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Drying-out as a key management practice for fish ponds, to promote primary producers and macrophytes species richness?

Léo GIRARD¹, Alexander WEZEL¹, Soraya ROUIFED¹, Vincent TOLON¹,
Mathieu GUERIN¹, Joël ROBIN¹

¹ Agroecology and Environment Unit, ISARA, 69007 Lyon Cedex 07, France

Maintaining and increasing pond biodiversity

International Pond Conference 2024, Wednesday 13th November 2024



Introduction

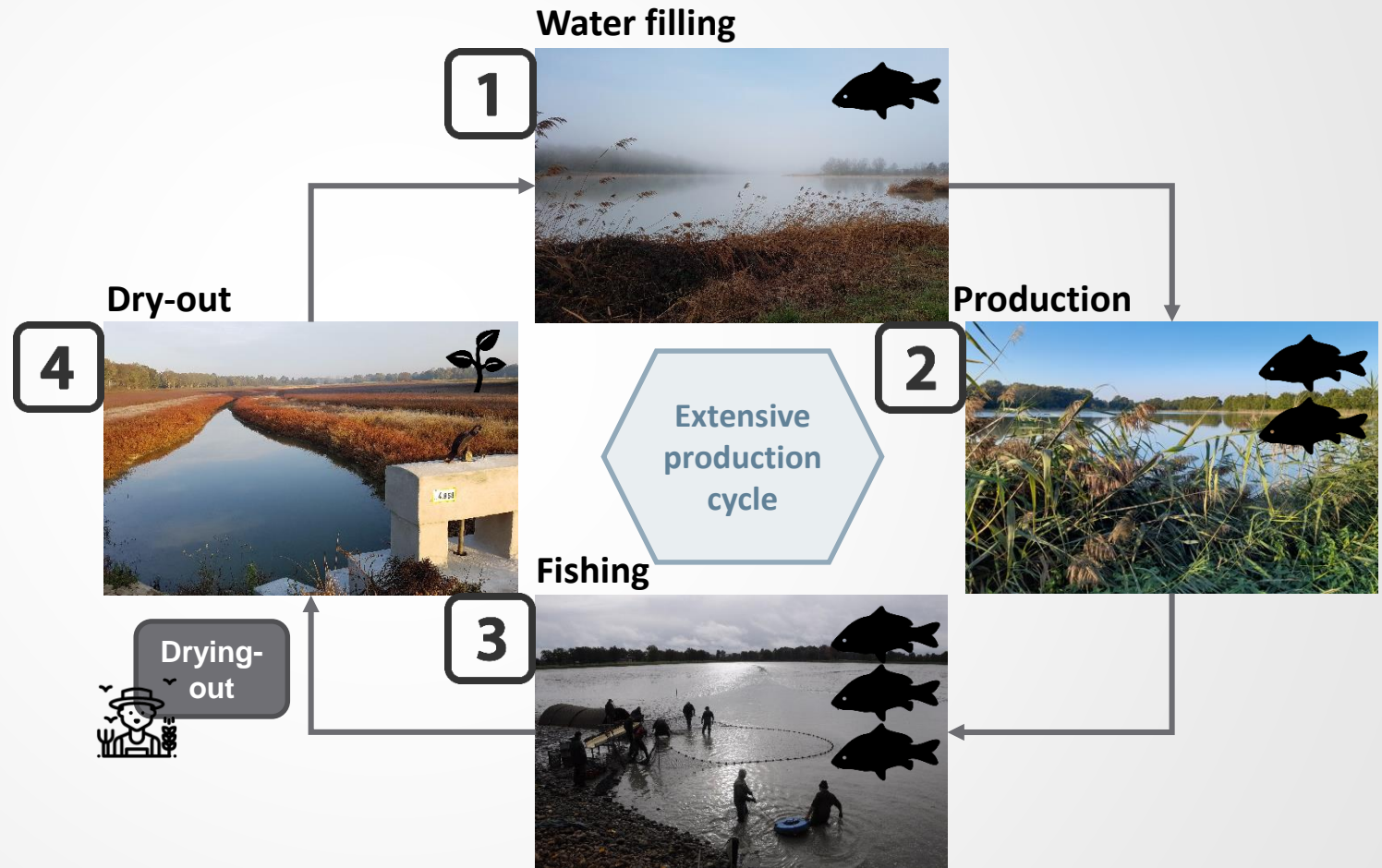
Ponds for fish production, the case of the Dombes region (France)

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

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 tonnes of fish produced per year

- Artificial and managed environments (*Hansson et al., 2005*)
- But also with significant biodiversity (*Wezel et al., 2014; Robin et al., 2014*)



➔ Drying-out, a **historical practice** but also a major **disturbance** for the ecosystem

Materials and Methods

How drying-out affect primary producers abundance and diversity?

(Wezel et al., 2013)



➔ Historical database of 85 fish ponds (134 statistical individuals) from the Dombes region (sampled several times between 2007-2014)

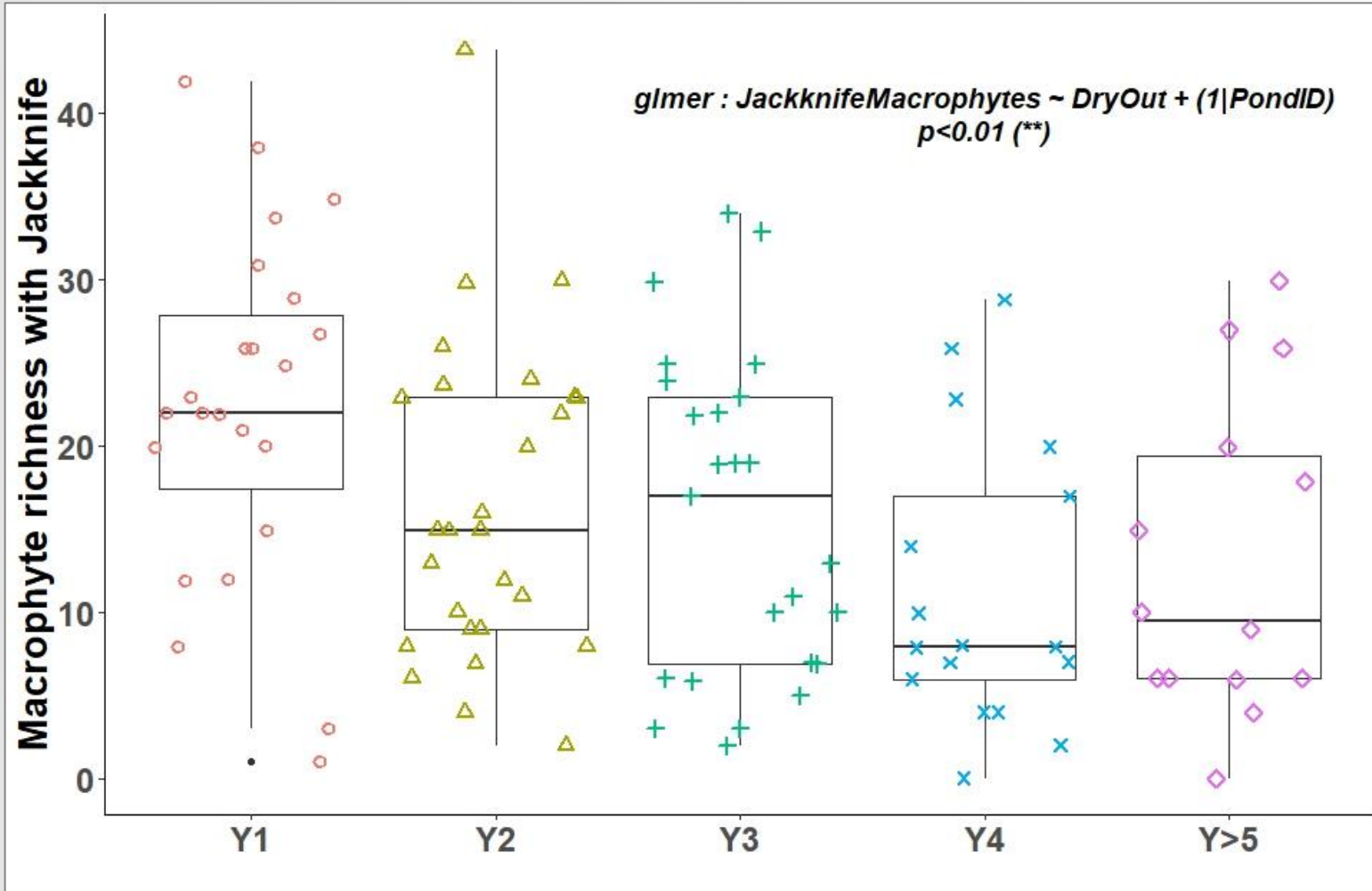
➔ Macrophyte species richness and cover
Chlorophyll a concentration

Management data (time since the last dry-out and fish yields)

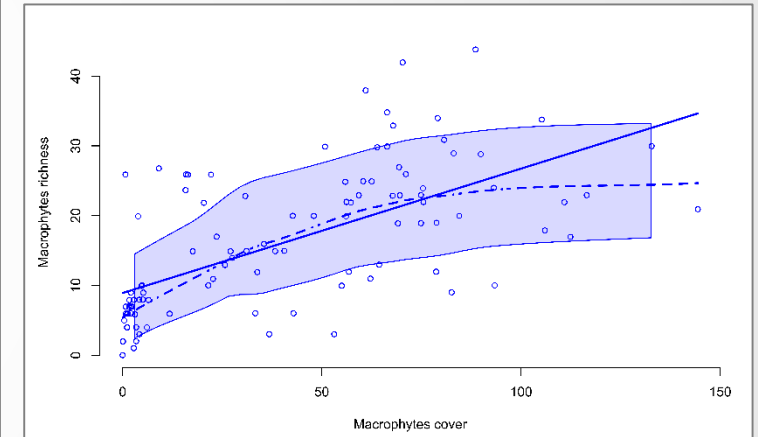


Results

Effects of drying-out on macrophyte richness and cover



(Girard et al., 2023)



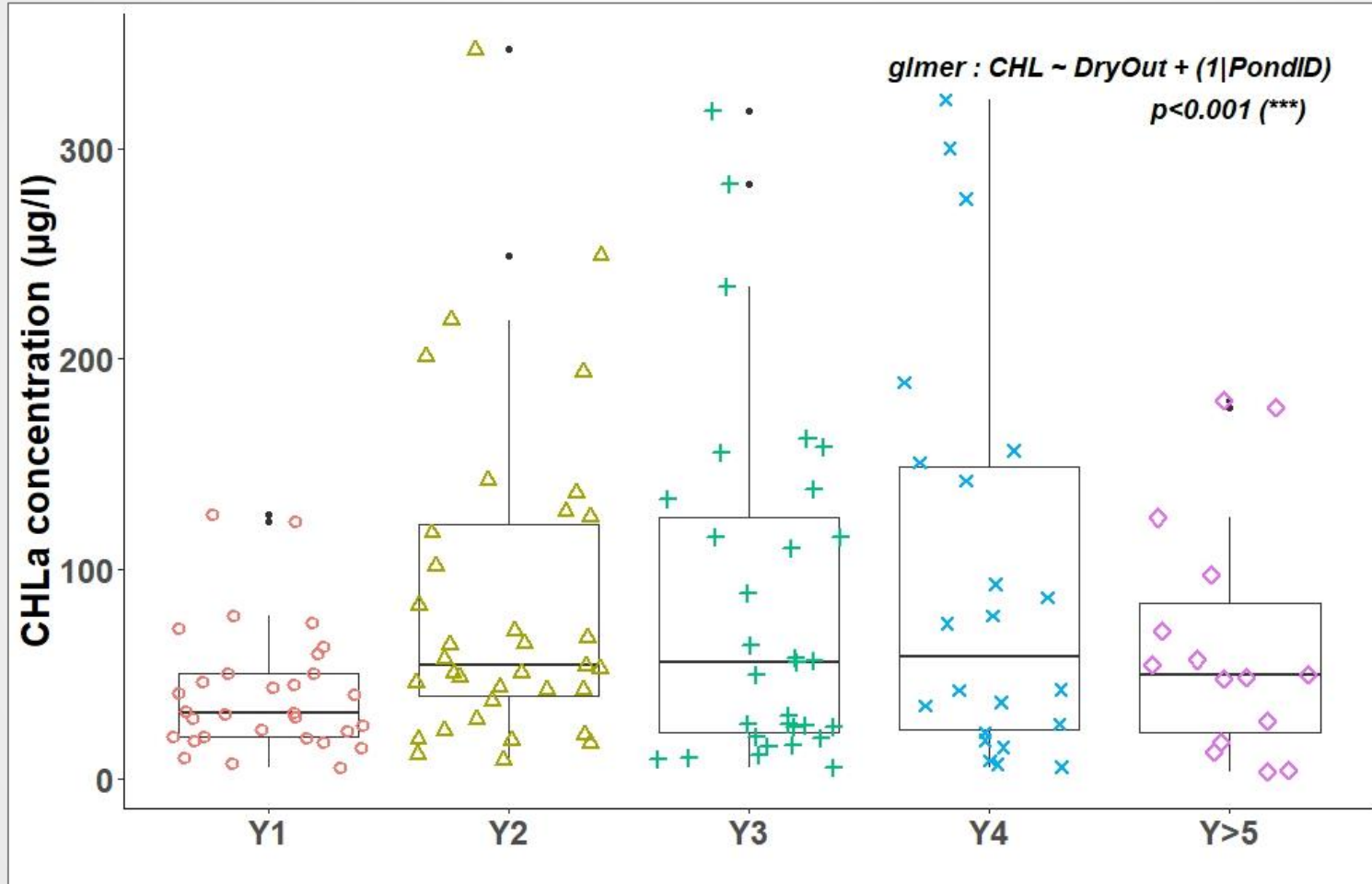
$(R^2 = 0.732, p < 0.0001)$

Same trends for species richness and cover

➔ Drying out is followed by **macrophyte recolonization**, with **higher diversity and cover in the first year of production**

Results

Effects of drying-out on chlorophyll a concentration

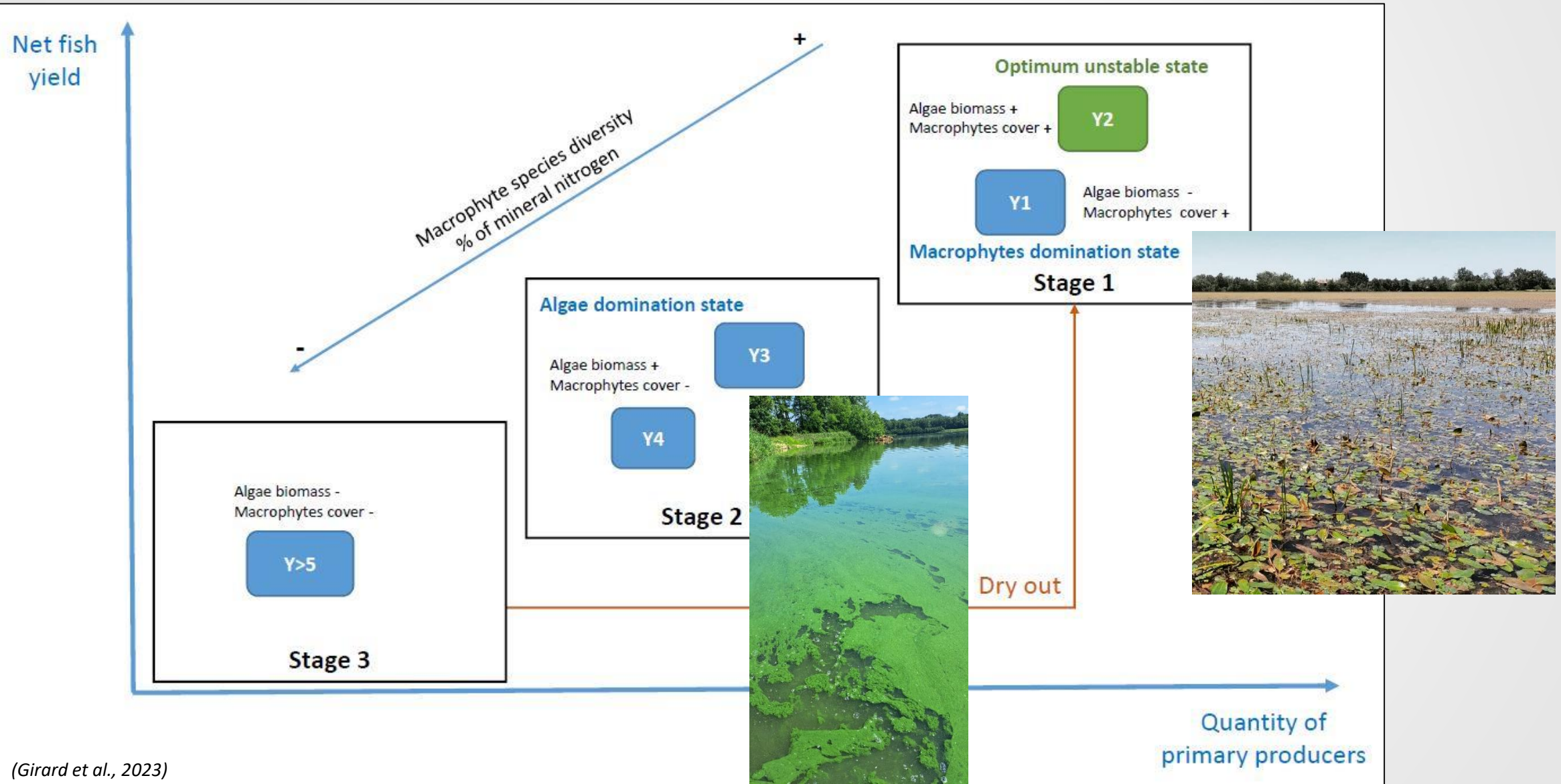


(Girard et al., 2023)



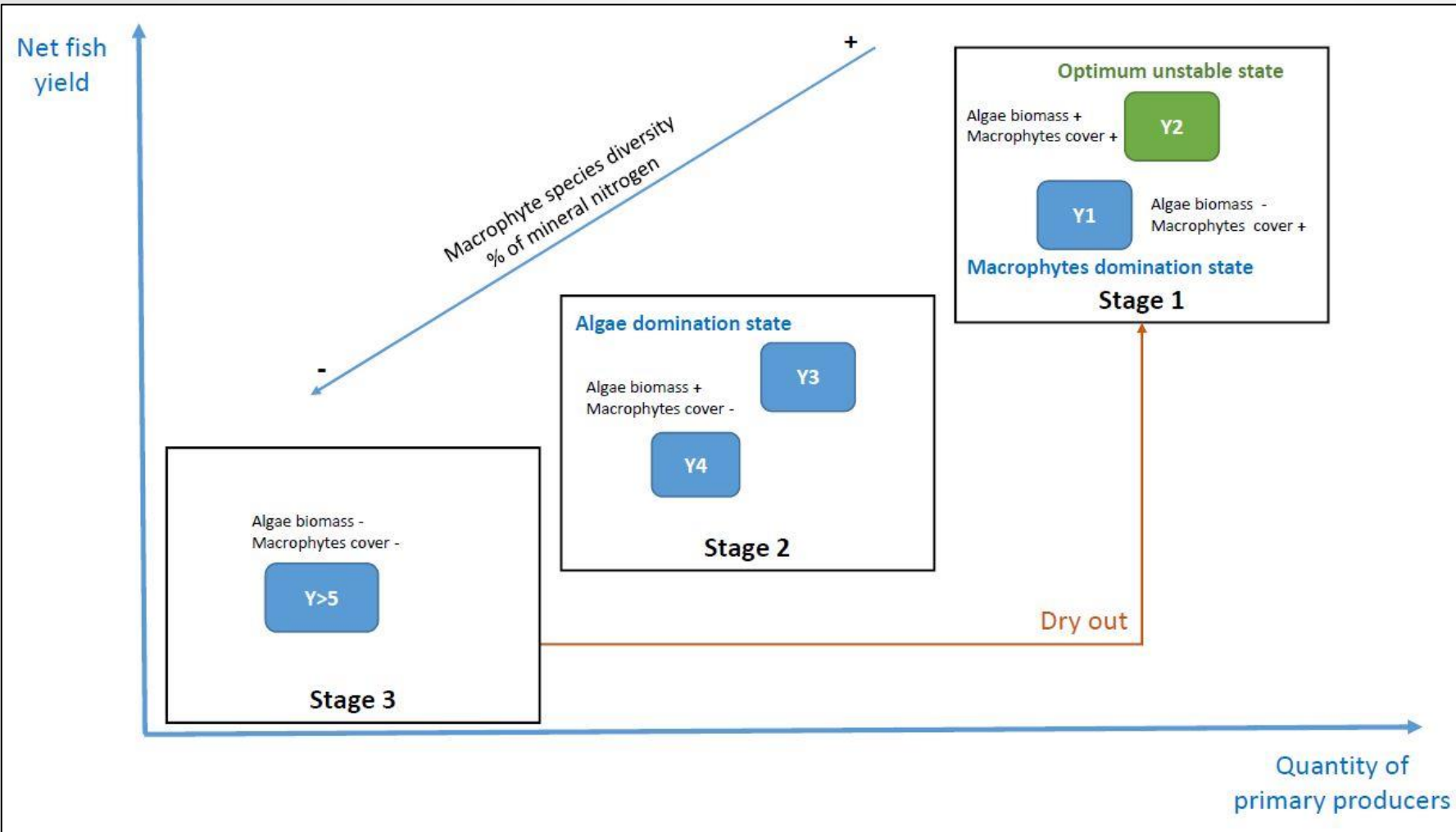
Phytoplankton gradually dominate in Y2 to Y4 and both phytoplankton and macrophytes decline in years 5 and more

Results and Discussion



(Girard et al., 2023)

Results and Discussion



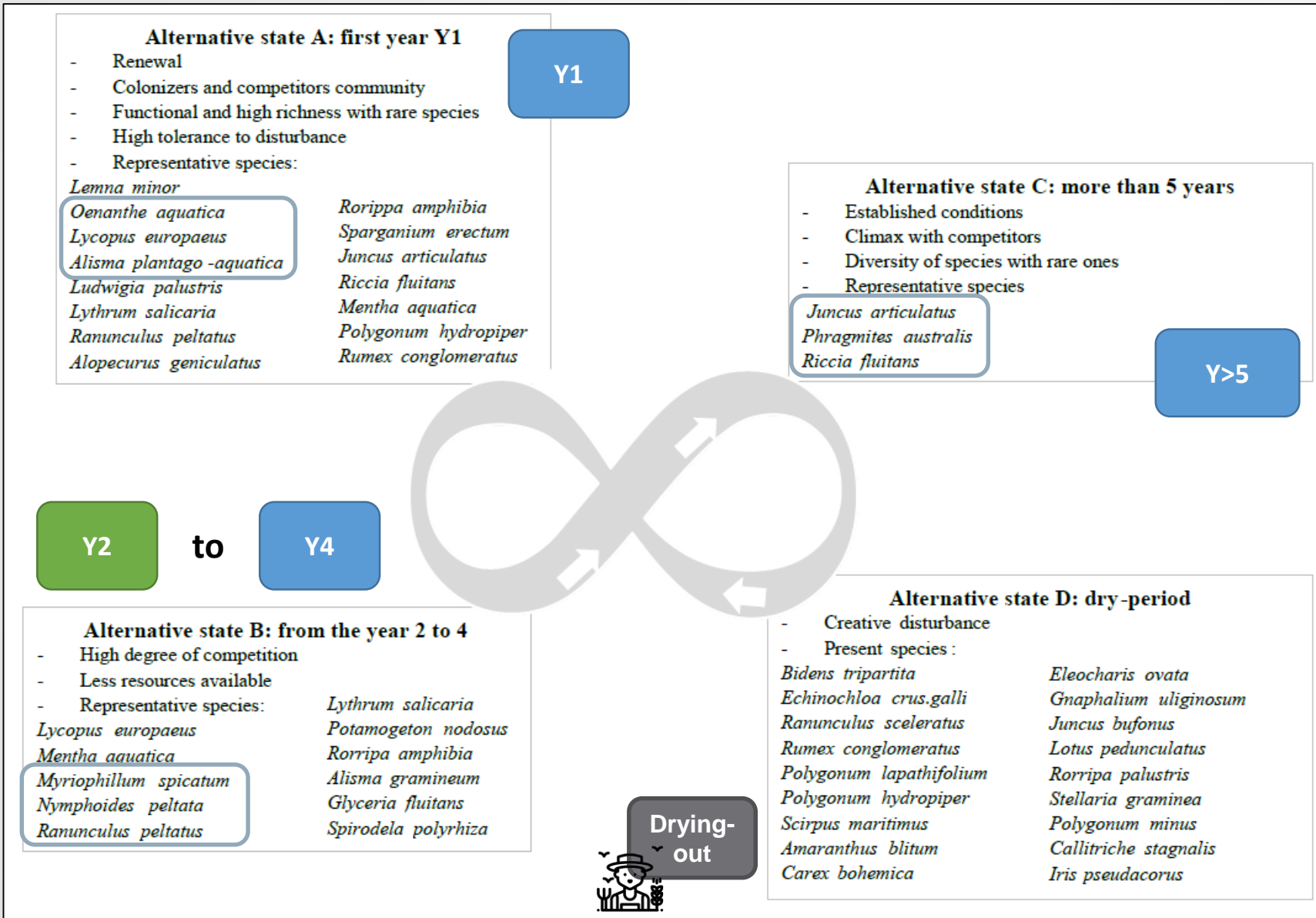
➔ An **unstable state, optimal for fish production and the diversity of primary producers**, favored by the practice of drying-out

↓

A **major agroecological practice** for extensive pond fish farming

(Girard et al., 2023)

Results



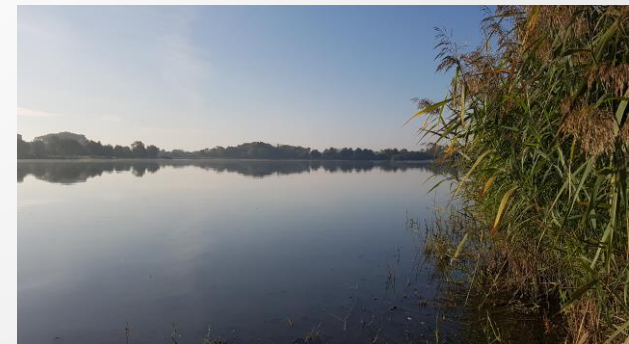
➔ An evolution of communities linked to the phenomenon of nestedness, based on a loss of several species but not on a complete turnover

(Fontanilles et al., 2023)

Discussion and Conclusion

- Drying-out allow the **recolonization of macrophytes** and provide an **“optimal unstable state”** during the second year of the cycle
- Drying-out is a **major agroecological practice** for extensive pond fish farming
- Drying-out is **essential to maintaining these environments** and the **ecosystem services** they can provide:
 - Biodiversity conservation (support services)
 - Extensive, agroecological fish production (provisioning services)
 - Carbon storage (regulating services)
- But also a **major disturbance**, associated with **significant emissions of greenhouse gas** (to be studied more in details on the entire dry year)

➔ A need for future research to rethink about the hierarchy of desired ecosystem services



Thanks for your attention!



legirard@isara.fr

Questions?

*Thanks to all colleagues and partners from Isara and PONDERFUL.
Thanks to all fish farmers and pondscape stakeholders.*