Considering evolutionary processes and connectivity to design control strategies for the invasive amphibian Xenopus laevis

Jean Secondi*†[1,2,3], Giovanni Vimercati[4], Natasha Kruger[5], Julien Courant[6], Measey John[7], and Anthony Herrel[6]

[1]UMR CNRS 5023 Laboratoire d'écologie des hydrosystèmes naturels et anthropisés (LEHNA) – Université Claude Bernard - Lyon 1 – France

[2]Université d'Angers (UA) – Université d'Angers – Faculté des Sciences, Université d'Angers, 2 boulevard Lavoisier, France

[3]LTSER Zone atelier Loire – LTSER Zone Atelier Loire – France

[4]Université d'Angers (UA) – Faculté de Sciences, Université dÁngers, Université d'Angers – 2 Boulevard Lavoisier 49045 ANGERS cedex 01, France

[5]UMR CNRS 5023 Laboratoire d'écologie des hydrosystèmes naturels et anthropisés (LEHNA) – Université Claude Bernard - Lyon I – France

[6]UMR 7179 - Mécanismes adaptatifs Évolution (MECADEV) – Museum National d'Histoire Naturelle - MNHN (FRANCE) – 57 rue Cuvier - 75231 Paris, France

[7]Stellenbosch University (CIB) – Stellenbosch UniversityPrivate Bag X1,Matieland, 7602,Stellenbosch, South Africa, South Africa

Abstract

Managing cryptic invasive species is challenging because their range is hard to determine, and little information is available about their dispersal behaviour. The African clawed frog *Xenopus laevis* is considered one of the most harmful invasive amphibians in the world. This southern African species was accidentally introduced in western France more than 30 years ago and is now expanding and threatening amphibian and invertebrate pond communities. Although urgent control actions are to be taken, their design needs to be based on scientific knowledge, especially considering that this species is particularly difficult to detect through visual observations and trapping techniques. In the context of the Life project CROAA, we updated the colonised range using environmental DNA. We then built a connectivity model of the range based on a resistance cost map that we derived from the classification of satellite images. Resistance costs for the main types of land uses were obtained from experiments on juveniles and adults. We then associated the connectivity map with a distribution map of ecological value for local biodiversity across the colonised range to generate alternative control strategies. The cost-efficiency of each strategy will be assessed to implement large scale control operations. We also assessed the evolutionary processes on each stage of this invasive population. We have observed an increase in the dispersal propensity and a change in the locomotor morphology of adults during expansion. For the larval stage, we investigated

*Speaker

†Corresponding author: jean.secondi@univ-angers.fr

the variation in larval development, measured the change in thermal acclimation between native and invasive populations of *X. laevis*, and quantified anti-predator response of *X. laevis* tadpoles to predators present in the colonised range. We discuss how information about evolutionary processes may help to gain insight into applied conservation programs and better forecast the expansion of invasive populations.