

An invasive population of *Xenopus laevis* (DAUDIN, 1802) in Italy

Several papers indicate that introductions of allochthonous species are a major threat for autochthonous biota and natural zoogeographical status of regions (e.g., IUCN 2000; MACK et al. 2000). Up to now, the allochthonous amphibians known from Italy are: American Bullfrog *Rana catesbeiana* SHAW, 1802, Balkan Frog *Rana kurtmuelleri* GAYDA, 1940, and Marsh Frog *Rana ridibunda* PALLAS, 1771 (SCALERA 2003). This note reports the occurrence in Italy of a new allochthonous anuran, the African Clawed Frog *Xenopus laevis* (DAUDIN, 1802).

In numerous subspecies *Xenopus laevis* occurs throughout the Afro-tropical region (TINSLEY et al. 1996). Among these, only the nominate race seems to constitute feral populations outside the original distribution area; populations are known to occur in the USA, Chile, Ascension Islands, Wales, Germany, the Netherlands (TINSLEY & MCCOID 1996) and France (ACEMAV et al. 2003).

Although a recent study proved this taxon to successfully colonize temperate climate regions (FOUQUET & MEASEY, submitted), the African Clawed Frog seems to have established its most abundant and invasive populations in those areas with a Mediterranean climate, like central Chile (LOBOS & MEASEY 2002) and the southwestern USA (CRAYON, in press).

The ease with which it breeds, the short time needed for attaining sexual maturity, its resistance to diseases and infections, along with its adaptability to extreme conditions, explain its worldwide diffusion as a pet and a laboratory animal and the possibility of accidental or deliberate releases in the wild (GURDON 1996).

Moreover, this species usually feeds on invertebrates (MEASEY 1998) but can also actively prey on vertebrates, as was observed in California on an endemic goby (LAFFERTY & PAGE 1997) and on *Bufo*, *Rana* and *Hyla* tadpoles and juveniles (CRAYON, in press). *Xenopus laevis* is also known to be highly cannibalistic (MEASEY 1998). Although it is considered a potential threat for native freshwater fauna (BEEBEE 1996), no exhaustive

studies have been carried out in order to quantify the real impact of the African clawed frog on the autochthonous biota.

Except for two specimens of *X. laevis* stored in the "Museo Regionale di Storia Naturale e Mostra permanente del Carretto siciliano" (Terrasini, Palermo district, Sicily) labelled "Diga Iato 5 Settembre 1999", no data about the actual presence of a viable Italian population of this taxon are available.

In June 2004 individuals of the African Clawed Frog were for the first time observed in the drainage area of the "Fiume Iato", a river originating in the "Monti di Palermo" area (Sicily, southern Italy) and, after flowing 25 km through an agricultural landscape, drains into the Tyrrhenian Sea. In the 1960's, the "Lago Poma" reservoir was built by damming Iato River to supply irrigation and drinking water. The reservoir lies at 197 m a.s.l., its volume is about 78×10^6 m³, the mean and maximum depths being 12.9 m and 46.8 m, respectively (CALVO et al. 1993). The uppermost part of the river is characterized by a variable water flow, which reaches its higher values during late autumn and early winter thanks to precipitation, and the lower ones at the beginning of autumn because of summer drought. Beyond the dam, the river discharge is highly reduced. The depth of the upper part of the river ranges from a few centimetres to more than 1.5 m and the river bed is 1.5 to 4 m wide. The river banks are covered with riparian vegetation and the most common aquatic macrophytes are filamentous algae.

A high number of agricultural ponds is present in the catchment area of the reservoir and their average surface is 1200 m². They are located 30 - 2000 m from the river, with their altitudes differing from that of the river by up to 250 m. The environmental features of these ponds are extremely varied concerning size, turbidity and presence of macrophytes. All the surrounding land is extensively farmed with vineyards and olive-groves. No "ecological corridors" such as irrigation ditches, channels, hedges or uncultivated fields are present.

From June to October 2004 field surveys were carried out in Fiume Iato, in the "Lago Poma" reservoir and in thirteen agricultural ponds in the reservoir watershed. In each site, the presence of *X. laevis* was

verified on different dates by visual survey of surfacing frogs and catching tadpoles, juveniles and adult specimens by means of dip nets. On the whole, observations have been performed in 29 sites: 10 along the river above the reservoir, five below the reservoir, 13 in agricultural ponds, and one in the reservoir, near the inlet of the river.

Several adult specimens of different size, juveniles and tadpoles were found in the river above the reservoir (eight sites out of 10, covering seven km of the river basin), in the reservoir itself and in most of the surveyed agricultural ponds (nine sites out of 13). The maximum distance between the riverbed and a colonized pond was about 1000 m; the large number of ponds likely constitutes a stepping-stone web for migrating animals as already observed in France (FOUQUET & MEASEY, submitted). It is noteworthy that *X. laevis* was not observed in any site between the dam of the reservoir and the mouth of Fiume Iato.

The occurrence of a viable population of *X. laevis* in Sicily is confirmed by the capture of a large number of individuals belonging to different size-classes, adults, tadpoles and juveniles. Although no attempt was performed to evaluate the number of individuals occurring in the Fiume Iato drainage area, in some of the study sites several dozens of individuals and large swarms of tadpoles were observed.

The presence of two individuals stored in the "Museo di Terrasini" suggests that the invasion should date back at least to 1999. Further studies are needed in order to get a better understanding of the real status and diffusion of this species in Sicily and to evaluate the potential threat to the autochthonous freshwater fauna. Such a study is of immediate importance as the African Clawed Frog has been shown to be capable of rapidly establishing very large populations in regions characterized by a Mediterranean climate (MCCOYD & FRITTS 1995; LOBOS & JAKSIC 2005).

ACKNOWLEDGEMENTS: We are especially grateful to John MEASEY (Laboratoire d'Ecologie des Sols Tropicaux, Bondy Cedex, France), Luigi NASELLI-FLORES (University of Palermo, Italy) and Antonio ROMANO (University of Rome "Tor Vergata", Italy) for their useful contribution to the draft of this note.

REFERENCES: ACEMAV coll. & DUGET, R. & MELKI, F. (eds.) (2003): Les amphibiens de France, Belgique et Luxembourg; Collection Parthénope, édi-

tions Biotope, Mèze (France), 480 pp. BEEBEE, T. J. C. (1996): Ecology and conservation of amphibians; London, (Chapman & Hall), VIII + 214 pp. CALVO, S. & BARONE, R. & NASELLI-FLORES, L. & FRADÀ ORESTANO, C. & DONGARRA G. & LUGARO, A. & GENCHI, G. (1993): Limnological studies on lakes and reservoirs of Sicily; Naturalista siciliano, Palermo; (Ser. 4) 17 (Suppl.): 1-292. CRAYON, J. J. (in press): Species account: *Xenopus laevis*; In: LANNOO M. J. (ed.): Status and conservation of U.S. amphibians; University of California Press (Berkeley). FOUQUET, A. & MEASEY, G. J. (submitted): Plotting the course of a African clawed frog invasion in Western France. GURDON, J. B. (1996): Introductory comments: *Xenopus* as a laboratory animal; pp. 3-6. In: TINSLEY, R. C. & KOBEL, H. R. (eds.): The biology of *Xenopus*. Oxford (Oxford Univ. Press), 440 pp. IUCN (2000): IUCN Guidelines for the prevention of biodiversity loss caused by alien invasive species - Approved by the 51st meeting of the IUCN council; Gland (Switzerland). LAFFERTY, K. D. & PAGE, C. J. (1997): Predation on the endangered Tidewater Goby, *Eucyclogobius newberryi*, by the introduced African Clawed Frog, *Xenopus laevis*, with notes on the frog's parasites.- Copeia, Washington, D.C.; 1997 (3): 589-592. LOBOS, G. & JAKSIC, F. M. (2005): The ongoing invasion of the African clawed frog (*Xenopus laevis*) in Chile: causes of concern.- Biodiversity and Conservation, Dordrecht; 14: 429-439. LOBOS, G. & MEASEY, G. J. (2002): Invasive population of *Xenopus laevis* (DAUDIN) in Chile.- Herpetological Journal, London; 12: 163-168. MACK, R. & SIMBERLOFF, D. & LONSDALE, M. & VANS, H. & CLOUT, M. & BAZZAZ, F. (2000): Biotic invasions: causes, epidemiology, global consequences and control.- Ecological Applications, Tempe, New York; 10: 689-710. MCCOYD, M. J. & FRITTS, T. H. (1995): Female reproductive potential and winter growth of African Clawed frogs (Pipidae: *Xenopus laevis*) in California.- California fish and game, Sacramento; 81: 39-42. MEASEY, G. J. (1998): Diet of feral *Xenopus laevis* (DAUDIN) in South Wales, U.K.; Journal of Zoology, London; 246: 287-298. SCALERA, R. (2003): Anfibi e rettili italiani. Elementi di tutela e conservazione; Ministero Agricoltura e Foreste, Roma, Collana Verde (104), 231 pp. TINSLEY, R. C. & LOUMONT, C. & KOBEL, H. R. (1996): Geographical distribution and ecology; pp 35-59. In: TINSLEY, R. C. & KOBEL, H. R. (eds.): The biology of *Xenopus*; Oxford (Oxford Univ. Press), 440 pp. TINSLEY, R. C. & MCCOYD, M. J. (1996): Feral population of *Xenopus* outside Africa; pp. 81-94. In: TINSLEY, R. C. & KOBEL, H. R. (eds.): The biology of *Xenopus*; Oxford (Oxford Univ. Press), 440 pp.

KEYWORDS: Amphibia: Anura: Pipidae: *Xenopus laevis*, feral population, invasive species, allochthonous species, Sicily, Italy, Fiume Iato

SUBMITTED: November 18, 2004

AUTHORS: Francesco LILLO, Wilderness Studi Ambientali, Via Cruillas 34, I-90100 Palermo; Federico MARRONE, Dipartimento di Scienze Botaniche, Università di Palermo, Via Archirafi 38, I-90123 Palermo, Italy < federico.marrone@neomedia.it >; Alessandra SICILIA, Wilderness Studi Ambientali, Via Cruillas 34, I-90100 Palermo; Giuseppe CASTELLI, Dipartimento di Scienze Botaniche, Università di Palermo, Via Archirafi 38, I-90123 Palermo, Italy; Bruno ZAVA, Wilderness Studi Ambientali, Via Cruillas 34, I-90100 Palermo, Italy.