Comparative study between environmental DNA and electrical fishing methods

NATURALIA ingénierie en écologie

HIBERT Amandine, GILLIS Hanneke, SKARNIAK Florent –
IENE 2020 – International Conference - LIFELINES Linear Infrastructure Networks with Ecological Solutions
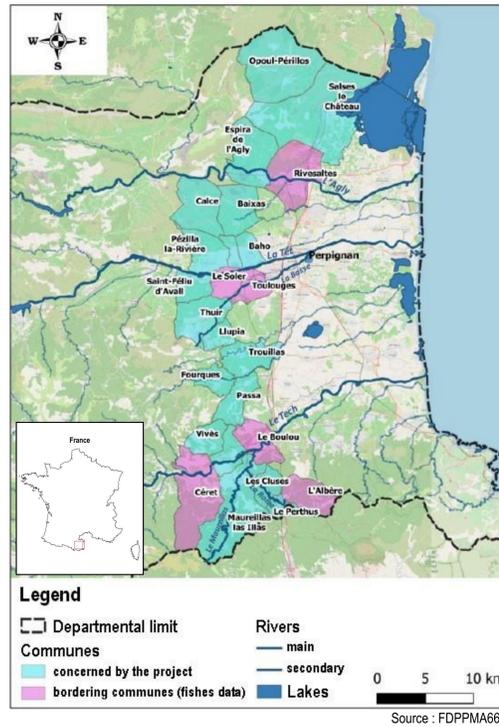Naturalia Environnement – Agence de Bordeaux – 43, rue Marcel Sembat 33130 Bègles

Introduction

Impacts of linear infrastructure on biodiversity are widely documented for roads and railways. In contrast, less studies about pipelines impacts on biodiversity are known. Impacts of these projects could particularly affect rivers through species richness collapse, high fish mortality.

Assessing these impacts on biodiversity with an adapted methodology is crucial.

To monitor aquatic biodiversity, two methods have been used and compared: **electric fishing** and **environmental DNA**.

What is the most efficient methodology to sample fish fauna of a river?

Location of the study area sampled by the two methods

Source : FDPPMA66

Study sites : 6 rivers
Agly – Têt – Basse – Tech – Rome - Maureillas

Materials & Methods

Electric fishing

This technique consists in sending a weak electric field into the river using a cathode (immersed part) and an anode (moving part made of a conductive metal ring). The electric field attracts fishes to the anode, where they are collected with nets, and placed in buckets for sorting.

Source : Fédération de Pêche et de Protection du Milieu Aquatique de la Gironde

Environmental DNA

The protocol consists in filtering some water using a pump and passing it through a strainer which collects the environmental DNA fragments present in the aquatic environment. Then, the samples are conditioned and stored under suitable conditions. Finally, samples are sent to the SPYGEN laboratory, which carries out a specific bioinformatic analysis. From this analysis, a list of fish species is obtained.

Environnemental DNA sampling capsule (Source : SPYGEN)

Results of both methods

Species richness and sampling pressure determined by the two methods

	Dates \ Rivers	Agly	Têt	Basse	Tech	Maureillas	Rome
Electric fishing	06/09/2012				8		
	12/07/2013		7				
	28/08/2013		11				
	29/08/2013	13					
	13/09/2013	9					
	01/10/2013					7	
	18/06/2014						3
	07/03/2016					9	
	18/08/2016					7	
	06/07/2017		8		7		
	25/08/2017	12					
	30/10/2017		7				
	Sept. to nov. 2018				9		
	2012 to 2018	15	14	7	10	9	3
eDNA	12/06 to 29/06/2018	18	20	15	11	10	10

Species richness by river using both methods

■ Electric fishing ■ eDNA
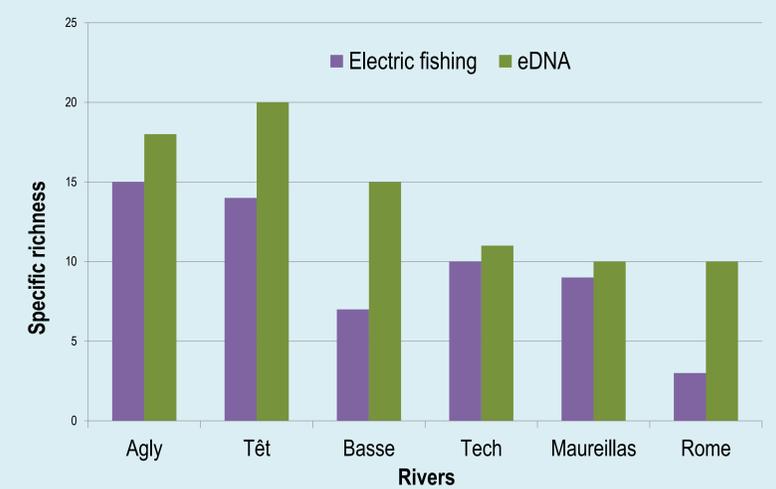
Environmental DNA → 1 visit per site in one year (2018)
Electric fishing → 1 visit per site over few years (2012 to 2018)

The results show that electric fishing revealed less fish species than environmental DNA technique.

Discussion

Methodological aspect	eDNA	Electric fishing
Security	100% SECURE	DANGER
Cost		
Human resources		
Invasive and mortality		

▨ : advantage over the other method

Scientific aspect	eDNA	Electric fishing
Species richness	+++	++
Abundance	-	+++
Density	-	+++
Biometry	-	+++
Sampled taxa		
Certain presence of species in the sampled river	?	✅

These two methods require the application of a standardized method and a prior training. There are biases in each one: species caught by electric fishing are not detected by environmental DNA and vice versa.
DNAe does not certify the presence of species because they are not directly observed in the river. The origin of DNAe may be other such as food waste, species from fish farming etc..
Nevertheless, DNAe appears to be the best method on methodological aspects. However, more scientific parameters are obtained with electric fishing.

Conclusion

Environmental DNA method seems to be a good alternative on economical, efficiency and security aspects to lead to the most exhaustive inventory of fish diversity possible and thus identify all river's conservation issues. Electric fishing appears to be a complementary method to eDNA by allowing an estimation of species density and abundance. The choice of the most appropriate method depends on the parameters of interest.