

Records of introduced stripe-necked terrapins (*Mauremys* species) in Italy

MATTIA PANZERI^{1,§}, EMILIANO MORI^{2,§,*}, GIUSEPPE MAZZA^{3,4}, MATTIA MENCHETTI³

¹ Department of Environment, Health, Safety, University of Insubria, Via J.H. Dunant 6, 1100 Varese, Italy

² Di.S.A.F.A., Entomology and Zoology, University of Turin, Via Leonardo da Vinci 44, 10095 Grugliasco (Turin), Italy. *Corresponding author. E-mail: moriemiliano@tiscali.it

³ Department of Biology, University of Florence, Via Romana 17, 50125 Florence, Italy

⁴ Consiglio per la Ricerca e la Sperimentazione in Agricoltura, Centro di Ricerca per l'Agrobiologia e la Pedologia (CRA-ABP), via di Lanciola 12/a, 50125 Cascine del Riccio, Florence, Italy

[§] These authors equally contributed to this manuscript

Submitted on 2014, 29th April; revised on 2014, 5th July; accepted on 2014, 7th July
Editor: Uwe Fritz

Abstract. Freshwater turtles belong to the most popular pets and are often introduced outside their native range. Some species are highly invasive and may compete with native species. Three *Mauremys* species are naturally distributed in the Mediterranean region, but none is native to Italy. In this work we summarize records of *Mauremys* spp. in Italy. Records exist for 9 regions, but there are no verified breeding records. Reproduction could have happened in southern Tuscany for *M. leprosa*.

Keywords. Popular pets, invasive species, pond turtles, *Mauremys leprosa*, inter-specific competition, native species.

The introduction of invasive alien species represents one of the main causes of extinction at the global scale (e.g. Vitousek et al., 1997; Lowe et al., 2000; Clavero et al., 2009) and it determines major economic, health and societal issues (Mooney and Hobbs, 2000; Mazza et al., 2014; Menchetti and Mori, 2014). Among Reptiles, the highly invasive *Trachemys scripta elegans* has been massively released worldwide with consequences of outcompeting with indigenous species (Cady and Joly, 2004; Pupins and Pupina, 2011). This problem concerns also the Italian peninsula, where the only native freshwater turtles are *Emys orbicularis* and *E. trinacris*, whose populations are declining mainly for habitat loss and alien competition (Gariboldi and Zuffi, 1994; Ferri, 1995; Semenzato et al., 1998; Chelazzi et al., 2000).

Three species of the genus *Mauremys* occur in the Mediterranean region and in the Near and Middle East: *M. leprosa*, *M. caspica* and *M. rivulata* (Barth et al., 2004; Mantziou et al., 2004), with *M. leprosa* in North Africa

and the Iberian Peninsula (Keller and Busack, 2001; Fritz et al., 2006), *M. caspica* in the Near and Middle East (Wischuf and Fritz, 2001; Vamberger et al., 2013) and *M. rivulata* in the eastern Mediterranean region (Wischuf and Busack, 2001; Vamberger et al., 2014). In syntopic populations of *Mauremys* spp. and *E. orbicularis*, the latter species often seems to suffer from the dominance of *Mauremys* (see the review in Fritz, 2003), thus the introduced *Mauremys* may pose a threat to local native populations of *E. orbicularis*.

This problem could also relate to populations of *E. orbicularis* and *E. trinacris* in Italy. To evaluate the present situation, here we summarize records of alien *Mauremys* spp. in Italy, presenting a synthesis of published data and new records. Published and unpublished records of *Mauremys* spp. in Italy were collected from: (i) scientific papers; (ii) general books and articles; (iii) data from an Italian national mailing-list dealing with Herpetology, social networks and contacts with experts in several Ital-

ian regions, and (iv) check of the zoological collections of the Italian Natural History Museums.

Between December 2013 and April 2014 we also conducted an extensive survey of online aquarium and pet shops in Italy to assess the presence of *Mauremys* species in the pet trade. In addition, to confirm the morphological identification of two road-killed terrapins collected in Gabellino (cf. Fig. 1), about 650 bp of the mitochondrial subunit 1 of cytochrome c oxidase of one specimen were sequenced and compared with GenBank sequences of *Mauremys* according to DNA barcoding guidelines (<http://ibol.org>).

Occurrences of *Mauremys* spp. have been reported for 9/20 Italian regions (Fig. 1).

Scalera (2001) reported observations of *Mauremys* spp., without any specific determination, in seven Italian

regions: Piedmont, Lombardy, Emilia Romagna, Latium, Abruzzi, Molise and Apulia. *Mauremys* cf. *sinensis* was recently observed in the botanical garden of Palermo (B. Borri, pers. comm.). The greatest group of *Mauremys* was introduced, with 1000-1500 individuals, in the north of Ravenna (Emilia Romagna, Romea State Road), in the early 1980s (V. Ferri, pers. comm.). Some terrapins, maybe from this introduction, were still present in 1997 (Scolo Marana: D. Miserocchi, pers. comm.); two more individuals have been recently removed from the city of Bologna (D. Scaravelli, pers. comm.). In northern Italy, at least 10 *Mauremys* were recorded in a wetland of Bosco di Barco (Province of Brescia, Lombardy: V. Ferri, pers. comm.); in March 2013, an adult *Mauremys* has been observed in the Lake of Arignano (Province of Torino, Piedmont: N. Destefano, pers. comm.). A further *Maure-*



Figure 1. Records of *Mauremys* spp. in Italy. Grey regions represent those including at least one record. White circles represent exact observation sites. In brackets, year of observation and number of individuals (if more than one). The black triangle represents the site of the only genetically verified specimens (*M. leprosa*). Asterisks refer to specimens stored in Natural History Museums.

mys was recently (March 2014) removed from an artificial pond in Grugliasco, Piedmont (pers. obs.).

Detailed records for Latium were reported by Bologna et al. (2000; 2007), with single individuals in the Circeo National Park before 1980s, in the areas of Monti della Tolfa (Rio Fiume and Magnone) in the late 1990s, in the Reserve of Macchiatonda (2004), and in Villa Doria Pamphili, Rome (2005). A photograph of a single adult *Mauremys* cf. *leprosa* was taken in spring 2012 near Florence, northern Tuscany (Locality “La Querciola”), during spring of 2012 (G. Bruni, pers. comm.). Two further *Mauremys* were caught at Villa al Ventaglio, Florence (B. Borri, pers. comm.). A group of six adult *Mauremys* has been found by the owner of a private pond, in the surroundings of the wetland of Gabellino (Grosseto, southern Tuscany). In October 2013, two *Mauremys* were collected as road kills (samples currently stored in 100% ethanol at the Maremma Natural History Museum, Grosseto: L131020 and L131027) in the surroundings of the same pond, an adult female (length of carapace: 19.2 cm) and a young individual (length of carapace: 5.7 cm); the skull of a third adult was collected on the bank of an irrigation canal. DNA barcoding analysis confirmed that these individuals represent *Mauremys leprosa* (cf. photos in Appendix 1).

There are only two records from 13 museums/regional observatories in Italy (Fig. 1): an adult *Mauremys* sp. (MZUF 20042) collected in Grosseto in 1968 is stored at the Natural History Museum of Florence “La Specola” (S. Vanni, pers. comm.); two specimens of *M. rivulata* (MSNM Re 3938 and MSNM Re 3939), collected at the beginning of 1990s along the Lambro river (maybe from the same group recorded as “Bosco di Barco”) are stored in the Natural History Museum of Milan (S. Scali, pers. comm.).

According to a screening of 54 online pet shops distributed in all Italy and main rural fairs, no *Mauremys* species was found to be offered as pet species.

Terrapins belonging to the genus *Mauremys* have been observed several times in Italy, but, in most cases, records refer to single individuals and without species identification. However, we cannot exclude that some turtles were confused with the common invasive slider turtle (*Trachemys scripta*). According to our summary, most introductions of *Mauremys* concentrate in two regions (provinces of Brescia and Ravenna), for which no recent data are available, with the last records dating to 1997. This suggests that no established populations exist there. If we exclude removed individuals, the most recent observations of more than one wild *Mauremys* (late summer 2013) refer to a hilly area of northern Grosseto province (Gabellino). Six *M. leprosa* were observed in a temporary pond located at the end of an irrigation canal,

within an alfalfa field. We suggest that these terrapins originate from the “Carapax Center”, which was closed in 2009 as a result of penal actions. This centre was located about 15 km distant from the observation site and there, *M. leprosa* were kept (R. Capecchi, pers. comm.). The record of a road-kill of a juvenile *M. leprosa* suggests reproduction in the wild.

ACKNOWLEDGEMENTS

We would like to thank B. Borri, G. Bruni, R. Capecchi, N. Destefano, V. Ferri, D. Miserocchi, D. Scaravelli and A. Vannini for information. DNA sequencing was carried out in collaboration with FEM2-Ambiente srl (Piazza della Scienza 2, I - 20126 Milano, Italy). Data from museums/regional observatories were kindly provided by: G. Boano (Museo Civico di Storia Naturale di Carmagnola), S. Guioli (Museo di Scienze Naturali di Voghera – PV), S. Scali (Museo Civico di Storia Naturale di Milano), K. Tabarelli de Fatis (MUSE, Trento), N. Novarini, M. Bon (Museo di Storia Naturale di Venezia), L. Latella (Museo di Storia Naturale di Verona), L. Lapini (Museo Friulano di Storia Naturale, Udine), G. Doria (Museo Civico di Storia Naturale “Giacomo Doria”, Genova), S. Vanni (Museo di Storia Naturale “La Specola”, Firenze), A. Sforzi (Museo di Storia Naturale della Maremma, Grosseto), M. Natali, A.M. Paci, U. Sergiacomi (Osservatorio Faunistico Regionale, Umbria), M. Capula, and L. Ancillotto (Museo Civico di Zoologia, Roma). Thanks to P. Jennings and G. Petri for language revision. Two anonymous reviewers greatly improved the first version of our draft.

REFERENCES

- Barth, D., Bernhard, D., Fritzsche, G., Fritz, U. (2004): The freshwater turtle genus *Mauremys* (Testudines, Geoemydidae) – a textbook example of an east-west disjunction or a taxonomic misconcept? *Zool. Scr.* **33**: 213-221.
- Bologna, M.A., Capula, M., Carpaneto, G.M. (2000): *Anfibi e Rettili del Lazio*. Fratelli Palombi Editore, Roma, Italy.
- Bologna, M.A., Salvi, D., Pittalis, M. (2007): *Atlante degli Anfibi e dei Rettili della Provincia di Roma*. Provincia di Roma, Gangemi Editore, Roma, Italy.
- Cady, A., Joly, P. (2004): Impact of the introduction of the red-eared slider (*Trachemys scripta elegans*) on survival rates of the European pond turtle (*Emys orbicularis*). *Biodiv. Conserv.* **13**: 2511-2518.

- Chelazzi, G., Lebboroni, M., Tripepi, S., Utzeri, C., Zuffi, M.A.L. (2000): A primer on the conservation biology of the European Pond Turtle, *Emys orbicularis*, of Italy. Proc. 2th Int. Symp. on *Emys orbicularis* 2: 101-104.
- Clavero, M., Brotons, L., Pons, P., Sol, D. (2009): Prominent role of invasive species in avian biodiversity loss. Biol. Conserv. **142**: 2043-2049.
- Ferri, V. (1995): *Emys orbicularis*: situation and conservation projects in Lombardy. International Congress of Chelonian Conservation, Gonfaron: 224-227.
- Fritz, U. (2003): Die Europäische Sumpfschildkröte. Bielefeld (Laurenti), 224 pp.
- Fritz, U., Barata, M., Busack, S. D., Frittsch, G., Castilho, R. (2006): Impact of mountain chains, sea straits and peripheral populations on genetic and taxonomic structure of a freshwater turtle, *Mauremys leprosa*. Zool. Scr. **35**: 97-108.
- Gariboldi, A., Zuffi, M.A.L. (1994): Notes on the population reinforcement project for *Emys orbicularis* (Linnaeus, 1758) in a natural park of north-western Italy. Herpetozoa **7**: 83-89.
- Keller, C., Busack, S.D. (2001): *Mauremys leprosa* (Schweigger, 1812) – Maurische Bachschildkröte. In: Handbuch der Reptilien und Amphibien Europas. Schildkröten (Testudines) I, pp. 57-88. Fritz, U., Ed., Aula-Verlag, Wiebelsheim.
- Lowe, S., Browne, M., Boudjelas, S., De Poorter, M. (2000): 100 of the World's Worst Invasive Alien Species. A Selection from the Global Invasive Species Database. The Invasive Species Specialist Group (ISSG), Gland, Switzerland.
- Mantziou, G., Poulakakis, N., Lymberakis, P., Valakos, E., Mylonas, M. (2004): The inter- and intraspecific status of the Aegean *Mauremys rivulata* (Chelonia, Bataguridae) as inferred by mitochondrial DNA sequences. Herp. J. **14**: 35-45.
- Mazza, G., Tricarico, E., Genovesi, P., Gherardi, F. (2014): Biological invaders are threats to human health: an overview. Ethol. Ecol. Evol. **26**: 112-129.
- Menchetti, M., Mori, E. (2014): Worldwide impact of alien parrots (Aves Psittaciformes) on native biodiversity and environment: a review. Ethol. Ecol. Evol. **26**: 172-194.
- Mooney, H.A., Hobbs, R.J. (2000): Invasive Species in a Changing World. Island Press, Washington DC, USA.
- Pupins, M., Pupina, A. (2011): First records of 5 allochthonous species of Turtles (*Trachemys scripta troostii*, *Mauremys caspica*, *Mauremys rivulata*, *Pelodiscus sinensis*, *Testudo horsfieldii*) and new records of subspecies *Trachemys scripta elegans* in Latvia. Manag. Biol. Inv. **2**: 95-107.
- Scalera, R. (2001): La Mauremide caspica *Mauremys caspica*. In Invasioni biologiche. Le introduzioni di vertebrati in Italia: un problema tra conservazione e globalizzazione, p. 222-225. Corpo Forestale dello Stato e Ministero delle Politiche Agricole e Forestali, Eds, Rome, Italy.
- Semenzato, M., Zanetti, M., Richard, J., Borgogni, N. (1998): Distribuzione storica ed attuale di *Emys orbicularis* e osservazioni sulla recente diffusione di *Trachemys scripta* nel Veneto. Atti 2 Conv. Faunisti Veneti, Ass. Faunisti Veneti, Boll. Mus. Civ. Sto. Nat. Venezia **48**: 155-160.
- Vamberger, M., Stuckas, H., Ayaz, D., Graciá, E., Aloufi, A.A., Els, J., Mazanaeva, L.F., Kami, H.G., Fritz, U. (2013): Conservation genetics and phylogeography of the poorly known Middle Eastern terrapin *Mauremys caspica* (Testudines: Geoemydidae). Org. Divers. Evol. **13**: 77-85.
- Vamberger, M., Stuckas, H., Ayaz, D., Lymberakis, P., Široký, P., Fritz, U. (2014): Massive transoceanic gene flow in a freshwater turtle (Testudines: Geoemydidae: *Mauremys rivulata*). Zool. Scr. **43**: 313-322.
- Vitousek, P.M., D'Antonio, C.M., Loope, L.L., Rejmanek, M., Westbrooks, R. (1997): Introduced species: a significant component of human-caused global change. New Zeal. J. Ecol. **21**: 1-16.
- Wischuf, T., Busack, S.D. (2001): *Mauremys rivulata* (Valenciennes in Bory de Saint-Vincent et al., 1833) – Ostmediterrane Bachschildkröte. In: Handbuch der Reptilien und Amphibien Europas. Schildkröten (Testudines) I, pp. 89-110. Fritz, U., Ed., Aula-Verlag, Wiebelsheim.
- Wischuf, T., Fritz, U. (2001): *Mauremys caspica* (Gmelin, 1774) – Kaspische Bachschildkröte. In: Handbuch der Reptilien und Amphibien Europas. Schildkröten (Testudines) I, pp. 43-56. Fritz, U., Ed., Aula-Verlag, Wiebelsheim.