Aquatic Casiers Girardon’s ecological functioning

Maxine THOREL, C. CLARET, S. FAYOLLE, C. BERTRAND, B. OURSEL, M. DUTILLEUL, E. FRANQUET

IMBE-UMR CNRS 7263 / IRD 237 Aix-Marseille Université
Post doc position – 1 year - 2015-2016

Objectives:

Inventory, evaluate and prioritize gains and risks related to Casiers Girardon restauration

Synthetize knowledges about Casiers Girardon from already carried out multidisciplinary studies

Promote a contradictory debate

Built a decision support conceptual model
Post doc position – 1 year - 2015-2016

Objectives:

Inventory, evaluate and prioritize gains and risks related to Casiers Girardon restauration

Synthesize knowledge about Casiers Girardon from already carried multidisciplinary studies

Promote a contradictory debate

Built a decision support conceptual model

Socio-environmental implications of process-based restoration strategies in large rivers: should we remove novel ecosystems along the Rhône (France)?

Maxine Thorel¹ · Herve Piégay² · Carole Barthelemy³ · Bianca Räpple² · Charles-Robin Gruel² · Pierre Marmonier⁴ · Thierry Winiar斯基⁵ · Jean-Philippe Bedel⁵ · Fanny Arnaud² · Gwenaelle Roux⁶ · Jonh C Stella⁷ · Gabrielle Seignemartin² · Alvaro Tena-Pagan² · Vincent Wawrzyniak²,⁸ · Dad Roux-Michollet⁹ · Benjamin Oursel¹⁰ · Stéphanie Fayolle¹⁰ · Céline Bertrand¹⁰ · Evelyne Franquet¹

Regional Environmental Change
https://doi.org/10.1007/s10113-018-1325-7
2 types of Casiers

- Terrestrialized ~ 90%
- Aquatic (still in water) ~ 10%

Questions of management of these 2 types were answered in the multidisciplinary article relying on results of geomorphology, sediments pollution, diversity, sociology.

Our part of work was interested in biology and ecological functionning of aquatic Casiers.
Studied parameters

- Geomorphology
- Connectivity/Submersion

Physical parameters
- Transparency, Depth, Substrate

Physico-chemical parameters
- $^\circ$C, Conductivity, Dissolved oxygen, Anions/Cations

Particulate elements
- Microbial activity in sediment
- Organic Matter

Phytoplankton & Benthos
- Richness, Density, Community functional structure
Study of different parameters allowed to a better understanding of hydrologic, geomorphologic and ecologic functioning of aquatic casiers
« Sector » and « casier » effects
Effects of sectors and casiers on water flow at 100 m³/s.
« Sector » and « casier » effects

C_37 and C_R1 = Casiers presenting a structure causing an isolation to the Rhône channel in both study sites, highly linked with high chl a concentrations.
« Sector » and « casier » effects

C_37 and C_R1 = Casiers presenting a structure causing an isolation to the Rhône channel in both study sites, highly linked with high chl a concentrations
C_37 and C_R1 = Casiers presenting a structure causing an isolation to the Rhône channel in both study sites, highly linked with high chl a concentrations.

Stations were ordered along the PC1 from the frequently connected stations (R2, S2, S3, S4 and 126) to the most isolated stations (R1 and 37) ➔ Increasing connectivity gradient = -PC1 = Proxy
Study of biological diversity: Rarefied richness, Number of taxa, Simpson and Shannon index

Relation between diversity and connectivity → Significant quadratic relation

Isolated and connected casiers → Low biodiversity
Intermediate connected casiers → higher values of diversity
Study of biological diversity: Rarefied richness, Number of taxa, Simpson and Shannon index

Relation between diversity and connectivity → Significant quadratic relation

Isolated and connected casiers → Low biodiversity
Intermediary connected casiers → higher values of diversity

Diversity is in agreement with Intermediate Disturbance Hypothesis (IDH) in aquatic Casiers

Diversity results translated 3 types of Casier's functioning depending on hydrological connectivity with the main channel of the Rhone River
Abundances were rather low in aquatic casiers except for isolated casiers C-37 and C-R1.

Concentrations appear higher in June than in September → Summer dynamics in aquatic systems.

High concentrations explain high chl a concentrations.

Hydraulic connectivity influences cell concentrations with high connectivity-low cell concentrations and low connectivity-high cell concentrations.
Cyanobacteria and Dinoflagellates were the principal groups.

High heterogeneity between both sites and among casiers.

Cyanobacteria were more present in Arles, especially in C-R1 (*Planktothrix agadhrii* - PSP).

Dinoflagellates were more present in Péage, especially in C-37 (*Ceratium hirundinella*).
Maxima in C-149 and C-F1 but special conditions may have biased the sampling.

The most populated casiers are connected in contrary to isolated casiers which are the least populated.

Aquatic casiers can therefore be a significant source of prey for certain predators.
Dipterians
Other insects
Macrocrustaceans
Microcrustaceans
Gasteropods
Oligochaetes

Different assemblages between both sites and among casiers

Microcrustaceans dominated Péage

Oligochaetes dominated Arles, especially C-F1
Conclusions

- 3 Types of aquatic casiers linked to the connectivity following the IDH concept

- Casiers with intermediary connectivity present higher diversity of phytoplankton and zoobenthos and it appears that this type of connectivity is the most interesting

- However, this type of casiers does not integrate the full range of taxa that can contribute to the global diversity of an area

- Isolated casiers can presented interesting nutritive function linked to their high primary production. They can also contribute to assimilative of water like other wetlands

- Connected casiers can be interesting with the high abundances of zoobenthos as source of prey

To conclude, it seems relevant to preserve the large diversity of casiers still in water because they contribute to taxonomic and functionnal diversity of the river system
I’m looking for a job!

Maxine THOREL

30 years old

PhD in Marine Biology – Ecology and Ecophysiology of phytoplankton

Post-doc in Hydrobiology

m.thorel888@laposte.net