
- The 5th R: Rejection (Don’t do it)



The Reasons for 2 Extra Rs

- Experiments on free-ranging wildlife are challenging (a *no-brainer*)
- Regulations and principles often difficult to apply in the field
- Difficult to get a decent sample size of animals
- Study animals get shot (legally), poached, disperse or ‘disappear’
- You never has a real ‘*control group*’ (which is the animals you don’t capture), i.e. you cannot evaluate effects of capture and tagging…
- A very high rate of problems with GPS (coverage, battery life, technical failures, software errors)
- ‘End-point’ challenge (*what to do when you’re done*):
  - Recapture to remove tags? Drop-off collars? Euthanasia/hunting?
  - Do you have funding for it?

‘Standard Operating Procedures’
‘Best Practice Guidelines’

Biomedical protocol

Brown bears (*Ursus arctos*)



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BEST-PRACTICE GUIDELINES FOR FIELD-BASED SURGERY AND ANESTHESIA OF FREE-RANGING WILDLIFE. I. ANESTHESIA AND ANALGESIA

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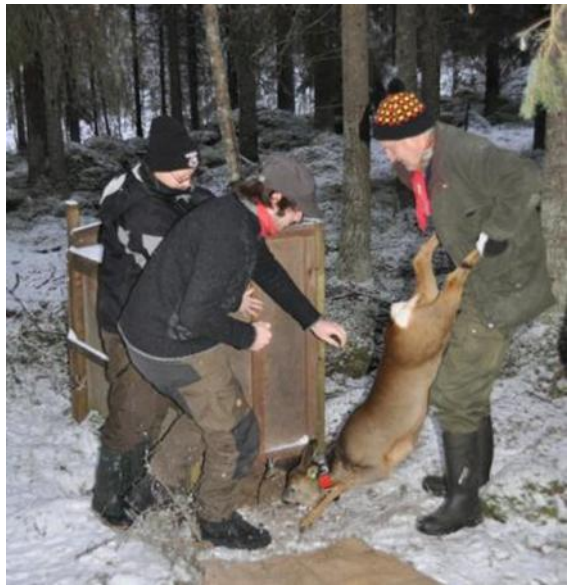
BEST-PRACTICE GUIDELINES FOR FIELD-BASED SURGERY AND ANESTHESIA ON FREE-RANGING WILDLIFE. II. SURGERY

Christine V. Fiorello,[1,5] Craig A. Harms,[2] Sathya K. Chinnadurai,[3] and Danielle Strahl-Heldreth[4]

Invasive experiments: Wild animals have to be captured

- Physical capture followed by manual restraint
  - E.g. snares, foot-hold traps, box traps, net-gunning, drive/drop nets, water/boat
- Physical capture followed by sedation/anesthesia
  - E.g. injection of drugs (hand, pole, dart) in a physical captured/restrained animal
- Chemical capture
  - E.g. ground or aerial darting, gas (in a box), (bait with drugs)

All kinds of captures - from ‘simple’…









… to ‘advanced’









‘Simple’ ID-tagging









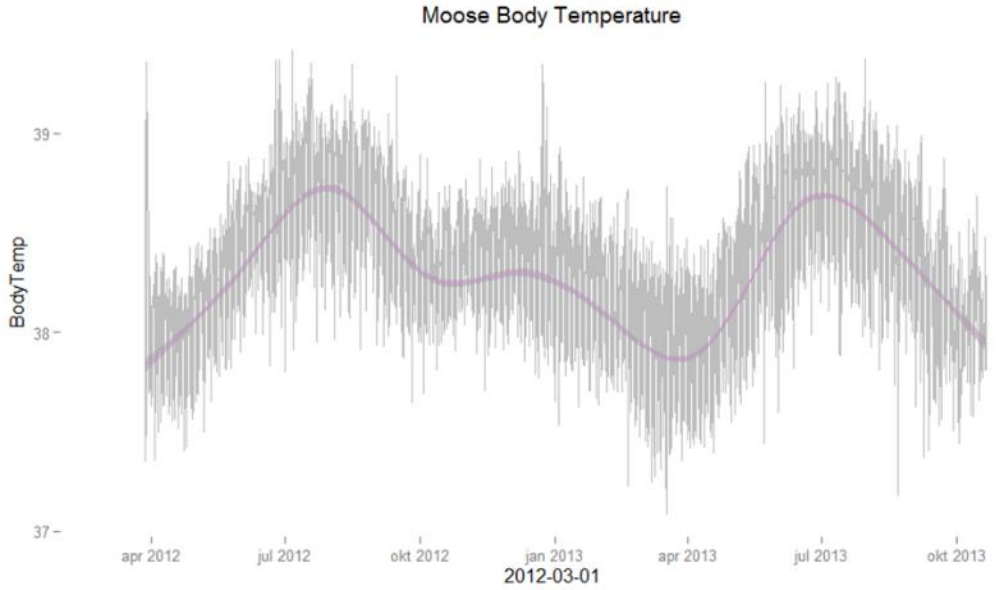
All kinds of ‘radio’ tagging

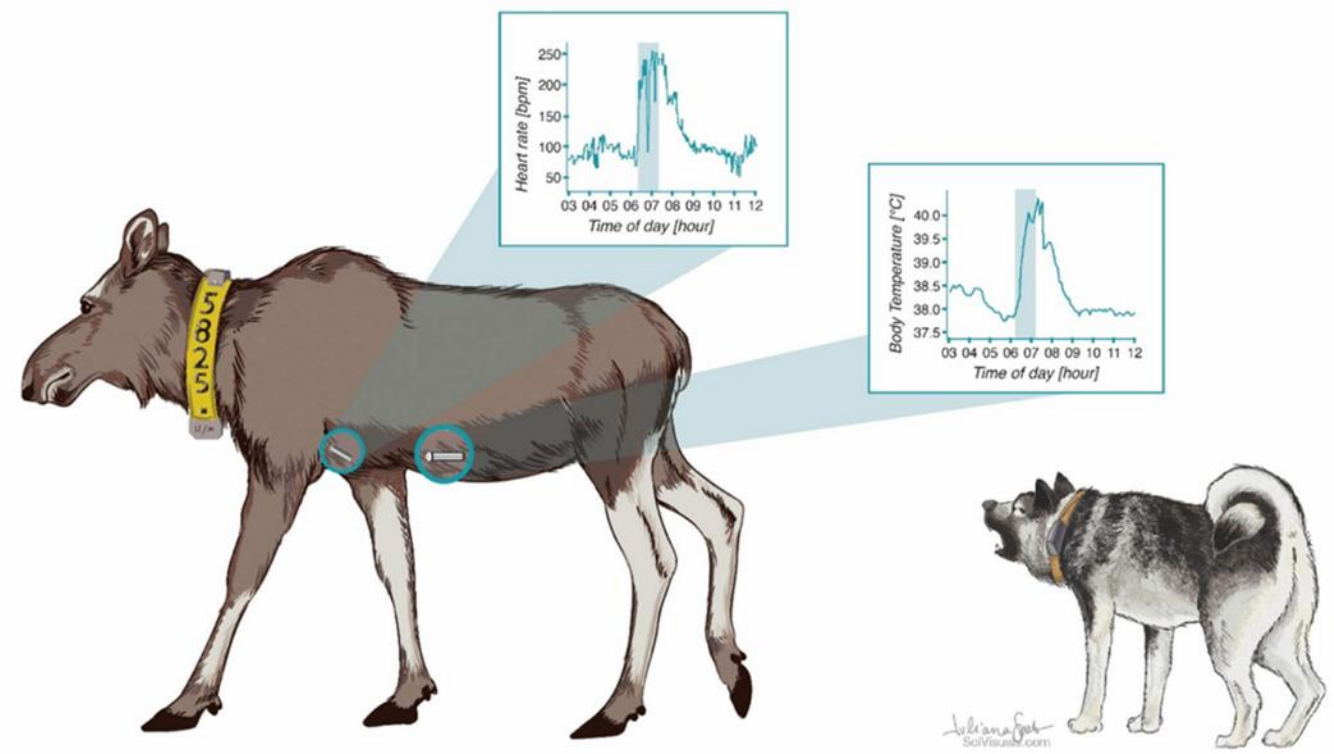




Invasive tagging







Mortality versus Morbidity

- Mortality (death) – immediate or delayed; usually obvious, easy to detect (if radiocollared)
- Morbidity («illness») – short-/long-term; e.g.: reduced health, mother-offspring separation, reproduction, behaviour, animal welfare, disease, **difficult to detect**, **may bias studies**



Mortality: The 2%-rule (aka the *Arnemo* rule)

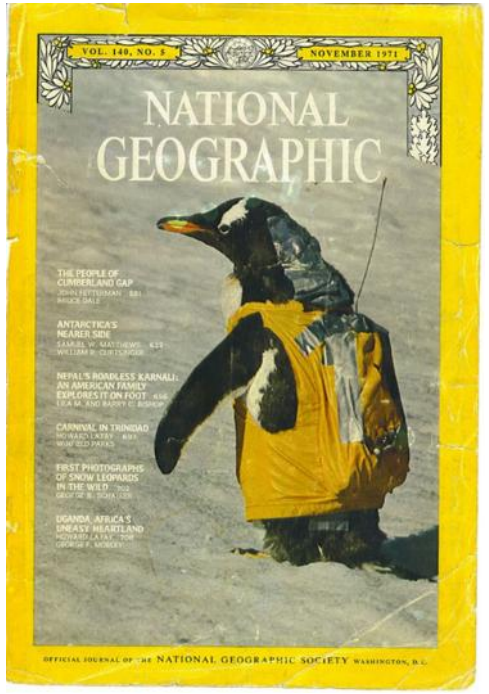
- Capture + 30 days post capture mortality < 2%
- If > 2%
  - Change the protocol (drugs, method)
  - Bring the required emergency drugs and equipment
  - Train the capture crew
  - Change the season/area
  - Don’t do the captures (the 5thR)



Morbidity: Effects of capture AND tagging…











Short-term effects of bio-logging on body mass and growth of a semi-aquatic mammal, the Eurasian beaver (Castor fiber)

Robstad, Christian Andre

Bio-logging studies often lack a control group, and the adverse effects of tagging may therefore not be observable. I investigated whether glue-on tagging affected Eurasian beavers body mass and growth per day. … analysing the tagged and un-tagged beavers combined indicated that the glue-on tag negatively affected the beavers' growth per day. This result emphasised the importance of using a control-group to reveal adverse effects that might have implications for animal welfare and sampling of biased data.

https://openarchive.usn.no/usn-xmlui/handle/11250/2733247

Morbidity – bears: *Research on research*

frontiers in Veterinary Science

ORIGINAL RESEARCH
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Long-Term Safety of Intraperitoneal Radio Transmitter Implants in Brown Bears (*Ursus arctos*)

Jon M. Arnemo[1,2], Bjørnar Ytrehus[3,4], Knut Madslien[4], Jonas Malmsten[2,5], Sven Brunberg[6], Peter Segerström[6], Alina L. Evans[1] and Jon E. Swenson[3,7]*

Conservation Physiology

Volume 4 • 2016

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SEB Society for Experimental Biology

Research article

Physiological reactions to capture in hibernating brown bears

Alina L. Evans[1,*], Navinder J. Singh[2], Boris Fuchs[1], Stéphane Blanc[3,4], Andrea Friebe[5], Timothy G. Laske[6,7], Ole Frobert[8], Jon E. Swenson[5,9] and Jon M. Arnemo[1,2]



Animal Welfare

The cost of research: Lasting effects of capture, surgery and muscle biopsy on brown bear (*Ursus arctos*) movement and physiology

Part of: AWF Wild Animal Welfare

Published online by Cambridge University Press: **21 November 2023**

Alexandra Thiel, Anne G Hertel, Sylvain Giroud, Andrea Friebe, Boris Fuchs, Jonas Kindberg, Anne Randi Græsli, Jon M Arnemo and Alina L Evans

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Weight of collars?



- 2-6% of body mass???
- Almost no long-term studies but most biologists have very strong opinions on this issue
- Zebras (GPS collars): 0.6% had significant effects on grazing behavior and movements compared to 0.4%
  - Brooks et al JWM 2008
- Caribou with GPS (1.6 kg): Annual survival reduced by 18% compared to VHF (0.5 kg)
  - Raselius et al JWM 2014

Effects of Global Positioning System Collar Weight on Zebra Behavior and Location Error

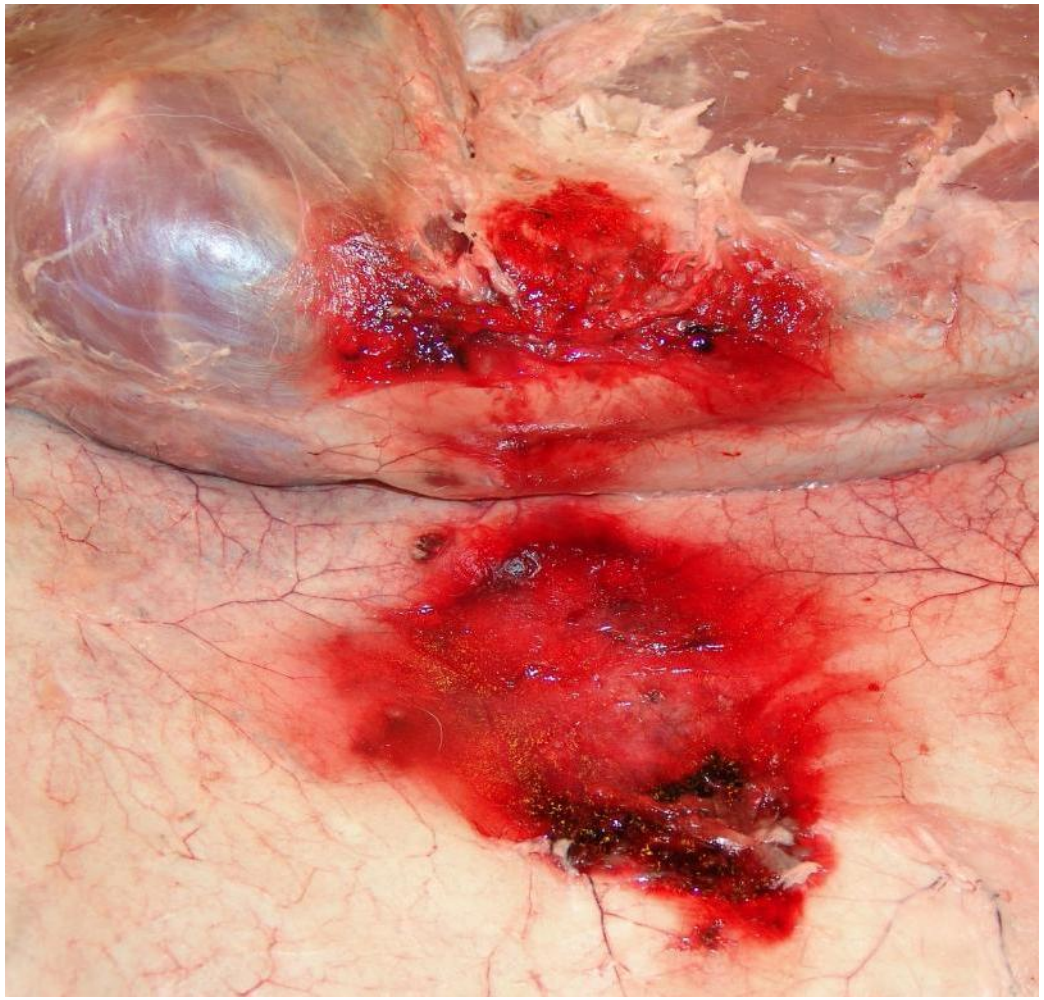
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Although both types of collar were well within accepted norms of collar weight, the slightly heavier collars (0.6% of total body mass [TBM]) reduced rate of travel by >50% when foraging compared with the collar that was 0.4% of TBM. Collar effect was activity specific, particularly interfering with grazing behavior; the effect was less noticeable when zebras crossed larger interpatch distances. We highlight that small differences in collar weight or fit can affect specific behaviors, limiting the extrapolation of fine-scaled GPS data. This has important implications for wildlife biologists, who hitherto have assumed that collars within accepted weight limits have little or no effect on animal movement parameters.

Morbidity – dart wound







The End

