

# PhD PROPOSAL FOR THE DOCTORAL SCHOOL « Végétal, Animal, Aliment, Mer, Environnement »

## GENERAL INFORMATION

<b>Thesis title:</b> Xenopus laevis in Western France: impacts on ecosystem and management
<b>Acronym of the project:</b> XenoGREEN
<b>Disciplinary field 1:</b> population biology & ecology <b>Disciplinary field 2:</b> ecology & evolution
<b>Three keywords:</b> invasive amphibians, habitat use, impacts on ecosystems
<b>Registration establishment:</b> Angers University
<b>Research unit:</b> BiodivAG
<b>Name of the thesis director HDR (Accreditation to supervise research) :</b> Pagano Alain <b>Email address of the thesis director:</b> <a href="mailto:alain.pagano@univ-angers.fr">alain.pagano@univ-angers.fr</a> <b>Name of the thesis co-director 1 HDR:</b> Bartoli Marco <b>Email address of the thesis co-director:</b> <a href="mailto:marco.bartoli@unipr.it">marco.bartoli@unipr.it</a> <b>Name of the thesis co-director 2 HDR:</b> Pays-Volard Olivier <b>Email address of the thesis co-director:</b> <a href="mailto:olivier.pays@univ-angers.fr">olivier.pays@univ-angers.fr</a>
<b>Contact(s) (mailing address and E-mail):</b> BiodivAG, Université d'Angers, UFR Sciences, 2 bvd Lavoisier, 49045 Angers cedex <a href="mailto:alain.pagano@univ-angers.fr">alain.pagano@univ-angers.fr</a>
<input type="checkbox"/> <b>Doctoral school contest</b> <input checked="" type="checkbox"/> <b>Interview</b> (2024/05/01 – 2024/06/14) <input type="checkbox"/> <b>Other (specify):</b>

## SCIENTIFIC DESCRIPTION OF THE PhD PROJECT

### Socio-economic and scientific context: (10 lines)

Biodiversity crisis is becoming a main issue for both public opinion and scientific community. Recently under lighted by IPBES (2019) it reports dramatic rates of autochthonous species extinction and biological invasions. The biodiversity crisis is due to several anthropic causes (see e.g. IPBES 2019) among them the introduction of alien species is considered as one of the most important ones (Bellard, Cassey, and Blackburn, 2016). Indeed, invasion by alien species has been hypothesized to have negative effects on biodiversity leading to ecosystem downgrading. Biodiversity losses due to invasion are thought to be driven by interspecific competition for space and resources, where aliens disproportionately outcompete and exclude native species. It is the case for *Xenopus laevis*, an invasive amphibian in Western France that impact negatively autochthonous amphibian communities. The project aims at explaining mechanisms that characterize invasion dynamics of *Xenopus laevis*.

### Assumptions and questions (8 lines)

The docent will test the hypothesis that ecological niches that become free because of anthropisation and/or pollution are more susceptible to be colonized by invasive alien species (IAS) like *Xenopus laevis*. As its tadpole is a planktonic feeder, we hypothesize that its presence and abundance should modify chlorophyll concentration (in water), turbidity, plankton abundance and should have cascading effects on trophic webs of the ecosystem (plankton, insects, fishes)

Moreover, we will study the drivers that contribute to invasion dynamics (habitat use, barriers and corridors to migration) and the putative synergy between different species present in sympatry (plants, crustaceans, fishes, mammals).

### The main steps of the thesis and scientific procedure (10-12 lines)

The projects is organized in three points :

1. A review of laws and management methods of *Xenopus laevis* at international, European, and French scale.
2. The characterization of the ecological niche of *Xenopus laevis* in France. The hypothesis that IAS, such as *Xenopus*, are more able to occupy anthropized/polluted habitats will be tested by evaluating habitat use described in terms of abiotic and biotic parameters. It implies field monitoring (in France) but also physico-chemical analysis of water (in the lab) that will be done in Italy. A GIS analysis of landscape will aim to identify corridors and barriers to dispersion of *Xenopus*.
3. 3 A network modelisation will be done in order to establish cascading effects on trophic webs of the aquatic ecosystem when *Xenopus* occupies an habitat.

### Methodological and technical approaches considered (4-6 lines)

Characterization of habitat and landscape : physico-chemical analysis of water, morphological description of sites, landscape analysis by GIS

biodiversity monitoring of aquatic ecosystems, electrofishing, environmental DNA

Ecosystem network analysis

### Scientific and technical skills required by the candidate

GIS, statistical analysis and modelisation, R programming, field knowledge of freshwater species

## THESIS SUPERVISION

<b>Unit name:</b> BiodivAG	<b>Team name:</b>
<b>Unit director name:</b> Pays-Volard Olivier	<b>Team director name:</b>
<b>Mailing address of the unit director:</b> olivier.pays@univ-angers.fr	<b>Mailing address of the team director:</b>
<p><b>Thesis director</b></p> <p>Surname, first name: Pagano Alain</p> <p>Position: associate Professor</p> <p>Obtained date of the HDR (Accreditation to supervise research): 11/07/2006</p> <p>Employer: Angers University</p> <p>Doctoral school affiliation: VAAME</p> <p>Rate of thesis supervision in the present project (%): 40%</p> <p>Total rate of thesis supervision in ongoing theses (supervisions and co-supervisions) (%): 0</p> <p>Number of current thesis supervisions/co-supervisions: 0</p>	
<p><b>Thesis co-director 1</b></p> <p>Surname, first name: Bartoli Marco</p> <p>Position: Associate Professor</p> <p>Obtained date of the HDR (Accreditation to supervise research): 01/01/2017 (when I became Associate Professor and I entered the PhD Committee)</p> <p>Employer: University of Parma</p> <p>Doctoral school affiliation: Evolutive Biology and Ecology</p> <p>Rate of thesis supervision in the present project (%): 30%</p> <p>Total rate of thesis supervision in ongoing theses (supervisions and co-supervisions) (%): 100%</p> <p>Number of current thesis supervisions/co-supervisions: 2 at their 3<sup>rd</sup> year (last year) of their PhD.</p>	
<p><b>Thesis co-director 2</b></p> <p>Surname, first name: Pays-Volard Olivier</p>	

Position: Professor

Obtained date of the HDR (Accreditation to supervise research): 2013

Employer: Angers University

Doctoral school affiliation: VAAME

Rate of thesis supervision in the present project (%): 30%

Total rate of thesis supervision in ongoing theses (supervisions and co-supervisions) (%): 0

Number of current thesis supervisions/co-supervisions: 0

**Professional status of previous PhD students supervised by both director and co-supervisors (from 5 years)**

*Please provide the following information for each PhD students supervised*

Surname, first name: Boyer Igor

Date of PhD beginning and PhD defence: 2019-2023

Thesis supervision: Pagano; 25%

Professional status and location: ONG Epiméthée, Prissac (36)

Contract profile (post-doc, fixed-term, permanent): fixed-term, 1 year

List of publications from the thesis work:

Boyer I, **Pagano** A, Isselin-Nondedeu F, Bertrand R. Elevational range shifts among Bombina toad populations in response to future climate change. Soumise à Regional Environmental change

**Professional status of previous PhD students supervised by both director and co-supervisors (from 5 years)**

*Please provide the following information for each PhD students supervised*

Surname, first name: Magri Monia

Date of PhD beginning and PhD defence: 2020-2023

Thesis supervision: Bartoli

Professional status and location: Cotutorship (Parma and Klaipeda Universities)

Contract profile (post-doc, fixed-term, permanent): post-doc at University of Parma

List of publications from the thesis work:

Magri, M., Benelli, S., Bonaglia, S., Zilius, M., Castaldelli, G. and Bartoli, M., 2020. The effects of hydrological extremes on denitrification, dissimilatory nitrate reduction to ammonium (DNRA) and mineralization in a coastal lagoon. *Science of the Total Environment*, 740, p.140169.

Magri, M., Benelli, S., Castaldelli, G. and Bartoli, M., 2022. The seasonal response of in situ denitrification and DNRA rates to increasing nitrate availability. *Estuarine, Coastal and Shelf Science*, 271, p.107856.

Benelli, S., Bartoli, M., Magri, M., Brzana, R., Kendzierska, H., Styrz-Olesiak, K. and Janas, U., 2024. Spatial and seasonal pattern of microbial nitrate reduction in coastal sediments in the Vistula River plume area, Gulf of Gdańsk. *Frontiers in Marine Science*, 11, p.1333707.

Magri, M., Bondavalli, C., Bartoli, M., Benelli, S., Žilius, M., Petkuvienė, J., Vybernaite-Lubiene, I., Vaičiūtė, D., Grinienė, E., Zemlys, P. and Morkūnė, R., 2024. Temporal and spatial differences in

nitrogen and phosphorus biogeochemistry and ecosystem functioning of a hypertrophic lagoon (Curonian Lagoon, SE Baltic Sea) revealed via Ecological Network Analysis. *Science of The Total Environment*, p.171070.

**Professional status of previous PhD students supervised by both director and co-supervisors (from 5 years)**

*Please provide the following information for each PhD students supervised*

Surname, first name: Politi Tobia

Date of PhD beginning and PhD defence: 2019-2023

Thesis supervision: Bartoli

Professional status and location: Cotutorship (Parma and Klaipeda Universities)

Contract profile (post-doc, fixed-term, permanent): post-doc at Parma University fo Gotheburg

**List of publications from the thesis work:**

Politi, Tobia, Mindaugas Zilius, Marco Bartoli, and Martynas Bučas. "Amphipods' grazing and excretion loop facilitates Chara contraria persistence in a eutrophic lagoon." *Aquatic Botany* 171 (2021): 103378.

Politi, T., Barisevičiūtė, R., Bartoli, M., Bonaglia, S., Cardini, U., Castaldelli, G., Kančauskaitė, A., Marzocchi, U., Petkuvienė, J., Samuiloviene, A. and Vybernaite-Lubiene, I., 2021. A bioturbator, a holobiont, and a vector: the multifaceted role of Chironomus plumosus in shaping N-cycling. *Freshwater Biology*, 66(6), pp.1036-1048.

Samuiloviene, A., Bartoli, M., Bonaglia, S., Cardini, U., Vybernaite-Lubiene, I., Marzocchi, U., Petkuvienė, J., Politi, T., Zaiko, A. and Zilius, M., 2019. The effect of chironomid larvae on nitrogen cycling and microbial communities in soft sediments. *Water*, 11(9), p.1931.

Marzocchi, U., Bonaglia, S., Zaiko, A., Quero, G.M., Vybernaite-Lubiene, I., Politi, T., Samuiloviene, A., Zilius, M., Bartoli, M. and Cardini, U., 2021. Zebra mussel holobionts fix and recycle nitrogen in lagoon sediments. *Frontiers in Microbiology*, 11, p.610269.

Politi, T., Zilius, M., Bartoli, M., Cardini, U., Marzocchi, U. and Bonaglia, S., 2023. Direct contribution of invertebrate holobionts to methane release from coastal sediments. *Limnology and Oceanography Letters*, 8(6), pp.876-884.

**Five main recent publications of the supervisors on thesis subject:**

**Publications majeures des 5 dernières années du·de la directeur·rice de thèse et co-directeur(s)/co-encadrant(s) sur le sujet de thèse :**

**Pagano A**, Harmange C, Rappoccio M, Colchen T, Combet G, , Chouteau P, **Bartoli M**, **Pays O**. Update on the invasion dynamics of *Xenopus laevis* in France: current situation and management prospects. (in prep)

**Pays O.**, Bonnet M., Marchand E., Harmange C., Bertolino S, **Pagano A.**, Picard D, Grillo X, Grimault-Fremy A. 2024. Landscape drivers influencing control activities of aquatic invasive alien rodents in western France. *Sustainability*, 16, 1970.

Bonnet M, Guédon G, Bertolino S, Harmange C, **Pagano A**, Picard D, **Pays O**. 2023. Improving the management of aquatic invasive alien rodents in France: appraisal and recommended actions. *Management of Biological Invasions* 14(4): 625-640.

**Pagano A.**, Ould Sehla Daf D., Ballouche A., Taïbi A. N., Sinsch U. 2022. Amphibian biodiversity in Mauritania: a bioacoustics survey in the Diawling National Park. *Salamandra* 58(4): 317-322.

Bonnet M, Guédon G, Pondaven M, Bertolino S, Padiolleau D, Péniçon V, Gastinel F, Angot F, Renaud PC, Frémy A, **Pays O**. 2021. Aquatic invasive alien rodents in western France: where do we stand today after decades of control? *PLoS ONE*. 16, e0249904

Magri, M., Benelli, S., Bondavalli, C., **Bartoli, M.**, Christian, R.R. and Bodini, A., 2018. Benthic N pathways in illuminated and bioturbated sediments studied with network analysis. *Limnology and Oceanography*, 63(S1), pp.S68-S84.

Benelli, S. and **Bartoli, M.**, 2021. Worms and submersed macrophytes reduce methane release and increase nutrient removal in organic sediments. *Limnology and Oceanography Letters*, 6(6), pp.329-338.

Zilius, M., Daunys, D., **Bartoli**, M., Marzocchi, U., Bonaglia, S., Cardini, U. and Castaldelli, G., 2022. Partitioning benthic nitrogen cycle processes among three common macrofauna holobionts. *Biogeochemistry*, 157, pp.193-213.

Zilius, M., **Bartoli**, M., Bonaglia, S., Cardini, U., Chiozzini, V.G., Marzocchi, U., Moraes, P.C., Zaiko, A. and Braga, E.S., 2023. Role of crab holobionts in benthic N cycling in mangroves with different trophic status. *Marine Ecology Progress Series*, 712, pp.87-99.

Zilius, M., Bonaglia, S., Broman, E., Chiozzini, V.G., Samuiloviene, A., Nascimento, F.J., Cardini, U. and **Bartoli**, M., 2020. N<sub>2</sub> fixation dominates nitrogen cycling in a mangrove fiddler crab holobiont. *Scientific reports*, 10(1), p.13966.

## THESIS FUNDING

Origin(s) of the thesis funding: Eu GREEN
Gross monthly salary: 2100€
Thesis funding state: Acquired
Funding beginning date/duration of the thesis funding: 01/10/2024, 3 years

Date: 20/03/2024

Name, signature of unit director:

Pays-Volard Olivier



Name, signature of team director:

Name, signature of thesis project director:

Pagano Alain

