Fish Migration and Barriers to Fish Migration

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Opening Statement

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Since the industrial revolution, which began in the late 18th century, man-made barriers have become a major feature of rivers across Europe and North America. Waterways provided a readily available source of power generation and transportation and were fundamental to the growth of many major industries since that time.

Barriers come in the form of dams, weirs, rock barriers, abstraction and discharge points. They can result in the fragmentation of waterways and cause severe disruption to fish passage and to the natural life cycle of many freshwater and estuarine fish species.

In the past, rivers were seen as water "channels" and there was a complete disregard of the fact that, in their natural state, they are living entities, which support complex, interacting aquatic food webs.

The effects of such barriers on large migratory fish species such as Atlantic salmon, European eels and sturgeon were very obvious but the more subtle and at times far more complex impacts on the physical flowing water environment were little understood. Facing into the full impacts of climate change over the years to come, it may well be that the impacts of barriers on flow/ river discharge patterns, sedimentation and water temperature will come to fore.

Barriers cause a wide range of issues for migrating fish – for example:

- Blockages and delays to migration, leading to mortality or the disruption of cyclic phenomena such as spawning time and juvenile migration (phenology)
- Mortality of migrants due to fish passage issues and increased predation at so called "pinch points"
- Water temperature impacts, particularly during prolonged and intense droughts
- Difficulty in traversing large reservoirs and failure of the fish's flow based, migration systems (rheotaxis)
- Unnatural changes in water discharge patterns and in the variation of the strength of flow
- Changes in sediment transport patterns and the build-up of sediment loads in reservoirs and slow flowing reaches of impounded river systems

Over the past two decades there has been a growing awareness of the need to tackle the issues relation to barriers and fish migration. Recognising that, in Europe, an increasing number of aging dams were approaching the end of their economic and technical lifespan,

(typically after 70-100 years), the European Commission developed guidance to assist EU Member States in identifying and prioritising barriers for removal.

The removal or mitigation of such barriers presents a unique opportunity for rejuvenating rivers and restoring ecological free passage for migrating fish and debris. These efforts align with the *European Biodiversity Strategy*, which aims to restore 25,000 kilometres of free-flowing, EU rivers by 2030.

A similar programme of barrier removal and mitigation is actively ongoing in North America. In 2022, some sixty dams were removed across the United States, reconnecting more than 430 upstream river miles (690 km) in 20 States. This effort aims to break down river barriers and restore natural flow patterns. The stated goal is to eventually see dam removals in all 50 States.

To identify and quantify the extent of the barrier issues involved in Europe, a major research programme was funded in recent years. The EU AMBER Project focused on fish passage in European rivers. Through Inland Fisheries Ireland, Ireland has been actively involved in assessing the barriers present across the country.

A major barrier and fish passage conference, hosted by the AMBER Project, was held in 2021. The Fish Passage Conference (2021) covered topics relating to: fish migration routes, fish behaviour, downstream migration, socio-economic considerations, tidal barriers, fishway solutions, policy improvements and monitoring technology. It also explored nature-based solutions, climate change, and dam removal options.

In terms of finding solutions to fish barrier issues, community involvement is essential. A cooperative, multidisciplinary approach has been found to be very effective in both Europe and North America. There are many examples showing just how effective such an approach can be.

Dam removal has been successfully achieved in both France and in the US. On the Sélune River in Normandy, the 36 m *Vezins Dam* was breached in 2019, marking the beginning of the largest dam removal project in Europe. The removal of this dam is part of a long-term effort to ensure that the Sélune River regains the status of a naturally free flowing waterway. In addition the 16m high *La Roche Qui Boit Dam* was successfully removed in June 2022.

The overall Sélune project aims to benefit wildlife, including Atlantic salmon and eels, and enhance water quality along the river. The Sélune River flows into the famous Mont-Saint-Michel Bay, a UNESCO World Heritage site and a major tourist attraction.

In the US, major dam removal projects have been successfully achieved though cooperative ventures on both the Penobscot and the Kennebeck Rivers. The Penobscot River faced significant challenges, including a dwindling population of wild Atlantic salmon and a drastic decline in alewives (a type of river herring). By 2009, wild Atlantic salmon were added to the endangered species list in the US. The river's health was in crisis, with only two alewives counted at the Veazie Dam in 2010 (historically, the river held millions of individuals of this species). The *Penobscot Nation* and other organizations formed the *Penobscot River Restoration Trust*. Through their efforts two major dams: the Veazie Dam and the Great Works

Dam were removed. In recent years, as many as 590,000 alewives (also known as river herring) were recorded moving upstream in the Penobscot River. This represents a 45-fold increase from the 2013 estimates of annual upstream migration!

In Europe, the European Rivers Network has been involved in the removal and mitigation of a wide range of barriers. The ERN were actively involved for many years in concluding an agreement with the French Electricity company EDF (Électricité de France), for the mitigation of the Poutès Dam on the upper Allier system – a key salmon spawning tributary of the Loire River, in France. The Poutès Dam was constructed during World War II for electricity production, without authorisation. Since the late 1980s, environmental NGOs have been concerned about its impact on the environment, particularly the near extinction of the Loire strain of Atlantic salmon. Following many years of negotiation between NGOs, local representatives, and EDF, a compromise solution emerged. The dam would be maintained, but significantly modified to allow for the free passage of both juvenile and adult migratory fish, particularly Atlantic salmon, over their key migration periods. Construction of the fundamentally re-designed dam was completed in 2022. The great achievement of this design is that it allows EDF to utilise some 70% of the rivers original capacity to generate electricity, while guaranteeing a completely free flowing passage for migratory fish, at key times in their life cycle.

The recent (December, 2023) IUCN designation of the global status of Atlantic salmon as *near threated* and in the UK as *endangered* is a reminder to us that time is not on our side in tackling the issues which are impacting our migratory fish species.

According to the IUCN (*International Union for Conservation of Nature*) Red List of Threatened Species, the status of Atlantic salmon has changed significantly:

Global Classification:

Previously, Atlantic salmon were categorized as of “Least Concern” on the IUCN Red List.

However, due to multiple threats during their long-distance migrations between freshwater and marine habitats, global Atlantic salmon populations have declined by 23% since 2006.

As a result, their global status has been reclassified from “Least Concern” to "Near Threatened".

UK Population**:**

UK populations of Atlantic salmon have faced even greater challenges.

Since 2006, British populations have declined by 30-50%.

Projections indicate a further decline of 50-80% between 2010 and 2025.

Consequently, the UK population of Atlantic salmon has been re-classified as "Endangered".

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Website Links:

Amber Project: https://amber.international/

Atlantic Salmon Trust – Moray Firth Programme:
https://atlanticsalmontrust.org/our-work/morayfirthtrackingproject/

Atlantic Salmon Federation – Walton's Dam Removal
https://www.asf.ca/waltons-mill-dam-removal-project-moves-forward/

European Rivers Network: https://www.ern.org/en/

IFI – Barriers Programme:
https://www.fisheriesireland.ie/what-we-do/research/national-barriers-programme#:~:text=National%20Barriers%20Programme%201%20Developing%20a%20barriers%20assessment,...%205%20Guidance%20for%20planning%20and%20construction%20

Penobscot Restoration Project:
https://www.nature.org/en-us/about-us/where-we-work/united-states/maine/stories-in-maine/restoring-the-penobscot-river/

Sélune River Restoration:
https://wwf.panda.org/wwf_news/?5919441/Removal-of-huge-dam-on-Frances-Selune-river-begins-as-EU-targets-massive-increase-in-free-flowing-rivers

Upper Allier Restoration:
https://www.ern.org/en/poutes-barrage/

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