Habitat selection for freshwater pearl mussels resettlement in Brittany (France)

Capoulade M., Pasco P.-Y. & Blaize C.

Bretagne Vivante sepnb

Une voix pour la nature



Dresde, Germany
26 th March 2019

UNION EUROPÉENNE
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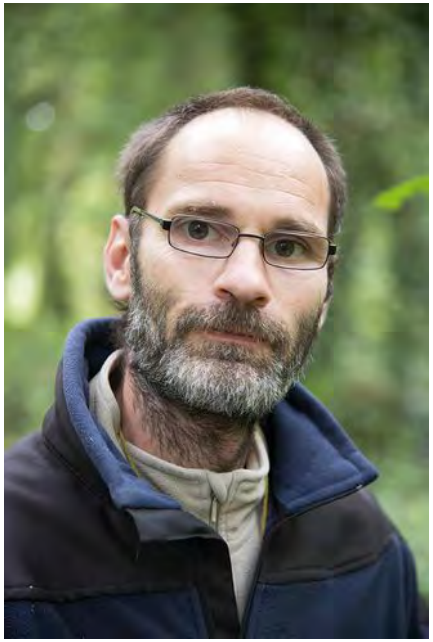
L'Europe s'engage en Bretagne / Avec le Fonds européen de développement régional

The freshwater mussel team of Bretagne Vivante



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Association Bretagne Vivante - SEPNB



60 years of nature protection
3 600 members
300 volunteers
54 employees

Knowledge of habitat and species

Area protections

Militancy

Education and formation

Years 1990-2000 : an alarming situation in France and especially in the west



Endangered populations !

No recruitment
Small populations
Old individuals

« *Since 1930, the number of pearl mussels rivers has decreased by more than 60% in France* » (Cochet, 1998)

« *At least 77% of the sites of historical presence of the species in Brittany are now extinct* » (Quéré, 1997)

« *The largest decrease is observed in the low altitude zones, in Brittany, in Normandy (…)* » (Cochet, 1998)

« *No young specimen has been found in Brittany* » (Quéré, 1997)

I’m not old
I’m vintage...



Programme LIFE+

CONSERVATION OF THE FRESHWATER PEARL MUSSEL OF THE ARMORICAN MASSIF

LIFE « Mulette » 2010-2016

Objective	Save the 6 major remaining populations of the Armorican Massif
Costs	2,5 millions €
Financial sponsors	50% European Commission DREAL Bretagne DREAL Basse-Normandie Région Bretagne Région Basse-Normandie Agence de l'eau Seine-Normandie Département des Côtes-d'Armor Département du Finistère Département de la Manche



Airou

Rouvre

Sarthon

Elez

Loc'h

Brasparts

Bonne Chère



Luxembourg – 09/2010



Pays de Galles – 11/2010



Rep. tchèque – 06/2011



Massif central – 11/2012



Riom – 06/2017



Irlande & Irlande du Nord – 02/2013



Autriche – 02/2013



Bretagne – 10/2014



Etats-Unis – 10/2015



Bretagne (P. Jakobsen & M. Lange) – 05/2015



Luxembourg – 11/2015



Bretagne (P. Oulasvirta & al.) – 11/2017



















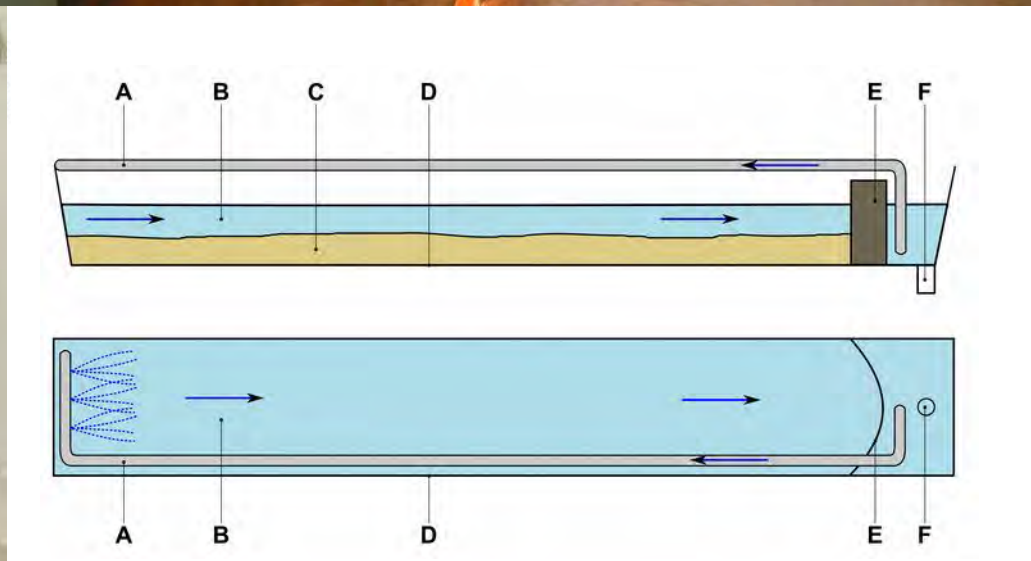
FEDE PECHE 29

Fédération du Finistère pour la Pêche et la Protection du Milieu Aquatique







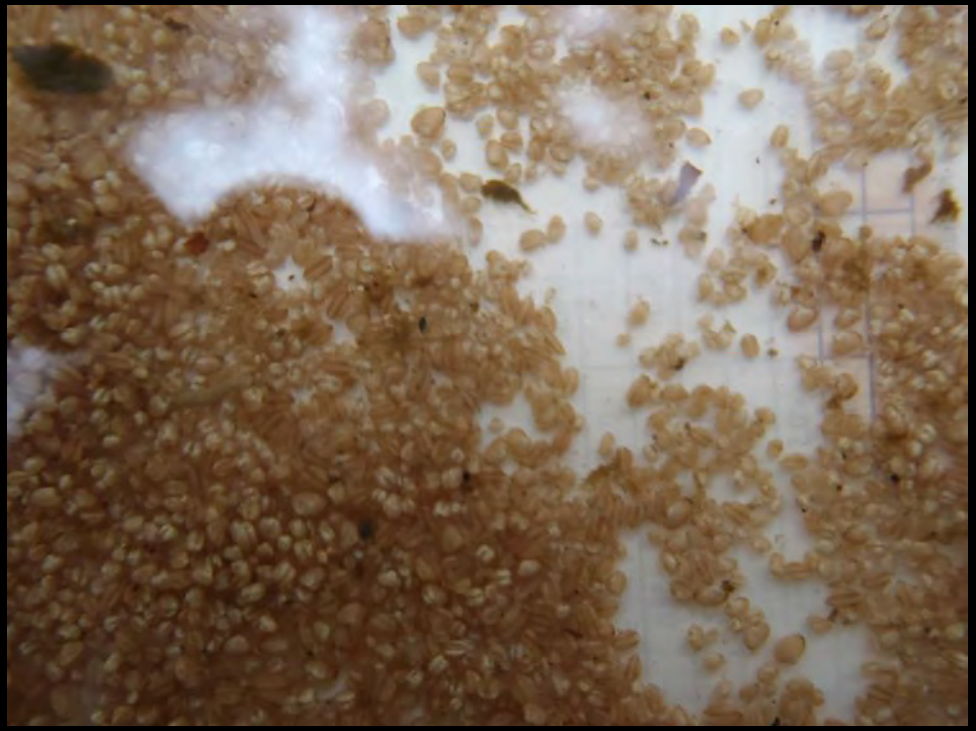


Juveniles at the breeding station of Brasparts
(November 2018)

Cohort (year of excystement at the breeding station)	Bonne Chère	Elez	Loc'h
0+ (2018)	-	-	-
1+ (2017)	x 1 000	-	x 1 000
2+ (2016)	x 1 000	-	x 1 000
3+ (2015)	5 000	-	-
4+ (2014)	--	1 750	850
5+ (2013)	2 350	1 000	395
6+ (2012)	-	800	-





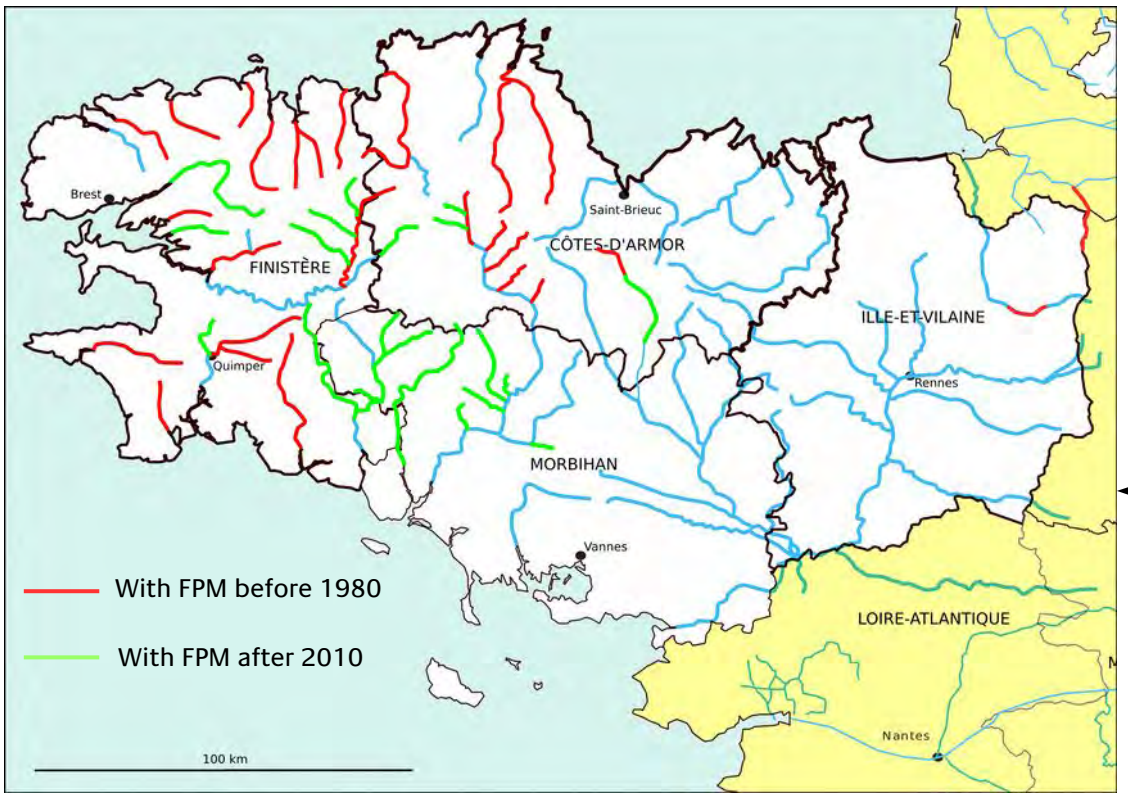


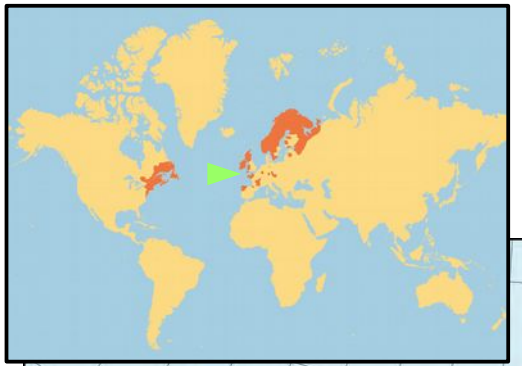



5 mm

Freshwater pearl mussel in Brittany (France)

→ decline of 90 % in 50 years
→ total population : 10 000 – 15 000 individuals



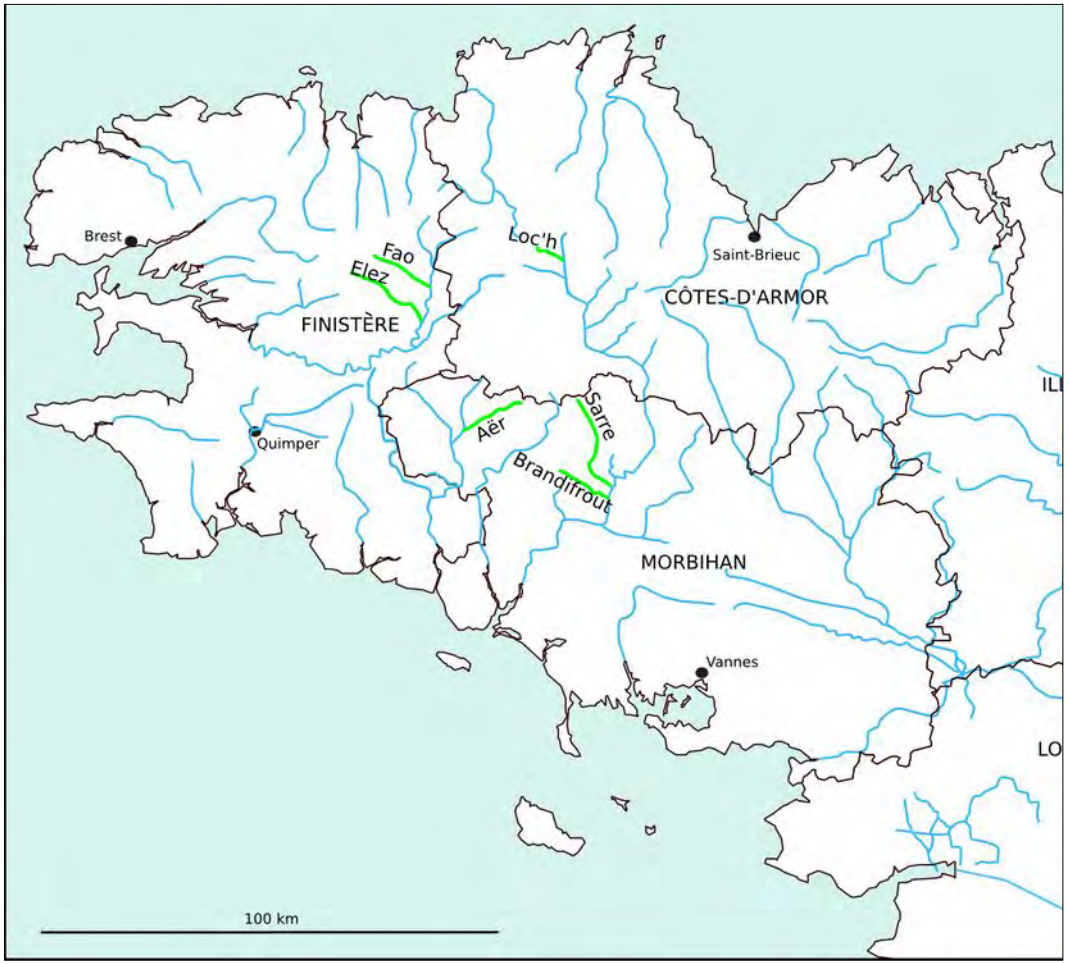




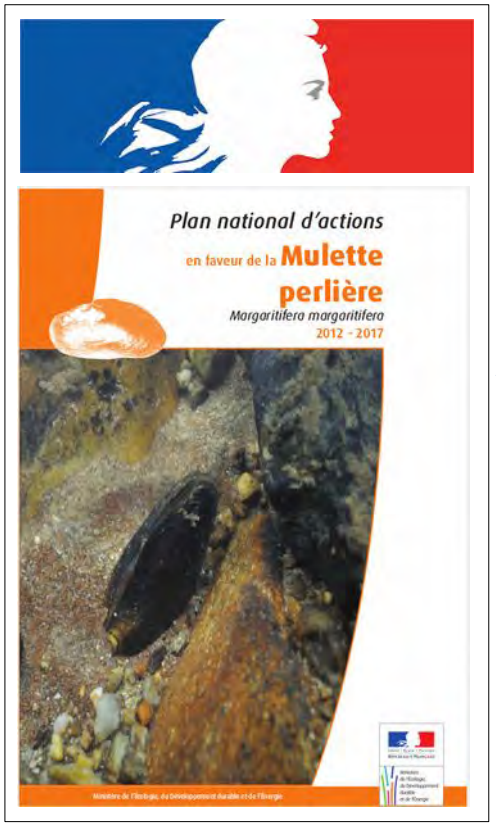
Beaume *et al.*, 2016. Freshwater Pearl Mussel Conservation in the Rivers of Brittany and Normandy: LIFE+ Nature «Freshwater Pearl Mussel Conservation in the Armorican Massif» Programme Report, 2010–2016

Distribution of freshwater pearl mussel in Brittany (October 2018)

Only 7 rivers > 100 ind.



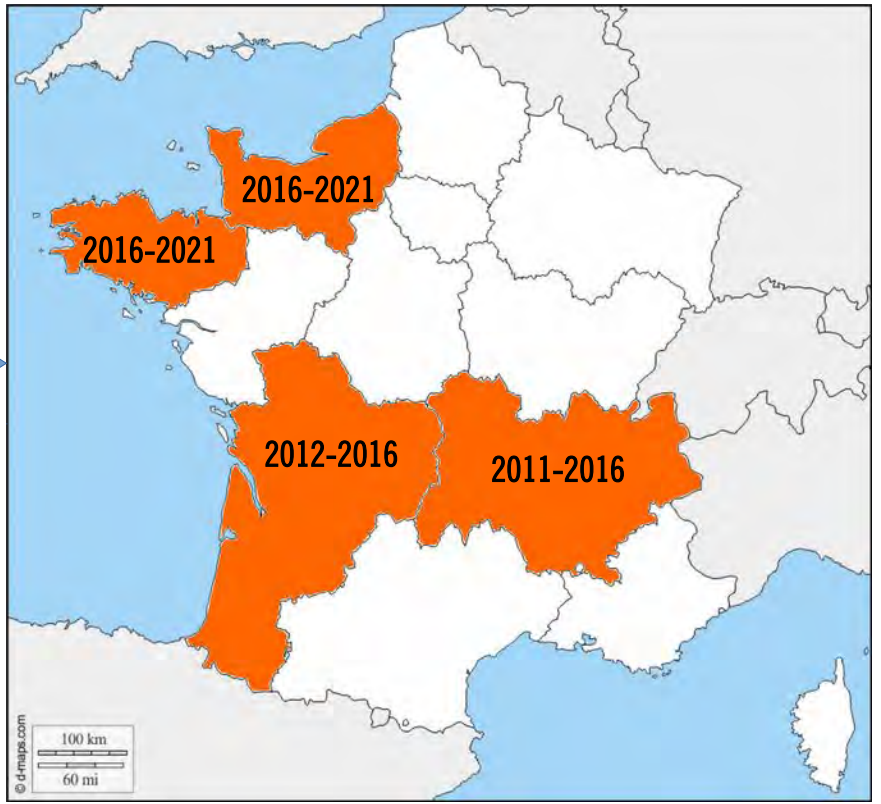
National Actions Plan for France
(= Specie Actions Plan)
2012-2017



No coordination

and
expired

4 Regional Adaptations



Conservation efforts in the long term

Need time and money

Freshwater pearl mussel life expectancy

Programme

Political time





Our first step : look litteratures and studies...

Monitoring of different parameters with « guidance values »

In water : T°C, dissolved oxygen, conductivity & pH, NO_3, PO_4

In sediments : red-ox potential (gradient), penetrability, intersitial water quality, hypoxy sticks, near-bed flow velocity, water depth

In environment : host fish population, pressures

From the micro-habitat... to the section, the river and the catchment



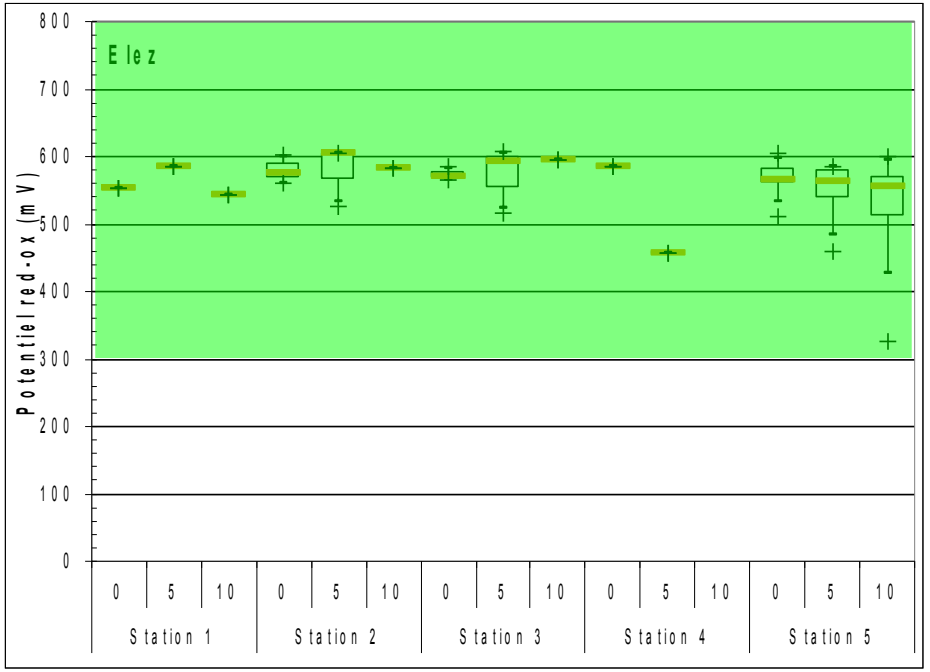


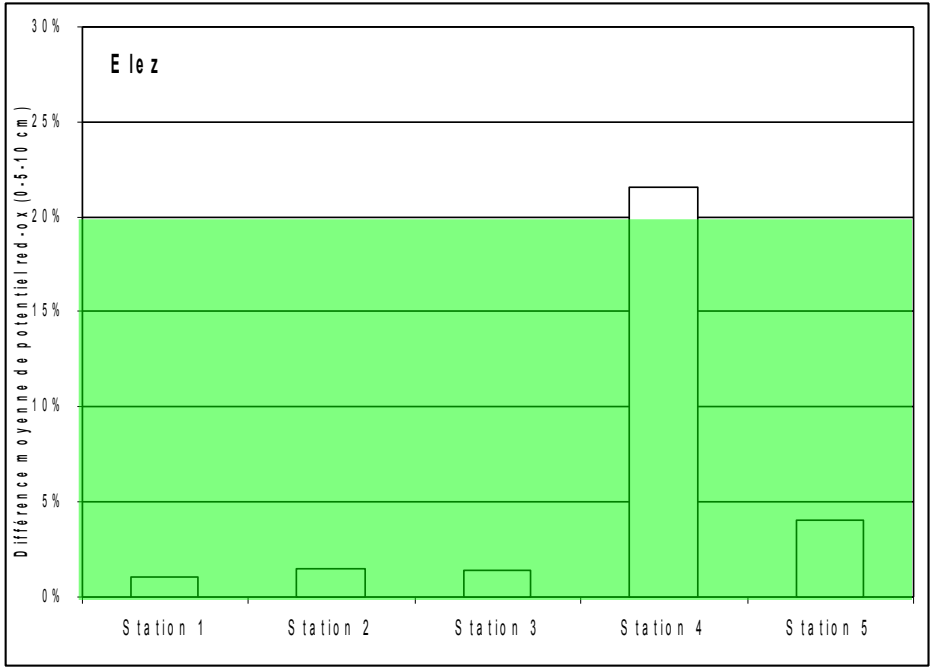


Water quality

	Conductivité à 25°C (µS/cm)	pH	Nitrates (NO3-mg/l)	Nitrates (N-NO3-mg/l)	Orthophosphates (PO43-mg/l)	Orthophosphates (P-PO43-mg/l)	Oxygène dissous (O2 mg/l)	Calcium (Ca mg/l)	Calcium (CaCO3 mg/l)
Elez	71 ± 18	6,2 ± 0,6	2,6 ± 1,2	0,6 ± 0,3	0,03 ± 0,01	0,01 ± 0,004	10,6 ± 1,8	1,7 ± 1,3	4,3 ± 3,2
Loc'h	131 ± 21	6,8 ± 0,3	11,2 ± 3,5	2,5 ± 0,8	0,07 ± 0,02	0,02 ± 0,008	10,6 ± 1,8	4,8 ± 3,9	11,9 ± 9,7
Bonne Chère	158 ± 24	6,6 ± 0,4	22,6 ± 4,4	5,1 ± 1,0	0,11 ± 0,09	0,04 ± 0,029	10,4 ± 1,6	5,6 ± 4,2	13,9 ± 10,4
Manéantoux	149 ± 22	6,9 ± 0,4	17,9 ± 4,7	4,1 ± 1,1	0,06 ± 0,04	0,02 ± 0,013	10,5 ± 1,1	5,1 ± 3,3	12,8 ± 8,1

Sediment quality





Host-fish densities

Average density of brown trout from 2011 to 2016. Per 100 m²

Bonne Chère	0+ ~ 12,1 1+ ~ 4,7
Manéantoux	0+ ~ 9,5 1+ ~ 2,6
Loc'h	0+ ~ 4,6 1+ ~ 12,6
Elez	0+ ~ 4,8 1+ ~ 2,8

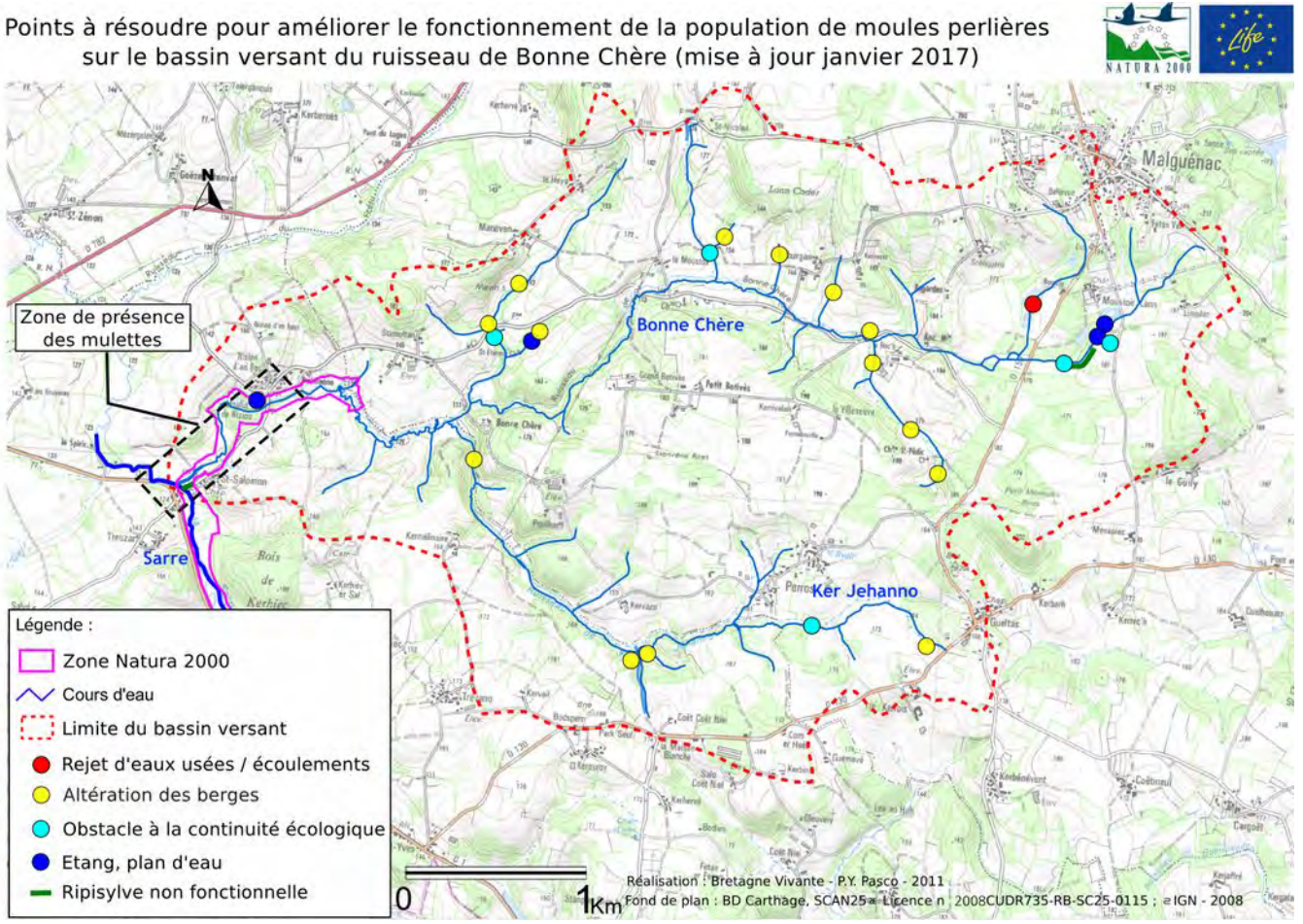
10 to 20 brown trouts per 100 m² (Ziuganov *et al.*, 1994 ; Bauer, 1991).

But low density could be compensate by :

- more gochidias holded by old fishes;
- the longevity of mussels and the fact that they reproducte for long time ;
- low level of post-parasitic mortality.

(Geist *et al.*, 2006)

Black-points maps





Using juveniles as bio-indicators to find suitable habitats



1. Our bads experiments : with Buddensiek cage and concrete silos



Buddensiek cage

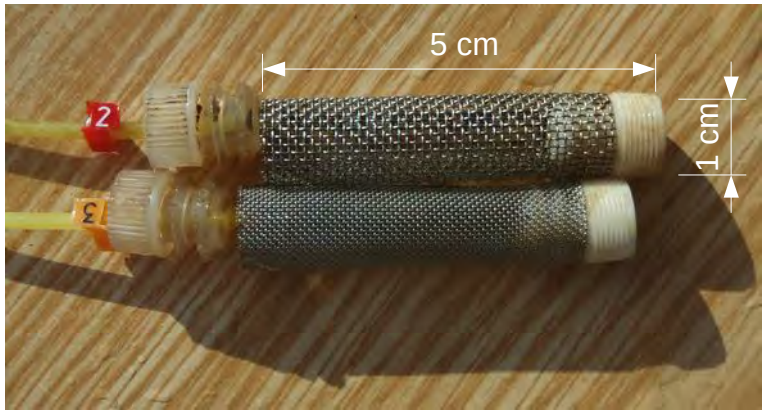
On the Loc'h river in 2012 : 0+ juveniles
Need to be cleaned very often
Measurements of the water quality…

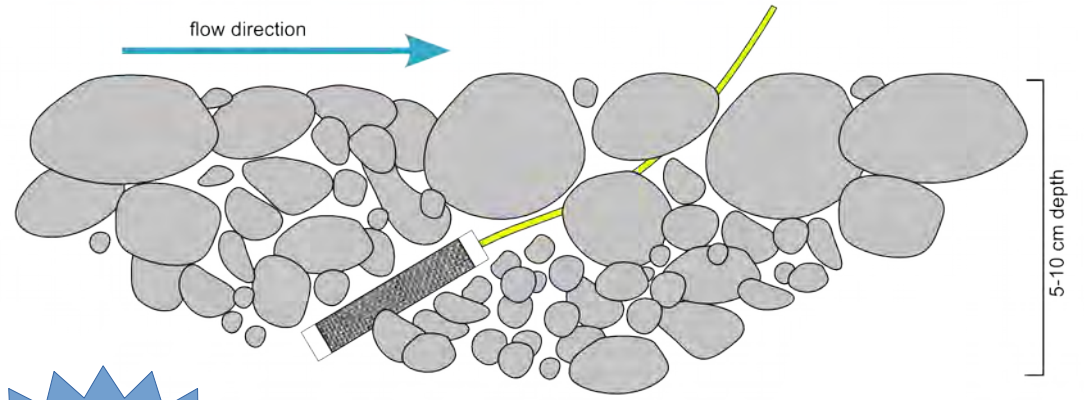


Concrete silos

On the Elez river in 2015 : 2+
« washing machine »
Not adapted for this place…

2. Large investigation of survival and growth





2015 → 2018

10 mussels per tube

4 tubes per station

5 to 8 stations per river

2 control stations in the farm

4 rivers in Brittany

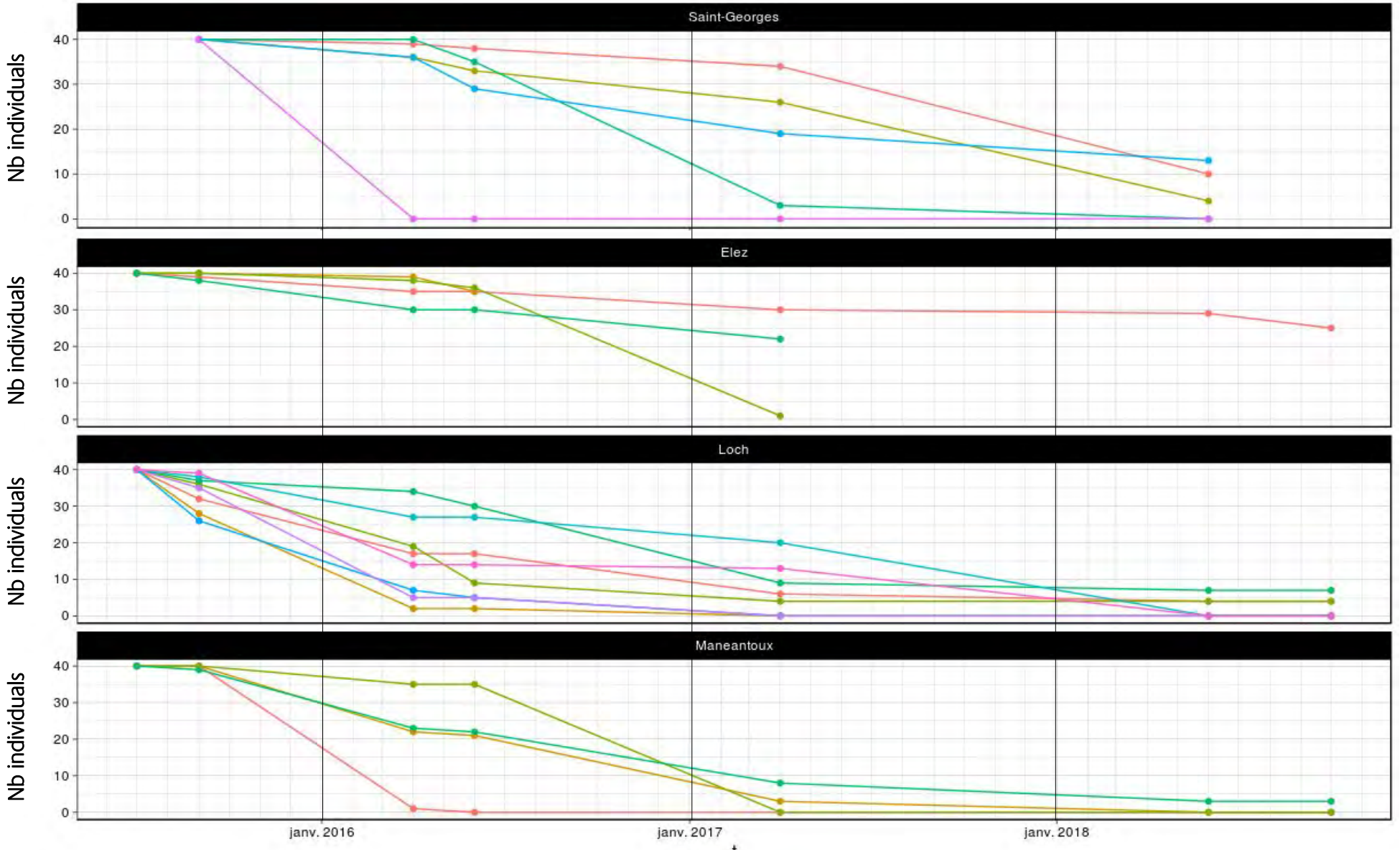
To assess growth and survival

SONY

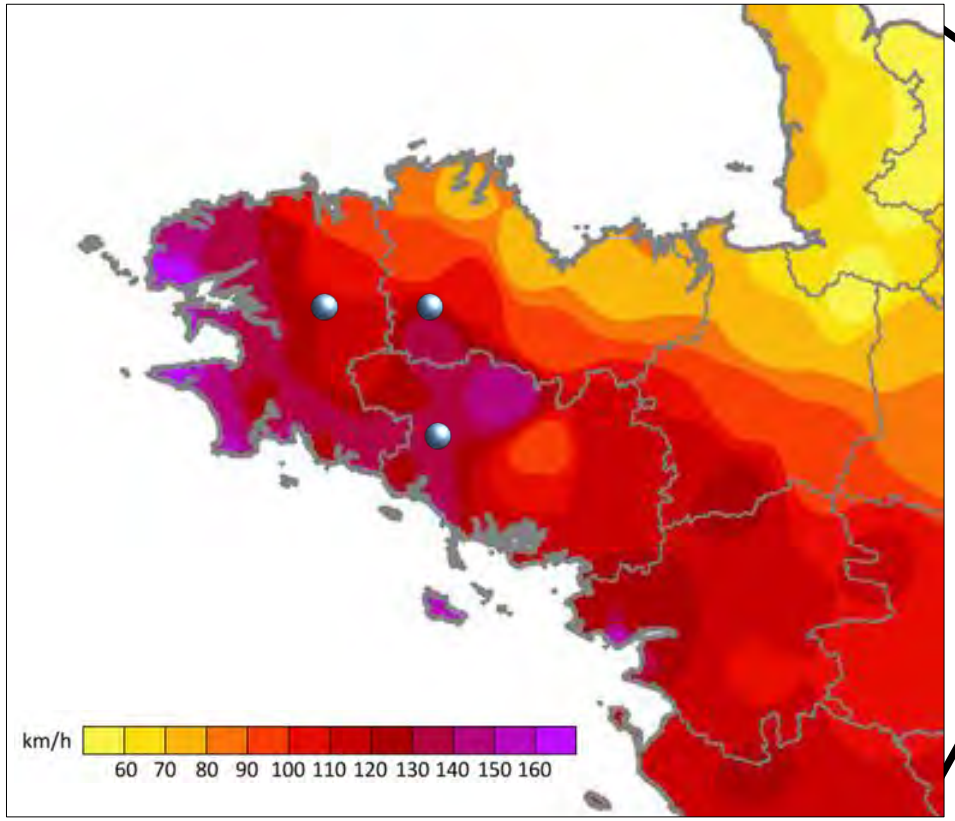
GRATICULES LTD.
TONBRIDGE, KENT
ENGLAND
100 x 0·1 = 10mm

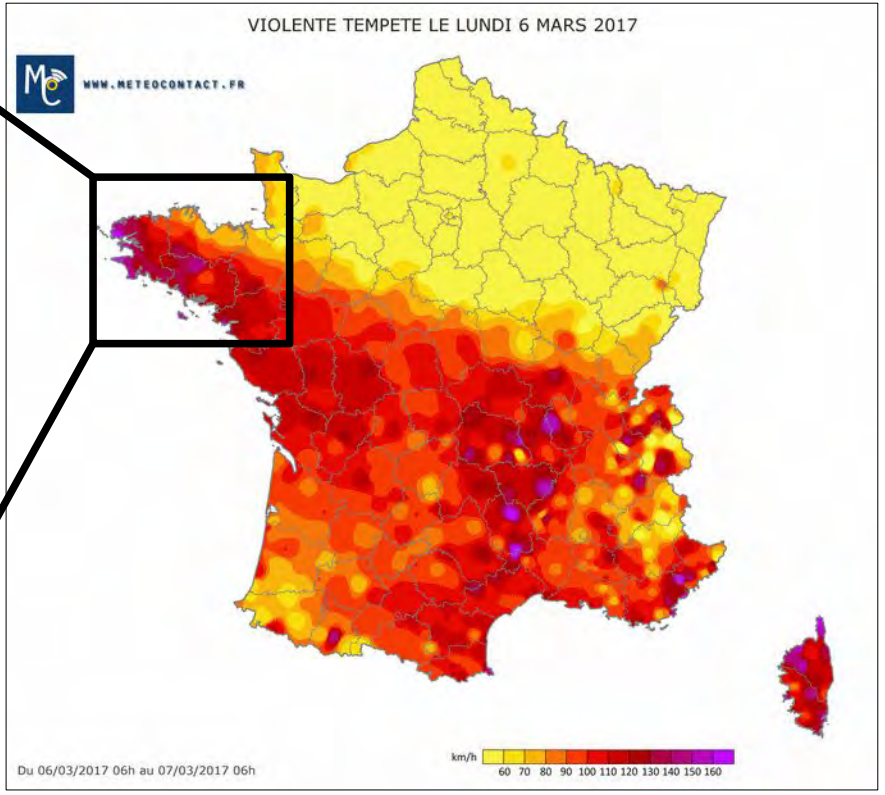
ImageJ : https://imagej.nih.gov/ij/download.html

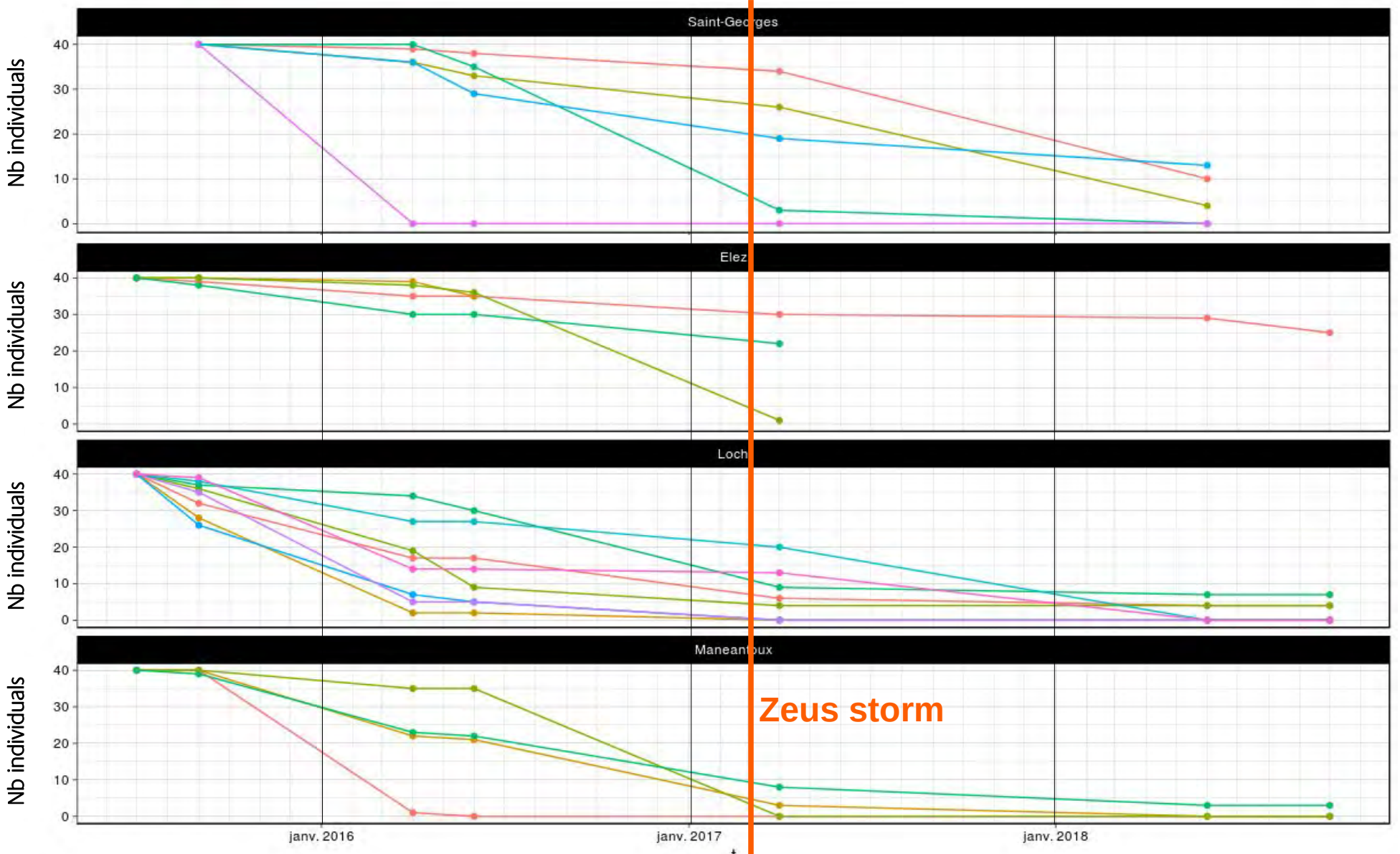


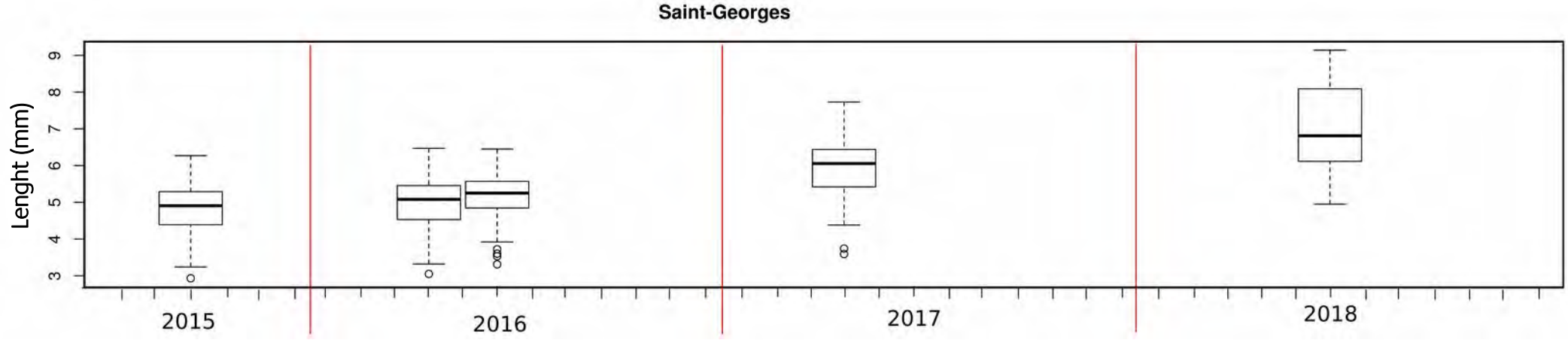

Saint-Georges
Elez
Loch
Maneantoux
Nb individuals
40
30
20
10
0
janv. 2016
janv. 2017
janv. 2018

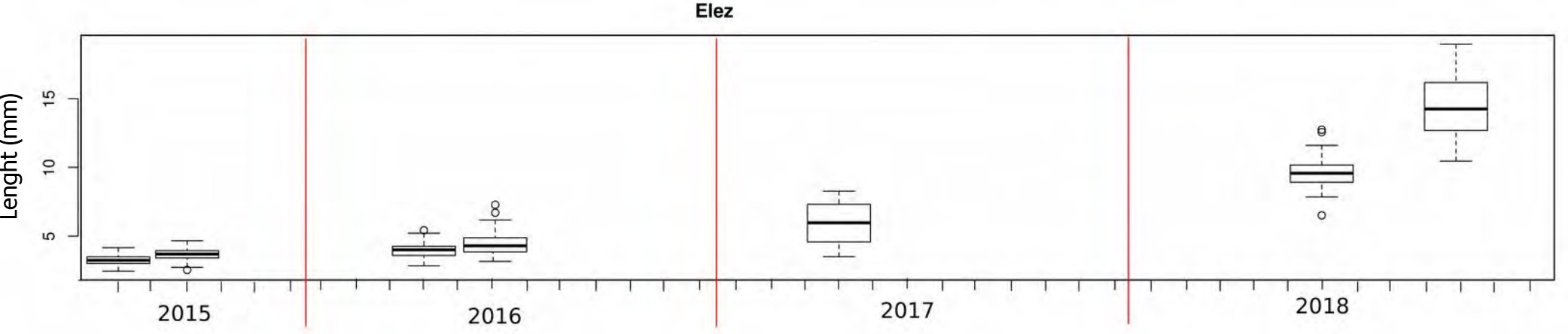
Zeus storm : 6-7th March 2017

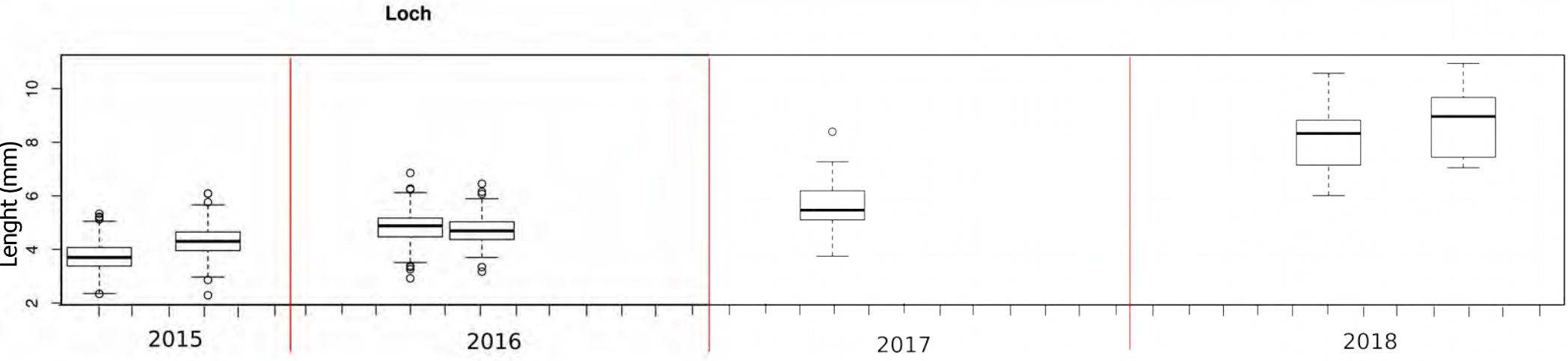


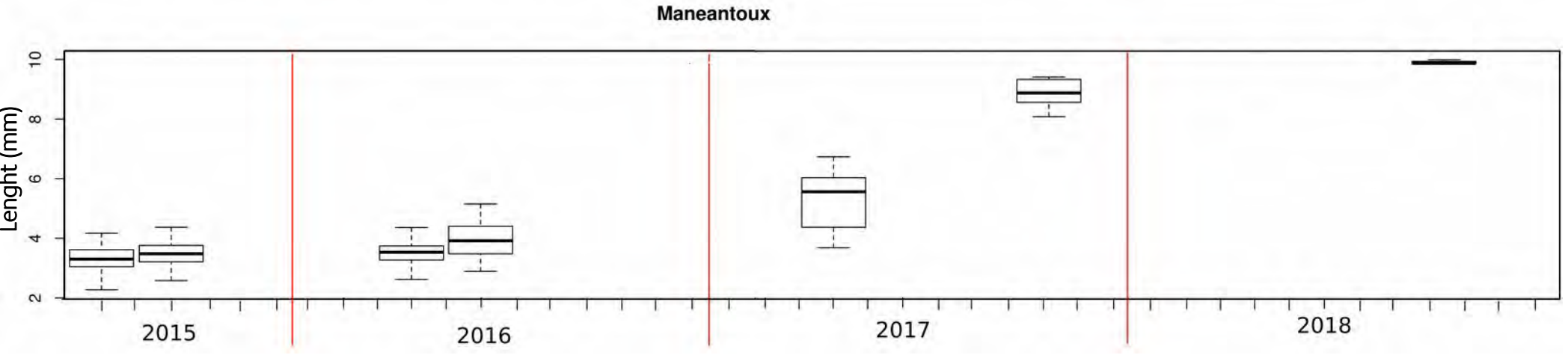


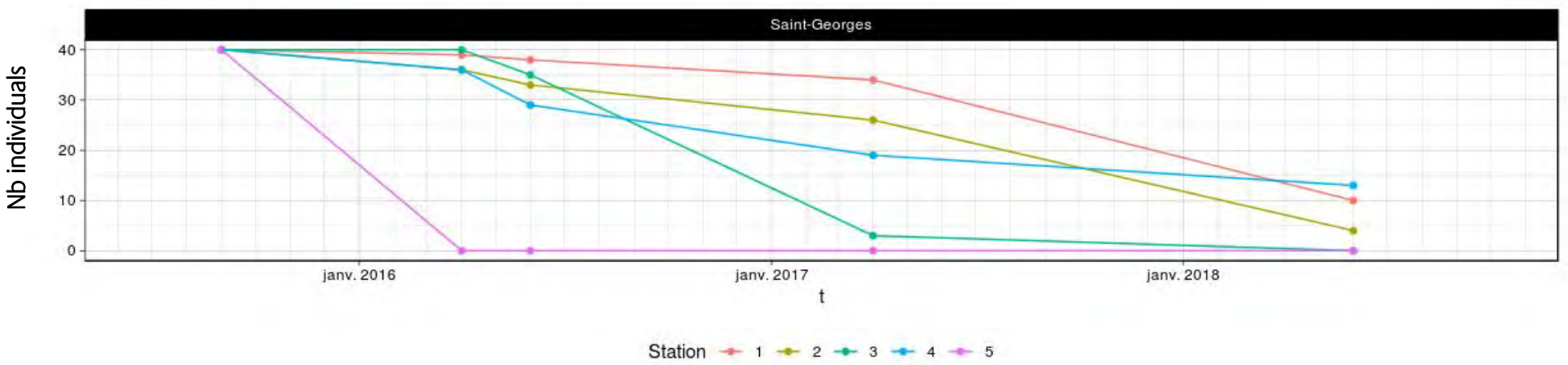

Saint-Georges
Elez
Loch
Maneant oux
Nb individuals
0
10
20
30
40
Zeus storm
janv. 2016
janv. 2017
janv. 2018

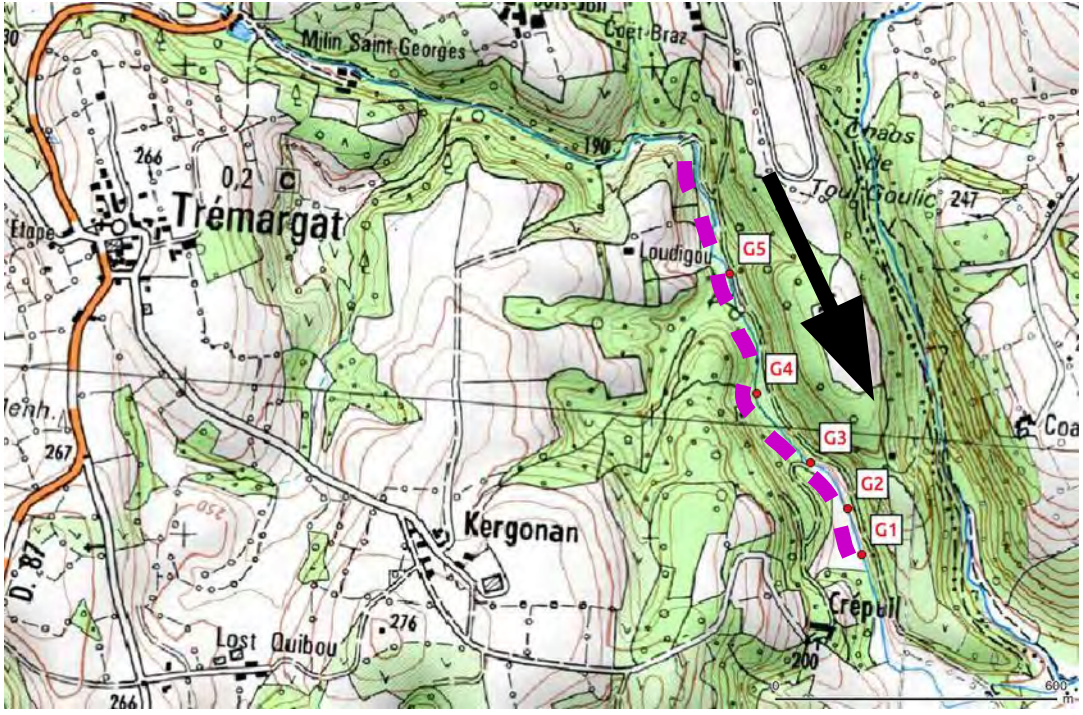

Saint-Georges
Lenght (mm)
3
4
5
6
7
8
9
2015
2016
2017
2018


Elez
Lenght (mm)
5
10
15
2015
2016
2017
2018


Loch
Lenght (mm)
2
4
6
8
10
2015
2016
2017
2018

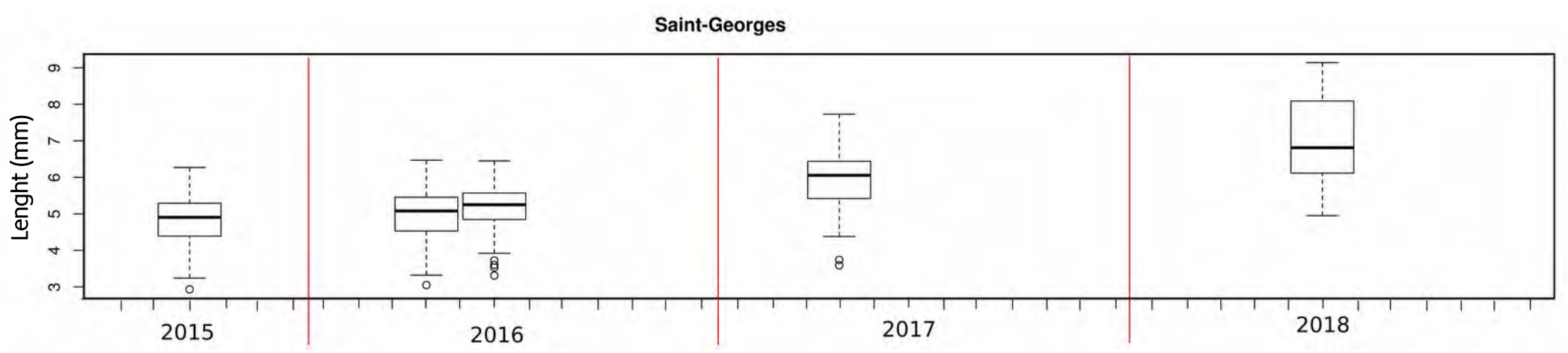

Maneantoux
Lenght (mm)
2
4
6
8
10
2015
2016
2017
2018

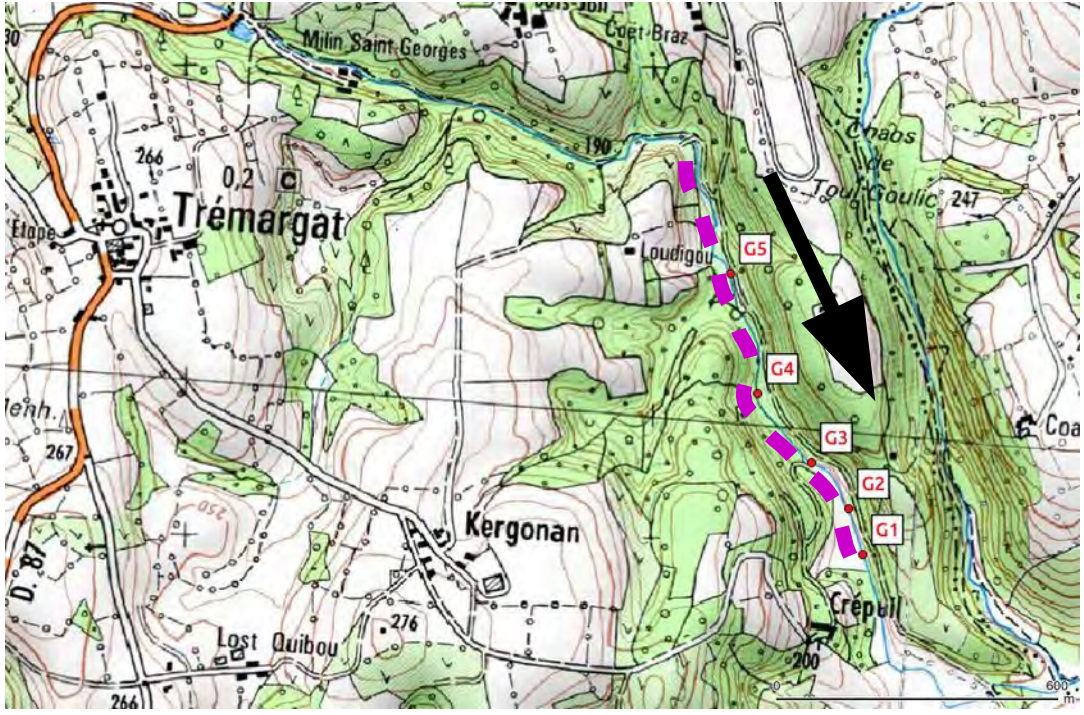




Saint-Georges

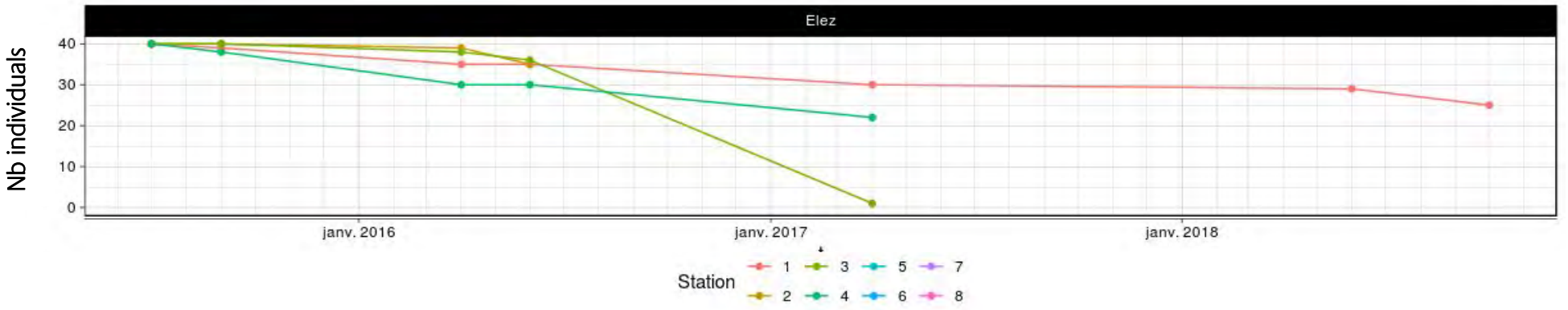
River population :
80-90 mussels
on 800 m

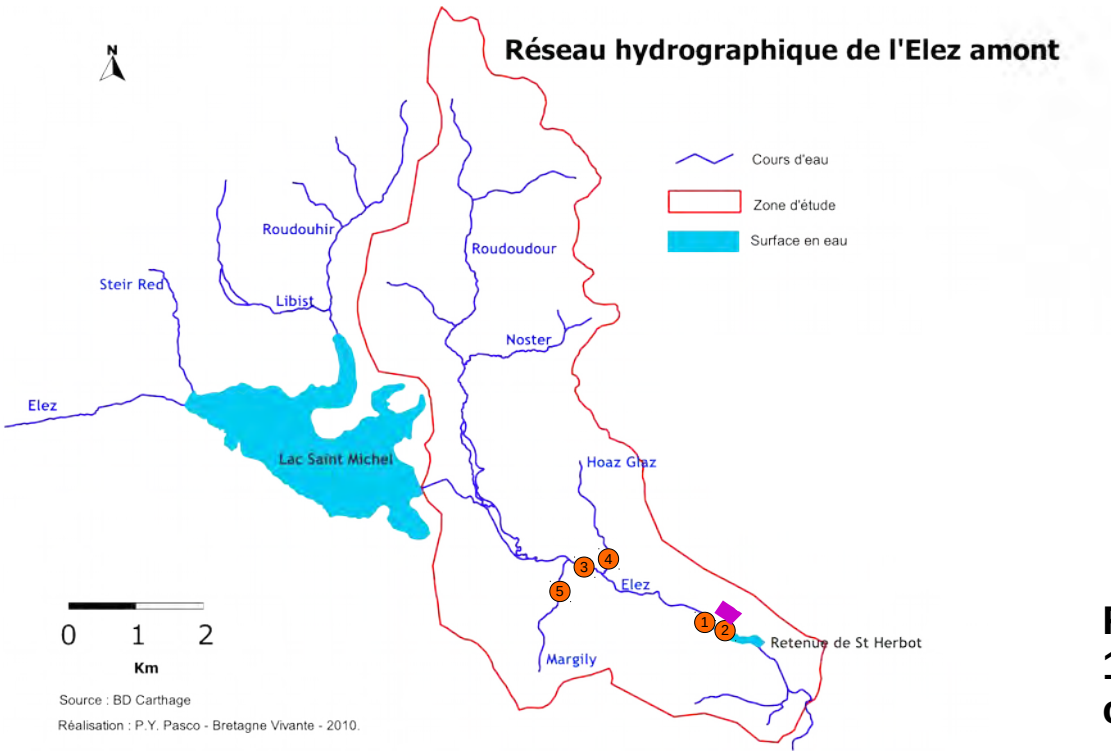




Saint-Georges

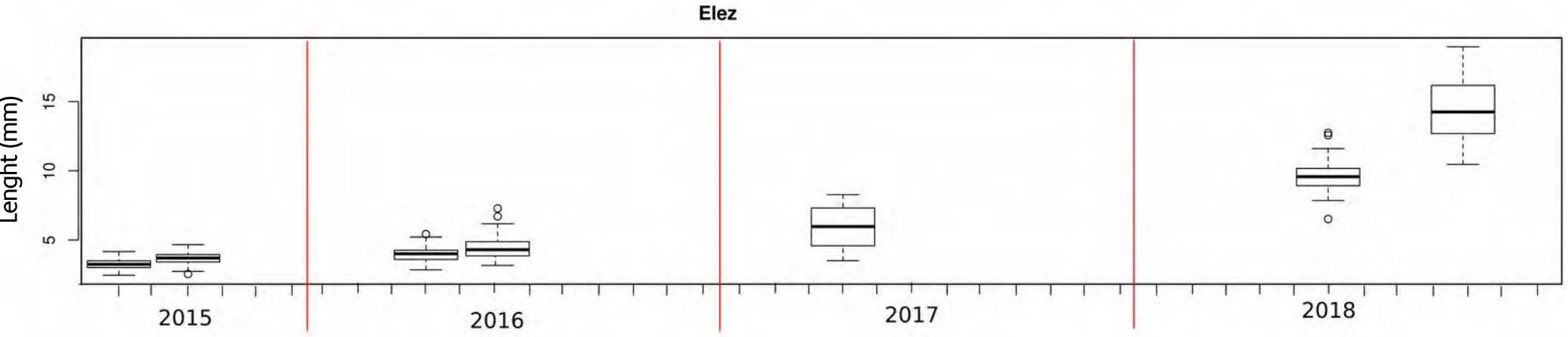
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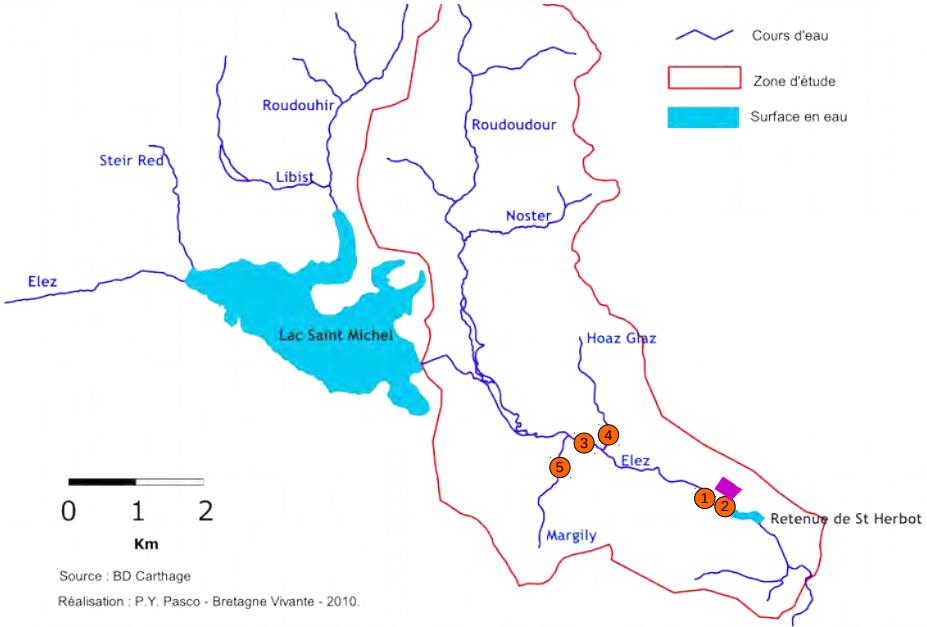




Elez amont

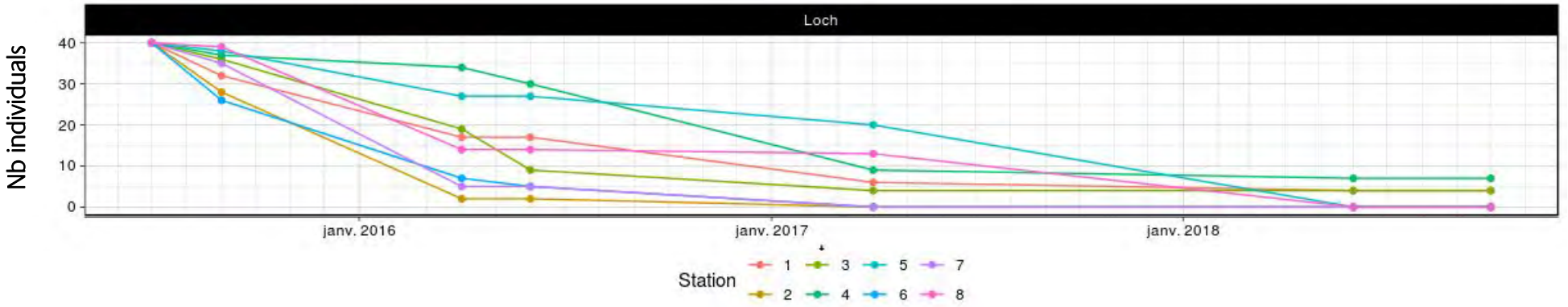
River population : 1000-1500 mussels on 300 m

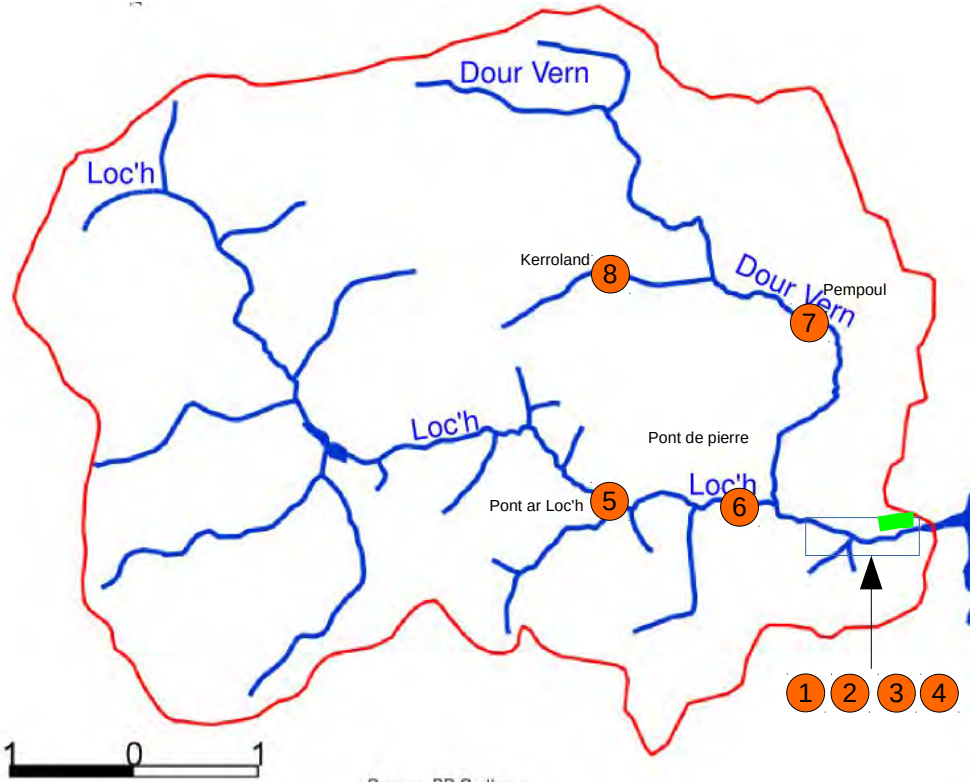




Elez amont

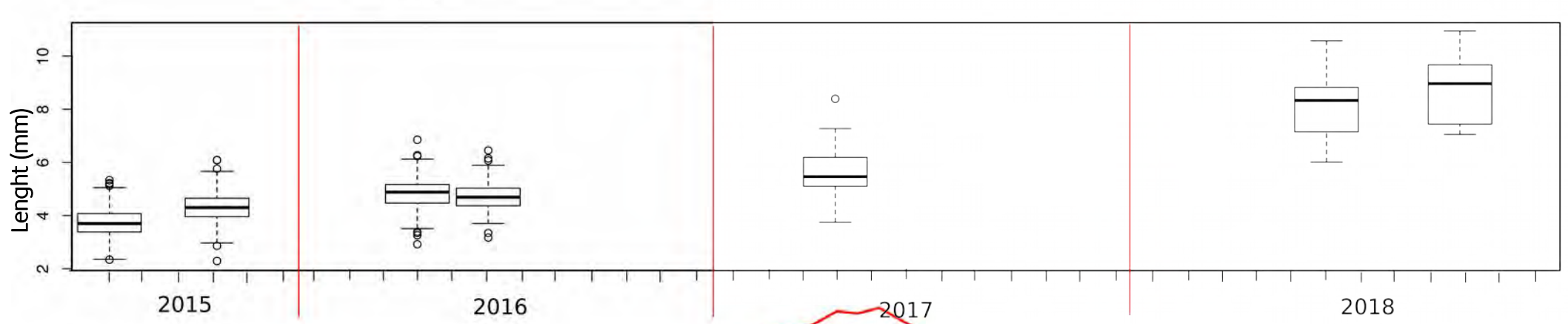
River population : 1000-1500 mussels on 300 m

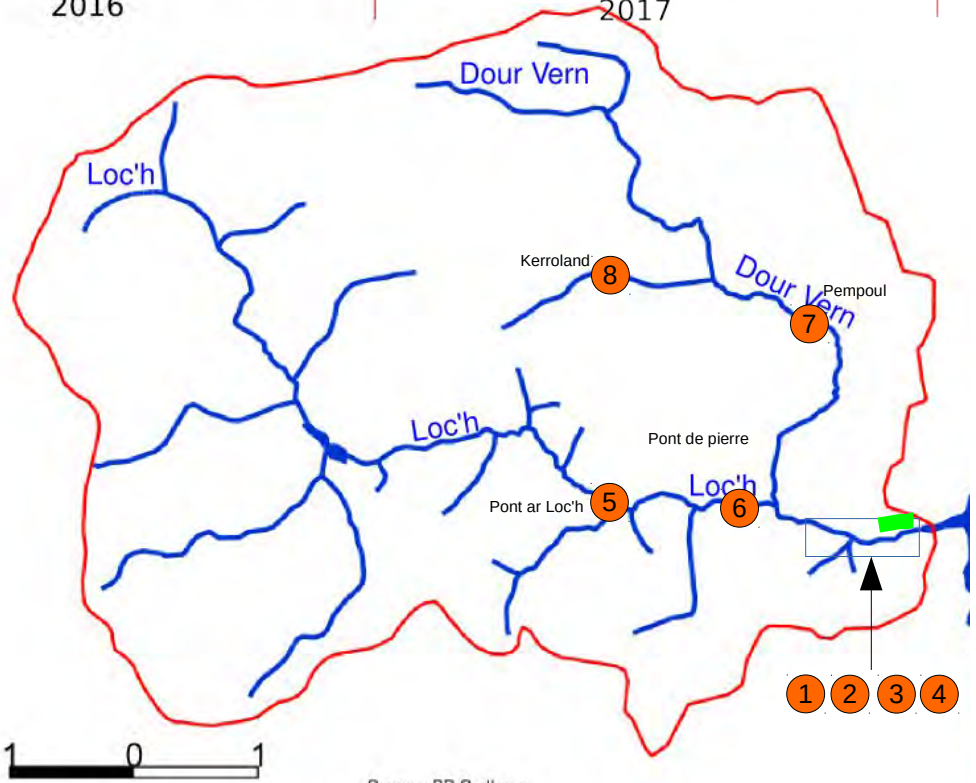




Loc’h

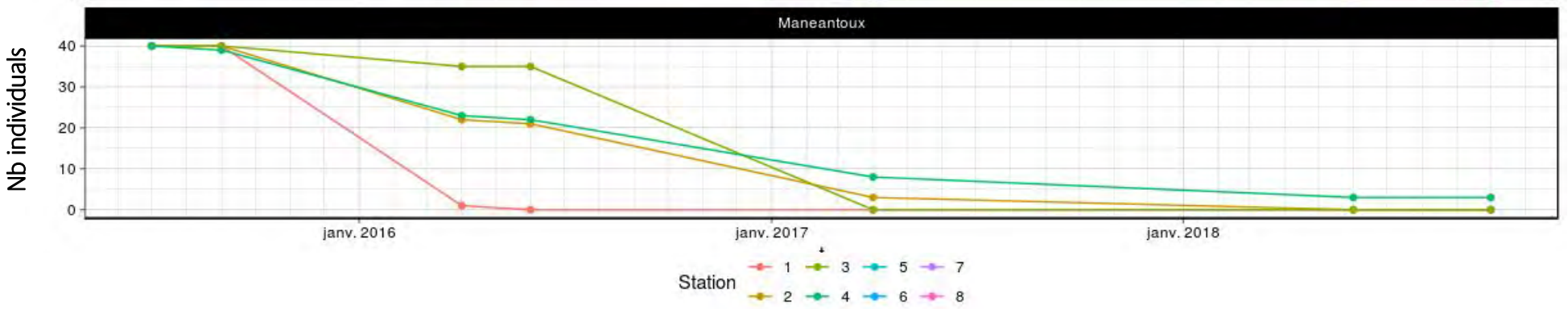
River population :
80-100 mussels
on 300 m

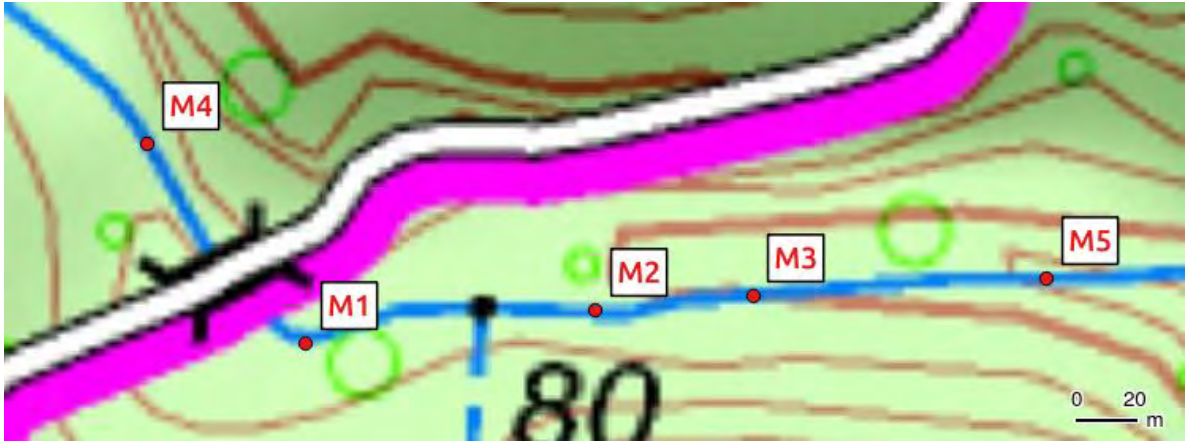




Loc’h

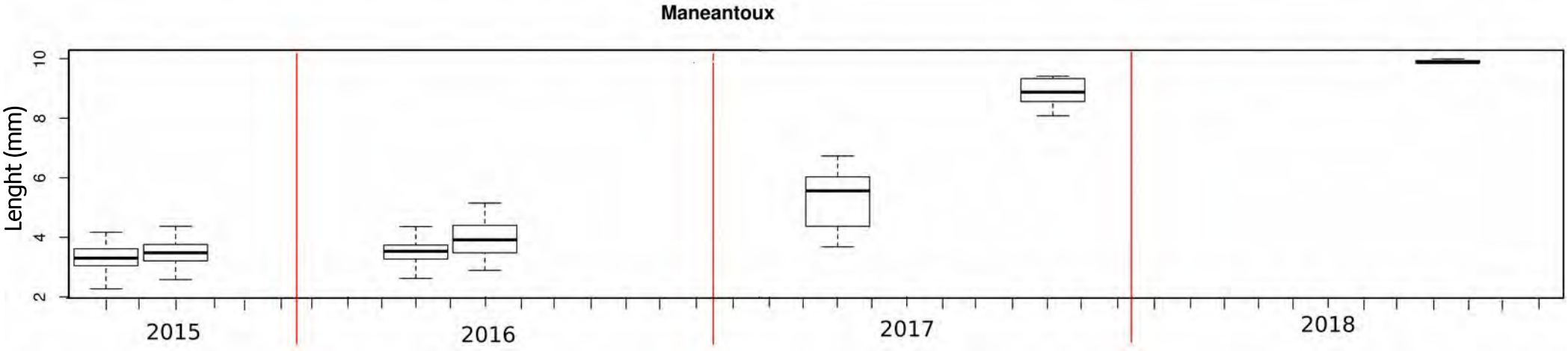
River population :
80-100 mussels
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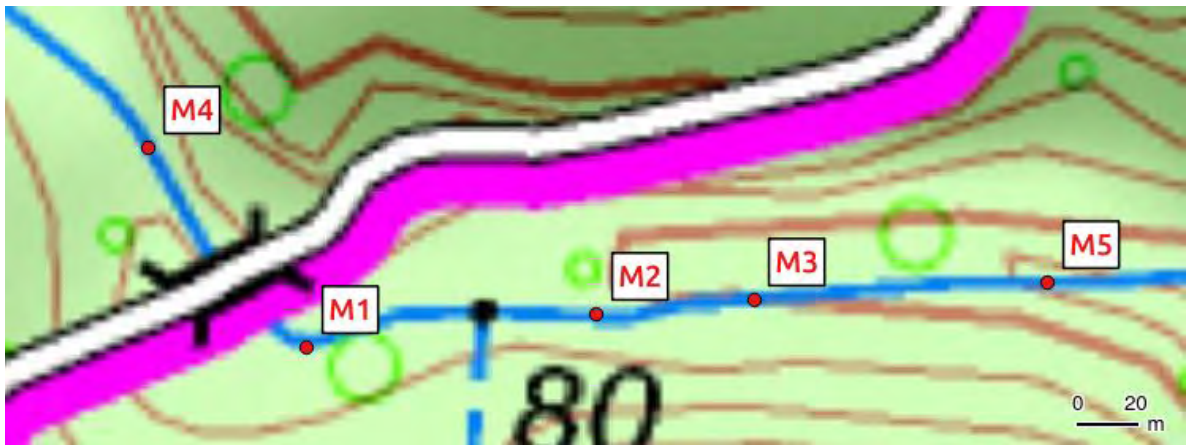




River population :
0 mussels
Re-introduction

Maneantoux

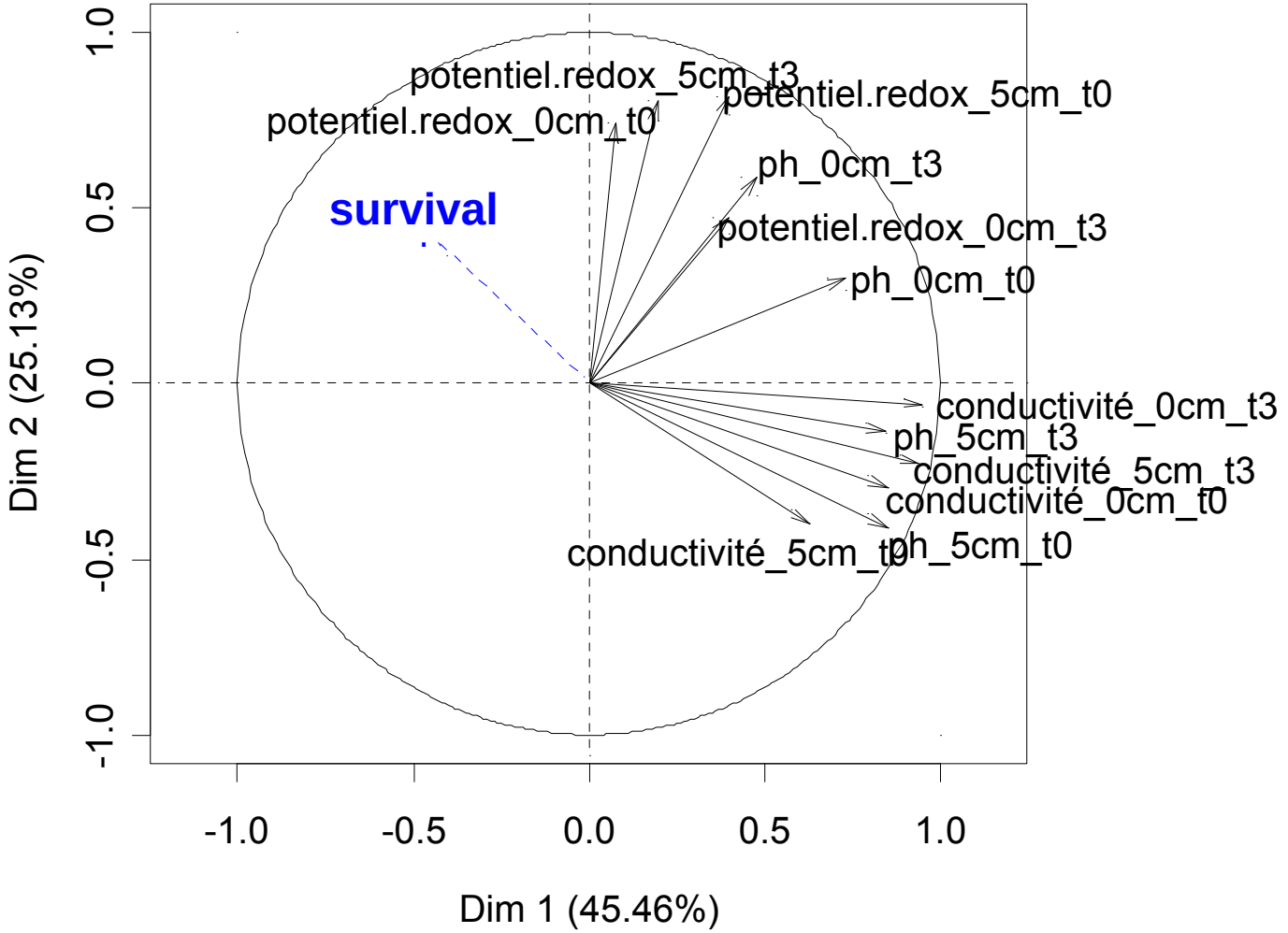




River population :
0 mussels
Re-introduction

Maneantoux

PCA on pH, red-ox-potential and sediment conductivity



In parallel : measurements (min-max)

	pH 0	Conductivity 0 cm	Red-ox 0 cm	pH 5 cm	Conductivity 5 cm	Red-ox 5 cm
Saint-Georges	6-3-6,9	116-132	518-585	6,3-6,9	116-135	481-586
Elez	5,7-6,8	87-134	538-599	5,5-6,6	86-155	259-597
Loc'h	6,54-6,9	144-184	482-560	5,64-7,18	121-192	502-571
Maneantoux	6,45-6,9	129-170	498-562	5,9-7,02	146-172	507-567

3. Trying to link survival and growth
- with juvenile size
- with flow velocity and depth

160 juveniles
3+

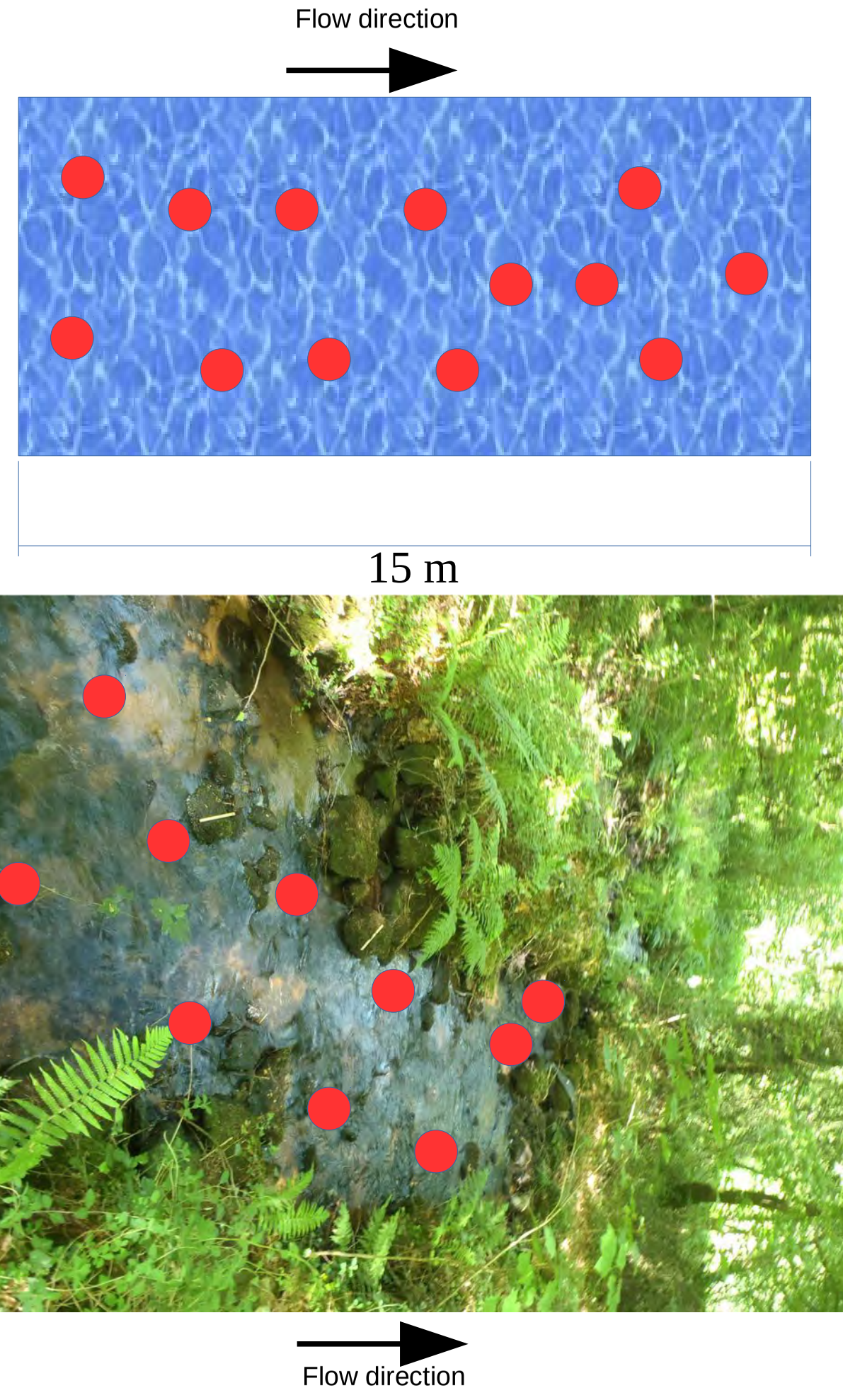
3 size class :
- 3,2-4,5 mm
- 4,6-6,5 mm
- 6,5-9,7 mm

To assess growth and survival

15 tubes of 0,400 mm mesh

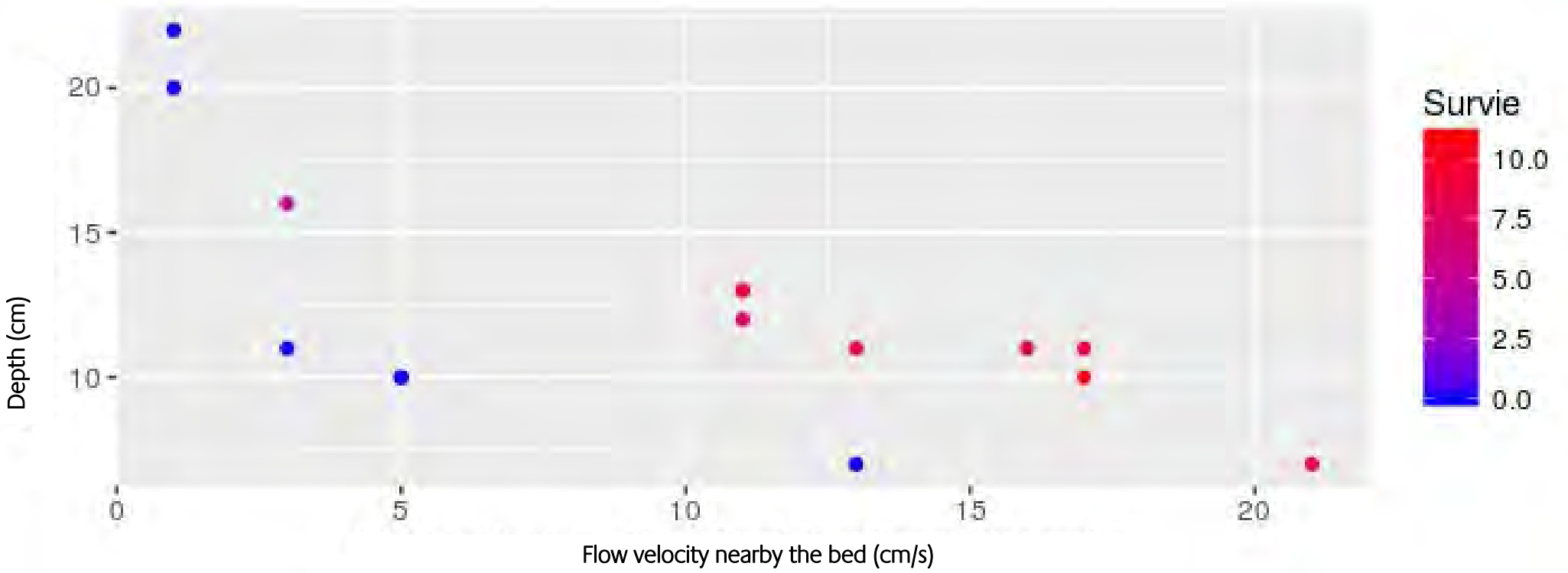
12 ind. / tube :
4 mussel from each size

June to october 2017


Flow direction
15 m
Flow direction

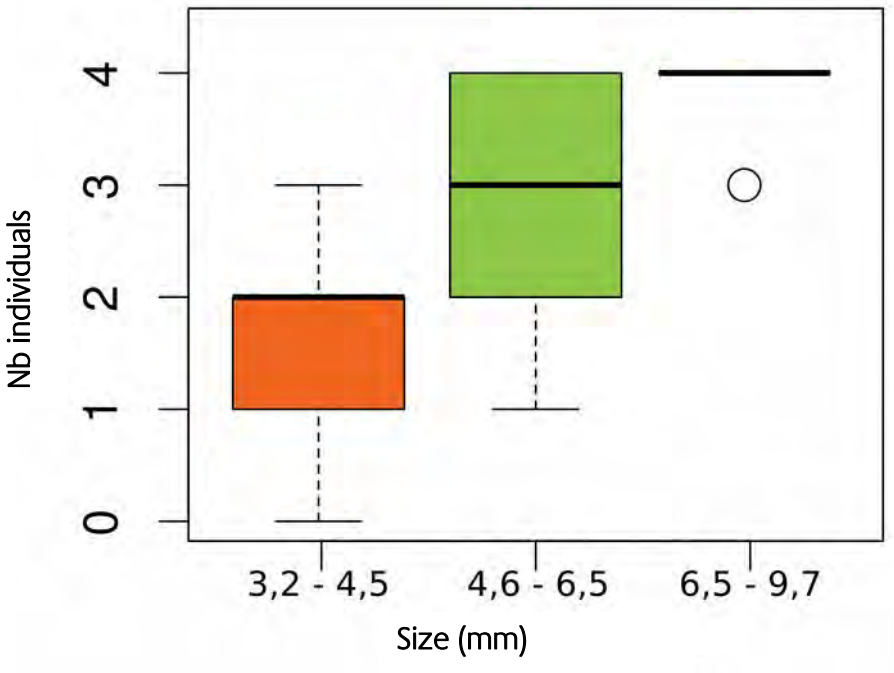
Position influence on survival

June-October 2017 - Manéantoux



Size influence on survival

June-October 2017 - Manéantoux



Plastic boxes with sediments

10 boxes settled since 2015. Survival > 50 %







What's next ?

Need to continue :

What happened in winter ?

Caracterize the place where we still found juveniles

Continue the in-situ breeding systems and try to link them with other parameters

The role of fine sediments ?

The stability of the habitat in time ? Hydrodynamics parameters ?

Breeding station is essential

For juveniles : let them grow before resettlement

For saving the differents strains :

- From any field disaster
- From any natural extinction

But we must not forget habitat recovery actions !

In conclusion...

Conservation efforts in the long term

Need time and money

Freshwater pearl mussel life expectancy

Programme

Political time



Thanks to our financial supports

Bretagne Vivante

Fédération de pêche du Finistère :



Thank you and see you tomorow for our resettlement activities !