



**The Quarterly
Magazine Of
The Institute
Of Fisheries
Management**

FISH

Saving Our Salmon

When we improve the freshwater
environment salmon respond

**RIVER RHINE
SALMON
COMEBACK
CAMPAIGN**

**PINK
SALMON**

Alien salmon caught
in English waters

THE VALUE OF SALMON

Iconic species of the
water environment

SALMON AT SEA

*Big picture thinking is required
for salmon at sea*

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Salmon are one of nature's wonders of the world, returning to their home rivers after an epic migration at sea, often battling strong currents and leaping seemingly impassable waterfalls to reach their spawning grounds to lay their eggs and produce the next generation.

They are an iconic aquatic species that people recognize as symbolising a healthy water environment, however across the north Atlantic they are in decline. In 2014 38 of England's 42 principal salmon rivers were assessed as being 'at risk' or 'probably at risk'.

In 2014 it was estimated that the number of salmon in the sea prior to their return to England and Wales rivers was 140,000, which is equivalent to ~560t. To put this figure in perspective there are now 1,800 times this number of farmed Atlantic salmon globally.

The biggest single factor impacting the status of salmon populations has been declining marine survival, which has nearly halved over the last 20 years. This has been linked to climate change induced environmental changes potentially affecting feeding opportunity.

To give salmon greater resilience in the face of environmental change it is critical that freshwater production is maximised.

Within this edition we outline how the Environment Agency is working with partners to conserve and enhance salmon. This is followed by Paul Knight, Chief Executive of Salmon and Trout Conservation UK, highlighting the value of salmon. Tony Andrews, Executive Director of the Atlantic Salmon Trust, then assesses the plight of salmon at sea and advocates taking a holistic approach. We then look at international efforts to bring salmon back to the River Rhine.

What is clear in these articles is that, in order to secure the future of salmon, there is a need to see salmon not only as a fisheries issue but as an iconic species that can galvanize interest and action to improve the water environment.

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River Rhine Salmon Comeback Campaign

Lawrence Talks having been to an Atlantic Salmon Summit in Huningue in France about reopening the Rhine to salmon, reports back on progress being made to return salmon to one of Europe's great rivers.



Salmon comeback © Michel Roggo

Extinction

The Rhine was once the largest salmon river in Europe. 100 years ago, there were millions of Atlantic salmon (*Salmo salar*) in the Rhine and its tributaries as the salmon utilised the vast catchment of Europe's third biggest river, which stretches from the Dutch coast near Rotterdam to its source in the Swiss Alps.

With the industrial revolution the Rhine was straightened, barriers and sluice gates were constructed to provide for navigation, hydroelectric power stations were built and the waters became polluted.

By the middle of the 19th century, salmon numbers were markedly declining and in response a salmon stocking programme was initiated, an international salmon treaty was passed, targeted at 'increasing the stock of salmon in the Rhine area' and fishermen demanded the construction of 'salmon ladders' to provide fish passage over the numerous weirs and barriers that were being built. However, despite all these efforts salmon became extinct in the Rhine by the 1950s.

Salmon having thrived in the Rhine for many thousands of years became extinct in just a hundred years because of man's impacts on the river.

International cooperation to restore salmon to the Rhine

In response to poor water quality in the lower course of the Rhine, the International Commission for the Protection of the Rhine (ICPR) was founded in 1950. Members include Switzerland, France, Germany, Luxemburg, Netherlands and the European Union, together with Austria, Lichtenstein, Belgium and the region

of Wallonia in Italy as observers. The focus of this cooperation is the sustainable development of the Rhine, its floodplains and the good state of all waters in its watershed.

Intensive use of water

58 million people live and work in the Rhine's catchment and 20 million of them receive their drinking water from the Rhine system. Of a catchment of 200,000km² about 8% is used for settlements, 50% for agriculture and it is Europe's most important industrial area. In the main Rhine between Lake Constance and the mouth of the river, there are 21 big hydroelectric power stations with a turbine performance of about 7 billion kilowatt hours, which is sufficient for 2.5 million households. More than 800km of the Rhine as well as the rivers Neckar, Main, Moselle and Sarre are navigable.

In the 1970s the Rhine was considered to be the sewer of Europe. Additionally the construction of dikes and straightening of the water course has resulted in a loss of 85% of its floodplain and shortened the water course by more than 90km.

In 1986 a fire in the Sandoz chemical factory near Basel led to 30 tons of pesticide being washed into the Rhine, which wiped out an estimated half a million fish and turned the river red. This was an environmental catastrophe that in a matter of moments reversed 10 years of painstaking work to clean up the Rhine.

Interestingly enough, however at the Salmon Summit, a number of delegates saw this disaster as a catalyst that galvanised international cooperation and action on the Rhine and led to the Rhine Action Programme (1986-2000) and Rhine 2020.

Rhine 2020

In January 2001, the ministers in charge of the Rhine adopted 'Rhine 2020', which is a programme for the sustainable development of the Rhine. The core parts of the programme, which support the implementation of the EC-Water Framework Directive and EC-Flood Management Directive, are:

- Improving habitat connectivity
- Implementing 'Salmon 2020'



Lawrence at Rhine Salmon Summit

- Reducing flood risk
- Further improving water quality
- Groundwater protection.
- The continuous surveillance of the state of the Rhine

Considerable progress has been made with over 96% of the population within the Rhine catchment now connected to wastewater treatment and many of the major industrial plants have their own wastewater treatment facilities. Water quality and biology of the Rhine and many of its tributaries has markedly improved, which has led to a significant increase in the number and diversity of plant and animal species. Considerable efforts have been made to reduce flooding, including increasing flood plain storage and since 2006 salmon and other migratory fish once more are able to reach Strasbourg, however much more remains to be done.

Salmon 2020

Signed up to by all the member states, Salmon 2020 sets a number of 'visions' for the Rhine to be achieved by 2020. These are: several thousand salmon in the Rhine; free upstream migration for salmon as far as Basel; a salmon stocking programme that utilises returning adults as broodstock; and wild salmon in the Rhine that are self sustaining.

Fish passage

Between 2000 and 2013, 481 barriers have been altered to improve fish passage. For example, in the Rhine Delta (Nederrijn/Lek) three barrages have been equipped with bypasses at a cost of ~€7 million and on the main stem of the Rhine fish passes have been built at two impoundments at Iffezheim and Gambenheim at a cost of ~€20 million. On the tributaries of the Rhine numerous weirs have been changed, lowered and fish passes constructed to improve fish passage at a cost of over €23 million.

Salmon can now swim upstream from Rotterdam to Strasbourg as well as in a number of the Rhine's tributaries notably the Sieg. However, there are a number of key bottlenecks that remain on the main stem of the Rhine, which include the coastal barrages of IJsselmeer and Haringvliet in the Netherlands and the EDF owned hydro-electric dams at Rhinau, Marckolsheim, Vogelgrün and Kembs in France.

Progress is being made. At Haringvliet plans have been drawn up for the partial opening of the barrage to provide for fish passage. At IJsselmeer a €50 million fishway has been designed which includes a glass sided viewing area. At Kembs Island just south of Basel EDF are constructing a fish pass and a restored river channel, which we visited during the Salmon Summit. For Vogelgrün dam, EDF are proposing a 'mobile fishway system' which involves trapping salmon and transporting



Kembs dam River Rhine

populations. Across the Rhine system approximately 1,000ha of potential spawning and juvenile habitat has been identified, however so far only a quarter of this is accessible.

For most of the Rhine, its habitat has been altered out of all recognition, from what was historically a heavily braided dynamic system to a straightened and engineered channel. Measures are being put into place to restore habitat and give more space to the river not only for biodiversity but also to manage flood risk, however the task is massive. As part of the Salmon Summit we visited Kembs Island near Basel where a new channel is being created as part of a river restoration scheme in an area known as the Petit Camargue.

A further issue highlighted at the Salmon Summit was the impact of dams and engineered banks on natural river processes notably gravel replenishment. A bed load reactivation plan has been drawn up which identifies areas of gravel depletion and surplus and includes proposals for lowering the level of barrages, promoting natural processes and adding gravel. However such work is hugely costly with an estimate of many tens of millions of euros to implement the plan.

Restocking

them upstream in a barge, though this was not seen as a sustainable solution at the Salmon Summit. An alternative proposal was put forward for a complex series of tunnels, which reflects the difficulty of providing for fish passage, hydropower and navigation at these substantial dams.

If these dams do become passable, however, salmon could once again populate both new Black Forest tributaries and their original spawning beds above Basel in Switzerland, as many of the dams in these areas have already been equipped with fishways.

For a sustainable salmon population both upstream and downstream passage is essential and so far the focus has been primarily on upstream migration. Safe downstream migration will present a real challenge particularly given the number of hydroelectric power stations on the river.

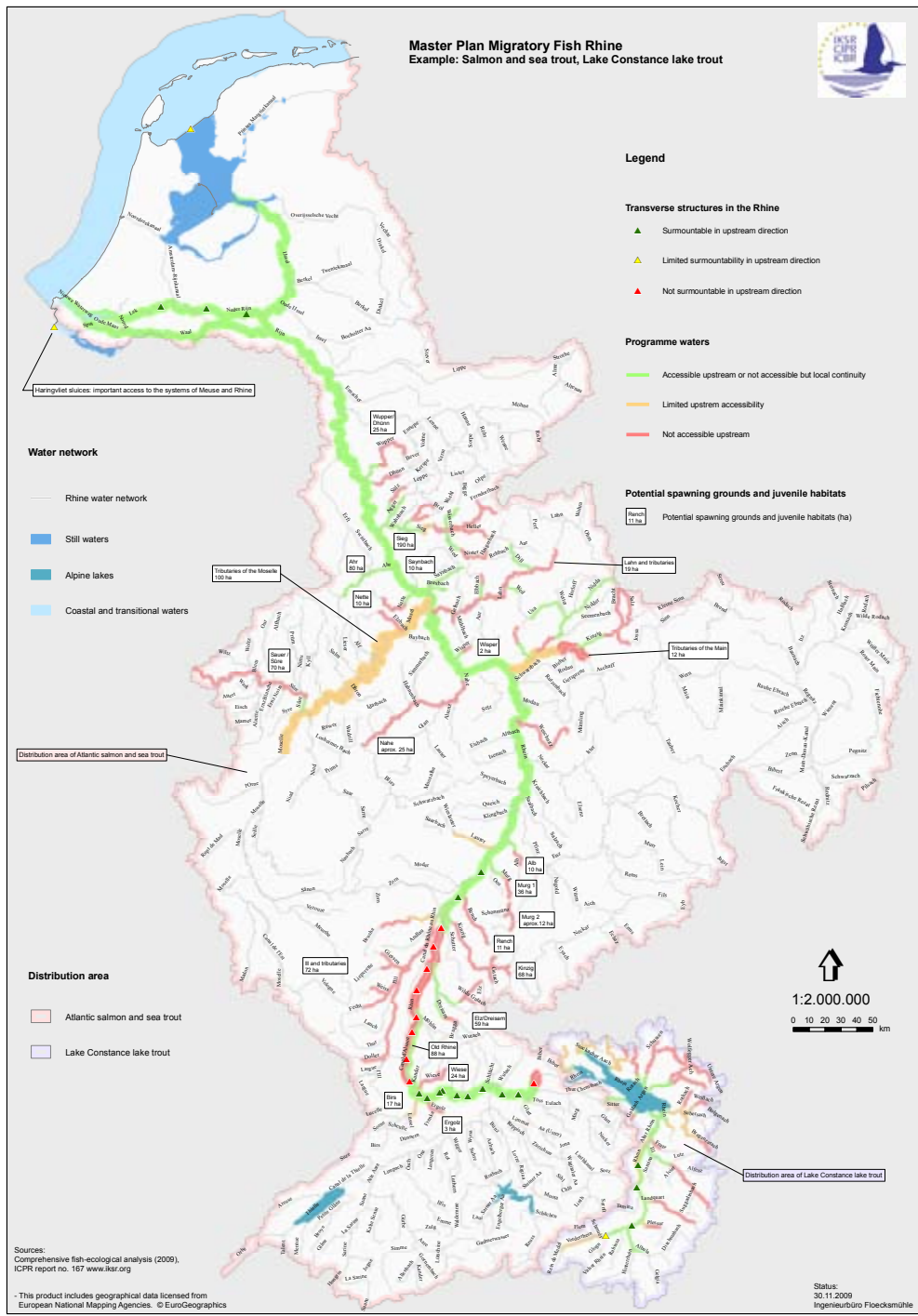
Habitat enhancement

Spawning and juvenile habitat is a critical component for self sustaining salmon

Following the extinction of salmon in the Rhine, stocking has been a central element of re-establishing a viable population. As referred to earlier, salmon stocking was embarked upon as early as the 1850s and we visited the Rhine's salmon hatchery near Basel that had been built by Napoleon the Third. This hatchery remains in use today and is the main rearing facility on the Rhine.

Between 1999 and 2003 over 11 million juvenile salmon were stocked into the Rhine. These fish have been largely stocked as fry and have gone on to support smolts and returning adults.

Great care has been taken in selecting the donor strain, which has been based on: geographic proximity, spawning time, length of river, timing of return, availability of source and health status restrictions. Since 2004 two strains have been used from the Swedish Ätran strain for the Middle Rhine and the French Allier strain for the Upper Rhine. Survival rates, growth and juvenile densities have been found to be good following stocking.



Since 1990 it is estimated that more than 3,000 adult salmon have returned to the Rhine system and natural reproduction has been successful in various river systems, including the Dhünn, Sieg, Saynback, Nette and Ahr. The Iffezheim fish counter indicates that nearly 200 salmon have got as far as Strasbourg this year.

Salmon comeback

Salmon have returned to the Rhine, but there is much more to be done. During the Salmon Summit many factors were cited as impacting on the return of salmon to the Rhine. They included barriers to upstream and downstream migration, the availability and accessibility of good habitat, the impacts of turbines, high predation levels by piscivorous birds and fish particularly in slow flowing waters, altered flows, the impacts of large container ships, poaching and by-catch by recreational and commercial fisheries, cumulative effects, climate change, mortality at sea and water quality issues. In the light of all these issues it is perhaps astonishing that salmon are returning.



The fact that salmon are returning is a testament to the international cooperation and commitment to the Rhine and a recognition of salmon being the ultimate indicator of a river reborn. For more information visit: www.salmoncomeback.org and www.iksr.org