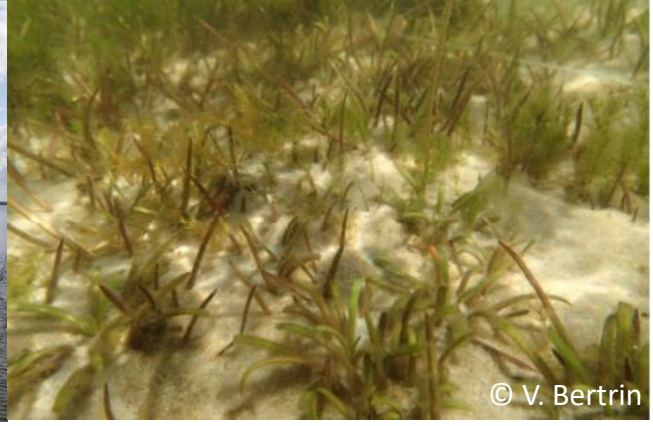
Genetic and taxonomic diversity of isoetid communities in Aquitaine shallow lakes

Estelle-Marie Blanquart, Aurélien Jamoneau, Olivier Lepais





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16th International Symposium on Aquatic Plants – 14/11/2023 - Antwerp

INTERNATIONAL AQUATIC PLANTS GROUP

RÉPUBLIQUE FRANÇAISE
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RÉGION Nouvelle-Aquitaine

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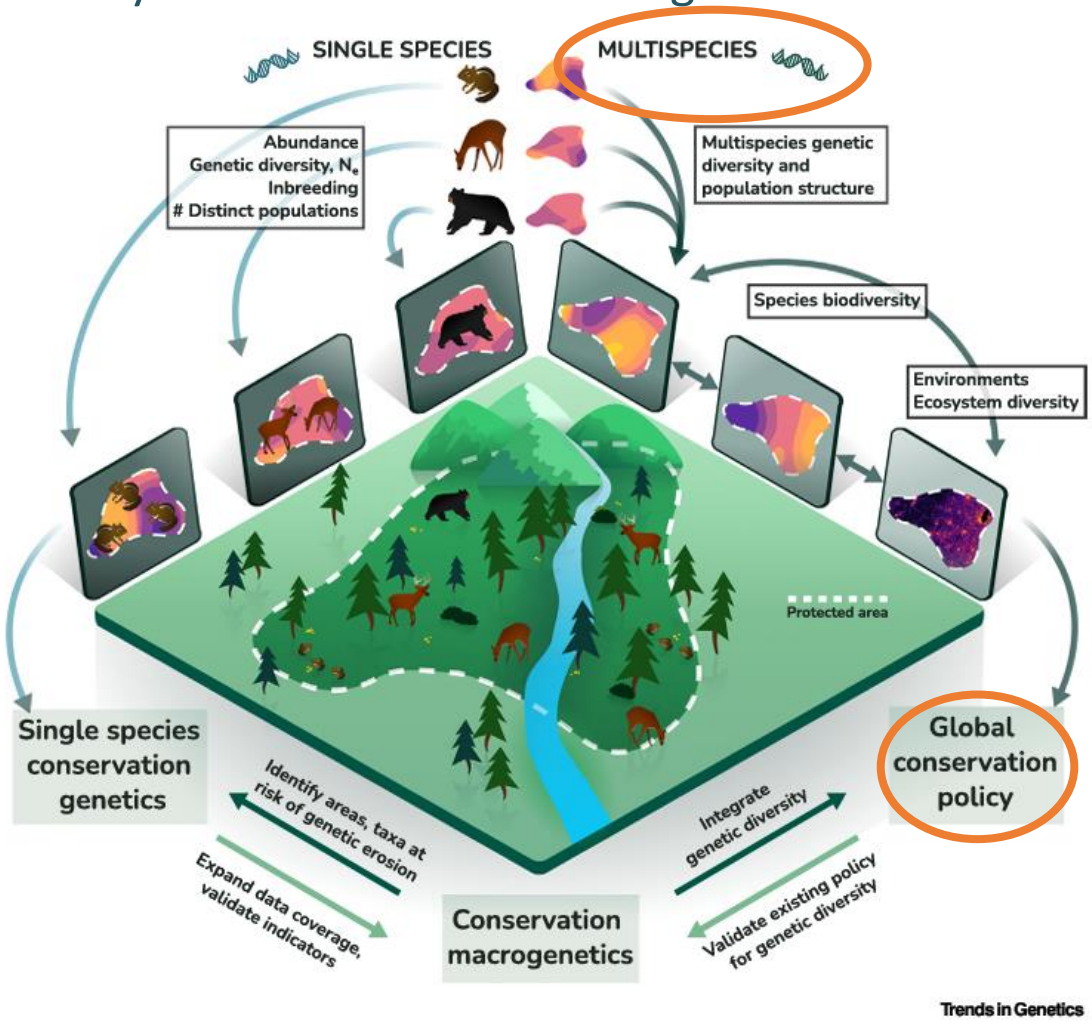
AGENCE DE L'EAU ADOUR-GARONNE

VIGIE-LACS

Context

THE IUCN RED LIST OF THREATENED SPECIES™

Biological diversity crisis and conservation genetics

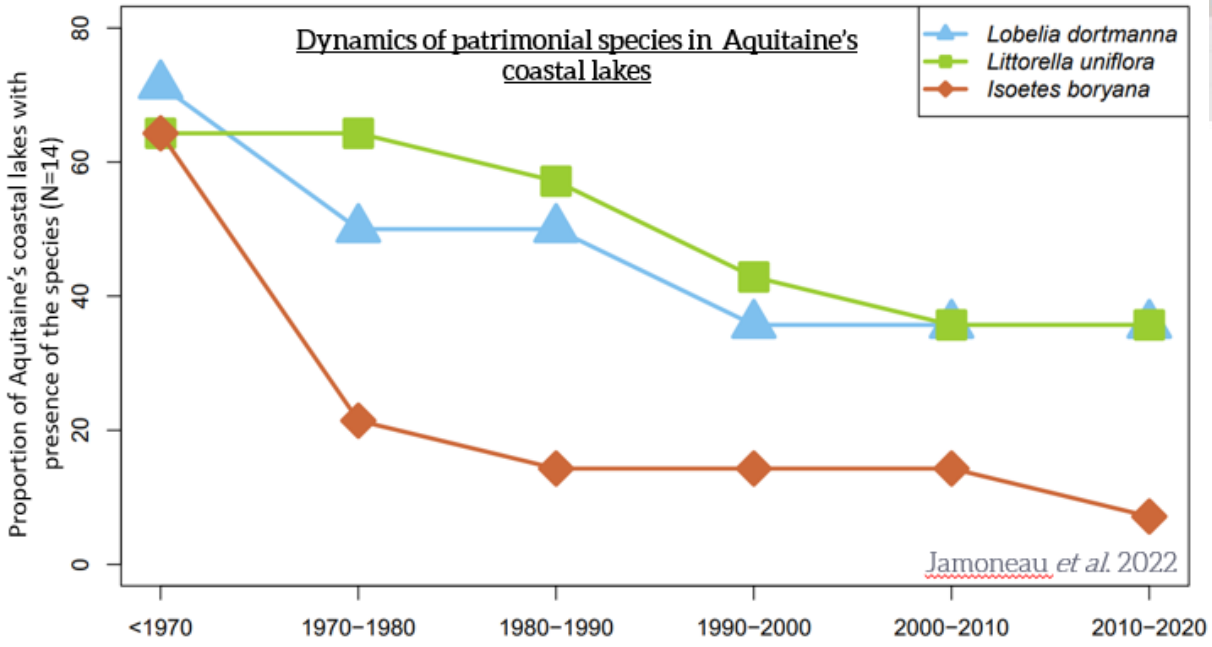


Integrating macrogenetics into existing conservation frameworks
C. Schmidt, S. Hoban & W. Jetz, 2023

Schmidt, Hoban, & Jetz, 2023
Schmidt *et al.*, 2022
Frankham, 1995

Context

Lobelia lakes and isoetid communities decline



Probable local causes:

- **Morphological degradations** (4x4, water sports, horse riding, etc.)
- **Eutrophication**
- Sediment erosion and **pollution**
- **Species invasion**

➡ **National Action Plan** for these communities

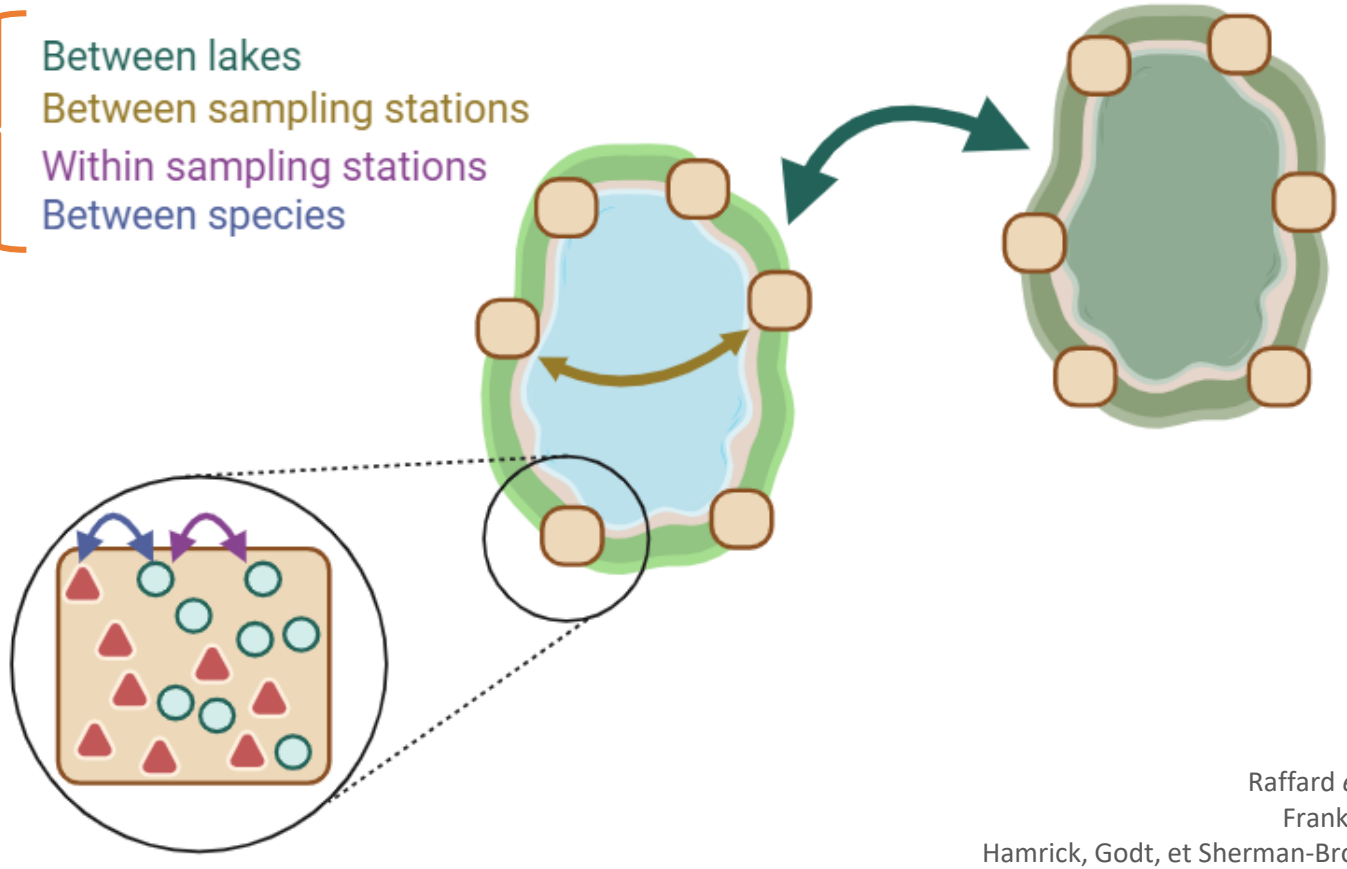
Pederson et al., 2006
Roelofs, 1983
Lucassen et al., 2016
Jamoneau et al., 2022

Objectives

Examine and compare genetic diversities of isoetid communities

Neutral genetic diversity

- Between lakes
- Between sampling stations
- Within sampling stations
- Between species



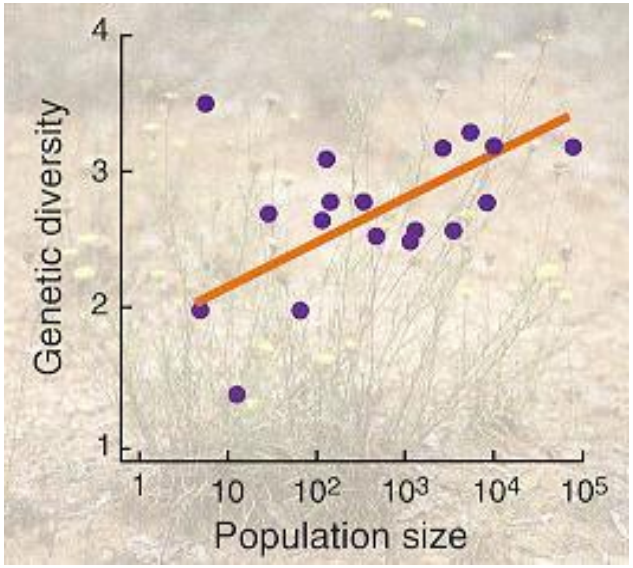
Raffard *et al.*, 2019
Frankham, 1995
Hamrick, Godt, et Sherman-Broyles, 1992
Ellegren et Galtier, 2016
Hamrick & Godt, 1996

Hypotheses

Conservation

- **Lower genetic diversity** for **rare species** and isolated populations
- Sites/lakes with lower **overall genetic diversity**

"Genetic erosion" occurs in small populations of the Button Wrinklewort (Rutidosis leptorrhynchoides).



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Raffard *et al.*, 2019
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Schmidt et al, 2021

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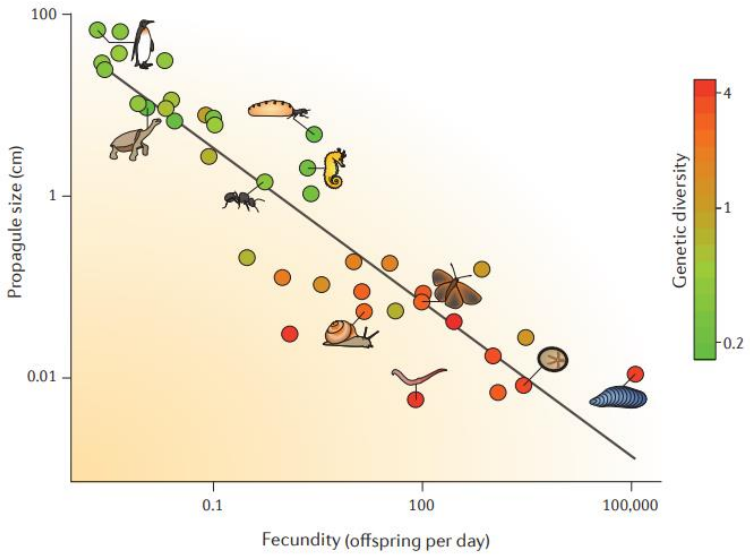
Evolutionary

- **Differences between species** with various life history traits
- **Similar population genetic** structure due to common **demographic history**

Genetic diversity and the r/K gradient in animals.



Ellengren & Galtier, 2016

Raffard *et al.*, 2019
Frankham, 1995
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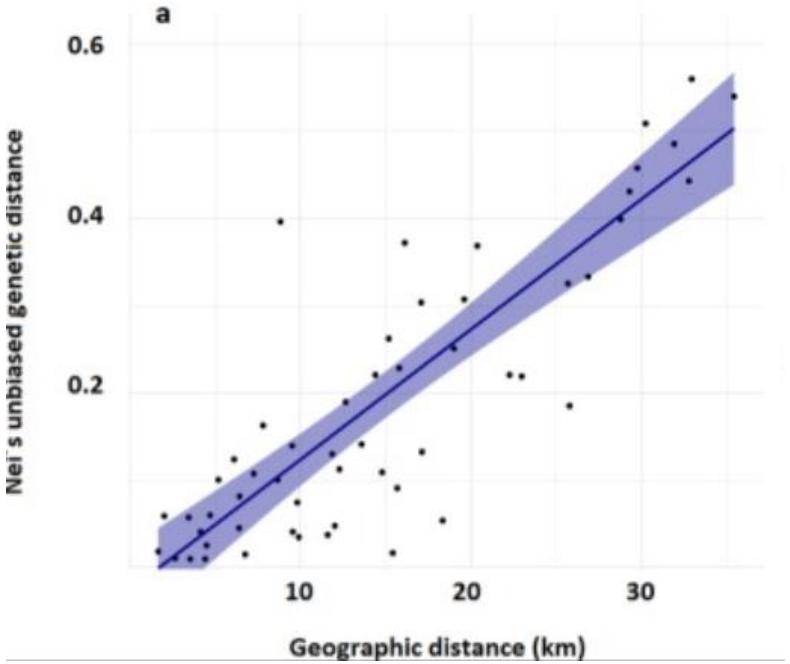
Ecological

- **Connected populations** between nearby lakes



García-Girón et al., 2019

Raffard *et al.*, 2019
Frankham, 1995
Hamrick, Godt, et Sherman-Broyles, 1992
Ellegren et Galtier, 2016
Hamrick & Godt, 1996
Schmidt et al, 2021

Material and Methods

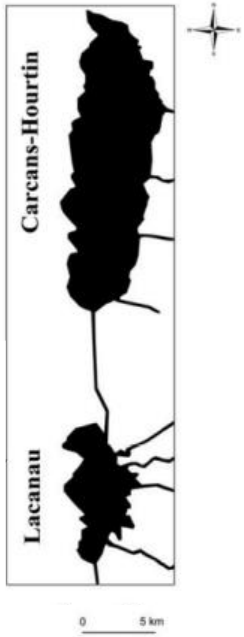
Shallow lakes of Aquitaine

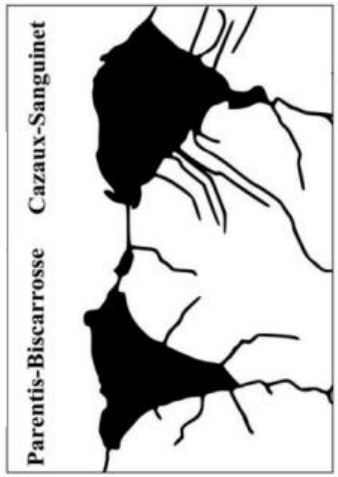
2000 BCE

Modern era

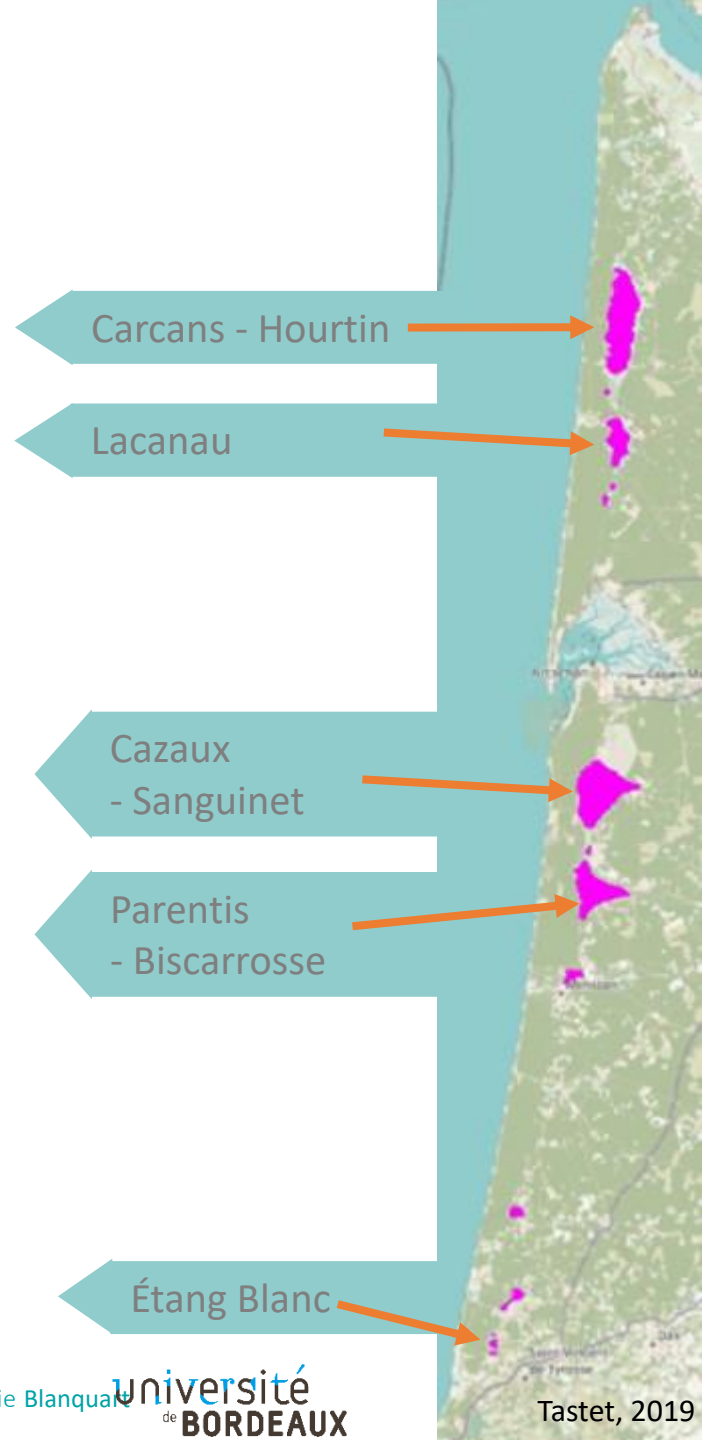
Actual

Geological history of **Cazaux-Sanguinet lake** (Tastet & Clavé-Papion, 2008). The arrow indicates the deepest part of the lake





Bertrin et al., 2017



Tastet, 2019

Material and Methods

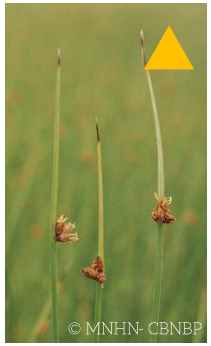
Isoetids communities

Protected patrimonial species

Littorella uniflora

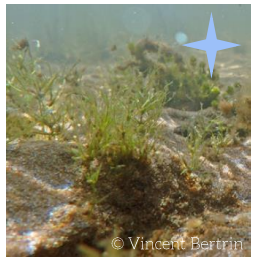
Lobelia dortmanna

+



Schoenoplectus pungens

Eleocharis multicaulis



Chara fragifera (algae)

Myriophyllum alterniflorum

Phragmites australis

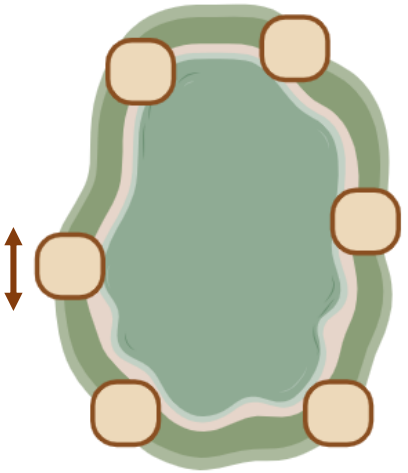
Baldellia ranunculoides

Juncus bulbosus

Hydrophyte Helophyte Amphibious

Material and Methods

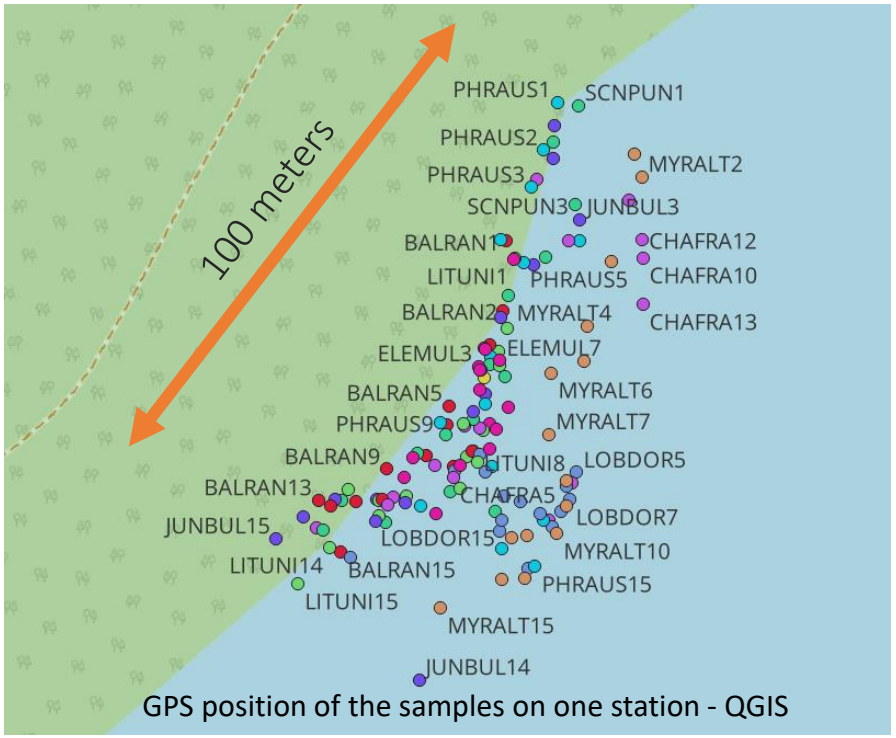
Sampling method and Data set



- **9 species**
- **5 lakes**
- **6 sampling stations** per lake (3 west and 3 east)
- **15 individuals** per station, per species

4050 individuals in theory

(Species not present on all sites)



GPS position of the samples on one station - QGIS

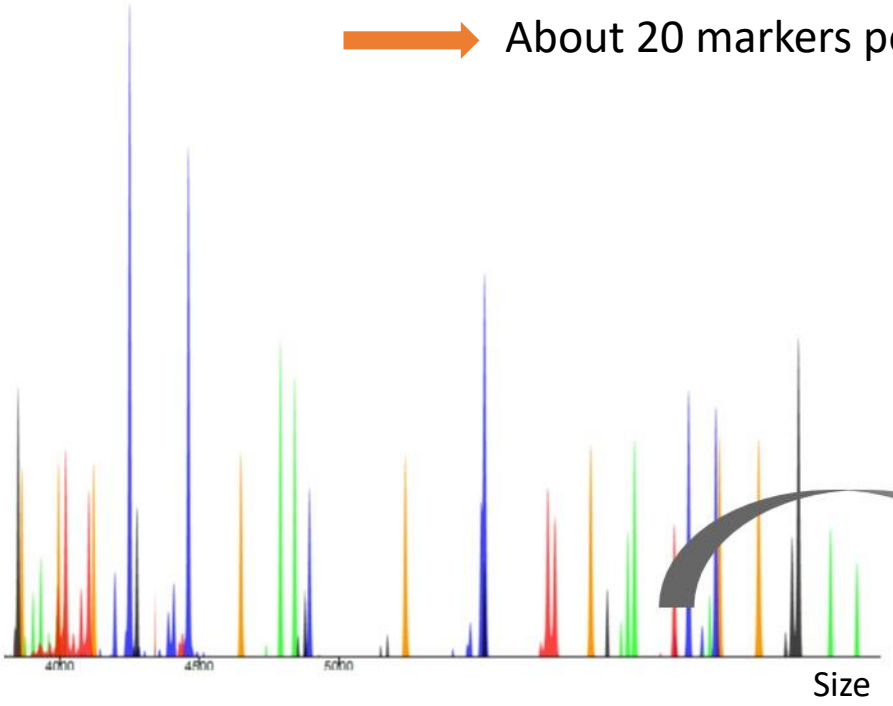
Material and Methods

Sequenced-based microsatellites markers

Workflow :

SSR marker developement → Multiplex PCR and sequencing → Bioinformatic pipeline

→ About 20 markers per species



- Fast
- Cheap
- Not size-based

TTTGATTAGAGGTGTTTTGGTCCCAACTATT(1)**GTT(7)**TTCTATTAC
TTTGATCAGAGGTGTTTTGGTCCCAACTATT(1)**GTT(7)**TTCTATTAC
TTTGATCAGAGGTGTTTTGGTCCCAACTATT(1)**GTT(8)**TTCTATTAC
TTTGATCAGAGGTGTTTTGATCCCAAATTTT(1)**GTT(9)**TTCTATTAC
TTTGATCAGAGGTGTTTTGATCCCAACTTTT(1)**GTT(9)**TTCTATTAC

Lepais et al., 2020

Material and methods

Conservation

- **Lower genetic diversity** for **rare species** and isolated populations
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Evolutionary

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➢ **Allelic Richness, Hill numbers** based genetic diversity

Chao, Chiu, & Jost, 2010
Alberdi & Gilbert, 2019

➢ IBD, Wright's statistics, structure

Nei et al., 1975
Evanno, Regnaut & Goudet, 2005

➢ Coalescent, ABC

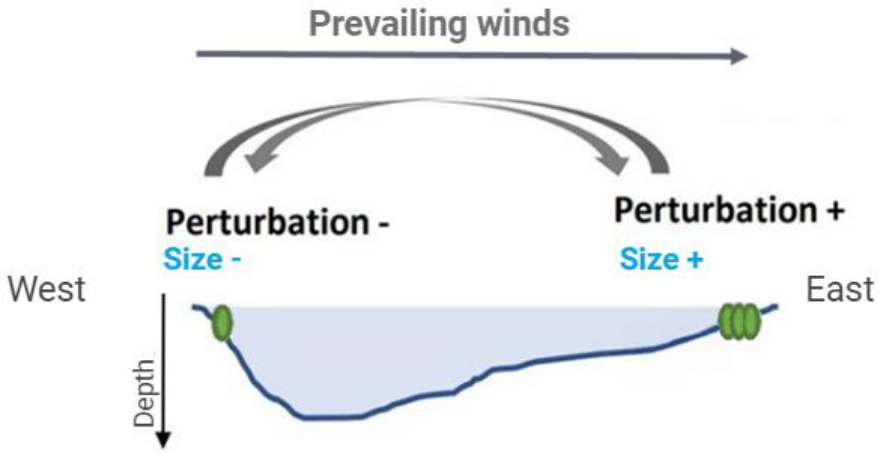
Mather et al., 2020

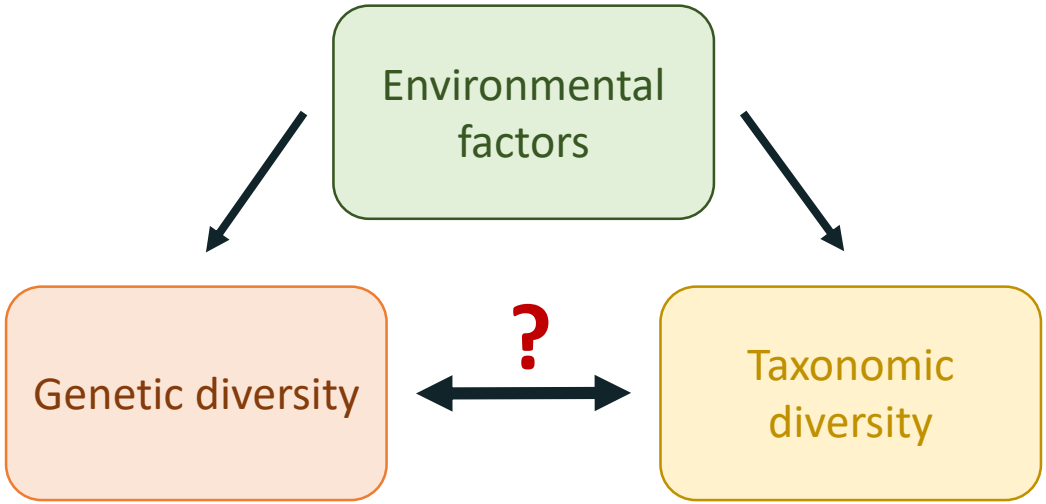
➢ Spatial / landscape genetics

Guillot et al., 2055

Future goals and perspectives

Environment impact on genetic diversity





Vellend, 2005
Kahilainena et al., 2014

Thank you !

METAPROGRAMME BIOSEFAIR

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Agence de l'Eau Adour Garonne

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Céline, Aurélien and the PGTB team for the lab work

INRAE EABX and BIOGECO

A multi-actors project

<u>Studying the genetics of Isoetid populations on a regional scale</u>

Maintaining the Isoetids in a **good conservation state**, as well as the **vegetation that shelters them**, through the **implementation of operational actions**

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Direction régionale de l'Environnement, de l'Aménagement et du Logement
NOUVELLE-AQUITAINE