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Decline of *Podarcis carbonelli* in its type locality, Laguna de San Marcos, Spain?

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Unexpected low densities of *Podarcis carbonelli* Pérez-Mellado, 1981 were recently described from La Nava de Francia, a small locality 9 km away from the type locality of the species, which was previously considered to represent one of the most dense populations in Salamanca (Sillero et al., 2012). This Iberian endemic lizard was described originally as a subspecies of *P. bocagei* (Seoane, 1884) by Pérez-Mellado (1981) but elevated to full species rank based on morphological and genetic data by Sá-Sousa and Harris (2002). The type locality of *P. carbonelli* is the locality of Laguna de San Marcos (Pérez-Mellado, 1981), consisting of a well-conserved Atlantic oak forest (*Quercus pyrenaica*) located near the village of La Alberca (Salamanca, Spain), which falls under the protection of the Natural Park Batuecas-Sierra de Francia. The density of *P. carbonelli* in the type locality was described as higher than 300 ind/ha (Pérez-Mellado, 1998). However, in La Nava de Francia, Sillero et al. (2012) found 43 individuals in six surveys in 1998, and only 27 individuals of *P. carbonelli* in 19 surveys performed in 2012. Nevertheless, *P. carbonelli* was considered a common species in suitable habitats (oak forests and dunes) until now. In Portugal, the species is abundant only in Aveiro (1500-1600 ind/ha: Pinhal de Cantanhede) and Espinho (Sá-Sousa, 2004) regions. Berlenga Island, also in Portugal, presented the highest known population density (2000-4000 ind/ha) (Vicente and Barbault, 2001). Accordingly, Portuguese southern populations have been described as restricted, but locally abundant (Sá-Sousa et al., 2009). In Doñana National Park in southern Spain, *P. carbonelli* is abundant in the dunes (Sá-Sousa, 2004).

Previous studies on *P. carbonelli* showed a continuous decline in its extent of occurrence, area of occupancy, extent and quality of its habitat, number of locations, and number of mature individuals (Sá-Sousa, 2002, 2008; Sá-Sousa et al., 2009). Consequently, the conservation status of *P. carbonelli* is classified Vulnerable in Portugal (Cabral et al., 2005) and globally Endangered, mainly because of its small occurrence area and highly fragmented populations (Sá-Sousa et al., 2009). Sillero et al. (2012) proposed population fluctuations due to climate change as possible causes for the population decrease, while transformation of the habitat, scientific

Table 1. List of species and number of individuals found in Laguna de San Marcos (Salamanca, Spain) during a survey in 18/5/2014.

Species	Ind	Acronym
Salamandra salamandra	2	SS
Triturus marmoratus	1	TM
Pelophylax perezi	Many	PP
Emys orbicularis	3	EO
Chalcides bedriagai	4	CHB
Lacerta schreiberi	1	LS
Timon lepidus	2	TL
Podarcis hispanica	2	PH
Psammodromus algirus	>10	PSA
Malpolon monspessulanus	2	MM
Natrix maura	3	NM

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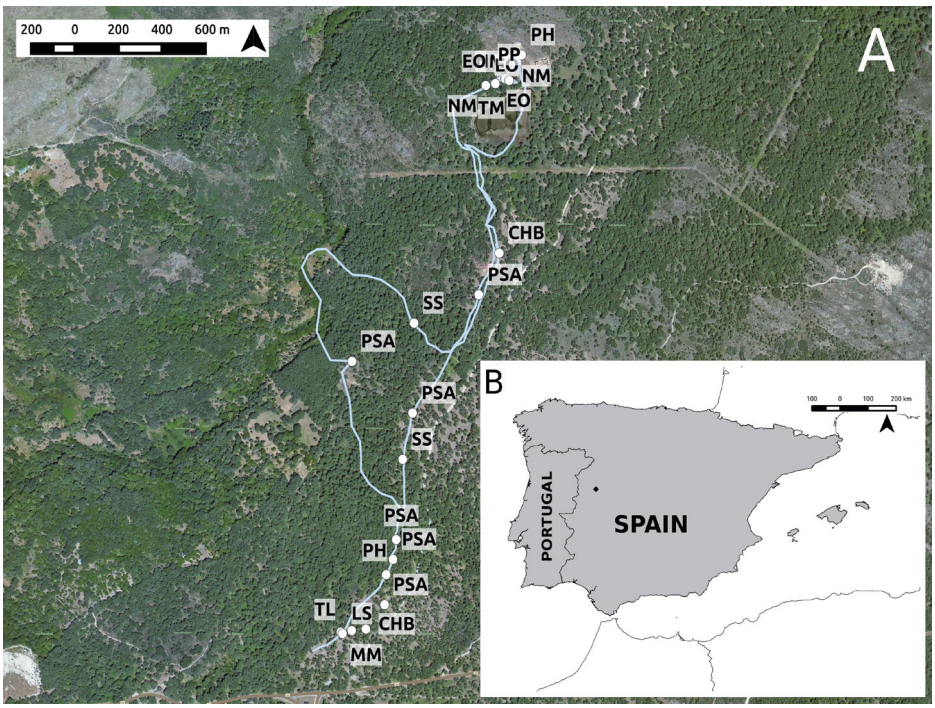

Figure 1. Map A: Aerial photography (Bing maps) of study area (Laguna de San Marcos) with the species record points and the track of the survey. Map B: Location of the study area in Salamanca province. Map B:. See Table 1 for species acronyms.

collection and human persecution were not considered to be probable causes for the decline.

We present here new data advising about a probable important decrease in the populations of *P. carbonelli* in Salamanca. Observations were conducted along a five kilometre long transect during 2.5 hours (from 12:00 till 14:30, UTC) at 18/5/2014, located near Laguna de San Marcos. This area consists of a forest of oaks (*Quercus pyrenaica*) surrounding a small lake (100×150 m), which is bordered by a ruined church. *Podacis carbonelli* is known to be present everywhere in the area (Pérez-Mellado, 1981). The weather was normal for this time of the year (León Llamazares, 1991): 23.1 ºC, 35.3% of humidity, and 1.9km/h of wind (measurements recorded in situ with a portable meteorological station SkyMate), corresponding to the peak of activity of *P. carbonelli*. While no individuals of *P. carbonelli* were observed, we found 11 amphibian and reptile species (Table 1 and Fig. 1): three amphibians (two urodeles, one anuran) and eight reptiles (one skink, four lacertids, and two colubrids).

The current transect at the type locality of *P. carbonelli* was conducted following our failure to find the species after two hours of sampling (from 9:00 till 11:00) in another oak forest (near the village Cercedilla de la Sierra) where the species was previously recorded (Sillero et al., 2005). Additionally, we sampled the same area surveyed in 2012 by Sillero et al. (2012), La Nava de Francia, in the afternoon of 18/5/2014, and found only two females and one male of *P. carbonelli*. La Nava de Francia and Laguna de San Marcos were also surveyed by one of us (WB) and other colleagues for approximately two hours at 27th May of 2013, where only two individuals, one in each area, were found.

Although we cannot confirm changes on maximum or minimum temperatures in Salamanca along time, a decrease on the precipitation is likely (Fig. 2). *Podarcis carbonelli* is a species with a strong dependence on humidity (Sillero and Carretero, 2013). It is also important to highlight the presence of *Chalcides bedriagai* found in the type locality. This species has been recorded in the area (Sillero et al., 2005), but never

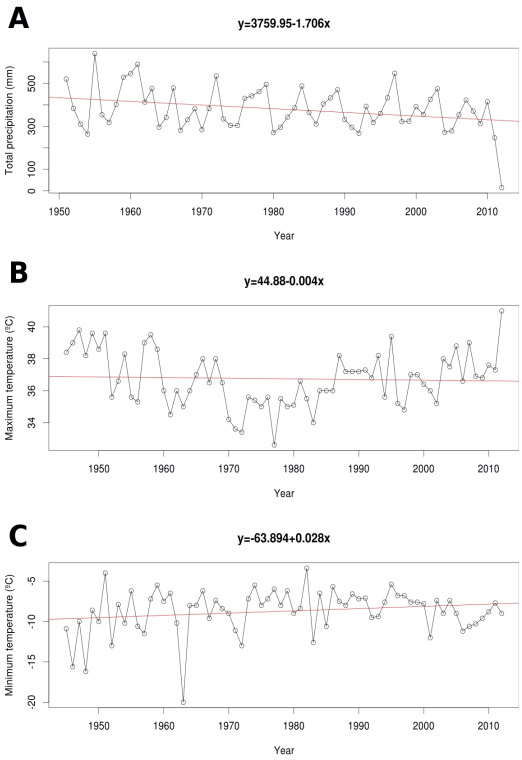

Figure 2. Graphs of total precipitation (A), maximum temperature (B), and minimum temperature (C) along time (1949-2012) using data from Matacán airport near Salamanca city. The regression equations and red lines correspond to fitted linear models (only precipitation model was highly significant). Data extracted from http://datosclima.es/.

in such numerous occurrence (pers. obs.). Perhaps, the presence of *C. bedriagai* might indicate an increment of their populations due to global warming. Moreover, *P. hispanica* Type 1B was also found (one of them road-killed on a track in the oak forest), indicating that wall lizards were active while the survey was performed. The relative low amount of *P. hispanica* specimens observed in the current study can be attributed to a lack of suitable (rocky) habitat along the forested surveyed areas; these are presumably only peripherally used by this species. In conclusion, we do not claim to ensure that *P. carbonelli* is disappearing from its type locality as we only performed one transect in each of the three visited areas. However, five surveys in three years in normal climatic conditions failed to replicate typical densities of the species. It is very clear that our results must be confirmed with robust data at a short-term in order to determine if *P. carbonelli* is effectively declining in Salamanca and other nearby localities. We cannot reject that these results are due to normal population fluctuations. While previously being a very common species in oak forests of the western Central Mountain Range of Salamanca, *P. carbonelli* now seems to be a remarkably rare species. Our intention with this note is to inform the herpetological community about our findings. We prefer to report this situation now than regret it in the near future.

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References

Cabral, M.J., Almeida, J., Almeida, P.R., Dellinger, T., de Almeida, N., Oliveira, M.E., Palmeirim, J.M., Queiroz, A.I., Rogado, L., Santos-Reis, M. (2005): Livro Vermelho dos Vertebrados de Portugal. Lisboa, Instituto da Conservação da Natureza.

León Llamazares, A. (1991): Caracterización agrícola de la provincia de Salamanca, 2nd edition. Madrid, Ministerio de Agricultura, Pesca y Alimentación.

Pérez-Mellado, V. (1981): Nuevos datos sobre la sistemática y distribución de *Podarcis bocagei* (Seoane, 1884) (Sauria: Lacertidae) en la Península Ibérica. Amphibia-Reptilia **2**: 259-265.

Pérez-Mellado, V. (1998): *Podarcis bocagei* (Seoane, 1884). In: Fauna Ibérica vol. 10, p. 243-257. Ramos, M.A. et al., Eds., Madrid, Museo Nacional de Ciencias Naturales.

Sá-Sousa, P. (2002) *Podarcis carbonelli*. In: Atlas de distribución y Libro Rojo de los Anfibios y Reptiles de España, p. 243-244. Pleguezuelos, J.M., Márquez, R. and Lizana, M., Eds., Madrid, Dirección General de Conservación de la Naturaleza-Asociación Herpetológica Española.

Sá-Sousa, P. (2004): Lagartija de Carbonell - *Podarcis carbonelli*. In: Enciclopedia Virtual de los Vertebrados Españoles, p. 1-13. Carrascal, L.M., Salvador, A., Eds., Madrid, Museo Nacional de Ciencias Naturales.

Sá-Sousa, P. (2008): *Podarcis carbonelli*. In: Atlas dos anfíbios e répteis de Portugal, p. 152-153. Loureiro, A., Carretero, M.A., Paulo, O., Eds., Lisboa, POA-ICN.

Sá-Sousa, P., Harris, D.J. (2002): *Podarcis carbonelli* Pérez-Mellado, 1981 is a distinct species. Amphibia-Reptilia **23**: 459-468.

Sá-Sousa, P., Pérez-Mellado, V., Martínez-Solano, I. (2009): *Podarcis carbonelli*. In: IUCN Red List of Threatened Species Version 2011.2.

Sillero, N., Argaña, E., Matos, C., Correia, E., Carneiro, C., Gomes, V. (2012): Unexpected low population levels of *Podarcis*

carbonelli in southern Salamanca (Spain). Boletin de la Asociacion Herpetologica Espanola **23**: 69-73.

Sillero, N., Carretero, M. (2013): Modelling the past and future distribution of contracting species. The Iberian lizard *Podarcis carbonelli* (Squamata: Lacertidae) as a case study. Zoologischer Anzeiger **252**: 289-298.

Sillero, N., Celaya, L., Martín-Alfageme, S. (2005): Using GIS to Make An Atlas: A Proposal to Collect, Store, Map and Analyse Chorological Data for Herpetofauna. Revista Española de Herpetologia **19**: 87-101.

Vicente, L., Barbault, R. (2001): Population dynamics of *Podarcis bocagei berlengensis* Vicente 1985 (Sauria, Lacertidae) on the island of Berlenga. In: Mediterranean Basin Lacertid Lizards – a Biological Approach, p. 93-103. Vicente, L., Crespo, E.G., Eds., Lisboa, Instituto da Conservação da Natureza.

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