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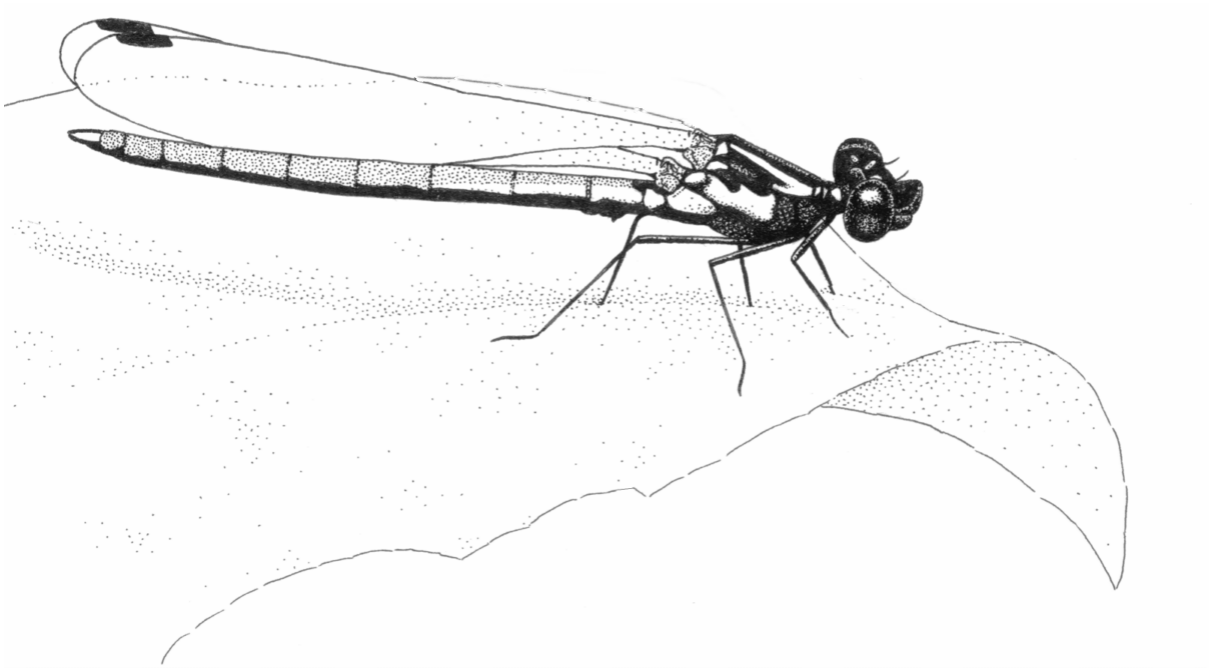

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BATHING BEHAVIOUR IN SPOTTED HYENAS (*CROCUTA CROCUTA*) IN LAIKIPIA, KENYA: TWO OBSERVATIONAL CASES

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ABSTRACT

Homeothermic animals have regulatory mechanisms to maintain a constant body temperature in response to harsh climatic conditions. In low latitude areas near the equator, animals have adapted a coat to avoid strong UV rays, but a thick coat interferes with heat dissipation due to high daytime temperatures. Therefore, animals spend hot hours in cool shade or dens as the most common method to avoid overheating Alternatively, some animals cool themselves by bathing with sand, mud or water. Spotted hyenas (*Crocuta crocuta*) are medium-sized carnivorous animals weighing about 45–70 kg, and aredouble coated. Bathing is a well-known behaviour in spotted hyenas, but it is not clear from natural historical descriptions whether their bathing is a heat-resistant behaviour. Here we report on two bathing observation cases of hyena and describe them with reference to the heat resistance function of bathing based on the time and temperature at which observations occurred. A wild hyena of a four-headed clan inhabiting Laikipia, Kenya bathed in a pool at around 18:00 h and 9:00 h in the dry season. The temperature at 18:00 h showed largest difference from the highest annual mean temperature. The bathing at 9:00 h in the morning was the time when the temperature began to rise. These observations suggest that hyena bathing may be a heat-avoiding behaviour. Bathing also has other functions such as parasite extermination, play and ambush hunting, hence more observations are needed in the future.

Keywords: heat resistance behaviour, double coat, body size, air temperature, hunting

INTRODUCTION

Recently, due to growing interest in global climate change, studies on thermoregulatory mechanisms in homeothermic animals regain attention more than ever (*e.g.* Jessen, 2001; Tattersall *et al.*, 2012; Ryding *et al.* 2021). When the body temperature becomes too high not only in humans but also in animals, the balance of water and salt in the body is lost and symptoms of heat stroke (various symptoms such as an increased body temperature, dizziness, convulsions, and headache) occur. The amount of heat released from the body is affected by body size: the larger the body, the smaller the surface-area-to-volume ratios, making it difficult for heat to be released (Taylor, 1969). Hair provides strong UV protection and regulates the temperature differences that tend to occur in dry areas (heat dissipation in hot hours and heat retention in cold hours). Especially in large terrestrial mammals such as elephants and rhinos, it is thought that they have lost/reduced hair because the body does not release enough heat (Wheeler, 1985; Williams, 1990). On the other hand, animals with hair (sometimes it is a very thick coat) need to avoid heat stress in other ways (Fuller *et al.*, 2014). The most common way to withstand heat is to spend hot hours in cool places (*e.g.* Arabian oryx, *Oryx leucoryx* (Pallas, 1777); Hetem *et al.*, 2012). Others include cooling the body by sandbathing, wallowing, or water bathing (*e.g.* elephants; Dunkin *et al.*, 2013; Weissenböck *et al.*, 2012). In livestock, huge amounts of research have been done because heat stress reduces animals' productivity, which directly links to the human economy, but the relationship between these behaviours and temperature has been rarely studied in wild animals.

Here we report on the heat-resistant function of spotted hyena *Crocuta crocuta* (Erxleben, 1777) water bathing based on the time of occurrence and temperature in two observation cases. Spotted hyena are medium-sized carnivores weighing about 45–70 kg and are currently distributed in sub-Saharan Africa and their habitat is mainly in tropical arid environments (semi-desert, savannah, arid forests, mountain forests)

(Mills & Hofer, 1998). The oldest known record (Stott, 1959) reported that hyenas bathed in the lake and stayed in the water for more than 30 min without swimming. Nowadays, a half-bathing of spotted hyenas in small ponds or pools is a known behaviour for observers both in the wild and in captivity. However, the behaviour of water bathing has not received sufficient attention, not only in hyenas but also in sympatric hairy wild animals. This is the first report of the time and air temperature of bathing behaviour in wild hyena.

MATERIALS AND METHODS

We studied the relationship between wild olive baboons *Papio anubis* (Lesson, 1827) and their predators at Mpala Research Centre, part of a private conservancy in Laikipia County, central Kenya (0°20'N, 36°50'E; Figure 1-a). The surrounding environment included bushed woodlands dominated by *Acacia* spp (for more details on the study site, see Isbell *et al*., 2018).

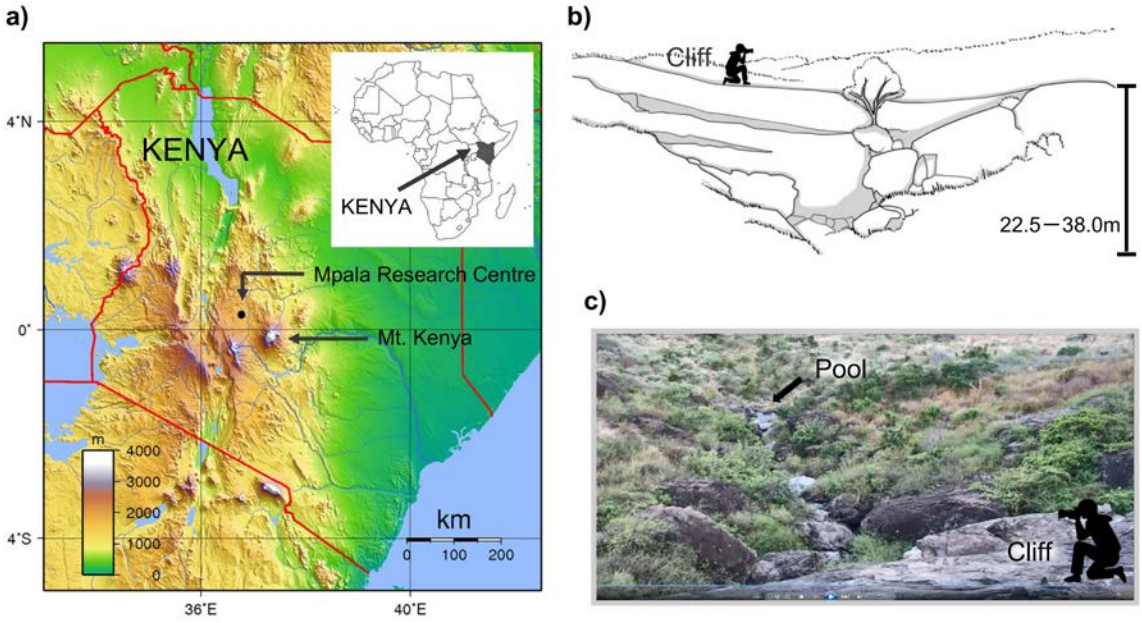


Figure 1 The location of the research site. a) Geographical location of the Mpala Research Centre, Laikipia, Kenya. b) The observation place (the Baboon Cliff) and its height. c) The distance from the cliff to the pond where the hyena bathed (210 m).

We visited the top of the Baboon Cliff, which was the sleeping site of a group of baboons, around 6:15 h and 16:00 h, and made observations there while the baboon group stayed (figure 1-b). The height from the top to the bottom of the cliff was 22.5–38.0 m, and rocks of various sizes were scattered in bushes under the cliff. Topographical restrictions prevented human observers from directly tracking wildlife in the area below the cliffs. The data collection periods on the cliff were between 13 July–27 August 2019 (19 h 36 min) and between 19 February–10 March 2020 (22 h 19 min). Observations were mainly recorded by a Sony DSC-HX 400V camera.

Rainfall and temperature were recorded at 15-min intervals at the Mpala Research Camp (Caylor *et al*., 2019), at a straight-line distance of 2150 m from the Baboon Cliff. Temperature readings were taken at the beginning of every hour.

RESULTS

Hyena observation during July–August 2019

A clan of four spotted hyenas (an adult pair and two cubs) was observed living in a rock gap just below the Baboon Cliff. After we arrived at the cliff every morning at around 6:15 h and in the evening around 16:00 h, we checked whether the hyenas were out of the den. The cubs often sat outside the den and never ventured far away. No hyenas were observed bathing in any of the pools during the period.

Water that flowed down from the pond closest to the cliff edge created some pools between the rocks in the wet season but, only a few ponds remained on and below the cliff during this time.

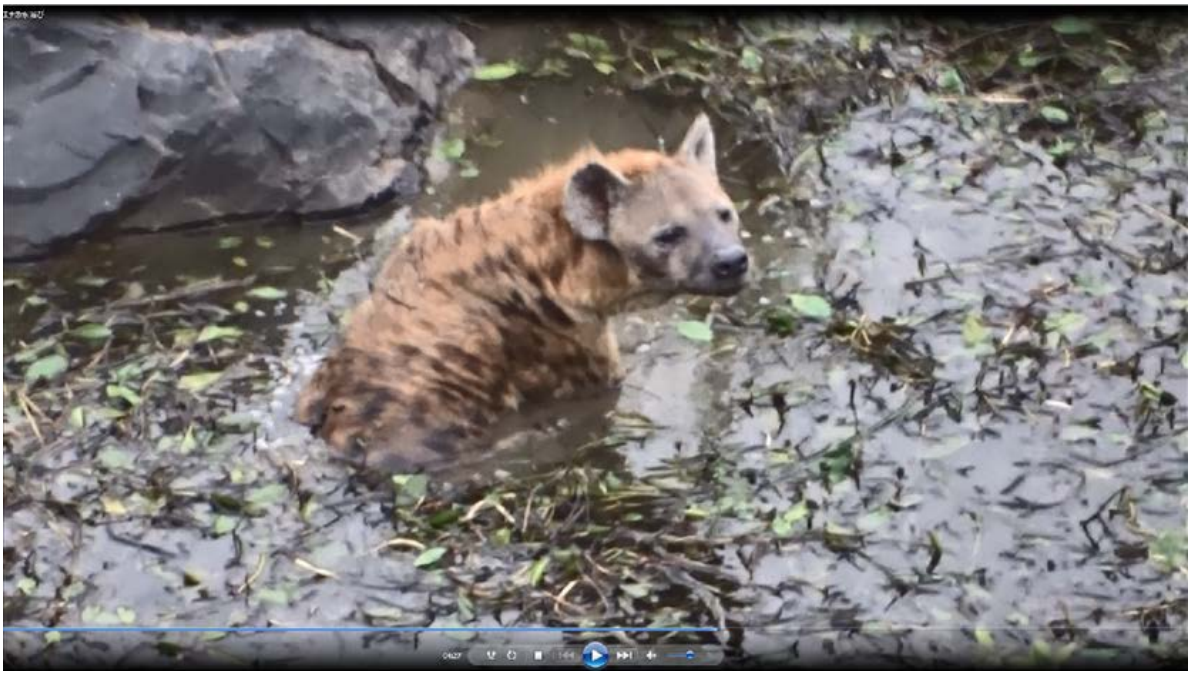
Hyena observation during February–March 2020

Case I. 4 March 2020. Observed from the top of the Baboon Cliff

Four hyenas of one adult pair and two cubs lived in the same den. Because weaning in spotted hyenas occurs at an average age of 13.4 (range 7–21) months (Boydston *et al*., 2005), it was estimated to be the same clan as in 2019. All the streams had disappeared, and a few ponds remained on and below the cliff.

18:16 h The largest hyena bathed in a pond (figure 2-a) at a distance of 210 m straight on the map from the edge on the cliff (figure 1-c, 2-a).

18:21 h The hyena got out of the pond and left through the bush to the den. Two cubs were out of the den.



a)

b)

Figure 2 Photographs of hyena bathing at Mpala Research Centre, Kenya. a) An adult hyena soaking in a seasonal pool on 4 September 2020 at 18:16 h. b) Three of the clan came to the pond where the same hyena was bathing on 9 September 2020 at 09:02 h.

Case 2. 9 March 2020. Observed from the top of the Baboon Cliff

09:00 h The largest hyena bathed in the pond.

09:02 h A smaller cub came to the pond and drank water (figure 2-b). The cub approached the large hyena and had only his feet in the water. A bigger cub also came and drank water at the edge of the pond. Another adult hyena was looking around near the pond.
09:03 h The largest hyena came out of the pond and moved south, followed by the three hyenas.
09:04 h An adult hyena carried the paw of a dead animal in its mouth and went eastward.
09:21 h The largest hyena lay in the bush.
09:24 h The smaller cub came back to the pond, drank water, and moved in an eastward direction.
09:45 h The largest hyena bathed again in the pond.
09:46 h The hyenas moved to the direction eastward.
During the observation, the baboons stayed at a distance of about 5 m from the hyena when it was closest.

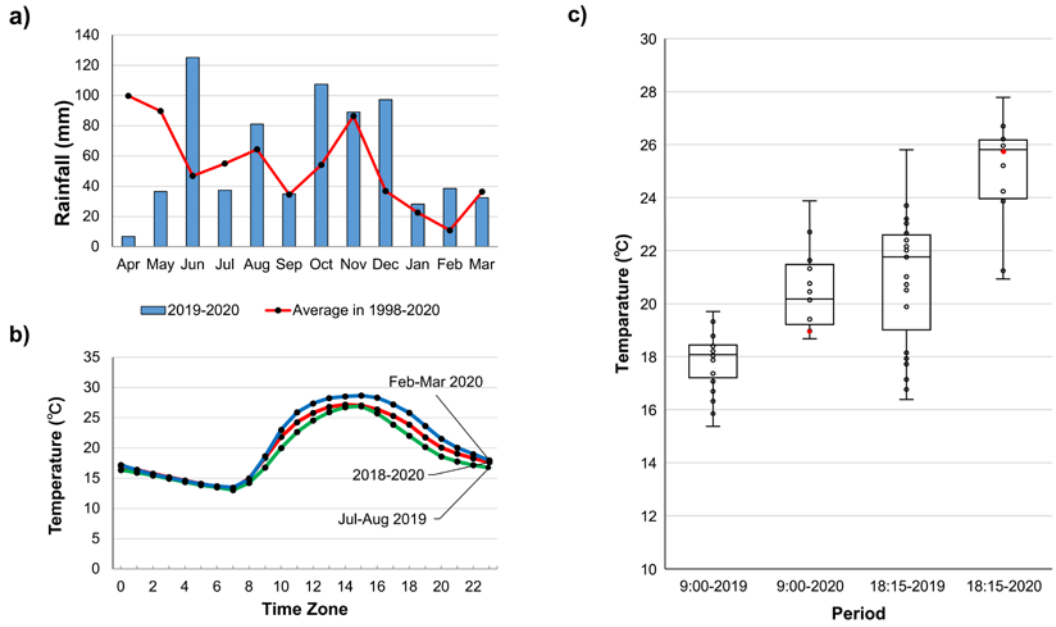


Figure 3 a) Monthly rainfall at Mpala Research Centre, Kenya. January–March is the driest season in this area, and June–September is the second driest. b) The monthly temperature. c) Daily temperature at 9:00 h and 18:15 h. The dots are the temperature on each observation day, and the red dots are the days when hyena bathing was observed. The middle line of the box graph shows the median temperature, the top line shows the 3/4 value, and the bottom line shows the 1/4 value.

Both observation periods were in the dry season in this area (figure 3-a, Rubenstein, 2011). The hourly temperatures from February to March 2020 were higher throughout the day than the hourly temperatures from July to August 2019, but both periods showed similar curves (figure 3-b). The temperature was lowest at 7:00 h, then rose sharply, peaked at 15:00 h, and consistently and gradually decreased. The temperatures at 9:00 h and 18:15 h, when bathing was observed, were significantly higher in February–March 2020 than in July–August 2019 (Exact Wilcoxon rank sum test, at 9:00 h: $W=13.5$, $p<0.001$; 18:15 h: $W=37$, $p<0.001$, figure 3-c). The temperature at 18:15 h on 4 March was the lowest during the period (25.87 °C), and that at 9:00 h on 9 March was in the middle (18.68°C).

DISCUSSION

The only individual bathing in the pool during the observations was the largest hyena. Generally, male mammals have larger bodies than females of the same species, but spotted hyenas may be one of the rare species of mammals in which females are generally larger than males (Swanson *et al*., 2013). According to this rule, it is likely that this individual was a female.

One of the functions of animals' bathing is to reduce heat load (Breed *et al*. 2019; Hayward & Hayward, 2007). Spotted hyenas have a double coat: the under hairs are coarse, woolly, and consist of moderately fine hairs of 15–20 mm long, and the over hairs are tough, flat bristles of 30-40 mm long (Mills & Hofer, 1998). This thick, long, and dark coat may cause an increase in heat load during the day, which can reduce daytime

activity in hyenas and promote nocturnal preference. Spotted hyenas are more commonly active at night, and around dawn and dusk than during the heat of noon even if they can be active at any time of day (Holekamp & Dloniak, 2010). In our study, the average temperature of the month when the hyena bathed was higher than the average monthly temperature of other years. Microclimate, the near-ground climate that organisms actually experience, directly affects the thermal state of animals (Fuller *et al.*, 2016). Moreover, the hyena bathing on 9 March seems to be doing so after a successful hunt. The two observations in our study suggest that the hyena released heat risen by air temperature and/or exercise into the water.

Other hypotheses about bathing function in terrestrial mammals include ectoparasite removal by keeping the hair clean (Loehle, 1995), play (Kruuk, 1972) or ambush hunting (Child & Robbel, 1975). In addition, some species, such as African and Asian elephants, which lack sebaceous and sweat glands, require regular skin wetting (Lillywhite & Stein, 1987). The reason why only the largest hyena bathed may relate to factors such as body size, age, or individual learning of bathing. In the future, more detailed quantitative data will be needed to consider those hypotheses and the question.

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