

Refinement of techniques for capture, immobilization & marking



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Major Scandinavian Mammalian Species

- Capture stress and physiology
- Capture/anesthetic risk and mortality
- Implantable radiotransmitters



Capture Stress & Mortality



Video follows...

Definitions

- ***Stress*** = generalized, nonspecific response of the body to any factor that overwhelms, or threatens to overwhelm, the body's compensatory abilities to maintain homeostasis. The agent or stimulus inducing this response is known as a ***stressor***.
- ***Eustress*** ("Good stress") = stress that is beneficial for the animal's ability to survive
- ***Distress*** ("Bad stress") = stress that is capable of inducing harmful responses or pathological changes

Stressors

(stimuli or agents inducing stress)

- **Physiological:** Heavy exercise, hemorrhage, hyperthermia, shock, pain, infection
- **Physical:** Trauma/surgery, intense heat/cold
- **Chemical:** Hypoxemia, acid-base imbalance, anesthetic drugs
- **Emotional:** Anxiety, fear

Effects of acute stress

- Adrenaline ↑ (sympathetic nervous system – ”fight or flight” response)
- Cortisol ↑ (hypothalamic-pituitary-adrenal axis)
- Heart rate ↑ (100% within 3-5 seconds)
- Blood pressure ↑ (100% within 10-15 seconds)
- Redistribution of blood: Brain, heart & muscles ↑
Kidneys & GI-tract ↓
- Respiratory rate & ventilation ↑
- Metabolic rate ↑ (100% increase within 20 minutes)
- Body temperature ↑
- Blood glucose ↑..... Lactic acid ↑ pH ↓

Effects of capture & anesthesia

- Fight-or-flight response
- HPA-axis activation
- Hyperthermia → increased oxygen demand
- Respiratory depression → hypoxemia
- Lactid acid build-up, acidosis
- In severe cases...
 - Neurological/myocardial dysfunction
 - Multi-organ failure
 - Capture (exertional) myopathy
 - Death – acute or delayed

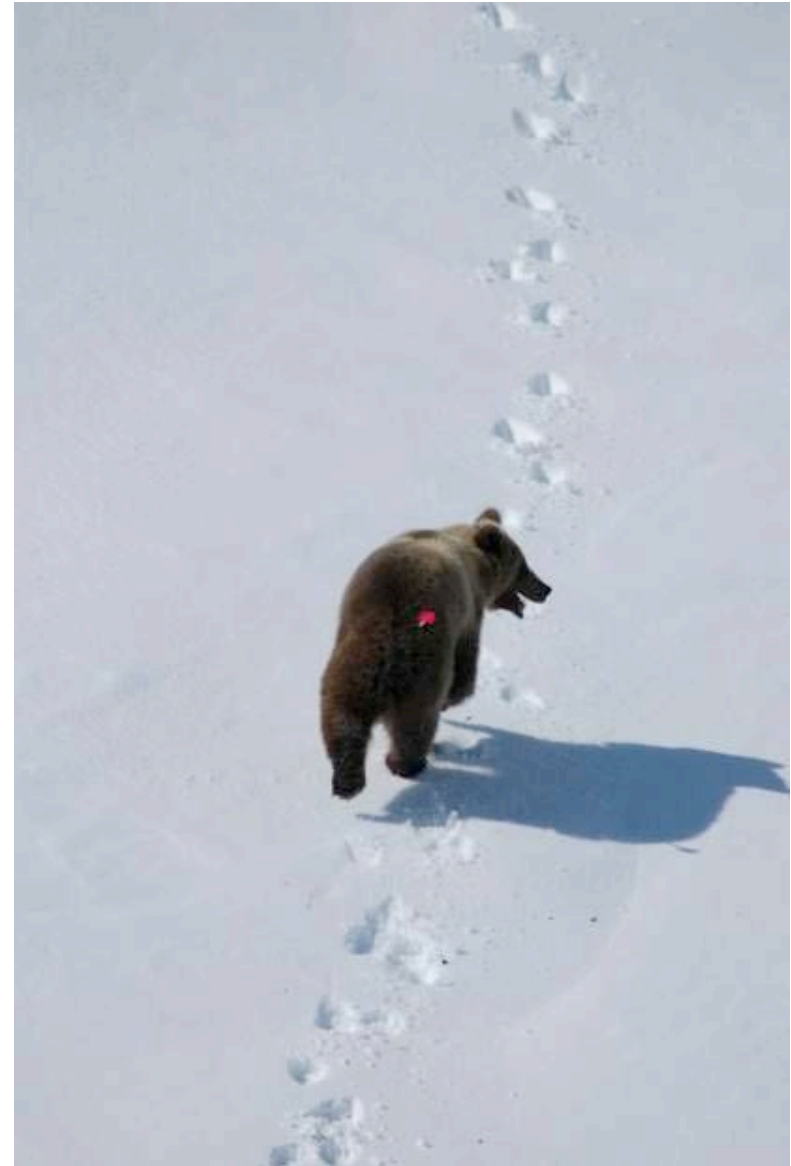
How to measure stress?

Is cortisol *the* parameter?



No!!

- All stressors produce a similar nonspecific, generalized response regardless of the type of stressor
- In horses, mating causes the same cortisol response as heavy exercise (endurance race)
- Extremely complex neural, hormonal and biochemical response
- Interspecies and intraspecies variation in drug effects
- Conclusion: Cortisol alone is useless



Assessment of acute stress requires...

- Monitoring of vital signs: T, HR, RR, CRT
- SpO₂, BP, blood gases, ECG
- Hematology and serum biochemistry
- Establishment of "normal" and critical values for each species

Anesthetic & Capture Mortality



Dead bear

Anesthetic risk

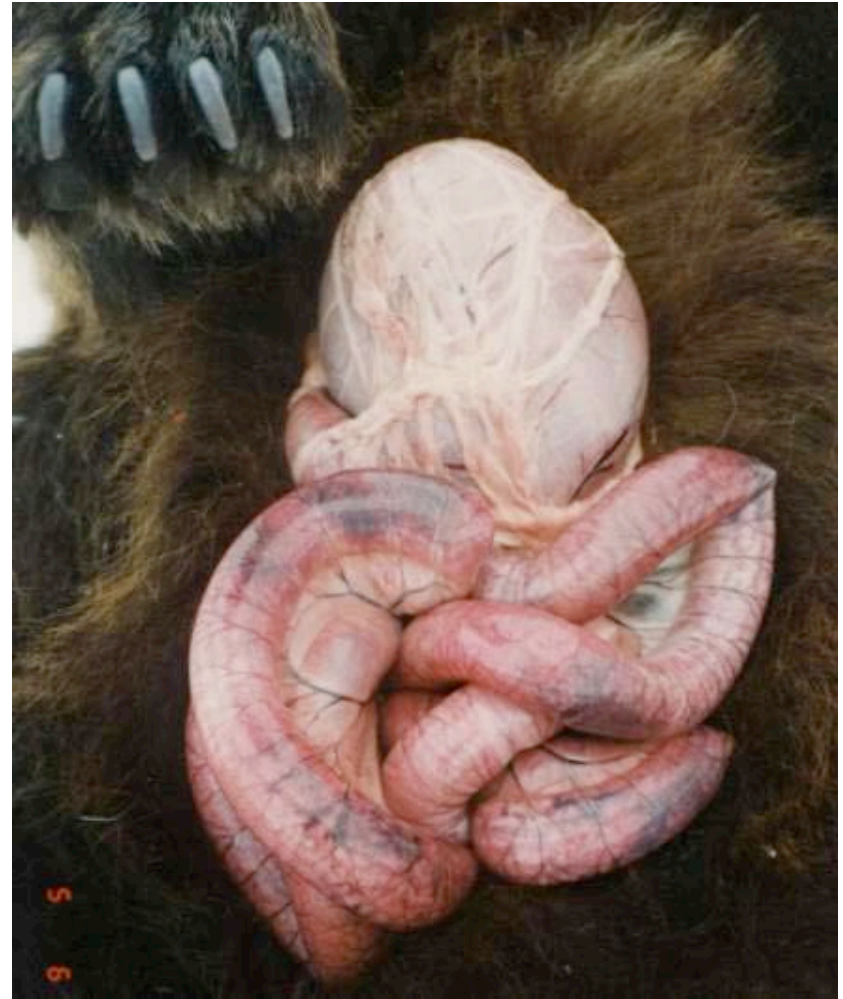
- Anesthesia is a controlled intoxication of the central nervous system
- Anesthetic drugs are never completely devoid of toxicity and induction of anesthesia invariably carries a risk to the life of even healthy patients
- Chemical immobilization of free-ranging animals is a form of veterinary anesthesia conducted under the most difficult circumstances

Capture and anesthetic mortality

- Direct effects of the immobilizing drug(s) [acute]
 - Respiratory depression, shock, hyperthermia, asphyxia due to vomiting or bloat, (predation)
- Indirect effects [acute or delayed]
 - Drowning during induction, dart trauma, trauma from chasing or traps (predation)
- Secondary effects [delayed]
 - Trauma from chasing or traps/snare, long-term effects from stress (myopathies), dam-off-spring separation, problems with collars and implants, (predation)

Mortality

- All capture deaths should be reported to the authorities (and usually also to the media)
- Necropsy should be performed on all dead animals
- Data on mortality should be published in the scientific literature



Comparative Anesthetic Mortality

- **Wildlife: 0.5-10%**
 - 1/200 to 1/10
- **Dogs & cats: 0.1%**
 - 1/1,000
- **Horses: 1%**
 - 1/100
- **Humans: 0.01-0.05%**
 - 1/10,000 to 1/2,000

Causes of mortality

- Human error (dart misplacement, miscalculation of drug dose, prolonged chasing)
- Lack of training/experience (human factor)
- Lack of anesthetic protocol, drug testing
- Preanesthetic examination not possible
- Lack of monitoring, emergency equipment/drugs
- Poor body condition, disease
- Species differences (moose versus muskox)
- Bad luck (Murphy's Law)

Mortality should decrease over time

- Brown bears (change of drugs)
 - 1984-1991 (n=183): 3.8% (7)
 - 1992-2007 (n=1,130): 0.53% (6)
- Eurasian lynx (5-yr periods)
 - 1993-1997 (n=144): 6,25 (9)
 - 1998-2002 (n=195): 4.62% (10)
 - 2003-2007 (n=164): 1.83% (3)

Mortality – Moose - Drugs

- 3,449 captures in Scandinavia (1984-2007)
 - Same protocol except for drugs & crew
 - Mortality: 0.84% (29)
- Sweden (1,603 captures)
 - Etorphine-xylazine: 1.06% (17)
- Norway (1,846 captures)
 - Etorphine: 0.65% (12)

Identification/tagging

- Ear tag
- Tattoo
- Microchip
- Tissue (DNA)
- Radiotransmitter
 - VHF
 - Collar
 - Implant
 - GPS
 - Recapture/Drop-off
 - Remote download
 - GSM/mobile network
 - Satellite



Implants – long-term effects

- Pain?
 - No indications (based on behaviour); difficult to assess
- Reproduction
 - No indications (bears, wolverines, lynx, wild boars, beavers)
- Physical obstruction
 - 3 cases in lynx with Telonics IMP/150; this model is no longer used
- Foreign body reaction
 - No indications in short-lived species
 - 45% of bears (3-10 yrs with implants)
 - Implant should be removed/changed after 3-4 yrs

Recommendations

- Written protocol for all species & projects – change the protocol if necessary
- Training of all people involved in the capture – keep the capture job on a few hands
- Use the best equipment available:
”Professionals use professional equipment!”
- Use the best drugs available
- Good clinical practice (monitoring!)
- Overall mortality rate should be $< 2\%$

Protocol depends on...

- Animal species
- Aim of the project
- Capture method
- Physical versus chemical capture
- Surgery?
- Collars versus implants
- VHF versus GPS
- End-point should be defined:
 - Recapture vs drop-off vs hunting

A photograph of a brown bear and her four cubs resting on a snowy, icy landscape. The bears are in the foreground, huddled together on a patch of snow and ice. In the background, there are several snow-capped mountains under a clear blue sky. The text "Thank You!" is overlaid in the center of the image in a bold, red, serif font.

Thank You!