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Biodiversity conservation and fish production in ponds: a contradiction?

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SS06. Ponds as integral part of aquatic and terrestrial landscapes

SEFS13, 19/06/2023, Newcastle



Introduction

In the Dombes region, ponds for fish production

Originally a wetland, transformed during the Middle Ages by monastic communities to create ponds (Avocat, 1975; Guichenon, 1650 cited in Sceau, 1980).

Several objectives:

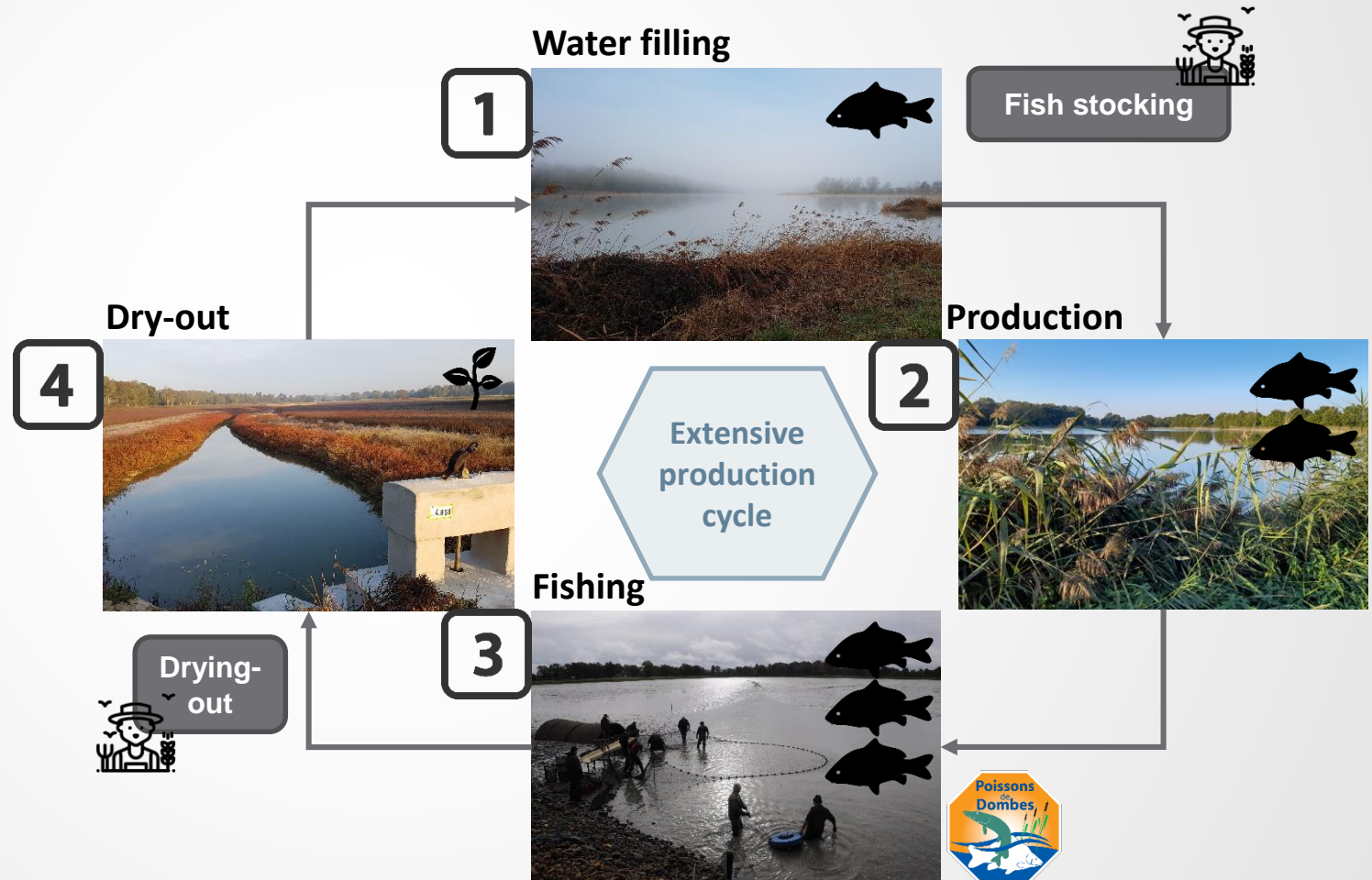
- Drain areas to cultivate land
- Create ponds to produce fish
- Sanitation and diseases control

A “productive pondscape”:

Around 1,100 ponds for 10,000 ha of water (average of 10 ha and 80 cm deep)
Between 600 and 1,000 tons of fish produced per year

- Artificial and managed environments (Hansson et al., 2005)

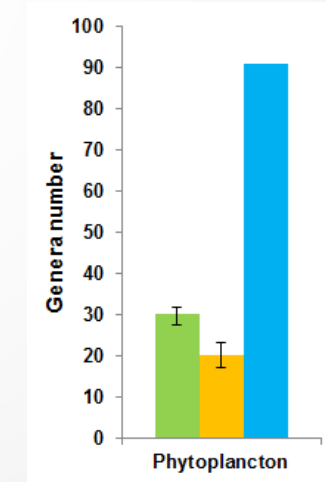
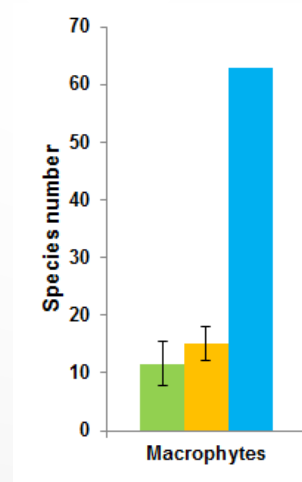
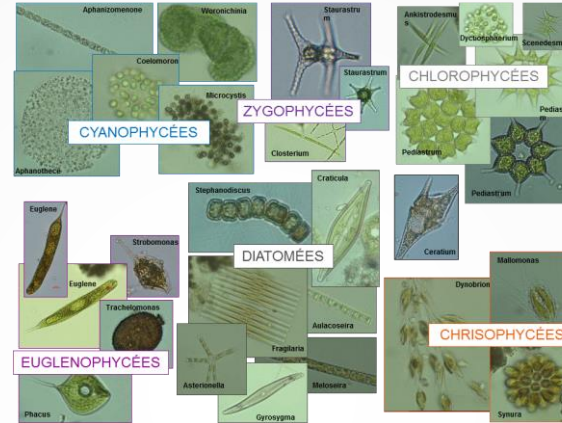
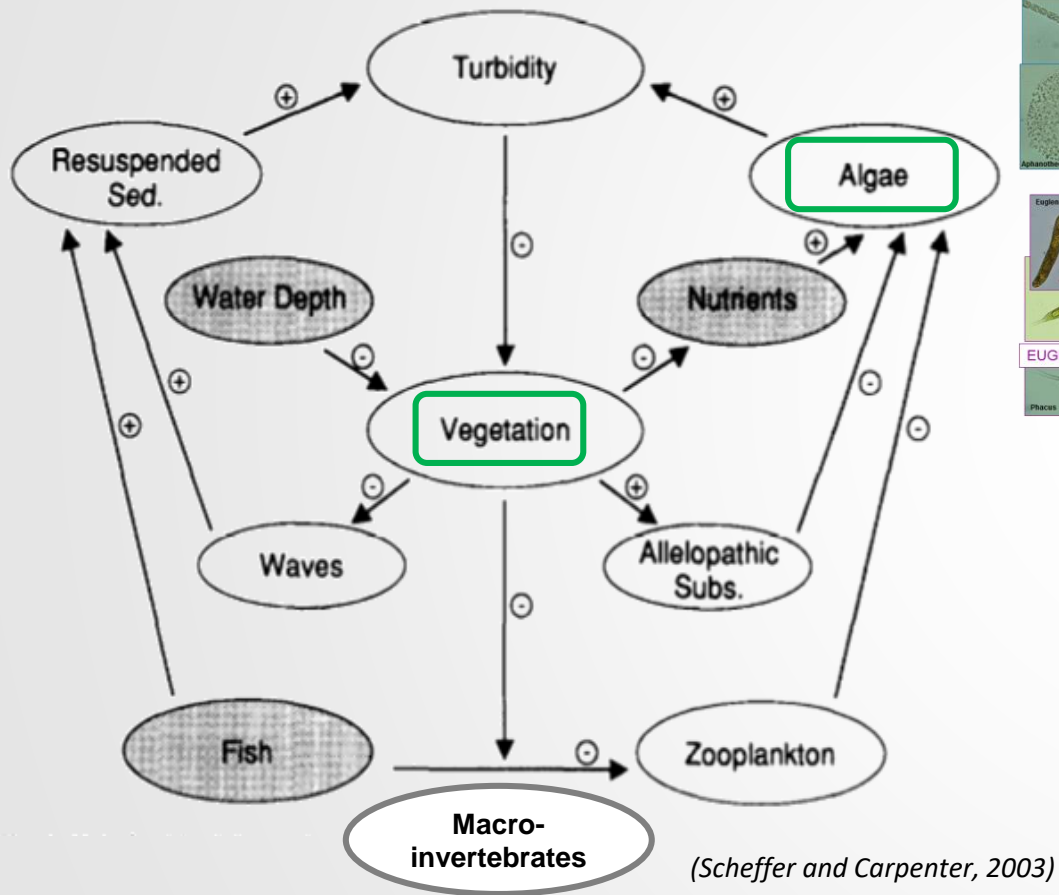
but also...



two historical practices = intermediate levels of disturbances ?

Introduction

Ecosystem functioning and biodiversity



■ Alpha
■ Beta
■ Gamma

(Wezel et al., 2013)

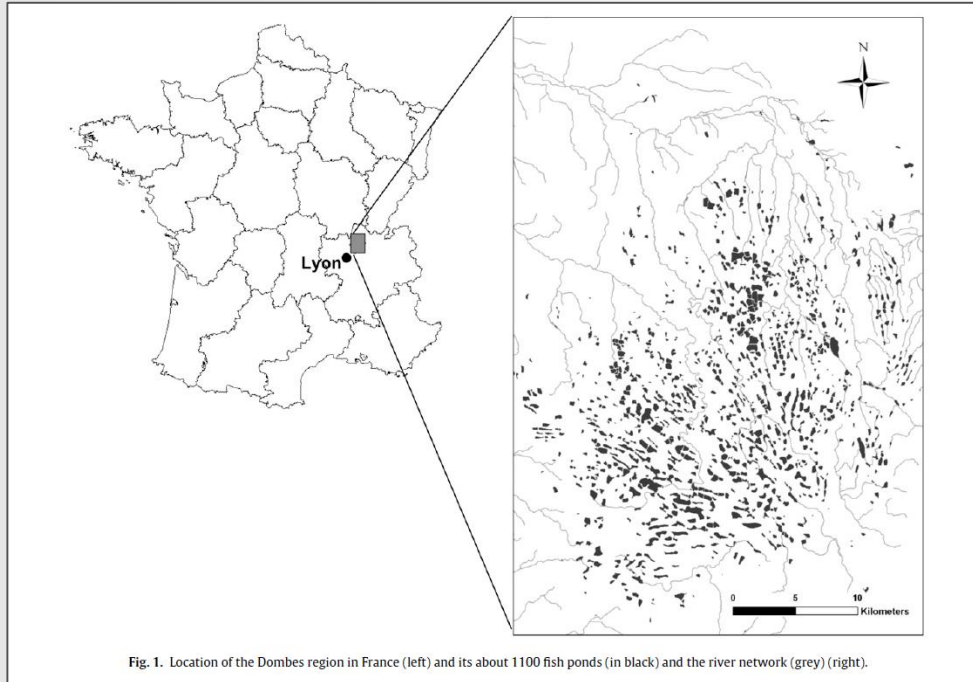
➔ **Two primary producers** at the base of food web functioning and energy: essential for **fish production** and **maintaining diversity**

➔ Fishponds = a **significant** contribution to **regional biodiversity**

How fish production practices affect biodiversity patterns ?

Materials and Methods

(Wezel et al., 2013)



Dombes

(Dombes Tourisme)

➔ Historical database of 85 fishponds from Dombes (2007-2014)

➔ PONDERFUL 2021 fishponds database from Dombes (France)



Midden-Limburg

and from Midden-Limburg (Belgium)

➔ Macrophyte species richness and cover

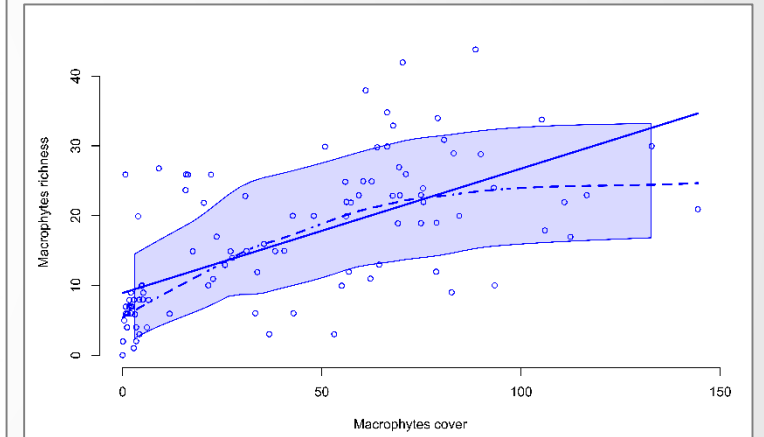
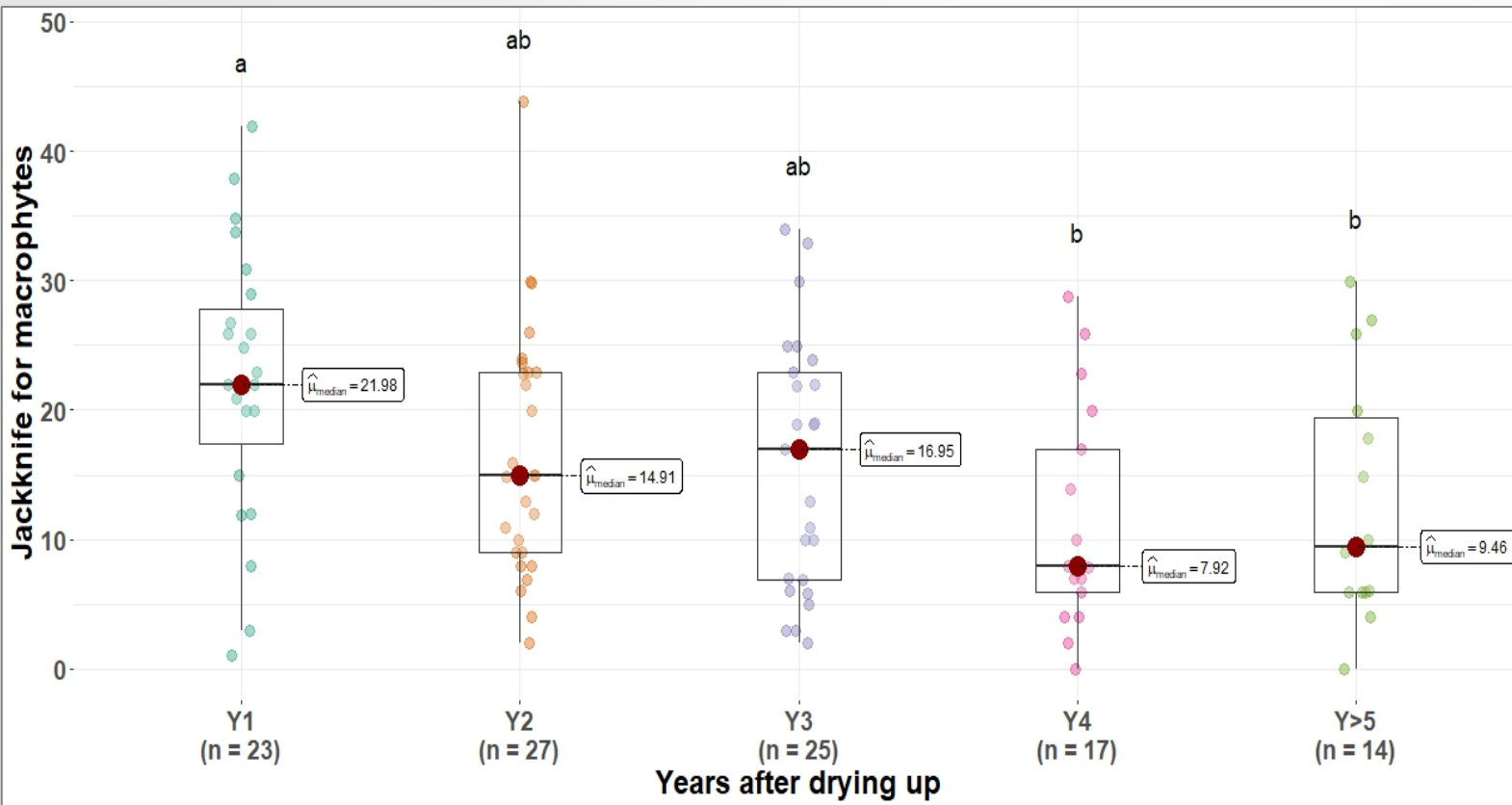
Phytoplankton richness and concentration

Management data (distance to last dry-out in Dombes and fish stock in both countries)



Results

Effects of drying-out on macrophyte richness and cover



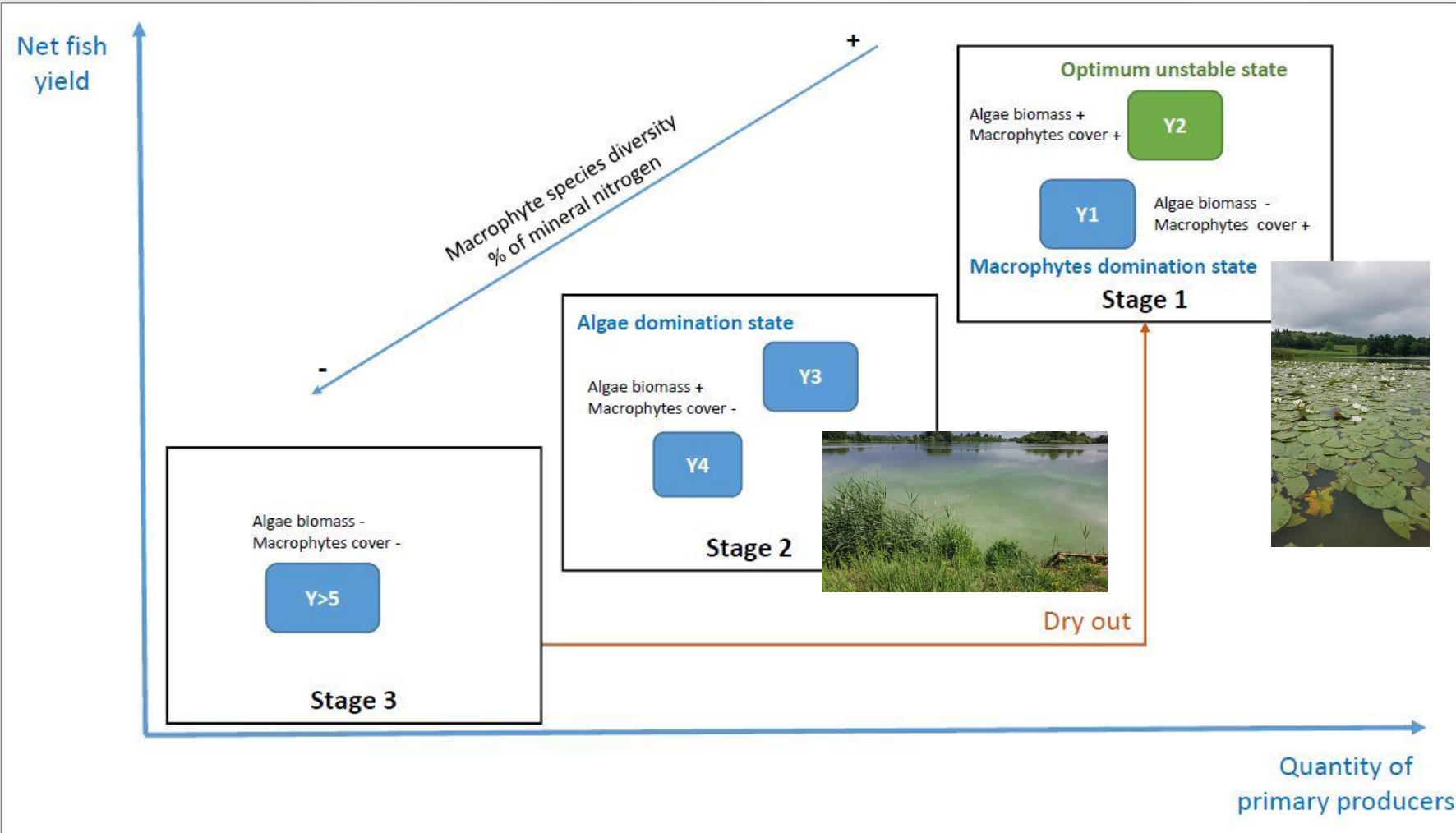
$(R^2 = 0.732, p < 0.0001)$

Same trends for species richness and cover

➔ Drying out encourage **macrophyte recolonization**

➔ Phytoplankton gradually dominate in following years, but the two primary producers are little present after 5 years and more

Discussion



An **unstable state, optimal for fish production and the diversity of primary producers**, favoured by the practice of drying-out



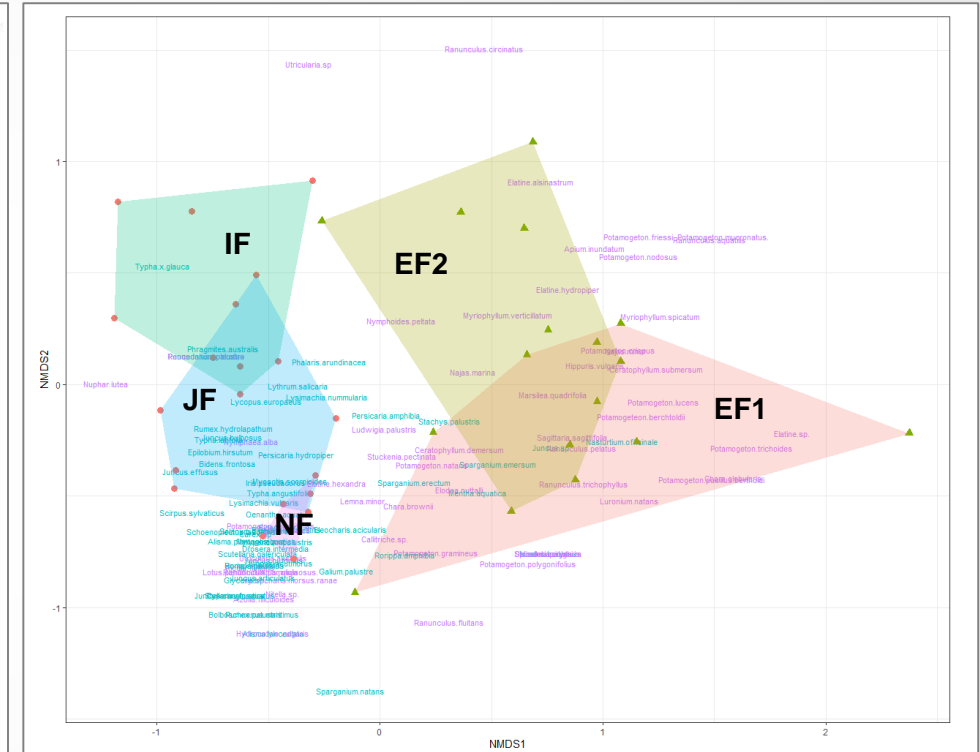
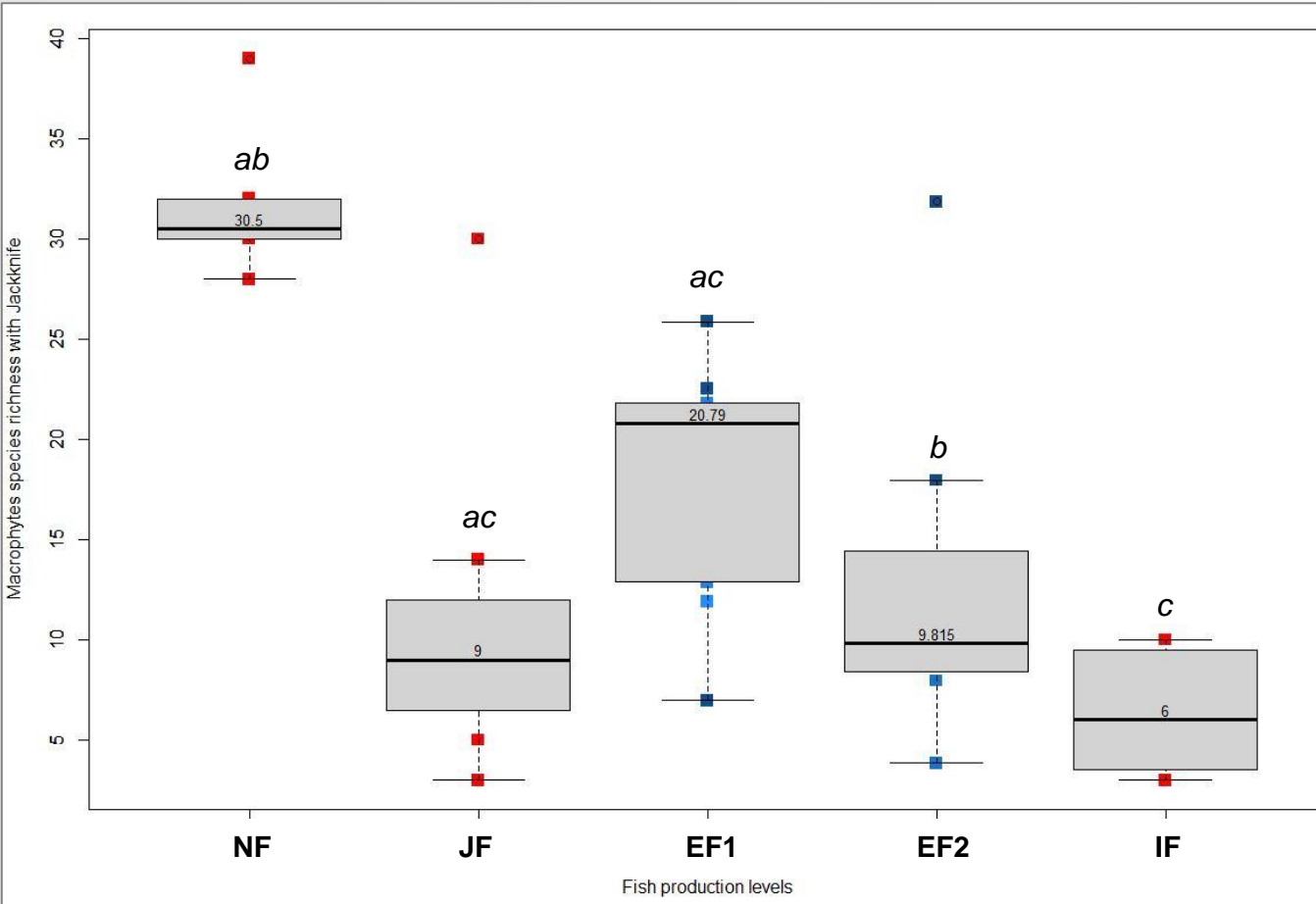
A **major agro-ecological practice** for extensive pond fish farming

Hyper-eutrophic

Eutrophic

Results

Effects of fish stock on macrophyte richness and community structure



NF : No Fish (Low density)
JF : Juvenile Fish (200-400 kg/ha)
IF : Intensive (1200-1500 kg/ha)

EF1 : Extensive 1 (300-500 kg/ha)
EF2 : Extensive 2 (500-900 kg/ha)

➔ A clear "fish density" effect on macrophyte species richness

➔ Fish density also partly explains community structure. Extensive production areas have more variable communities.

Discussion and Conclusion

- Fishponds are **important biodiversity reservoirs** on a regional scale:
 - **High variability** at individual level
 - Number of macrophyte species **comparable to other pond types**
 - **Rare or protected species** on a European scale
- Fish farming practices create **intermediate levels of disturbance**
- They are **essential to maintaining these environments** and the **ecosystem services** they can provide:
 - Biodiversity conservation (support services)
 - Extensive, agroecological fish production (provisioning services)
 - Climate regulation ? (regulating services)



Biodiversity conservation and fish production are not contradictory !



Among all the ponds, fish ponds also have a role to play



Thanks for your attention!



Questions ?

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