

# SWIMWAYS OF THE WORLD

## fish migration around the globe and Europe



### Fish migration

#### Fish need to swim

Migratory fish are real athletes. Some swim thousands of miles, migrating from their place of birth to locations where they can find food or suitable habitats to reproduce. They depend on free flowing rivers to survive. Their routes present many challenges like rapids, waterfalls and fishing nets, but also the claws and jaws of predators like grizzly bears and sea eagles.

#### Monster fish

Some migratory fish can grow to be very large. Like the 3 meter long piraiba, which undertakes a 4000 kilometre journey through the Amazon basin. There are stories that it is capable of swallowing a human in one piece! The Congo River in central Africa is home to the tigerfish which has large crocodile-like teeth. The tigerfish hunts other fish and even jumps out of the water to catch passing swallows! The taimen is the largest salmonid in the world, living in the rivers of Siberia and the Amur region. It can grow over 2 meters long and can live up to 50 years. The taimen is very popular among anglers.



#### Food

Fish are an important food source for millions of people around the world, particularly in Africa, Asia and South America where they are the main source of protein. Large predators like bears, eagles, otters, seals and orcas also depend on them as an important food source. This makes migratory fish a crucial link in the food chain.

#### Obstacles

Piraiba, tigerfish, taimen and thousands of other fish species encounter many obstacles during their journeys. They are able to face many of the challenges that nature poses, like rapids and waterfalls, but man-made structures like dams, weirs and sluices prevent fish from reaching their spawning or feeding grounds. Free-flowing rivers are vital for migratory fish species.



### AMBER

#### Our AMBER project

*Reconnecting European rivers*

When rivers are fragmented we can do something about it! But we have to do it smart, using knowledge for barriers that is not the same as a hundred years ago when many of the barriers were built. A multi-disciplinary EU funded research project called AMBER will deliver the first comprehensive Atlas of river barriers across Europe and will apply adaptive barrier management to reconnect Europe's rivers.

#### Collaboration

In collaboration with 20 partners from 11 countries, AMBER (Adaptive Management of Barriers in European Rivers), will combine citizen science and cutting-edge advances in environmental DNA, use of drones, and valuation of ecosystem services, to map the distribution of barriers and assess their effects on freshwater organisms. It will work with hydroelectric companies, water providers, NGOs, anglers and local authorities to restore river connectivity in a way that maximizes the benefits of water abstraction but reduces environmental impacts.

#### Citizen Science

AMBER also seeks to raise awareness on the problems posed by stream fragmentation, the pressures on freshwater ecosystems, and the need for innovative solutions to restore river connectivity. This project will encourage citizens to become involved in efforts to reconnect Europe's rivers by mapping the location of barriers and assessing their impacts with the help of a smartphone app.



### Dams

#### Barriers and passes

Dams represent serious obstacles for migratory fish. Dams have been constructed in rivers everywhere: from the gigantic Hoover Dam in the Colorado River, to the Aswan Dam in the Nile River and the Hume Dam in Australia's Murray River.



Dams serve a number of purposes, they supply us with water and provide the opportunity to produce renewable energy. These are major benefits but there are also many harmful effects. The construction of the Three Gorges Dam in China greatly altered sediment and water flow of the Yangtze River, which has had a severe impact on the downstream ecosystems.



However, there are ways to help migratory fish, for instance by keeping rivers free-flowing and by including specially constructed fishways (passes) around existing dams. These must be custom designed to be effective. Some nature-like fishways can be very large as they wind around high dams. The fishway at the Brazilian Itaipu Dam on the Parana basin is over 10 kilometres long to allow fish species like the dorado, the curimbata and the pintado to ascend the 120 meters height difference.

In North America and Europe large dams, up to 50 meters high, have been removed. This allows fish to swim freely again, rebuilding their populations in restored rivers offering fishermen and predators the opportunity to catch more fish. For more information about fishways and dam removal, visit [www.fromseatosource.com](http://www.fromseatosource.com)

#### Fish Migration River

The Netherlands now plans to construct a special fish migration river for fish to pass a major barrier "The Afsluitdijk". This fishway will be shaped like a winding river and is designed to allow fish to adapt as they swim from salt into freshwater. Millions of three-spined stickle backs, eels and smelts are expected to use the Fish Migration River. For more information about the fish migration river, visit [www.vismigratierivier.nl](http://www.vismigratierivier.nl)

### 6000km journey



#### European eel

This fish has a very special life strategy. The eel's eggs are laid and hatch in the Sargasso Sea, close to Bermuda. After hatching, they change from tiny larvae, to a shape like a willow leaf. Their transparency makes them difficult to see for predators. The gulf stream transports them 6000 kilometres across the Atlantic swimway towards Europe. Along the way they change their body shape again to the glass eel stage, a transparent small version of the adult eel.

In Europe they swim into estuaries, changing from transparent form into a brown colour, this is called the elver stage. Eventually they enter rivers, lakes and canals in their search for habitat to grow up. During the day the eels hide but at night they emerge and hunt invertebrates and small fish. Once mature, now called silver eels, they make the journey back to the Sargasso Sea where they spawn in the deep sea and then die.

The eel is now critically endangered. Dams, sluices and weirs have made their migration into freshwater habitats difficult or even impossible. The number of eels has declined severely over the last few decades. New European regulation has been installed to turn the tide.



**FISH FACT**  
The European eel has the longest migration route of all migratory fish. It swims 6000 kilometres to reach its spawning grounds!

### Rivers

#### The Rhine

The Rhine River flows through several European countries, including Switzerland, France, Belgium and Germany, before it reaches the Dutch delta where it flows into the North Sea. In the past many fish species, such as Atlantic salmon, sea trout, European eel and Atlantic sturgeon migrated between the sea and the rivers upstream.

But due to water quality deterioration, hydro-morphological changes in the river, construction of weirs and dams and overfishing, fish stocks decreased dramatically. The Atlantic sturgeon disappeared completely from these river systems.

The countries that share the Rhine river basin started the International Commission for the Protection of the Rhine in the 1980s to try to turn the tide. Many plans were drawn to improve ecological quality of the river from its source to the sea, including a Salmon Action Plan. There are still many opportunities to improve the situation.



#### Dam removal

Rivers in Europe are filled with barriers. Built in the last centuries for reasons like safety, water supply or flood protection. However, many of them are now old, have lost their original function and need costly maintenance. In that case removing barriers instead of renewing them becomes a realistic option.

An iconic dam removal worldwide has been the demolition of a large dam on the Elwha River. Almost immediately after the removal the salmon returned and the ecosystem started to recover. Following this success, old dams all over North America and, increasingly, Europe are being demolished. After removal, not only fish returned, but also the habitats around them.



**FISH FACT**  
The USA is already removing large numbers of dams. They removed over 1,000 dams in the last 25 years! (Source: American Rivers)

### Barrier Tracker

#### Welcome to the citizen science program

By becoming an AMBER citizen scientist you can help reconnect European rivers, track barriers, and learn about their impacts! Rivers rank among some of the most threatened ecosystems in the world due in part to the fragmentation of habitats caused by tens of thousands of dams and weirs. Some barriers are old and out of use but others provide energy, water, fishing or leisure opportunities. Your help by recording barriers with the Barrier Tracker app is vital to map all barriers in European rivers and build the first European Barrier Atlas.

#### The Barrier Tracker App

With the app, called "Barrier tracker", you can record new barriers into a database. Using the app in the helps with gathering of more data and greater spatial coverage of records than would have been possible using conventional surveys. Typical data gathered includes a photo of the barrier, the location of the barrier and the height of the barrier.



### Made possible by

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### Species

**Between sea and the source**  
Fish species illustrated in the poster are shown with an arrow that represents their swimming direction. There is even a shark species, the Bull shark, that swims in the Zambezi River in Africa.

Migrates between sea and rivers, spawns in rivers ---  
Migrates between rivers and sea, spawns in sea ---  
Spends entire life cycle in freshwater ---

Number	Common name	Scientific name
1	Sockeye salmon	<i>Oncorhynchus nerka</i>
2	Pacific lamprey	<i>Entosphenus tridentatus</i>
3	Mississippi paddlefish	<i>Polyodon spathula</i>
4	Atlantic salmon	<i>Salmo salar</i>
5	Sea lamprey	<i>Petromyzon marinus</i>
6	Alewife	<i>Alosa pseudoharengus</i>
7	Shortnose sturgeon	<i>Acipenser brevirostrum</i>
8	Common sawfish	<i>Pristis pristis</i>
9	Piraiba	<i>Brachyplatystoma filamentosum</i>
10	Pintado	<i>Pseudoplatystoma corruscans</i>
11	Curimbata	<i>Prochilodus lineatus</i>
12	Dorado	<i>Salminus brasiliensis</i>
13	African longfin eel	<i>Anguilla mossambica</i>
14	Largemouth yellowfish	<i>Labeobarbus kimberleyensis</i>
15	Atlantic tarpon	<i>Megalops atlanticus</i>
16	Goliath tigerfish	<i>Hydrocynus goliath</i>
17	Nile perch	<i>Lates niloticus</i>
18	Senegal carp	<i>Labeo senegalensis</i>
19	European eel	<i>Anguilla anguilla</i>
20	Allis shad	<i>Alosa alosa</i>
21	Atlantic sturgeon	<i>Acipenser sturio</i>
22	Houting	<i>Coregonus lavaretus oxyrinchus</i>
23	Sea trout	<i>Salmo trutta trutta</i>
24	Vimba bream	<i>Vimba vimba</i>
25	Russian sturgeon	<i>Acipenser gueldenstaedtii</i>
26	Caspian brown trout	<i>Salmo trutta caspius</i>
27	Taimen	<i>Hucho taimen</i>
28	Arctic cisco	<i>Coregonus autumnalis</i>
29	Japanese huchen	<i>Hucho perryi</i>
30	Hilsa shad	<i>Tenualosa ilisha</i>
31	Mekong giant catfish	<i>Pangasianodon gigas</i>
32	Chinese pangasid catfish	<i>Pangasius pangasid</i>
33	Barramundi	<i>Lates calcarifer</i>
34	Longfin eel	<i>Anguilla reinhardtii</i>
35	Golden perch	<i>Macquaria ambigua</i>
36	Murray cod	<i>Maccullochella peelii</i>
37	Australian bass	<i>Macquaria novemaculeata</i>
38	Common galaxias	<i>Galaxias maculatus</i>
39	Shortfin eel	<i>Anguilla australis</i>
40	Bull shark	<i>Carcharhinus leucas</i>

### Connecting fish, rivers and people!

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For more information and to see how you can help  
[www.worldfishmigrationday.com](http://www.worldfishmigrationday.com)

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