PROVIDING NEW SOLUTIONS OF FISH STOCKING FOR FRESH WATER POND SYSTEMS IN FRANCE

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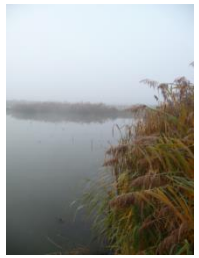
Issues of pond aquaculture sector in France

- A patrimonial activity (from Middle Age)
- A component of the landscape
- A low fish productivity (200 kg/ha/year)
- A decline of the fish production
- Controversial interactions with the environment
- Multiple use by different actors: fish production, recreational, hunting, angling, water reservoir, protected wetlands, biodiversity conservation…

Ecosystem services adapted to ponds from MEA (2005)



- Primary production
- Fauna and flora protection
- Habitat and refuge
- Plant multiplication
- Nutrient cycling

Support

Provisionning

- Food
- Fresh water
- Combustible/Fuel
- Fiber
- Genetic resources
- Biochemistry, medicine, pharmacology
- Ornemental resources
- Fertilizer

Ecosystem Services

- Spiritual
- Inspiration
- Education
- Recreation
- Attractivity

Cultural

Regulation

- Climate
- Hydrology
- Protection against natural hazards
- Pollution control and depollution
- Regulation of erosion
- Biologic regulation
- Disease regulation

The decline of fishponds and the loss of the management of ponds in France calls into question the provision of ecosystem services and the biodiversity support

Objectives for agroecological development of fishponds

A need for the revision of pond production systems that must be efficient, profitable, respectful of the environment and integrated into the territories

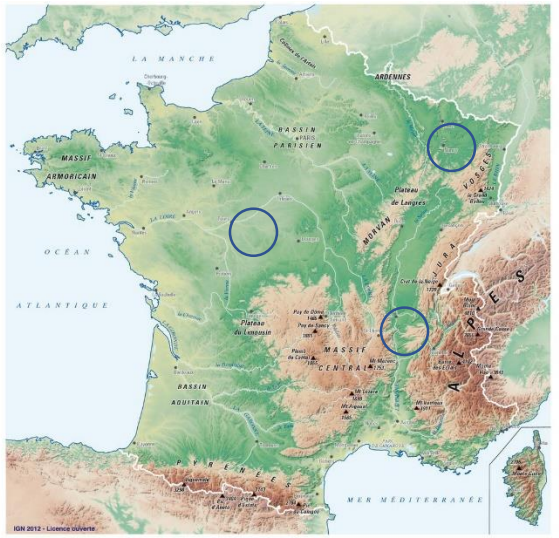
Aubin et al., 2017

New strategies for the construction and management of pond production systems for sustainable fish farming (2020-2023)

Our objective : to propose new practices for pond fish farming

A central theme: **Defining the composition of fish assemblage in polyculture**

- To produce in a more sustainable way
- Adapted to the diversity of contexts (methods of production of polycultures)
- Taking into account all the biological compartments of the cultured ecosystem



Our working method:

- A co-construction with the actors of the three main production areas to embrace the objectives and constraints of the sector
- A multidisciplinary approach to address the complexity of interactions between pond compartments
- The introduction of the notion of ecosystem services to discuss the vocation of ponds
- The explicit consideration of biodiversity in the functioning of ponds
- Modeling approaches to help build new solutions

Our Ambition :
Propose recommendations and practical tools for producers

Method

Questionnaires on practices and drivers of choices

Data from farmers' organizations

Bibliography

Regional workshops on new fish stocking practices

Fish traits modeling TOFF

12 scenarios of fish polyculture

Discussion with farmers on feasability

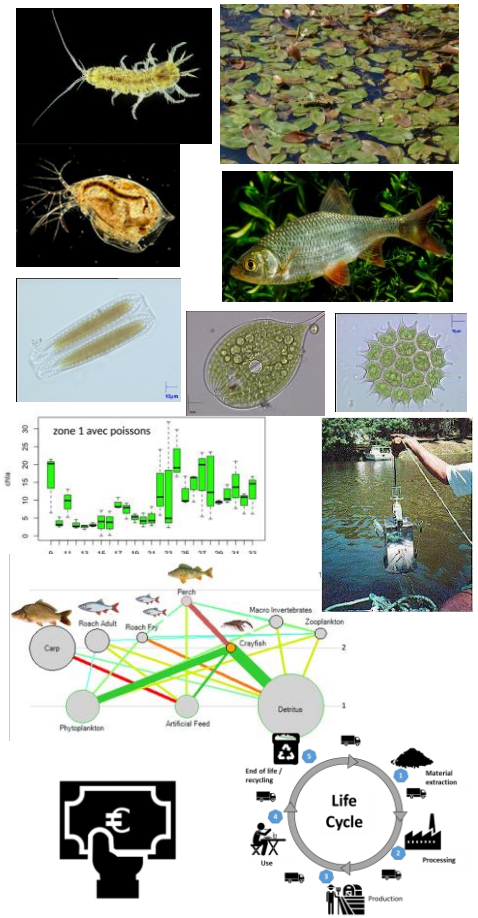
Feedback with farmers

2023 Development of tools and recommendations

2021 Application to 12 ponds in 4 regions

2022 Application to 12 ponds in 4 regions

Multicriteria assessment



Traits of Fish TOFF database

TOFF database site

https://toff-project.univ-lorraine.fr

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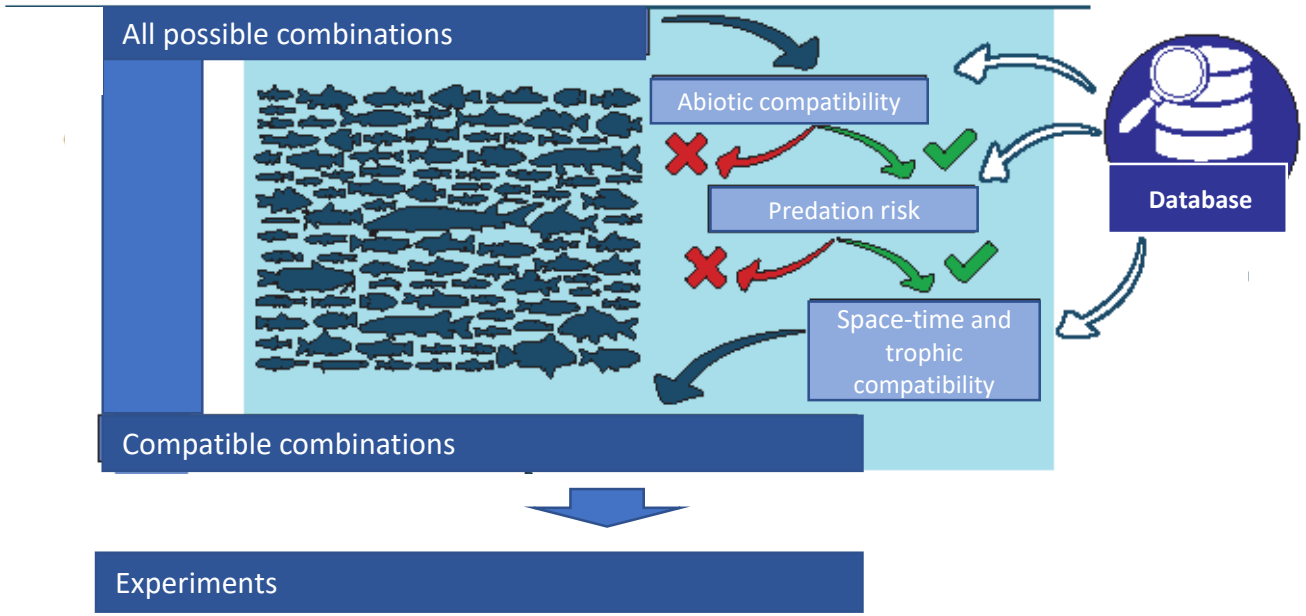
UNITÉ DE RECHERCHE ANIMAL & FONCTIONNALITÉS DES PRODUITS ANIMAUX

- a curated database focusing on functional traits of fish
- aims at bringing together behavioral, morphological, phenological, and physiological traits coupled to environmental measurements
- 241 functional traits for 248 fish species
- a single open-source access repository.
- hosts data from published field and experimental studies : 14 010 lines of records & 547 scientific references.

A 3 steps process in SEPURE project



Trends in scenarios

Key parameters considered

- Experience of fishpond farmers (local practices)
- Water availabilty and temperature in summer
- Pond depth
- Feeding and liming practices
- Presence of submerged vegetation
- Complementarity of species based on their trophic and behavioral traits
- Existence of local or national market for species

Paths of explorations

- Move away from the dominant model: common carp polyculture + roach/rudd + one predator
- Find ways to take advantage of invasive species (Pseudorasbora, louisian crawfish) as resource for predators
- Take into account climate change
- Explore the adaptability of new species in ponds: orfe, sturgeon, grass carp, polyodon…
- Explore the compatibility with different management practices: pond segmentation, floating cages, planted rafts, use of ponds for gaming…

12 scenarios of fish polyculture built with actors

Carp intensive

- Common carp
- Orfe
- Pike

No carp for profitability

- Roach/ rudd
- Tench
- Black bass

Avian predation management with floating cages

- Crucian carp
- Tench
- Sturgeon
- Pikeperch

Predators to limit invasive species

- Pike, pikeperch, or black-bass
- Tench, or grass carp
- Common carp

Wels catfish to limit expansion of Louisiana crawfish (invasive sp.)

- Wels catfish
- Common carp
- Roach and tench

Favour duck hosting through a 2-year rotation

- Tench
- Roach/ rudd
- Grass carp (year 2)
- Pikeperch (year 2)

12 scenarios of fish polyculture built with actors

Chinese way against global warming

- Common carp
- Grass carp
- Roach
- Black bass

Pond segmentation to favour natural biomass

- Common carp
- Roach/ rudd
- Tench
- Pikeperch

Planted raft for juveniles' protection and periphyton development

- Orfe
- Tench
- Roach
- Eurasian perch

Sturgeon

- American paddlefish
- Bighead carp
- White sturgeon / Siberian sturgeon
- Grass carp

15 scenarios from TOFF exploitation.

Examples:

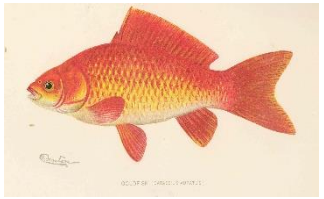
Low species compatibility

- White sturgeon
- Pikeperch
- Tench
- Rudd

High species compatibility

- Common carp
- Tench
- Roach/ rudd

Example 1: Predators to limit invasive species



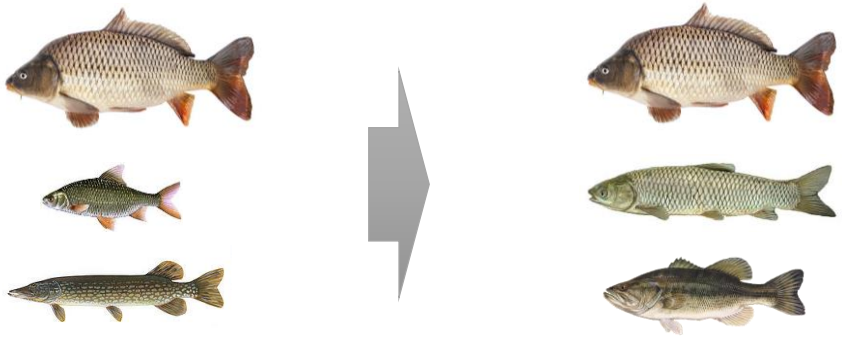
Objective: Limit *Pseudorasbora parva* and *Carassius auratus*

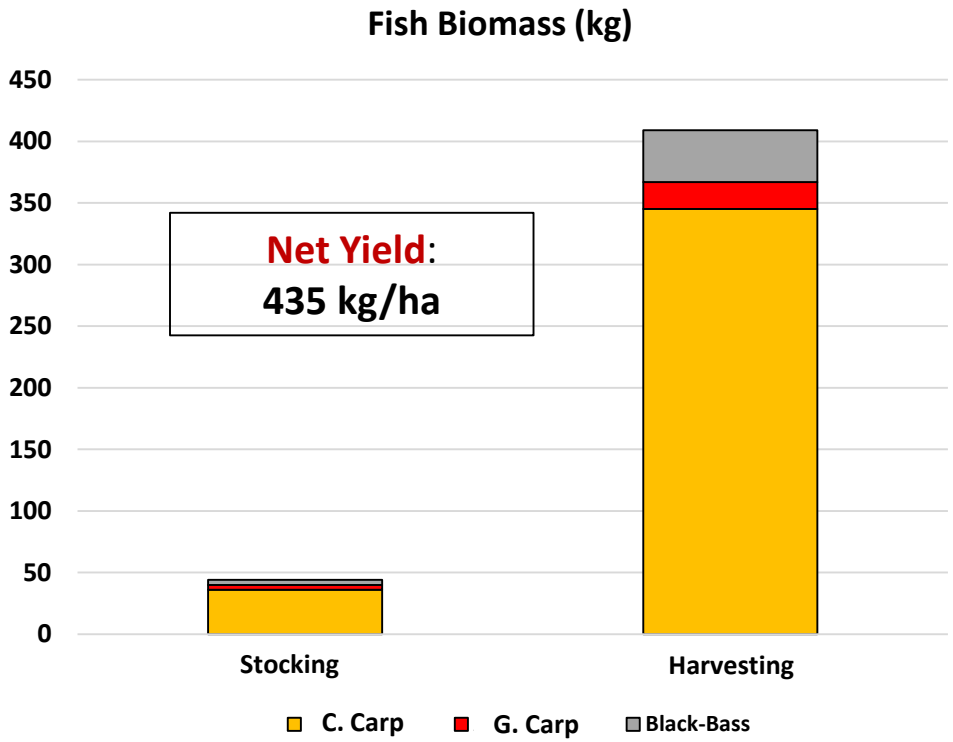
Principles:

- Common carp as key species
- Grass carp to reduce vegetation
- Black bass as efficient predator and adapted to high temperatures

Characteristics:

- Small pond : 0.84 ha
- No addition of food





Example 2: No carp for profitability

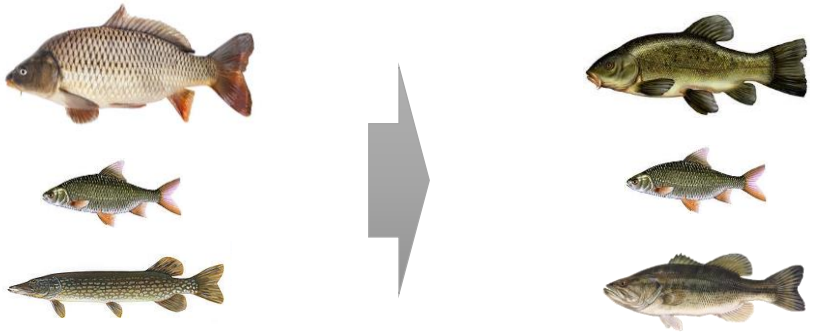
Objective: Check the economic interest of abandoning the production of common carp

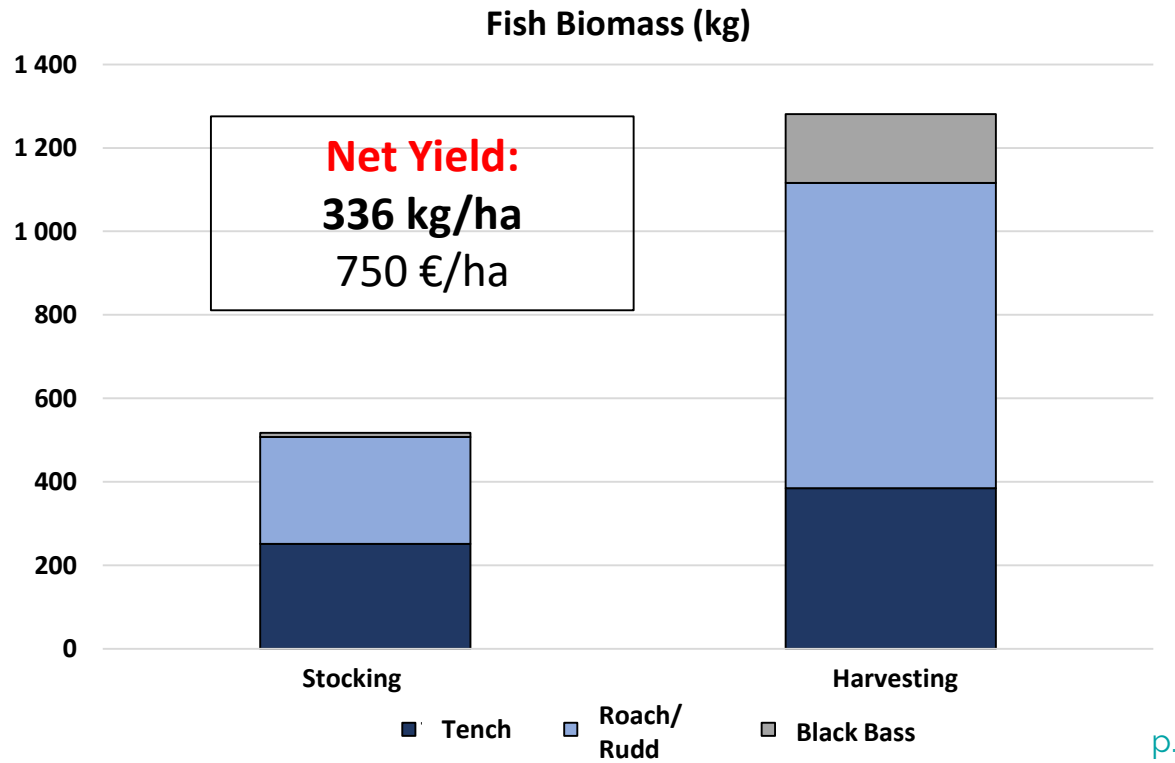
Principles:

- Roach & rudd as key species with high demand on market
- Tench for bioturbation to support natural productivity
- Black bass as predator with high value

Characteristics:

- Small pond : 3.8 ha
- Limited addition of food





Conclusion

Revitalizing the pond sector in France is challenging.

We have the hope that new fish association and polyculture strategies should open new opportunities in an agroecological perspective

A broad partnership allowing a close collaboration between scientists and producers was built

Necessity to validate management proposal by applying them in the field in various contexts to understand their robustness

The analysis of the results should lead to a better understanding of biological and biogeochemical processes.

The multicriteria approach should help support decision making for future development of the pond sector and help maintain local economies in the pond landscapes of France.

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Thank you for your attention