

## Updated status and management of non-native freshwater species in the Iberian Peninsula

Rafael Miranda<sup>1\*</sup> and Pedro M. Leunda<sup>2</sup>

<sup>1</sup>*Department of Zoology & Ecology, University of Navarra, Iruñlarrea 1, E-31008 Pamplona/Iruña, Navarra, Spain*

<sup>2</sup>*Gestión Ambiental Viveros y Repoblaciones de Navarra S.A., C/ Padre Adoain 219 Bajo, E-31015 Pamplona/Iruña, Navarra, Spain  
E-mail: [rmiranda@unav.es](mailto:rmiranda@unav.es) (RM), [pleuurr@alumni.unav.es](mailto:pleuurr@alumni.unav.es) (PML)*

\*Corresponding author

Received: 4 June 2010 / Accepted: 29 June 2010 / Published online: 30 July 2010

This special issue of *Aquatic Invasions* concerning the updated distribution, impacts, evaluation and management of non-native freshwater taxa in Iberia is comprised of the peer-reviewed Proceedings of the Symposium on Non-native Freshwater Species Introduction in the Iberian Peninsula that was held on the 12–13 of November 2009 at the University of Navarra, Pamplona, Spain. The local organization and scientific program committees were constituted by, in alphabetical order, David Galicia, Pedro M. Leunda, Javier Oscoz, Andrea Pino, Ibon Tobes and Antonio Vilches, whose efforts greatly contributed to the overall success of this symposium. Major sponsors of the symposium were the Ministry of Science and Innovation of the Spanish Government and the Department of Rural Development and Environment of the Government of Navarra. Administrative support was provided by the School of Sciences of the University of Navarra, especially the Administrative Offices and the Department of Zoology and Ecology.

With the aim of analysing this topic, the organization of this symposium was proposed with a double focus. On one hand, giving a technical and scientific view, where researchers and managers exchanged experiences and knowledge about the biology, status and management of principal invasive species. On the other hand, the symposium had an educational purpose oriented to university students and the general public, with the aim of introducing them to the future and actual actors in the research and management framework as

well as the particular characteristics and adequate control measures for non-native freshwater species.

In this symposium, more than 120 plants, 25 invertebrates, 29 fishes, five turtles and three mammals were cited as non-native species related to freshwater ecosystems in the Iberian Peninsula. Invasive species can constitute a major threat to biodiversity and ecosystem integrity and in some cases lead to substantial economic loss (Kolar and Lodge 2001; Gozlan et al. 2010). Spain is the European Mediterranean country with the highest biodiversity but nearly 20% of it is endangered according to IUCN (2009). Freshwater ecosystems are particularly prone to invasion by non-native species, including plants, invertebrates and vertebrates (García-Berthou et al. 2005). This symposium aimed to review the state of the biological invasion in the Iberian Peninsula and set up the agenda for future management and mitigation efforts.

This editorial paper introduces ten papers, which are a representative sample of the topics from this symposium. First, Gozlan (2010) analyses the costs of non-native freshwater introductions into Spain. Afterwards, an extended revision of the current knowledge on impacts of non-native fishes is presented (Leunda 2010). Oscoz et al. (2010) revise and update the current distribution of non-native invertebrates in the Ebro River basin. Additional records of freshwater fishes in this basin are presented by Miranda et al. (2010). Three of the published papers describe the management plans

for the zebra mussel *Dreissena polymorpha* in the Ebro River basin (Durán et al. 2010), the signal crayfish *Pasifastacus leniusculus* in the Andalusia region (Dana et al. 2010) and the Chinese mitten crab *Eriocheir sinensis* in the Guadalquivir River estuary (García-de-Lomas et al. 2010). Subsequent papers include case studies on control methods (Valdeón et al. 2010) and new records (Alarcos Izquierdo et al. 2010) of invasive turtles. Finally, Tomás et al. (2010) display the distribution and ecological parameters of the diatom *Didymosphenia geminata* in the Ebro River basin.

The development of management plans for these non-native freshwater species is a priority in order to mitigate their impacts on the environment, as well as to reduce the likelihood of establishment in new regions. This is especially important in such a biodiversity hotspot as the Iberian Peninsula. Knowledge and evaluation of threats and invasiveness levels of non-native species are keystones in the conservation of the native biota and ecosystems.

Finally, the editors thank the following reviewers, in alphabetical order, for their generous help refereeing the papers included in this special issue: Saúl Blanco (University of León, Spain), Miguel Clavero (Centre Tecnològic Forestal de Catalunya, Spain), Elías D. Dana (University of Almería, Spain), Francesca Gherardi (University of Florence, Italy), Stephan Gollasch (GoConsult, Germany), Simon Hallstan (University of Agricultural Sciences, Sweden), Lauren A. Harrington (University of Oxford, UK), David Holdich (EMEC Ecology, UK), Fabien Leprieur (Muséum National d'Histoire Naturelle, France), Lorenzo Mari (Politecnico di Milano, Italy), Cathy Kilroy (National Institute of Water & Atmospheric Research, New Zealand), Jose Luis Moreno (University of Castilla-La Mancha, Spain), Julian D. Olden (University of Washington, USA), Javier Oscoz (University of Navarra, Spain), Natividad Perez-Santigosa (Doñana Biological Station, Spain), Nuria Polo-Cavia (Museo Nacional de Ciencias Naturales, Spain), Quim Pou i Rovira (Sorelló, Spain) Anne-Caroline Prevot-Julliard (Muséum National d'Histoire Naturelle, France), Filipe Ribeiro (Museu Nacional de Historia Natural, Portugal and Virginia Institute of Marine Science, USA), Robert E. Schmidt (Bard College at Simon's Rock, USA) and David L. Strayer (Cary Institute of Ecosystem Studies, USA).

## References

- Alarcos Izquierdo G, Flechoso del Cueto F, Rodríguez-Pereira A, Lizana Avia M (2010) Distribution records of non-native terrapins in Castilla and León region (Central Spain). *Aquatic Invasions* 5: 303–308, doi:10.3391/ai.2010.5.3.08
- Dana ED, López-Santiago J, García-de-Lomas J, García-Ocaña DM, Gámez V, Ortega F (2010) Long-term management of the invasive *Pacifastacus leniusculus* (Dana, 1852) in a small mountain stream. *Aquatic Invasions* 5: 317–322, doi:10.3391/ai.2010.5.3.10
- Durán C, Lanao M, Anadón A, Touyá V (2010) Strategy of management of the zebra mussel invasion in the Ebro River basin. *Aquatic Invasions* 5: 309–316, doi:10.3391/ai.2010.5.3.09
- IUCN (2009) Red List of Threatened Species. <http://www.iucnredlist.org> (Accessed 31 December 2009)
- García-Berthou E, Alcaraz C, Pou-Rovira Q, Zamora L, Coenders G, Feo C (2005) Introduction pathways and establishments rates of invasive aquatic species in Europe. *Canadian Journal of Fisheries and Aquatic Sciences* 62: 453–463, doi:10.1139/f05-017
- García-de-Lomas L, Dana ED, López-Santiago J, González R, Ceballos G, Ortega F (2010) Management of the Chinese mitten crab, *Eriocheir sinensis* H. Milne Edwards, in the Guadalquivir Estuary (Southern Spain). *Aquatic Invasions* 5: 323–330, doi:10.3391/ai.2010.5.3.11
- Gozlan RE (2010) The cost of non-native aquatic species introductions in Spain: fact or fiction. *Aquatic Invasions* 5: 231–238, doi:10.3391/ai.2010.5.3.02
- Gozlan RE, Britton JR, Cowx I, Copp GH (2010) Current knowledge on non-native freshwater fish introductions. *Journal of Fish Biology* 76, 751–786, doi:10.1111/j.1095-8649.2010.02566.x
- Kolar CS, Lodge DM (2001) Progress in invasion biology: predicting invaders. *Trends in Ecology and Evolution* 16: 199–204, doi:10.1016/S0169-5347(01)02101-2
- Leunda PM (2010) Impacts of non-native fishes on Iberian freshwater ichthyofauna: current knowledge and gaps. *Aquatic Invasions* 5: 239–262, doi:10.3391/ai.2010.5.3.03
- Miranda R, Leunda PM, Oscoz J, Vilches A, Tobes I, Madoz J, Martínez-Lage J (2010) Additional records of non-native freshwater fishes for the Ebro River basin (Northeast Spain). *Aquatic Invasions* 5: 291–296, doi:10.3391/ai.2010.5.3.06
- Oscoz J, Tomás P, Durán C (2010) Review and new records of non-indigenous freshwater invertebrates in the Ebro River basin (Northeast Spain). *Aquatic Invasions* 5: 263–284, doi:10.3391/ai.2010.5.3.04
- Tomás P, Oscoz J, Durán C, Fernández D, Marín JP (2010) Distribution of the bloom-forming diatom *Didymosphenia geminata* in the Ebro River basin (Northeast Spain) in the period 2006–2009. *Aquatic Invasions* 5: 285–289, doi:10.3391/ai.2010.5.3.05
- Valdeón A, Crespo A, Egaña A, Gosá A (2010) Update of the pond slider *Trachemys scripta* (Schoepff, 1792) records in Navarre (Northern Spain), and presentation of the Aranzadi Turtle Trap for its population control. *Aquatic Invasions* 5: 297–302, doi:10.3391/ai.2010.5.3.07