

Short Communication

The Near Threatened Eurasian otter *Lutra lutra* in Morocco: no sign of recovery

MIGUEL DELIBES, JAVIER CALZADA, MIGUEL CLAVERO, NÉSTOR FERNÁNDEZ
CARLOS GUTIÉRREZ-EXPÓSITO, ELOY REVILLA and JACINTO ROMÁN

Abstract Although the Near Threatened Eurasian otter *Lutra lutra* has been recovering in Europe since the 1980s nothing is known about population trends of the species in northern Africa. Ninety sites were searched for signs of otters in northern and western Morocco in 1983 and we repeated this survey in 2011. At each site we searched for otter spraints (faeces) or clear footprints along a maximum of 600 m of river bank, ending the search when the first sign was found. Overall results were strikingly similar in 1983 and 2011, with 36 positive sites and the same general distribution pattern of the species. Healthy otter populations appear to remain in the foothills of the Middle and High Atlas but the trend of populations disappearing from the relatively flat Atlantic slope has increased. The results are in clear contrast with the recovery of otter populations in Europe, probably because of differences in the implementation of environmental policies, especially regarding water pollution.

Keywords Eurasian otter, *Lutra lutra*, Morocco, PCB, pollution, recovery, survey

The Eurasian otter *Lutra lutra*, categorized as Near Threatened on the IUCN Red List (Ruiz-Olmo et al., 2008) suffered a large decline in both range and population size throughout Europe between approximately 1945 and 1985, disappearing from many areas (Mason & Macdonald, 1986). In the early 1980s efforts were made, mainly on the initiative of the Vincent Wildlife Trust, to evaluate the status of the species in several southern European and North African countries (Macdonald & Mason, 1994). Since that time the otter has recovered across its European range (Crawford, 2003; Prigioni et al., 2007; López-Martín & Jiménez, 2008). This recovery has been mostly attributed to efficient environmental policies to control pollution, and

especially to reduce organochlorine pesticides and polychlorinated biphenyls (PCBs) in the environment (Roos et al., 2001; Mason & Macdonald, 2004). However, nothing is known about the current status of otter populations in North Africa, where environmental legislation and its enforcement differ from that in Europe. Here we examine the status of the Eurasian otter in Morocco by repeating a survey carried out 28 years ago (Macdonald & Mason, 1984).

Between 8 and 21 April 1983 Macdonald & Mason surveyed 90 sites in northern and western Morocco (Fig. 1a) to characterize the distribution of the otter. The sampling protocol consisted of searching transects of up to 600 m for otter signs, mainly spraints (faeces) and footprints, along river banks. A site was considered positive (and the search was halted) whenever at least one sign was detected, and negative otherwise. We used the same protocol to resurvey the same areas during 7–16 June 2011. We assigned the sampling sites shown on the map in Macdonald & Mason (1984) to the nearest confluence between rivers and roads (mostly bridges) from a road map of that period. Although Macdonald & Mason assumed that otters were absent in dry sampling sites, we searched them because otters in Mediterranean areas can occupy temporarily dry stretches of river (Ruiz-Olmo et al., 2007). Rainfall in Morocco from October 1982 to March 1983 was c. 60% of the mean precipitation (UNDP Climate Change Country Profiles, 2006–2011) and 12 of the 90 sites visited by Macdonald & Mason were dry. We do not have rainfall data interpolated for the whole country in 2011 but precipitation was probably higher as we only found five sites dry out of the 90 visited.

The results from the 2011 survey were strikingly similar to those of 1983. Macdonald & Mason (1984) found 36 positive sites (46% of the 78 non-dry sampling sites), the same number that we found in 2011 (42% of the 85 non-dry sites; $\chi^2 = 1.167$, $P = 0.28$). The distribution of the positive and negative sites was also similar (Fig. 1a,b), with the status (otter presence or absence) of each site tending to be the same in both surveys (2×2 summary table of coincidences and discrepancies; $\chi^2 = 10.15$, $P = 0.001$). Otters tended to be absent from intensively populated and cultivated flat areas, where river banks had scarce or no vegetation. The species is, however, widespread in the foothills of the Middle and High Atlas.

MIGUEL DELIBES (Corresponding author), MIGUEL CLAVERO, NÉSTOR FERNÁNDEZ, ELOY REVILLA and JACINTO ROMÁN Estación Biológica de Doñana, CSIC, Américo Vespucio s/n, 41092 Sevilla, Spain. E-mail mdelibes@ebd.csic.es

JAVIER CALZADA Departamento de Biología Ambiental y Salud Pública, Universidad de Huelva, Huelva, Spain

CARLOS GUTIÉRREZ-EXPÓSITO Doñana National Park, Centro Administrativo El Acebuche, Matalascañas, Spain

Received 20 July 2011. Revision requested 25 August 2011.

Accepted 12 September 2011. First published online 1 March 2012.

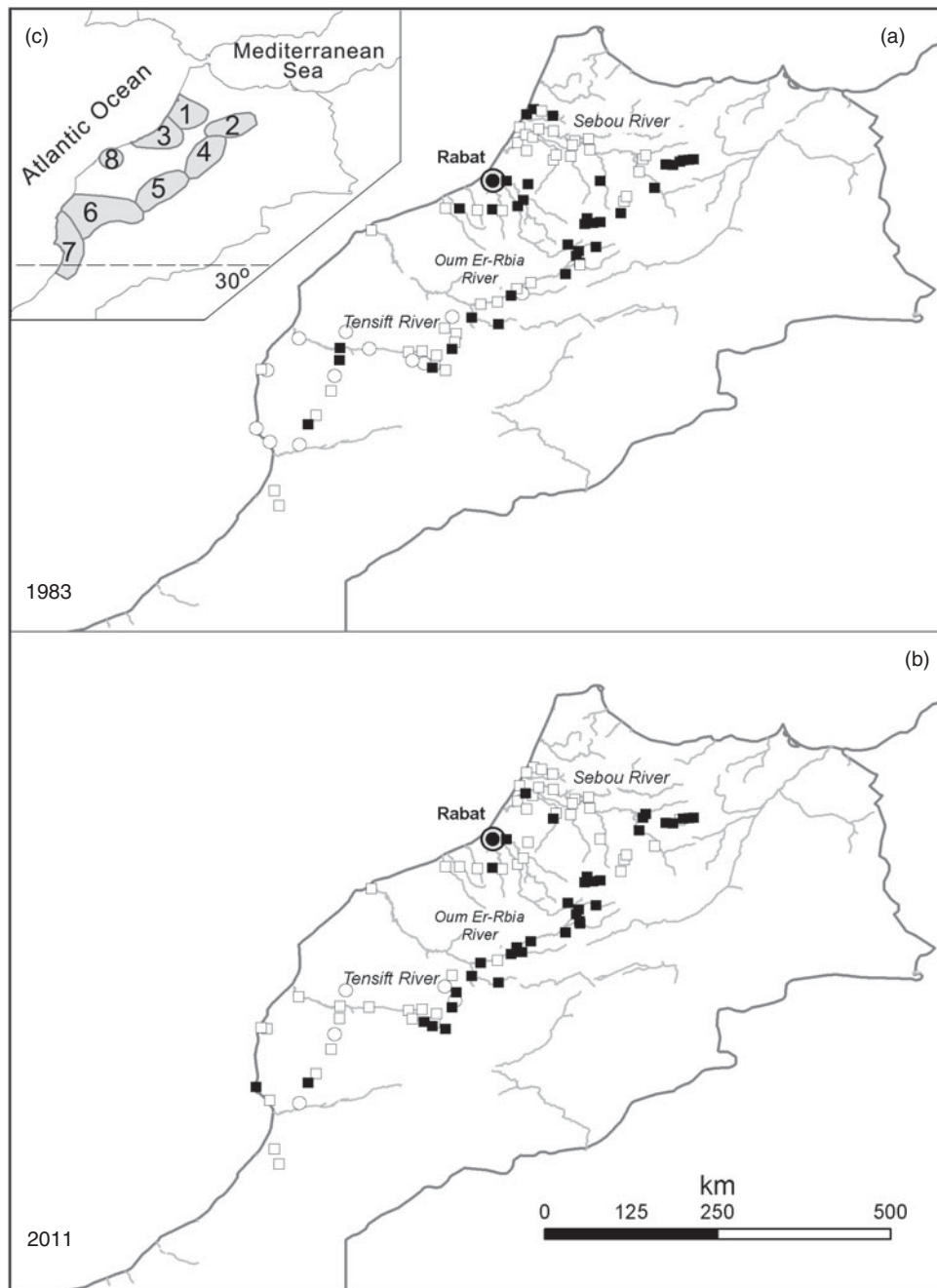


FIG. 1 Results of the otter surveys for the Eurasian otter *Lutra lutra* in Morocco in (a) 1983 and (b) 2011. Black squares indicate sites where otter signs were found (i.e. positive sites) and white squares negative sites. White circles indicate dry sites. Map (A) was modified from Macdonald & Mason (1984) by assigning their points to the nearest confluence between rivers and roads. Zones 1–8 in (c) are referred to in the text.

A detailed comparison reveals some minor changes in the distribution of the otter between 1983 and 2011. The largest difference is in the small rivers running directly to the coast from the hilly land east of the cities of Casablanca and Rabat (Zone 3 in Fig. 1c). In this area six out of nine sites were positive in 1983 but only two in 2011, suggesting that the otter is declining on the Atlantic plains. In 1983 a remnant otter population was detected near the Ramsar

categorized lagoon of Merdja Zerga and in the lower Sebou River, where it is still present (Zone 1). In 1983 there were positive sites at the Merdja Zerga lagoon but in 2011 the positive sites in this Zone were in the lower Sebou River and its tributary, the Beth. In upstream reaches of the Sebou basin (Zone 2), below the Idriss First reservoir on the Inaouen River, the otter was detected in 2011 but not in 1983.

In the northern foothills of the Middle Atlas (Zone 4) 11 of 13 sites were positive in both surveys (otters were detected even inside the city of Khenifra). Negative sites were in mountain stretches close to Ifrane, where rivers are cold and flow fast, prey are probably scarce and foraging efficiency may be lower than downstream. In the middle stretches of the Oum er Rbia River and its tributaries Abid and Tessaout (Zone 5) the presence of otters seemed to be more continuous in 2011 than in 1983 (four out of 13 sites were positive in 1983 vs nine in 2011).

In both surveys three out of 16 sites were positive in the Tensift basin (Zone 6). However, we found all signs above Marrakech, whereas Macdonald & Mason (1984) recorded otters in the Chichaoua tributary. During our visit this river had a lot of water, abundant fish and well-developed bankside vegetation cover (i.e. apparently good conditions for otters), and many potential sprainting places but we were unable to find any otter signs. Six sites within the Tensift basin were dry in 1983 but only two in 2011.

One sampling site on the Asif n'Ait Moussa, a northern tributary of the Souss River in the south-western foothills of the High Atlas, was positive in 1983 and 2011. The Souss River is strongly affected by water extraction for irrigation (three sites dry in 1983 and one in 2011). Two sites on the Massa River, in the hilly and dry area around the city of Tiznit, and the mouth of the small Igrounzar River, by the coastal town of Essaouira, were negative in both surveys. We found otter signs at Tamri, at the mouth of a small river that was dry in 1983. This suggests that an otter population may be inhabiting coastal habitats at this southern latitude (Zone 7). The isolated mouth of the Oum er Rbia river, near El-Jadida (Zone 8), was negative in both surveys.

The main finding of our survey is that the distribution of the otter in Morocco in 2011 is similar to that of 28 years ago, although the species could be declining on the lowland plains. This is a striking contrast with the recovery of otter range recorded in Europe since the 1980s (Hammershoj et al., 1996; Jones & Jones, 2004; Mason & Macdonald, 2004). The current status of the species in Morocco is similar to that of some Mediterranean European countries in the early 1980s (Delibes & Rodríguez, 1990; Prigioni et al., 2007), when the species tended to be confined to less cultivated, mountainous areas. In Spain the positive sites increased from 33% in 1984 to 49% in 1995 and 65% in 2005 (López-Martín & Jiménez, 2008) and in southern Italy from 18% (positive 10-km UTM grid squares) in 1985 to 41% in 2004 (Marcelli & Fusillo, 2009). In Morocco, however, the occupied range may have slightly decreased since 1983. In Europe the main factor associated with the recovery of the otter seems to have been the reduction of pollution by organochlorine pesticides and PCBs (Mason, 1998) whereas in Morocco PCBs are still widely used. Schneider (2004) inventoried c. 1,150 t of PCBs in equipment and waste,

mostly in the plains between Tanger and Casablanca. However, Morocco ratified the Stockholm Convention in June 2004, which calls for the elimination of the use of PCBs in equipment by 2025, and the Basel and Rotterdam Conventions regarding hazardous waste. If these treaties are properly enforced there it is possible that the Eurasian otter could recolonize the plains from source populations in mountainous areas, as is happening in Spain (Clavero et al., 2010).

Acknowledgements

This article is a homage to Sheila Macdonald and Chris F. Mason who, in the last quarter of the 20th century, called the attention of the international community to the conservation of the otter in the Western Palearctic. We acknowledge the help of Sofía Conradi, Seila Alvaré, Abdeljebbar Qninba and the Universidad Internacional de Andalucía. Two anonymous referees provided useful comments and C.F. Mason kindly reviewed the English. Financial support was received from Estación Biológica de Doñana-CSIC. Permission was obtained from the Haut Commissariat aux Eaux et Forêts et a la Lutte contre la Désertification du Royaume du Maroc.

References

- CLAVERO, M., HERMOSO, V., BROTONS, L. & DELIBES, M. (2010) Natural, human and spatial constraints to expanding populations of otters in the Iberian Peninsula. *Journal of Biogeography*, 37, 2345–2357.
- CRAWFORD, A. (2003) *Fourth Otter Survey of England 2000–2002*. Environment Agency, Bristol, UK.
- DELIBES, M. & RODRÍGUEZ, A. (1990) La situación de la nutria en España: una síntesis de los resultados. In *La Nutria (Lutra lutra) en España* (ed. M. Delibes), pp. 157–167. ICONA Serie Técnica, Madrid, Spain.
- HAMMERSHOJ, M., MADSEN, A.B., BRUN-SCHMIDT, I.O., GAARDMAND, B., JENSEN, A., JENSEN, B. et al. (1996) *Otter (Lutra lutra) Survey of Denmark 1996*. Miljø-og Energiministeriet Danmarks Miljøundersøgelser, Copenhagen, Denmark.
- JONES, T. & JONES, D. (2004) *Otter Survey of Wales 2002*. Environment Agency, Bristol, UK.
- LÓPEZ-MARTÍN, J.M. & JIMÉNEZ, J. (eds) (2008) *La nutria en España. Veinte años de seguimiento de un mamífero amenazado*. SECEM, Málaga, Spain.
- MACDONALD, S.M. & MASON, C.F. (1984) Otters in Morocco. *Oryx*, 18, 157–159.
- MACDONALD, S.M. & MASON, C.F. (1994) *Status and Conservation Needs of the Otter (Lutra lutra) in the Western Palearctic*. Nature Environment 67. Council of Europe, Strasbourg, France.
- MARCELLI, M. & FUSILLO, R. (2009) Assessing range re-expansion and recolonization of human-impacted landscapes by threatened species: a case study of the otter (*Lutra lutra*) in Italy. *Biodiversity and Conservation*, 18, 2941–2959.
- MASON, C.F. (1998) Decline of PCB levels in otters (*Lutra lutra*). *Chemosphere*, 36, 169–171.
- MASON, C.F. & MACDONALD, S.M. (1986) *Otters. Ecology and Conservation*. Cambridge University Press, Cambridge, UK.

- MASON, C.F. & MACDONALD, S.M. (2004) Growth in otter (*Lutra lutra*) populations in the UK as shown by long-term monitoring. *Ambio*, 33, 148–152.
- PRIGIONI, C., BALESTRIERI, A. & REMONTI, L. (2007) Decline and recovery in otter *Lutra lutra* populations in Italy. *Mammal Review*, 37, 71–79.
- ROOS, A., GREYERZ, E., OLSSON, M. & SANDEGREN, F. (2001) The otter (*Lutra lutra*) in Sweden. Population trends in relation to total DDT and total PCB concentrations during 1968–99. *Environmental Pollution*, 111, 457–469.
- RUIZ-OLMO, J., JIMÉNEZ, J. & LACOMBA, I. (2007) The importance of ponds for the otter (*Lutra lutra*) during drought periods in Mediterranean ecosystems: a case study in Bergantes river. *Mammalia*, 71, 16–24.
- RUIZ-OLMO, J., LOY, A., CIANFRANI, C., YOXON, P., YOXON, G., DE SILVA, P.K. et al. (2008) *Lutra lutra*. In *IUCN Red List of Threatened Species v. 2011.2*. <http://www.iucnredlist.org> [accessed 1 December 2011].
- SCHNEIDER, U. (2004) *PCB inventory in Morocco*. UNEP PCB Consultation Meeting, 9–10 June 2004. Geneva, Switzerland. [http://www.chem.unep.ch/Pops/pcb_activities/PCB_proceeding/Presentations/Ueli%20Schneider%20\(ETI\).pdf](http://www.chem.unep.ch/Pops/pcb_activities/PCB_proceeding/Presentations/Ueli%20Schneider%20(ETI).pdf) [accessed 1 December 2011].

UNDP CLIMATE CHANGE COUNTRY PROFILES (2006–2011) School of Geography and the Environment, Oxford, UK. <http://country-profiles.geog.ox.ac.uk/> [accessed 7 October 2011].

Biographical sketches

The authors are scientists and wildlife biologists who met at Doñana National Park in Spain and have worked together for more than 10 years on the conservation biology of threatened species, mostly mammalian carnivores but also other mammals, birds and fish. They focus on the behavioural, demographic and biogeographical factors that are shaping the fate of biodiversity in a changing environment. They have investigated conservation problems faced by threatened species, including charismatic species such as the Iberian lynx, brown bear, Andalusian hemipode and Eurasian otter, as a consequence of human domination of landscapes, and have participated in the surveys for otters in Spain. Their admiration for the work of C.F. Mason and S.M. Macdonald, which was a turning point for knowledge about and conservation of otters in the Western Palaearctic, led to the resurvey of the Eurasian otter in Morocco 28 years later.