Rapid systematic literature review: Camera trap sampling in ecological studies: Considerations of wildlife welfare

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Appendix 1

Meta-data extracted from 20 publications of empirical research on wildlife in their natural habitat between January 2019 and June 2023. Out of 267 eligible publications, these were the ones classified as Category 2b (i.e., the authors reference the potential impact of using camera traps on wildlife welfare beyond descriptors such as 'non-invasive').

Publication	Species	Location	Time of data collection	Number of camera traps	Quote(s)	Framing	Reference(s) cited[1]
Tang *et al.* (2019)	Eurasian Lynx *(Lynx lynx*)	Saihanwula Nature Reserve in Central Inner Mongolia, China	2014–2017	50 digital cameras	"lynx did not show any fear from the infrared lights and operators' odor left on the digital cameras" (p 3)	Negative	N/A
Luo *et al.* (2019)	Tibetan Snowcock birds (*Tetraogallus tibetanus*)	Mt. Gongga on the eastern edge of the Qinghai-Tibetan Plateau in Sichuan Province, China	2016	103 camera traps	"Due to disturbances from curious animals…" (p 4) → In reference to camera traps that were removed from the dataset	Negative	N/A
Anile *et al.* (2019)	European wildcat (*Felis silvestris*)	Mt. Etna Regional Park, Sicily, Italy	2015	91 cameras traps	"wildcat detections can decrease along with an increase in the effort if a trap-shy response occurs" (p 5)	Negative	Wegge *et al.* (2004)
Ünal *et al.* (2019a,b)	Caracal (*Caracal caracal*)	Düzlerçamı WRA, in the Mediterranean region of	2015–2017	32 camera traps	"avoid camera trap locations on the days that they are visited by people" (p 6)	Negative	N/A

	Fallow Deer (*Dama dama*) Wild Boar (*Sus scrofa*)	southern Turkey, in Antalya city					
Satter *et al.* (2019)	Ocelot (*Leopardus pardalis*)	Belize, Central America	2002–2016	227 camera trapping stations	"Although, it is possible that ocelots did exhibit some type of behavioral response to capture, this would be surprising given that camera traps were not baited" (p 292)	Positive	N/A
Edwards *et al.* (2019)	Brown Hyena (*Parahyaena brunnea)* Leopard (*Panthera pardus)*	Okonjima Nature Reserve, North-central Namibia	2018	40 camera trap stations	"Behavioural response to a camera trap was not expected, as camera traps as passive detectors placed at naturally occurring latrine" (p 522) "models […] influenced by reaction to a camera trap were not considered" (p 522)	Positive	N/A
Palmero *et al.* (2021)	Eurasian Lynx (*Lynx lynx*)	Bavarian Forest National Park and the Šumaza National Park in the Bohemian-Bavarian Forest Ecosystem in Central Europe	2009–2018	79 trap stations with one or two cameras each	"non-invasive devices allow simultaneous monitoring of different species and help to avoid stressful animal immobilisation" (p 2)	Positive	Noss *et al.* (2003)

Jayasekara *et al.* (2021)	Meso-mammal Carnivore community (Fishing cat *Prionailurus viverrinus;* Rusty-spotted cat *Prionailurus rubiginosus;* Jungle Cat *Felis chaus;* Ring-tailed civet *Viverricula indica;* Golden palm civet, *Paradoxurus zeylonensis;* Stripe-necked mongoose *Urva vitticollis;* Ruddy mongoose *Urva smithii;* Brown mongoose *Urva fuscus;* Otter *Lutra lutra;* Golden	Maduru Oya National Park (MONP), Sri Lanka	2019 or earlier (estimated based on date provided on photograph shown in Figure 2, p 140)	90 camera trap stations	"We especially used these flash types to reduce interference to animals" (p 139) "type of camera flash also has an impact on the behaviour and the movement speed of the animals. We highly recommend a no glow flash model […] which causes minimum interference to the animals" (p. 144) "species did not react to the cameras in a greater proportion of encounters. However, there were several instances where fishing cats and ring-tailed civets were observing the cameras in an enthusiastic nature where we had to discard some parts of the videos" (p 144) "we had to discard the capture records as behavioural changes were observed" (p 144) "elephants were highly reactive to the cameras and were often found attacking them" (p 144)	Negative	Rowcliffe *et al.* (2008)

	jackal *Canis aureus)*						
Gueye *et al.* (2021)	Western Derby eland (*Taurotragus derbianus*)	Niokolo Koba National Park (NKNP), Senegal	2017–2018	71 camera traps	"because no trapping response in the ID animals was expected as they were all photographed within the daylight period" (p 5)	Positive	N/A
Farhadinia *et al.* (2021)	Leopard *(Panthera pardus*)	Bafq Protected Area of Central Iran	2011–2012 2016	47 stations 66 stations	"We included a trap-specific behavioral response in the baseline detection model because we expected the leopard behavior to change after being detected at a specific trap for the duration of the session (bk)." (p 366) "The bk effect tested the hypothesis that leopard behavior changes after being detected at a specific site for the duration of the survey (trap response)." (p 368) "when a leopard was detected in a specific camera trap site, the probability of a subsequent encounter for the entire survey was increased, i.e., the individual became 'trap happy'" (p 368)	Negative	N/A
Rather *et al.* (2021)	Tiger *(Panthera*	Bandhavgarh Tiger Reserve	2016–2017	35 pairs of camera	"The learned response model or behavioral response model (b)	Negative	Otis *et al.* (1978)

	tigris tigris) Leopard (*Panthera pardus fusca*)	in Central India		traps	assumes that detectors (camera traps) incite a behavioral response in individuals after their first encounter with detectors. Thus the probability of capturing an individual on any later occasion is affected. Moreover, the learned response may be specific to the detector location (bk) rather than generally applying across all detectors. We considered the possibility of either sort of induced behavioral response in tigers and leopards." (p 7)		
Brommer *et al.* (2021)	White-tailed deer (*Odocoileus virginianus*)	Southwestern Finland	2016, 2017	36 trail cameras traps	"show a behavioral response (i.e., detection in a trap changes after an individual has been encountered once in that trap)" (p 5) "…a behavioral response was not supported (Table 1)"	Negative	
Hardouin *et al.* (2021)	Striped Hyena (*Hyaena hyaena*) Aardwolf (*Proteles cristata*)	Ruaha-Rungwa Landscape in Southern Tanzania	2018	111 camera trap stations	"individuals […] are not deterred by camera trap flashlights (xenon or LED flash)." (p 9) "minimises interference with their natural behaviour" (p 3)	Positive	N/A

Lombardi *et al.* (2022)	Ocelots (*Leopardus pardalis*)	Sierra Tamaulipas, México.	Summer (24 May to 28 August 2009) and fall (29 August to 9 December 2009)	23 trap stations during summer and 58 in winter: each station had one to two cameras	"observed a trap-specific behavioral response, which affected encounter probabilities" (p 62) "trap-specific behavioral responses are usually linked to lures or baits used to help increase detection in some studies, which was not the case here" (p 64)	Negative	N/A
Séguigne *et al.* (2022)	Arboreal and Flying Frugivore Vertebrates e.g. kinkajou (*Potos flavus*), Marail Guan (*Penelope marail*), Howler Monkey (*Alouatta palliata*), Brown Capuchin (*Cebus apella*), Channel-billed Toucan (*Ramphastos vitellinus*)	Eastern French Guiana	Between December 1, 2019 and January 24, 2020	24 camera traps	"standard flash photography in camera traps leads to avoidance behaviour in kinkajou" (p 7) "infrared moving sensor camera traps suggested by Schipper *et al.* (2007) minimised disruption to the foraging behaviour of the animals, as evidenced by a large number of kinkajous captured." (p 7) "primates who look at the lens, sometimes touching it (*S. apella*), but do not linger on it and do not seem bothered by camera traps when feeding" (p 7)	Negative	Schipper (2007)

Burton *et al.* (2022)	Caribou (*Rangifer tarandus*) White-tailed deer (*Odocoileus virginianus*) Moose (*Alces alces*)	70 km southwest of Fort MacMurray, Alberta, Canada	2015–2017	73 camera traps	"emphasize the potential importance of animal responses to cameras, which can influence interpretations of natural behaviors" (p 9) "assumed animal curiosity with respect to cameras would reflect secure behavior, and apprehension toward cameras would reflect risk-averse behavior […] future studies could further probe these assumptions relative to alternatives, such as neophobic responses leading to camera avoidance" (p 9)	Negative	Caravaggi *et al.* (2021) Meek *et al.* (2016)
Lovell *et al.* (2022)	Red fox (*Vulpes vulpes*) European badger (*Meles meles*)	South-west London, England	2017–2019	211 camera traps	"Camera traps can survey continuously and remotely, whilst reducing human interference compared to telemetry, despite the potential for camera traps to be detected by animals and influence behaviors" (p 2)	Negative	Meek *et al.* (2016)
Bhattacharya *et al.* (2022)	Asiatic Black Bear (*Ursus thibetanus*)	Daranghati Wildlife Sanctuary and the Rupi Bhaba Wildlife Sanctuary in the Indian Himalayan Region	May–July 2018 and May–July 2019	87 camera traps	"our study used a noninvasive method (camera traps) with minimal chance of behavioral change" (p 7) "We speculate that use of baited camera traps and hair trap stations possibly can alter the behavior and movement of the species."	Negative	Ngoprasert *et al.* (2012) Sathyakumar *et al.* (2013)

					(p 7)		
Green *et al.* (2023)	Mammal Community (12 species; for full list please see Table 1)	Northern Utah, United States	From April 28 to August 29 in 2018 and from April 13 to August 25 in 2019	343 camera sites	"Other than setting up remote sensing camera traps, no environmental manipulations, especially any that may be deemed harmful to individual animals, were needed to conduct this research. None of the animals in this study were trapped, tagged, radio-collared or otherwise manipulated in a way that would cause either distress or pain" (p 121)	Positive	N/A
Laporte-Devylder *et al.* (2023)	Arctic Fox (*Vulpes lagopus*)	Snøhetta-South Central Norway	2011–2018	21 camera trap sites	remote technologies [are] "minimizing stress and disturbance that could arise from repeated intensive fieldwork efforts" (p 215)	Positive	N/A

[1]References cited: references listed were those provided by the authors justifying their framing of the camera trap technology.

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