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Research Article

Lack Of Data Or Lack Of Weasels? The Likely Silent Extinction Of Weasel Mustela Nivalis (Carnivora: Mustelidae) In Spain.

Ana B. LloDrca, Francisco S. TorDtosa and José GueErrero-Casado.

Public Health and Microbiology, Bharuch, India.

Abstract

The abundance, distribution, and population trends of poorly studied species that are typically not adequately observed can be better understood thanks to records from online biodiversity databases, including citizen science data. The purpose of this study is to show how useful GBIF data may be in identifying the probable decrease of species that were once numerous and extensively distributed but whose conservation status is currently unknown, like the Spanish weasel (Mustela nivalis). In order to answer this, we examined GBIF.org's statistics on its presence in Spain from 2008 to 2022 and contrasted it with the 2007 Atlas of Mammals of Spain's distribution data. The findings show that: (i) GBIF.org data show a moderate reduction (negative trend) in the weasel population in Spain during the study period; (ii) the species has been observed in a small number of 10 × 10 km UTM-squares (Universal Transverse Mercator) within its range as defined by the 2007 atlas; and (iii) there are sizable regions of Spain where the species has not been found recently. These results show the carnivorous species' worrisome conservation state and emphasize the need of data from open access platforms like GBIF in detecting possible silent extinctions.

Keywords : *Carnivora; citizen science; Mustelidae; extinction; population decline; wildlife conservation.*

INTRODUCTION

A fundamental element of conservation initiatives is the range and population size of wild animals. To identify species of concern, focus the appropriate conservation interventions to prioritize species and areas, and evaluate their efficacy, accurate population trends are crucial [1,2]. However, for a variety of reasons, including logistical support, high fieldwork needs, and financial and technological limitations, scientists and public officials may find it extremely challenging to carry out large-scale species monitoring in order to accomplish these aims [3,4]. Our knowledge of the distribution of many species has improved thanks to the recent development of open-access database platforms, which have made it feasible to gather, store, and manage biodiversity data [5]. The largest open-access biodiversity database is probably the Global Biodiversity Information Facility (GBIF: https://www.gbif.org/, accessed on July 15, 2024). The goal of this global network and data infrastructure, which is supported by governments around the world, is to make data about all forms of life on Earth freely accessible to everyone, everywhere [7]. More than 2000 publishing institutions have published 2.9 billion species occurrence records from over 100,000 databases on GBIF as of July 2024. These records have been cited in over 10,000 peer-reviewed publications.More precisely, the substantial growth of citizen science in recent years has resulted in a huge increase in the amount of these databases [8,9]. Therefore, opportunistic data from citizen research that is included into these platforms can supplement long-term, large-scale species monitoring with minimal resource investment [10–12].Since not all species are equally represented—some are overrepresented with a lot of data, while others are underrepresented with very few records—there is a considerable taxonomic bias in these database platforms [13, 14]. Certain animal taxa are underrepresented in the case of mammals for a variety of reasons, such as smaller body size, nocturnal activity, elusive behavior, low visibility in the habitat, rare species, identification difficulties, or a smaller distribution area [16,17]. The small number of records for several of these species may also point to their scarcity and a likely reduction in population. The phrase "silent extinction" was recently used by some scientists and environmentalists (e.g., [18,19]) to describe species whose population patterns have not been sufficiently These factors

***Corresponding Author:** José GueErrero-Casado, Public Health and Microbiology, Bharuch, India.
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have led to the development of several novel techniques for weasel monitoring in recent years, including citizen science, detecting dogs, camera traps modified for weasel detection, and non-invasive genetic surveys (see the review [21]). Although Mustela nivalis (Linnaeus, 1758), the least weasel, is widely distributed throughout Europe, little is known about its ecology, distribution, and population trends [22, 23]. This is likely due to a number of factors, including the difficulty of detecting it and the dearth of long-term, large-scale data. There have been recent reports of weasel population declines in the United States [24], United Kingdom [25], and Tunisia [26]. However, given how little research has been done on this species in Spain, this information vacuum is especially significant there [27]. Since only one weasel with a sampling effort greater than 20.000 trap nights was recorded in the second period (2005–2008), the nearly exclusive study on weasel population trends in Spain suggested a significant decline in Catalonia (NE Spain) between the first sampling period (1995–1998) and the second period [28].Recent worries about potential weasel population decreases in other nations emphasize the necessity of critically assessing the abundance and dispersion data now available to determine whether Spain is experiencing a decline as well. In order to achieve this, we have examined whether the GBIF data available supports the species' recent declining population trend. Therefore, we want to draw attention to how crucial biodiversity databases are for examining the population trends of species whose.

MATERIALS AND METHODS

Data Collection and Management

Using the GBIF plugin installed in QGIS, the Global Biodiversity Information Facility (GBIF.org, accessed on July 16, 2024) provided the data of M. nivalis in Spain from 2008 to 2022 (Figure 1). The Atlas of Mammals of Spain, the most extensive data on mammal ranges in Spain, was published in 2007 [29], thus we chose this date because it corresponds with the evolution of biodiversity data gathering on this platform. A total of 644 M. nivalis records were acquired over this time span [30], 639 of which came via machine observation, 4 from preserved specimens, and 639 from human observations. The data on M. nivalis in Spain are derived from a variety of databases, including citizen science, because GBIF aggregates data from various sources.According to Santos et al. [32], the number of records of M. nivalis was standardized for every 1000 records of all carnivores (Carnivora; relative abundance 1; Formula (3)) and all mustelids (Mustelidae; relative abundance 2; Formula (2)) for each year because sampling efforts and/or data quantities can vary significantly from year to year (for example, because of the COVID-19 lockdown in 2020 [31]). Figure 1 shows the geographic location of Mustela nivalis records (red spots) on GBIF.org for Spain from 2008 to 2022. The boundaries of Spain's autonomous communities (ACs) are shown by the black lines.For every autonomous community (henceforth referred to as AC), the annual number of records was also determined. To confirm the proportion of UTM 10 2007 and the locations where it was later discovered (occurrence frequency; Formula (3)), the Atlas of Mammals of Spain [29] was checked with the data of M. nivalis's presence in Spain from 2008 to 2022.

Statistical Analysis

The TRIM program version 3.54 (trends and indices for monitoring data), which employs a log-linear Poisson regression model to estimate temporal population trends, was used to predict the population trends from 2008 to 2022 [33]. The analysis used the AC (n = 15) as the site and the standardized number of weasel records in each year in each AC (n = 225) as the experimental unit. The relative abundance of M. nivalis, as determined by the Mustelidae (RA1) and Carnivora (RA2) records, was used in two distinct analyses.

RESULTS

644 recordings of M. nivalis were accessible on GBIF.org over the study period (2008–2022), with an annual mean of 43.5 (±26.5 S.D.) records. These records only make up 1.21% and 2.3% of all Carnivora (54,401) and Mustelidae (28,797) records during this time period, respectively. Since there were no records of M. nivalis in many years for many ACs (out of 225 combinations of 15 years × 15 AC, in 118 there were no records of 65.5% of the presences located in the Catalonia and Valencia ACs, which means that only M. nivalis), the records calculated in each AC showed that the mean yearly value was 2.59 (±7.8), with 0 for the median value. With an estimated population change of -59.19 percent and -50.6%, respectively, the two TRIM analyses of the data for Spain, excluding Valencia and Catalonia, reveal a significant negative trend (Table 1; Figure 2). In both cases, the decline is categorized as moderate, meaning that it is significant but not significantly greater than 5% annually. There is no discernible fall, although it is not definite that the trends are less than 5% annually, according to the TRIM analysis of the data from Catalonia and Valencia, which reveals a negative non-significant trend.Table 1. Findings from the TRIM models for M. nivalis's relative abundance (RA) normalized to Mustelidae (RA1) and Carnivora (RA2) records for the combined data from Valencia and Catalonia Using the data from 2008 as a reference value (RA in 2008 = 1), Figure 2 shows trends in the relative abundance (RA) of Mustela nivalis in Spain standardized to the number of records of Mustelidae (RA1) and Carnivora (RA2). The standard error is displayed by the vertical error bars.According to the 2007 atlas, M. nivalis was found in 274 UTM 10 × 10 km cells out of 2336 cells where the

species was found (Figure 3). This indicates that 11.73% of the cells where the species was present in 2007 were also detected between 2008 and 2022. Nevertheless, there was spatial irregularity in the M. nivalis data throughout this time (Figure 3). UTM cells were present in 2007, but just 5% of the cells in the remainder of the nation had the species registered.Gure 3. The Atlas of Mammals of Spain [30] shows the potential distribution (orange squares) of M. nivalis in 2007. The 10 × 10 km UTM cells where the species was registered between 2008 and 2022 are indicated by the green squares.

DISCUSSION

The weasel is a scarce species in Spain, according to data on GBIF.org. While these data should be interpreted cautiously (see below), this method can be helpful in identifying the rarity of some species that were once thought to be common and widely distributed but are not being sufficiently monitored, raising questions about their conservation status. Because funding for biodiversity protection is scarce, monitoring programs typically concentrate on a few species, especially flagship species, species with a higher ecological and economic significance, or species with a known problematic conservation state [34, 35]. Since some species may be experiencing quiet extinction in this situation, it is important to monitor their population patterns using GBIF and other The first information regarding a species' conservation status can be found in open-access databases. In the instance of M. nivalis in Spain, a species that was once widely distributed (Figure 3), it has recently been observed in a small number of locations within its potential distribution area (Figure 3), its population is declining moderately (Figure 2), and the few studies that are currently available [27] point to a possible silent extinction. There are extremely few records, and the species has not been found in large parts of the country (Figures 1 and 3), with the exception of the eastern Iberian Peninsula (see below). In fact, there are less than 20 records in 15 years in 8 of the 15 ACs. Furthermore, certain comparisons can help put the volume of weasel data in context. Figure 4. Over the course of four years (2020–2024), the study team has only been able to capture one image of Mustela nivalis by photo-trapping. The weasel's decline and scarcity are probably caused by a number of factors, including changes in land use, road kill [39], exposure to anticoagulant rodenticides [40], loss of optimal habitat as a result of rural abandonment in Mediterranean areas [28,38], top-down regulation by larger predators, especially in poor habitat with low refuge availability [28], the effects of climate change [41], or even certain diseases with an unknown cause.Impact. Furthermore, these elements may work in concert. For example, changes in land use may make habitats less desirable for top predators, or climate change may have detrimental effects on prey [28,41,42]. Therefore, further research is required to identify the primary contributing causes, which is a crucial prerequisite for creating effective conservation strategies. Weasels are an essential predator of rodents but are prey for certain other animals, so their decline could upset predator-prey relationships and ecological dynamics.It is important to take into account our approach's two drawbacks, which are especially prevalent in data from citizen science [10,13]: (1) the challenge of identifying small creatures like weasels and their potential underrepresentation; and (2) the bias in data collecting caused by spatial and temporal sampling. In fact, the ACs of Valencia and Catalonia have their own systems for gathering biodiversity data (Banco de Datos de la Biodiversidad de la Comunidad Valenciana and Ornitho.cat, respectively), and they post these local data—which include data from regional monitoring programs as well as citizen science—on the GBIF website. 65.5% of the M. nivalis data in Spain came from the 2008–2022 Catalonia and Valencia dataset (see Results), necessitating the independent interpretation.They can be helpful in answering a straightforward question, like ours: has the weasel been recorded anywhere during a given period? Despite these limitations, GBIF data are frequently used in the scientific literature, and the majority of criticisms are directed towards using occurrence data to reconstruct and model species' distribution ranges [43]. In the specific case of citizen science, these data can be a valuable supplementary tool to data gathered by scientists and public administrations, helping to monitor and comprehend weasel population trends with appropriate design, training, and validation protocols, followed by appropriate interpretation.combining various techniques (e.g., non-invasive genetics, customized camera traps to identify small mammals).In conclusion, the weasel's mild decline in Spain, the fact that records are lacking for many years and locations, and the fact that it has been found in a small number of sites where it was previously found, all point to the possibility that the species may be less common than previously thought. As a first step to alert people to their potentially alarming conservation state, we believe that our method of utilizing GBIF data could be helpful in identifying the scarcity and likely recent decline of some species that are not typically widely monitored (known as silent extinctions). Thus, in order to properly evaluate the conservation status of M, extensive and long-term monitoring procedures ought to be put in place.

Author Contributions

J.G.-C. and F.S.T. conceptualization; A.B.L., F.S.T., and J.G.-C. methodology; A.B.L., F.S.T., and J.G.-C. formal analysis; investigation, A.B.L., and J.G.-C.; data curation, A.B.L. and J.G.-C. writing—preparation of the original draft; writing—review and editing, A.B.L., F.S.T., and J.G.-C.; visualization; supervision, F.S.T. and J.G.-C. The published version of the manuscript has been read and approved by each author.

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The information utilized in this article is publicly accessible at https://www.gbif.org/. (retrieved July 15, 2024).

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Conflicts of Interest
No conflicts of interest are disclosed by the writers.

REFERENCES

1. Kleiman, D.G.; Reading, R.P.; Miller, B.J.; Clark, T.W.; Scott, J.M.; Robinson, J.; Wallace, R.L.; Cabin, R.J.; Felleman, F. Essays Improving the Evaluation of Conservation Programs. Conserv. Biol. 2000, 14, 356–365. [CrossRef]

2. Moussy, C.; Burfield, I.J.; Stephenson, P.J.; Newton, A.F.E.; Butchart, S.H.M.; Sutherland, W.J.; Gregory, R.D.; McRae, L.; Bubb, P.;Roesler, I.; et al. A quantitative global review of species population monitoring. Conserv. Biol. 2022, 36, e13721. [CrossRef] [PubMed]

3. Stephenson, P.J. Technological advances in biodiversity monitoring: Applicability, opportunities and challenges. Curr. Opin.Environ. Susta. 2020, 45, 36–41. [CrossRef]

4. Kerry, R.G.; Montalbo, F.J.P.; Das, R.; Patra, S.; Mahapatra, G.P.; Maurya, G.K.; Nayak, V.; Jena, A.B.; Ukhurebor, K.E.; Jena, R.C.;et al. An overview of remote monitoring methods in biodiversity conservation. Environ. Sci. Pollut. Res. 2022, 29, 80179–80221.[CrossRef] [PubMed]

5. Troia, M.J.; McManamay, R.A. Filling in the GAPS: Evaluating completeness and coverage of open-access biodiversity databases in the United States. Ecol. Evol. 2016, 6, 4654–4669. [CrossRef] [PubMed]

6. Saran, S.; Kumar Chaudhary, S.; Singh, P.; Tiwari, A.; Kumar, V. A comprehensive review on biodiversity information portals.Biodivers. Conserv. 2022, 31, 1445–1468. [CrossRef]

7. GBIF Secretariat. What is GBIF? 2024. Available online: https://www.gbif.org/what-is-gbif (accessed on 15 July 2024).

8. Kosmala, M.; Wiggins, A.; Swanson, A.; Simmons, B. Assessing data quality in citizen science. Front. Ecol. Environ. 2016, 14,551–560. [CrossRef]

9. Fischer, H.; Gerber, L.R.; Wentz, E.A. Evaluating the Fitness for Use of Citizen Science Data for Wildlife Monitoring. Front. Ecol.Evol. 2021, 9, 620850. [CrossRef]

10. Horns, J.J.; Adler, F.R.; ¸Sekercio˘glu, Ç.H. Using opportunistic citizen science data to estimate avian population trends. Biol.Conserv. 2018, 221, 151–159. [CrossRef]