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Short Note

The Eurasian beaver in the western Iberian Peninsula

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Abstract

The Eurasian beaver experienced a severe reduction in its distribution during the past centuries as a consequence of intensive hunting by humans. However, as a result of human-assisted re-introduction projects and translocations along the European territory, the species has increased its range significantly. Since beaver was introduced in Spain, its distribution had been restricted to the Ebro Basin and its surroundings. In this note, we report the presence of the species outside its known range, in the western part of the Iberian Peninsula, near the border with Portugal. We estimated an expansion rate of 15 km per year along the Ebro basin and discuss why the presence of beaver in the western area seems a result of an unauthorised translocation. Finally, we examine some important aspects that need further discussion when dealing with translocation or reinforcement events.

The Eurasian beaver (beaver hereafter; *Castor fiber*) was once widespread throughout Europe and part of Asia, including the large rivers of the Iberian Peninsula, constituting a key species of the Palaearctic fauna . However, as a result of intensive hunting in search of meat, fur and *castoreum*, beaver experienced a severe reduction in its distribution and, by the late 19th century, the species was reduced to a few fragmented populations (Nolet and Rosell, 1998). Nevertheless, since the beginning of the 20th century, beaver has been restored to much of their native range (Fig. 1A) through human-assisted re-introduction projects and translocations (Halley et al., 2020, 2012; Halley and Rosell, 2002). This action of moving individuals from one area to another is commonly done following conservation purposes as they are usually made to help species to re-establish populations in some areas and, in this way, recover their native range (Seddon et al., 2014). Regarding these actions, the IUCN published some guidelines (IUCN/SSN, 2013) to provide a basis for the design and management of conservation translocations.

After its extirpation, beaver arrived to the Iberian Peninsula in 2003, when 18 specimens from northern and southwestern European countries (Gómez-Moliner and Ruiz-González, 2008) were unofficially released into the Aragón River (Navarra; Spain) (Lopo et al., 2012; Ceña et al., 2004) (Fig. 1B). The environmental offices from those regions where beaver was present (Navarra, Aragón and La Rioja) obtained special permission supported by the European Commission to exterminate the beaver population, as it was considered an illegally introduced species (Guerrero-Campo et al., 2009). As a result, a total of 216 beavers were trapped from 2008–2017 in these regions (Fig. 1B, C) (Halley et al., 2020). Some of them were donated to zoological institutions (Lopo et al., 2012). However, eradication was not successful and implied economic efforts wasted: the amount of 131K€ was estimated for the eradication of 100 individuals (Rueda, 2016). In 2018, the European Commission considered beaver a historically native species. Consequently, the Spanish Ministry of the Environment declared beaver as a protected species (BOE, 2020), and was also included in an official list of protected species (LESPRE). After its introduction, beaver has expanded throughout many areas of the Ebro basin and has also colonized some locations of the Douro and Tagus basins (Fig. 1B-D).

In this note, we report the new presence of beaver 332 km away from the nearest known range (Fig. 1D), in the "29TQF17D" terrestrial grid code (5×5 km) of the Spanish ministry for geographical representation. The new location is situated on the Spanish side of an international protected natural area (Parque Natural Arribes del Duero and Parque Natural do Douro Internacional) that encloses several border territories from Portugal and Spain (Fig. 1D). The main feature of the territory is a deep canyon carved by the Douro River, as well as some tributary rivers (Tormes, Camaces, Huebra).

The presence of beaver in this area was identified by some signs on the banks of the Tormes River (a tributary of the Douro River) ca. eight kilometres before it flows in the Douro River (Fig. 1D). The main finding consisted of a willow (*Salix atrocinerea*) trunk gnawed (Fig. 2A). Although the field signs were immediately identified due to their singularity, an expert assessed the correspondence of these marks with the beaver presence (Benjamín Sanz's *personal comment*). Afterwards, about 500 m of the Tormes riverbanks were explored both up- and downstream where we could find more evidences such as tree trunks

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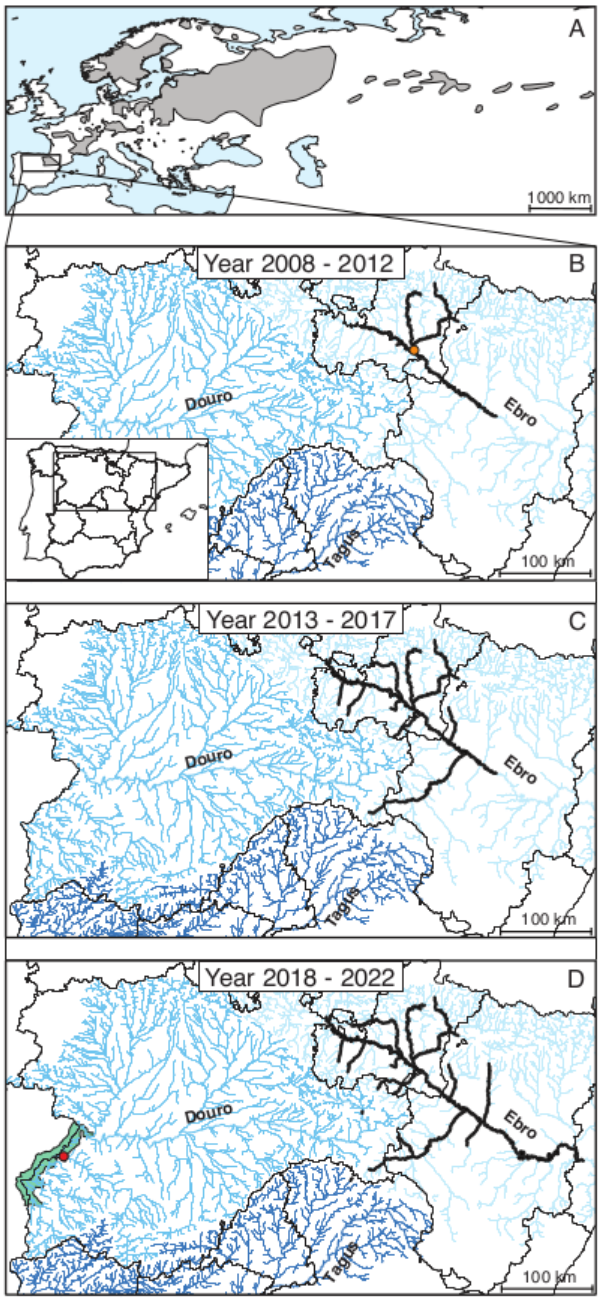

Figure 1 – Beaver distribution maps. (A) Beaver presence in the Palaearctic; (B, C, D) evolution of the occupancy areas in the Iberian Peninsula along three different time intervals: (B) 2008–2012, orange dot indicates the initial release in 2003; in the bottom left corner: detail of the Iberian Peninsula with the Spanish administrative areas and the zoom-in area represented in B-D; (C) 2013–2017; (D) 2018–2022, red dot indicates the new location described in this study and the green area shows the international protected natural region. Light blue , Ebro basin; blue , Douro basin; dark blue , Tagus basin; main river names indicated and represented with thicker lines. The map was generated using QGIS 3.16 in (A) WGS 84 reference system and (B-D) ETRS89 / UTM zone 30N projection with beaver distribution areas (A) adapted from IUCN (Batbold et al., 2021) and (B-D) obtained from literature (Halley et al., 2020; Ceña et al., 2004), new locations reported by experts (Benjamín Sanz; https://muskarirastros.com, and from authors.

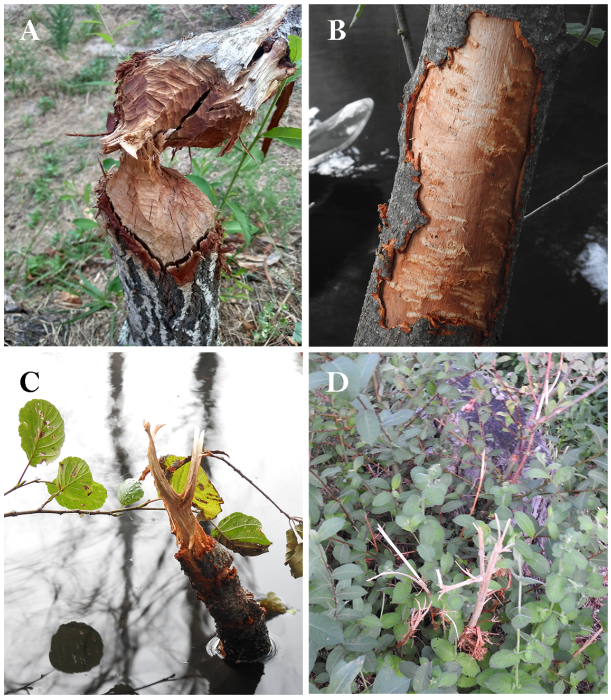

Figure 2 – Signs of beaver presence found on the banks of the Tormes River. (A) Willow trunk gnawed; (B) tree trunks with teeth marks and gnawed bark; (C) small tree (*Alnus* sp.) with gnawed bark; (D) foraged vegetation.

with teeth marks and gnawed bark (Fig. 2B, C) and foraged riparian vegetation (Fig. 2D) in areas surrounded by water.

The direct observation of the individual/s in the area has not yet been achieved. However, it is important to remark that due to the territory topography (great canyons), the river is mostly inaccessible from land and the presence of beaches or open areas is quite rare, making it difficult to spot the animal/s. Moreover, these few accessible areas are conditioned by high anthropogenic pressure, as they are used as recreational spots during the summer, which may affect the settlement of the beavers.

We hypothesized two possible origins of the population in the new location: (i) a natural dispersal event and (ii) an anthropogenic introduction. Based on the average advance of the dispersal fronts through the rivers between time periods (Fig. 1B, D), we have estimated a rate of expansion of 15 km per year along the Ebro basin. These calculations were performed using the Network Analysis — Shortest path tool in QGIS 3.16 (QGIS Development Team, 2022) and the river shape file from Spain. According to these data, it would take around 41 years to reach the mouth of the Tormes River by natural expansion, as there is a 611 km distance along the river banks between the new location and the other observation documented in the Douro River (i.e. 332 km in straight line) (Fig. 1D). Our prediction agrees well with previous works (Campbell-Palmer et al., 2016) that state that dispersal individuals only travel dozens of kilometres from its birth site and an effective expansion may take ca. 20 years on large river systems, as is the case of the Douro River. However, some authors have reported cases of great dispersal distances in individuals moving into uncolonised areas (e.g. up to hundreds of kilometres in Russian territories; Saveljev et al., 2002; up to 80 km in French territories; Fustec et al., 2001).

Considering the wide range of dispersal distances found in literature, we wanted to test the possibility that some animals could have reached the Tormes River by natural dispersion through the Douro-Tormes confluence. To obtain more information about this hypothesis, we explored ca. 300m along the bank sides adjacent to the river mouth (it was not possible to cover more distance due to the hard topography). However, there was no success in the search for signs of beaver presence in this area.

The estimated rate of expansion for the Iberian Peninsula together with the absence of any sign along the river mouth and the lack of data about beaver presence in the intermediate regions between the known range and the new location, supported the alternative hypothesis about a possible anthropogenic translocation (as occurred when it was introduced for the first time in Spain; Ceña et al., 2004). Similar cases have been recently reported in other European countries (e.g. Italy; Pucci et al., 2021; Mori et al., 2021; Belgium; Verbeylen, 2003; Scotland; Campbell, 2012).

However, there are some important aspects that need further discussion when dealing with translocation or reinforcement events. First, a genetic assessment should be developed in order to use individuals with low levels of inbreeding, coming from a source population that

is from the same evolutionary unit or geographically closer to avoid outbreeding depression.

Genetic studies performed with mitochondrial and nuclear markers have pointed out that the western beaver lineage, which is also the one present in the Iberian Peninsula can be an appropriate source, although it consists in admixed populations as a result of distinct reintroduction project strategies (Frosch et al., 2014; Senn et al., 2014; Durka et al., 2005). Second, regional authorities must choose the best scientific-based policies to apply in each case (Lopo et al., 2012). Third, these actions should include a previous project to ensure the suitability of the habitat for the species as well as studies about the impacts of the beaver presence in the area that can stimulate the social awareness and promote the coexistence in wildlife communities (Mori et al., 2022; Pucci et al., 2021; Scottish Natural Heritage., 1996). Finally, it is important to add that translocated or introduced individuals without the appropriate management may face strong difficulties (such as predation, malnutrition, etc.) and carry parasites or diseases dangerous to the native fauna (Massei et al., 2010). For all these reasons, uncontrolled initiatives without scientific and technical support should be avoided.

In summary, the purpose of this note is to report the presence of beaver in the western part of the Iberian Peninsula. However, further work is needed to shed light on the past (where these individuals came from), the present (the population size and the current distribution in the area) and the future of this population (projection of its future distribution within the western watercourses). In addition, as the area is located within an international protected natural area (Portugal and Spain), politicians and decision-makers should take the appropriate actions regarding the presence of this new mammal species and develop the necessary conservation policies.

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