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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:

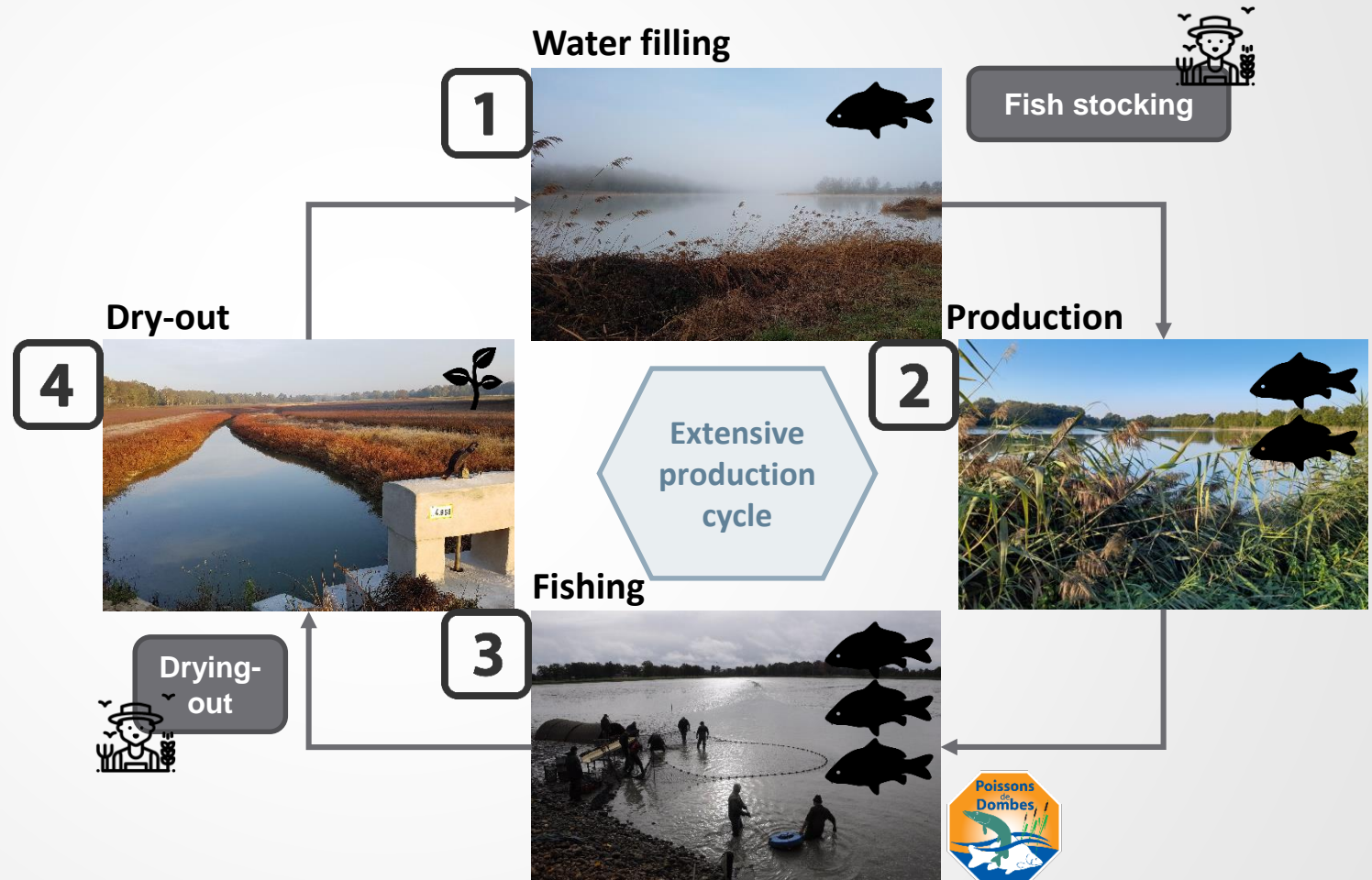
- Drain areas to cultivate land
- Create ponds to produce fish
- Sanitation and diseases control

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)

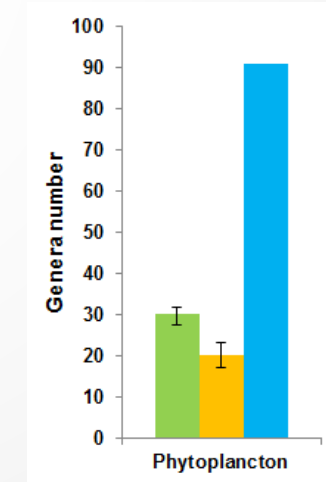
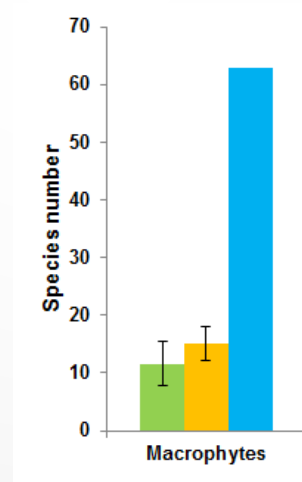
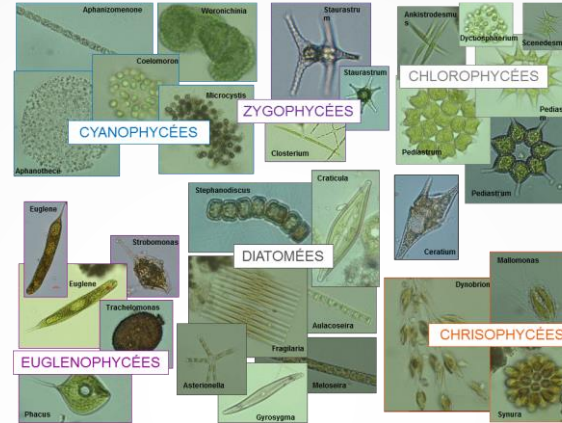
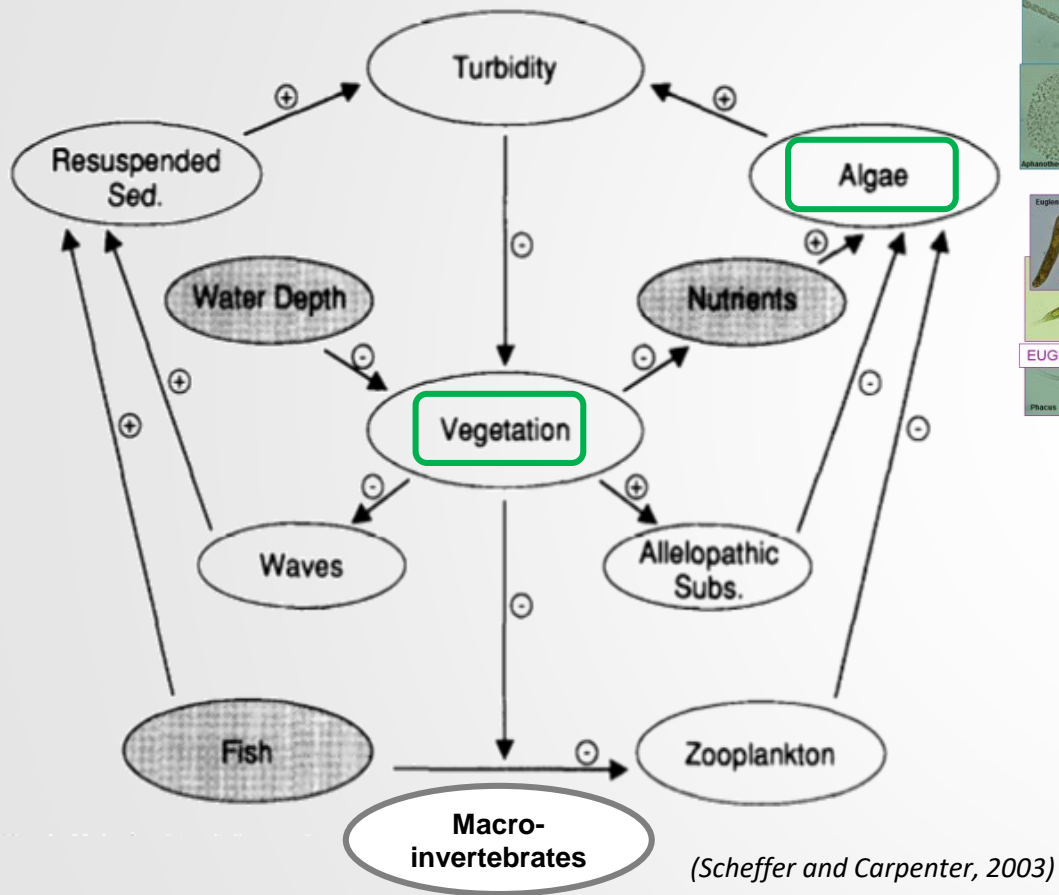
but also...



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)

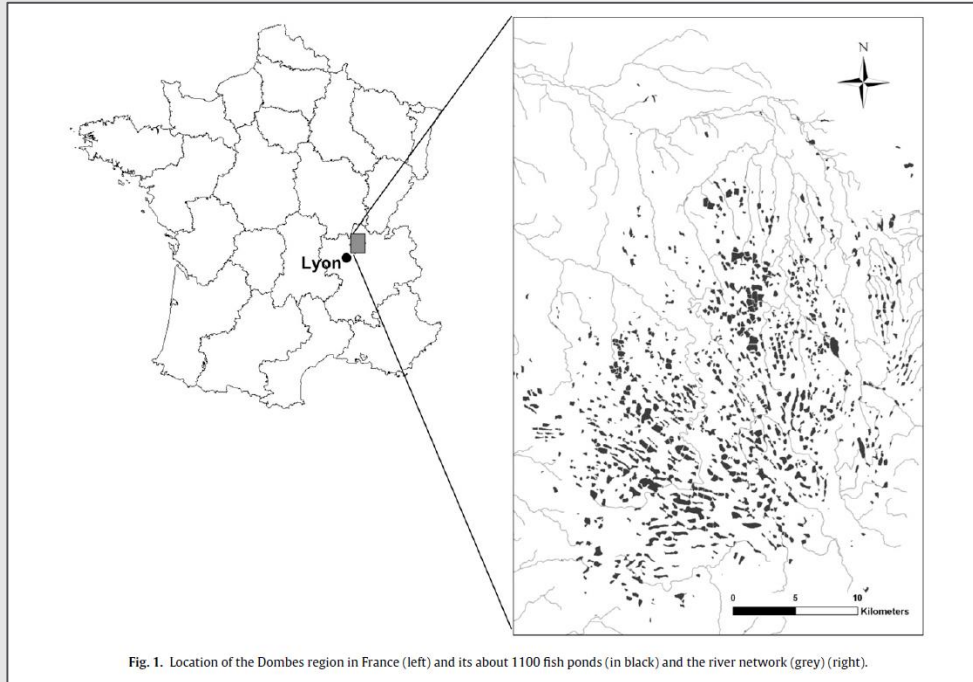


Fig. 1. Location of the Dombes region in France (left) and its about 1100 fish ponds (in black) and the river network (grey) (right).



Dombes

(Dombes Tourisme)

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

➔ PONDERFUL 2021 fishponds database from Dombes (France)



Midden-Limburg

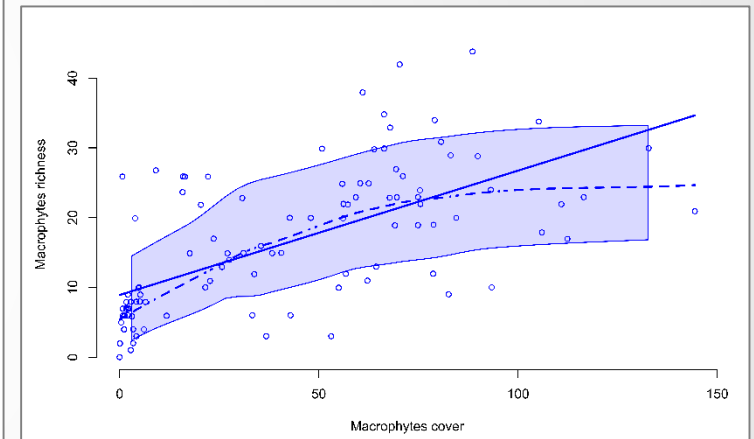
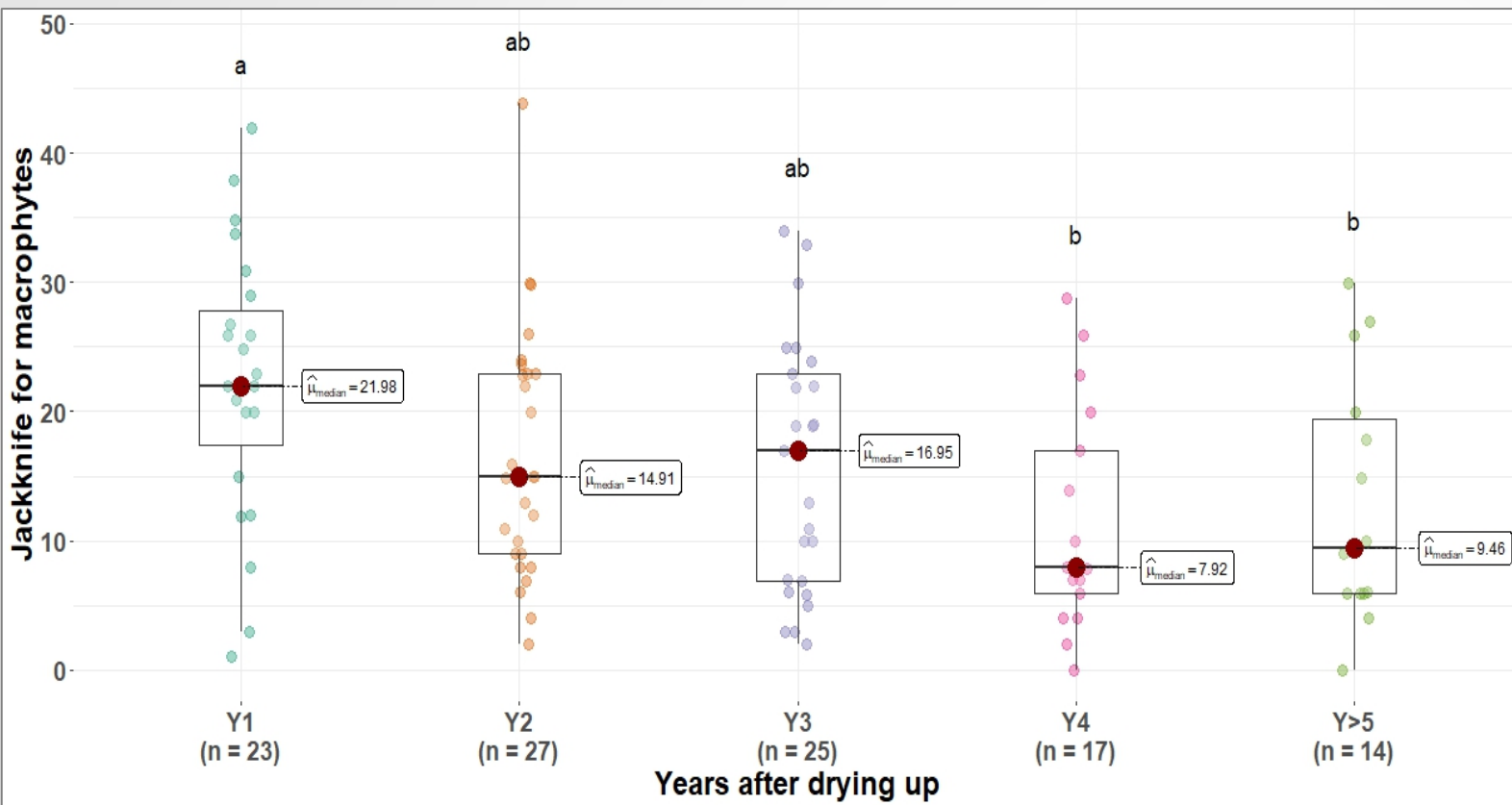
- ➔ Macrophyte species richness and cover
- Phytoplankton richness and concentration
- Management data (distance to last dry-out in Dombes and fish stock in both countries)



and from Midden-Limburg (Belgium)

Results

Effects of drying-out on macrophyte richness and cover



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

Same trends for species richness and cover

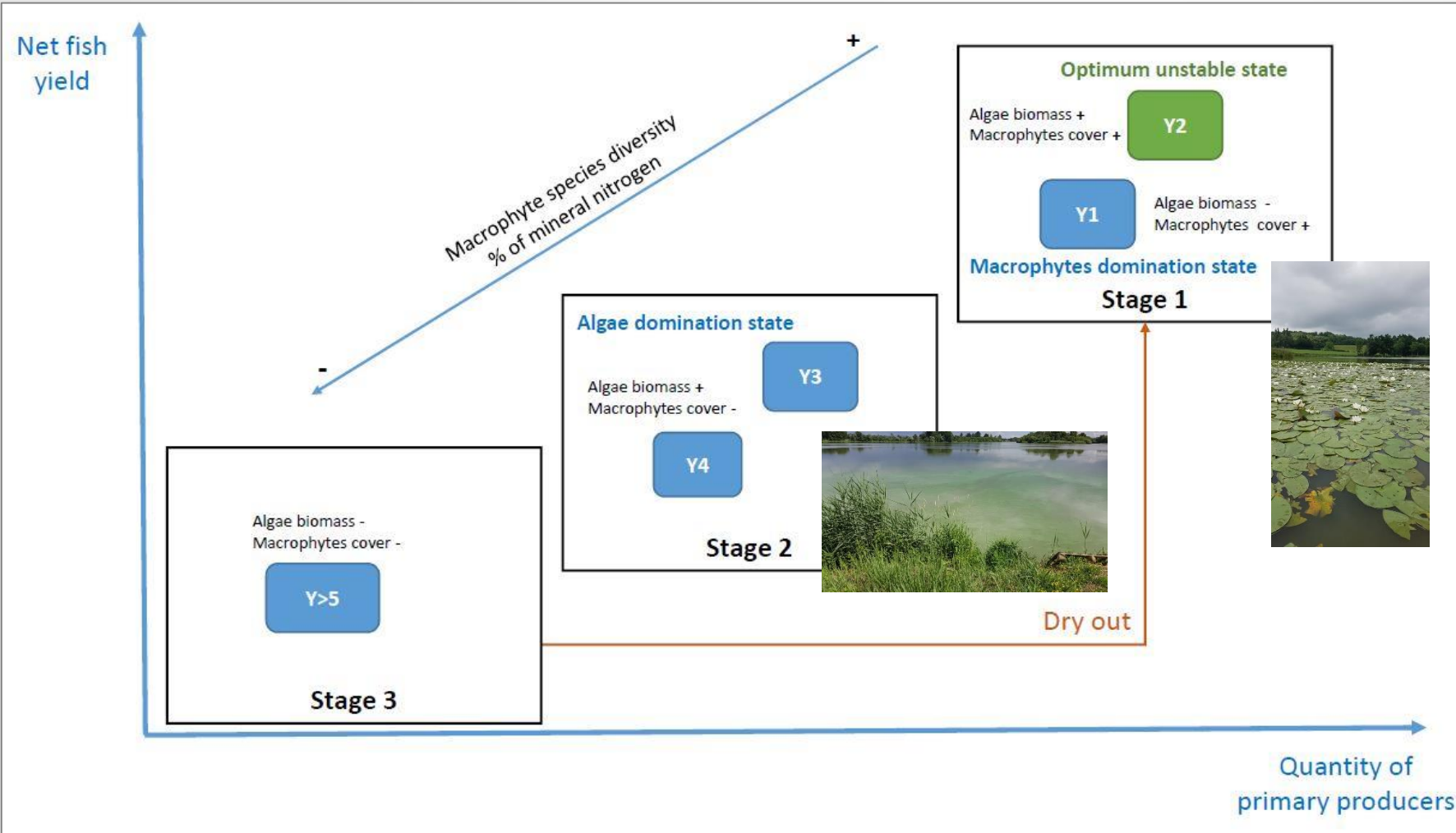


Drying out encourage **macrophyte recolonization**



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



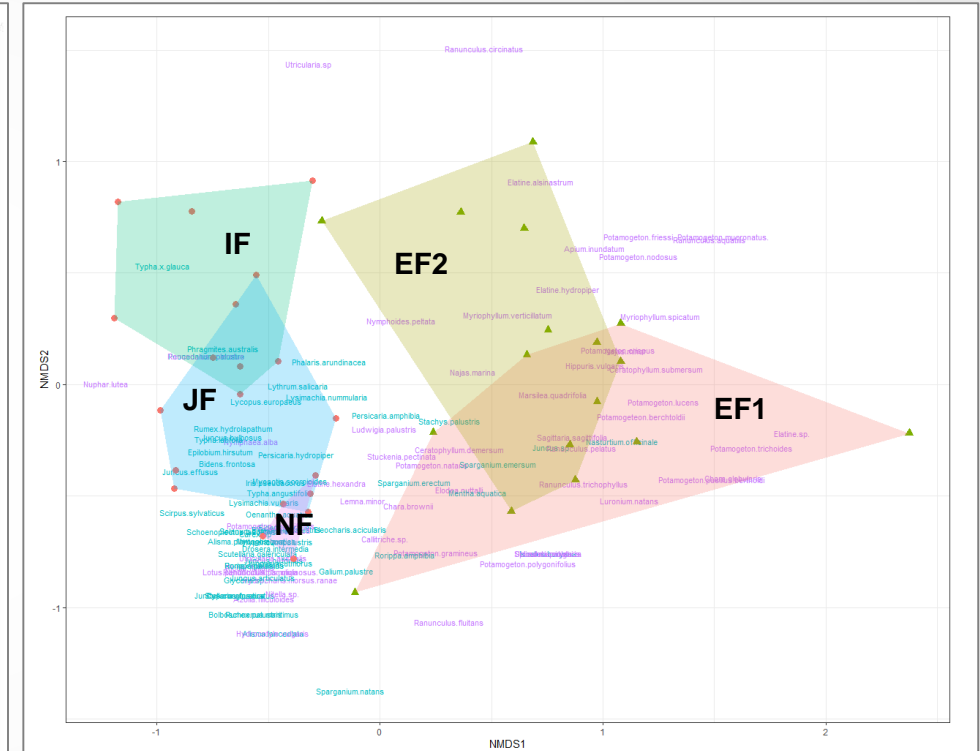
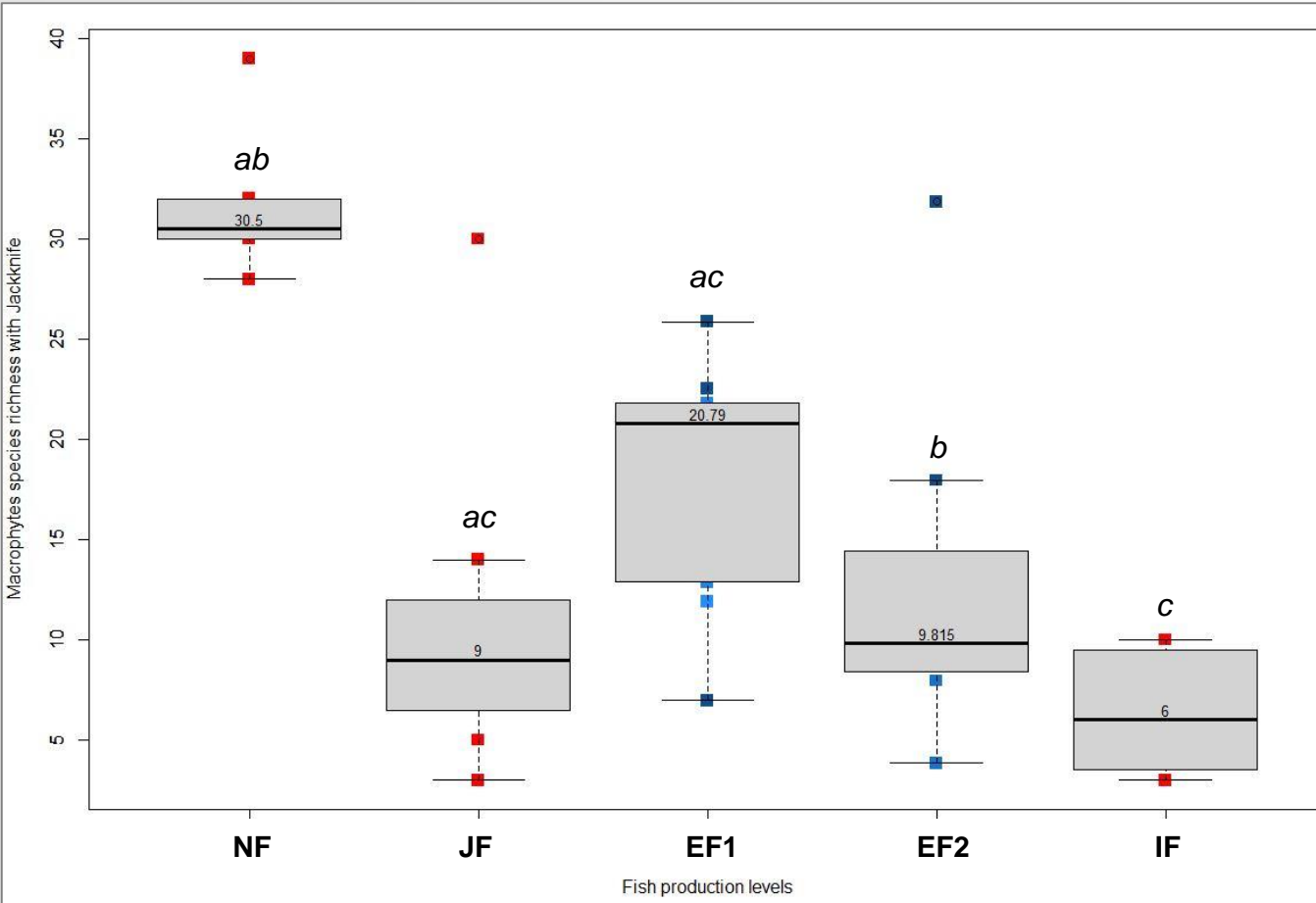
A **major agro-ecological practice** for extensive pond fish farming

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)

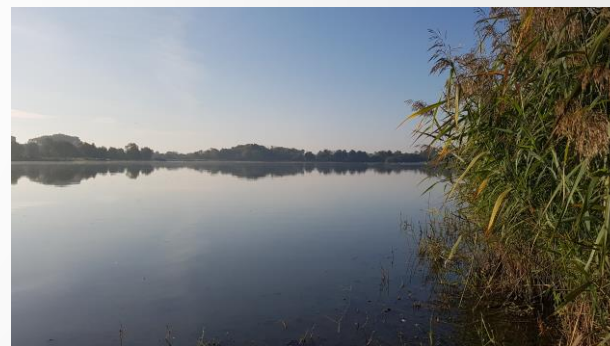
EF1 : Extensive 1 (300-500 kg/ha)
EF2 : Extensive 2 (500-900 kg/ha)

➔ 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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