Short Note

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New distribution data of the least weasel *Mustela nivalis* in Castilla y León, Spain

Nuevos datos sobre la distribución de la comadreja *Mustela nivalis* en Castilla y León, España

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The least weasel (*Mustela nivalis* Linnaeus, 1766) is the world's smallest carnivore (King & Powell 2007) and probably one of the most difficult to detect (García & Mateos 2009). It is widely distributed throughout the northern hemisphere (McDonald *et al.* 2016), and seems to be a common and relatively abundant species, at least in some areas of the European continent (Larivière & Jennins 2009, Tikhonov *et al.* 2010). However, many basic aspects of its biology, distribution, population dynamics and ecology remain largely unknown in most areas of its range, a lack of information that is especially striking in Spain (Palazón 2017).

Most of the scarce background knowledge available in Spain comes from general studies about carnivores (Millán *et al.* 2001, Barea-Azcón *et al.* 2007) or cases in which weasels are predated by other species (Gil & Pleguezuelos 2001, Álvarez 2003, Palazón *et al.* 2016). In addition, these studies are made at small spatial scale (Alcover & Jaume 1983, Camps & Llimona 2000, Gil-Sánchez *et al.* 2001, Torre *et al.* 2003, García & Mateos 2009), since there has never been a national (standardized) census of the species. The few available data are compiled in specific chapters of two general compendia about Spanish Mammals (Gisbert & Santos-Reis 2007, Palazón 2017), showing a nearly ubiquitous presence in peninsular Spain, Mallorca and Menorca islands and Ceuta and Melilla, albeit unevenly distributed over the territory (Fig. 1).

In Castilla y León (the largest autonomous region in Spain, ~93,000 km^2, 18.5 % of the country's total area) it has a widespread distribution and it has been reported in almost any type of

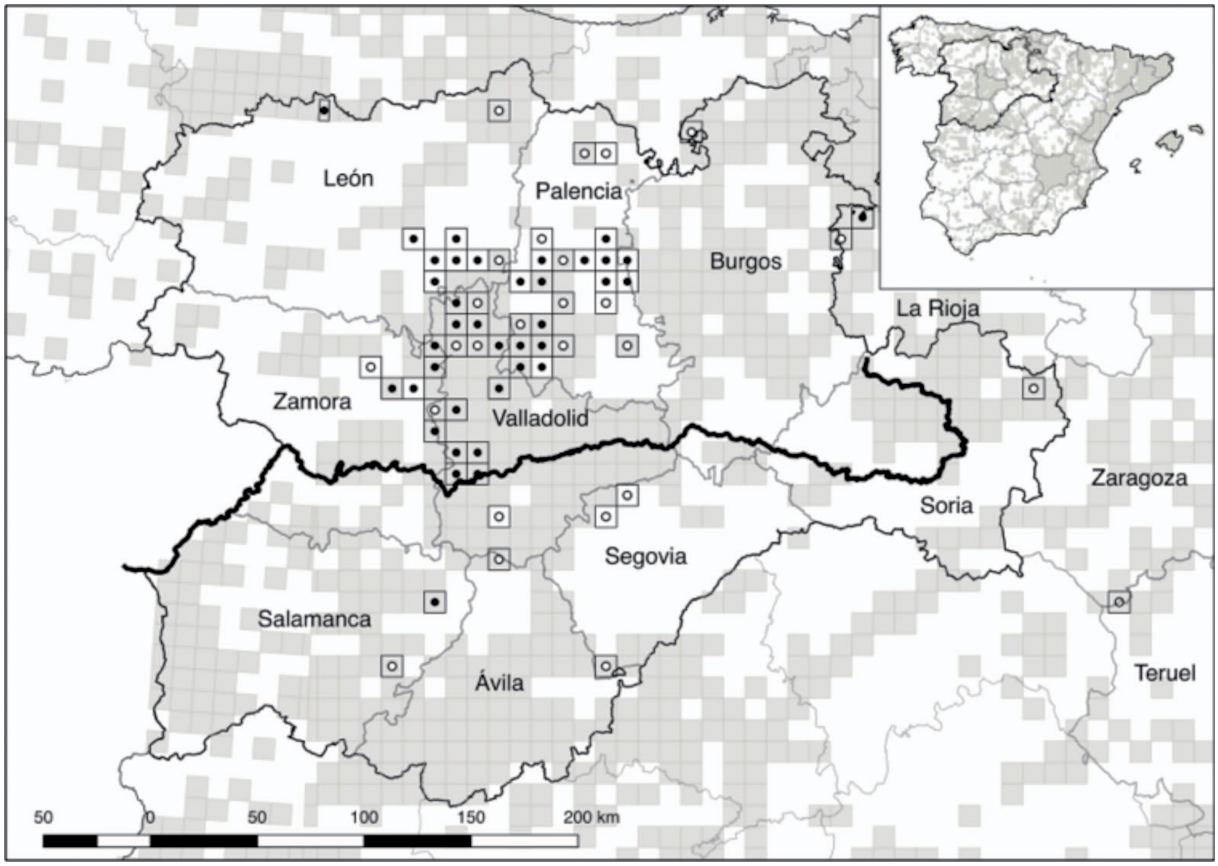

Figure 1. Map of Castilla y León depicting the previous known distribution of least weasel *Mustela nivalis* (light grey), with black and white dots representing UTM cells with and without captures during our study, respectively. Duero river (bold line) and province names are shown for display purposes. Inset shows the Spanish distribution of least weasel *Mustela nivalis* (10x10 km UTM-grids; Gisbert & Santos-Reis 2007).

environment (riverside, forest, agricultural land, *dehesas*, shrubland, pastures and meadows, human settlements, etc; Peris *et al.* 1999, Gisbert & Santos-Reis 2007, Palazón 2017), so most of the region can be regarded as potential habitat for the species. However, the existence of some noticeable gaps in an otherwise continuous distribution across the region is difficult to explain. This probably reflects an inadequate sampling of UTM cells and/or geographical differences in occurrence records reported over the map (Gisbert & Santos-Reis 2007), as shown by its continuous distribution in some provinces (e.g. Salamanca, Fig. 1, Peris *et al.* 1999) and its generalized absence in others (e.g. Segovia and León provinces).

The elusive and secretive habits of the least weasel and its small body size (92-263 g body mass in males and 65-90.5 g in females; Palazón 2017) lead to reduced detectability. Thus, the lack of species-specific methods in detecting (Torre *et al.* 2003, Barea-Azcón *et al.* 2007), capturing (Gorini *et al.* 2013) or quantifying the species populations (García & Mateos 2009) may contribute to explain the observed distribution gaps, which is a common issue in the occurrence records of several rare and elusive species at large scale (O'connell *et al.* 2006, Croft *et al.* 2017).

The least weasel is listed as Least Concern in the IUCN, both globally (McDonald *et al.* 2016), and in Spain (Blanco 2007), but faces mayor threats along its continental distribution (McDonald *et al.* 2016). Incidental poisoning with rodenticides could also affect the species in agricultural areas, given its rodent-based diet, particularly microtines (Sheffield & King 1994, Gisbert & Santos-Reis 2007). Outbreaks of vole populations have been recurrent in recent years in Castilla y León, and hot debates have taken place around the use of poison to control them due to side effects on other species (Olea *et al.* 2009). Therefore, a better knowledge of the least weasel distribution would be essential for the design of successful conservation and management strategies. Further, a better estimation of the species' real distribution will allow more reliable

predictions under future scenarios of climate/land use change (Araújo *et al.* 2011), now considered two major threaths to open agricultural habitats, which are the preferred by least weasels (McDonald *et al.* 2016). Other potentially important threats for weasels come from habitat loss and fragmentation (Swihart *et al.* 2003), road-kill (Cervinka *et al.* 2015, Simpson *et al.* 2016), infectious diseases and pathologies (Simpson *et al.* 2016), or the rapid expansion of new invasive competitors such as the American mink (*Neovison vison*) (Põdra & Gómez 2018).

We present here new data of the least weasel distribution in Castilla y León and surrounding areas (2 UTM-grids in La Rioja and 1 UTM-grid in Aragón). Castilla y León mostly comprises the northern plateau of the Iberian Peninsula, an area dominated by agricultural landscapes (3.7 million ha; 37.81% of the total area of Castilla y León; MAGRAMA, 2012) over the eastern basin of the Duero River. The known distribution of the species in Castilla y León includes 537 10x10 km UTM-grids, corresponding to the 50.5% of the total UTM cells in the region (Gisbert & Santos-Reis 2007). Data on weasel distribution gathered here are the results of trapping data (Sherman traps) collected between 2007 and 2017 by our research group. Weasels were incidentally trapped in surveys conducted in agro-ecosystems to understand different aspects of the population dynamics and dispersal of common vole *Microtus arvalis* (Pallas, 1778) and its predators, funded by different projects. Therefore, presence of the species in each UTM cell was confirmed by different trapping protocols, variable number of trapping sessions per site, variable trapping effort and different spatiotemporal coverage, factors that can influence the number of UTM with recorded presence and absence. However, some presences obtained during 2016 and 2017 (N = 21; 7 UTM cells), were recorded by the use of specific sampling methods (live traps, track traps, hair traps and video-trapping) aimed to develop a methodology to monitor weasel populations in agricultural landscapes (Díaz-Ruiz *et al.* 2017a, 2017b). Individuals were always released at their respective capture site and all handling procedures were performed in accordance with the Spanish and European regulations for animal protection and experimentation and were approved by the Ethics Committee of the University of Castilla-La Mancha (reference number CEEA: PR20170201).

Overall, 168 weasels were captured in 252,385 trap-nights during the period 2007-2017 in all nine provinces of Castilla y León, and one weasel was captured in a nearby locality (Haro, La Rioja, Fig. 1). Our trapping work was carried out in 64 UTM-grids (5.9% of the UTM grid in Castilla y León), and the species was captured in 38 of them (59.4%). Weasels were captured in 16 new UTM-grids where it had not been previously reported (Gisbert & Santos-Reis 2007), now totalling 553 UTM-grids with confirmed presence of the species in the region. Finally, the species was not detected in 19 out of the 26 UTM-grids where it had previously been reported.

Taken together, these results suggest that the species is actually present in a larger number of UTM cells than those reported in the Spanish Mammal Atlas (Palomo *et al.* 2007) and that many empty UTM cells likely correspond with false absences, in line with the low detectability of the species. However, we cannot rule out the possibility of real absences, given that quick colonisations or local extinctions are well known to occur in this species (Meijide *et al.* 1996, Palazón 2017), perhaps associated with prey fluctuations (coupled predator-rodent cycles; Krebs 2013). We captured weasels in several types of habitat within the agricultural landscape, including rural tracks, riversides and different crops (both irrigated and non-irrigated) and edge types, according to a wide range of habitats in well-surveyed provinces where the species has been reported (Peris *et al.* 1999). All of this suggests that the species could be present in most of the UTM cells of central Duero valley, where vole plagues are recurrent (Luque-Larena *et al.* 2013), but also warns about the potential recent impact of management and treatments against these plagues on this specialist predator.

The development and application of a standardized method to sample weasel populations is recommended, since everything suggest an apparent absence of the species in large areas of Castilla y León (more than the 50% of the territory) due to the lack of specific studies on this small carnivore. Therefore, a national census would be desirable for a better understanding of its distribution as well as to ascertain to which degree conservation and management measures should be implemented. It should be noticed that the species looks particularly rare in the southern half of Spain (Fig. 1), where additional sampling should be considered a priority in the current scenario of global warming.

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