

Impact of otter (*Lutra lutra*) predation on amphibians in temporary ponds in Southern Spain

DAN COGĂLNICEANU¹, RAFAEL MÁRQUEZ², JUAN FRANCISCO BELTRÁN³

¹ University Ovidius Constanța, Faculty of Natural Sciences, Aleea Universității 1, corp B, R-900470, Constanța, Romania. Corresponding author. E-mail: dcogalniceanu@univ-ovidius.ro; dan_cogalniceanu@yahoo.com

² Fonoteca Zoológica, Dept. de Biodiversidad y Biología Evolutiva. Museo Nacional de Ciencias Naturales (CSIC). José Gutiérrez Abascal 2, E-28006, Madrid, Spain.

³ Departamento de Fisiología y Zoología, Facultad de Biología, Universidad de Sevilla. Avda. Reina Mercedes 6, E-41012, Sevilla, Spain.

Submitted on: 2009, 21th October; revised on: 2010, 27th, August; accepted on: 2010, 22th October.

Abstract. We report the observation of an event of mortality of ribbed newts (*Pleurodeles waltl*) and Iberian spadefoot toads (*Pelobates cultripes*) due to predation by a pair of otters (*Lutra lutra*) in a temporary pond complex in southern Spain. The peculiar predation mode on ribbed newts, with extraction of soft organs through an incision in the upper part of the thorax, may result in an underestimation of the importance of this species in the diet of otters. The high number of dead amphibians killed by two otters in only several hours suggests that the presence of these predators may pose a serious threat to amphibian populations. The risk is especially high in arid areas, with few ponds, synchronous reproductive migration, and high density of animals. We consider that measures promoting the conservation and population and range increase of otters may have a negative impact on amphibians.

Keywords. amphibians, *Pleurodeles waltl*, *Pelobates cultripes*, otter, predation, conflicting conservation goals.

The goal of conservation is the persistence of biodiversity (Williams and Araujo, 2000), so current methods of planning include multiple species and landscape features. Most conservation priorities and initiatives are focused on endangered and threatened species. These often result in specific action plans aimed at maintaining and increasing the effectiveness, density or area covered by the target species. Negative secondary effects occur when the target species is a major predator or competitor of other endangered or threatened species. This is a major challenge for conservation, posing conflicting goals and requiring serious prioritization. Until now, most reports were focused on the conflicts between humans and wildlife (Drechsler, 2004; Maikhuri et al., 2001; Marrs et al., 2007).

We report an event of massive predation of ribbed newts (*Pleurodeles waltl*) and Iberian spadefoot toads (*Pelobates cultripes*) by a pair of otters (*Lutra lutra*) in a temporary pond complex in southern Spain. The ponds are located in the south of Spain, in the Parque Natural de la Sierra Norte de Sevilla, Navas del Berrocal, Almadén de la Plata, Sevilla (N 37°47'29.0" W 06°04'30.0", elevation 439 m a.s.l.). The study area is of restricted access, and part of the West Sierra Morena environment, with hot, dry summers (Fernández-Alés, 1979). For the interval 1991-2001, mean annual temperature was 16.8 °C, and mean annual rainfall 768.4 mm (Junta de Andalucía, 2002). The landscape has a gentle slope, surrounded by scattered oaks (*Quercus ilex*) and cork-oaks (*Quercus suber*), and interspersed with shrubs of *Cistus*, *Lavandula*, *Rosmarinus*, *Retama* and *Pistacia lentiscus*. The major pond is approximately 20 m in diameter and is part of a group of four ponds of similar size; two of them reaching depths of 40-60 cm and the other two being shallower 20-30 cm. These ponds typically fill with water with the fall rains and dry up along the spring, although in rainy years water can be present throughout the year. In addition to *P. waltl* and *P. cultripes*, the ponds are used for reproduction by *Pelodytes ibericus* and *Bufo calamita* and less than 100 m away is a temporary stream inhabited by a breeding population of *Alytes cisternasii* which has been studied over several years (Penna et al., 2006; Márquez et al., 2007, 2008; Tejedo et al., 2008).

The autumn rains started in 2006 on October 18, after an extremely dry summer. This triggered a massive reproductive migration of amphibians towards the ponds. On the night of October 19, 2006, we found partially consumed bodies of 24 ribbed newts (*Pleurodeles waltl*) and rests of more than five adult Iberian spadefoot toads (*Pelobates cultripes*). Two additional bodies of ribbed newts were collected during daytime the day after. The predators, two otters (*Lutra lutra*) were identified initially by one fresh scat found on land, one meter away from the edge of the water and later the two adult otters were directly observed in the vicinity of a pond.

The remains of the ribbed newts were nearly complete bodies showing a characteristic wound in the upper thoracic area (Fig. 1) which appeared open and emptied, as described by Alarcos et al. (2006). In all cases, the heart, lungs and liver were consumed. Some of the bodies were still moving, indicating that predation was very recent. Newts were sexed based on the presence of male nuptial pads, totaling 11 males and 14 females and one individual that could not be sexed. Collected bodies were measured in the laboratory to the nearest 0.5 mm with a digital caliper (Table 1). Only snout-vent length was significantly larger in females than in males (t - test, $P < 0.05$).

The remains of Iberian spadefoot toads found consisted in shreds of skin and part of the digestive tract (stomach) and egg-masses in females. All the remains found were fresh, most likely from the same night and all but two ribbed newts were found on land, less than 50 cm away from the edge of the pond. The two ribbed newts found in the water were floating less than one meter away from the shore.

Although previous occurrences of massive predation events of toads have been reported for otters (Lizana and Pérez-Mellado, 1990; Lizana et al., 1996; Bartralot and Bonet-Arbolí, 2000), and there is even a recent report of presumed otter predation on ribbed newts (Alarcos et al., 2006), this is the first instance with visual confirmation of the nature of the predators, and the event with the highest mortality reported for a single night. This is particularly true since the otters were observed around midnight by the



Fig. 1. Close-up of ventral view of some predated *Pleurodeles waltl* (© R. Márquez).

Table 1. Mean and standard deviation of body size measurements of male and female *Pleurodeles waltl* killed by otters. n = Number of individuals; SVL = snout-vent length; TL = tail length; HW = head width. Measurements are in mm following Fontanet and Horta (1989). Significant differences between sexes ($P < 0.05$; *t*-test) are marked with *.

	n	SVL	TL	HW
Males	11	79.8 ± 4.5 *	89.2 ± 5.4	15.0 ± 0.5
Females	14	85.8 ± 6.6 *	82.9 ± 9.9	15.6 ± 1.3

researchers (only three hours after sunset) and they could have continued their predation if not interrupted. Ten additional living ribbed newts were observed. The peculiar predation mode on ribbed newts, with the selective consumption of a small amount of soft organs, may cause the underestimation of this type of predation in diet studies of otters based on scat analyses (e.g., Clavero et al., 2005).

The ponds where this occurred were visited yearly in fall by researchers since 2001 and no similar predation events were ever observed (Tejedo et al., 2008). The fact that in previous years Iberian Parsley frogs (*Pelodytes ibericus*) were never heard in this pond

may suggest that the otters, who are typically found near the shore of a dam which is more than one km away downstream, may have located the ponds through the calls of the parsley frogs. Otters typically have home ranges that can be of more than 10 km² (Erlinge, 1967). A similar survey in 2007, at the start of the fall rains found only six adult ribbed newts. While locally important, the otter predation reported did not eliminate the prey populations and its medium-term impact has still to be assessed.

The scarcity of breeding sites for pond-dwelling amphibians in our study area results in high concentrations of amphibians in these temporary ponds, making them extremely vulnerable to the threat posed by opportunistic predators. Both *P. waltl* and *P. cultripipes* are considered Near Threatened in the Spanish Red Book (Montori et al., 2002, Tejedo and Reques, 2002) and in the IUCN global and European Red Lists (IUCN 2007; Temple and Cox, 2009), but given the general climatic trends in their home ranges, their threat status is likely to increase. Repeated massive killing events combined with dry years may thus pose a severe threat to the survival of amphibian communities in the area. Thus, during a severe winter, otters fed on European pond turtles (*Emys orbicularis*) killing almost 200 individuals within a protected area (Lanszki et al., 2006). Reintroduction and management plans focused on increasing otter populations should consider mitigating the impact on prey populations, especially endangered ones. The persistence of amphibians is important for otters, since they represent an important trophic resource, so management measures that would allow their persistence are required (e.g., creation of artificial ponds). These conflicting conservation goals involving protected species require solid priority settings and trade-offs in decision-making. Overall, present species-based conservation approaches appear biased and unable to foresee and prevent this type of conflicts. A more complex, integrated management approach is thus required.

ACKNOWLEDGEMENTS

Synthesys ES-TAF-1964 provided travel funds for DC. Fieldwork was funded by Ministerio de Educacion y Ciencia (Spain) projects TEMPURA, CGL2005-00092/BOS and ACURA, CGL2008-04814-CO2/BOS, and CGL2006-27892-E/BOS. Permits to work in the Natural Park and scientific collection permits were granted by Consejería de Medio Ambiente, Junta de Andalucía. We thank Dr. Miguel Lizana for providing bibliography and two anonymous reviewers for helpful comments.

REFERENCES

- Alarcos, G., Ortiz, M., Fernández, M.J., Lizana M. (2006): Depredación del gallipato (*Pleurodeles waltl*) por nutria en los Arribes de Duero, Salamanca. Bol. Asoc. Herpetol. Esp. **17**: 85-88.
- Bartralot, E., Bonet-Arbolí, V. (2000): Depredación de mustélidos sobre sapo común (*Bufo bufo*). Bol. Asoc. Herpetol. Esp. **11**: 32-33.
- Clavero, M., Prenda, J., Delibes, M. (2005): Amphibian and reptile consumption by otters (*Lutra lutra*) in a coastal area in southern Iberian Peninsula. Herpetol. J. **15**: 125-131.

- Drechsler, M. (2004): Model-based conservation decision aiding in the presence of goal conflicts and uncertainty. *Biodiv. Conserv.* **13**: 141-164.
- Erlinge, S. (1967): Home range of the otter *Lutra lutra*. *Oikos* **19**: 81-98.
- Fernández-Alés, R. (1979): Características ecológicas de la Sierra Norte de Sevilla. *Jornadas sobre la gestión del Parque Natural de la Sierra Norte de Sevilla*. C.E.P.A.
- Fontanet, X., Horta, N. (1989): Biometría y dimorfismo sexual en *Pleurodeles waltl* Michahelles, 1830 Amphibia, Salamandridae de una población del NE de la Península Ibérica. *Misc. Zool.* **13**: 202-206.
- IUCN (2007): IUCN Red List of Threatened Species. www.iucnredlist.org.
- Junta de Andalucía (2002): La información ambiental de Andalucía. Publicación anual en CD. Consejería de Medio Ambiente. Junta de Andalucía. Sevilla.
- Lanszki, J., Molnár, M., Molnár, T. (2006): Factors affecting the predation of otter (*Lutra lutra*) on European pond turtle (*Emys orbicularis*). *J. Zool., Lond.* **270**: 219-226.
- Lizana, M., Pérez-Mellado, V. (1990): Depredación por la nutria (*Lutra lutra*) del sapo de la Sierra de Gredos (*Bufo bufo gredosicola*). Doñana, *Acta Vertebrata* **17**: 109-112.
- Lizana, M., Martín-Sánchez, R., Antín, J., López, J., Morales, J.J., Gutiérrez J., del Arco, G. (1996): Nuevos datos sobre la depredación de anfibios por nutrias (*Lutra lutra*) en zonas altas de la Sierra de Gredos. *Actas de Gredos 1993*. Boletín Universitario UNED **13**: 9-16.
- Maikhuri, R.K., Nautiyal, S., Rao, K.S., Saxena, K.G. (2001): Conservation policy-people conflicts: a case study from Nanda Devi Biosphere Reserve (a World Heritage Site), India. *Forest Policy Econ.* **2**: 355-365.
- Márquez, R., Bosch, J., Penna, M. (2007): Sound pressure level of advertisement calls of *Alytes cisternasii* and *Alytes obstetricans* (Anura, Discoglossidae). *Bioacoustics* **16**: 27-37.
- Márquez, R., Bosch, J., Eekhout, X. (2008): Intensity of female preference quantified through playback set points: call frequency versus call rate in midwife toads. *Anim. Behav.* **75**: 159-166.
- Marrs, R.H., Galtress, K., Tong, C., Cox, E.S., Blackbird, S.J., Heyes, T.J., Pakeman, R.J., Le Duc, M.G. (2007): Competing conservation goals, biodiversity or ecosystem services: element losses and species recruitment in a managed moorland-bracken model system. *J. Environ. Manage.* **85**: 1034-1047.
- Montori, A., Llorente, G.A., Santos, X., Carretero, M.A. (2002): *Pleurodeles waltl*. In: Atlas y Libro Rojo de los Anfibios y Reptiles de España, p. 51-53. Pleguezuelos, J.M., Márquez, R., Lizana, M., Eds. Dirección General de Conservación de la Naturaleza-Asociación Herpetológica Española, Madrid.
- Penna, M., Márquez, R., Bosch, J., Crespo, E.G. (2006): Non-optimal propagation of advertisement calls of midwife toads in Iberian habitats. *J. Acoust. Soc. Am.* **119**: 1227-1237.
- Tejedo, M., Reques, R. (2002): *Pelobates cultripes*. In: Atlas y Libro Rojo de los Anfibios y Reptiles de España, p. 94-96. Pleguezuelos, J.M., Márquez, R., Lizana, M., Eds. Dirección General de Conservación de la Naturaleza-Asociación Herpetológica Española, Madrid.
- Tejedo, M., Márquez, R., Beltrán, J.F., Marangoni, F., Llusia, D. Cambron, M., Gómez-Mestre, I., Meier, A., Eekhout, X., Bowker, R.G., Benítez, M., Moreira, C.N., Crespo,

- E.G., Sousa do Amaral, J.P., Penna, M.C. (2008): Las investigaciones sobre anfibios en el Parque Natural de la Sierra Norte. In: Investigación científica y conservación en el Parque Natural Sierra Norte de Sevilla, p. 3-16. Menor, A., Cuenca, I. Eds., Junta de Andalucía, Consejería de Medio Ambiente, Sevilla.
- Temple, H.J., Cox, N.A. (2009): European Red List of Amphibians. Office for Official Publications of the European Communities, Luxembourg.
- Williams, P.H., Araujo, M.B. (2000): Using probability of persistence to identify important areas for biodiversity conservation. *Proc. R. Soc. Lond. B* **267**: 1959-1966.