



# Present Distribution of the Marble Polecat *Vormela peregusna* (Güldenstädt, 1770) (Carnivora: Mustelidae) in central Western Bulgaria, with an Observation on its Defensive Behaviour

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**Abstract:** Data on the recent distribution of the marbled polecat *Vormela peregusna* in the central Western Bulgaria since 2000 are presented. The information collected suggests that the species is numerous in the study area. The significant share of registrations of individuals killed on the road shows that road traffic poses a serious threat to the marbled polecat in the area. The collected data coupled with literature data from the previous period reveal the importance of the studied area for the conservation of the species in the region. Thanatosis posture (death feigning) was described and photographed in a male marbled polecat. This observation contributes to clarification of this phenomenon and its use by mammals, in particular by carnivores.

**Key words:** marbled polecat, Mustelidae, anti-predator behaviour, thanatosis

## Introduction

The marbled polecat *Vormela peregusna* (Güldenstädt, 1770) is distributed from western parts of South-eastern Europe, through the Caucasus, Middle East and Central Asia to northern China and eastern Mongolia (MITCHELL-JONES et al. 1999). In Bulgaria, the species has a mosaic distribution throughout its territory, excluding the higher parts of the mountains and large forests; its density is highest in north-eastern and western parts of the country (SPASSOV & SPIRIDONOV 1993, SPASSOV et al. 2002). The marbled polecat is a rare and cryptic mustelid; as a result, it is poorly studied throughout its European range. Most published data on its distribution in Bulgaria come from questionnaires conducted before 2000 (SPASSOV et al.

2002). Data from the beginning of the 21<sup>st</sup> century are included in the distribution map of the species in the Red Data Book of Bulgaria (SPASSOV & SPIRIDONOV 2011). For the last decade, there are only fragmentary published data, mainly for casual registrations of the species (IVANOV & SPASSOV 2015, ZLATANOVA & POPOVA 2018). In recent years, data on the marbled polecat have been purposefully collected throughout the country in 2011 and 2012 for assessment of its conservation status in the Natura 2000 ecological network (ZIDAROVA & POPOV 2013). Out of 181 sites of Natura 2000 in Bulgaria, in whose standard data forms the marbled polecat is included, data on the species' localities were collected for a total of 31 sites.

Habitat loss is considered to be the major threat to *V. peregusna* but the use of rodenticides, road traf-

fic and decrease of the main prey are also pointed out as important factors negatively affecting its populations (SPASSOV 2007, SPASSOV & SPIRIDONOV 2011, ABRAMOV et al. 2016). The assessment of the marbled polecat according to The IUCN Red List of Threatened Species is vulnerable (VU), both globally and at the European level (ABRAMOV et al. 2016). The species is listed in Annex II and IV of Council Directive 92/43/EEC and Annex II of the Bern Convention. In Bulgaria, it is protected by Annex II and III of the Biological Diversity Act and categorised as VU in the Red Book of Bulgaria (SPASSOV & SPIRIDONOV 2011). The vulnerability and the unclear status of the marbled polecat in Bulgaria call for more information on its distribution, ecological patterns and threats.

The aim of the present study is to assess the distribution of the marbled polecat in the central Western Bulgaria. In this article, an interesting case of defensive behaviour known as thanatosis, which has been observed during the field studies, is also described. Thanatosis is a behavioural defensive adaptation described as tonic immobility aiming to inhibit further attack by predators and frequently resulted from physical contact with a predator (HUMPHREYS & RUXTON 2018). Although it has been observed in many taxonomic groups (CASSILL et al. 2008, HUMPHREYS & RUXTON 2018), there is not much detailed information about this anti-predator behaviour in mammals. Probably among the main reasons are its difficult study in the field as well as ethical considerations (HUMPHREYS & RUXTON 2018). The phenomenon has been reported in a number of mammalian taxa: lagomorphs, rodents, artiodactyls, carnivores and pinnipeds (EWER 1968, EWELL et al. 1981, GABRIELSON & SMITH 1985, DE LA CRUZ et al. 1987, ESTES 1992, FRANCO 1996, COOKE et al. 2004, GRIEBEL et al. 2005, BOVENG et al. 2013, GIANNICO et al. 2014). Tonic immobility as defensive strategy is still poorly studied and any observation of it (especially in the wild) would contribute to its understanding.

## Materials and Methods

Data on the distribution of the marbled polecat in the central Western Bulgaria since 2000 are summarised. The information collected came from various sources: accidental observations of live or dead individuals (victims of road traffic) by experts (including the present author), questionnaire survey conducted in 2011 and 2012 with local people as well as from three published records. The study area is part of the Vitoshko-Kraishtenski Subregion of the Transitional Geomorphological Region in Bulgaria

(GALABOV et al. 1977). The area is characterised by diverse relief of valleys, hills as well as low- and medium-high mountains. The landscape is predominantly agricultural. Arable land alternates with pastures (not intensively used in most cases), desolate lands and forests in the hilly and mountainous areas. As a result of human activity, the natural vegetation has changed greatly. The valleys and southern slopes of the mountains are almost completely deforested. The landscape in the vicinity of the town of Pernik is strongly anthropogenically influenced due to mining activity.

Defensive behaviour was observed and photographed by chance in a case of a male marbled polecat caught by a dog on June 26<sup>th</sup> 2020 in the vicinity of the village of Slakovtsy, Pernik District (N42.70408 E22.91385).

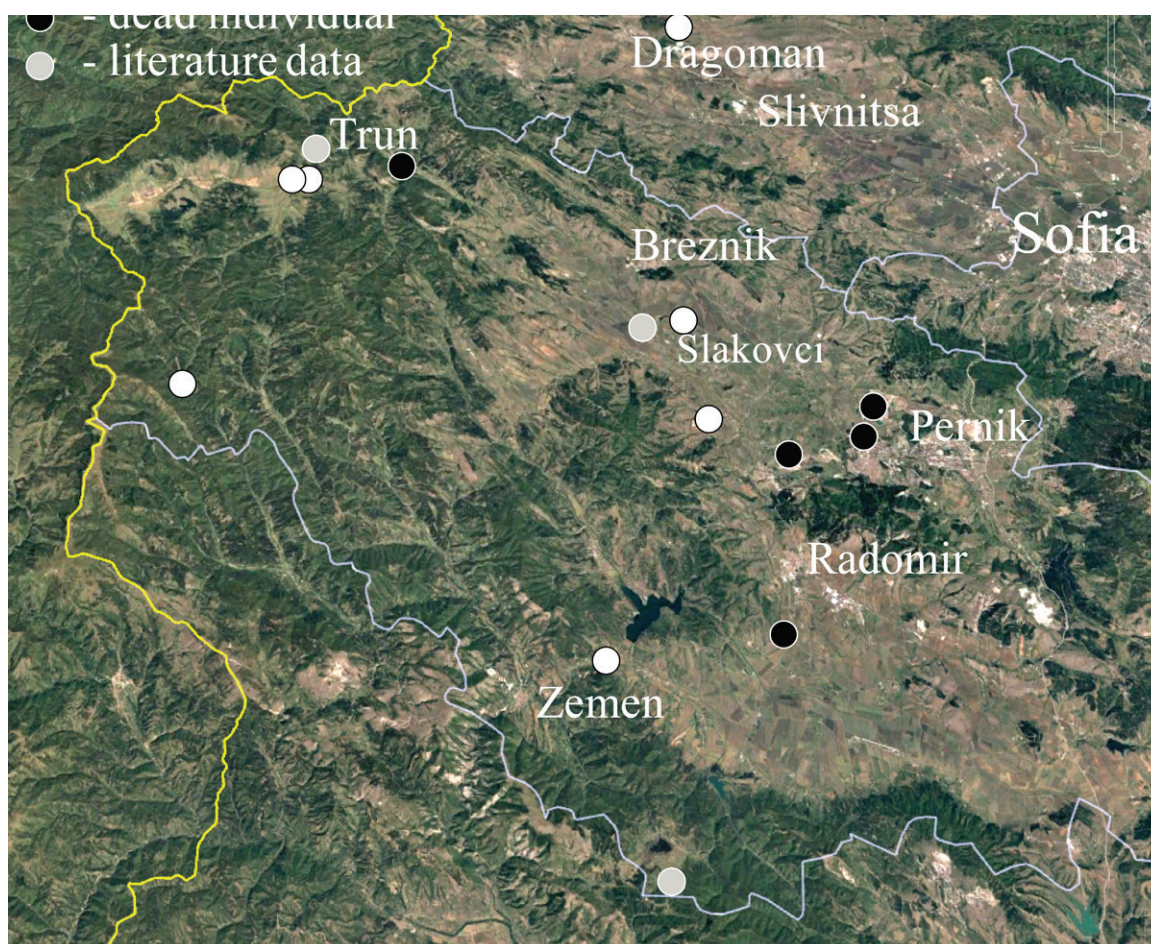
## Results

### Distribution data

Data on 12 registrations of *Vormela peregusna* in Pernik Region were collected for the period 2000–2021 (Fig. 1, Table 1). Eight of them are incontestable as they are from visual observations of live or dead (traffic victims) individuals by biologists, five of them photographed (one individual collected for the National Museum of Natural History at the Bulgarian Academy of Sciences). The remaining four reports derive from questionnaires. Seven of the polecat's registrations were casual observations of live animals and five records were from dead individuals (victims of road traffic).

### Thanatosis

Thanatosis was observed in a male marbled polecat, caught by a dog in agricultural lands near the Slakovtsy Reservoir (Figs. 2, 3). Upon command, the dog released the polecat and it remained lying motionless in the grass. Despite the lack of visible injuries, the animal appeared to be dead as it lay completely still with its eyes widely opened. Only its breathing testified that it was alive. Turning and examining its body, including lifting his hind legs, did not cause any movement in the animal. Its body was completely relaxed. Then, it was left alone for a while. When the observers returned to the place of capture in less than a minute, the animal had disappeared. Apparently, as the threat receded, the polecat had quickly hidden in the surrounding grass. Its lightning reaction indicated good general condition and suggested no serious injuries as a result of the dog's attack. Thanatosis lasted 2-3 minutes and was ceased when the threat was removed.



**Fig 1.** Distribution data of the marbled polecat *Vormela peregusna* in central Western Bulgaria, 2000–2021.

**Table 1.** Registrations of the marbled polecat in central Western Bulgaria from 2000 to 2021. Source: expert – observations of live or dead individuals (victims of road traffic) by experts (including the author); questionnaire – questionnaire survey conducted in 2011 and 2012 with local people.

Period	Geographical coordinates	Source	Status of the animal
2010-2021	N42.60942 E22.96850	expert	dead
2010-2021	N42.61924 E23.03367	expert	dead
2000-2009	N42.63763 E23.04117	expert	dead
2000-2009	N42.50660 E22.94436	expert	dead
2010-2021	N42.81785 E22.72077	expert	dead
2010-2021	N42.81515 E22.62614	expert	live
2010-2021	N42.70408 E22.91385	expert	live
2010-2021	N42.63992 E22.91520	expert	live
2010-2021	N42.49780 E22.81503	questionnaire	live
2010-2021	N42.66927 E22.52493	questionnaire	live
2000-2009	N42.81877 E22.62154	questionnaire	live
2010-2021	N42.93593 E22.99060	questionnaire	live
2010-2021	N42.70219 E22.89651	IVANOV & SPASSOV (2015)	live
2010-2021	N42.844222 E22.650556	IVANOV & SPASSOV (2015)	dead
2010-2021	N42.385048 E22.826256	IVANOV & SPASSOV (2015)	dead



**Fig. 2.** A male marbled polecat (*Vormela peregusna*) in thanatosis posture observed near Slakovtsy Reservoir, Breznik Region.



**Fig. 3.** The habitat of the marbled polecat at the locality of capture near Slakovtsy Village.

## Discussion

In view of the extremely scarce registrations of the marbled polecat in Bulgaria for the last 20 years, the data presented here can be considered as evidence of a comparatively high number of the species in the study area at present. Central Western Bulgaria (west of Pernik) was one of the areas

where the species was most common in 1990's (SPASSOV et al., 2002). Most of the records presented here are from the area of towns of Tran, Pernik and Breznik. However, three of the five individuals killed on the road were from the vicinity of Pernik. Unfortunately, almost half of the registered animals were victims of road traffic. This indicates a high mortality of the species as a result

of road traffic. According to the data collected, the distribution of the marbled polecat in central Western Bulgaria over the last two decades is similar to that of the end of the 20th century. The persistently high number of the species in this region shows its importance for the conservation of this vulnerable mustelid in the Continental Biogeographical Region in Bulgaria.

The observed post-contact immobility is undoubtedly a defensive behaviour caused by the capture of the polecat by a dog and the subsequent contact with humans. Similar behaviour has been observed in *V. peregusna* in a sudden attack by a larger animal (SPASSOV & SPIRIDONOV 1993). Feigning death in response to a threat is reported for the species by IVANOV & SPASSOV (2015); however, in that case, it was an attempt by the mother to distract people from her young, imitating she is dead and subsequently wounded. Threatening posture accompanied by typical vocalisation is another display of defensive behaviour observed in this species (SPASSOV & SPIRIDONOV 1993). Obviously, thanatosis is the final phase of defensive behaviour, which is reached in very critical situations and in cases when it is impossible to escape or intimidate the enemy.

Being small-sized and inhabiting badly sheltered open habitats, marbled polecat has probably developed a number of defensive tactics that enable its survival. Undoubtedly, the bad-smelling secretion of its anal glands as well as the characteristic camouflage colouration contribute to its protection from attackers (SPASSOV & SPIRIDONOV 1993). Although this mustelid is not a typical victim of any predator, larger carnivores pose a potential threat in direct contact and occasionally it is preyed by some carnivore mammals and birds of prey (PESHEV et al. 2004). Among the potential enemies of the marbled polecat in the study area are stray domestic dogs (*Canis familiaris*), red foxes (*Vulpes vulpes*), golden jackals (*Canis aureus*), stone martens (*Martes foina*), European polecats (*Mustela putorius*), wildcats (*Felis silvestris*), etc.

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## References

- ABRAMOV A. V., KRANZ A. & MARAN T. 2016. *Vormela peregusna*. The IUCN Red List of Threatened Species 2016: e.T29680A45203971. <https://dx.doi.org/10.2305/IUCN.UK.2016-1.RLTS.T29680A45203971.en>. Downloaded on 03 December 2021.
- BOVING P. L., BENGTSON J. L., CAMERON M. F., DAHLE S. P., LOGERWELL E. A., LONDON J. M., OVERLAND J. E., STERLING J. T., STEVENSON D. E., TAYLOR B. L. & ZIEL H. L. 2013. Status review of the ribbon seal. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-255, 174 p.
- CASSILL D., VO K. & BECKER B. 2008. Young fire ant workers feign death and survive aggressive neighbors. *Naturwissenschaften* 95: 617–624. <https://doi.org/10.1007/s00114-008-0362-3>
- COOKE F., DINGLE H., HUTCHINSON S., SCHODDE R., TAIT N. & VOGT R. 2004. The Encyclopedia of Animals: A Complete Visual Guide. University of California Press, Berkeley and Los Angeles. 608 p.
- DE LA CRUZ F., JUNQUERA J. & RUSSEK M. 1987. Ontogeny of immobility reactions elicited by clamping, bandaging, and maternal transports in rats. *Experimental Neurology* 97: 315–326.
- ESTES R. D. 1992. The Behaviour Guide to African Mammals. University of California Press, Los Angeles. 1: Introduction 16
- EWELL A. H., CULLEN J. M., WOODRUFF M. L. 1981. Tonic immobility as a predator-defence in the rabbit (*Oryctolagus cuniculus*). *Behavioral and Neural Biology* 31 (4): 483–489. doi:10.1016/s0163-1047(81)91585-5. ISSN 0163-1047
- EWER R. 1968. Ethology of Mammals. Springer, Boston, MA. 418 p. <https://doi.org/10.1007/978-1-4899-4656-0>
- FRANCO E. 1969. Behavioural aspects of feigned death in the opossum *Didelphis marsupialis*. *American Midland Naturalist* 81 (2): 556–568. doi:10.2307/2423988. JSTOR 2423988
- GALABOV J., IVANOV I., PENCHEV V., MISHEV K. & NEDELICHEVA V. 1977. Physical geography of Bulgaria. Sofia: Narodna Prosveta. 346 p.
- GABRIELSON G. & SMITH E. 1985. Physiological responses associated with feigned death in the American opossum. *Acta Physiologica Scandinavica* 123: 393–398.
- GIANNICO A. T., LIMA L., LANGE R. R., FROES T. R. & MONTANI-FERREIRA F. 2014. Proven cardiac changes during death-feigning (tonic immobility) in rabbits (*Oryctolagus cuniculus*). *Journal of Comparative Physiology A*. 200 (4): 305–310. doi:10.1007/s00359-014-0884-4. ISSN 0340-7594.
- GRIEBEL G., STEMMELIN J. & SCATTON B. 2005. Effects of the cannabinoid CB1 receptor antagonist rimonabant in models of emotional reactivity in rodents. *Biological Psychiatry* 57 (3): 261–267. doi:10.1016/j.biopsych.2004.10.032. PMID 15691527. S2CID 18429945
- HUMPHREYS R. & RUXTON G. 2018. A review of thanatosis (death feigning) as an anti-predator behaviour. *Behavioural Ecology and Sociobiology* 72: Article 22. <https://doi.org/10.1007/s00265-017-2436-8>
- IVANOV V. & SPASSOV N. 2015. Some new data on the distribution, habitats and ecology of the threatened European mustelids *Mustela eversmannii* and *Vormela peregusna* in Bulgaria. *Historia Naturalis Bulgarica* 21: 267–271.

- MITCHELL-JONES A. J., AMORI G., BOGDANOWICZ W., KRYSZTOFEK B., REIJNDERS P.J.H., SPITZENBERGER F., STUBBE M., THISEN J.B.M., VOHRALIK V. & ZIMA J. 1999. The atlas of European mammals. London: Poyser. 250 p.
- PESHEV T. H., PESHEV D. T. & POPOV V. V. 2004. Fauna Bulgarica. 27. Sofia: "Marin Drinov" Publishing House of the Bulgarian Academy of Sciences. 633 p. (In Bulgarian)
- SPASSOV N. 2007. Marbled polecat (*Vormela peregusna*). In: POPOV V., SPASSOV N., IVANOVA T., MIKHOVA B. & GEORGIEV K. (eds.): Mammals important for conservation in Bulgaria. Arnhem, The Netherlands: Dutch Mammal Society VZZ, pp. 270–273. (In Bulgarian)
- SPASSOV N. & SPIRIDONOV G. 1993. *Vormela peregusna* Gueld., 1770 – Tigeriltiss. – In: Handbuch der Säugetiere Europas. Aula Verlag GmbH, Wiesbaden. Band 5/II (Carnivora), pp. 817–854.
- SPASSOV N., GEORGIEV K., IVANOVA N. & IVANOV V. 2002. Study of the status of marbled polecat (*Vormela peregusna peregusna* Guld.) in Western and North-Eastern Bulgaria with data on the status of its potential main prey species and competitors. *Historia Naturalis Bulgarica* 14: 123–140.
- SPASSOV N. & SPIRIDONOV G. 2011. Marbled polecat (*Vormela peregusna* Guldenstaedt, 1770). In: GOLEMANSKI V. (ed.) Red Data Book of the Republic of Bulgaria. Vol. 2. Animals. Bulgarian Academy of Sciences & Ministry of Environment and Water, Sofia, Digital Edition. <http://e-ecodb.bas.bg/rdb/en/vol2/>
- ZIDAROVA, S. & POPOV, V. 2013. General report for target species: 2635. Marbled polecat (*Vormela peregusna*). <http://natura2000.moew.government.bg/Home/Reports?reportType=Mammals>
- ZLATANOVA D. & POPOVA E. 2018. Biodiversity estimates from different camera trap surveys: A case study from Osogovo Mt., Bulgaria. *Nature Conservation Research* 3 (2):13–25.

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