

## RED-EARED SLIDER TURTLES (*TRACHEMYS SCRIPTA ELEGANS*) INTRODUCED TO FRENCH URBAN WETLANDS: AN INTEGRATED RESEARCH AND CONSERVATION PROGRAM

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In a world with a growing urban population, owning an exotic pet may be representative of connection to nature by the urban public. Exotic pets are all the more attractive because they are rare, they differ from the more “usual pets” (such as cats and dogs), and they come from distant countries. For these reasons, an intensive pet trade has developed involving turtle farms in the United States (Lutz 2000; Telecky 2001) selling young Red-eared Slider turtles (*Trachemys scripta elegans*) to developed countries. In France, Slider Turtles became very popular because of their small size, their simple husbandry requirements, and their reasonably low price. Fifty two million individuals were produced in the United States for foreign markets between 1989 and 1997 (Telecky 2001) and about 4 million juveniles were sold in France between 1985 and 1994 (Warwick 1991).

Unsuspecting turtle owners are rarely prepared to maintain large adults (up to 30 cm carapace length) for a significant length of time (up to 50 years) in captivity. Larger adult turtles have often been released by their owners to ponds in many places. Because of these introductions, Red-eared Sliders now occur in freshwater ecosystems in many developed countries (e.g., de Roa and Roig 1997; Luiselli et al. 1997; Arvy and Servan 1998; Chen and Lue 1998; Lever 2003; Martinez-Silvestre et al. 2003), with high densities in urban wetlands.

The impact of *T. scripta elegans* on local ecosystems and communities remains unknown. However, there is some information available concerning its reproductive success: egg deposition has been observed in Spain, Southern Europe (e.g., Capalleras and Carretero 2000) and in France (A. Cadi and

V. Delmas, pers. obs.), and the production of young of both sexes was observed in the south of France (Cadi et al. 2004). In this context, the Slider Turtle provides a good example of the release of an exotic pet. Although this species is well known and popular with the general public, few studies have investigated its impact on local ecosystems and native species, or its invasive status. This situation is similar with regards to other pet species released into the wild and sometimes demonised, such as the Rose-ringed Parakeet (*Psittacula krameri*) or Siberian Chipmunk (*Tamias sibiricus*).

Our research laboratory, in collaboration with managers and local communities, and a research unit in Anthropology of Nature, began a project in 2002 that focused on research and education to study and manage *T. scripta elegans* populations in the Paris region. This project has three goals: (i) knowledge acquisition on invasive status of Slider Turtles and on social representations of this species (research aspects), (ii) public education, and (iii) to provide suggestions for management strategies.

*Impact of introduced turtles on local communities* — The impact of introduced species on local communities can be direct or indirect. Direct impacts of Slider Turtles on prey species can be approximated by examining the diet of captured individuals. A qualitative study of stomach contents of captured Slider Turtles introduced near Paris revealed the presence of aquatic plants and animals (mostly arthropods and molluscs, Prévot-Julliard et al. 2007), as is the case for adult sliders in their area of origin (Parmenter and Avery 1990). More exhaustive infor-

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mation will be obtained from analyses of data gathered from an experiment aimed at estimating both direct and indirect (through competition, habitat modification) effects of Slider Turtles on aquatic communities. This experiment involved surveying several compartments of the aquatic communities of 12 semi-natural ponds (algae, vascular plants, zooplankton, arthropods, gastropods and amphibians) coupled with a survey of water composition. Weekly samplings were conducted in 2005–2006 in each pond, where 0, 1, or 3 turtles are present. Statistical analyses to detect an effect of Sliders on these communities are being undertaken (P. Teillac-Deschamps et al. unpublished).

*Consequences of turtle removal on pond restoration* — The effects of turtle removal on aquatic communities will be analysed in the same experimental ponds in 2007, by conducting the same weekly samples in the ponds after removing the turtles.

*Spread of Slider Turtles after introduction* — Like other pet species, Slider Turtles released in the wild are generally introduced continuously, at different spatial points but in small numbers each time. This pattern, combined with demographic and dispersal parameters of Slider Turtles, as well as landscape structure, would lead to spread and colonising patterns that are difficult to predict. Modelling the spreading process of Slider Turtles from their introduction points, depending on climate conditions, landscape structure, and demographic parameters, is possible through complex individual-based modelling (P. Teillac-Deschamps et al. unpublished). In particular, we are studying the potential effect of global warming on colonising probabilities, knowing that reproductive success and survival of Slider Turtles are currently low in European countries (e.g., Luiselli et al. 1997).

*Social representations of slider turtles as a “natural” species* — Upon asking the general public about their feelings on turtles, many people who spent time hiking commented that they liked seeing turtles during their walks. For some urban people, this exotic species is one of the few representations of nature to which they are exposed in urban parks. This non-intuitive result is contrary to the conservationist’s beliefs that every exotic species is a problem. The fact that exotic species could attract people towards nature should be taken into account in decision-making processes, in the same way that the potential impacts of this species on the environment should also be considered.

Our research findings will thus be used to propose management strategies for Slider Turtles in natural wetlands: is it worth systematically removing turtles, considering the balance between impact, spreading potentialities, and public opinion? What should be done with the turtles after capture, and how should the public be educated or informed about this process of ecosystem conservation? What should be done to prevent owners from releasing turtles? We will use a multi-agent system (Bousquet and Le Page 2004) to integrate biological data

(impact and reproduction of sliders in different geographical contexts) with social data (understanding of Slider Turtles by the general public or more concerned people), as well as with economical costs of removal (e.g., one person a day to remove one turtle). This system simulates different scenarios, which will be used as a concrete basis for management discussions.

Finally, education tools are being proposed for schools and communities (posters, short movie, exhibition, teaching guidelines, and Internet site) in order to encourage people to think about the consequences of releasing exotic pets into nature. More generally, these tools aim to change the perception each citizen has towards nature and the relationship they build with it.

This program is a concrete process that integrates interdisciplinary research (biology and sociology), education and management to try to solve a complex societal and potential biological question concerning urban wetland conservation. As noted by Alberti et al. (2003), urban ecology can only be studied successfully where human and biological sciences are studied together. Moreover, we believe, like Berkes (2004), that conservation biology will be able to reach ambitious objectives only by having a systemic approach and by integrating societal concerns in several (all) levels of the process. This program, supervised by a research laboratory, received funding from local communities, mainly because of its multi-functionality and objectives.

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