A toolbox to assess the spatio-temporal dynamics of Atlantic salmon recolonization after dam removal on the Sélune River (Normandy, France)

E. Lasne[1,2], F. Martignac[1,2], E. Quemere[1], Z. Raphalen[1], A. Bazin[3], M. Druet[3], J. Tremblay[3], G. Evanno[1], L. Soissons[1], L. Beaulaton[2,4], J.M. Roussel[1,2]

1. DECOD (Dynamics and sustainability of ecosystems, from source to ocean), INRAE, Institut Agro, IFREMER, Rennes, France
2. Pole MIAME, Management of diadromous fish in their environment, OFB, INRAE, UPPA, Institut Agro, Rennes, France
3. U3E (Unité Expérimentale d'Ecologie et d'Ecotoxicologie Aquatiques), INRAE, OFB, Rennes, France
4. Service Conservation et gestion durable des espèces exploitées, OFB, U3E, France

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The Mont-Saint-Michel Bay

Bayeux Tapestry (1066-1082): scene showing the Norman army crossing a river flowing into the Bay…

… walking on beds of Salmon and eels

The Sélune River

- 85 km
- 1 083 km²
- ~57 000 inhabitants
- Agricultural catchment

Sources: BD Carthage 2017 et SAGE Sélune

Local migratory fish species

Sea lamprey
(*Petromyzon marinus*)

River lamprey
(*Lampetra fluviatilis*)

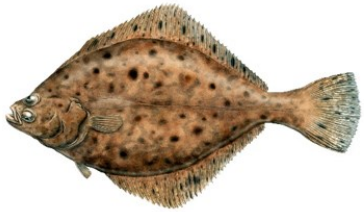
Atlantic salmon
(*Salmo salar*)

Sea trout
(*Salmo trutta*)

European eel
(*Anguilla anguilla*)

Thinlip mulet
(*Chelon ramada*)

Allis shad
(*Alosa alosa*)

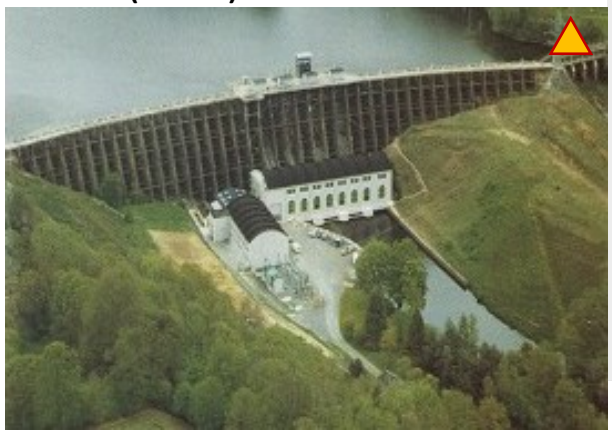


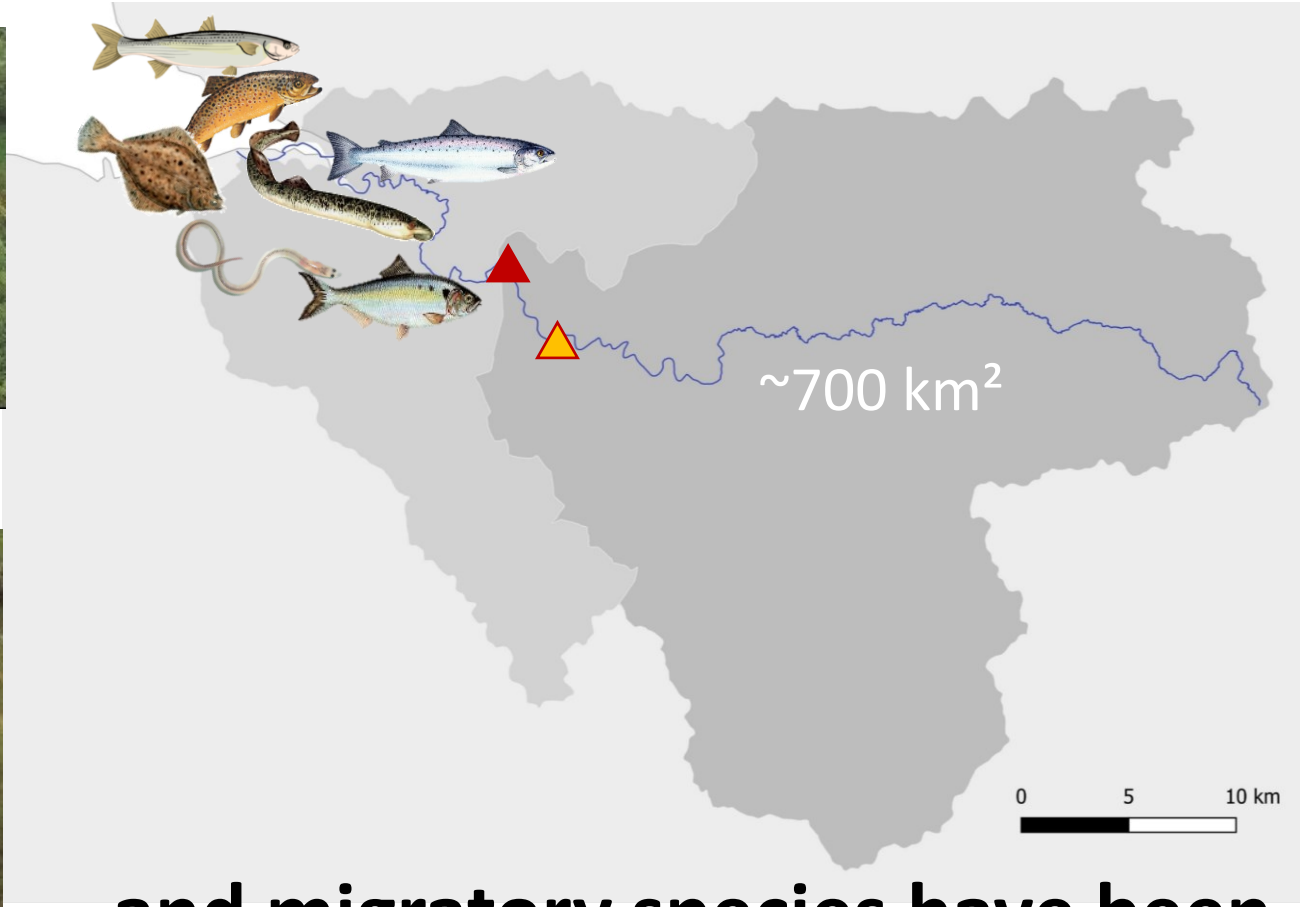
European flounder
(*Platichthys flesus*)

1920's: The Selune River was damned

Roche-qui-Boit (16m)

Vezins (36m)



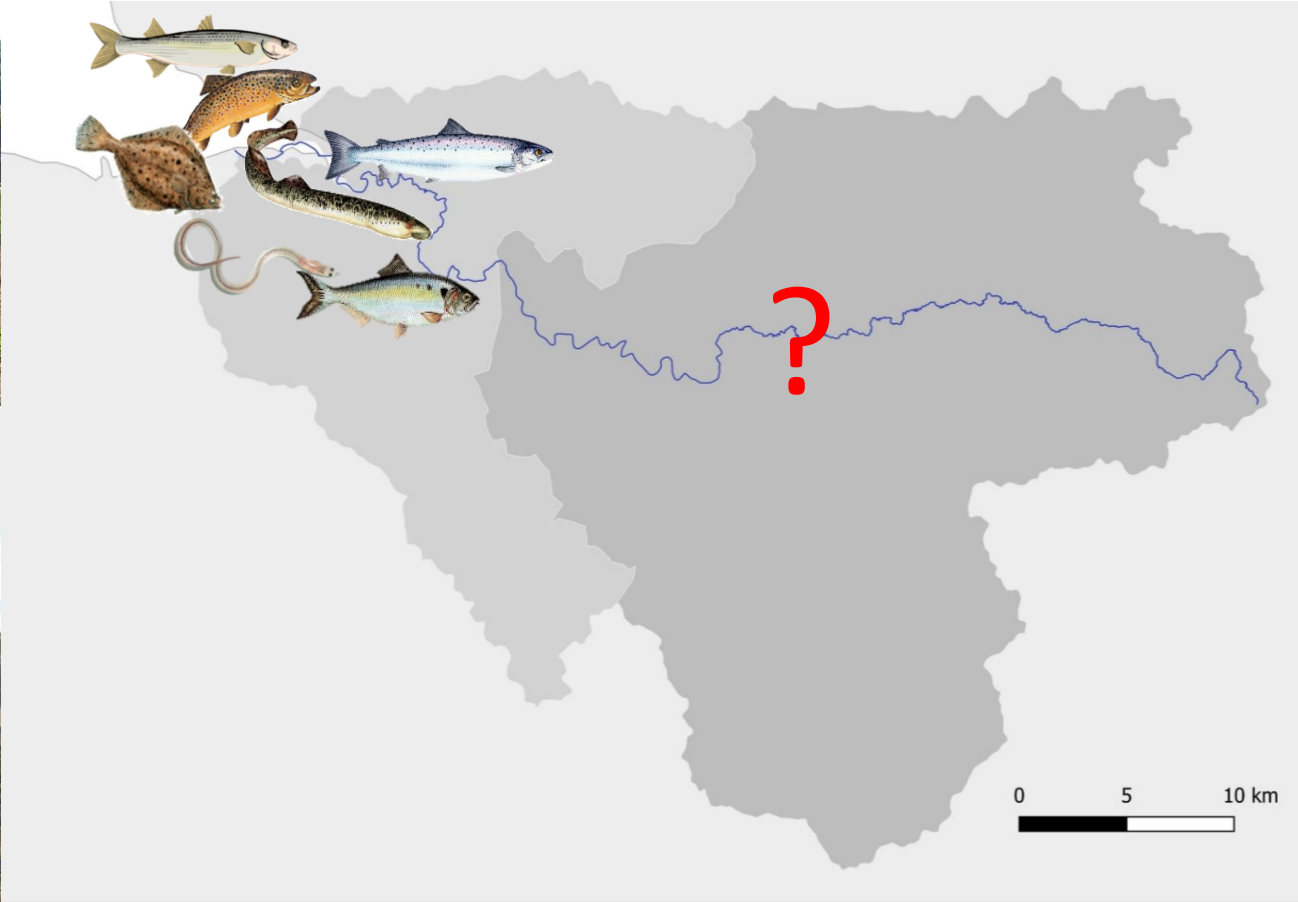


… and migratory species have been limited to downstream areas

2022 : The Sélune flows freely again!

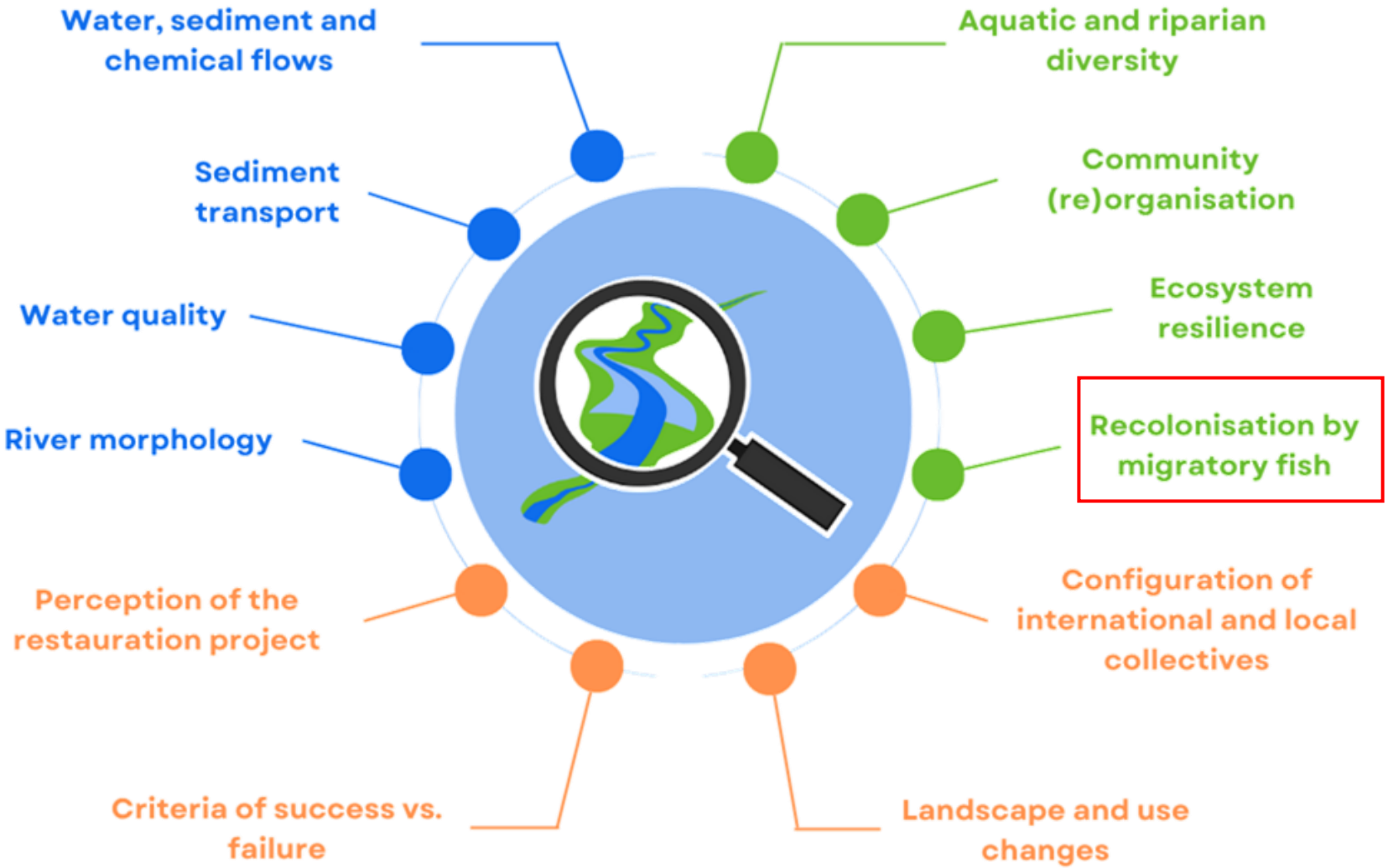
Roche-qui-Boit (16m)

Vezins (36m)



… so what happened then?

An extensive scientific program has been implemented



An extensive scientific program has been implemented

Water, sediment and chemical flows

Aquatic and riparian diversity

Tomorrow, 10:55:

Dam Removal – Large dams session

Ecological restoration of the Selune River (Normandy, France) through the removal of two large dams

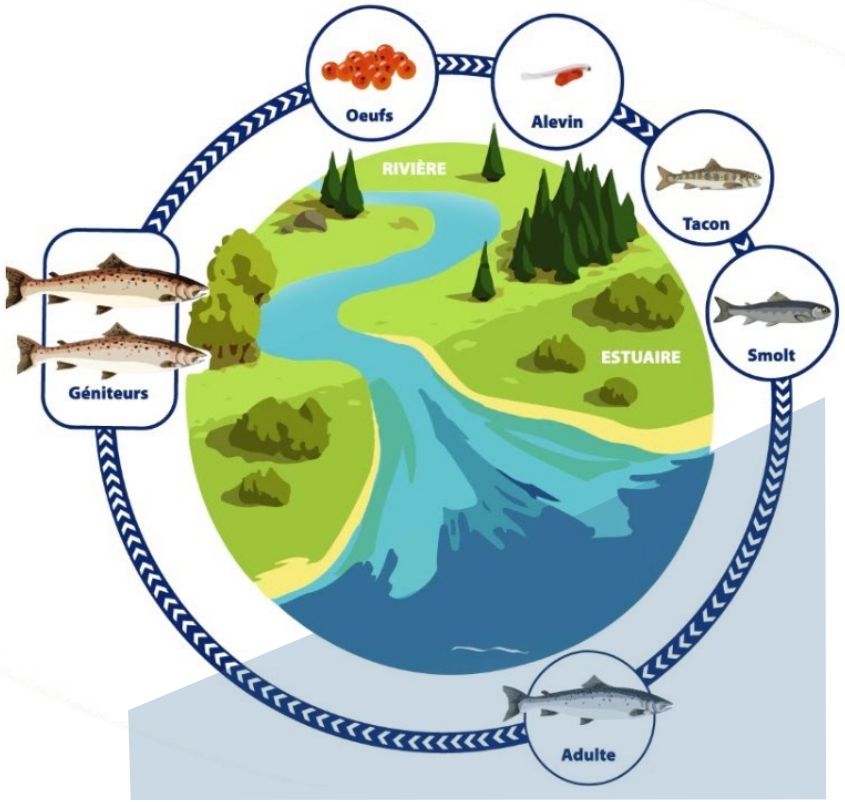
by Laura Soissons

programme-selune.com

Criteria of success vs. failure

Landscape and use changes

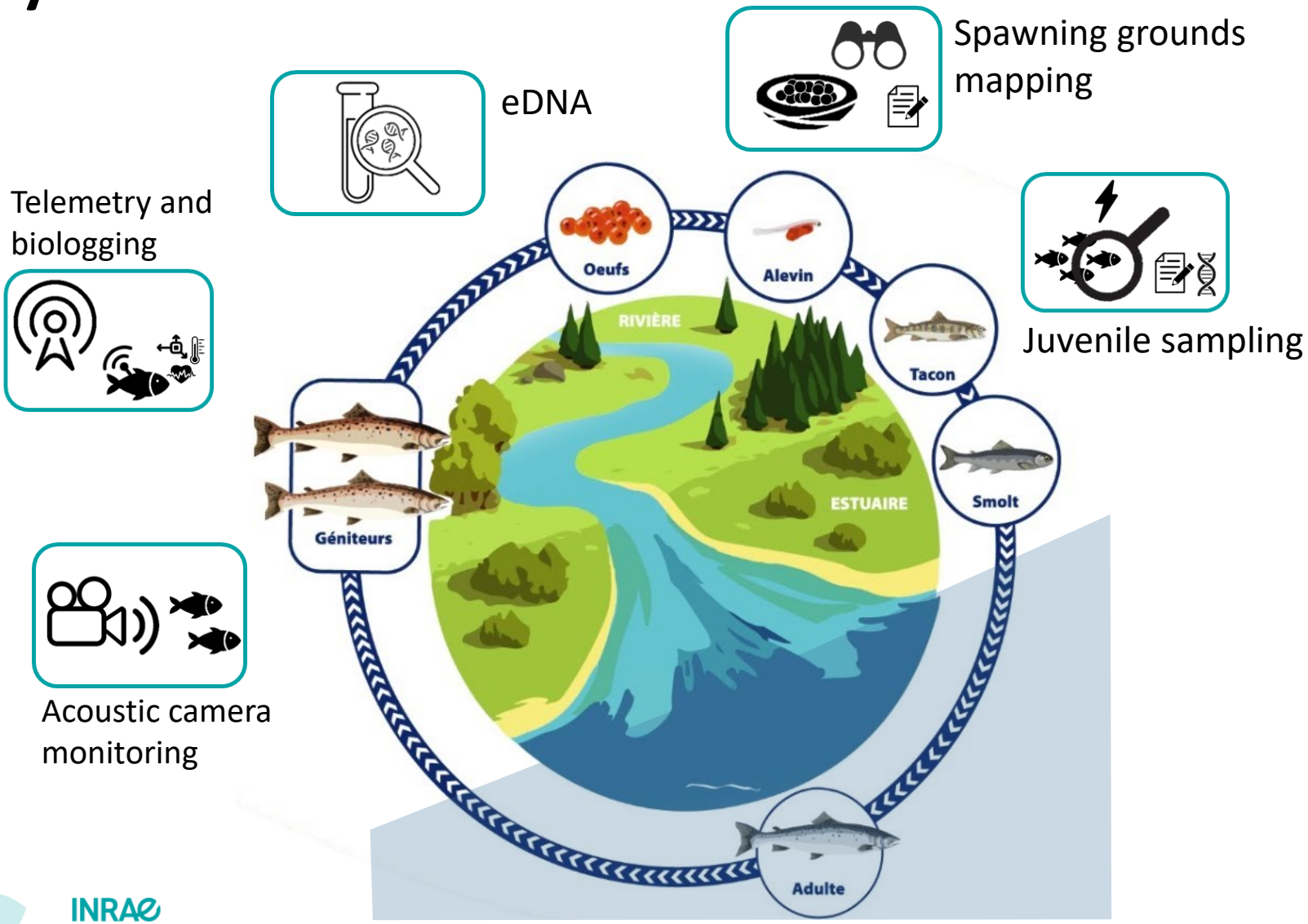
A toolbox to assess the spatio-temporal dynamics of Atlantic salmon recolonization



How fast?
How much?
Where?
Benefits for the population?
Short- and long-term response?

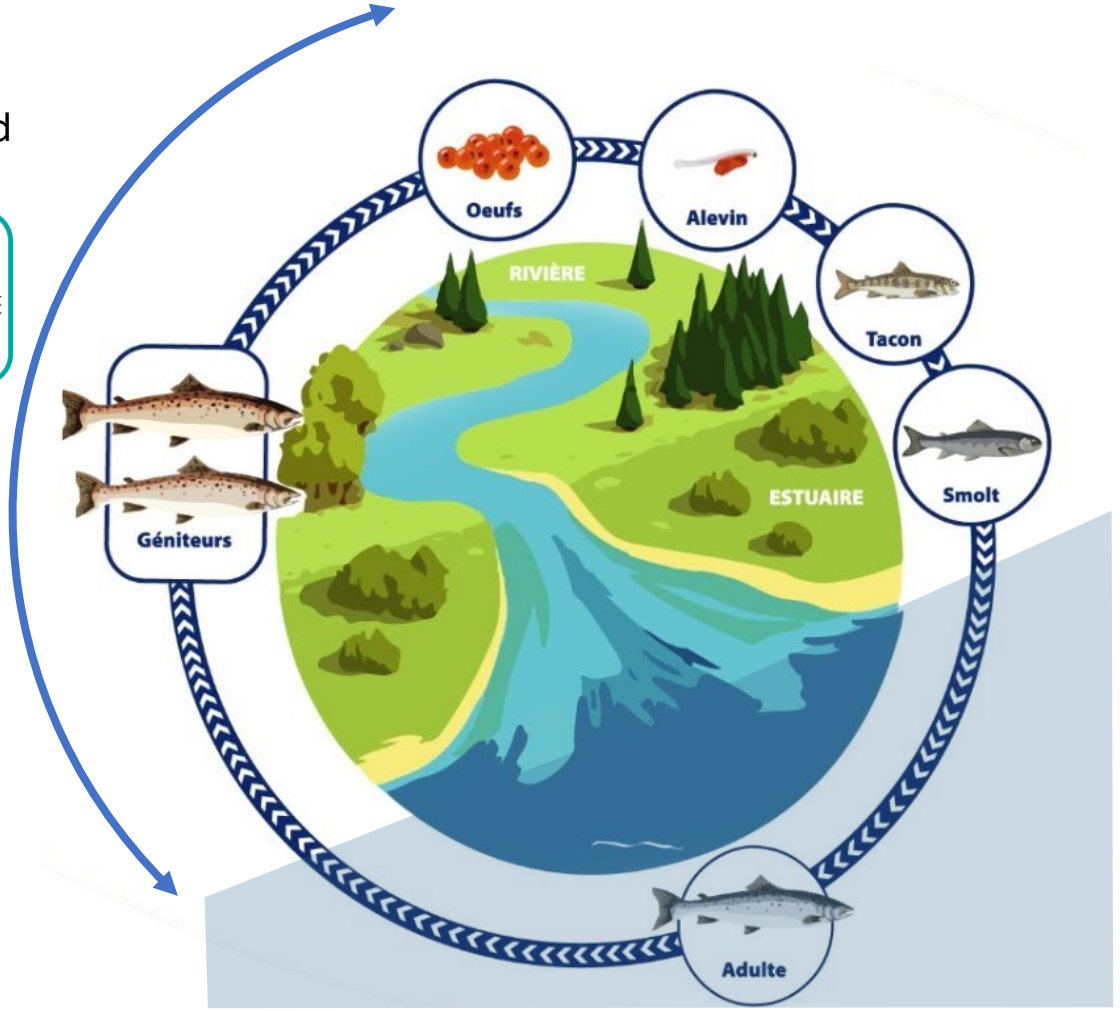
Very high expectations regarding the return of salmon (public decision-makers, managers and local populations) !

A toolbox to assess the spatio-temporal dynamics of Atlantic salmon recolonization



Telemetry and biologging

Telemetry and biologging



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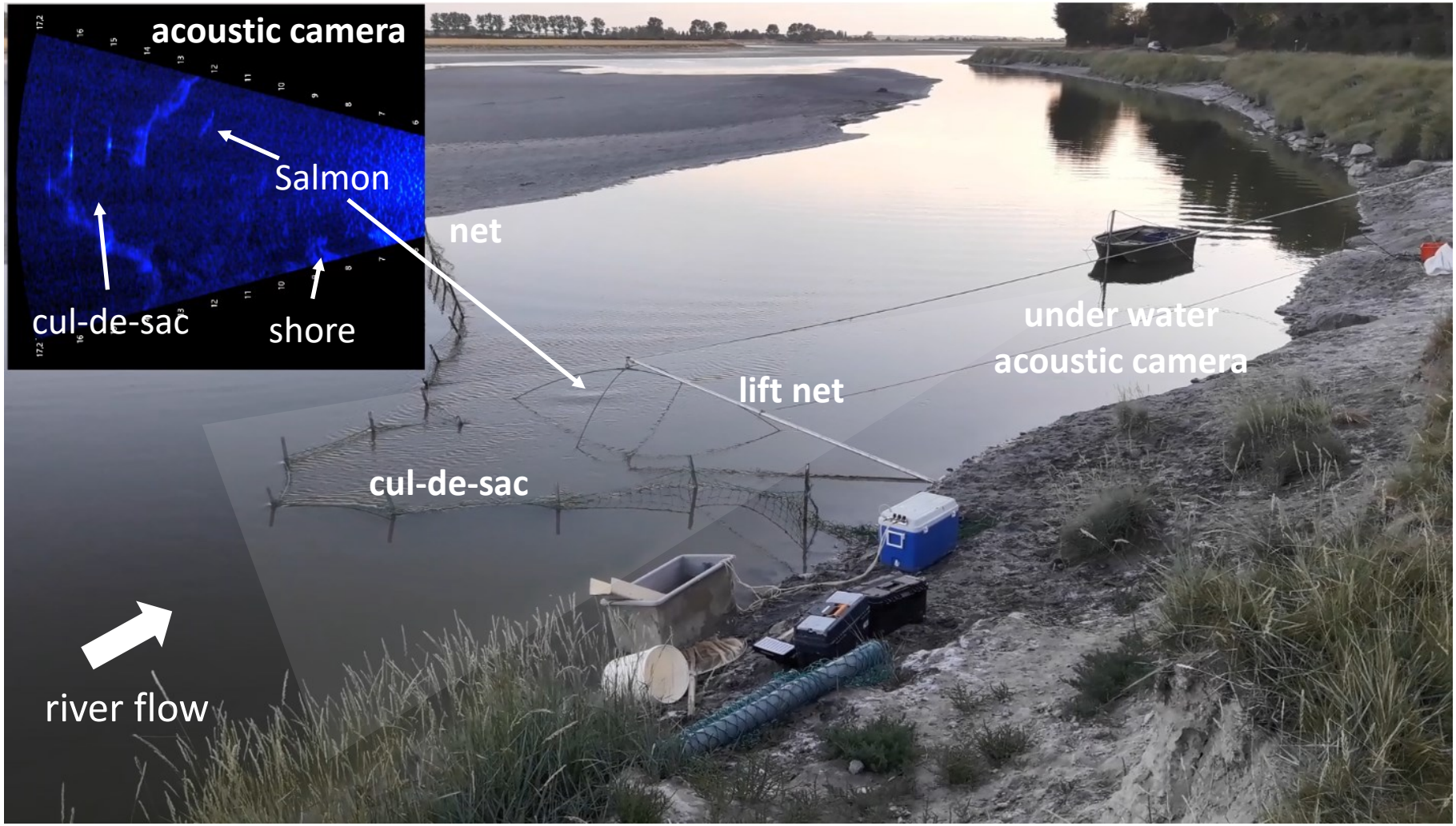
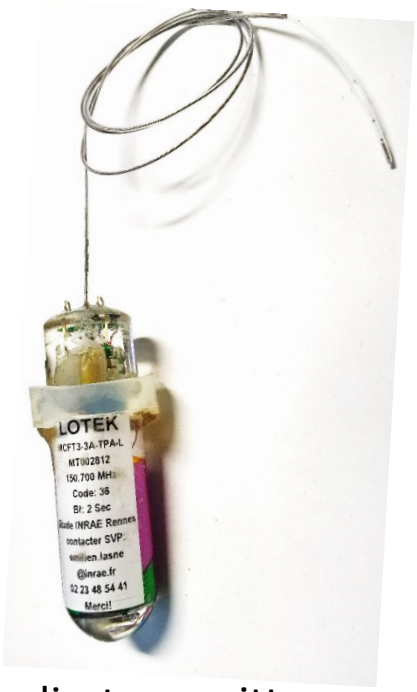


Telemetry and biologging



Radio-transmitter

+

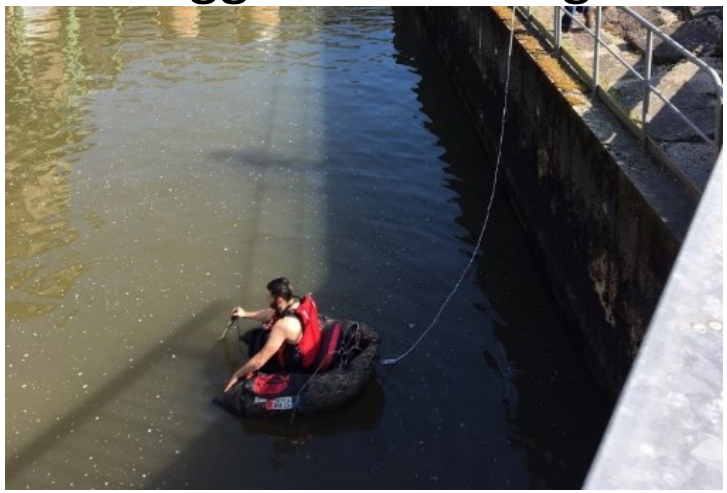
Biologger
(depth, activity, temperature)

1. Tagging

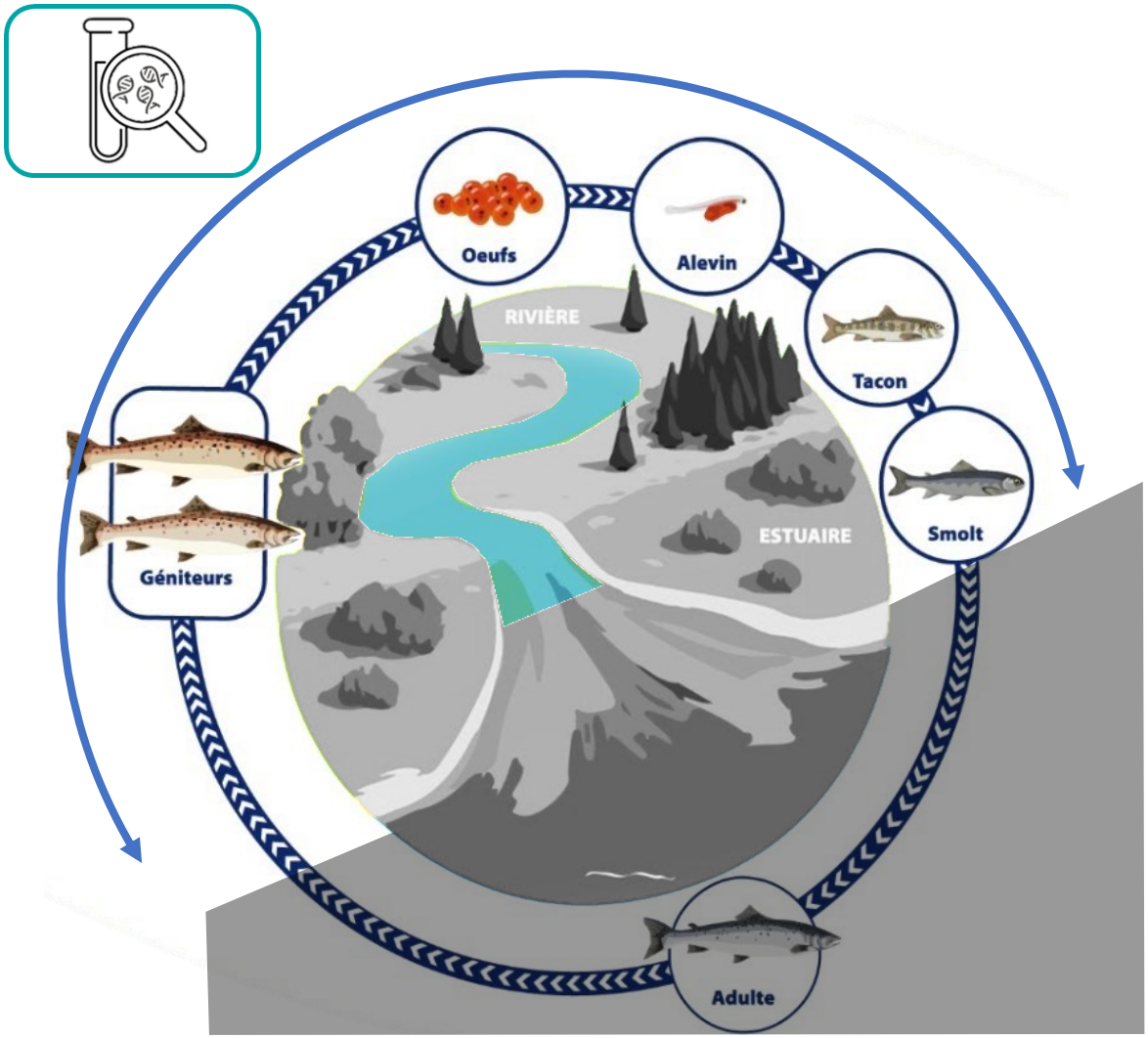
2. Fixed listening station

3. Mobile tracking

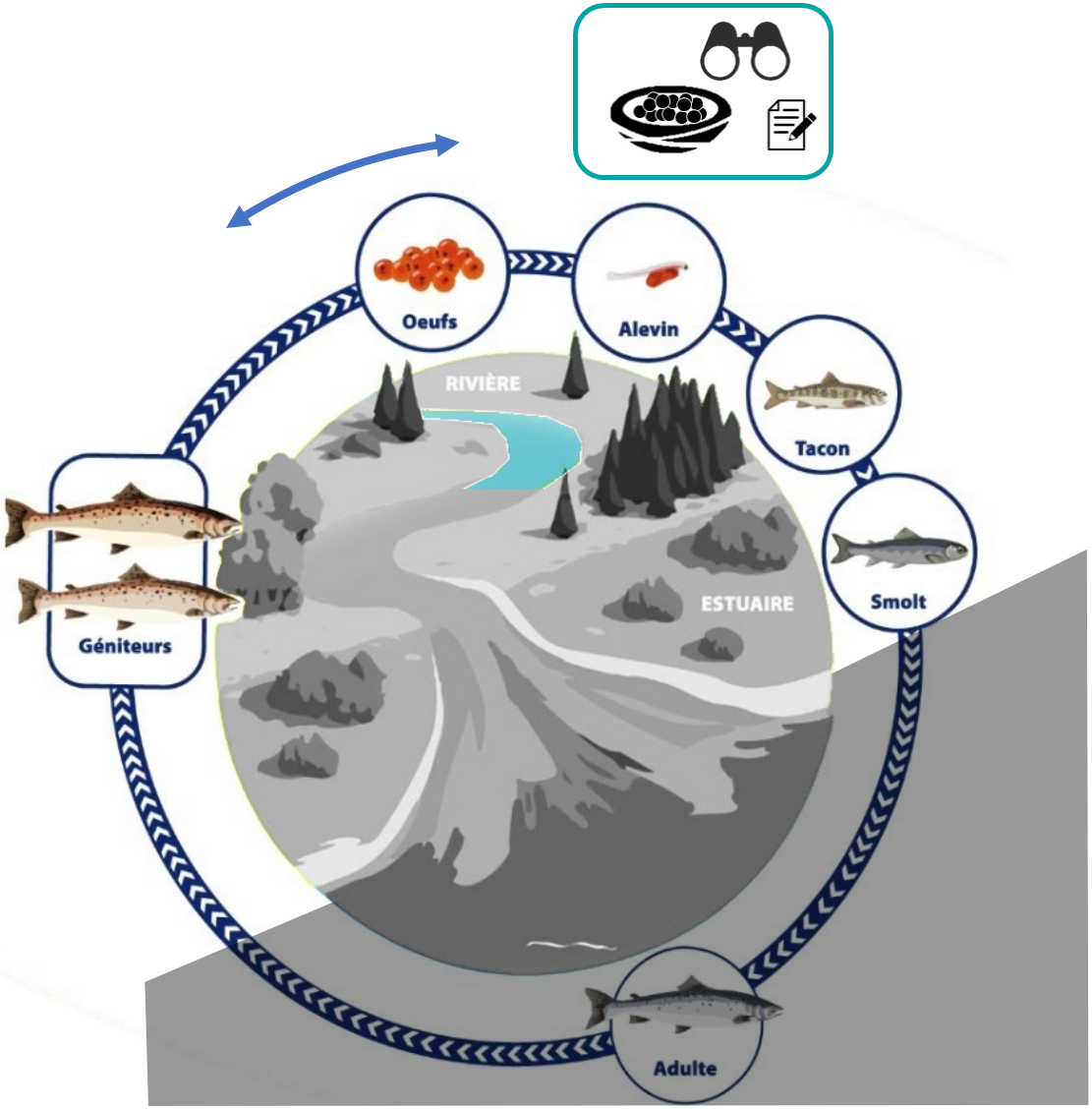
4. Biologger recovering



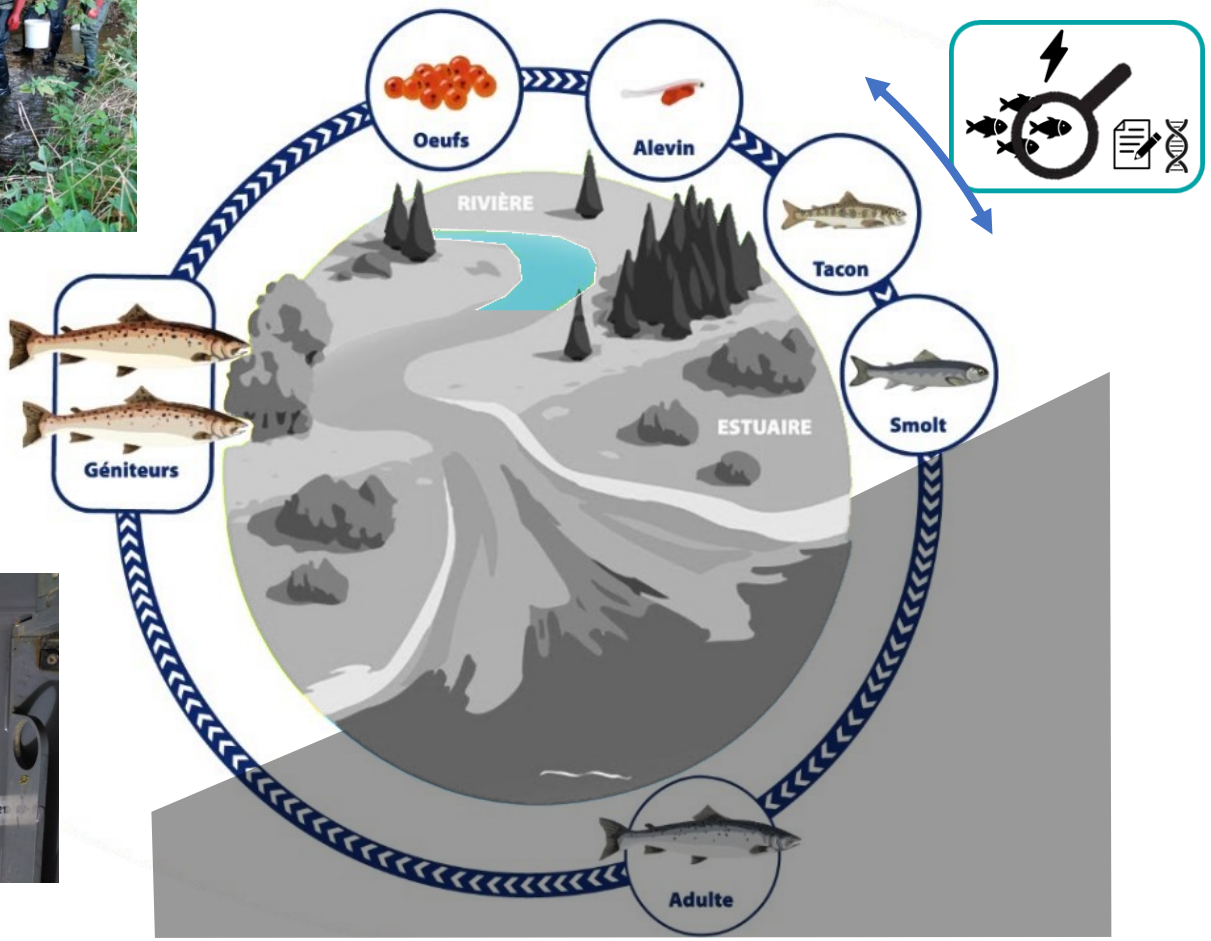
eDNA


Oeufs
Alevin
Tacon
Smolt
Adulte
Géniteurs
RIVIÈRE
ESTUAIRE

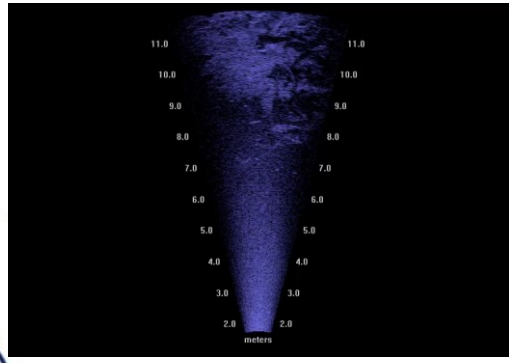
Spawning ground counts

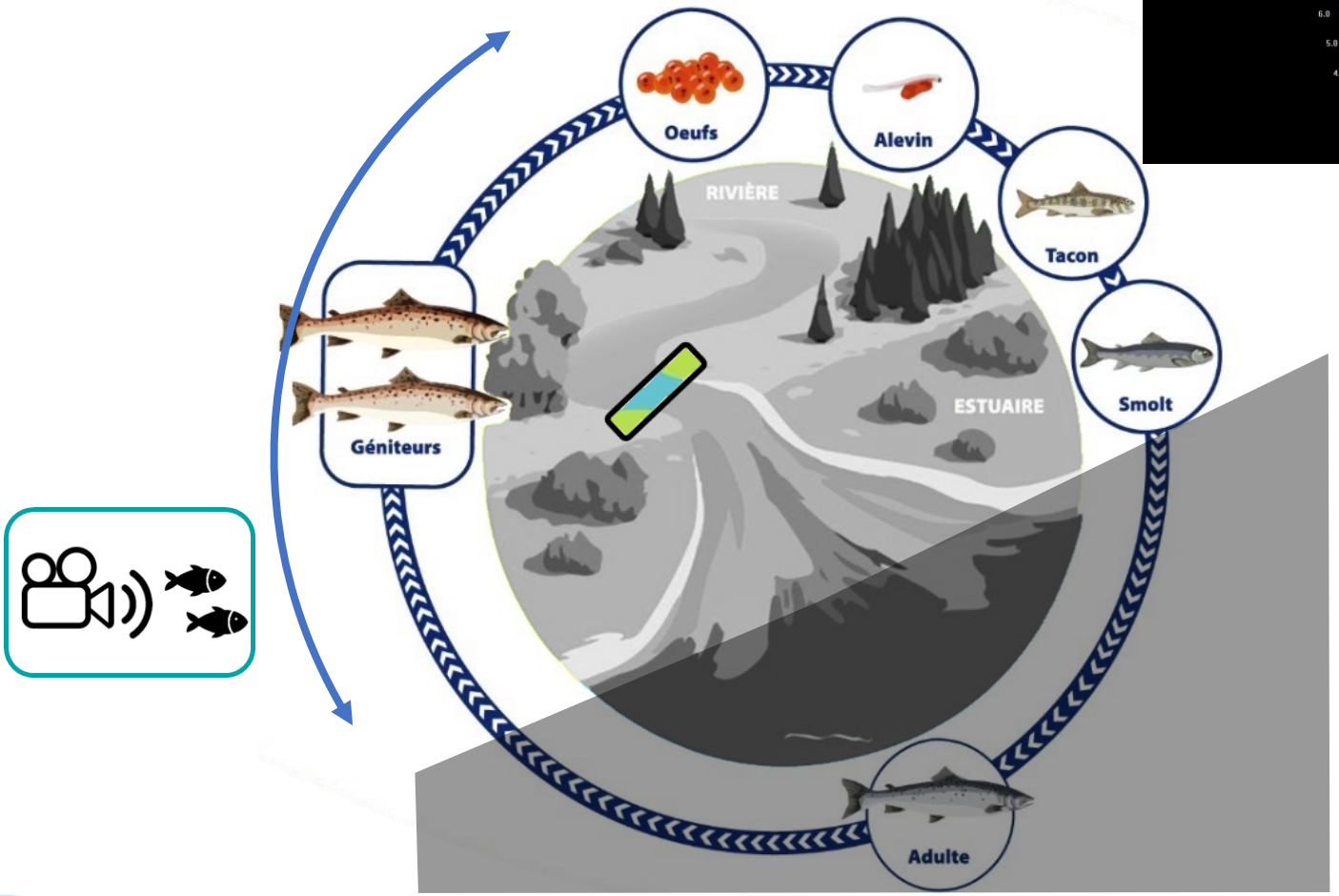


Sampling juveniles



Acoustic camera : monitoring fish passage

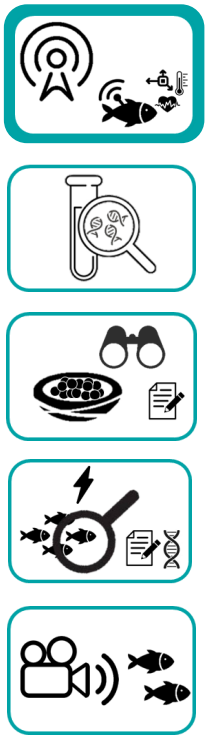


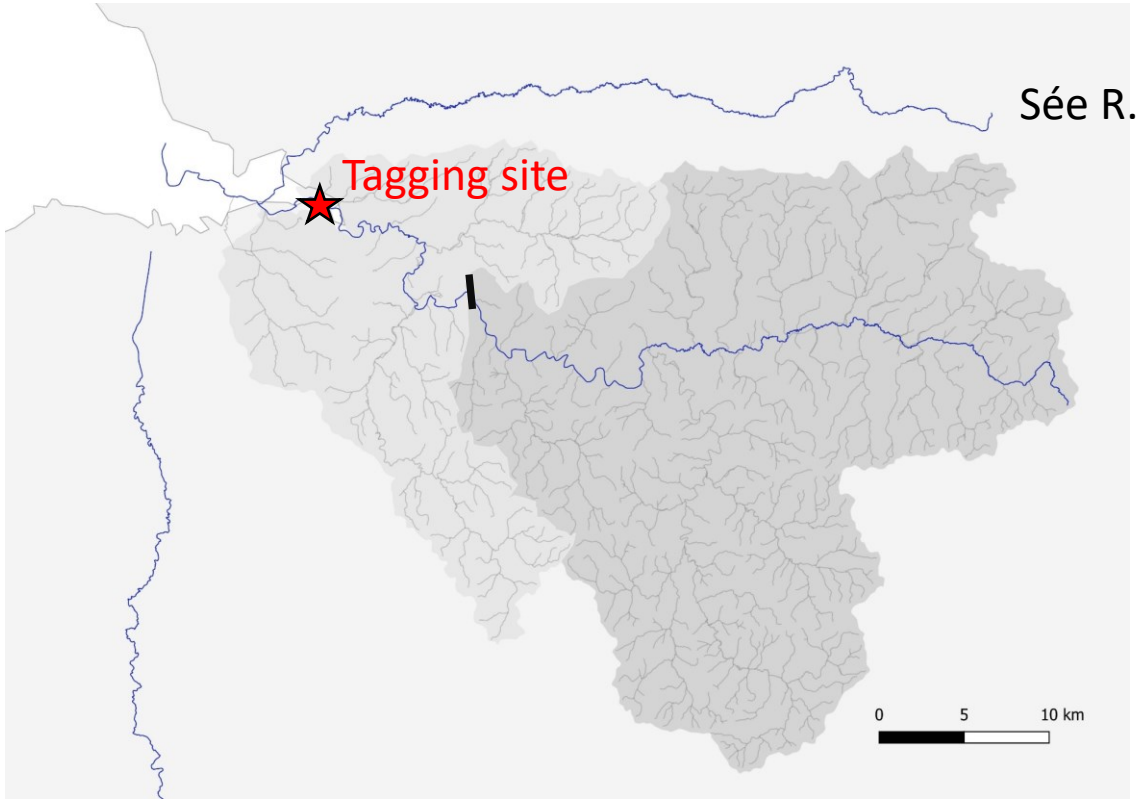


Monitoring salmon's come back

Before removal (2019)

18 to 34 ind. tagged each year



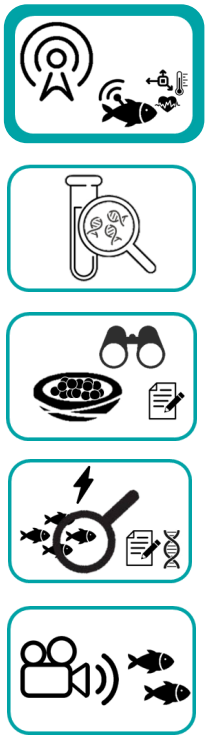


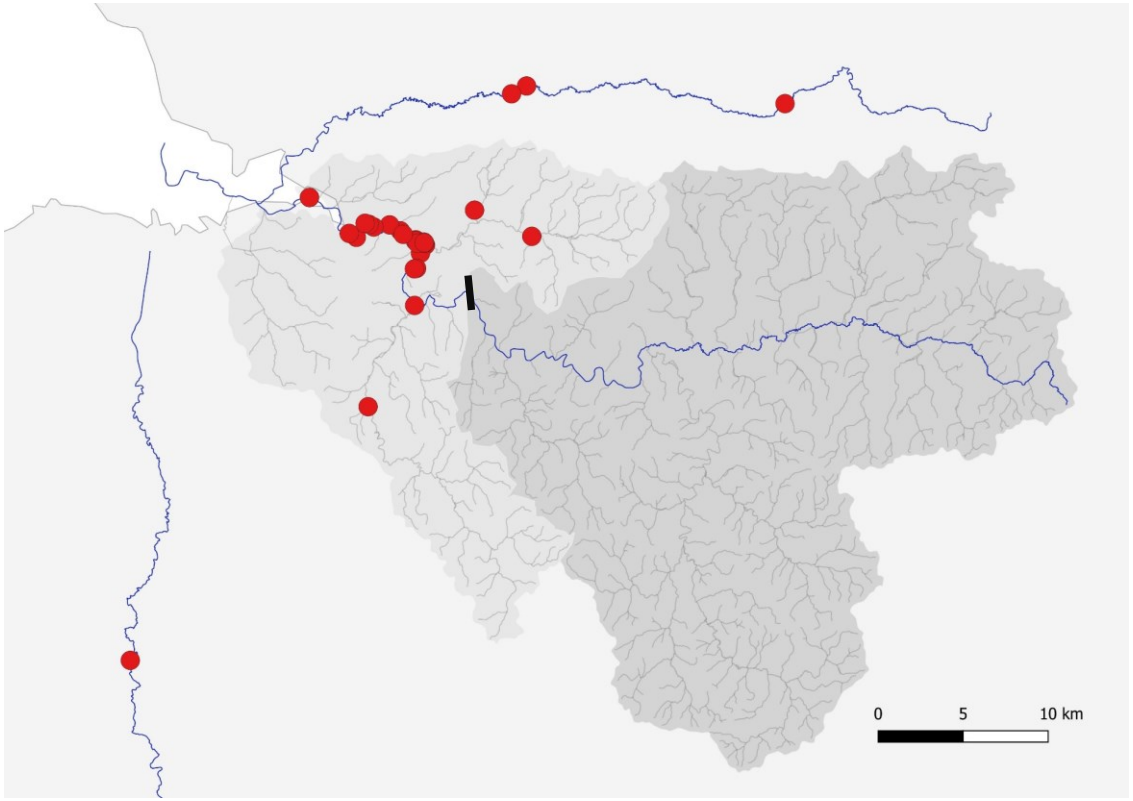
Couesnon R.

Monitoring salmon’s come back

Before removal (2019)

● Final position of fish
(dead or on spawning ground)

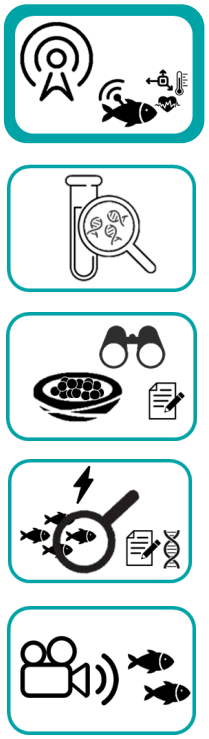


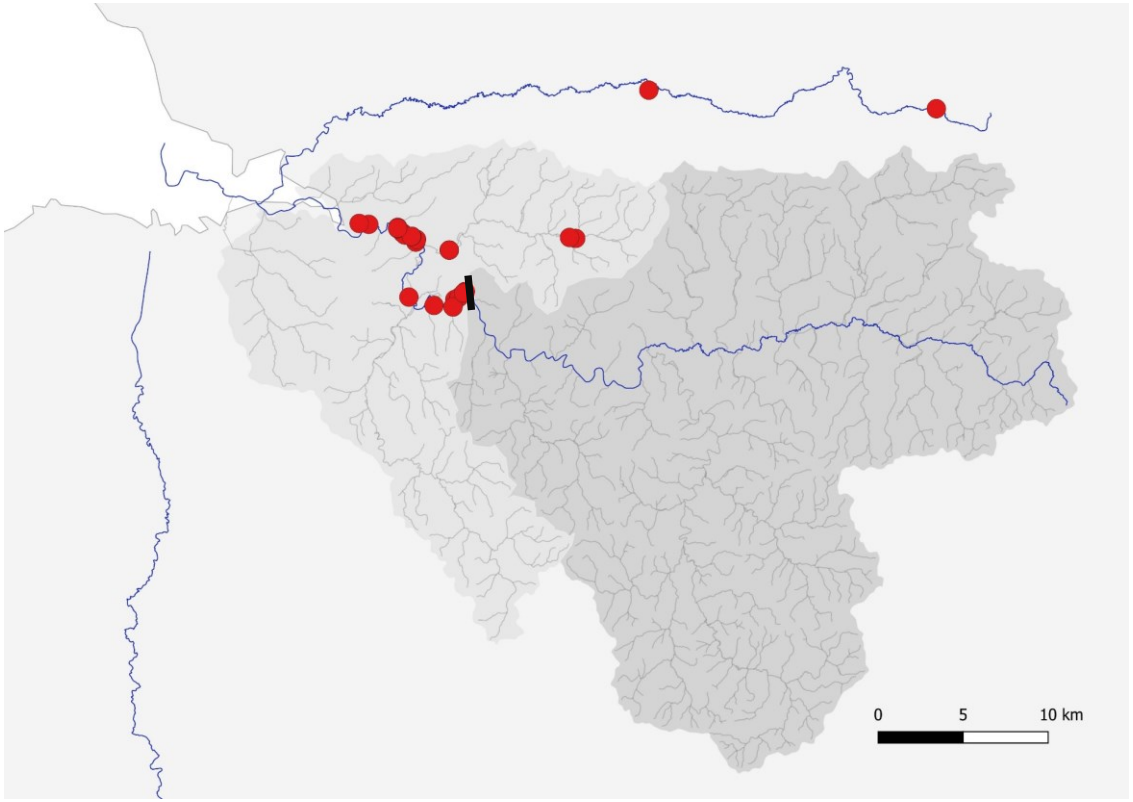


Monitoring salmon’s come back

Before removal (2020)

● Final position of fish
(dead or on spawning ground)

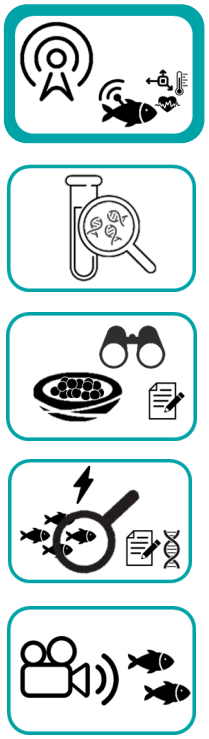


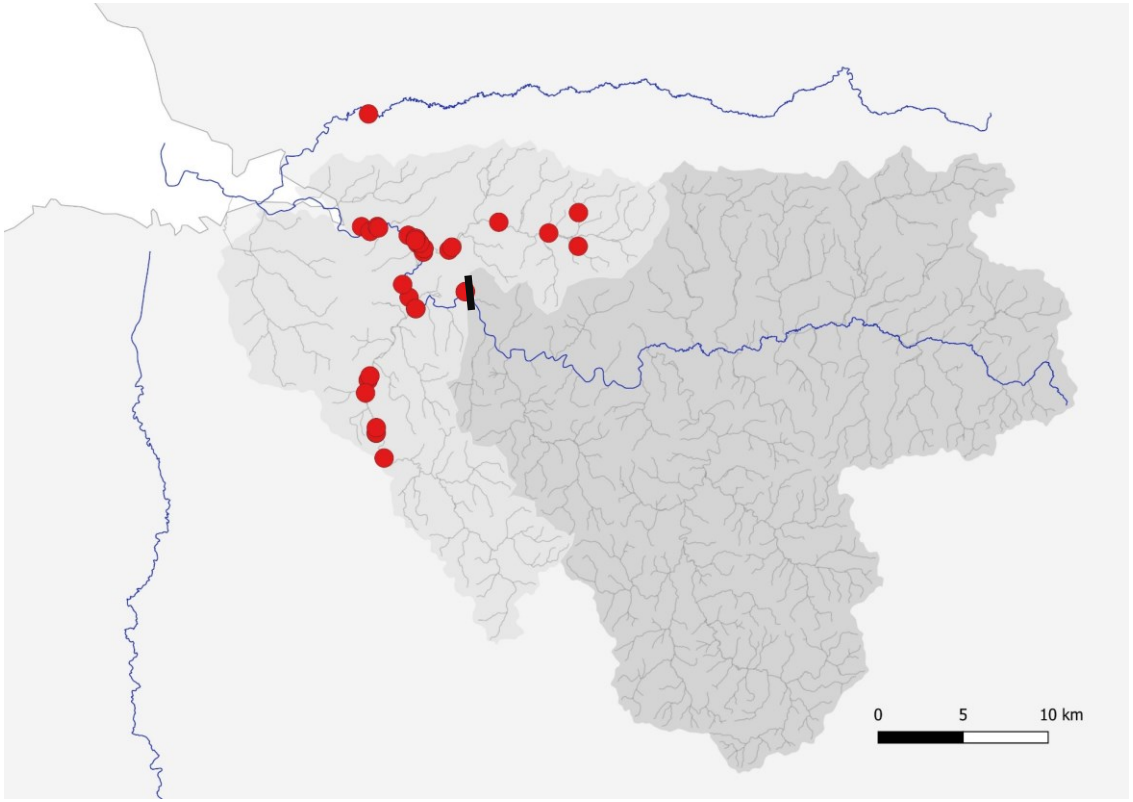


Monitoring salmon's come back

Before removal (2021)

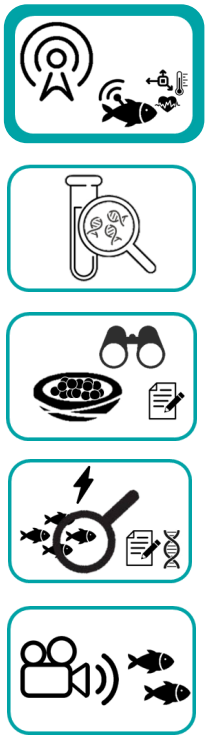
● Final position of fish
(dead or on spawning ground)





Monitoring salmon's come back

Before removal (2019-2021)



● Final position of fish
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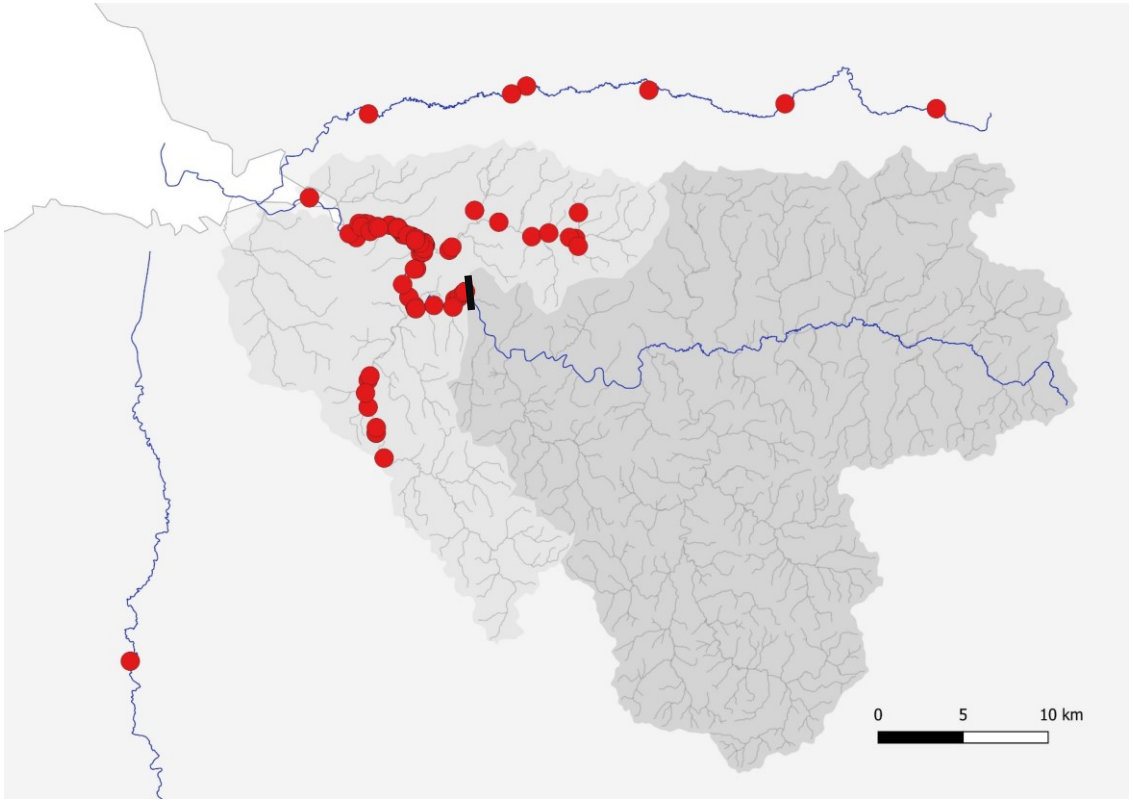
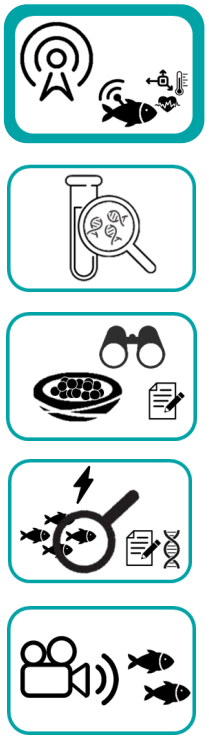


Monitoring salmon's come back

Before removal (2019-2021)



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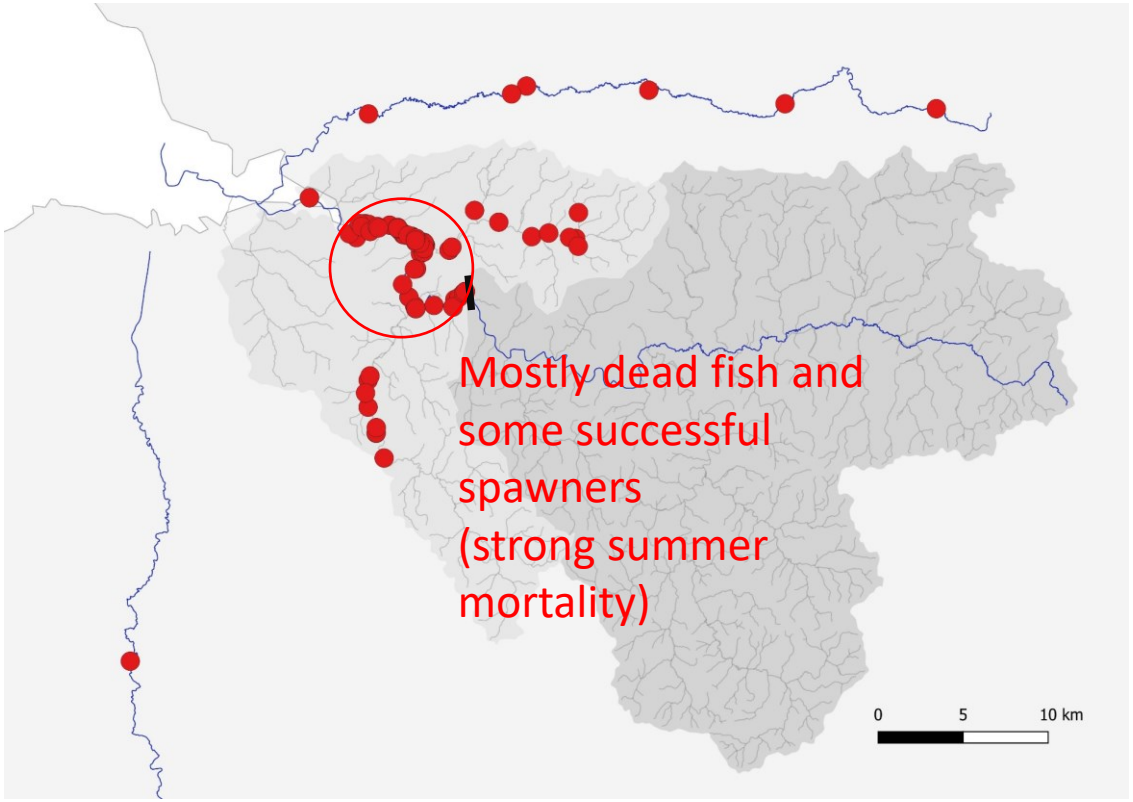
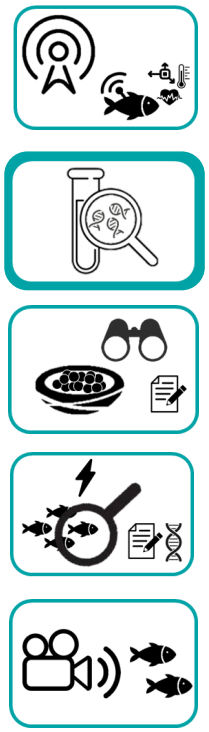
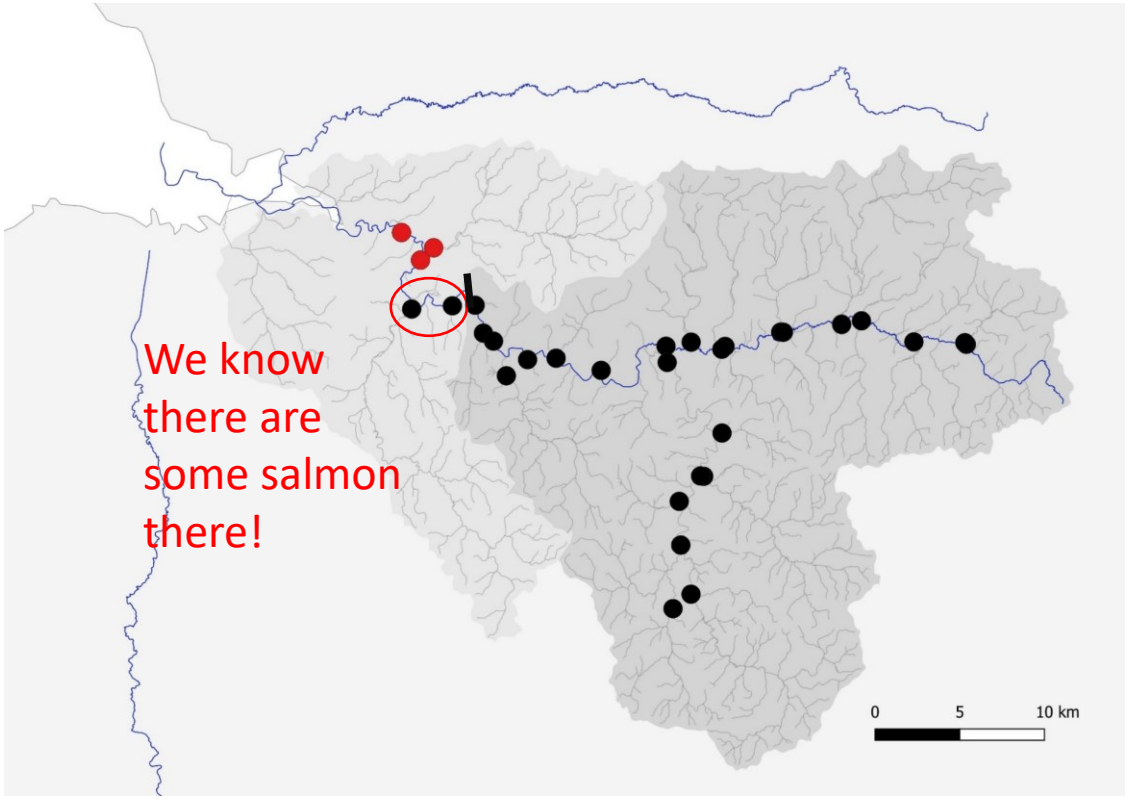


Monitoring salmon's come back

Before removal (spring+autumn 2021)

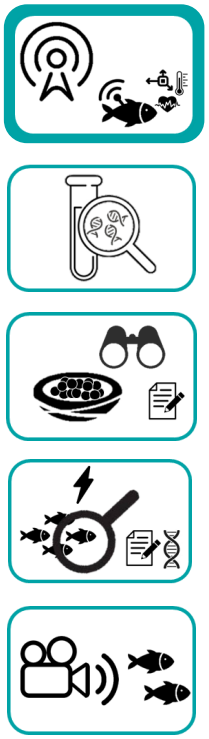
Sites prospected with ( ) or without ( ) salmon eDNA

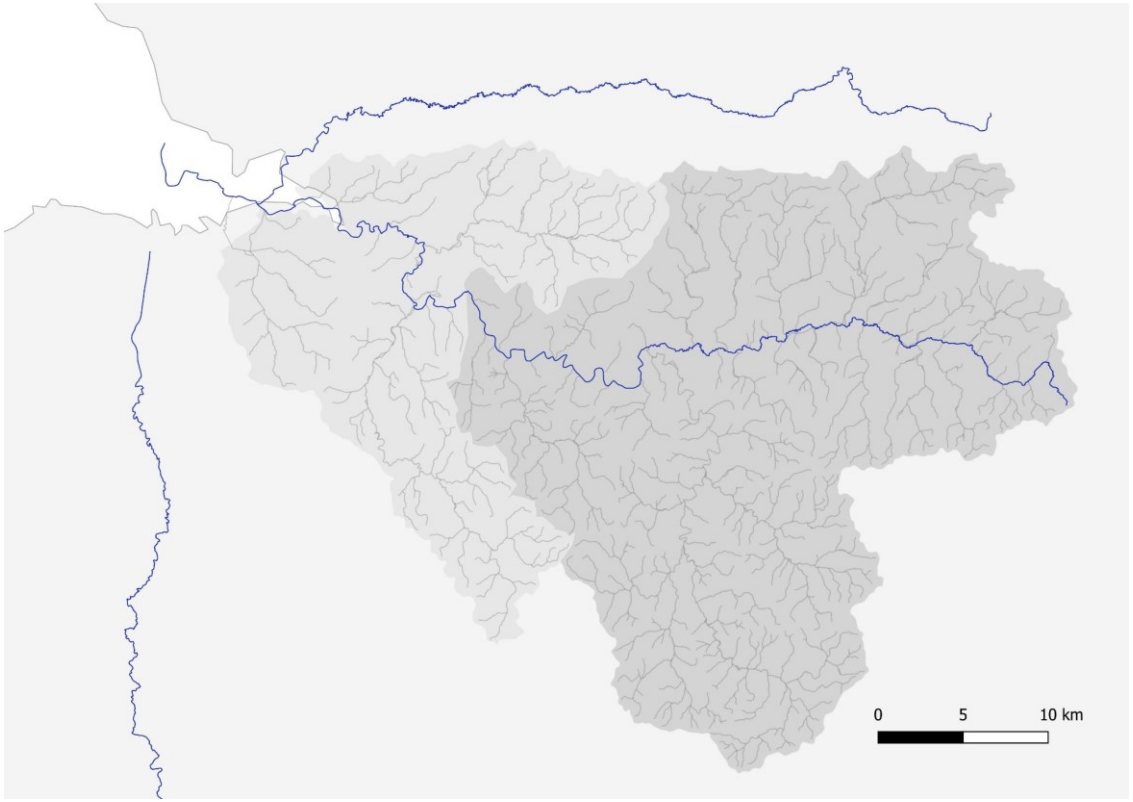




Monitoring salmon’s come back

During removal works (june-october 2022)





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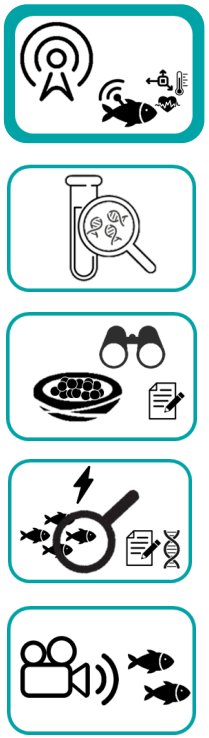
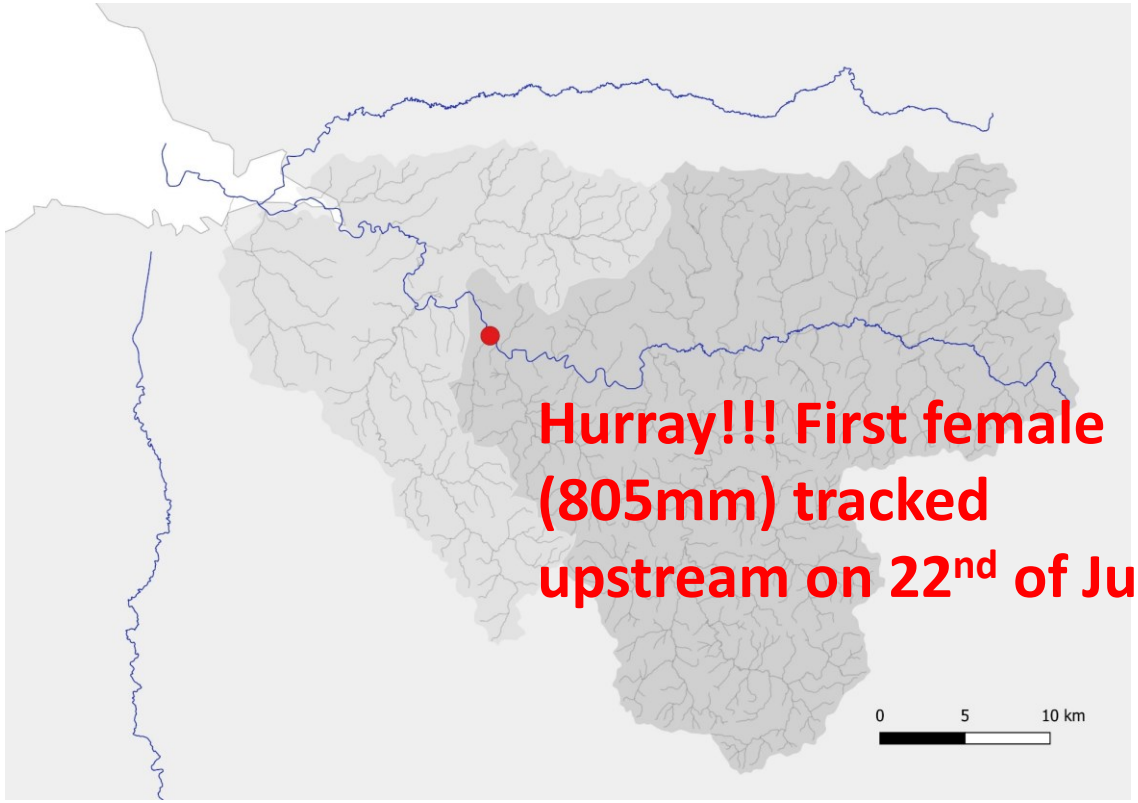




Monitoring salmon's come back

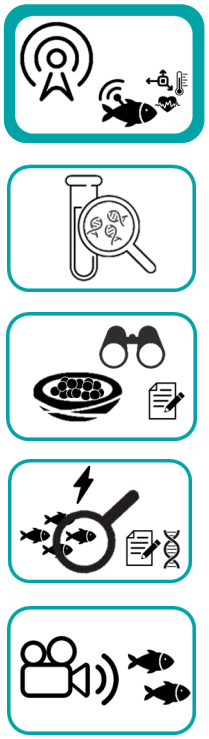
During removal works (june-october 2022)

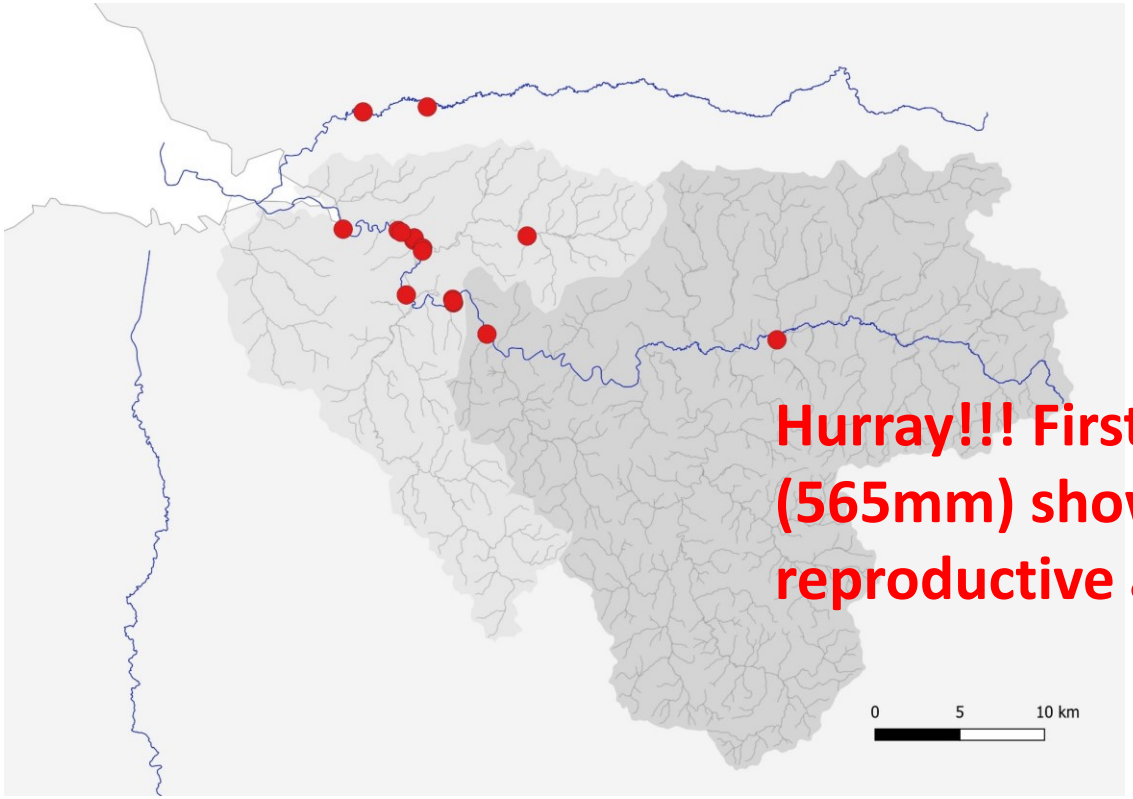
Boo-hoo!!!! It died in early August (still a mystery)

Monitoring salmon's come back

Just after removal (winter 2022-2023)

Final position of fish
(dead or on spawning ground)

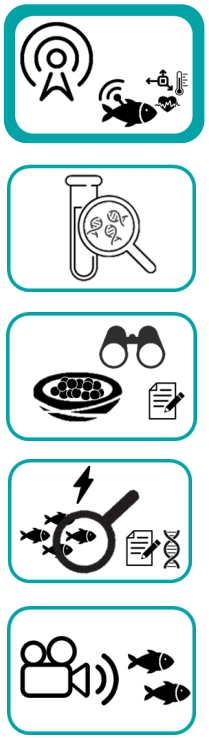


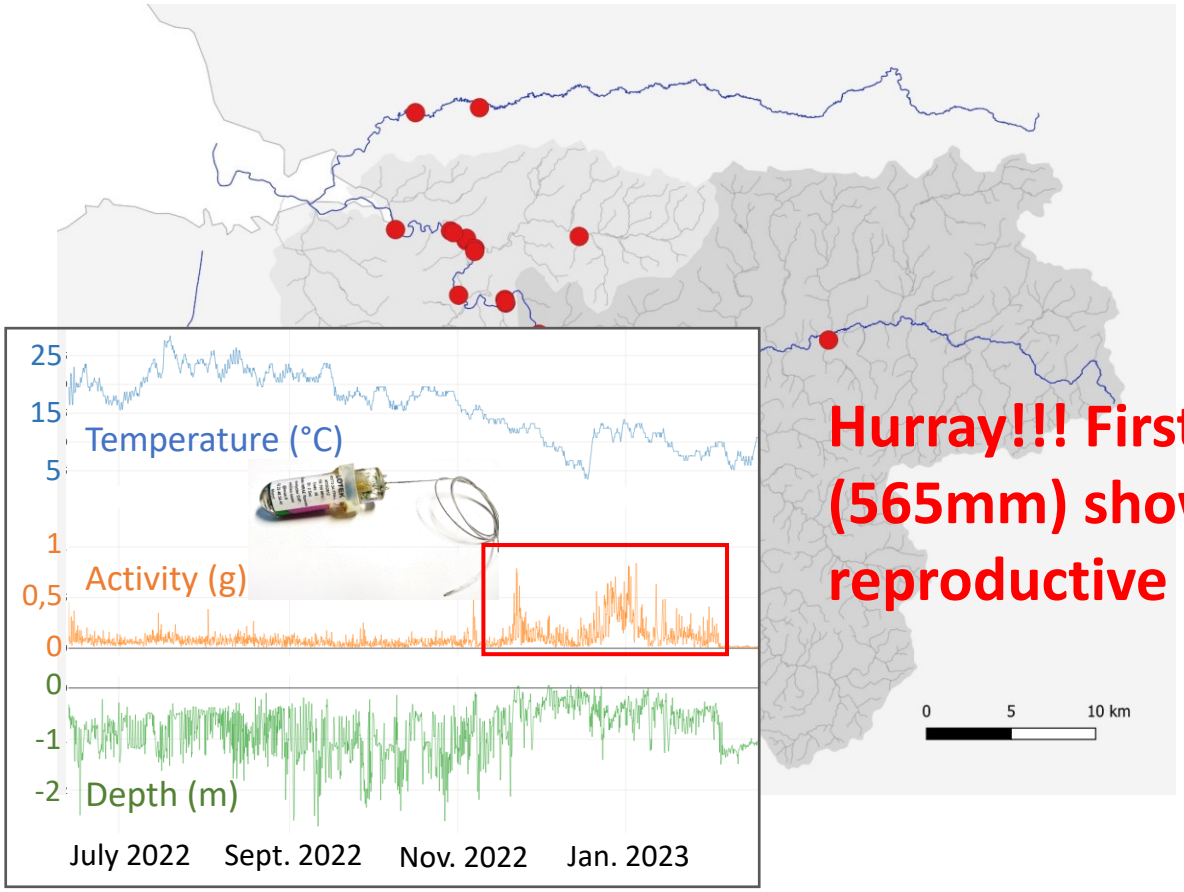


Hurray!!! First male (565mm) showing reproductive activity

Monitoring salmon's come back

Just after removal (winter 2022-2023)



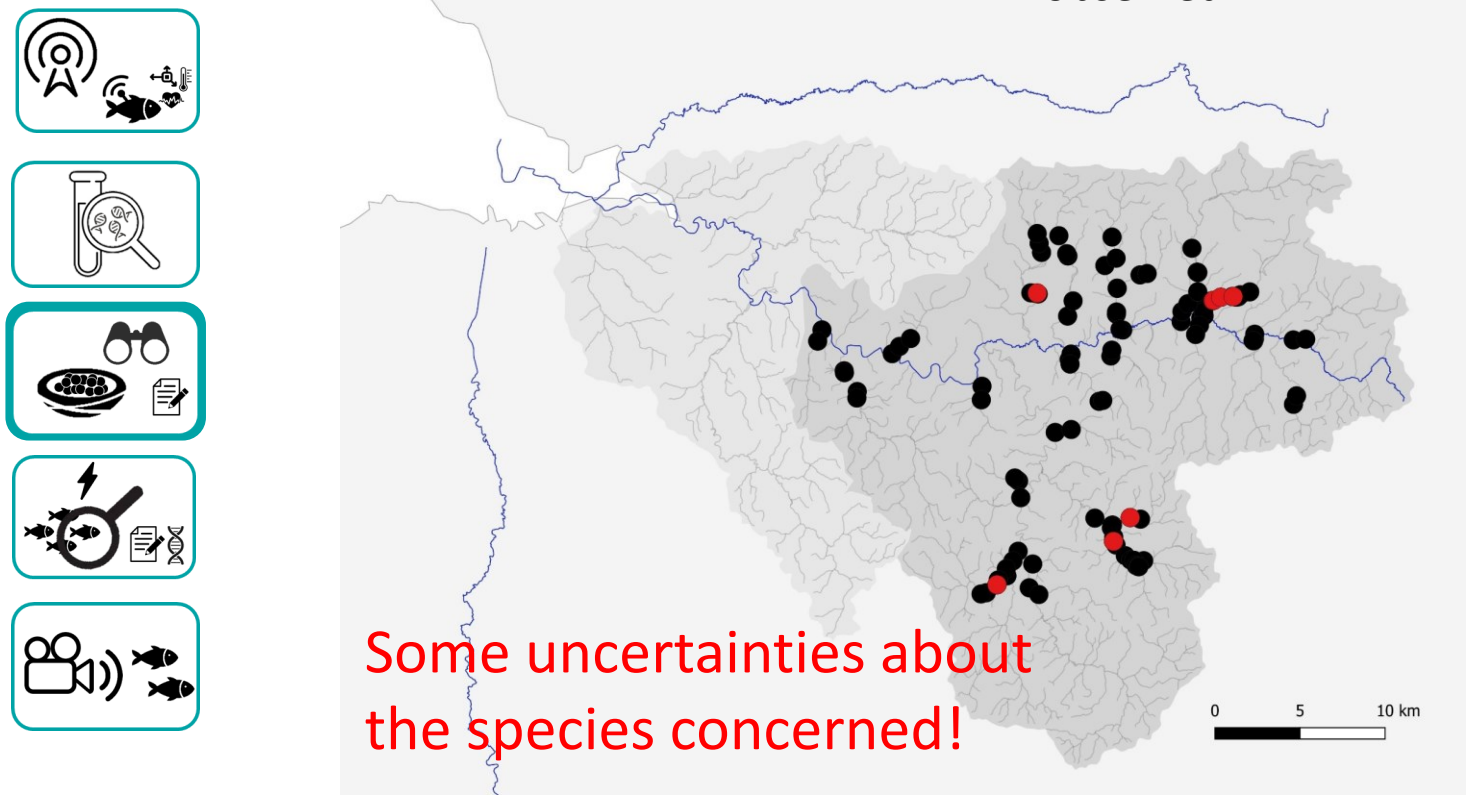


Hurray!!! First male (565mm) showing reproductive activity

Monitoring salmon's come back

Just after removal works (winter 2022-2023)

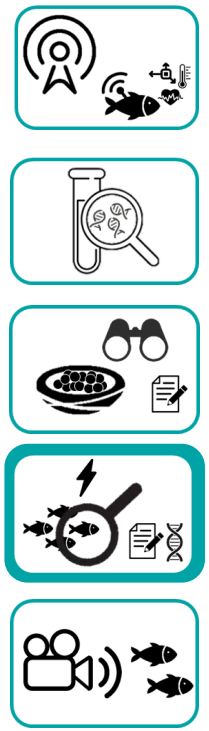
Suitable area prospected with ( ) or without ( ) spawning ground observed

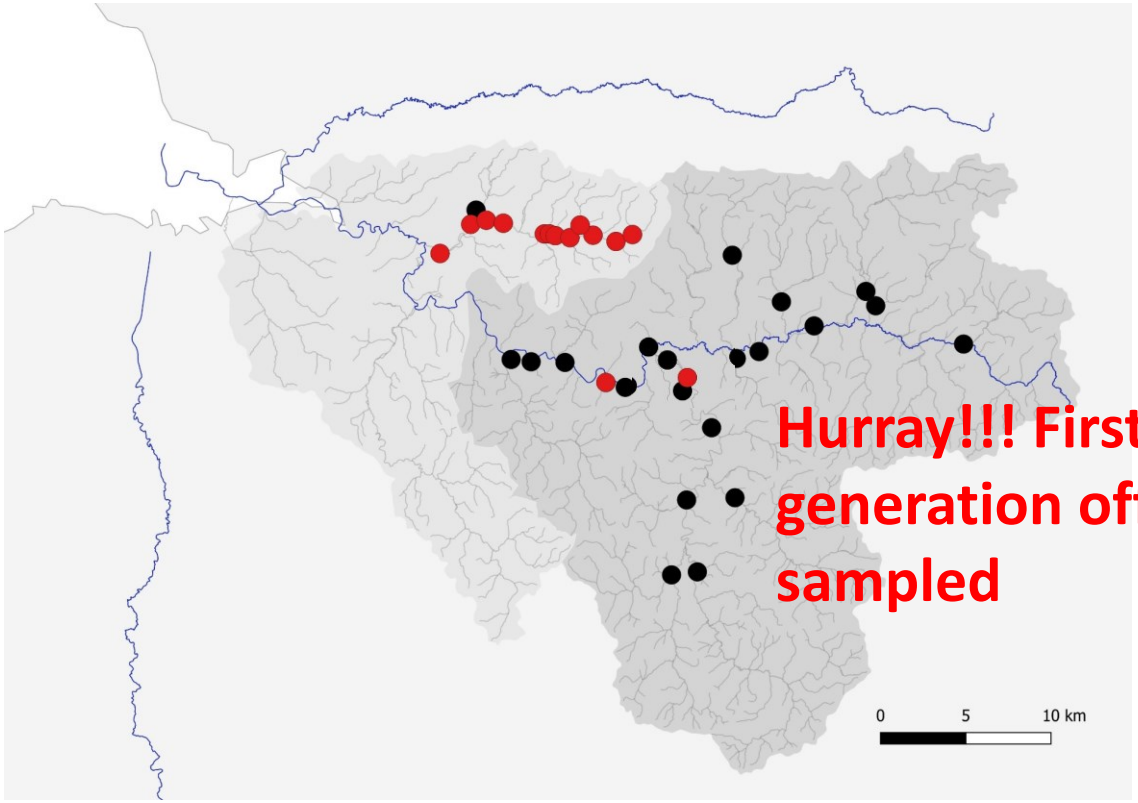


Monitoring salmon's come back

The year after (autumn 2023)

Suitable area prospected with (●)
or without (●) juveniles observed



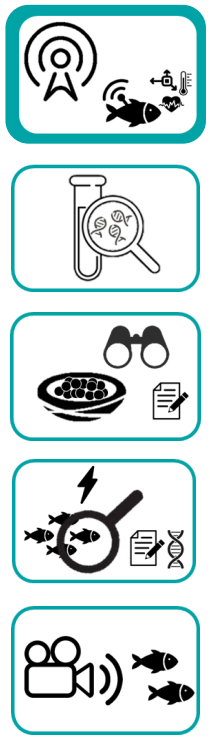


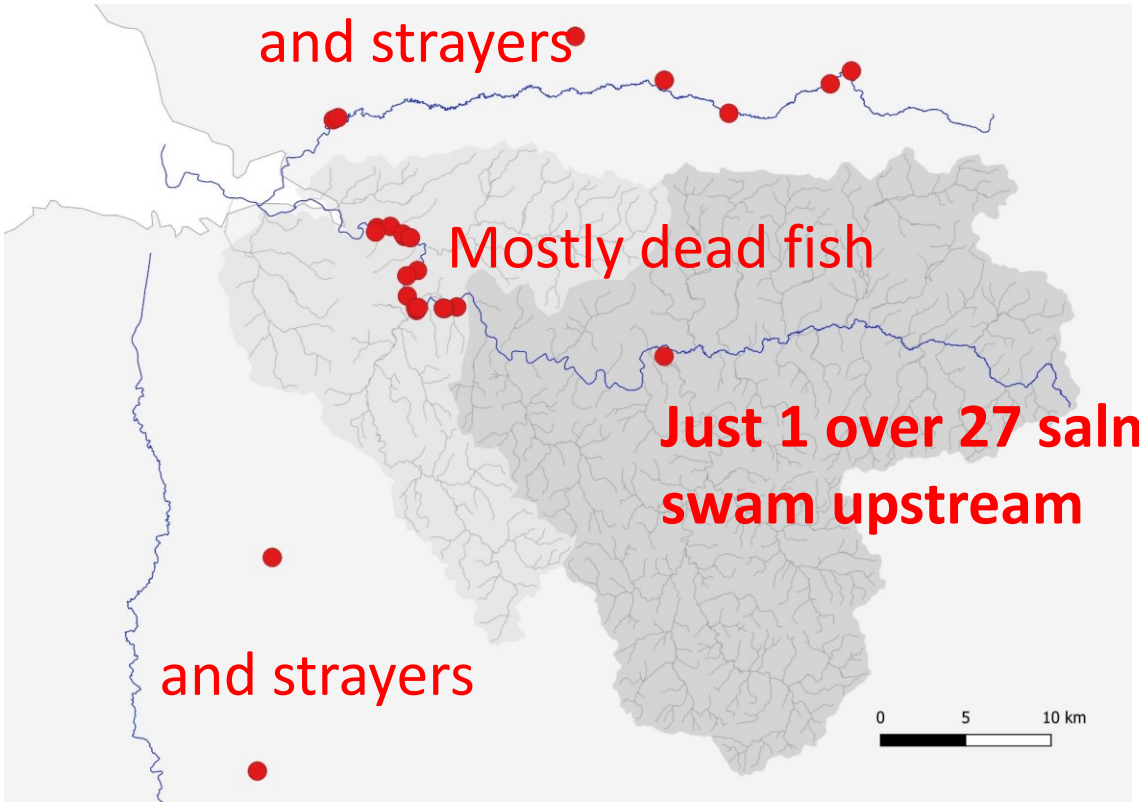
Hurray!!! First generation offspring sampled

Monitoring salmon’s come back

The year after (winter 2023)

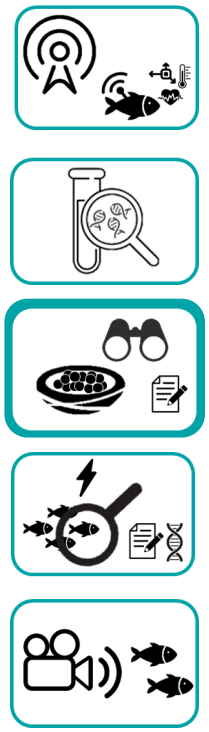
● Final position of fish
(dead or on spawning ground)

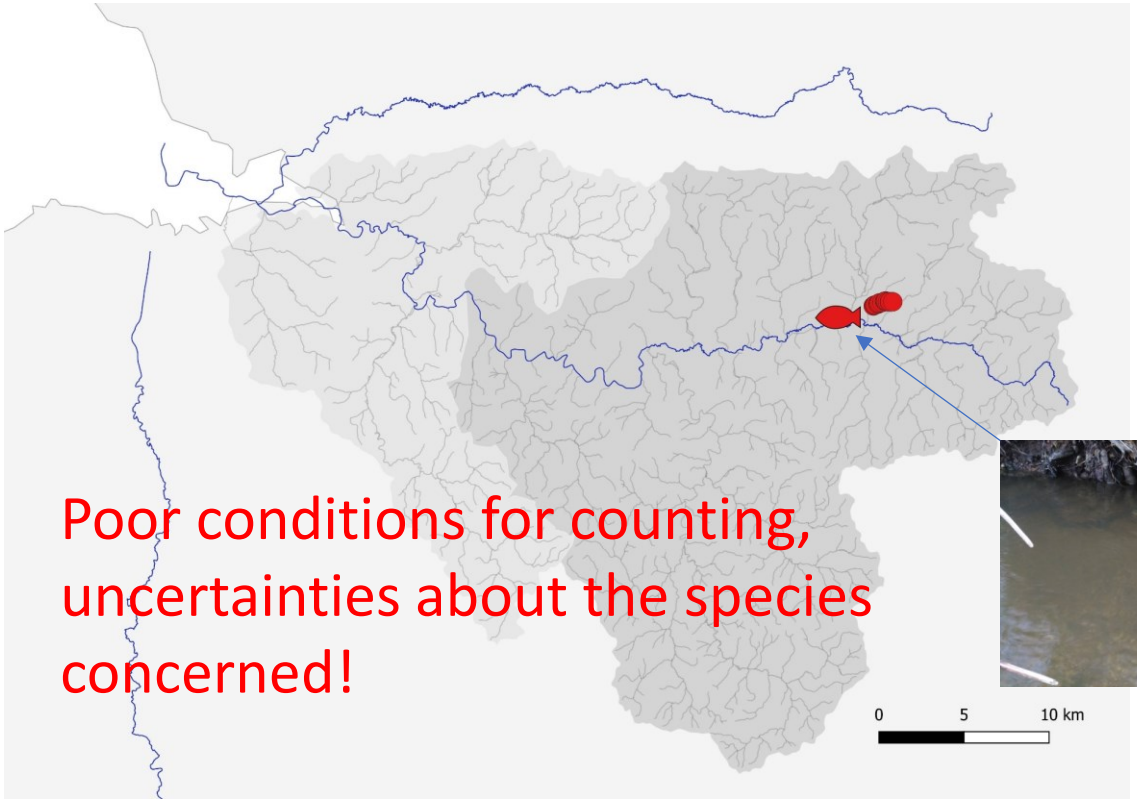




Monitoring salmon's come back

The year after (winter 2023-2024)





Take home message

A combination of complementary tools is useful (variable reliability)

Salmon immediately colonized the opened streaches

But at a low intensity

Environmental conditions are not yet stabilized (turbidity, sediments)

Context of regional Salmon demographic decline

Factors other than connectivity affect populations: Climate change? Marine conditions? Habitat quality? Alien predators?

We need a holistic approach to population management

And now?

Routine monitoring (eDNA, juvenile sampling, and maybe spawning ground counts)

Telemetry monitoring is paused (informative but costly!)

Acoustics and genetics will provide information on demogenetics in the longer term

A toolbox to assess the spatio-temporal dynamics of Atlantic salmon recolonization after dam removal on the Sélune River (Normandy, France)

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Thanks!

FREEFLOW 2024 | April 15-17, 2024 | Oosterpoort, Groningen, The Netherlands