

PHYSIOLOGICAL EFFECTS OF HUMAN ENCOUNTERS AND HUNTING ON THE SCANDINAVIAN BROWN BEAR (*URSUS ARCTOS*)

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Hikers



Background

Centuries of human persecution in Scandinavia have induced a strong antipredator behavior in the brown bear (*Ursus arctos*), and this predator-prey relationship has resulted in a landscape of fear [1]. A physiological response during a human-bear interaction is likely the precursor to such behavioral adaptations. Accelerated heart rates (beats per minute, HR) and consequent increases in body temperature (T_b) stimulated by the sympathetic nervous system are indicators of stress [2]. Biologging devices recording these parameters together with GPS data allows for evaluation of human activities as stressors in a quasi-experimental setup using free ranging brown bears. In Scandinavia bears are commonly hunted using baying dogs. The bear hunt has been shown to alter the behavior, physiology and movement of the bears [1, 3]. During this time berry picking, small game and moose hunting increase human disturbance in the bear's habitat. In experimental human approaches and simulated hunts using baying dogs, we assess the physiological response to these stressors. We also describe data retrieved from bears shot during the regular hunt.

Objective: Evaluate the effect of human disturbance and hunting with dogs on the Scandinavian brown bear using heart rate, body temperature and movement as indicators of stress.

Bear

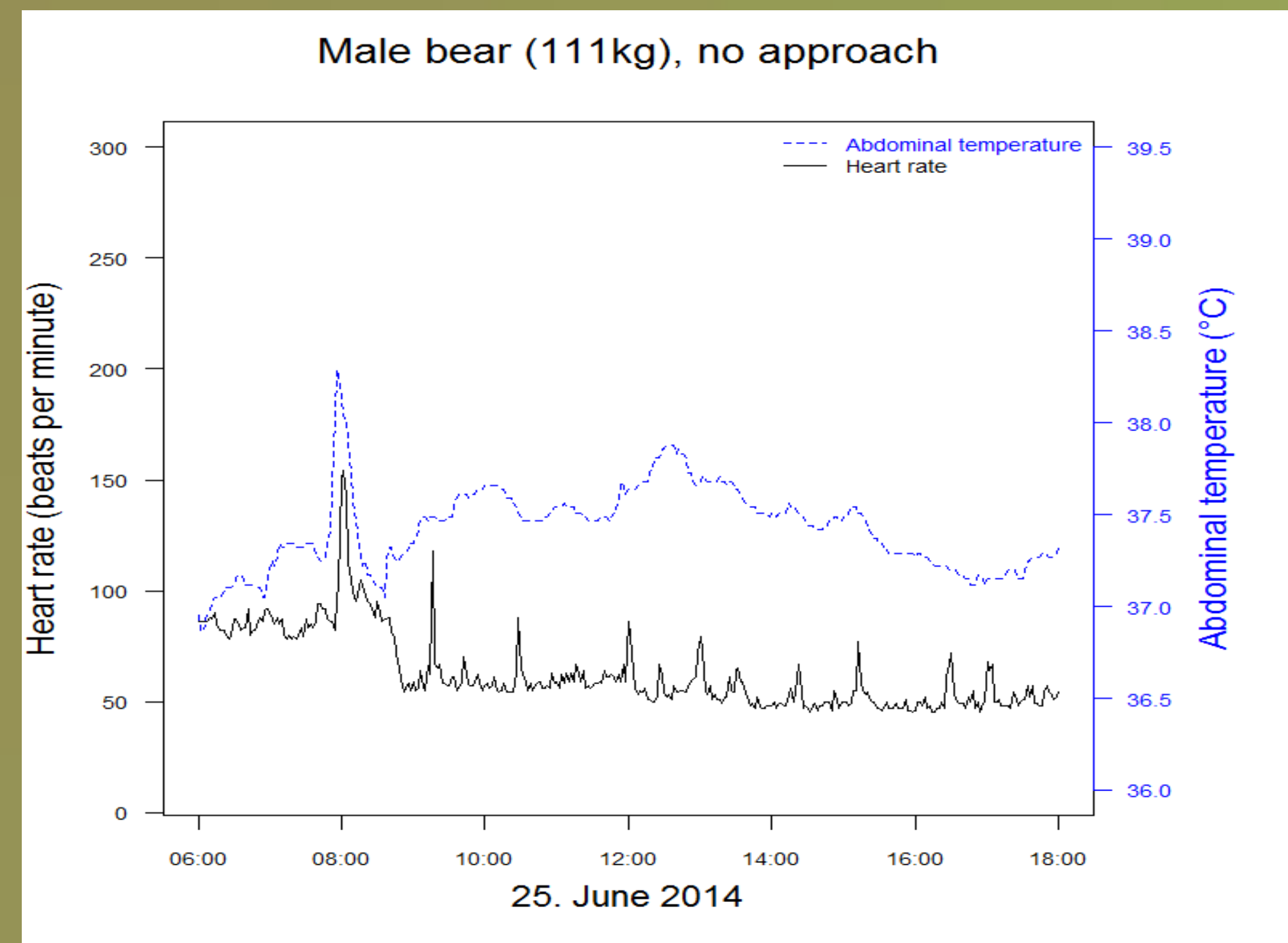


Figure 1: Abdominal body temperature (blue dotted) and heart rate (black solid) of a bear during a day with no known approaches.

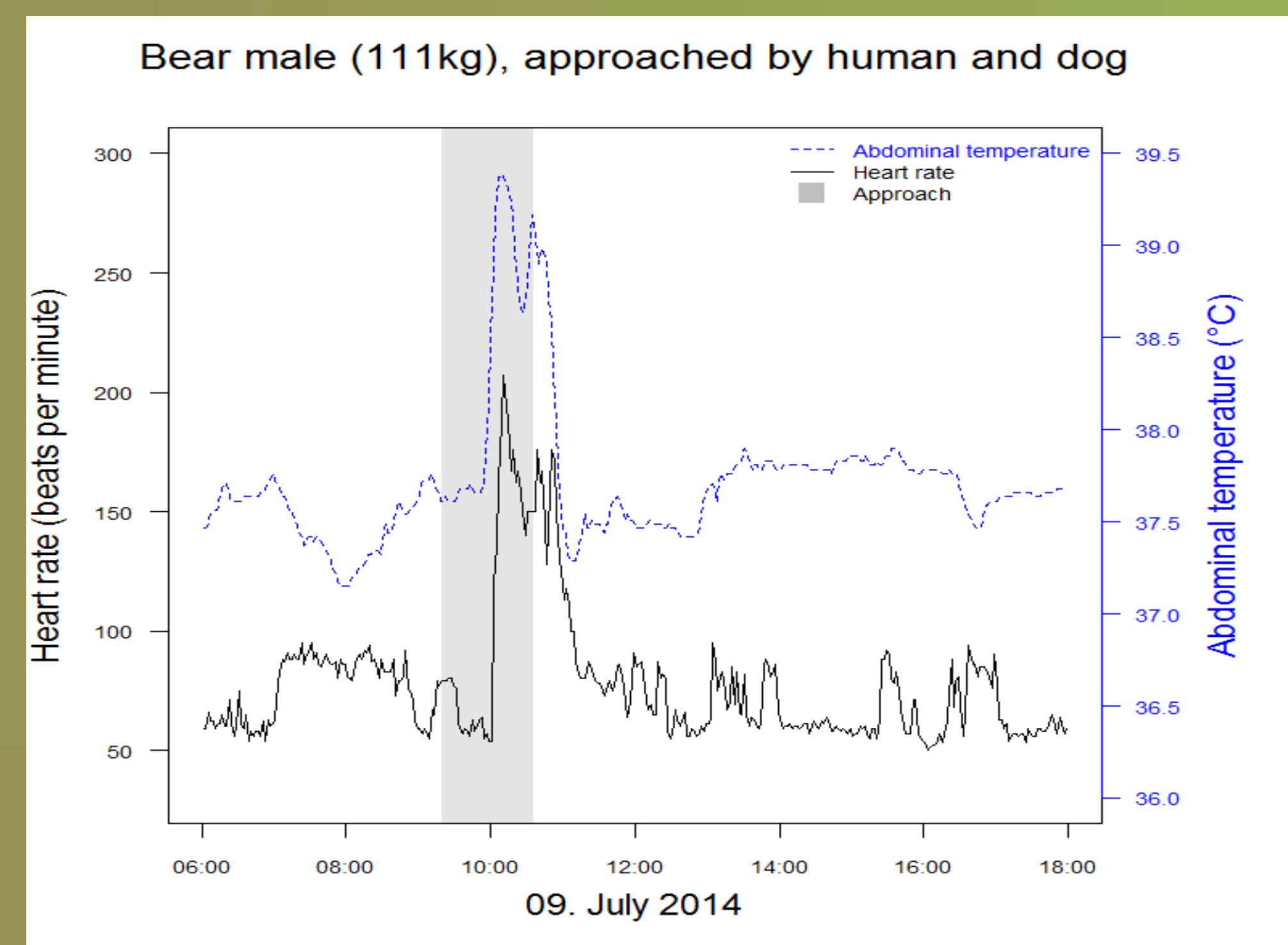


Figure 2: Abdominal body temperature (blue dotted) and heart rate (black solid) of a bear approached by human accompanied by a dog.



Surgical insertion of temperature logger and heart rate logger.



Hunters & Dogs

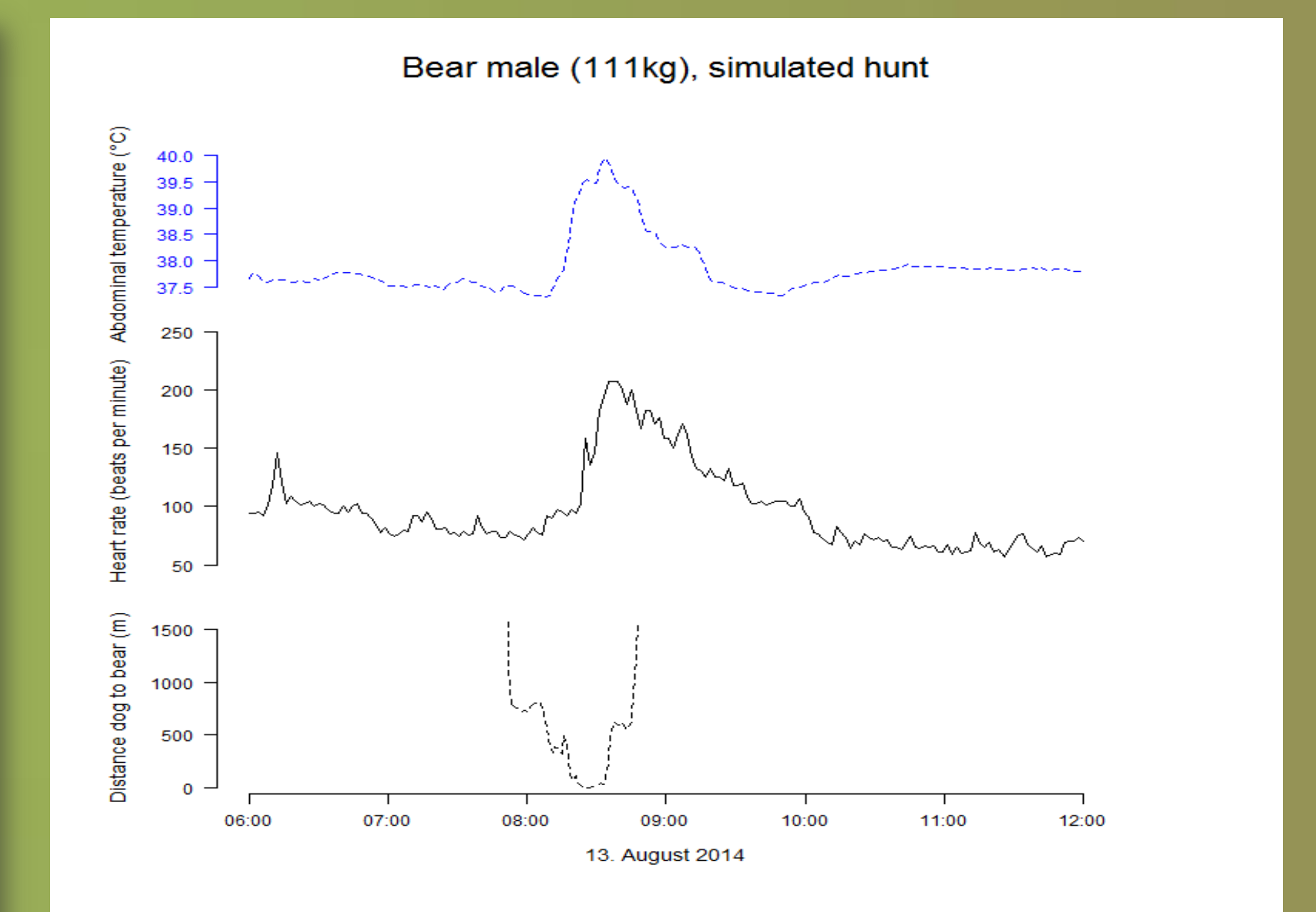


Figure 3: Abdominal body temperature (blue dotted), heart rate (black solid) and distance dog to bear during a simulated hunt.

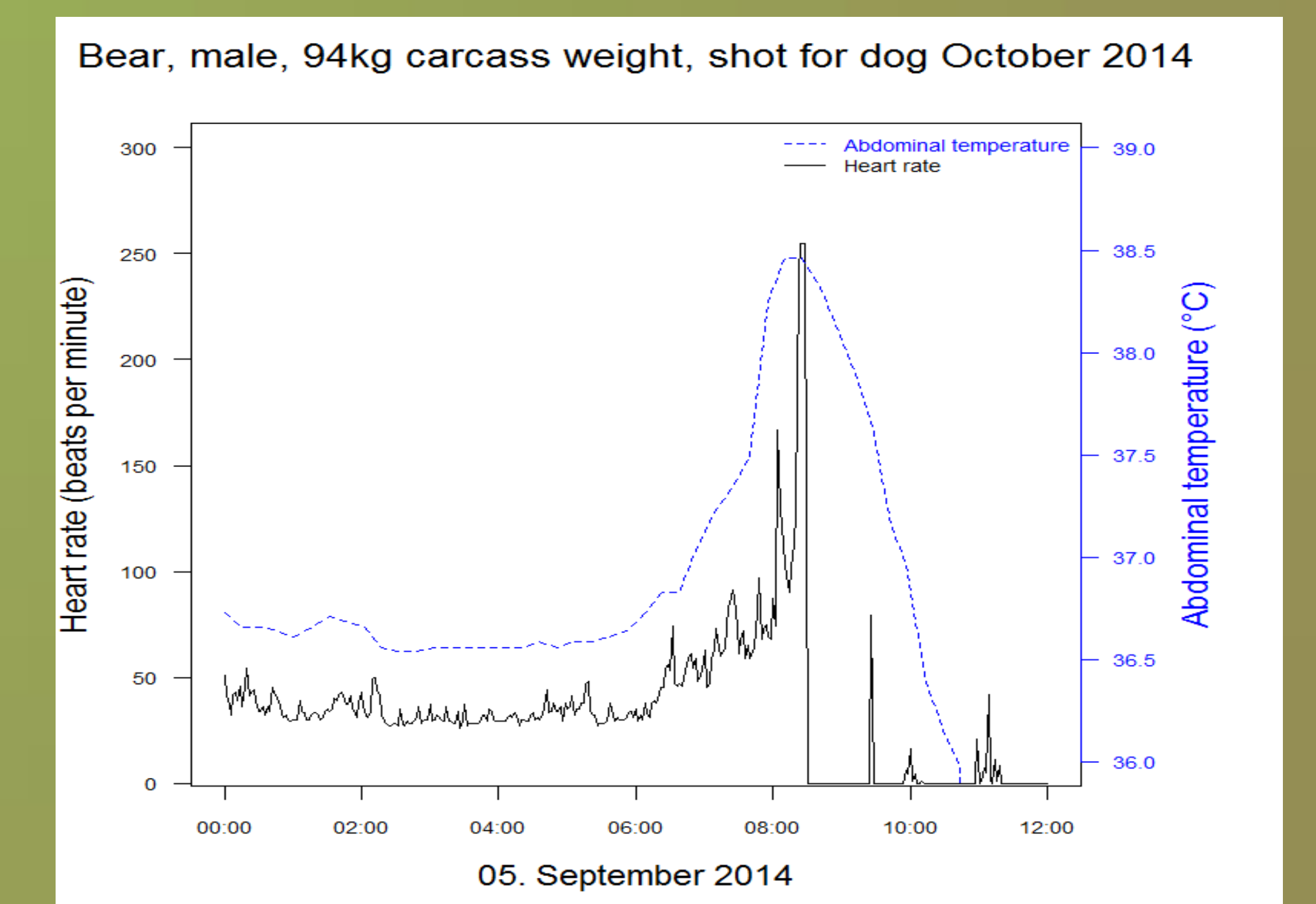


Figure 4: Abdominal body temperature (blue dotted) and heart rate (black solid) of a bear during the real hunt.

Materials and Methods

For this study, 35 bears were captured and equipped with GPS-collars, abdominal temperature loggers (DST Centi, Star Oddi, Iceland) and heart rate loggers (Medtronic Reveal XT™, Minnesota) were implanted. We recorded bear positions every 1 min when approached or hunted by a human or dog. Body temperature was recorded at 4 min and heart rate at 2 min intervals.

Dogs were equipped with GPS collars (Garmin Astro, USA) logging six positions per minute and providing real time positions to the handler. Bears were approached downwind by field personnel accompanied by a dog. The dog-handler pair walked 50 meters beside the assumed current position of the bear. For simulated hunts, one or two baying dogs were released on a track of a GPS collared bear. Once the dogs began barking at the bear, they were retrieved in a similar way as during real hunts, i.e. when the bear passed a road or after approached by the dog handler. These simulated hunts occurred before the hunting season. Within this ongoing study, 77 experimental hunts are successfully conducted so far.

Eighteen bears equipped with biologgers and GPS collar were shot by hunters. In Sweden, each legally hunted bear is inspected, sampled and tagged by the county administrative board. Carcass weight, estimated age and sex of the bear, number of fired shots, number of involved hunters and number of involved dogs are recorded.

References

1. Støen O-G, Ordiz A, Evans AL, Laske TG, Kindberg J, Frøberg O, Arnemo JM, Swenson JE. Physiological evidence for a human-induced landscape of fear in brown bears (*Ursus arctos*). *Physiol Behav.* 2015; 152, Part A: 244-8.
2. Costanzo LS. *Physiology*. Philadelphia: Saunders Elsevier; 2011.
3. Ordiz A, Støen O-G, Delibes M, Swenson JE. Predators or prey? Spatio-temporal discrimination of human-derived risk by brown bears. *Oecologia.* 2011; 166 (1): 59-67.