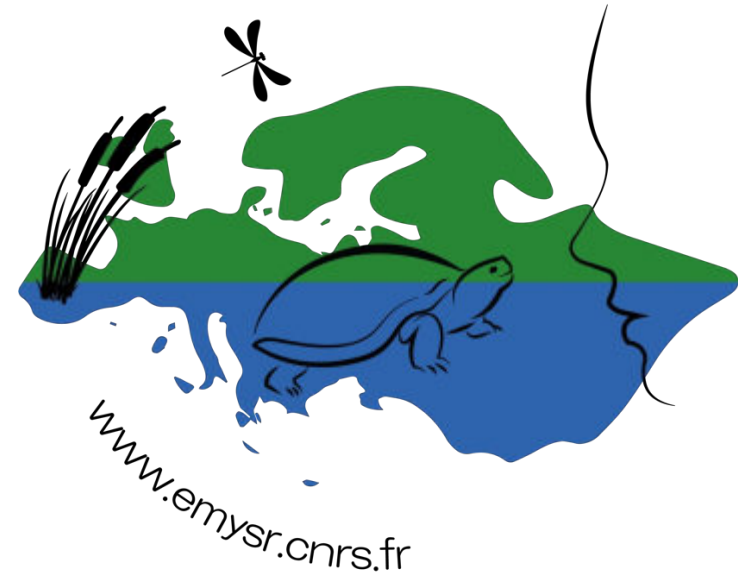


# How can reintroductions of threatened species mitigate biodiversity loss?

Johannes Meka<sup>1,2</sup>, Oleksii Marushchak<sup>2,3</sup>, Andris Čeirans<sup>4</sup>,  
Oksana Nekrasova<sup>2,3</sup>, Mihails Pupins<sup>4</sup>, Arturs Škute<sup>4</sup>,  
Kathrin Theissinger<sup>1,5</sup>, Jean-Yves Georges<sup>2,5</sup>

Speaker: [jean-yves.georges@iphc.cnrs.fr](mailto:jean-yves.georges@iphc.cnrs.fr)



<sup>1</sup> Justus Liebig University Giessen & Fraunhofer Institute for Molecular Biology and Applied Ecology, Giessen, Germany

<sup>2</sup> Université de Strasbourg, CNRS, IPHC, UMR 7178, Strasbourg, France

<sup>3</sup> I.I. Schmalhausen Institute, National Academy of Sciences of Ukraine, Kyiv, Ukraine

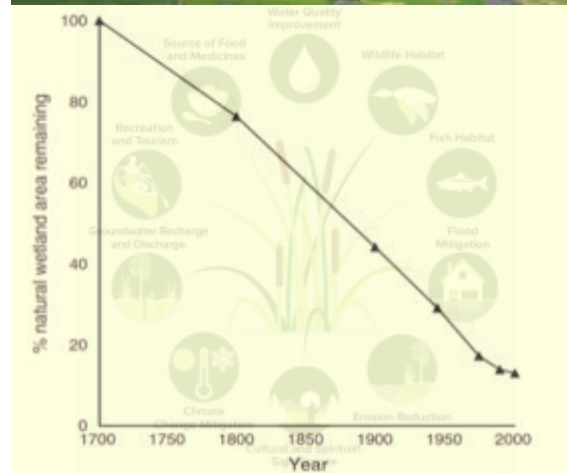
<sup>4</sup> Department of Ecology, Institute of Life Sciences and Technologies, Daugavpils University, Daugavpils, Latvia

<sup>5</sup> Long term Survey in Ecology and Evolution (SEE-Life) program of CNRS – Neu Woerr, France

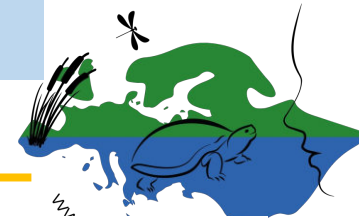


# General context

- 6<sup>th</sup> biodiversity crisis
  - Ecological and socio-economical crisis
  - ~ €450 billions per year (*source EU*)
- Wetlands
  - Hotspots of biodiversity and ecosystem services
  - 90% collapse since 18<sup>th</sup> century due to mismanagement worldwide



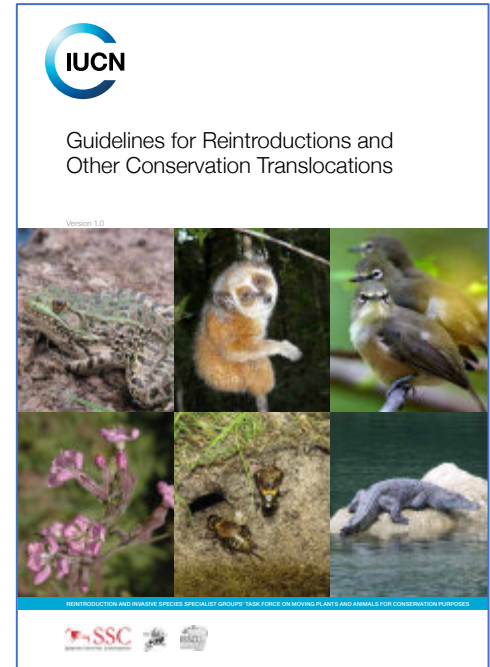
Ontario Ministry of Natural Resources and Forestry (2017)  
Davidson 2014 Mar Fresh Water Res

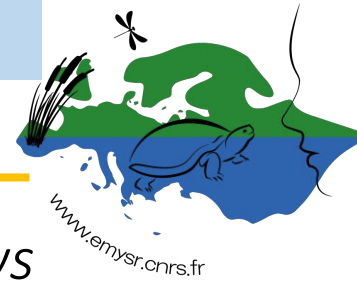


## Scientific context

- Bending the curve of biodiversity loss: species reintroductions
  - *“Intentional movement and release of an organism inside its indigenous range from which it has disappeared”* (IUCN 2018)
  - Habitat restoration is required prior reintroduction (IUCN 2018)
  - Open-air experiments, both basic and applied (Sarrazin & Barbault 1996 *TREE*)

→ Promising Nature-based Solutions



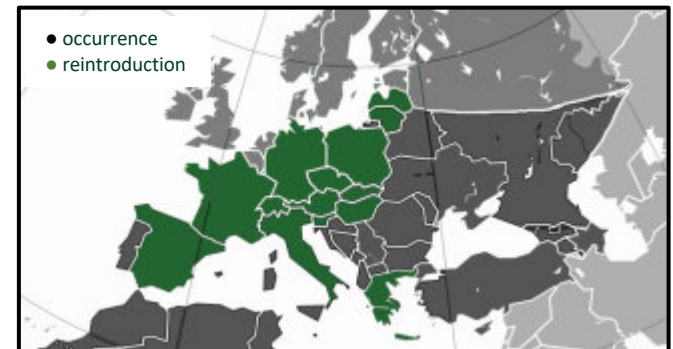


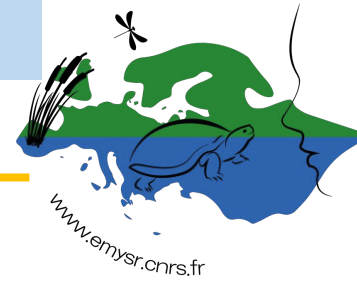
# Research question

- Case study: wetlands and the European pond turtle *Emys*
  - *Emys*: Most dramatic decline for reptiles in Europe
  - Numerous reintroductions throughout Europe
    - Umbrella species and a flag-bearer species
    - Results poorly disseminated
- Three major questions remain
  - Are *Emys* reintroductions successful?
  - What make them successful?
  - Do they benefit biodiversity?



*Emys orbicularis*

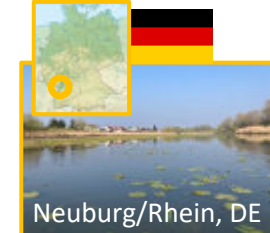


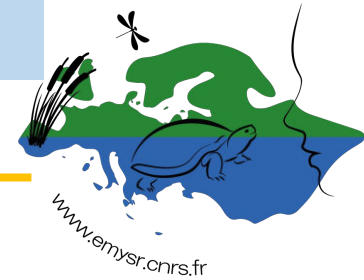


# The Emys-R project

A 3-yr transdisciplinary action-oriented research project

- for defining the most efficient, socially-supported, ecological methods to restore wetlands in favour of *Emys* reintroduction and associated biodiversity in Europe
- based on
  - literature review of former EU-funded conservation initiatives
  - long term monitoring on 3 study sites in FR, DE and LV

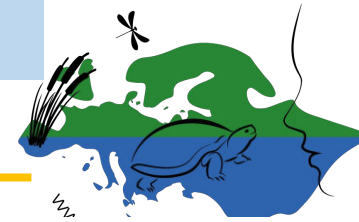




# Data gathering

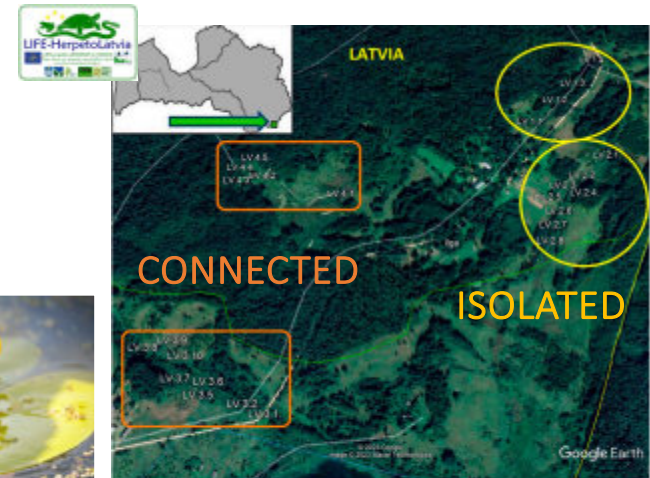
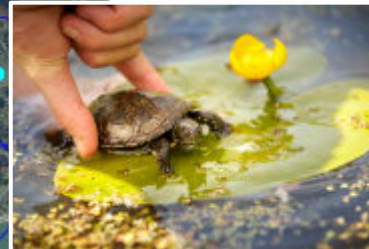
- Past UE funded projects
  - LIFE advanced database
  - Literature review
  - Online survey
  
- Emys-R project (2022-2025)
  - Long-term monitoring
  - Restored wetlands
  - Reintroduced *Emys* populations
  - Associated species

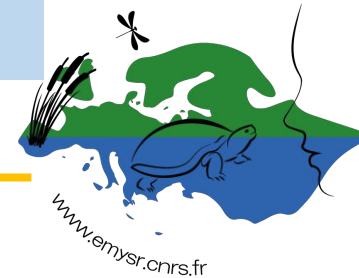




# Emys-R study sites

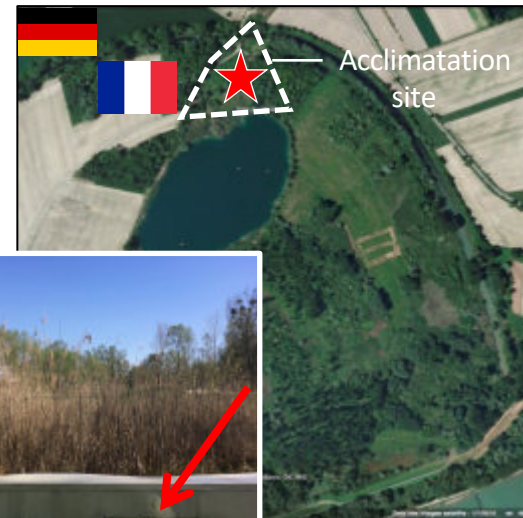
- The Neu Woerr site (DE+FR)
  - DE-FR cross-bordering area (5x5 km<sup>2</sup>)
  - Enhanced pondscape connectedness
  - Release of *Emys*: DE=200, FR=500 ind.
- The Silene, Sitas Lake site (LV)
  - No man's land (LV-BY border)
  - Connected vs. isolated ponds
  - Release of *Emys*: LV=62 ind.



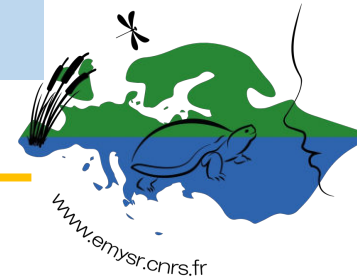


# Assessing reintroduction success on Woerr (1/6)

- Reintroduction design
  - 2013-2023: 573 captive bred individuals released
  - Soft release for 511 ind. (~95%)
  - Hard (wild) release for 26 ind. (~5%)

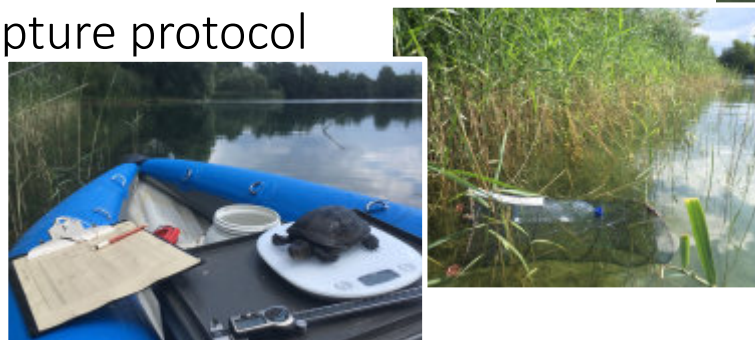
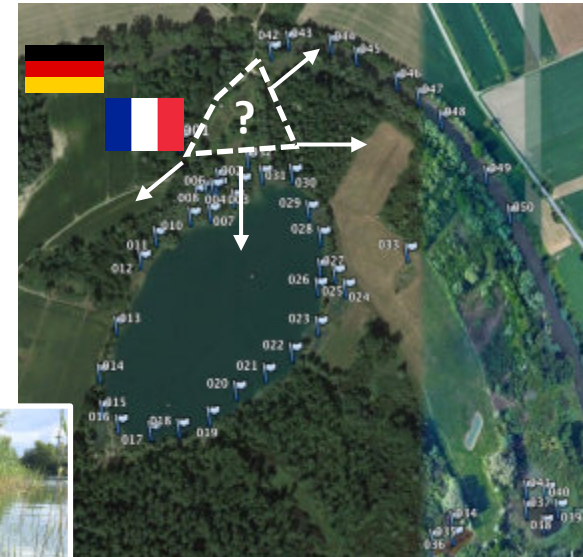


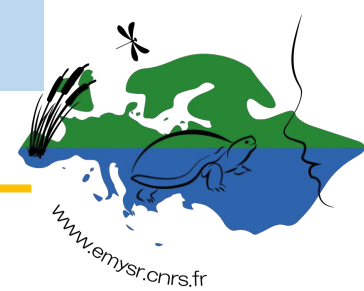




# Assessing reintroduction success on Woerr (2/6)

- Reintroduction design
- Monitoring design
  - Assessing
    - Survival
    - Dispersion
    - Reproduction
    - Forecast modelling
  - Capture-Mark-Recapture protocol
    - Since 2013
    - April-Sept
    - 1 week/mo.
    - ~3000 day.trap/yr.



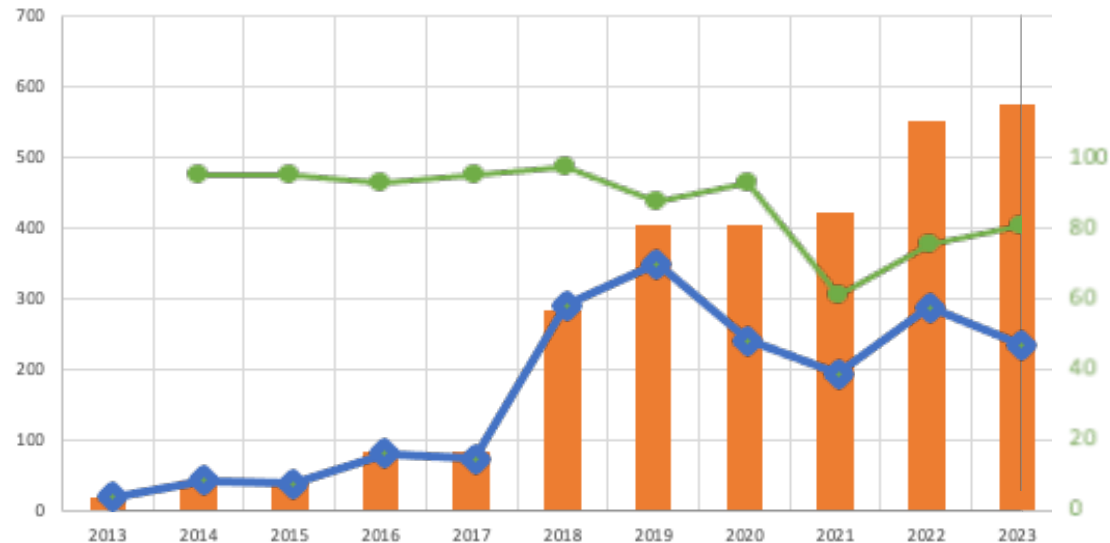


# Assessing reintroduction success on Woerr (3/6)

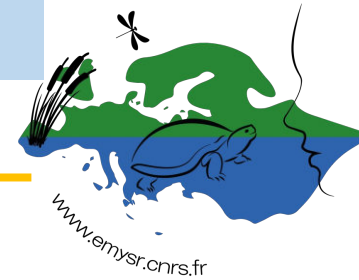
## • Survival

- Closed population models (Canessa et al. 2016 *Biol Cons*)
- Recapture proba. = 86%
- Apparent annual survival
  - soft release = 76%
  - hard release = 44%

Cumulative number of *Emys* released



Georges et al. (in prep)

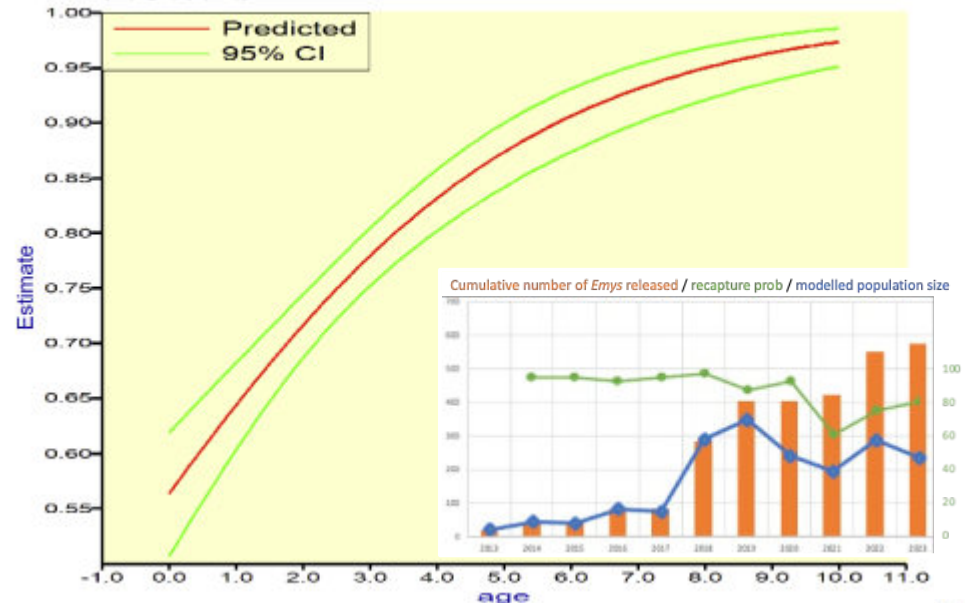


# Assessing reintroduction success on Woerr (3/6)

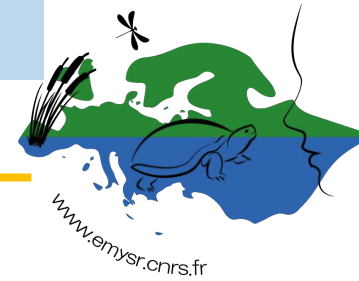
## • Survival

- Closed population
- Recapture proba. = 86%
- Apparent annual survival
  - soft release = 76%
  - hard release = 44%
- Major determinant of survival
  - Age >>> body size at release
- Current pop
  - 212 alive out of 573 released

→ Overall survival ~37%



Georges et al. (in prep)



# Assessing reintroduction success on Woerr (5/6)

- Survival
- Dispersion
- Reproduction
  - N = 8 wild born ind. (< 2%)

→ Low reproduction does not compensate for mortality



Georges et al. (in prep)



# Assessing reintroduction success on Woerr (5/6)

- Survival
- Dispersion
- Reproduction
- Diet and food web

→ Thursday 10am, Seehorn  
Johannes MEKA

Impacts of European pond turtle reintroduction on wetland food webs

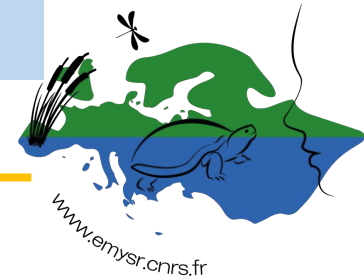
K. Theissinger<sup>1,2,3,4</sup>, J. Meka<sup>1,5</sup>, C. Grac<sup>6</sup>, F. Labat<sup>7</sup>, Zon<sup>7</sup>, A. Meyer<sup>9</sup>, J.-Y. Georges<sup>4,5</sup>

Speaker: Johannes Meka (johannes.meka@univ-strasbourg.fr)

www.emysr.cnrs.fr

**Tomorrow 10am!  
Seehorn**

1 Justus Liebig University Gießen, Germany  
2 Fraunhofer Institute for Molecular Biology and Applied Microbiology, Gießen, Germany  
3 LODIC, Center for Transdisciplinary Research, University of Applied Sciences, Gießen, Germany  
4 Long-Term Study in Ecology and Evolution, Program of CNRS, Nancy, France  
5 Université de Strasbourg, CNRS, IRP, Strasbourg, France  
6 National School for Water and Environmental Engineering, EMSE, Strasbourg, France  
7 AQUARIUM, Clermont-Ferrand, France  
8 Université de Strasbourg, CNRS, UMR 1181 1362, Strasbourg, France  
9 INRAE, Clermont, France

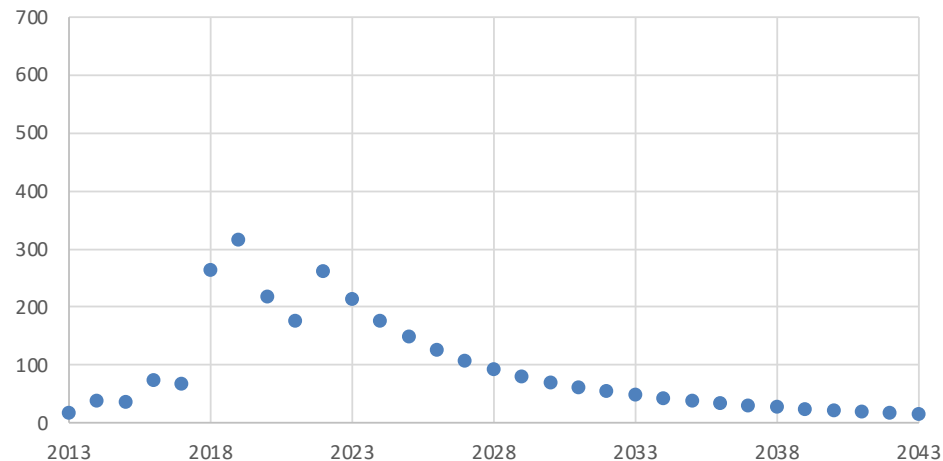


# Assessing reintroduction success on Woerr (6/6)

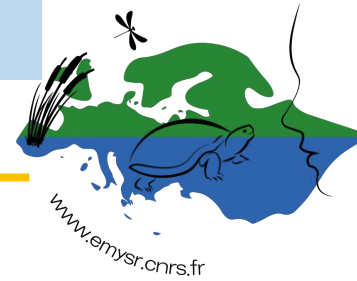
- Survival ~37%
- Dispersion ~10%
- Reproduction ~2%
- Diet and food web
- Forecast modelling

→ The reintroduced population of *Emys* is not self-sustaining on the short term

Predicted trends of the Emys population on Woerr (FR)



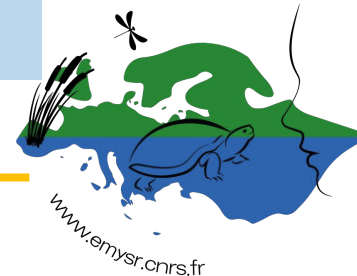
Georges et al. (in prep)



# The other sides of restoration/reintroduction (1/3)

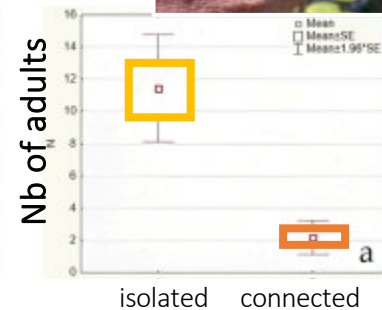
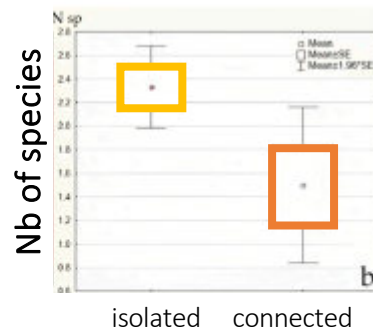
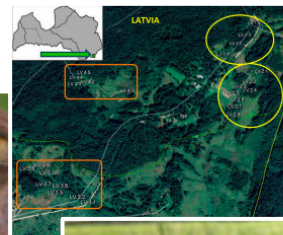
- Neu Woerr (DE+FR): A new invasive alien species, the calico crayfish *Faxonius immunis*
  - Originated from North America
  - Active burrowing behaviour
  - High food consumer
- Massive impacts on the overall restored ecosystem
- Testing experimental calico-proof, *Emys* friendly, ponds
- Adaptive management is needed post restoration





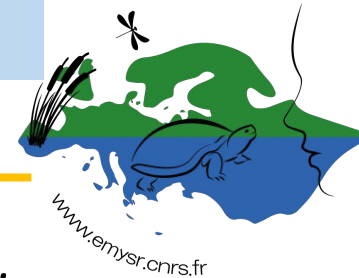
# The other sides of restoration/reintroduction (2/3)

- *Silene* (LV): A well settled invasive alien predatory fish, the Chinese sleeper *Perccottus glenii*
    - Originated from Asia
    - Widespread throughout Europe
    - Massive impacts on natural and restored ecosystems
  - Testing new pondscape designs on amphibian communities
- Restoring pondscape connectedness is not always the solution

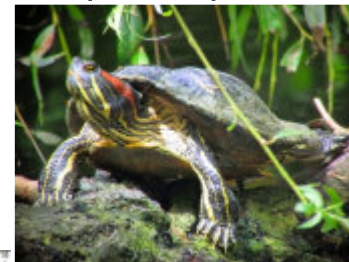




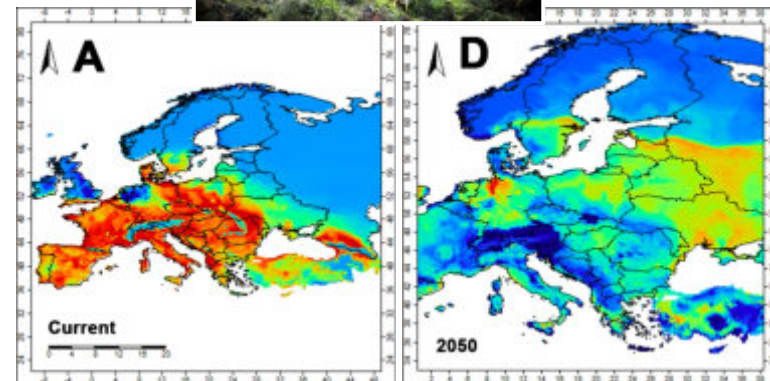
# The other sides of restoration/reintroduction (3/3)



- Europe: the red-eared slider turtle *Trachemys scripta sp.*
  - Originated from Northern America
  - One of the 100 worst invasive species (*Daisy 2015*)
  - High competition with native European freshwater turtles
- Modelling (A) present overlap & (D) future non-overlap areas



→ **Priority conservation areas** for *Emys* are in Eastern Europe, including Ukraine



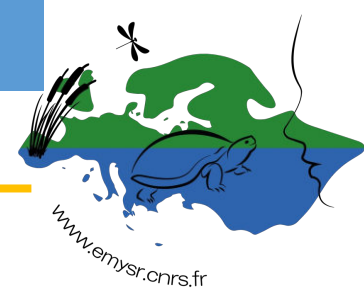
# The other sides of restoration/reintroduction

- Europe: the red-eared slider turtle *Trachemys scripta elegans*
  - Originated from Northern America
  - One of the 100 worst invasive species (Daly *et al.* 2015)
  - High competition with native European freshwater turtles
- Modelling (A) present overlap & (B) future non-overlap areas

→ Poster 33

Oksana NEKRASOVA (NAS-Ukraine)

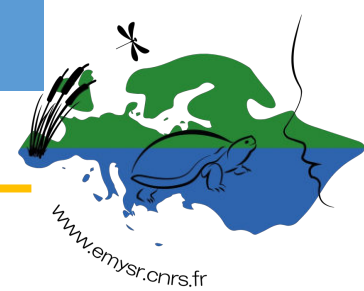




# Summary

- *Are Emys reintroductions successful?*
  - Highly dependent on ecological context and further management
- *What make them successful?*
  - Soft release of aged individuals
- *Do they benefit biodiversity?*
  - Native vs. alien invasive conflicts



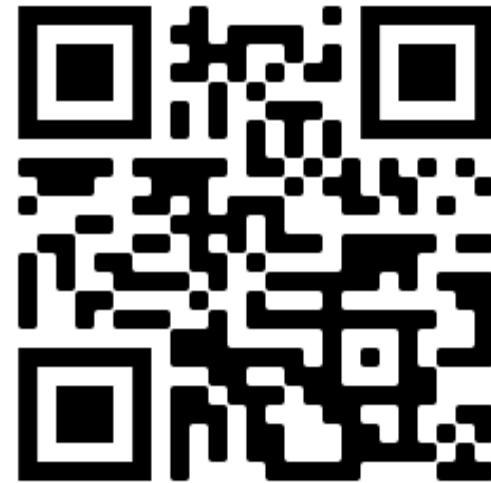


# Take home message

Habitat restoration and species reintroductions are relevant **Nature-based Solutions** for mitigating biodiversity loss, e.g. EU Nature Restoration Law, yet require **long-term monitoring** and **appropriate adaptive management** for preventing adverse impacts.

Jean-Yves GEORGES

[jean-yves.georges@iphc.cnrs.fr](mailto:jean-yves.georges@iphc.cnrs.fr)



*More on our website!*

Emys-R (<https://emysr.cnrs.fr/>) was funded through the 2020-2021 Biodiversa+ and Water JPI joint call for research projects, under the BiodivRestore ERA-NET Cofund (GA N°101003777), with the EU and the funding organisations Agence Nationale de la Recherche (ANR, France, grant ANR-21-BIRE-0005), Bundesministerium für Bildung und Forschung (BMBF, Germany, grant BMBF project number 16LW015), State Education Development Agency (VIAA, Latvia, grant ES RTD/2022/2), and National Science Center (NSC, Poland, grant 2021/03/Y/NZ8/00101).