

## Evidence of use of road drainage culverts by *Timon lepidus* (Daudin, 1802) in Western Andalusia

Juan Domingo Delgado<sup>1</sup> & María de los Ángeles Gómez<sup>2</sup>

<sup>1</sup> Área de Ecología, Dept. Sistemas Físicos, Químicos y Naturales, Univ. Pablo de Olavide, E-41013 Ctra. de Utrera Km.1, Sevilla, Spain.

### Resumen

#### Correspondence

J.D. Delgado

E-mail: [jddelgar@upo.es](mailto:jddelgar@upo.es)

**Received:** 15 January 2016

**Accepted:** 15 April 2016

**Published on-line:** 16 May 2016

*Evidencia del uso de drenaje viario por Timon lepidus (Daudin, 1802) en Andalucía occidental*

El uso de estructuras de drenaje viario y otros pasos inferiores potenciales para reptiles se encuentra escasamente estudiado. En esta nota presentamos una evidencia fotográfica de lagartos ocelados (*Timon lepidus*) usando un conducto estrecho lineal de drenaje bajo una carretera de tráfico intenso en Andalucía occidental (Sevilla). Nuestros datos sugieren que los lagartos podrían estar usando esta alternativa de desplazamiento contribuyendo a movimientos entre hábitats de esta especie amenazada, disminuyendo el riesgo de atropellos y mitigando los efectos de la fragmentación del hábitat.

**Palabras clave:** Lagartos, Lacertidae, Fragmentación viaria, Paso inferior, Permeabilidad viaria.

### Abstract

Use of road drainage structures and other potential underpasses such as culverts by reptiles is scarcely studied. We present photographic evidence of Ocellated lizards (*Timon lepidus*) using a narrow, linear road drainage under an intense-traffic road in western Andalusia (Seville). Our finding suggests that lizards could benefit of using these alternative routes diminishing risks of road killing, and that even narrow culverts could be contributing to an inter-habitat displacement in this threatened lizard species by mitigating habitat fragmentation effects.

**Key words:** Lizards, Lacertidae, Road fragmentation, Underpass, Road permeability.

### Introduction

The Ocellated lizard, *Timon lepidus* (Daudin, 1802), is a lacertid species of southwestern Europa (Near Threatened according to IUCN criteria; Pleguezuelos *et al.* 2009). This species is

distributed mainly through Spain and Portugal, with localized populations in France and Italy (Bischoff *et al.* 1984, Mateo 2002, Salvidio *et al.* 2004, Grillet *et al.* 2010, Doré *et al.* 2011). Main declining causes of the species are habitat loss and fragmentation, including roads and traffic im-

pacts, pesticides, poisoning, predator shifting to lizard prey, increase in generalist predator density, consumption by humans, and reduction of livestock grazing (Pleguezuelos *et al.* 2009, Mateo 2011).

Road-traffic mortality is one of the most important causes inducing lizard population reductions (Martínez-Rica 1981, Pleguezuelos *et al.* 2002, PMVC 2003). In this way, *T. lepidus* represented 5.4 % of the killed reptiles (147 of 2714) and 35.4 % of all killed lacertids, as recorded by a national-scale road-kill survey in Spain (PMVC 2003). Andalusia was the region with a higher incidence of kill records within Spain (22.4 %; PMVC 2003). Most records of road-killed lizards were produced in spring-summer (peaking April to July; PMVC 2003). However, impact of traffic on this saurian could be overestimated due to its higher detectability along road surveys, compared with smaller lizards (PMVC 2003). Apart from mortality sinks for lizards, roads may act as barriers against dispersal (Forman *et al.* 2002). For this reason, the availability of refuges and passageways are a more critical factor conditioning distribution of *T. lepidus* than other meso-habitat traits such as vegetative cover, substrate type or even human presence (Doré *et al.* 2011, Mateo 2011).

Use of drainage culverts and other road underpasses by lizards of various species is scarcely studied. However, some authors have recorded such passage use by reptiles in the Iberian Peninsula, including lizards (Yanes *et al.* 1995, Rodríguez *et al.* 1996, Ascensão & Mira 2007, Mata *et al.* 2008). Tellería *et al.* (2011) did not detect barrier effect on *T. lepidus* in a motorway crossing forest habitat in northern Spain. Yanes *et al.* (1995) found that intensity of passage use was higher in summer than in spring and autumn, and detected only two tracks of *T. lepidus* through culverts under transport corridors in Madrid, suggesting that culverts would allow safer passage for these reptiles.

Fourteen such potential underpasses were surveyed in May-June 2014 along the road A-376, between the kilometer points 12 and 17 (Seville province, SW Spain) (See underpass features in Appendix). The studied road is a four-lane motorway, ca. 37 m wide, with a service parallel dirt track alongside each asphalt verge. It maintains a traffic intensity of 17,170 vehicles/day (Ministerio

de Fomento, 2014). Both sides of the motorway were fenced, although there were holes at irregular intervals, some of them coinciding with European rabbit trail routes.

We surveyed road culverts and other drainage and mixed-use structures that could be used as faunal conducts, with one unit of Döerr Boly-Guard, 5.0 megapixel IR digital camera. The selected culverts had their mouths surrounded by concealing vegetation which aided to minimize removal by pedestrians and drivers. Only 2 culvert-type structures were a priori appropriate as placements for installation of the camera, due to high degree of exposition to pedestrians and vehicles of the remaining ones. We placed the camera at these 2 underpasses (coded #4 and #6, see Appendix) in different days, and set the camera at hours of lower human activity for discrete 24-h periods of operation.

In previous inspections of both structures, we incidentally detected signs of Ocellated lizard or other species at the entrance of underpass #4 but none at underpass #6. The camera was thus operated for only one 24-hour period at underpass #6 and for six 24-hour periods (144 hours) at underpass #4. In all, we obtained 11 photos (not showing any animal species) in underpass #6 and 26 photos in underpass #4, of which 14 photos showed animal use or presence at the underpass entrance.

In underpass #4, 8 photos corresponded to rats (probably *Rattus rattus* L., 1758), clearly entering or emerging from the culvert; 1 to a House sparrow, *Passer domesticus* (L., 1758) at the entrance; and 5 photos showed presence of Ocellated lizard, two of them neatly emerging from the culvert mouth. The camera was stolen in subsequent days from another nearby location, and the photographic survey was thus interrupted.

The used culvert had the following traits: location UTM: 30S 246404 E, 41289 N; elevation: 65 m; type of section of the structure: circular; diameter: 60 cm; approximate length: 48 m; material: concrete; linear shape: straight; visibility: both mouths visibly open and unconcealed by deposits or rubbish; fitted with a central air vent (median of the road); presence of outer lateral ledges; vegetation cover within 5 m of mouth: 60%, composed of shrub and herbs; distance to asphalt road edge: 5 m; road edge located at a height from passage mouth level of ca. 3.5 m.

The culvert used by Ocellated lizards in the A-376 motorway was longer (48 m) and narrower (0.6 m) than those crossed by reptiles in another camera study in Madrid (average culvert length: 13.1 m, diameter: 1.2 m; Yanes *et al.* 1995). In fact, wider available culverts near from our culvert #4 did not show consistent signs of lizard use. On the other hand, the structure crossed by lizards was also used by other animals. This could be indicating that other environmental and structural factors associated to both the culvert and immediate surroundings may determine selective use of the underpass by several species.

Other researchers have concluded that reptiles prefer crossing conducts of intermediate dimensions, as compared to small mammals which would use narrower underpasses (Rodríguez *et al.* 1996). Furthermore, the roof of the conduct was perforated at the center of the road corridor, in the median band, allowing light to reach the interior of the structure. This could mean more favorable conditions of temperature and light environment for lizard crossing.

The absence of detritus pits (that could act as biological traps for some species) at both ends of the culvert and the presence of vegetation and sandy-rocky ground nearby could be other favoring habitat features for vertebrate species using underpasses (Ascensão & Mira 2007). No specifically-designed vertebrate crossing structures were found along the road A-376 in our study.

Hence, in roads of dense traffic and high risk of road killing, such common, narrow drainage structures may be frequently used as conducts under the asphalt corridor in lizard movement.

Our observations stress the idea that reptiles, especially lacertids, can effectively use this kind of draining conducts within their home ranges and probably also to disperse to new areas (see also Yanes *et al.* 1995). Large overpasses or wildlife crossing platforms would be perhaps more effective for reptiles and other local species because they provide a larger and quieter amount of habitat than culverts. However, other economic, landscape and legal (the studied road does not cross protected natural areas) prospects are to be considered for minimizing road barrier effects in this concrete sector. Provided this lizard species is vulnerable to mortality by traffic and road-traps, the inclusion of new specifically designed culverts and improvement of operating ones, in road projects in sensible zones, would be more affordable aiding measures for the conservation of this and other reptile species. If this is not just a casual phenomenon, our observations point to a possible use of drainage conducts which is relevant given the important negative effect of roads in this lizard species. In future studies it would be necessary to extend these surveys to other road underpasses, different seasons along a full annual cycle, and with a larger sampling intensity (i.e. increasing camera numbers).



**Figura 1.** Capturas de cámara de dos adultos diferentes de lagarto ocellado en el paso inferior #4, segmento de carretera 1; A) arriba: individuo #1; 14/05/2014 (GMT: 14:56:34 h); B) abajo: individuo #2; 19/05/2014 (GMT: 11:59:05 h).

**Figure 1.** Camera captures of two different adults of Ocellated lizard at underpass # 4, road segment #1; A) above: individual #1; 14/05/2014 (GMT: 14:56:34 h); B) below: individual #2; 19/05/2014 (GMT: 11:59:05 h).

## Acknowledgements

We thank José Antonio Gómez for his help in the field work. This work was partially supported by grant “Ayuda p.p. 11.10, Grupos Emergentes” of the Universidad Pablo de Olavide, Seville, Spain, to the first author.

## References

- Ascensão F & Mira A. 2007. Factors affecting culvert use by vertebrates along two stretches of road in southern Portugal. *Ecological Research* 22: 57-66.
- Bischoff W, Cheylan M & Böhme W. 1984. *Lacerta lepida* Daudin 1802. Pp. 181-210 in: Böhme, W. (ed.): *Handbuch der Reptilien und Amphibien Europas*, Aula-Verlag, Wiesbaden.
- Díaz-Ruiz F & Ferreras P. 2011. Depredación de *Timon lepidus* por gato asilvestrado. *Boletín de la Asociación Herpetológica Española* 22: 148-151.
- Doré F, Grillet P, Thirion JM, Besnard A & Cheylan M. 2011. Implementation of a long-term monitoring program of the ocellated lizard (*Timon lepidus*) population on Oleron Island. *Amphibia-Reptilia* 32:159-166.
- Forman RTT, Sperling D, Bissonette JA, Clevenger AP, Cutshall CD, Dale VH, Fahrig L, France R, Goldman CR, Heanue K, Jones JA, Swanson FJ, Turrentine T & Winter TC. 2003. *Road Ecology: Science and Solutions*. Island Press, Washington, D.C.
- Grillet P, Cheylan M, Thirion JM, Doré F, Bonnet X, Dauge C, Chollet S & Marchand MA. 2010. Rabbit burrows or artificial refuges are a critical habitat component for the threatened lizard, *Timon lepidus* (Sauria, Lacertidae). *Biodiversity Conservation* 19: 2039-2051.
- Martínez-Rica JP. 1981. Nota sobre la protección de especies amenazadas de anfibios y reptiles en España. *Pirineos* 114: 75-86.
- Mata C, Hervás I, Herranz J, Suárez F & Malo JE. 2008. Are motorway wildlife passages worth building? Vertebrate use of road-crossing structures on a Spanish motorway. *Journal of Environmental Management* 88: 407-415.
- Mateo JA. 2002. *Lacerta lepida* Daudin, 1802. Lagarto ocellado. Pp. 225-227 in: Pleguezuelos, J. M., R. Márquez, and M. Lizana (eds.): *Atlas y libro Rojo de los Anfibios y Reptiles de España*. Dirección General de Conservación de la Naturaleza, Asociación Herpetológica Española, Madrid.
- Mateo JA. 2011. Lagarto ocellado – *Timon lepidus*. En: *Enciclopedia Virtual de los Vertebrados Españoles*. Salvador, A., Marco, A. (Eds.). Museo Nacional de Ciencias Naturales, Madrid. Available in <http://www.vertebradosibericos.org>.
- Ministerio de Fomento. 2014. *Mapas provinciales de tráfico*. Sevilla. Secretaría de Estado de Infraestructuras, Transporte y Vivienda, Secretaría General de Infraestructuras, Dirección General de Carreteras, Gobierno de España. Available in <http://www.fomento.gob.es/Carreteras/MapProvin2014.pdf> (accessed on 15-III-2016).
- Pleguezuelos JM, Márquez R & Lizana M (eds.) 2002. *Atlas y Libro Rojo de los Anfibios y Reptiles de España*. Dirección General de Conservación de la Naturaleza-Asociación Herpetológica Española (2ª impresión), Madrid, 587 pp.
- Pleguezuelos JM, Sá-Sousa P, Pérez-Mellado V, Márquez R, Cheylan M, Corti C & Martínez-Solano Í. 2009. *Timon lepidus*. The IUCN Red List of Threatened Species. Version 2014.3. Available in [www.iucnredlist.org](http://www.iucnredlist.org) (accessed on 26-III-2015).
- PMVC. 2003. *Mortalidad de vertebrados en carreteras*. Documento técnico de conservación nº 4. Sociedad para la Conservación de los Vertebrados (SCV). Madrid, 350 pp.
- Salvidio S, Lamagni L, Bombi P & Bologna MA. 2004. Distribution, ecology and conservation status of the ocellated lizard (*Timon lepidus*) in Italy (Reptilia, Lacertidae). *Italian Journal of Zoology* 71: 125-134.
- Tellería JL, Díaz JA, Pérez-Tris J, De Juana E, De La Hera I, Iraeta P, Salvador A & Santos T. 2011. Barrier effects on vertebrate distribution caused by a motorway crossing through fragmented forest landscape. *Animal Biodiversity and Conservation* 34: 331-340.
- Yanes, M, Velasco JM & Suárez F. 1995. Permeability of roads and railways to vertebrates: The importance of culverts. *Biological Conservation* 71: 217-222.

## Appendix

### Features of the studied underpasses in the road A-376 (Seville province, Spain).

The viaduct dimensions are shown as width and height. Ø = Diameter (tubular structures or culverts). Maximum vegetation cover estimated within a radius of 5 m around one accessible mouth of the pass. All dimensions are in meters.

Underpass	Type	Dimensions	Air vent	Light inside	Water	Distance of mouth to road	Habitat type
1	Culvert	Ø 0.60	Yes	Yes	No	3	Industrial-rural
2	Culvert	Ø 0.60	Yes	Yes	Yes	4	Agricultural
3	Culvert	Ø 1.80	No	Yes	No	5	Agricultural
4	Culvert	Ø 0.6	Yes	Yes	Yes	5	Agricultural
5	Culvert	Ø 1.80	No	Yes	No	5	Agricultural
6	Culvert	Ø 0.6	Yes	Yes	Yes	4	Agricultural
7	Culvert	Ø 1.80	No	Yes	No	5	Agricultural
8	Culvert	Ø 1.80	Yes	Yes	Yes	6	Agricultural
9	Viaduct	19.0 x 4.25	Yes	Yes	Yes	1	Agricultural
10	Culvert	Ø 1.80	Yes	Yes	Yes	1	Agricultural
11	Culvert	Ø 0.60	Yes	Yes	Yes	3	Agricultural
12	Culvert	Ø 1.80	Yes	Yes	Yes	5	Agricultural
13	Culvert	Ø 1.80	Yes	Yes	Yes	4	Agricultural
14	Culvert	Ø 1.80	Yes	Yes	Yes	2	Industrial-rural