Research Note

Behavioral and Physiological Responses of Trap-Induced Stress in European Badgers

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Key words

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Reasons for mammal trapping include removal of individuals for population management purposes, scientific purposes, pest control, and obtaining fur, skin, or meat for economic purposes. The type of trap used highly affects the responses of captured animals (Kreeger et al. 1990*a*, White et al. 1991). Research on captured red foxes (*Vulpes vulpes*) has shown that foothold traps inflict greater trauma compared with box traps even when the traps had padded jaws (i.e., the animal does not experience any obvious physical damage, Kreeger et al. 1990*a*). Also procedures, such as chemical immobilization, have been shown to affect the life history of mountain goats (*Oreamnos americanus*; Côté et al. 1998), moose (*Alces alces*; Ballard and Tobey 1981), and polar bears (*Ursus maritimus*; Ramsay and Stirling 1986). Thus, not only can entrapment cause physical trauma, such as limb, tissue, or tooth damage, but the overall response is likely to be affected by how the animal perceives the situation. White et al. (1991) demonstrated higher pathological responses in red foxes captured in box traps compared with untrapped individuals, which shows that even traps like box or cage traps that are likely to minimize physical injuries can have negative effects on animals. Stress-induced hyperthermia has been shown to be closely associated with activation of the hypothalamic-pituitary-adrenal axis and the sympathetic-adrenal-medullary system, for example, in foxes (Moe 1996), thus, resulting in increased heart rate, body temperature, and cortisol levels. Cortisol levels have been used as indicators of stress during restraint of wildlife species (Morton et al. 1995), but although physiological responses often can be useful indicators of stress (Broom and Johnson 1993), it is not suitable to use them alone as stress indicators (Rushen 1991) because similar reactions can also be observed during nonstress situations (Kreeger et al. 1989, 1990*b*).

It is well-known that psychological factors may cause or increase stress responses in animals. If an individual is in a threatening environment and is not able to cope with the situation it is likely to be stressed even without any physical injury (Jensen and Toates 1993, Toates 1995, Jensen 1996). An animal's ability to predict or control its situation highly influences the response, with stress levels decreasing with increased ability to predict or control the situation (Weiss 1972, Jensen 1996). Therefore, besides potential physical trauma, a captured animal might also be exposed to psychological stress by experiencing lack of control because it is unable to escape from the trap. Furthermore, during long entrapment times there is also a risk of enhanced stress levels due to disruption of, or failure to perform, natural behaviors such as feeding. External factors, such as type of trap, entrapment duration, and time of day, most likely affect the stress response. Also species-specific factors, such as diurnal rhythms, general activity levels, and sociality, are likely to have an influence on how the animal responds to the situation.

The European badger (*Meles meles*) is a nocturnal species that lives in social groups varying in size from 2–30 individuals (Rogers et al. 1997). A group uses a shared territory with one or several setts, but the individuals commonly feed independently from each other (Kruuk 1978*a*). Badgers are used in Sweden to train earth dogs (i.e., dogs that enter the sett when hunting [e.g., foxes and badgers]), and our study was a part of a project investigating stress coping in such badgers on commission of the Swedish Ministry of Agriculture, Food, and Consumer Affairs.

Our aim was to examine some behavioral and physiological (heart rate, body temperature, and fecal cortisol) responses of semitame European badgers to restraint in cage traps for short and long capture periods during day and night time. We also studied behavior during 3 consecutive nights postrestraint (i.e., after the treatment period) and compared behavior to undisturbed conditions. We predicted that longer entrapment would affect the badgers more than short entrapment periods in terms of higher heart rate, body temperature, and fecal cortisol metabolites (FCM) levels and in terms of more long-term changes in behavior. We also predicted that entrapment during dark hours when badgers normally are active would be more stressful than during daylight.

Study Area

The study animals were raised in captivity and transported to Kolmården Wild Animal Park in Sweden (58°N, 16°E) more than 1.5 years before the beginning of the trial. They were kept in an outdoor enclosure (>700 m^2) with pine trees and with 5 huts

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(1.5 m length, 1.2 m width, 0.8 m lowest height, 1.0 m highest height) in which the badgers slept during the day.

Methods

We had access to 4 female European badgers (age 3–7 years old). We fed the badgers daily with dog pellets, and water was provided ad libitum. We considered the animals to be semitame because they were accustomed to humans feeding them and moving around in their enclosure, but they were not tame in the sense that they could not be handled and did not voluntarily approach humans. All badgers had previous experience being transported but had not been transported for more than 1.5 years before our trial. The advantage of using semitame animals was that the animals are less likely to be disturbed by humans in close vicinity compared with wild animals. This, in turn, facilitated transportation and the recording of behavior, although their reactions were likely to be underestimated in comparison with those of wild badgers. We identified the badgers using a microchip implanted subcutaneously in the neck, and we marked them individually with a colored earmark. We also shaved 3 of the badgers in different patterns (10–20 cm) to facilitate identification during the night.

We carried out our study in August 2003, and it consisted of 4 experimental periods and 1 period during which the animals were undisturbed. An experimental period consisted of 1 treatment day, where each badger received a different treatment, followed by 3 consecutive nights of observations (posttreatment nights where no treatments were performed) before the next experimental period began. We repeated this pattern until each badger had received all treatments alternating short and long treatments per individual. For logistic reasons, the undisturbed period (6 consecutive nights) followed the experimental periods.

The 4 treatments consisted of 15 minutes or 4 hours of entrapment during light and dark hours, respectively. During 1 treatment day, each badger received a different treatment, and after the 4 treatment periods, all badgers had been exposed to all treatments. Badgers did not receive 2 short or 2 long treatments consecutively to avoid any carryover effects, but the badgers received the treatments in a different order. We chose entrapment times to study the immediate response when trapped (15 min) and more long-term response (4 hr). We did not choose an entrapment time longer than 4 hours so that we could study the animals when they returned to the home enclosure. During a treatment day, we transported the first focal animal from the enclosure to the trap, which was located 50 m from the enclosure. We kept the focal animal in its covered transportation box for 10 minutes to allow it to calm down after the transportation. Then, we gently persuaded it, by vocal encouragement, to enter the trap that was an uncovered cage trap (1.25 × 0.32 × 0.32 m; Type L8, The Swedish Association for Hunting and Wildlife Management, Öster-Malma, Sweden), approved by the Swedish Environmental Protection Agency, and located outside the home enclosure in a novel location. When we removed the cover of the transportation box to the trap, the badgers usually entered the trap without any additional involvement from us. We also placed 5–7 pieces of dog food in the trap to facilitate the movement. We observed the focal animal for 15 minutes or 4 hours, depending on the treatment, from a nearby tent. After the treatment, we allowed the animal to enter the covered transportation box again, where we left it undisturbed for another 10 minutes before transportation back to the enclosure. We performed the short day treatment between 1440–1455 hours, the long day treatment between 1550–1920 hours, the short night treatment between 2210–2225 hours (when badgers normally become active in Sweden at that time of the year), and the long night treatment between 2250–0250 hours.

We monitored behavior, heart rate, and body temperature continuously during each treatment, and we sampled behavior and FCM during the posttreatment period following a treatment day. We also sampled behavior and fecal cortisol during the undisturbed period (i.e., 6 consecutive nights after the last posttreatment period).

We recorded the behavior in the trap by direct observation. The same observer watched the badgers under all treatments using a PSION workabout and Observer 3.0 (Noldus Information Technology, Wageningen, The Netherlands). We also filmed the trapped badger using infrared-sensitive video equipment (Ikegami ICD-47E, Ikegami Tsushinki, Tokyo, Japan), and we recorded all direct behavioral observations continuously from a monitor with the PSION workabout for all treatments. We registered the behaviors (Table 1) as durations (%) or events (No.), and the behaviors registered as durations were mutually exclusive and could not occur simultaneously. The shortest time a behavior could be observed depended on the definition and the reaction time of the observer (approximately 1 sec).

After each treatment, we filmed the badgers in the enclosure during the night. We also filmed them during the posttreatment period (3 nights) and during the undisturbed period (6 nights) using the same infrared-sensitive equipment. Every night filming (sunset to sunrise) consisted of 9 observational cycles, during one of which, we filmed each badger for 10 minutes/cycle. Thus, 1 cycle consisted of filming the 4 badgers for 10 minutes each (4 × 10 min) followed by a 10-minute break before beginning a new cycle; thus, each badger was filmed for 9 × 10 minutes per night. We filmed the badgers in a randomly selected order each night. We analyzed video tapes using the Observer Software Package 3.0 and VideoPro (Noldus Information Technology) with respect to behavior and location in the enclosure.

In each badger, we implanted surgically a radiotelemetry transmitter (69 × 41 × 10.5 mm, 44.7 g) intra-abdominally according to the protocol outlined by Ågren et al. (2000). The zoo veterinarian anesthetized the animals while they were sleeping in their huts during the day, and we brought them to the surgery room when fully anesthetized. We performed the surgery at the beginning of May, and the recovery and health status of the badgers were closely monitored by the zoo veterinarian and zoo staff. We measured heart rate (beats/min) and body temperature (mean °C/min, range 35–42°C, resolution of 0.05°C, accuracy 0.2°C) using a receiver and a portable computer (Dell laptop, model Latitude PPOIX, Round Rock, Texas). Mean values per minute were stored in an internal memory lasting for up to 180 days.

We fed all animals daily with 125 g of minced veal, mixed with 2 teaspoons of colored pearls (2 mm) to enable identification of the feces from each individual (Delahay et al. 2000, Wilson et al.

Table 1. Badger behavior ($n = 4$) observed a) in the cage trap, and b) in the home enclosure during undisturbed conditions. We carried out the study at Kolmården Wild Animal Park, Sweden, in August 2003.

a) Behaviors recorded in the trap	
Dig/bite (%)	Bite the mesh and/or dig with front paws on ground or on trap. These behaviors were often performed simultaneously and thus grouped together.
Active (%)	
Feed	Feed on dog food. Chewing sounds and mouth movements.
Walk	Move more than 2 feet without any pause.
Nose	Move nose in air or at ground.
Stand	Stand still with no other movements.
Inactive (%)	Sit on rump or lie on back or belly.
Others (%)	Behaviors not defined above.
b) Behaviors recorded in the home enclosure	
Active (%)	
Dig	Ground dig with front legs.
Forage	Stand or walk slowly with head closer to ground than to a horizontal body position.
Gallop	Move the front legs simultaneously and hind legs simultaneously.
Nose	Stand or walk with nose pointing upwards.
Stand	Stand with head closer to horizontal body position than to ground.
Trot	Move 2 diagonal feet at the same time without pause.
Walk	Move 2 feet without pause. Head closer to horizontal body position than to ground.
Inactive (%)	Belly or back on ground or sit on rump.
In hut (%)	Spend time in hut.
Friendly interactions	
Sniff (No.)	Touch another badger with the nose.
Receive sniff (No.)	See above.
Groom (%)	Lick or rub another badger with nose and/or receive lick or rub. The badgers were often involved in mutual grooming so the behaviors were grouped together.
Nonfriendly interactions	
Aggressive contact (No.)	Rapid head movement towards another badger within <1.5 m.
Receive aggressive contact (No.)	See above.
Threat (%)	Rapid trot or gallop towards other badger from a distance of approximately 2–3 m.
Receive threat (%)	See above.
Comfort (%)	
Preen	Nose movements on own body.
Scratch	Scratch own body with front or hind leg.
Mark and urinate/defecate (No.)	Mark other badger or ground with subcaudal gland by pressing the rump to other individual or ground, and defecate or urinate. The behaviors could not be separated.
Others (%)	Behaviors not defined above.

2003). We collected feces twice per day (after feeding and after night filming) to measure cortisol metabolites. The samples were immediately deep frozen pending analysis. For the analyses, the 11-oxoetiocholanolone-EIA (enzyme immunoassay) was used measuring 3a-11-oxocortisol metabolites as described by Möstl et al. (2002).

Because of the low sample size, we analyzed all data using the nonparametric Mann–Whitney *U* test with 95% confidence explanation interval (Minitab Statistical Software, Version 12.21, Minitab Inc., State College, Pennsylvania). We divided the behaviors into different groups to reduce the number of pairwise comparisons. We classified behaviors while in trap as active or inactive (Table 1). We analyzed the behaviors dig and bite separately. We analyzed all behaviors in the trap as a percentage of total observation time. We classified the behaviors that we analyzed during the nights following treatments as active, inactive, in hut, friendly interactions, nonfriendly interactions, or comfort (Table 1). We analyzed all behaviors as percentage per cycle (mean per night) except for aggressive contact, sniff, and mark for which we analyzed frequencies. We compared the behaviors to undisturbed conditions in the home enclosure. We also analyzed heart rate (beats/min), body temperature (°C), and cortisol metabolites in feces (max. and mean ng/g) using Mann–Whitney *U* test (Minitab vs. 12.21). We analyzed correlations between activity and physiological variables using Pearson correlation coefficient (Minitab vs. 12.21). One of the transmitters had a mechanical failure, thus allowing body temperature measurements in only 3 of the badgers. It is likely that FCM results were underestimated because of a large proportion of unmarked samples and consequent missing data. Our study was approved by the local Ethical Committee of The Swedish National Board for Laboratory Animals.

Results

In general, the badgers were very active when captured in the trap (mean % of total observation time ± SE: short day: 63 ± 21,

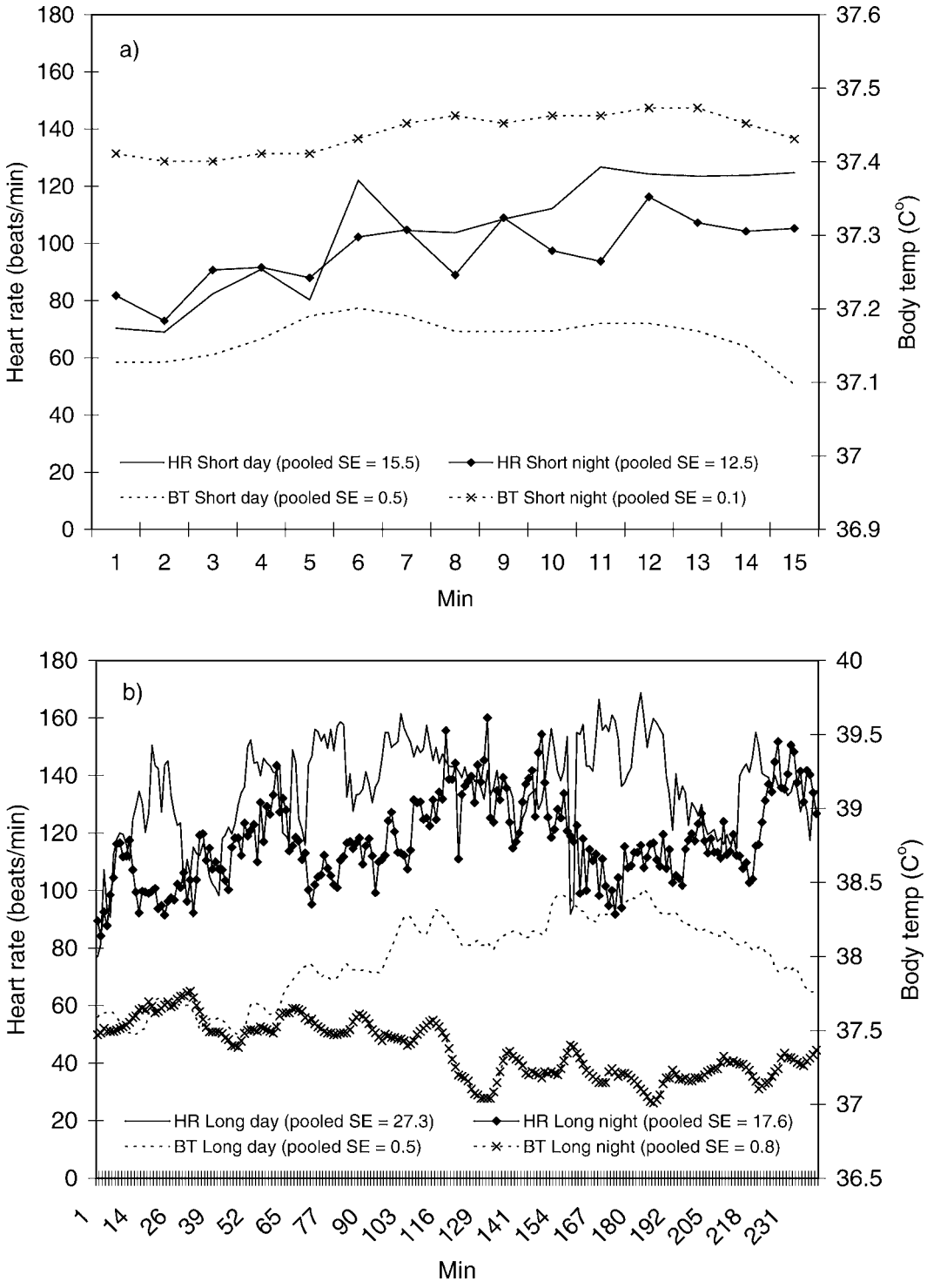

Figure 1. Mean heart rate (HR) and body temperature (BT) of 4 female European badgers when restrained in an uncovered cage trap for a) 15 min, and b) 4 hr during day and nighttime, respectively. We carried out the study at Kolmården Wild Animal Park, Sweden, in August 2003, and the short day treatment was carried out between 1440–1455 hours, the long day treatment between 1550–1920 hours, the short night treatment between 2210–2225 hours, and the long night treatment between 2250–0250 hours.

short night: 89 ± 4, long day: 65 ± 20, long night: 76 ± 14, $n = 4$). A large proportion of the active behavior consisted of bar biting or digging, with these behaviors often occurring simultaneously (mean % of total observation time ± SE: short day: 41 ± 21, short night: 42 ± 19, long day: 55 ± 21, long night: 56 ± 15, $n = 4$). The badgers tended to be more active in the trap when trapped for the short night treatment compared with the long day treatment (mean % of total observation time ± SE: short night: 47.5 ± 15.4, long day: 10.1 ± 3.5, $n = 4$, $W = 11.0$, $P = 0.061$).

We found a positive correlation between mean heart rate and activity in the trap during the short night treatment ($r = 0.952$, $P = 0.048$, $n = 4$), but we found no significant difference in heart rate between treatments (Fig. 1, mean beats/min ± SE: short day: 118 ± 21, short night: 97 ± 13, long day: 132 ± 25, long night:

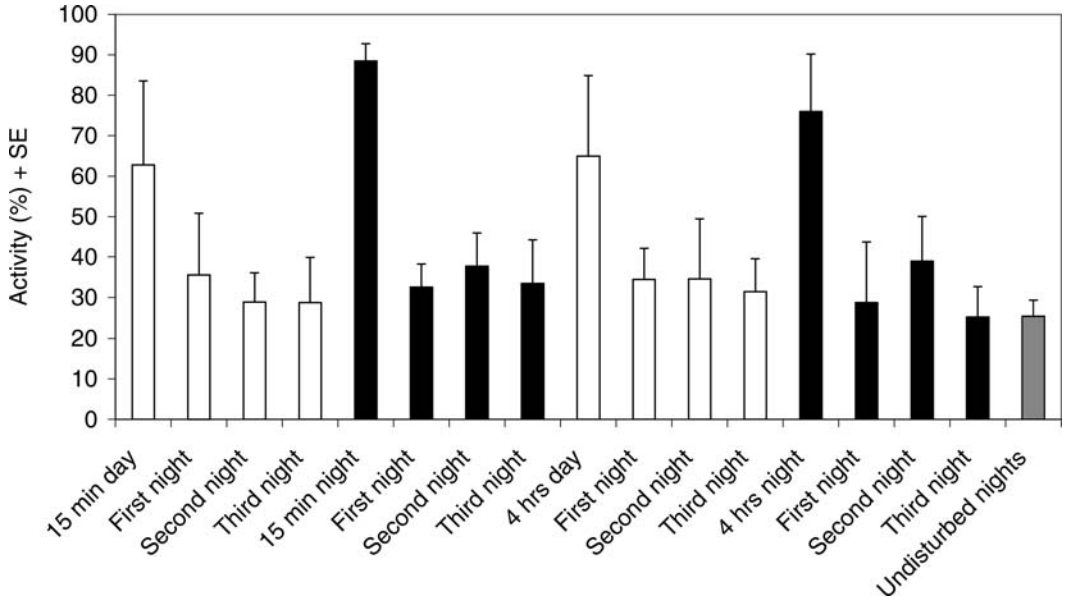

Figure 2. Mean activity (% of observations) in 4 female badgers when exposed to different restraint times (15 min and 4 hr day and night, respectively) in uncovered cage traps and during 3 consecutive nights after each treatment (first, second, and third night). Mean activity during 6 undisturbed nights is also shown (grey bar). We carried out the study at Kolmården Wild Animal Park, Sweden, in August 2003, and the short day treatment was carried out between 1440–1455 hours, the long day treatment between 1550–1920 hours, the short night treatment between 2210–2225 hours, and the long night treatment between 2250–0250 hours.

118 ± 14, undisturbed day: 55.8 ± 2.5, undisturbed night: 68.9 ± 4.7, $n = 4$). We did not find any difference in body temperature between treatments (Fig. 1, mean °C ± SE: short day: 37.0 ± 0.4, short night: 37.4 ± 0.1, long day: 38.0 ± 0.5, long night: 37.4 ± 0.8, undisturbed day: 36.9 ± 0.1, undisturbed night: 36.3 ± 0.3, $n = 3$). When comparing the heart rate and body temperature during the short treatments to the first 15 minutes during the long treatments, we found no differences between treatments ($P > 0.471$), indicating that the immediate response was the same in all treatments. During the day following the long day treatment, the badgers had higher mean heart rate ($W = 26.0$, $P = 0.030$, $n = 4$), and after the long night treatment, body temperature tended to be higher than during the undisturbed conditions ($W = 15.0$, $P = 0.080$, $n = 3$).

The badgers' behavior changed when they returned to the home enclosure after the short and long day treatments. After the short day treatment, they were involved in fewer social interactions compared with undisturbed conditions (e.g., friendly and non-friendly; $W = 10.0$, $P = 0.030$, $n = 4$). After the long day treatment, the badgers performed less comfort behavior (preen and scratch, $W = 10.0$, $P = 0.030$, $n = 4$) and spent less time in the huts ($W = 10.0$, $P = 0.030$, $n = 4$) compared with undisturbed conditions.

We also found behavioral changes during the first posttreatment night subsequent to the long day and to the short night treatments. The badgers spent less time in the huts after the long day treatment ($W = 10.0$, $P = 0.030$, $n = 4$) and after the short night treatment ($W = 10.0$, $P = 0.030$, $n = 4$) compared with undisturbed conditions.

We noted further behavioral changes during the second posttreatment night subsequent to the short and to the long night treatments. The badgers spent less time in the huts after the short night treatment ($W = 10.0$, $P = 0.030$, $n = 4$) and tended to perform more comfort behavior ($W = 25.0$, $P = 0.061$, $n = 4$) compared with undisturbed conditions. They also tended to be more involved in social interactions after the long night treatment compared with undisturbed conditions (nonfriendly: $W = 25.0$, $P = 0.061$, friendly: $W = 11.0$, $P = 0.061$, $n = 4$).

During the third posttreatment night, the badgers tended to be less involved in social grooming ($W = 11.0$, $P = 0.061$, $n = 4$) and comfort behaviors ($W = 11.0$, $P = 0.061$, $n = 4$) after the short night treatment compared with undisturbed condition, and they tended to perform fewer comfort behaviors after the long night treatment compared with undisturbed conditions ($W = 11.0$, $P = 0.061$, $n = 4$). Overall, general activity levels differed during the treatments, posttreatment periods, and during undisturbed conditions (Fig. 2).

We found higher maximum levels of fecal cortisol metabolites after the short night treatment ($W = 10.0$, $P = 0.030$, $n = 4$) and after the long day treatment ($W = 11.0$, $P = 0.061$, $n = 4$) compared with the short day treatment. We found higher mean values of cortisol metabolites after the short night treatment compared with undisturbed conditions ($W = 26.0$, $P = 0.030$, $n = 4$, Fig. 3). We found a weak correlation between mean FCM levels and heart rate when trapped during the short night treatment ($r = 0.935$, $P = 0.065$, $n = 4$).

Discussion

Overall, the results indicated that the badgers were very active when restrained in the cage trap and did not seem to habituate to the situation. In general, the behavioral and physiological findings support our hypothesis that longer entrapment times, especially during dark hours, would be more stressful for the animals than shorter entrapment times during daylight.

A high proportion of the active behavior in the trap consisted of bar biting or ground digging. White et al. (1991) showed that red foxes captured in box traps were active for 36% of an 8-hour

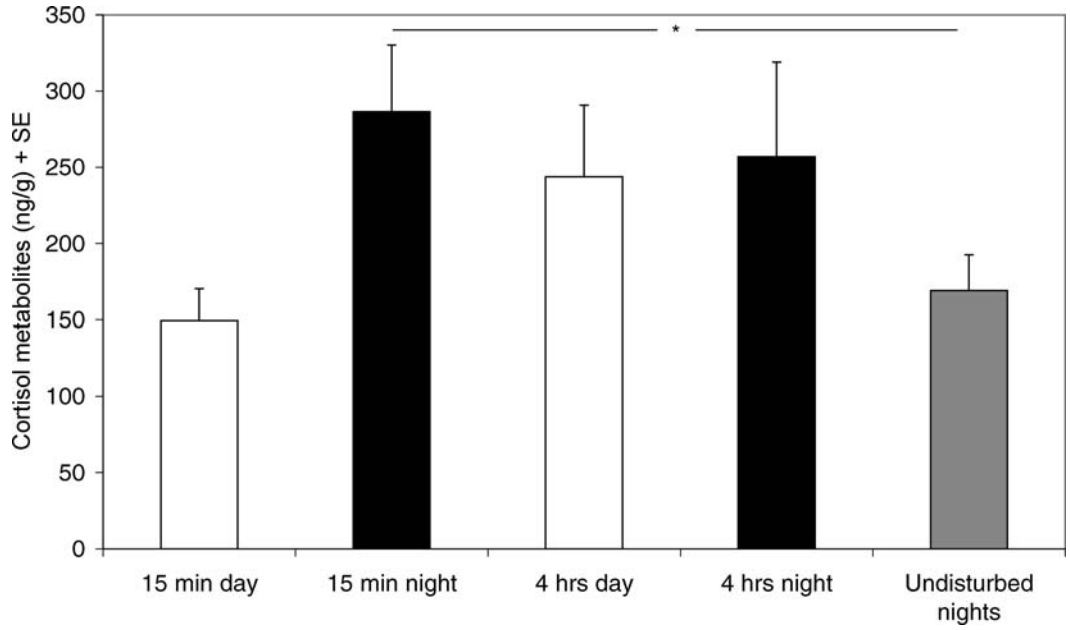

Figure 3. Mean levels of fecal cortisol metabolites of 4 European badgers exposed to different restraint times (15 min and 4 hr) in an uncovered cage trap during day and nighttime and during undisturbed conditions. We carried out the study at Kolmården Wild Animal Park, Sweden, in August 2003, and the short day treatment was carried out between 1440–1455 hours, the long day treatment between 1550–1920 hours, the short night treatment between 2210–2225 hours, and the long night treatment between 2250–0250 hours.

restraint period, and 91% of the first 10 minutes after capture was spent pacing, chewing on the trap, or digging. The findings are consistent with our results in which the badgers were active for 89% of the time during 15 minutes of entrapment during dusk, which is when badgers normally become active.

Increased heart rate and body temperature could be used as indicators of stress (Moe 1996), and rapid increases in body temperature were found in red foxes trapped in box and foothold traps (Seal et al. 1988, White et al. 1991). Such an increase was not as clear in our study, and this could be because the badgers did not freely enter the trap. Instead, the badgers had to enter the trap after a short transportation time of about 5 minutes, and it is possible that the transportation time (and the adaptation time in the covered transportation box) may have masked an increase in heart rate and body temperature. There were no differences between treatments in heart rate and body temperature during the first 15 minutes in the cage trap. This indicated that the immediate response was the same during all treatments, and that the badgers did not get accustomed to being repeatedly restrained in the trap. Lack of behavioral and physiological differences between treatment periods indicated that the badgers did not become habituated to the trap during the long treatments, rather they continued to be active until they were released.

On the day after the long treatments (when the animals normally were sleeping in their huts), there was some evidence of increased heart rate and body temperature compared with undisturbed conditions, which may indicate increased activation of the symphaticus-adrenomedulla axis and elevated stress levels (Moberg 1985). It is possible that this was due to more activity during the day, possibly because the badgers were unable to search for food during the longer entrapment. However, this would not have explained the elevated heart rates seen during the day following the long day treatment because the animals could have searched for food throughout the whole night after the treatment. Therefore, it is more likely that the elevated heart rates and body temperatures were a direct effect of the long treatments.

The short- and long-term behavioral changes that we found after all treatments further indicated that the badgers were disturbed by the entrapment. It has been suggested that badgers in a small social group respond to moderately stressful situations with changes in social and comfort behaviors and respond to more severe stressors with an increase in activity (K. Schütz, Kolmården Wild Animal Park, Kolmården, Sweden, unpublished data). The badgers spent less time in the huts after the long day treatment and the short night treatment compared with undisturbed conditions, and this is interpreted as increased overall activity or restlessness. The badgers often went into the huts but immediately left them again. Because we could monitor the heart rate, we know that while the badgers were in the huts they spent most of the time sleeping. We interpreted the increase in activity as being restless because the badgers did not regularly enter the huts to rest during the undisturbed nights. The increase in activity after the long day treatment occurred during the night following the treatment, whereas the same activity increase after the short night treatment was still present during the second post-treatment night. Badgers are nocturnal animals that normally are inactive in the sett during the day and feed during the night. The higher activity levels following treatment may have been caused by increased hunger levels because the restraint restricted the animal from foraging. However, the increase in activity is not considered to be foraging related because we did not find an increase in exploratory or foraging behavior. Also, increased foraging behavior would not explain the increased activity after the short night treatment because the animals were not restrained for a long

time, or after the long day treatment because badgers normally sleep rather than feed during daylight hours.

Increased activity might also be interpreted as a cumulative need of movement because badgers normally range over and defend large territories (Kruuk 1978*b*, Kruuk and Parish 1982). However, this would not explain the increase in activity that we found after the long day treatment, which is a period of time when badgers normally are inactive. Instead, increased activity, or restlessness, is more likely a direct effect of the restraint in the trap and could be an indication of psychological stress and elevated anxiety or alarm states. It is possible that capture times longer than the 4 hours used in our study would have had an even greater effect on the badgers (e.g., by increased feeding motivation), thus, resulting in increased stress levels. Badgers spend a high proportion of their active time searching for food, and it is, therefore, likely that they have a very high feeding motivation. It has been suggested that animals might be stressed when they are unable to perform behaviors that they are highly motivated to perform (Jensen and Toates 1993, Jensen 1996), and it is possible that the badgers experience elevated stress levels when prevented from feeding or moving.

The elevated FCM levels that we found after some of the treatments could be a further indication of increased stress levels during entrapment. Increased circulating cortisol levels have historically been used as an indication of stress responses in animals (Moberg 1985), and elevated levels of blood cortisol have been found in red foxes captured both in box traps and in foothold traps (Kreeger et al. 1991). However, despite the clear advantages of measuring cortisol metabolites in feces (Möstl and Palme 2002), thus, avoiding unnecessary handling of the animals, it is possible that we underestimated cortisol metabolites due to a high proportion of unmarked samples.

There was an immediate decrease in social interactions (friendly and nonfriendly) during the night when the badgers returned to the home enclosure after the short day treatment, and there were some tendencies for more long-term changes in social interactions and comfort behavior after the 2 night treatments, but the results were not consistent. General changes in social and comfort behavior might be an indication of disrupted natural behavior caused by the restraint. Restraint by chemical immobilization for less than 1 hour has been shown to negatively affect social behavior in bighorn rams possibly caused by physical weakness or impaired mental state (Pelletier et al. 2004). We did not observe behavioral changes during the night when the badgers returned to the home enclosure after the 2 night treatments. This might be due to a lack of sufficient data because we did not observe the badgers in these treatments throughout the whole night.

Our results suggested that badgers that actively resist the trap continue to do so even during longer entrapment durations. We found no behavioral or physiological differences between long or short entrapment times or between night or day, which indicated that the response was the same during all treatments. Overall, the badgers appeared to be most affected by being trapped at dusk, which is the time when badgers normally become active and the motivation to move and feed can be assumed to be high. The badgers were also affected by the long entrapment periods, and this could be a result of disrupted natural behavior and motivational systems. The badgers in our study were semitame and had had some experience of being restrained in a (transportation) box, and it is, therefore, likely that the responses of wild badgers would be even more pronounced.

Management Implications

We recommend that the length of capture in uncovered cage traps be minimized, especially during times when badgers normally are active, because of psychological factors influencing stress levels.

Acknowledgments

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