

Original paper

A *Meles anakuma* mother and two cubs appeared in an urban Okayama City area for three months in summer 2021

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Abstract: Japanese badgers (mother and two cubs) were observed in an urban residential area in Okayama City in summer 2021 for three months. It was the first prolonged occurrence of the species in the area. The badgers, being basically nocturnal, were also active during the daylight hours only until midsummer. They bathed in water on hot days (> 30℃) in daylight hours and at night. They captured and ate live adult cicadas (*Cryptotympana facialis*) fallen on the ground as well as cicada nymphs and earthworms underground. The abundance of cicadas in the house lot with large trees and shrubs could be a reason for the badgers' visit there. The concurrent COVID-19 pandemic, resulting in a sharp drop in the number of passing people and vehicles on the nearby campus of a university, could be another factor. Given the continued population aging in the country, conflicts between badgers and humans are feared to increase.

I. Introduction

Ministry of Agriculture, Forestry and Fisheries (2018) has included the Japanese badger *Meles anakuma* in "Wildlife Damage Prevention Manual" (https://www.maff.go.jp/j/seisan/tyozyu/higai/manyuaru/manual_tyuugata_jyuurui/180330-4.pdf; downloaded October 4, 2021) with no threatened species status nationwide ("Ministry of the Environment Red List 2020, Mammals"; https://www.env.go.jp/press/files/jp/114457.pdf; downloaded October 4, 2021). Egi et al. (2011) and Konno and others in charge of mammals in Okayama Prefecture Wild Fauna and Flora Survey Study Group (2019) recorded the species to inhabit wooded areas throughout the prefecture. However, its occurrence in urban populated areas is uncommon.

On August 7, 2017, I observed a badger before my eyes to pass by my house for the first time in my residence there since 1999. The house lies in an urban residential area, Tsushima-Niino in Okayama City, on a flat terrain (5 m a.s.l.) between Okayama University Tsushima Campus (OUTC) and Okayama Prefectural Multipurpose Grounds (Fig. 1). Since then, traces of occurrence of the species, e.g. digging of the ground as well as sniffing and foraging under fallen leaves, have been occasionally noticed in the backyard. However, the situation changed in July 2021. A mother and two cubs appeared in the house lot. This article briefly reports the monitoring of their visit there for three months since then from July to early October 2021 using camera traps.

II. Study site and methods

OUTC is divided into three sectors by a set of T-junctioned roads. The east-west road separates the northern OUTC from the rest, and the north-south road divides the rest into the southeastern and southwestern blocks. Both roads are two-laned and hinder sizable mammals from easy crossing. In the aerial photo map (Fig. 1), farther south of the southwestern OUTC for Faculty of Agriculture, Tsuhima-Niino lies in the rectangular block overlaid by the lettering of "Tsushima-Niino" largely covered with buildings, concrete and asphalt.

The small backyard (about 10 m x 6 m in area) in the house lot in Tsushima-Niino has shrubs in the hedge and stands of four naturally grown trees (three *Celtis sinensis* and one *Aphananthe aspera*, both Cannabaceae) with diameters over 25 cm at breast height. There earthworms and land snails live under and on fallen leaves. Cicada nymphs live underground depending on the tree and shrub root systems.

For recording, a camera trap "Cam1" (TREL 20J, GISupply, Inc.) was set on July 12, targeting at the animals' in and out from under the house. Another set of same model camera trap ("Cam2") was added to record their behavior in the backyard on July 17. The camera traps captured photos

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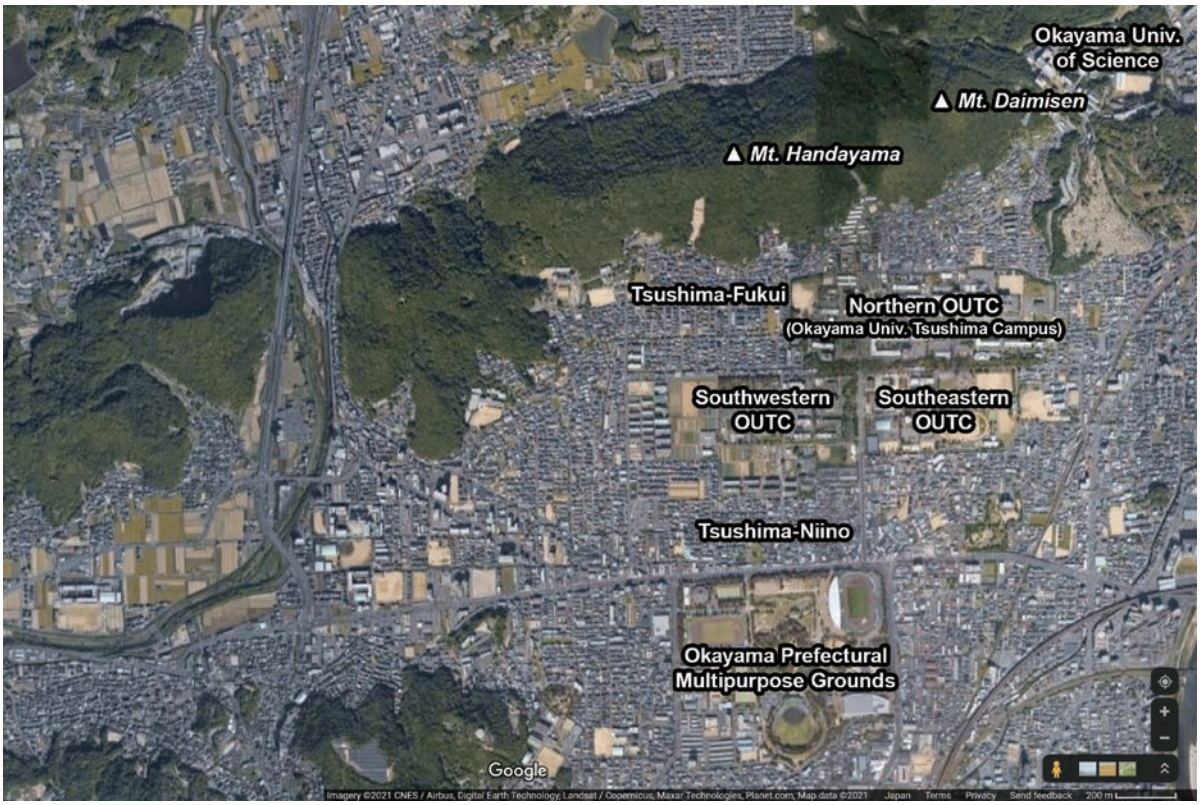

Fig. 1. Aerial photo map overviewing the occurrence site. Tsushima-Niino lies in the rectangular block overlaid by the lettering of "Tsushima-Niino" largely covered with buildings, concrete and asphalt. Google Map data: (C)2021 CNES / Airbus, Digital Earth Technology, Landsat / Copernicu, Maxar Technologies, Planet.com.

with date, time, and temperature. The two camera traps were distanced less than four meters from each other. Following the photo capture of wet fur coat on a badger on August 26, a shallow tray (30 cm W, 21 cm L, 6 cm H) filled with water was set in front of Cam2 after August 4, when the SD card and batteries for recording were replaced.

III. Background supplementary notes

Beside the badger, ten mammal species have been recorded to occur in the forested area along the hill ridges (Mt. Handayama, peak 152 m a.s.l., and Mt. Daimisen, peak 160 m a.s.l.; colored "forest" green in Fig. 1) lying 1-2 km northwest to northeast of Tsushima-Niino : sika deer (*Cervus nippon*) (Seike et al. 2014), wild boar (*Sus scrofa*), red fox (*Vulpes vulpes japonica*), racoon dog (*Nyctereutes procyonoides*), marten (*Martes melampus melampus*), weasel (*Mustela sibirica coreana*), hare (*Lepus brachyurus*), field mouse (*Apodemus speciosus*), mole (*Mogera wogura*), and rarely passing macaque (*Macaca fuscata*), besides accidental occurrences of non-native mammals in the area (e.g. copypu and racoon) and pet escapees presumably not-established [e.g. hedgehog and ferret; Okayama Prefecture Wild Fauna and Flora Survey Study Group (2020)].

Around 2010, feces, traces, and setts of badgers began to be found on the campus of Okayama University of Science (OUS), which lies northeast of the Mt. Daimisen forested area (Fig. 1). A peculiar soldierfly (*Ptecticus aurifer*) dependent on the badger feces has been noted on the campus (Sakuraba et al. 2016). On March 21, 2017, Mr. H. Konno at OUS Department of Zoology recovered a roadkill specimen (male) with a stomach full of earthworms on the east-west road through OUTC. At least since 2018, Okayama University equestrian club students have frequently seen badgers at the manure pile beside the barn in the northeastern corner of the northern OUTC. There the badgers forage for earthworms. On November 20, 2018, a licensed trapper culled a badger in Tsushima-Fukui, north of OUTC, after the animal damaged home gardens in the area (Ms. N. Oniki, pers. comm.).

In the northern OUTC, on May 20, 2021, Dr. K. Nakahori (pers. comm.) at Okayama University Faculty of Science video-recorded a mother badger with swollen breasts visiting his beehive in the daytime. She was apparently in the nursing stage. She could be the very mother who appeared at the house, though not confirmed even after close examination of the photos and video clips

Fig. 2. Two cubs by the house in daylight (July 15, 14:04).

Fig. 3. Footprints on the mud in a ditch between houses (July 16).

for identification.

IV. Observasions

On the afternoon of July 7, 2021, vocal sounds of an animal, "cub squeak" (http://www.badgerland.co.uk/animals/voice_detailed.html; retrieved 18 August 2021) in retrospect, were noticed under the house. Traces of digging were found in many spots on the ground in the house lot. Digging was made to enlarge openings prepared by cicada nymphs for emergence, besides traces of sniffing and foraging under fallen leaves. Five species of adult cicadas (*Platypleura kaempferi*, *Cryptotympana facialis*, *Graptopsaltria nigrofuscata*, and *Meimuna opalifera* in the order of their appearance) were identified by their sounds on the trees in the yard during the summer. *C. facialis* was the most numerous.

Cam1 captured images (photos and video clips) of badgers on July 12, 13, 14, 15, 18, 19, 21, 23, 24, 26, 28, 29, 30, 31, August 1, 2, 3, 4, 6, 7, 8, 11, 13, 22, 26, 30, September 3, 5, 6, 13, 14, 15, 16, 17, 18, 20, 21, 22, 23, 24, 25, 26, 30, October 1, 3, 4, and 8. Cam2 captured badger images on July 17, 18, 19, 21, 23, 24, 25, 26, 27, 28, 29, 30, 31, August 2, 3, 4, 6, 10, 11, 12, 13, 14, 17, 18, 20, 21, 22, 24, 26, 28, September 5, 6, 8, 9, 10, 12, 14, 15, 16, 17, 18, 20, 21, 22, 24, 25, 26, 28, 29, 30, October 3, 4, and 8.

Occasionally the camera traps malfunctioned owing to misoperation and low batteries, although such troubles became rare as I got used to the device. In the 90-day period (from July 12 to October 11, 2021), neither camera trap recorded any badger on 20 days (22%): July 16, 22, August 9, 15, 16, 23, 29, 31, September 1, 2, 4, 11, 19, 27, October 2, 5, 6, 7, 9, and 10. The number of days with camera trap records in each month (July, 18/20 = 90%; August, 25/31 = 81%; September, 24/30 = 80%; October, 5/11 = 42%) indicated a gradual decline in the badgers' appearance in the house lot. The trend could be seasonal, although it cannot be conclusive at least until next summer.

The following are notable incidents and records:

- July 12, Cam1 captured some images of the animals. They turned out to be badgers. One of the animals, the mother, had swollen breasts in nursing. My wife was disappointed to have her hydrangea pots overturned. Their in and out from under our house indicated their use of the space there.
- July 14, a photo recorded at 04:45 was obtained, showing the animal moving toward under the house. In the morning, our next door neighbor's wife came to us in a frenzy, asking: "What are they?" She saw three animals, an adult and two young, going under her house. During the next door neighbor's residence there for 60 years since 1962, badgers were seen for the first time. There was no noise or sign of life on the evening of the same day, but Cam1 recorded that they came out of under our house at 22:11. In other words, they moved from the next door neighbor's to under our house and rested there in the daytime.
- July 15, video clips around 13:50 recorded that badgers captured and ate at least two live adult cicadas (*C. facialis*), which happened to land on the ground. Several photos of badgers

Fig. 4. A badger with wet fur coat (July 26, 14:02). Likely after bathing in a nearby watercourse connected from the ditch between houses (Fig. 3).

Fig. 5. A cub bathing in the water tray set in the backyard (August 6, 00:23). A part of the mother's belly is captured in the upper left corner of the photo.

were recorded midday (around 14:00; Fig. 2). Video clips recorded that the two cubs tumbled and played by the house.

- July 16, footprints of an adult and cubs were clearly left on the mud in the ditch beside our house (Fig. 3).
- July 19, Cam2 recorded that they were still roaming in the backyard during the day.
- July 21, Cam1 revealed they moved during the daytime. Also they played in the yard after sunset with loud cracking noises.
- July 24, series of photos showed a plural number of animals present (the mother and two cubs). They seem to have slept under the house during the day. They dug around the yard for earthworms and cicada nymphs.
- July 25, in the morning hydrangea cuttings were found to have been pulled out of pots.
- July 26, a badger was recorded at 14:02 with its fur coat soaked wet (Fig. 4). The temperature 34℃ and the record time 14:02 likely indicate that the badger "bathed in the nearby main watercourse" through the ditch noted on July 6 just before this photo was taken. It was the last photo captured in the daylight hours by October 11.
- July 28, midnight before (27-28 July), some plastic products were heard being dragged around by the front door of the house. In the morning, it turned out that the jug left in the yard the evening before had been tipped over and emptied, water flowed onto the dry ground, and the animal drank the spilled water. Also their footprints were left on the ground.
- August 4, Cam2 recorded a cub bathing in the water tray at night. The temperature was 30℃. Also drinking from the tray was photoed. Another scene of a cub bathing in the water tray was captured on August 6, 00:14, at 32℃ (Fig. 5). A part of the mother's belly was captured in the upper left corner of the photo. In the consequent video clip, the mother striding over licked to groom the cub.
- August 6, a bag of "garden soil for vegetables" was placed on the ground of the bicycle parking corner in the evening before in preparation for the day's work, but at dawn some animals dragged it around, tore it up and threw the contents all over the place. The mother badger and cubs must have smelled the scent of earthworms in the package.

Similar camera trap records have been abundantly obtained by October 11, the end of data retrieval for the 90-day period. On October 10, enquiries in the neighborhood in the western half of Tsushima-Niino (i.e. near the area overlaid by the lettering of 'Tsushima' in "Tsushima-Niino" in Fig. 1) revealed that the badgers appeared and caused minor damages, e.g. holes dug out and fecal piles on the ground, in four house lots at least scattered all over in the western block, although with no clue to the boundary of the badger family's home range.

The observations are summarized as follows. The badgers were mainly nocturnal, and active during the daylight hours only until midsummer. On hot days (> 30℃), they bathed in water in daylight hours and at night. They captured and ate live adult cicadas fallen on the ground, and cicada nymphs and earthworms underground. Swollen breasts of the mother ceased to be noted in August.

Incidentally to prove the effect of water tray for attracting mammals and birds, Cam2 recorded a Japanese marten (*Martes melampus melampus*) drinking on several separate days (Takasaki 2022), once each a great tit (*Parus minor*) drinking and bathing, and a white-eye (*Zosterops japonicus*) drinking. Cam2 also once recorded a passing Siberian weasel (*Mustela sibirica coreana*).

V. Discussion

The annual breeding cycle and activities of *Meles anakuma* in the area likely follow the patterns recorded elsewhere; nursing in spring, weaning in summer, and active in daylight hours until midsummer (e.g. Kaneko & Maruyama 2005, Tanaka 2005). However, the occurrence site is exceptionally urban. The abundance of cicadas in the house lot with large trees and shrubs could be the reason for their visit there. The definitive reasons for their appearance remain unsolved at present. Circumstantial evidences likely indicate expansion of the badger habitat as well as their increased population in the area. In addition, a sharp decrease in the traffic of humans and vehicles in Okayama University Tsushima Campus and vicinities due to the COVID-19 pandemic, which started in the onset of 2020 in Japan, may have facilitated their spread.

In June 2021, Prof. S. Katayama at OUS Department of Life Science, resident in the suburban Seto area in the same Okayama City, saw a badger in his residence. He has known the area since his school days almost 50 years ago with a blank period of 17 years away home, and continually ever since he returned in 2001. It was his first observation of the species in life. Okayama City Government included the badger among the pest animals in 2018, for which the incentive for culling is granted (https://www.city.okayama.jp/jigyosha/cmsfiles/contents/0000016/16858/1.pdf; downloaded September 30, 2021).

Also in vast suburban residential areas in Kagoshima City, southern Kyushu, where I have many friends and relatives, badgers are known to occur now at least in Meiwa, Toso, Tagami, Murasakibaru, Usuki, and Kôtokujidai (pers. comm. from various informants, 2021). They roam in home gardens and sometimes live under houses. In some areas, omnivorous badgers scavenge for garbages. On July 10, 2020, Kagoshima City Government announced warnings concerning damages caused by badgers to the citizens (https://www.city.kagoshima.lg.jp/kankyo/kankyo/hozen/anagumanomokugekijouhou.html; accessed 30 September 2021). Half a century ago, under heavy culling and hunting, this situation could have been undreamed of.

The badger population has likely increased recently in some habitats despite the reportedly shrinking population trends (Kaneko et al. 2016). Although excessive culling of Japanese badgers is alarmed (Kaneko et al. 2017), the present situation has reached the level that conflicts with humans will likely occur in some regions. Fast human population aging is ongoing in the country. Empty or abandoned houses are increasing not only in underpopulated backcountries but also in populated urban areas. The number of hunters and trappers are in a sharp decline. Such are likely factors aggravating the present state of wildlife animals, including the badger, in Japan.

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高崎浩幸：2021年夏，岡山市街住宅地にニホンアナグマ（母＋２幼獣）が３ヵ月間にわたって出没

要約

2021年夏，　岡山市街住宅地でニホンアナグマ親子（母＋２幼獣）が３ヵ月間にわたって観察された．この地域で本種がこれほど長期にわたって見られたのは初めてである．基本的に夜行性のアナグマではあるが，真夏の昼間にも活動し，暑い（> 30℃）日中や夜間に水浴びした．地面に落下した生きたクマゼミの成虫や地中にいるセミの幼虫，ミミズを食べた．高木や低木のある敷地にセミがたくさんいたことから，ここを訪れたのかもしれない．新型コロナウイルスの流行によって，近隣の大学構内の人通りが激減したことも，原因として考えられる．高齢化が進む日本では，アナグマと人間との軋轢が増えることが懸念される．

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