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Source: *Ursus*, 2021(32e7) : 1-5

Published By: International Association for Bear Research and Management

URL: <https://doi.org/10.2192/URSUS-D-20-00015.2>

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Burying of dead cubs by a brown bear in Greece: Food caching or ‘grief’ behavior?

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Abstract: Understanding animal behavior is essential for the conservation of endangered species. We document the case of a female brown bear (*Ursus arctos*) burying her 2 cubs-of-the-year, following their death in a car accident in May 2020 in the Prefecture of Kastoria, northern Greece. Both cubs were partially buried, half-covered with earth in an open field. We explore the circumstances and causes of this unusual behavior in relation to 2 potential explanations: caching of food and ‘grieving.’ Although the evidence collected is not conclusive enough to accept either of the 2 explanations, we report this observation to draw attention to this type of behavior in brown bears in the wild and hope that it will serve as a source for motivating future research.

Key words: behavior, brown bear, burying, emotion, food caching, Greece, grief, *Ursus arctos*

DOI: 10.2192/URSUS-D-20-00015.2

Ursus 32:article e7 (2021)

Numerous studies have demonstrated the inextricable link between animal behavior and conservation biology and that animal behavior can be applied successfully in the conservation of biodiversity (Berger-Tal et al. 2011). Understanding animal behavior is particularly important for species that are endangered and in urgent need of targeted conservation actions (Festa-Bianchet and Apollonio 2003).

Brown bears (*Ursus arctos*) are classified as endangered in Greece, but the population has been showing signs of genetic (Karamanlidis et al. 2018), demographic (Karamanlidis et al. 2015b), and range (Bonnet Lebrun et al. 2019) recovery since about 2000. A thorough un-

derstanding of the behavior of the species in the country could be useful in developing effective conservation measures that will support this ongoing recovery. We report the unusual incident of a female bear partially burying her dead cubs, which was recorded by the Bear Emergency Team (BET; i.e., intervention team officially tasked by the Hellenic State to mitigate human–bear conflicts) in the Prefecture of Kastoria, northern Greece (40°32′31.2″N, 21°19′45.6″E). The observation occurred in an area of high human activity (i.e., several smaller human settlements, a major city of >45,000 residents, and intense agricultural activities), where major land-cover types include sparse lowland oak (*Quercus* spp.) forests and agricultural fields.

On 17 May 2020, the BET was alerted to a bear–vehicle collision. From the inspection of the site and over the course of the next 2 days, the BET managed to reconstruct the course of events as follows: • At 0245 hours a driver encountered an adult bear wandering around a bear cub lying dead on the pavement at the collision site (Fig. 1A). When the driver stopped to take a photograph, the adult bear moved aggressively toward the car.

• At 0930 hours the BET was officially alerted to the incident.

• Upon arrival at the area at approximately 1030 hours, the BET identified the collision site from a small pool of fresh blood on the pavement (Fig. 1B). The BET found a bear cub partially buried in an open, recently plowed field, approximately 50 m from the collision site. The bear cub was buried partially under the ground, partially covered by earth (Fig. 1C), and had sustained severe injuries to the left front leg, the thorax, and the abdomen, with the intestines protruding (Fig. 1C). Numerous footprints and claw marks were found around the ‘burial’ site and throughout the field, suggesting that the bear cub had been buried by a bear. No other claw marks, footprints, or tracks from humans or any other wildlife were found at the ‘burial’ site. At 1130 hours the dead cub was transported to the Veterinary Service of the Prefecture of Kastoria for inspection and subsequent disposal.

• At 1200 hours the BET was alerted again to the presence of a second partially buried cub near where the first one had been, in the same field.

• Upon arrival at the collision site at 1330 hours, the BET encountered a second cub buried in the field, approximately 120 m from the collision site and 80 m

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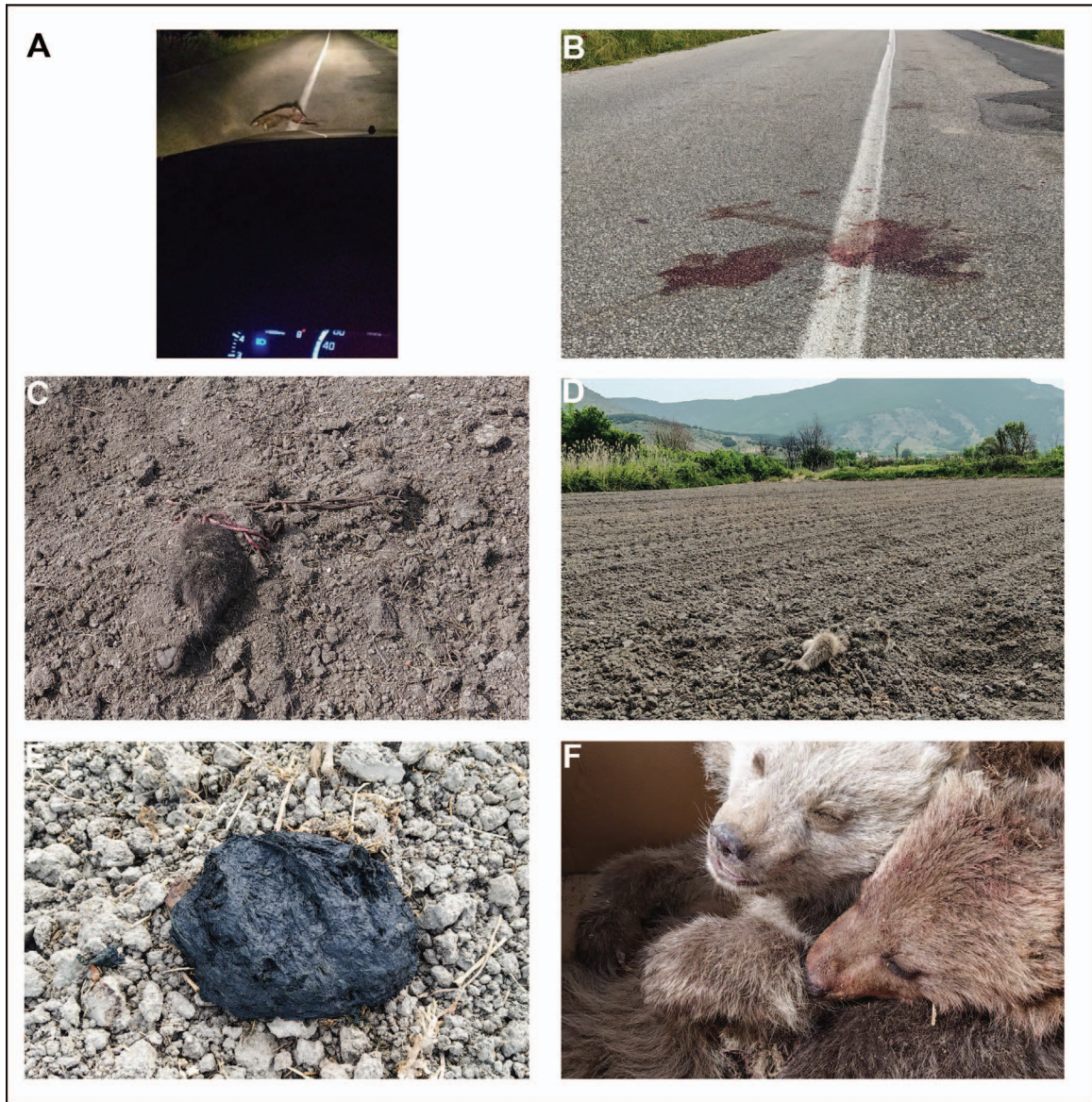


Fig. 1. (A) A brown bear (*Ursus arctos*) cub-of-the-year killed in a vehicle collision in northern Greece—Photograph taken at approximately 0245 hours on 17 May 2020; (B) The collision site at 1000 hours; the bear cub has been removed and only a pool of blood remains; (C) ‘Burial’ site of the first bear cub; (D) ‘Burial’ site of the second bear cub; (E) Fresh bear scat with grass, near the ‘burial’ site of the second bear cub; (F) The 2 bear cubs at the Veterinary Service of Kastoria (Photos:[A] © Ntavatzidis; [B–F] © Panagiotopoulos).

from the first buried cub. The second cub was buried in the same fashion as the first one (Fig. 1D). No external injuries were visible and postmortem rigidity had not yet set in. Numerous footprints and claw marks around the ‘burial’ site suggested that the second cub also had been buried by a bear; again, no other claw

marks, footprints, or tracks from humans or any other wildlife were found at the ‘burial’ site. Upon thorough inspection of the field, 2 fresh bear scats containing grass were found (Fig. 1E).

• A thorough inspection of the cubs at the Veterinary Service (Fig. 1F) indicated that the 2 female cubs-of-the-

year, each of approximately 5 kg body mass, had died from injuries that were consistent with a vehicle collision (i.e., multiple fractures and internal bleeding). From the stiffness of the carcasses, a 3–4-hour difference in the time of death was speculated, with the first cub with the several and more severe injuries believed to have died first.

It should be noted that a questioning of the person who found the bear cubs (who was also the owner of the field where the cubs had been buried) revealed that at 0600 hours on 17 May, 1 of the 2 cubs was still lying on the pavement. A day later, on 18 May 2020 the same person reported observing an adult bear, possibly the mother of the cubs, wandering in his field.

From the information that the BET collected, we conclude that, following a collision with a vehicle sometime in the late hours of 16 May to the early hours of 17 May 2020 that resulted in the death of 2 female brown bear cubs of the year, a bear carried ≥ 1 of them and buried both of them in a nearby, open field. Considering the short timeframe between the assumed time of collision and the arrival of the BET to the collision site, the documented presence of the mother bear in the area, and the lack of tracks from another species at the ‘burial’ site, we believe that it is unlikely that the cubs were buried by an unrelated bear or cached by another predator and speculate that they were most likely buried by the cubs’ mother. In an attempt to understand the circumstances and causes of this behavior, we elaborate about what we view as the 2 most parsimonious potential explanations: caching of food and ‘grieving.’

Caching of a food source

Caching of food has been developed as an evolutionary strategy to preserve food for later use, while minimizing detection by competitors (Smith and Reichman 1984, Cristescu et al. 2014). It has been recorded in numerous species, including polar bears (*Ursus maritimus*; which cache bodies of various seal species systematically and belugas [*Delphinapterus leucas*] and conspecifics opportunistically; Stirling et al. 2020) and brown bears (Elgmork 1982, Clevenger et al. 1994, Cristescu et al. 2014). Food-caching behavior in bears is generally influenced by prey size (i.e., medium to large prey is cached more often; Cristescu et al. 2014, Stirling et al. 2020), and caching sites are chosen to minimize detection risk (Cristescu et al. 2014). In the case of the unusual burial behavior in Greece, none of these 2 options apply because the bear cubs were small in size and were buried in the middle of an open field and, thus, could easily be

detected. Even if we accept that the burying was performed hastily as a result of the increased presence of humans (i.e., the BET) in the area, caching on this occasion would have involved conspecifics. Caching in brown bears has been documented so far only for ungulates (Elgmork 1982, Clevenger et al. 1994, Cristescu et al. 2014) and never for conspecifics. Although natural foods are available in sufficient quantities in Greece during spring, they are often nutritionally deficient, which may result in bears having difficulty maintaining their weights until late summer and autumn when higher quality foods become available. If the grass scats found at the burial site are an indication of consumption of nutritionally deficient foods, then this incident could indicate that the female bear might have cached her dead cubs with the intent of consuming them later. Although intraspecific predation has been recorded in brown bears (Swenson et al. 2001, Karamanlidis et al. 2015a), it has never been recorded among related individuals (i.e., mother–offspring) in the wild.

‘Grief’

There is mounting scientific evidence from both observational and experimental studies that suggests that at least some animals have deep, rich, and complex emotional lives (Bekoff 2000). This recognition has led in turn to an increased interest in understanding the effects of the death of a conspecific on the emotions and behavior of animals (i.e., the scientific discipline known as ‘comparative thanatology’; Anderson 2016). Postmortem behavioral responses have been observed, in varying forms, in several mammalian species, notably primates (e.g., Barbary macaques [*Macaca sylvanus*, Campbell et al. 2016], gorillas [*Gorilla beringei*, Porter et al. 2019]), but also in nonprimate mammals (e.g., dingos [*Canis lupus dingo*, Appleby et al. 2013], dolphins [e.g., several species of the family Delphinidae, Bearzi et al. 2018], African bush elephants [*Loxodonta africana*, Poole 1998]). The postmortem behavioral responses of chimpanzees (*Pan troglodytes*), which have often been compared to the anthropomorphic behavior of ‘grieving,’ have received increased scientific attention recently (Anderson 2016). While ‘grieving,’ the survivor may alter his or her normal behavioral routine (King 2013). We speculate that the unusual burial behavior of the female bear might constitute such a change in her normal behavioral routine. Opportunistic observations of the dragging of corpses and the partial burying of conspecifics (including offspring), not related to the caching of food sources, also has been

reported for European badgers (*Meles meles*; Wildlife Online 2020).

In accordance with the health safety protocols in place for such incidents, the buried cubs were removed from the burial site, thus depriving us the opportunity to closely monitor the behavior of the mother in the days following the incident. Therefore, the data collected are not conclusive enough to accept either of the 2 suggested explanations. In the case of caching food, the incident in Greece differs from the typical caching of food in brown bears because it involves the burial of a related conspecific, of small size, and in a rather easily detectable location. In regard to 'grieving,' little systematic empirical research has been devoted to the study of animal emotions (especially in free-ranging animals), and therefore our understanding of these processes is still rudimentary. Further comparative research in neurobiology, endocrinology, and behavior is necessary in order to better understand the subjective nature of animal grief and evaluate whether the incident here constitutes such an event (Bekoff 2000). Despite not being able to provide a conclusive explanation to this observation, we consider it important to report it in order to draw attention to this type of behavior of the brown bear in the wild, and hope that it will serve as a useful source for motivating future research.

Acknowledgments

We thank the Police and Forestry Department and the Veterinary Service of the Prefecture of Kastoria for field assistance and A. Zedrosser and D. Huber for the insightful discussion that inspired the writing of this paper. J. Beecham, the Associate Editor, and 3 anonymous reviewers provided comments that improved the quality of the manuscript.

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Received: May 26, 2020

Accepted: August 3, 2020

Associate Editor: A. Sergiel