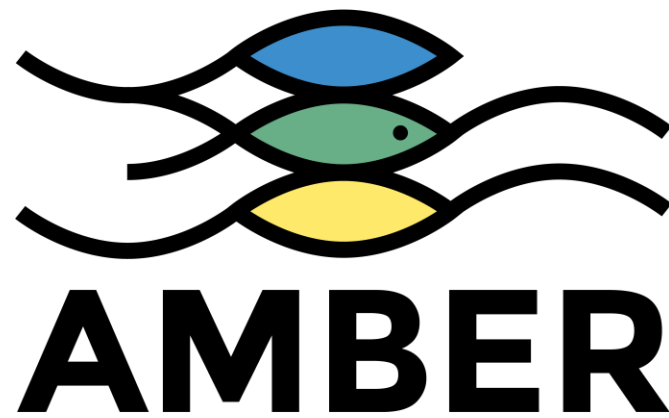


# Project Overview

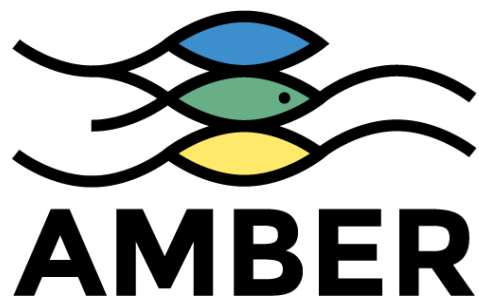
Brussels 04/06/2019



Carlos Garcia de Leaniz  
& the AMBER consortium



Funded by the Horizon 2020  
Framework Programme of the  
European Union



[www.amber.international](http://www.amber.international)



# Adaptive Management of Barriers in European Rivers

H2020, €6.2 M, 20 partners, 11 countries 2016-2020



**8 Universities**  
**4 Industrial partners**  
**4 NGOs**  
**4 Government Agencies**

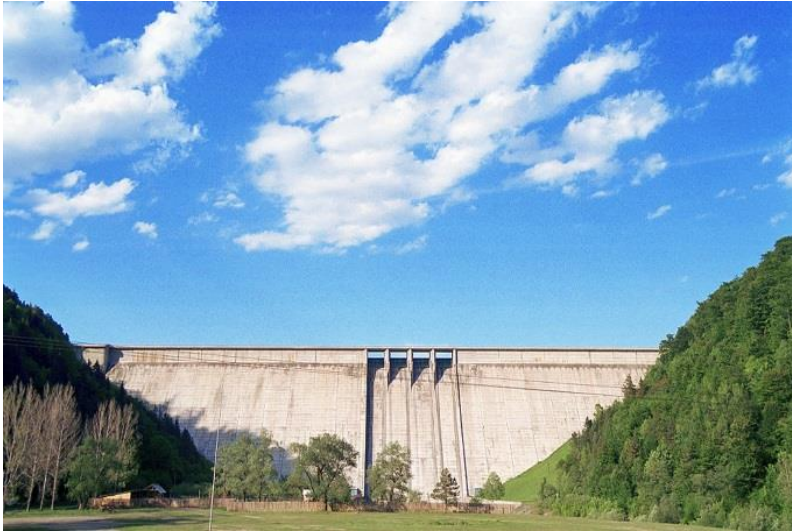


1. To develop *more efficient methods of restoring stream connectivity*
2. By applying *adaptive management*, to **maximise benefits** and **minimise impacts**



# What is a Barrier (in AMBER)?

## 1. An artificial structure

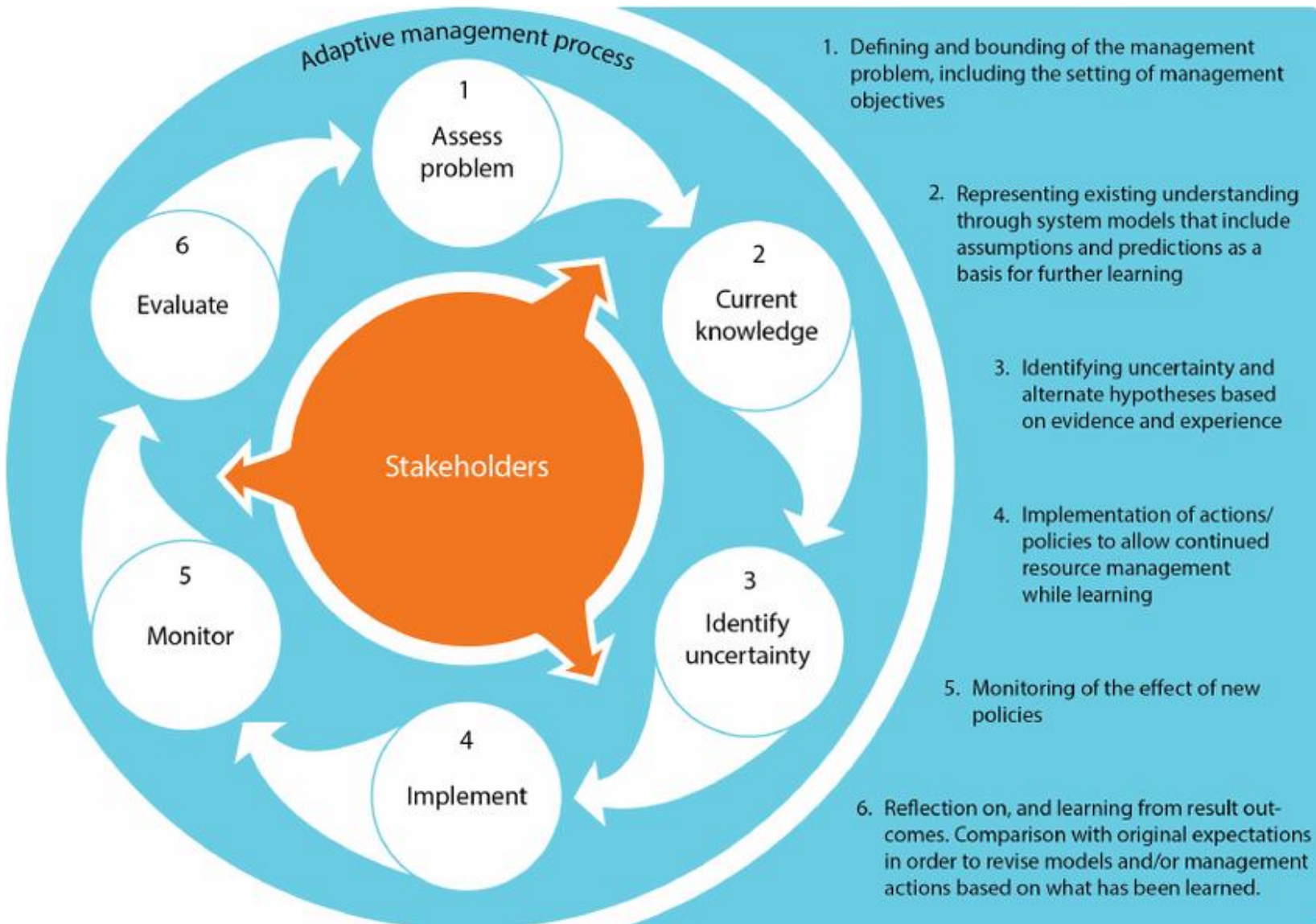


2. Interrupts or modifies the flow of water, the transport of sediments, or the movement of organisms

3. It results in longitudinal *discontinuity*

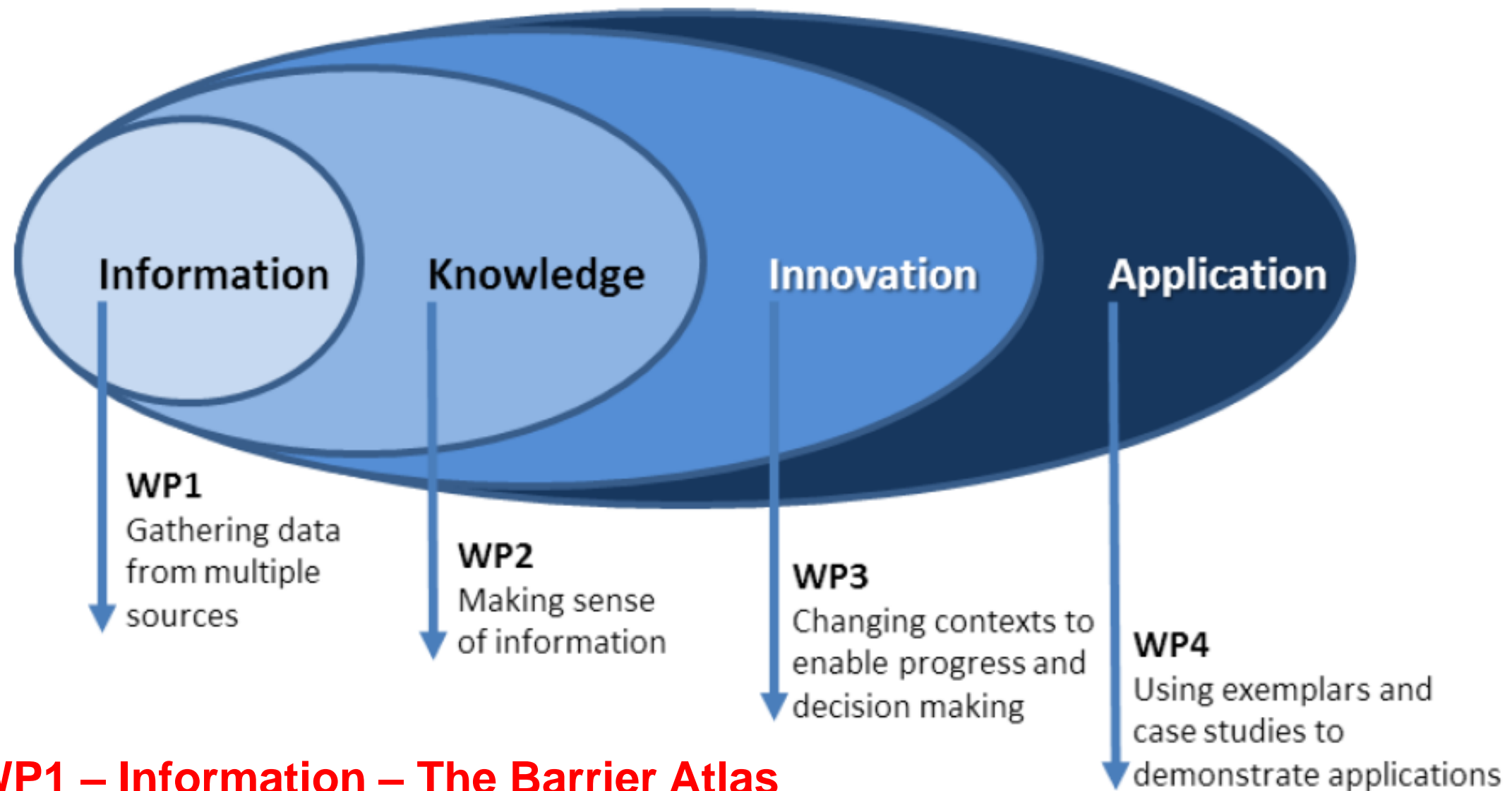
Paradigm shift: from an emphasis on blocking fish (*passability* - taxon specific) to consideration of *discontinuity*

# What is Adaptive Management?



1. It has a clear objective: maximise benefits & minimise impacts
2. It's a dynamic process, modified as more knowledge becomes available
3. It systematically tests assumptions, adapts and learns

# Structure of AMBER



**WP1 – Information – The Barrier Atlas**

**WP2 – Knowledge - Impacts**

**WP3 – Innovation – Decision Support Toolkits**

**WP4 – Application – Case Studies**

**WP5 – Dissemination – Knowledge Exchange**

**WP6 – Management**

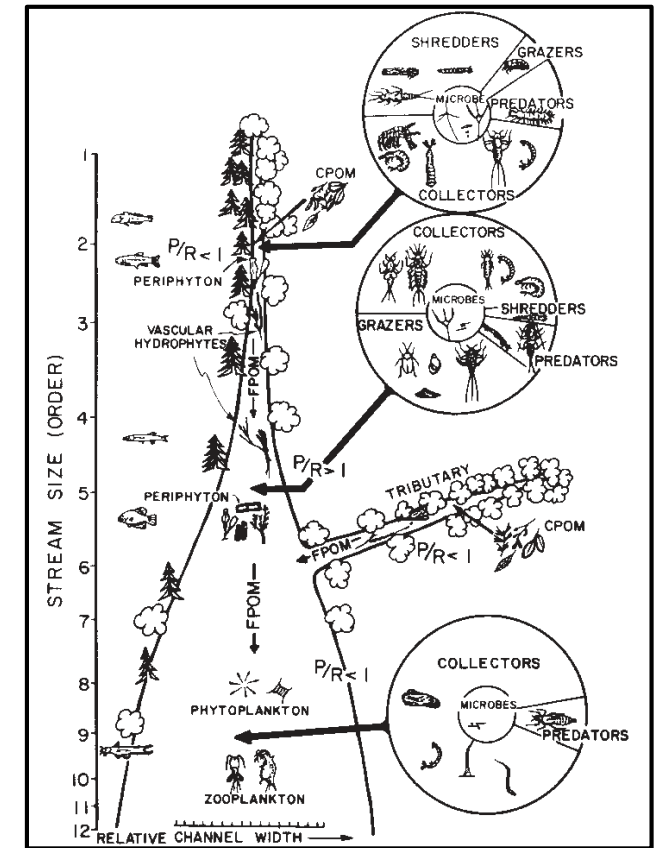


# Why AMBER?

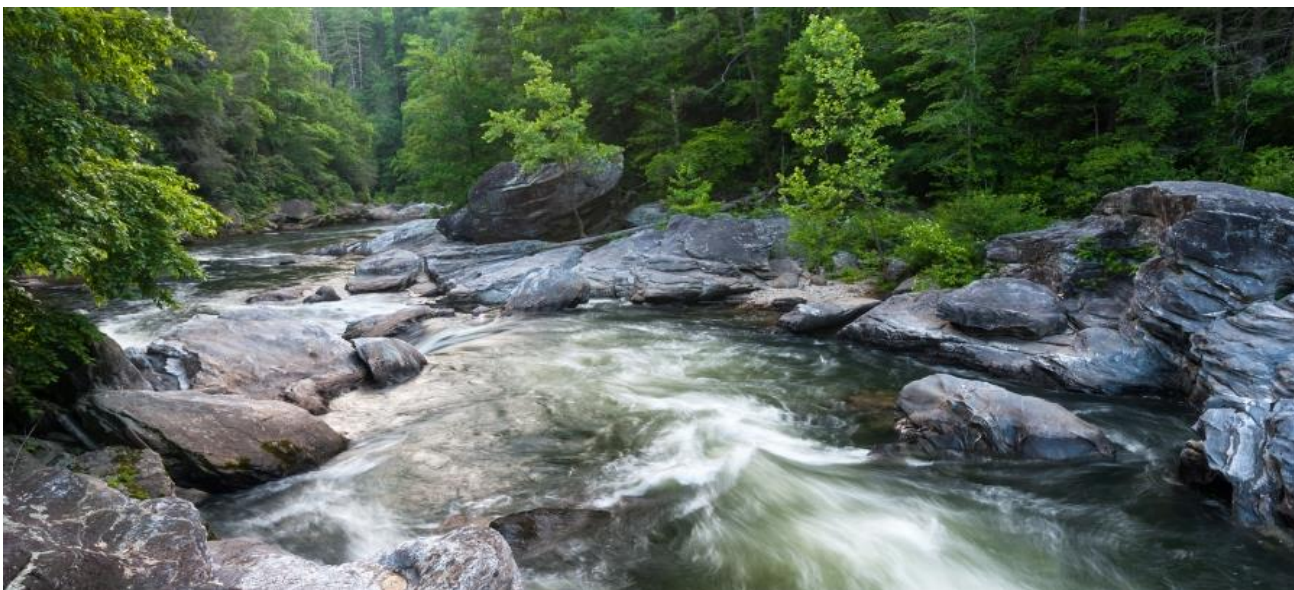
Healthy rivers = Flowing rivers

**Flow** = defining characteristic of rivers

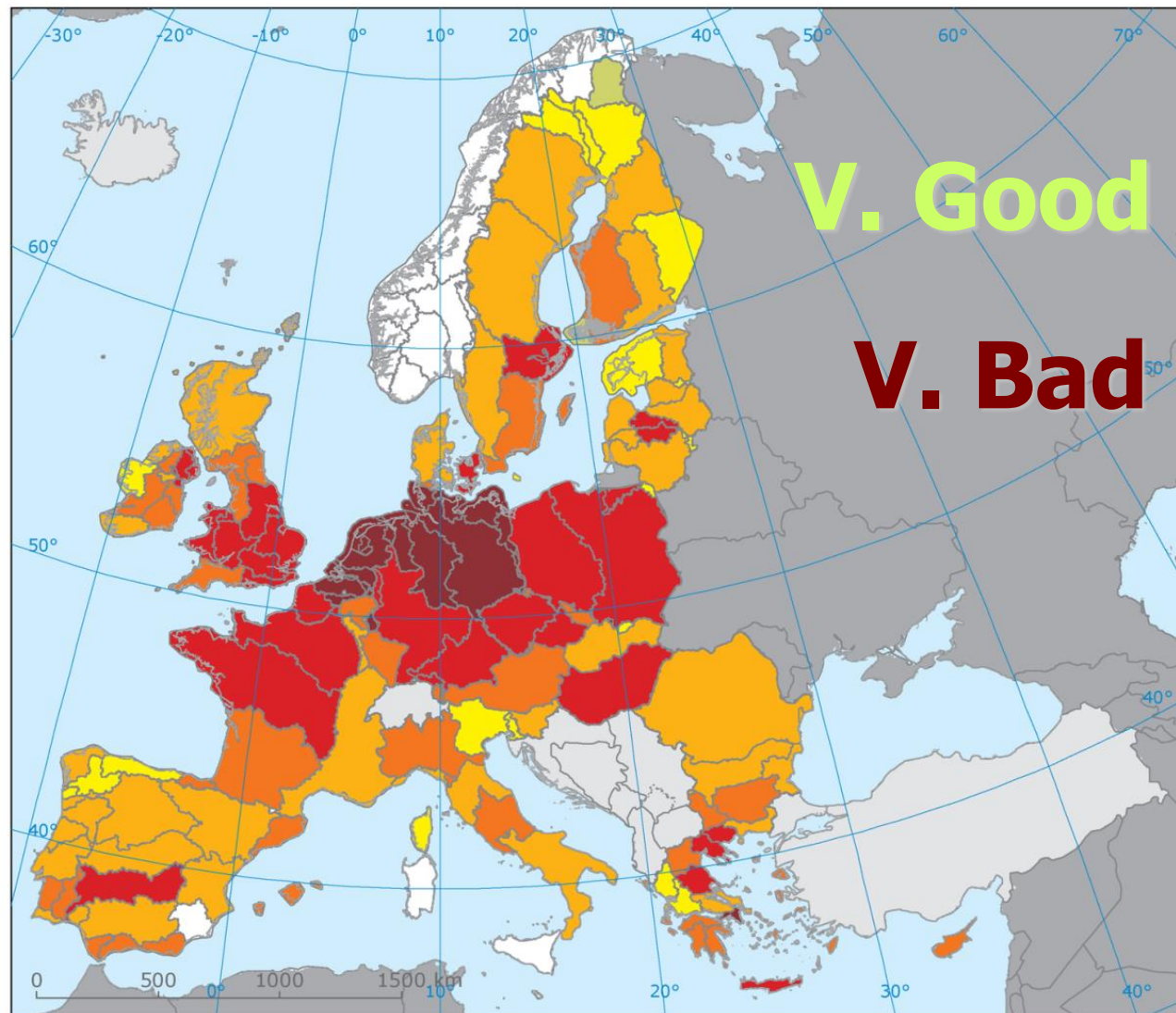
River Continuum Concept underpins the structural and functional integrity of rivers



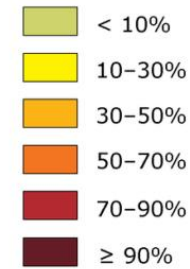
Vannote et al 1980



# Why AMBER?



Proportion of classified river and lake water bodies in different River Basin Districts (RBD) holding less than good ecological status or potential



EEA member countries not reporting under Water Framework Directive

No data

Outside coverage

EEA 2015

**Yet....  
EU rivers  
don't flow  
as they  
should**

**Most EU rivers have failed to meet good ecological status in part due to loss of habitat & fragmentation**



# Why AMBER?

European Environment Agency [DK] | <https://www.eea.europa.eu/data-and-maps>

## Fragmentation of river systems

Indicator Specification — Indicator codes: SEBI 014 — expired — Created 26 Feb 2007 — Published 21 May 2010 — Last modified 21 Oct 2016 — 8 min read



Topics: Biodiversity — Ecosystems



This page was **archived** on 21 Oct 2016 with reason: Content is outdated



The data sets for the indicator are still under construction.

Indicator Specification | Data and maps

Fragmentation of river systems

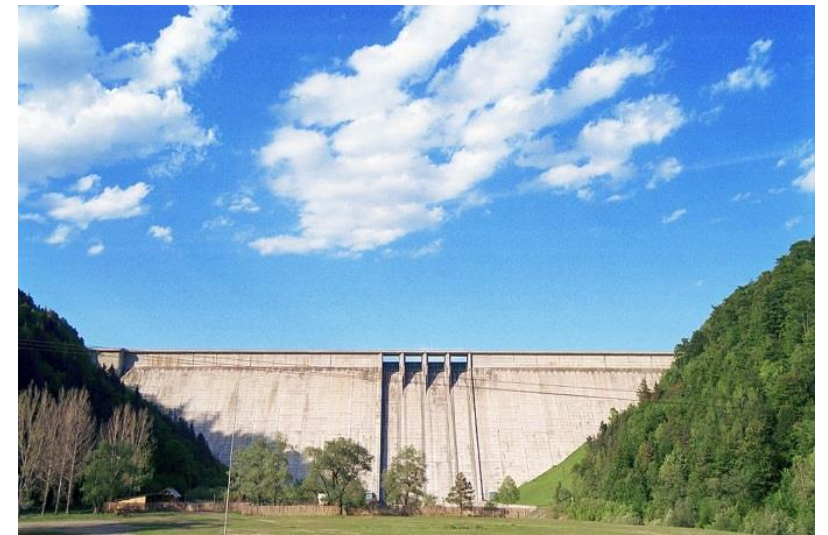


**Yet, extent of river fragmentation is unknown!**

# Challenges for restoring river connectivity in EU

## 1. Number of barriers in EU rivers is unknown

- Definition of 'barrier', country coverage, scale



## 2. ... but certainly more than we can mitigate for

- Best estimate (based on regional data) =

**0.6 to 1.8 million dams & weirs!**

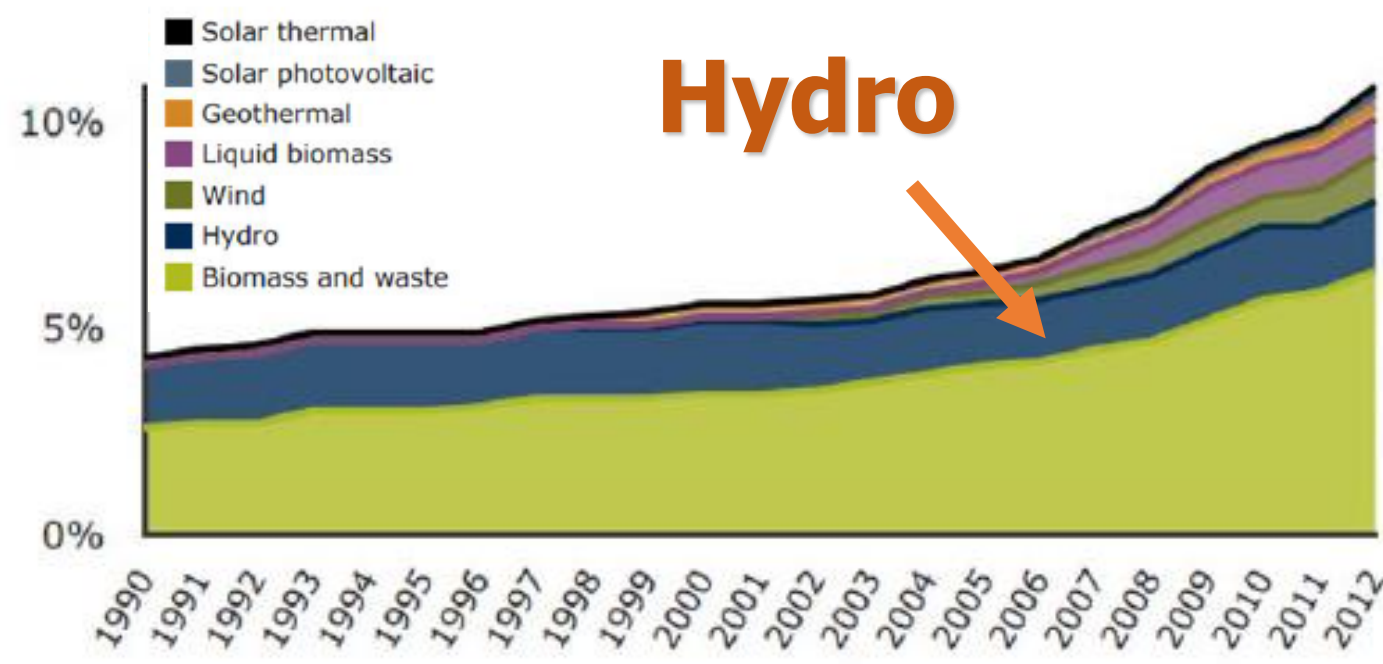
## 3. An Atlas of barriers in Europe is needed!





Projected changes in river flows over baseline values (EEA)

- 4. River flows will decrease, ...where water is most needed!
- 5. Increase in hydro to meet EU energy targets
- 6. Impacts of barriers will worsen



Breakdown of renewable energies/total



**7. Much is known about restoring fish [salmonid] passage, little about other taxa or fluvial processes**

[WWW.FISHPASSAGECONFERENCE.COM](http://WWW.FISHPASSAGECONFERENCE.COM)





# FISH PASSAGE 2015

International conference on river connectivity best practices and innovations



June 22-24, 2015

| Groningen (The Netherlands)

Made possible by:

**American Rivers**  
Rivers Connect US®

**FishFlow**  
INNOVATIONS

**waddenacademie**

**provincie groningen**

**WORLD FISH MIGRATION FOUNDATION**

**FFSG**  
Fish Passage Society Group

**WORLD FISH MIGRATION PLATFORM**

**SMITH-ROOT**

**Rijkswaterstaat**  
Ministerie van Infrastructuur en Milieu

**UMASS AMHERST**  
Center for Aquatic Ecosystems

**provincie drenthe**

**Fortum**

**anteagroup**

**FISHTEK**  
CONSULTING

**vemco**

**Grontmij**

**INSTITUTE OF FISHERIES MANAGEMENT**

**VisAdvies**  
Ecologische advies & consultancy

**BLUE LEAF**  
ENVIRONMENTAL

**VHL**  
Hogeschool University of Applied Sciences

**Biotactic**  
FOODS & BIOTECHNOLOGIES

**stowa**

**PROGRAMMA NAAR EEN RIJKE WADDENZEE**

**waddenfonds**  
Waddenzee Fonds

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biochemical monitoring and assessment

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FAIRBANKS NULIJUS®

**VATTENFALL**

**PHA MACH Inc.**  
Environmental Technology Solutions

**WWF**

**region Rijn**

**Europese Kaderrichtlijn Water**  
Regelmatig Bestuurslijn Dwingelo

**Deelstromgebied Rijn-West**



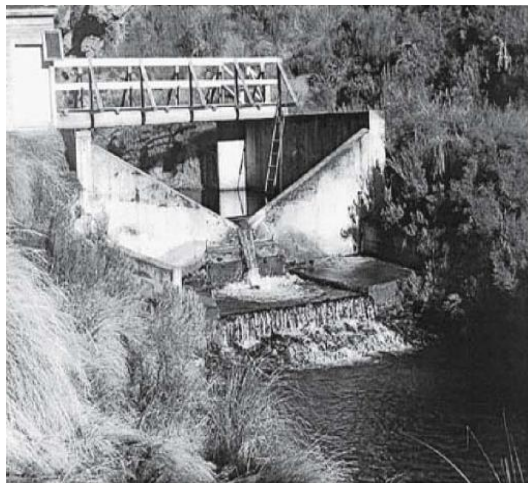


## 8. Not all barriers can – or should – be eliminated

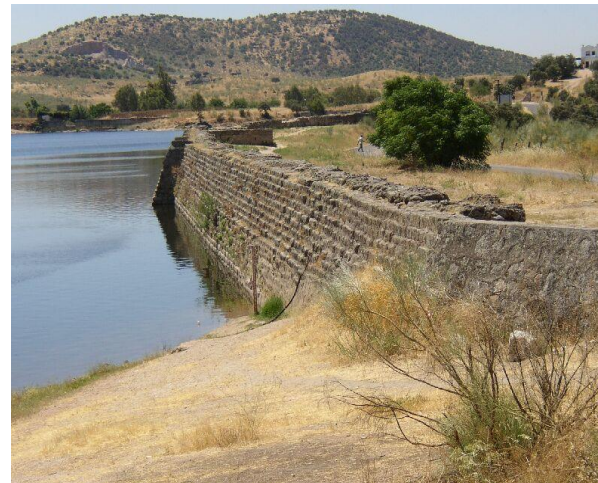
- Services to Society
- Aquatic Invasive Species
- Cultural heritage
- Pollution & Toxic sediments



topmouth gudgeon



Barrier to prevent salmonid invasions



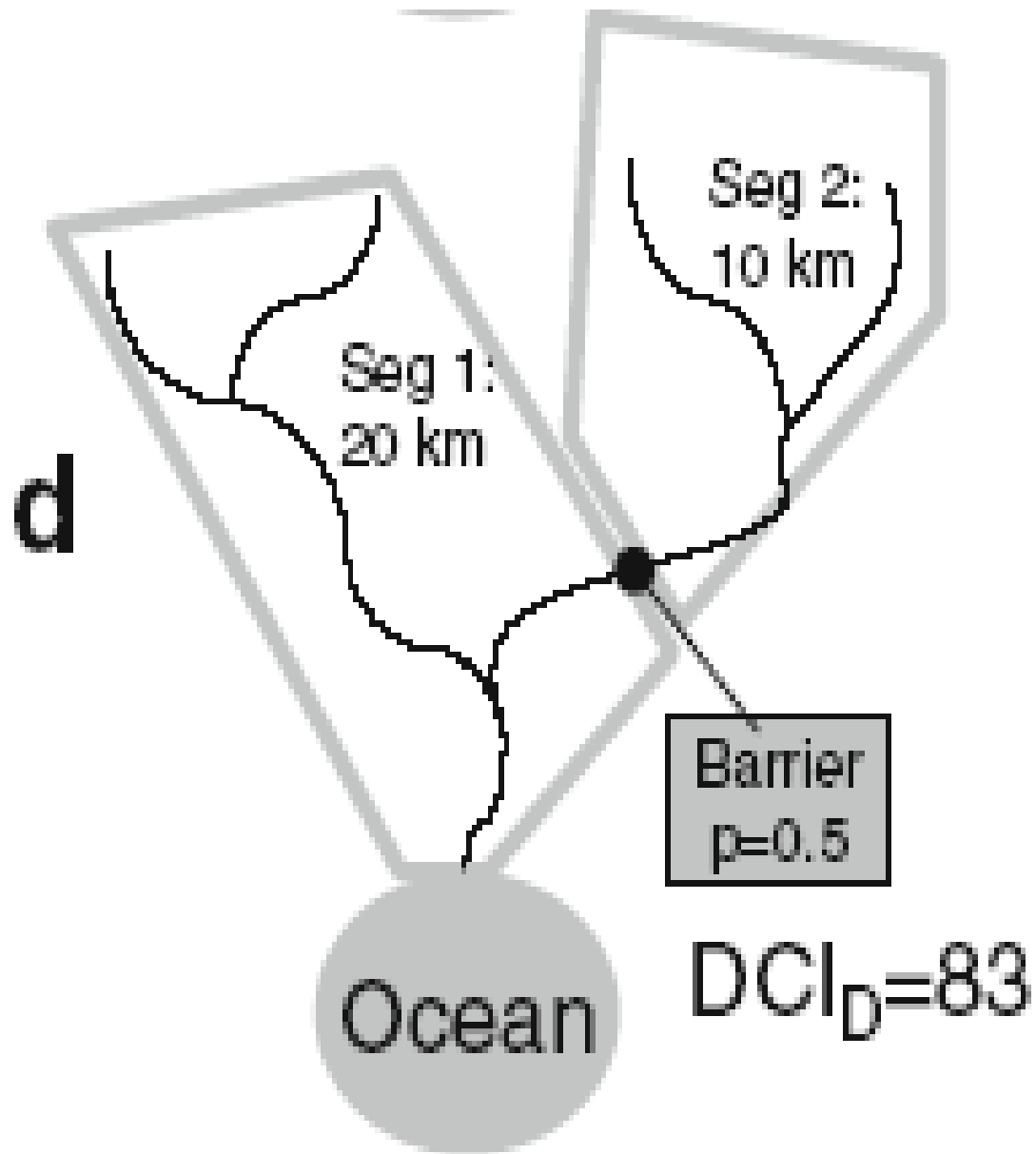
Roman dam



Polluted river

Connectivity? Yes....but the *good habitats!*

## 9. Better decision & prioritization tools are needed!



### Barrier Impacts:

- Number
- Location
- Passability (?)

### Barrier Mitigation:

- Cost
- Opportunity
- Benefits (?)

Dendritic connectivity index



# New opportunities for restoring river connectivity

## 1. eDNA/meta-barcoding

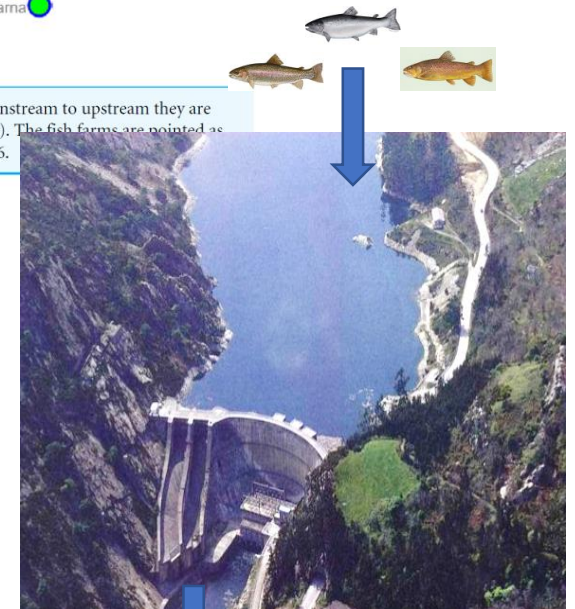


An extremely sensitive nested PCR-RFLP mitochondrial marker for detection and identification of salmonids in eDNA from water samples

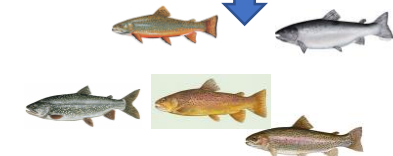
Laura Clusa<sup>1</sup>, Alba Ardura<sup>2</sup>, Sara Fernández<sup>1</sup>, Agustín A. Roca<sup>1</sup> and Eva García-Vázquez<sup>1</sup>



**Figure 2** Nalón River basin. Dams along the river are shown; from downstream to upstream they are Valduno (D1), Priañes (D2), Furacón (D3), Rioseco (D4) and Tanes (D5). The fish farms are pointed as F1 to F7 and finally the sampling points are numbered in red from 1 to 16.



eDNA can help identify discontinuities





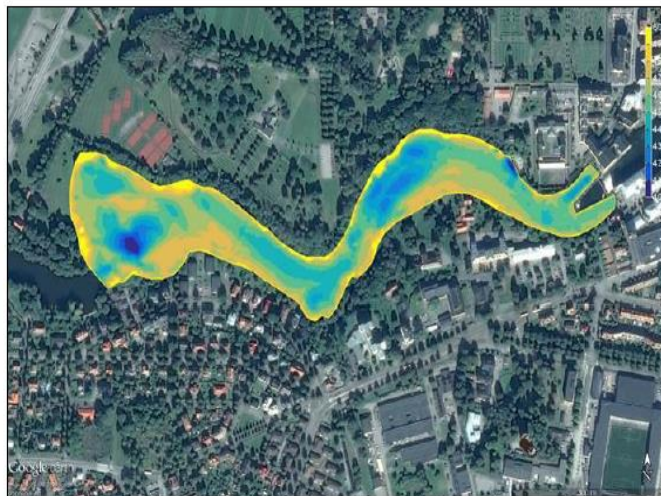
# New opportunities for restoring river connectivity

## 2. Drones & Remote sensing for quick surveying, respirometry & telemetry for better assessment of animal movements

Quantification of hydraulic conditions common at river infrastructure (T3.2.1)



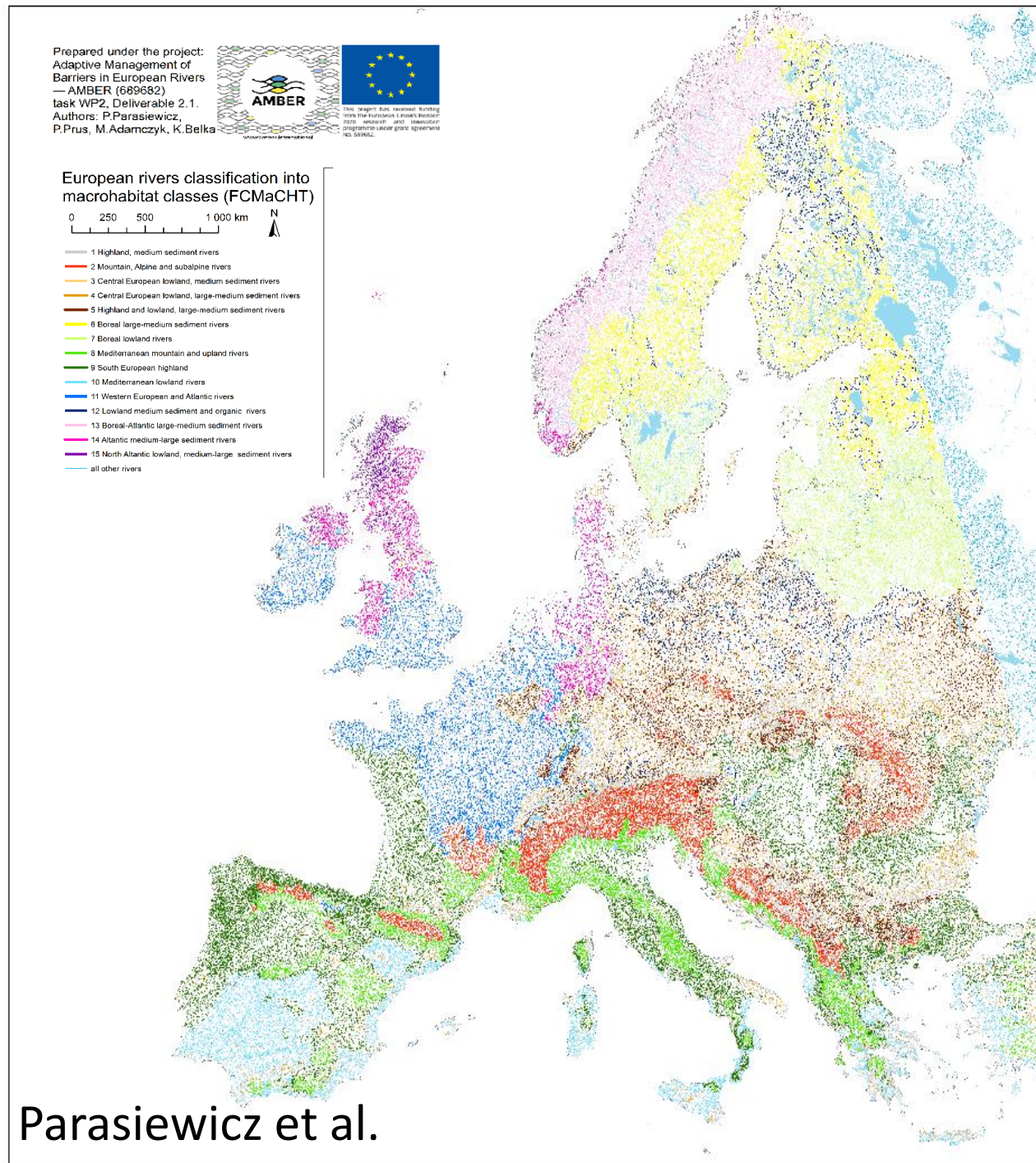
University of Southampton's ArcBoat - RTK GPS linked to ADCP provides high resolution flow velocity and bathymetric data.





# New opportunities for restoring river connectivity

## 3. Better models (Predictive modelling, ABM)



**Combines data on fish distribution and habitat types to**

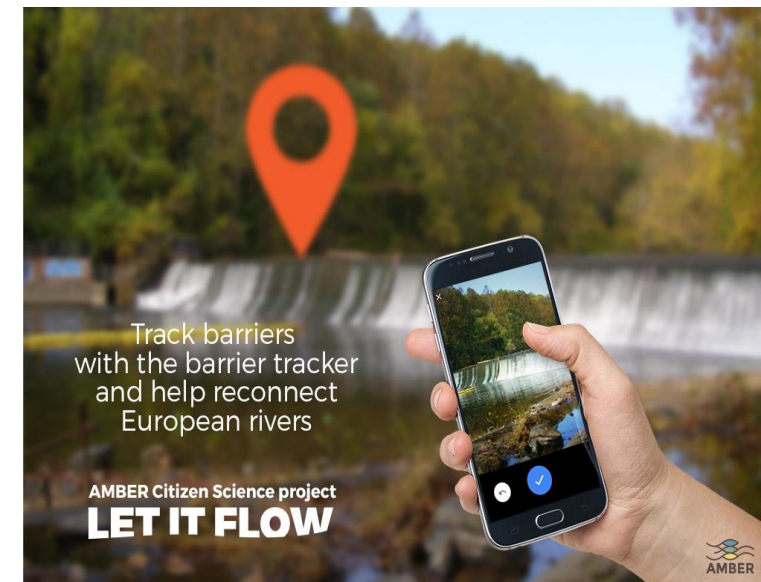
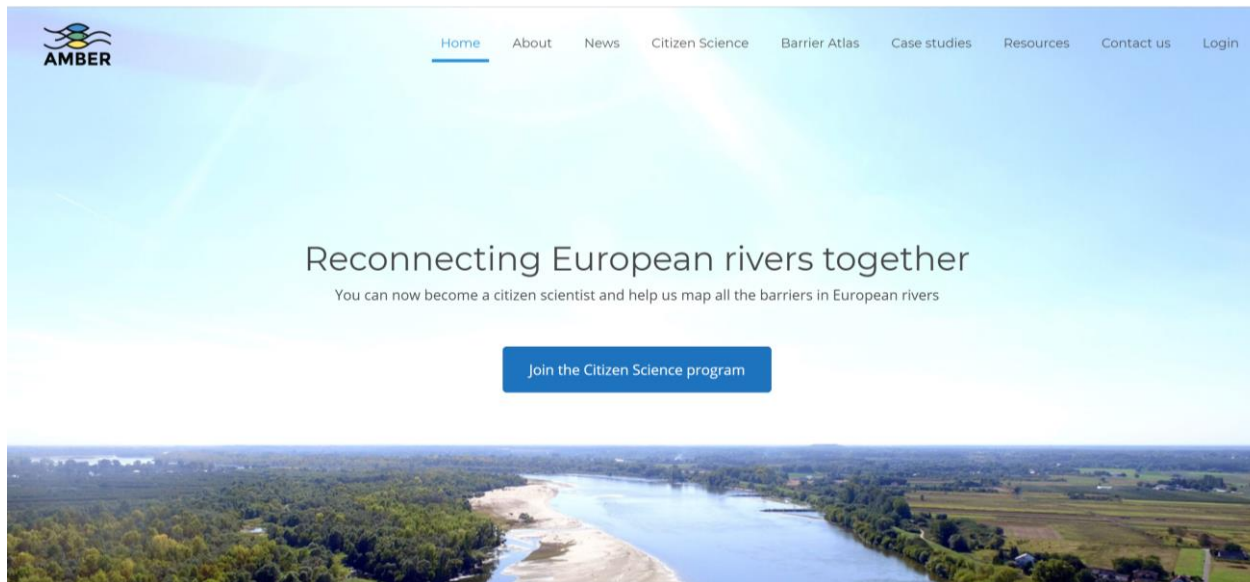
1. Classify rivers
2. Derive baseline expected values
3. Gauge barrier impacts
4. Quantify habitat losses & potential gains



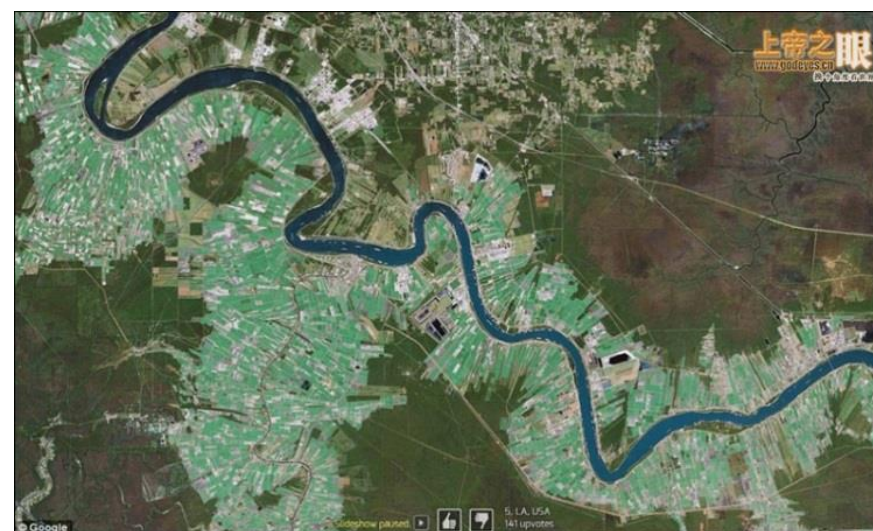
# New opportunities for restoring river connectivity

## 4. Citizen science & local engagement

- Smartphone app/ CS portal



- Google Earth



# Impact of AMBER

## In the News

25 items in the press

Featured *in Nature*

## Publications

14 peer-reviewed publications, some of high impact (*Nature Sustainability*)

19 popular science

## Dissemination

Website, flyers, CS portal, smart app, 7 videos, 10 newsletters

11 Citizen Awareness events, +7500 people reached

## Webinars

2 Webinars: Assessing stream discontinuities, Fish Pass Design

## AMBER sponsored Conferences & Workshops

15 Workshops

+40 presentations at Conferences

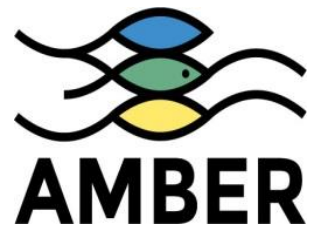


ECOLOGY

## Dam removal restores rivers

*Huge European demolition projects offer hope for fragmented ecosystems.*

290 | NATURE | VOL 557 | 17 MAY 2018



# Cooperation AMBER and FIThydro

## AMBER

Adaptive Management of Barriers in European Rivers

[More effective ecosystem restoration in the EU](#)

## FIThydro

Fishfriendly Innovative Technologies for Hydropower

[Developing the next generation technologies of  
renewable electricity and heating/cooling](#)

**Joint workshop planned for 2020 Fish Passage Conference  
(Lisbon) with joint publication and guidance**



# Any Questions?



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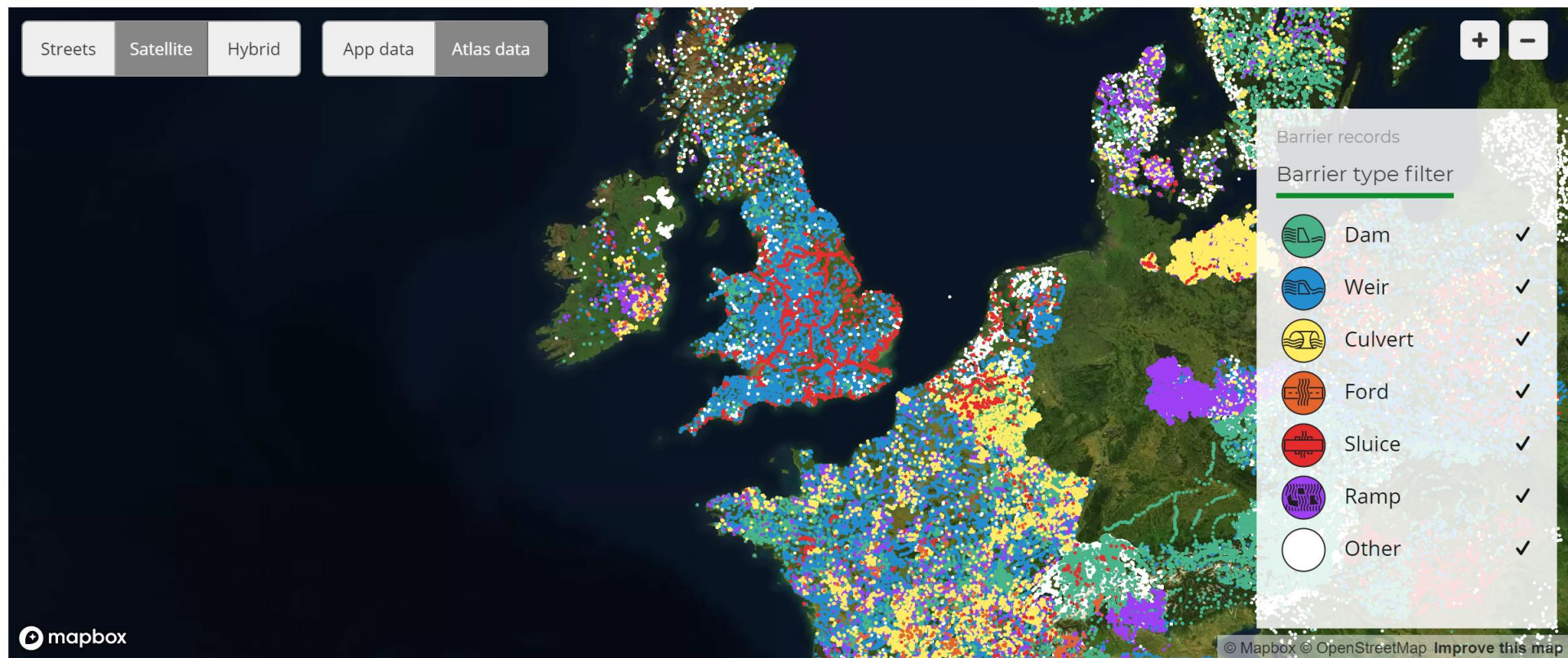
Citizen Science

Barrier Atlas

Case studies

Resources

Contact us



## Preview of AMBER Atlas

**Official launch: 30<sup>th</sup> November 2019**