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A preliminary study of fin rays microchemistry data in Salmo trutta : Is it possible to trace back to the original watershed from fin rays ?

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A preliminary study of fin rays microchemistry data in *Salmo trutta* : Is it possible to trace back to the original watershed from fin rays ?

Guénard.M [1,2], Beauchard. T[2] , Aymes. J.C [1], Daverat. F [1], Guéraud. F [1]

1. INRAE, ECOBIOP, St-Pée-sur-Nivelle 2. University of Pau and Pays de l'Adour (UPPA), Master 2 DYNEA

RÉPUBLIQUE FRANÇAISE
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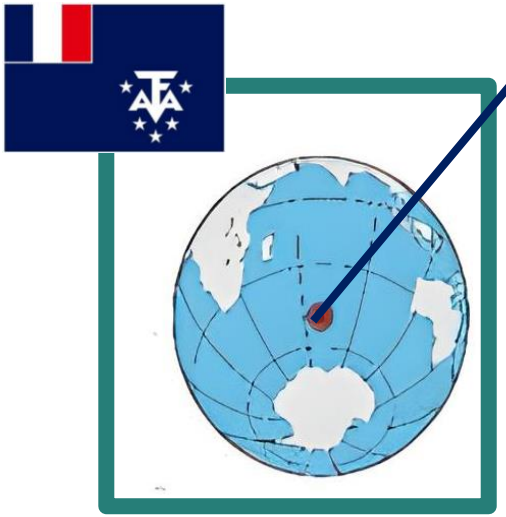
INRAE

UNIVERSITÉ DE PAU ET DES PAYS DE L'ADOUR

Kerguelen islands : an open-air laboratory



Réserve Naturelle TERRES AUSTRALES FRANÇAISES

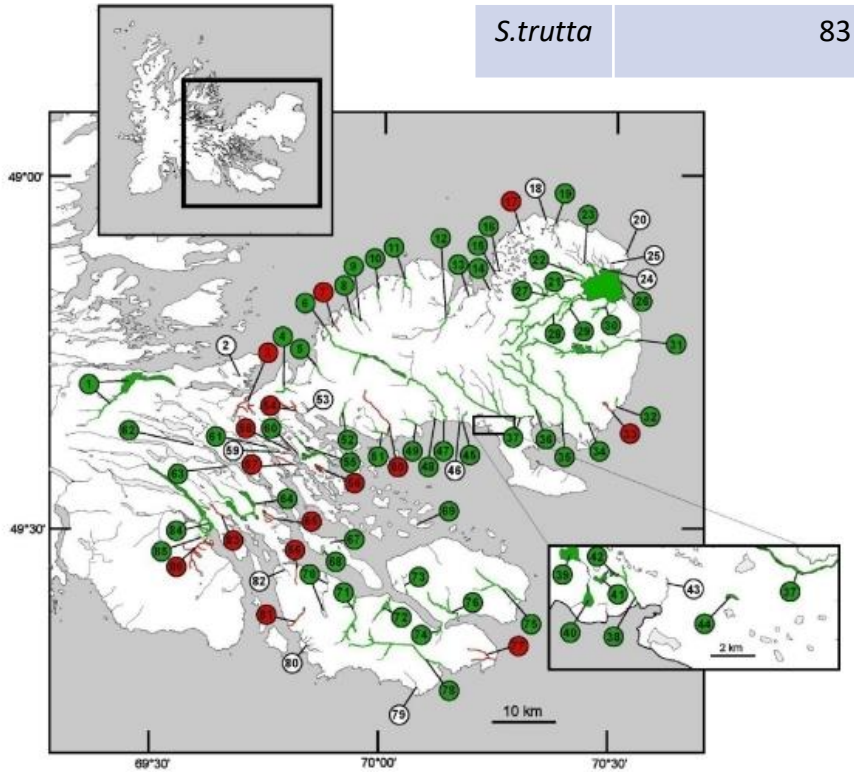
2006

UNESCO · PATRIMONIO MUNDIAL · WORLD HERITAGE · PATRIMOINE MONDIAL

2019

A context of colonization of the Kerguelen islands by the common trout (Salmo trutta)

Species	Number of individuals released into the river	Number of rivers seeded	Number of rivers currently colonised
S.trutta	83 000	12	42



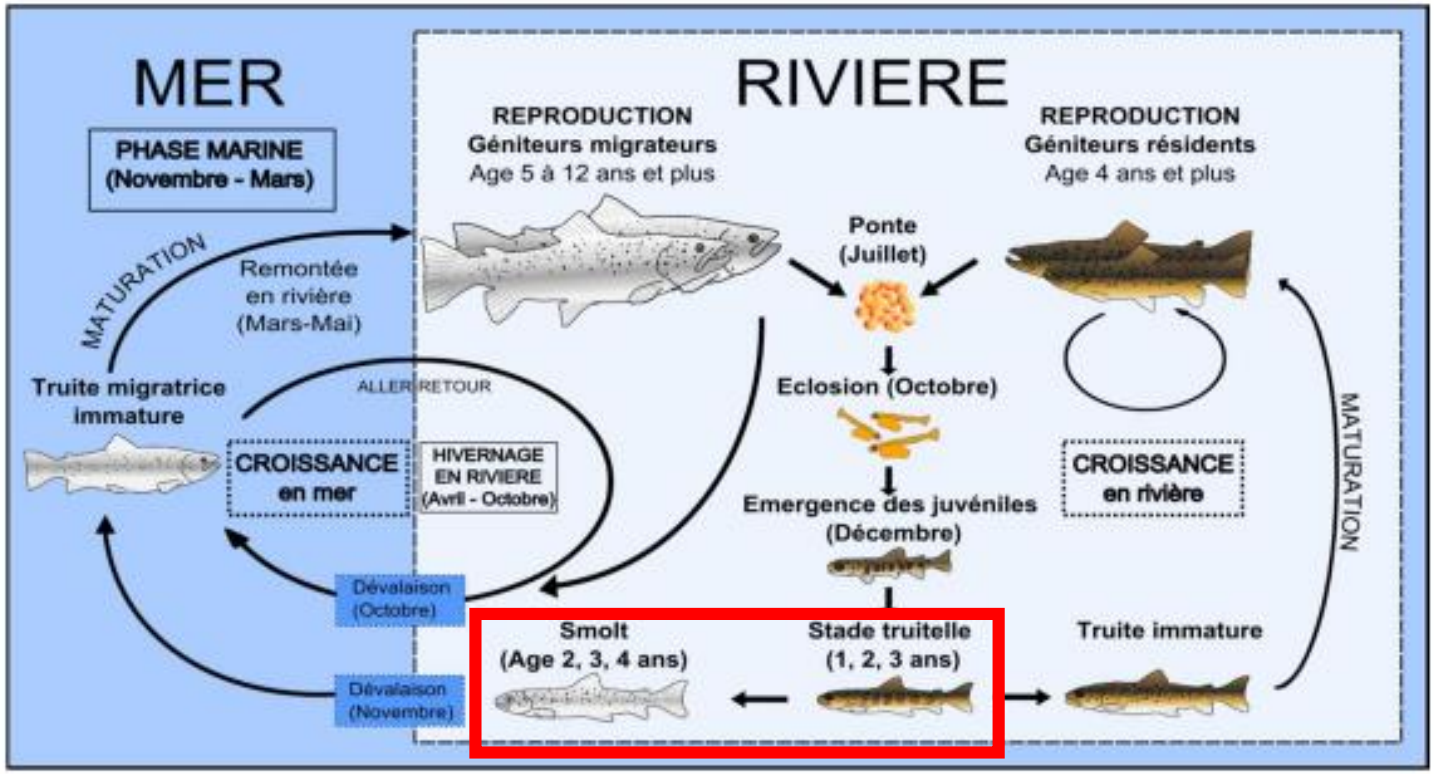
(Labonne et al., 2013)

Introduction of salmonids since 1962

Dispersion of *S.trutta* by anadromous phenotype

(F.GUERAUD, technician at INRAE on site)

Life cycle of trout in Kerguelen islands



(Labonne et al., 2013)

Minimum age for going to sea is 2 years (Sea trout)

A large collection of anatomical parts

INRAE (COLISA) has a large collection of anatomical parts dating back to 1962, such as scales in majority but also fin rays.

Species	number of captures	Pockets of scales	Adipose fin	Tip of the fin	Ray of pectorals	Stomach content	Otoliths	Whole fish
Salmo trutta	91853	37593	6074	1177	583	3508	1612	1107
Salvelinus fontinalis	48983	14348	905	88	3	2146	458	65
Salmo salar	8909	4452	170	0	0	48	63	0
Oncorhynchus kisutch	5094	3134	100	0	0	15	451	3
Salvelinus alpinus	363	160	84	48	0	49	50	0
Oncorhynchus tshawytscha	51	51	0	0	0	0	4	0
Oncorhynchus mykiss	25	25	0	0	0	0	0	0
Inconnu	938	556	22	1	1	4	60	122
Total	156216	60319	7355	1314	587	5770	2698	1297

A study was being carried out on the fin rays of trout and one of the objectives of this study was to find out if :

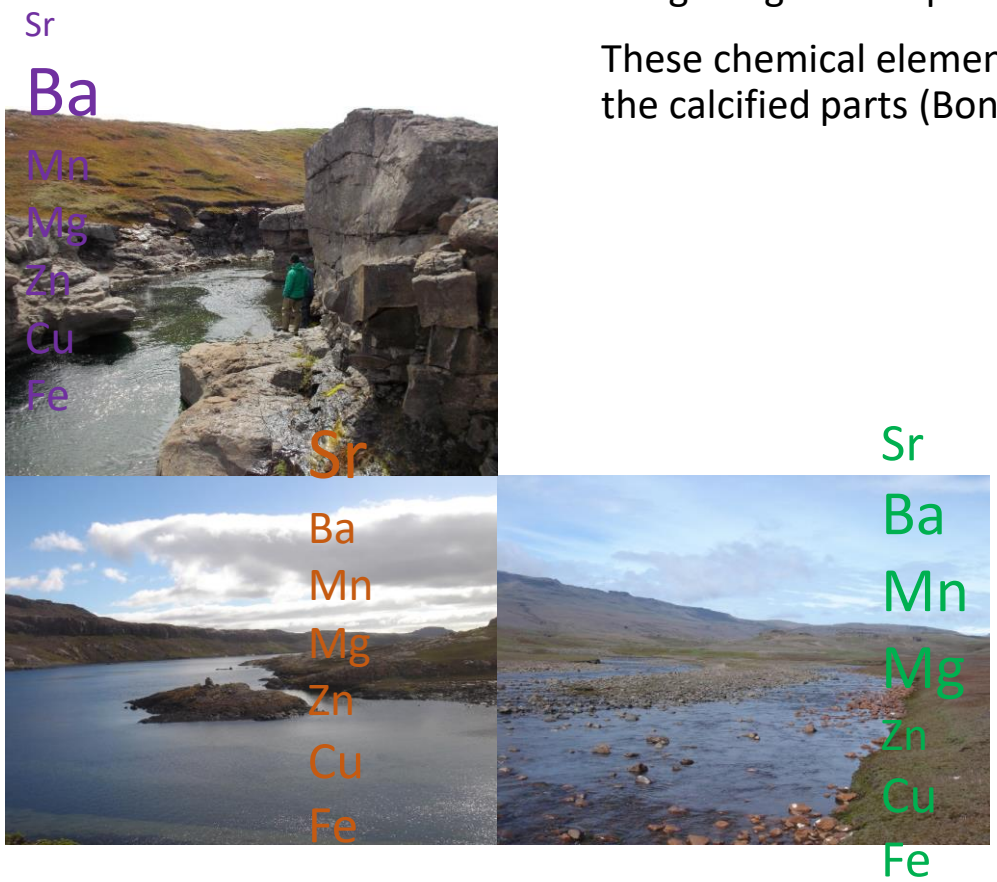
Is it possible to trace back to the original watershed from microchemistry data collected by the use of fin rays ?

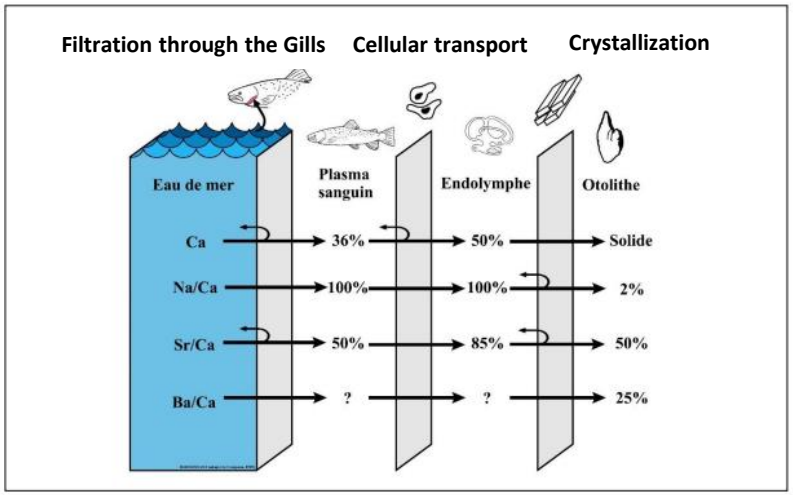
Why sclerochronology to study the dispersion of individuals?

Incorporation of chemical elements

Each watershed has its own chemical signature. It is the result of the geological composition and environmental conditions

These chemical elements are transported and then assimilated in the calcified parts (Bones) during the growth of the individuals.

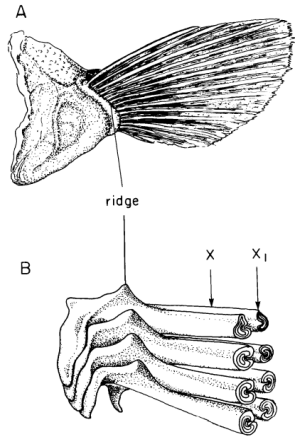




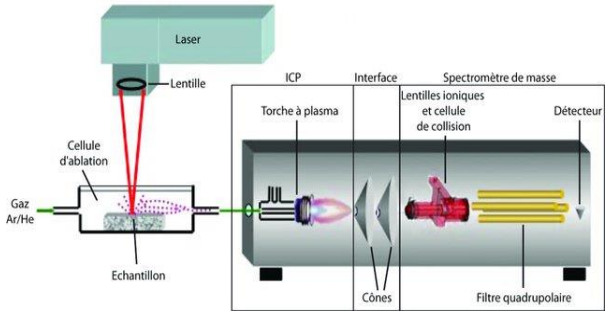
(Rogissart d'après Campana, 1999)

Method

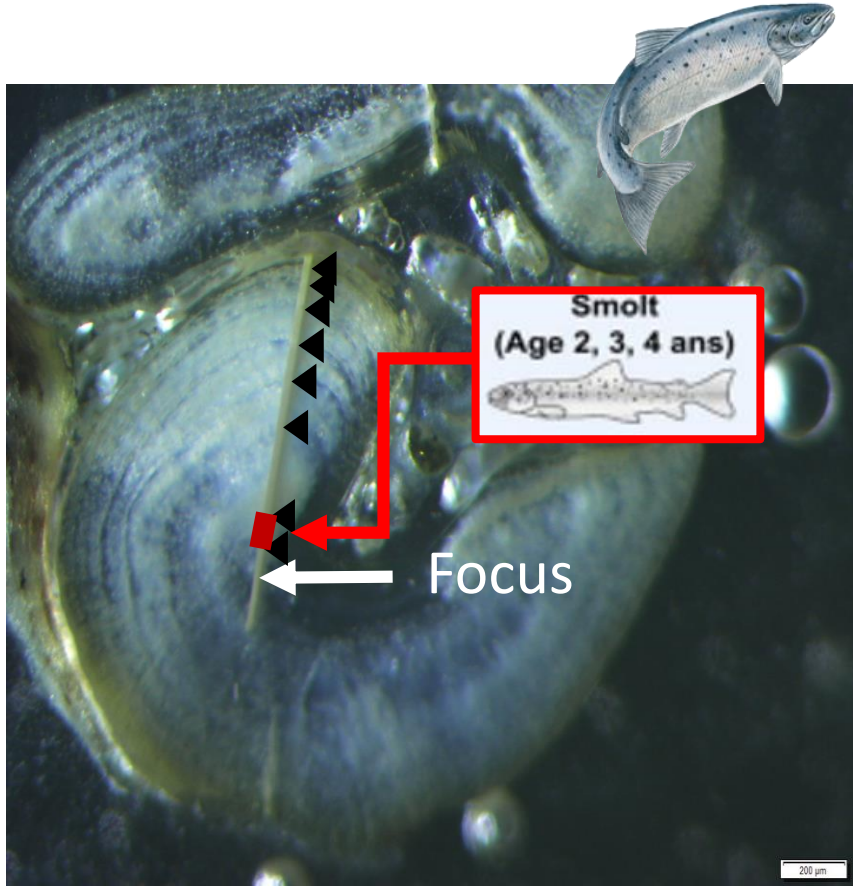
From fin rays to microchemistry data



Calcium phosphate structure (Beamish, 1981)



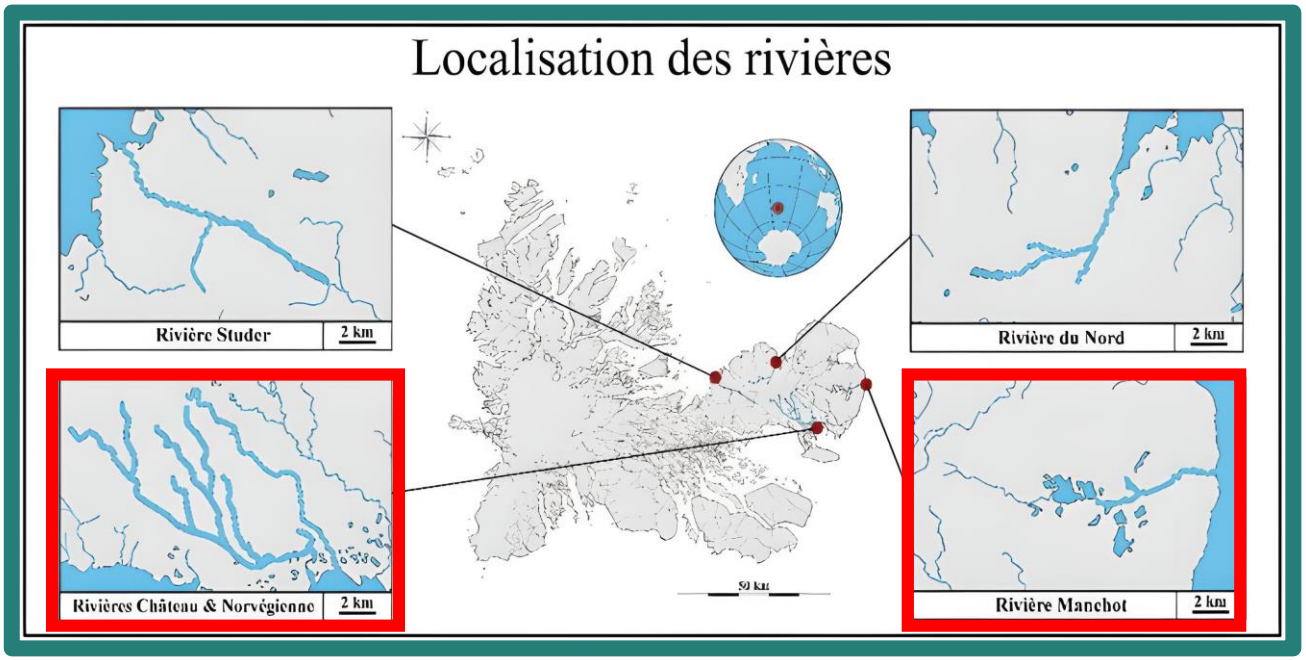
(Pierre FEUTRY modifié d'après Tabouret 2009)



(M. GUENARD)

Study site and sampling

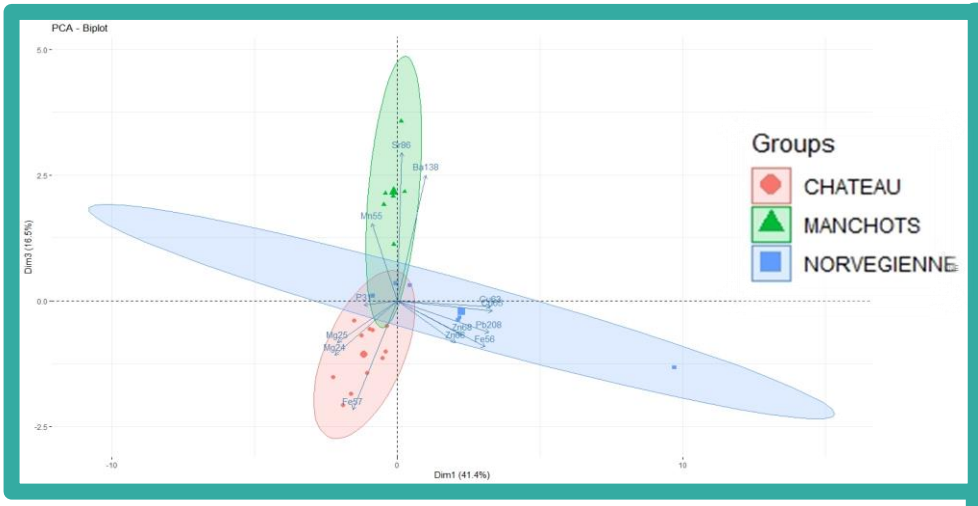
Study on 3 of the main rivers studied

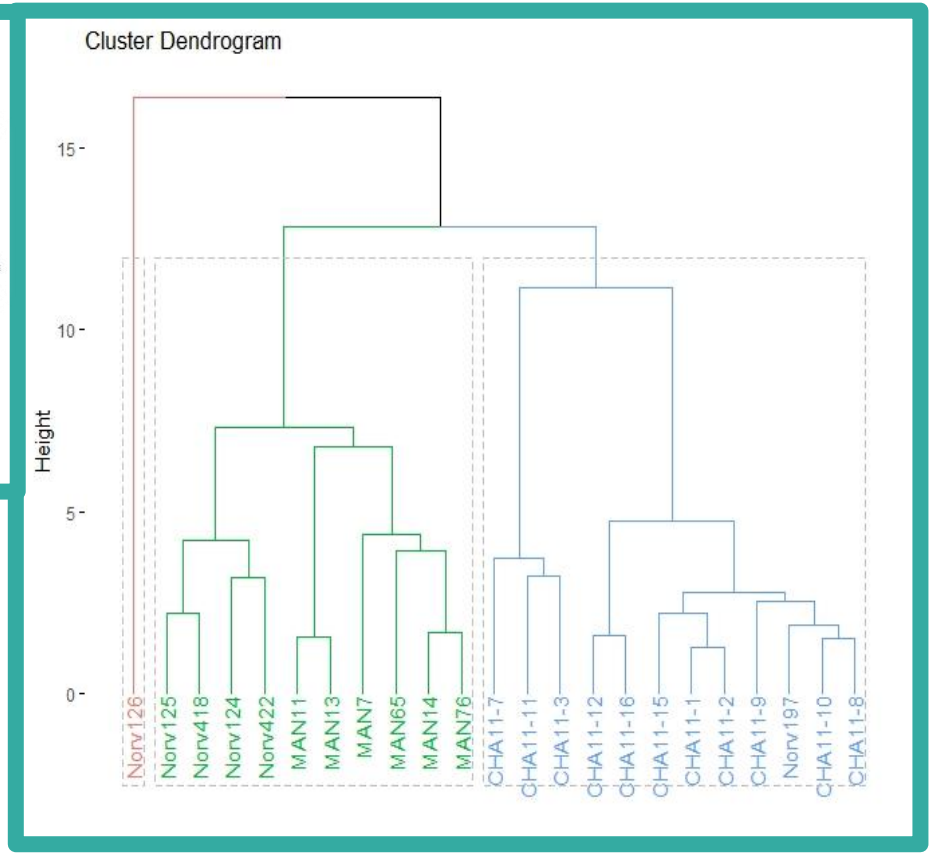


Populations	Sedentary trouts	Sea trouts	Total
CHÂTEAU	11	11	22
MANCHOTS	6	15	21
NORVEGIENNE	6	16	22
Total	23	42	65

Age > 4 years

Results Sedentary trouts



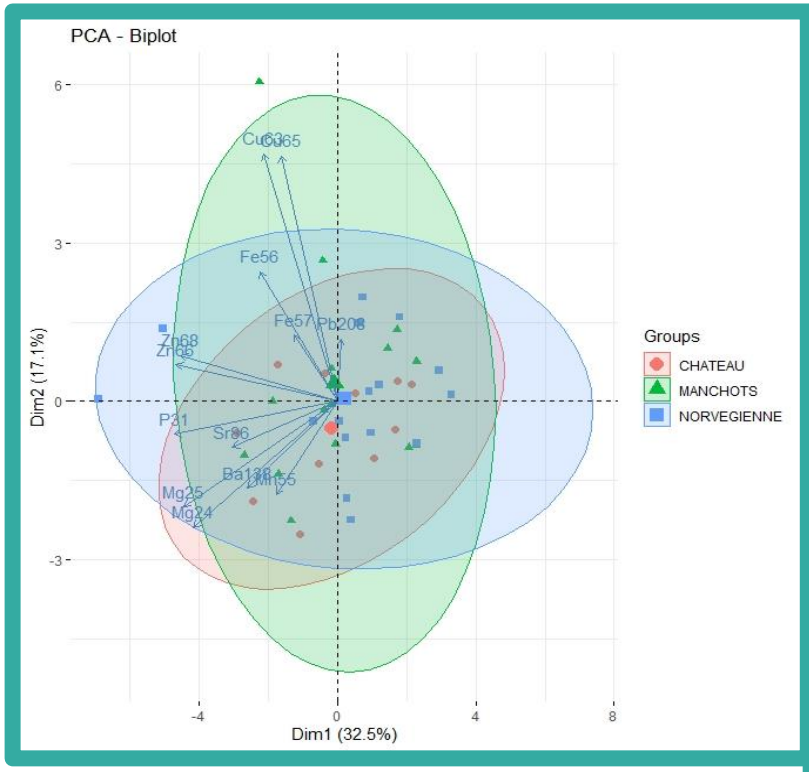


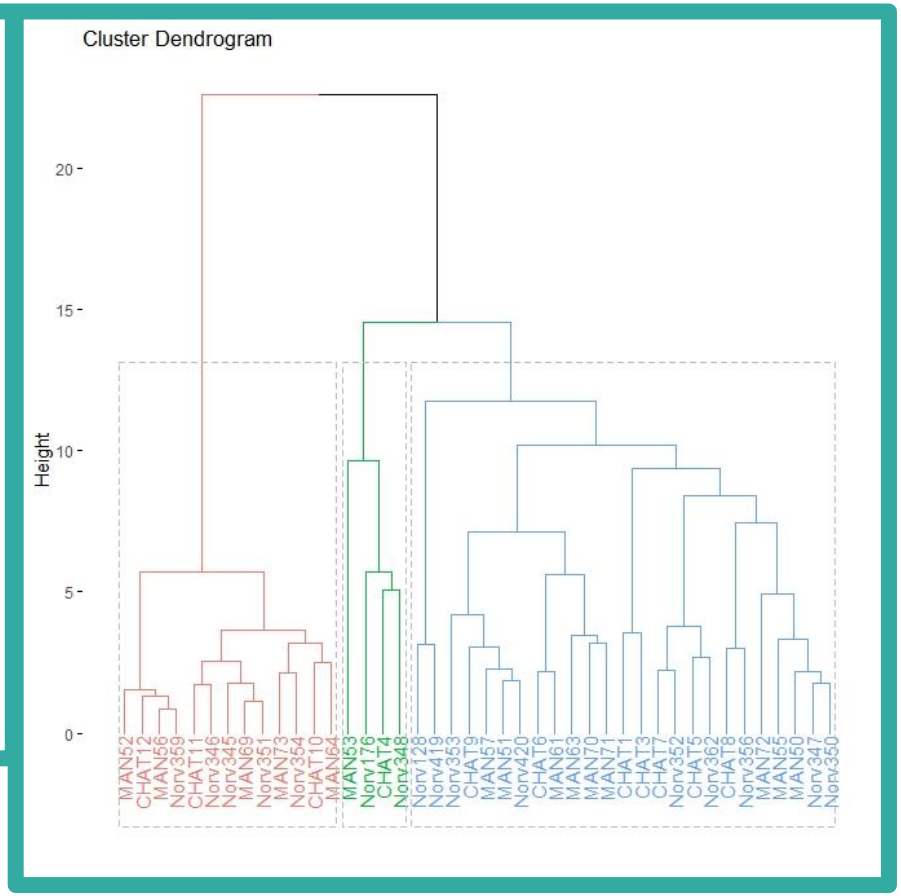
Clear watershed discrimination for sedentary individuals with the PCA and the HCA .

The chemical compositions of watersheds are sufficiently different to allow discrimination between individuals according to their river.

So we could in principle reallocate individuals to their watersheds

Results Sea trouts





Overlapping data makes it impossible to discriminate groups in any dimensions of the PCA

Chemical data do not allow to discriminate the watersheds with the HCA

Results Sea trouts

QDA and Jackknife reclassification

	CHÂTEAU (reassignment) %	MANCHOTS (reassignment) %	NORVEGIENNE (reassignment) %
CHÂTEAU (origin)	0	73	27
MANCHOTS (origin)	0	67	33
NORVEGIENNE (origin)	0	56	44

The QDA coupled with the jackknife reclassification shows us a very low percentage of good reclassification in hindsight.

So, we will not be able to reassign individuals to their watersheds of origin.

Discussion

A disappointing record

Sedentary trouts

Satisfying discrimination of watersheds of origin explained by environmental conditions (hydromorphology and geology of the site).

Sea trouts

The discrimination of the watersheds of origin is not satisfying.

HYPOTHESE : remobilization (structural modification of the bone matrix) of elements during the stay at sea.

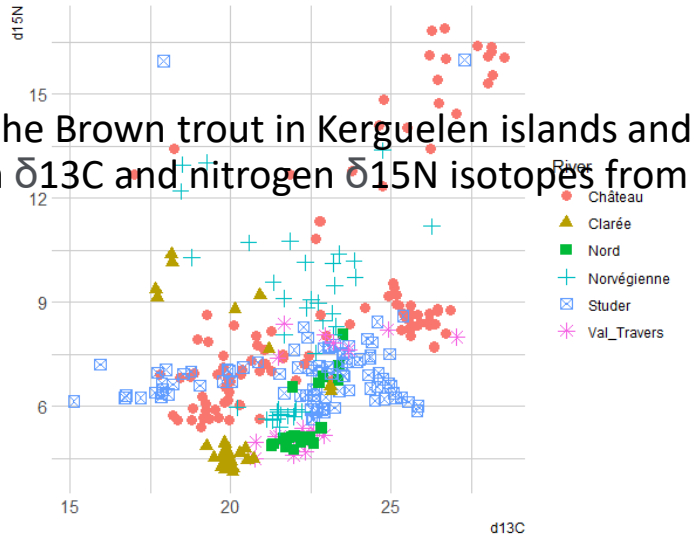
To conlude

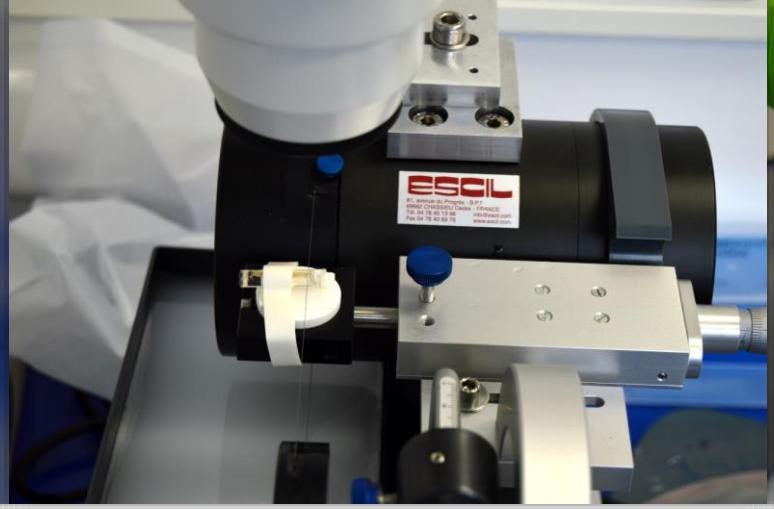
Because this study was not designed to incorporate geologically disparate natal sources, it may be more effective on a larger scale.

Moreover, an isotopic analysis ($^{86/87}Sr$) of fin rays could allow us to discriminate more efficiently Or may be not !

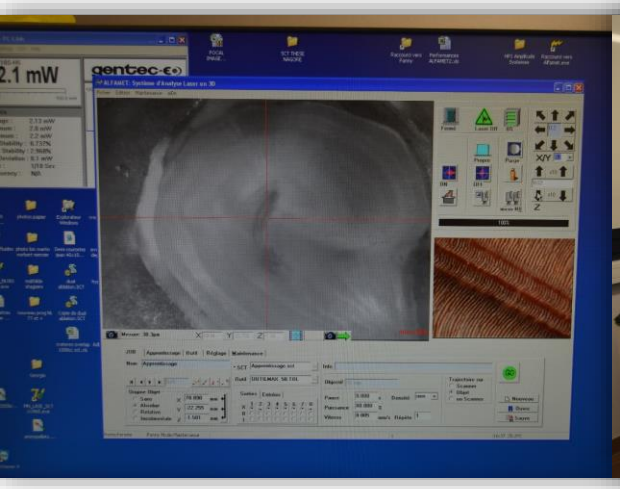
Future tests

This year, we want to study the food web of the Brown trout in Kerguelen islands and study the variation since the 60s from carbon δ13C and nitrogen δ15N isotopes from the scales.





Thank you for your attention !

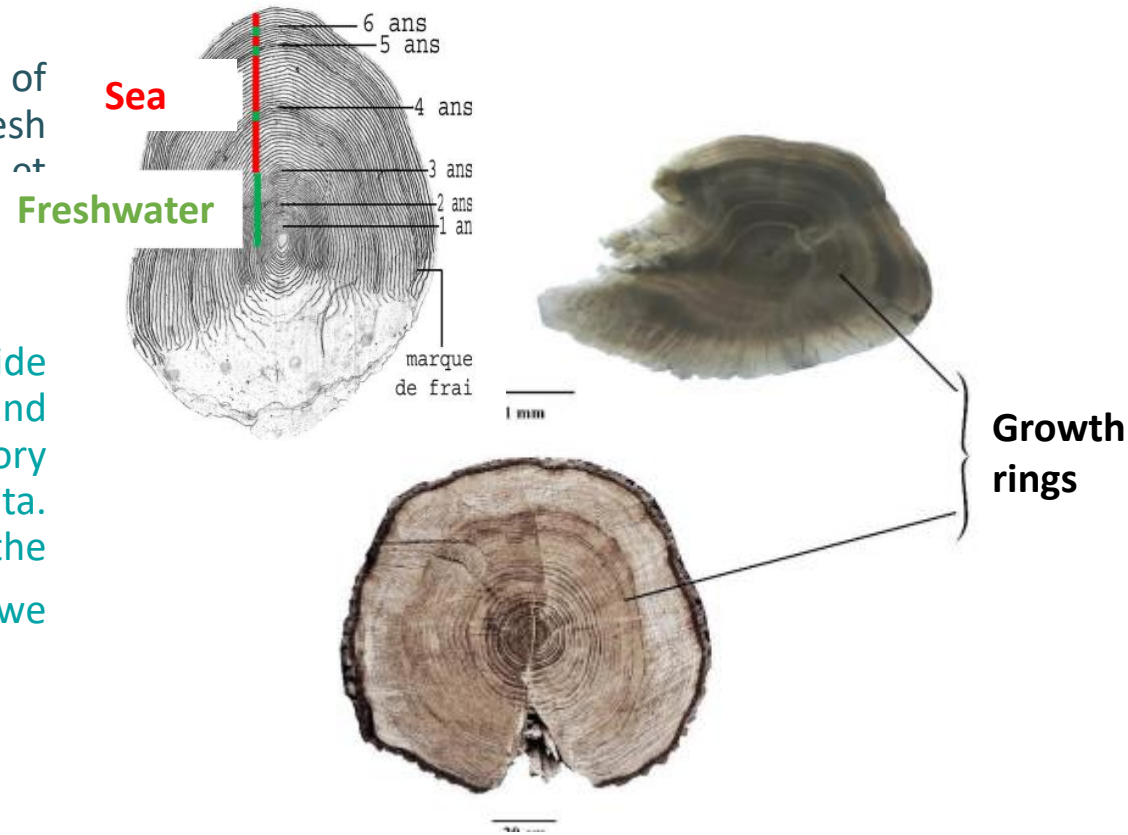


continuation of the method

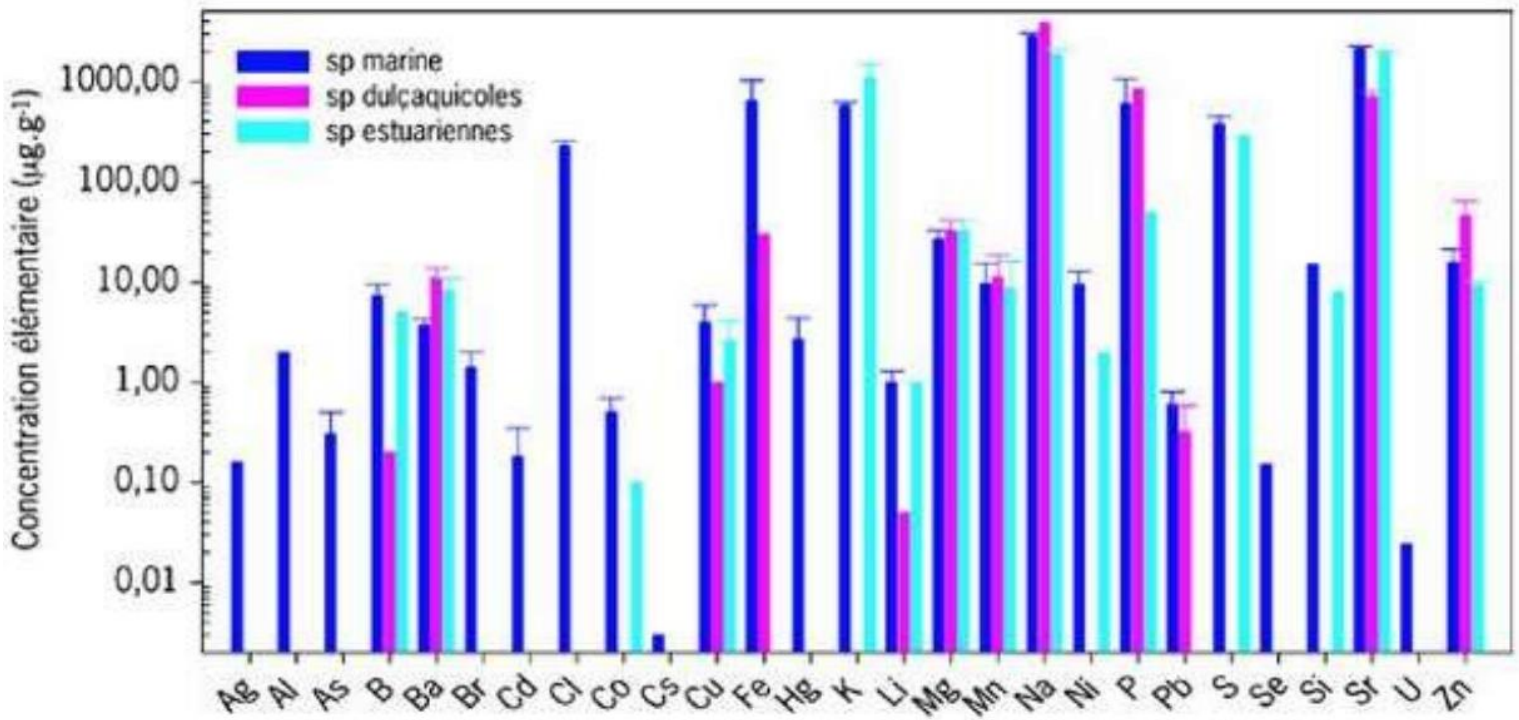
Sclerochronology

Scale : Age, age at sea, number of spawnings, number of returns to fresh water...but not chemistry data (Vignon et al., 2020).

Otoliths are generally use to provide individual data on fish structure and composition of ecology (Age, migratory status, habitats, etc.) and chemistry data. However, otoliths require the sacrifice of the fish, that is why we are interested in fin rays.



Elements linked to Habitats or Physiology



(De Pontual et Geffen, 2002 d'après Campana, 1999)