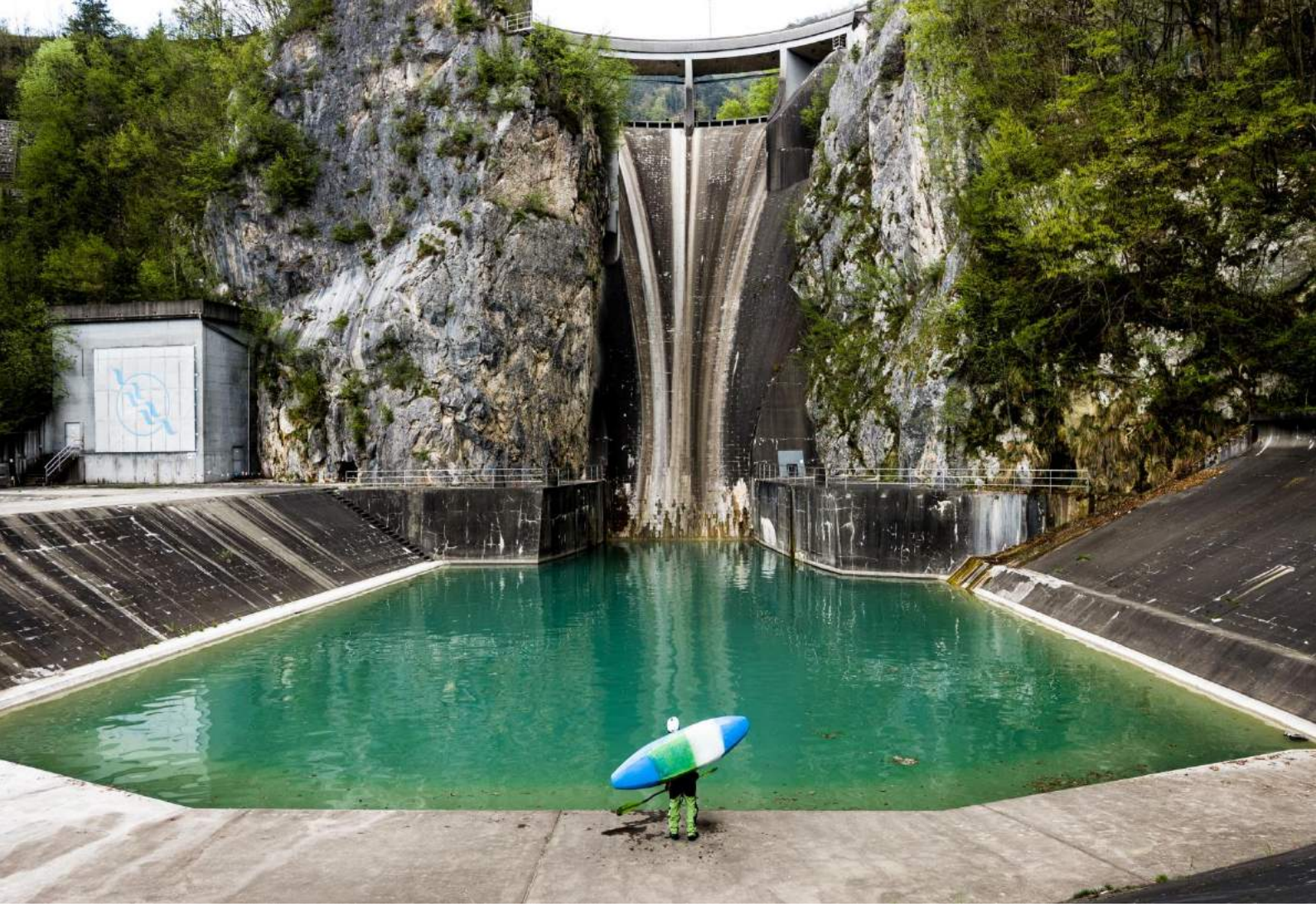


REMOVE THE DAMS

FREE OUR RIVERS

Concept paper

An initiative of

RiverWatch and Manfred Hermsen Stiftung für Natur und Umwelt

Background

Background

Rivers are the most endangered habitats on Earth. No other habitat type has been so drastically impaired in the past 50 years - not forests, not even oceans. Rivers are being channelled, polluted and dammed. This is particularly true in European watercourses.

Fortunately, a process of rethinking has already started and rivers and creeks are being restored within the EU, meaning that they are being liberated from their artificial corset and given more space on each side of their course.

However, a significant element of river restoration – arguably the most important one – has not received any consideration yet: thousands of hydropower plants and weirs in our rivers (refer to hydropower and other barriers in the Alps map from WWF/BOKU) are severely impairing life in rivers and are ultimately preventing the recovery of our watercourses.

We want to change that!

Goal of the campaign

With the "Remove the Dams – Free our Rivers" campaign, Riverwatch and the Manfred-Hermsen-Stiftung want to promote the de-damming movement in Europe. For this purpose, we are collecting the necessary data (questionnaire) and promote the issue through public outreach. Within one year, we want to draft a list of the TOP 50 dam projects to be removed. In the medium term, we intend to implement concrete dam removal projects.

Free Elwha River in the USA after removal of two large dams: Glines dam (64m) and Elwha dam (33m) © Jason Jaacks

Requests

1. **The removal of dams is an essential measure/ in river restoration and is to be intensified and promoted;**
2. **the demolition of a dam has to be considered and reviewed (ecologically and economically) as a variant when hydropower plants are renovated;**
3. **In the frame of dam concession extensions the removal of dams is to be included in the decision making process.**
4. **Subsidies for small hydropower plants are to be stopped.**

REMOVE THE DAMS
FREE OUR RIVERS

HOW TO IMPLEMENT OUR CAMPAIGN

Questionnaire

We will send out an online questionnaire to NGOs, river initiatives, fly fishers, kayak associations and other river lovers requesting suggestions of particularly harmful dams. We want to identify the dams which should be removed in the people´s point of view. The list will then be analysed by experts who will prioritize certain dams. This way, we will come up with a list of 50 most important dams to be demolished.

Critical assessment of dam concession extensions

Many old dams and hydropower plants have concessions which will expire in the coming years. This is an ideal moment to demand the dismantling of these dams. In other EU countries (exp. Spain and France), this is already an established practice. We ask our decision-makers that the demolition variant must also be checked in the decision-making process when dams are renovated or their concessions extended.

Uncover the environmental damage caused by dams

We will make the negative effects of dams visible, for example in the form of actions, media work and lobbying. In doing so, we are working together with citizens' initiatives and NGOs on the ground and we will profit from our local and international network.

Anti-Dam action in Bosnia-Herzegovina organised by our local Partner CZZS
@ Dinno Kasalo

Join forces

We want to accomplish our campaign goals together with NGOs and other river organisations, which are already involved in dam removal projects in Europe or are interested in this issue. Riverwatch is part of the Dam Removal Europe platform, which is promoting dam removal within the EU since 2016.

Participants of the first dam removal conference in Leon, Spain 2016
© Dam Removal Europe

Dam removal database

Whenever dams or weirs are being removed we report it to the EU Dam Removal platform, which is operating a pan-European database. Data from Spain, UK, Sweden and Finland can already be found on the online map.

When is a dam a dam?

In principle, any transverse structure (that is, any structure that is constructed across the river) that is an obstacle for fish and water insect migration is problematic and should be removed. For the sake of efficiency and practicability, we are concentrating on dams and weirs of at least a height of one meter.

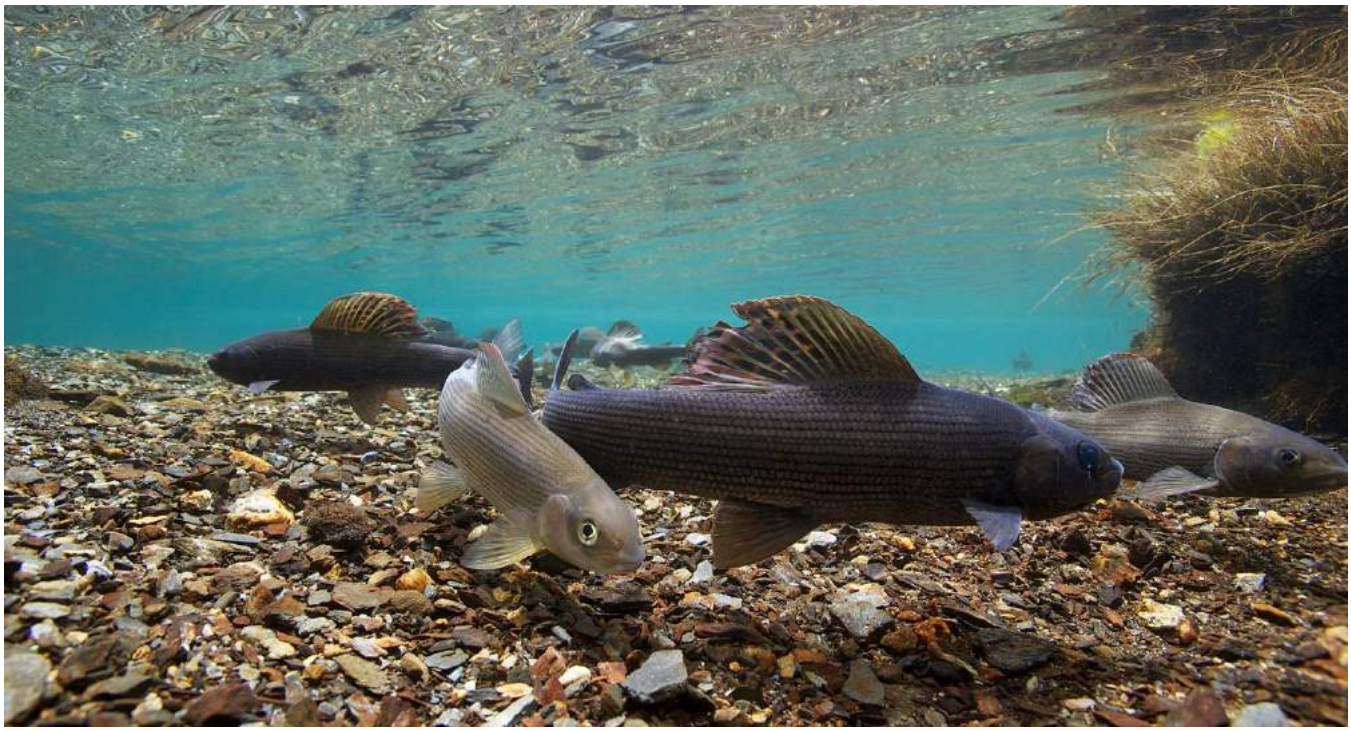
The type of use – whether it is for hydropower, river regulation or irrigation – does not play a role in the selection of our TOP 50 dam removal candidates. To water organisms and sediments, it makes no difference what use these obstacles have, so it makes no difference to us as well!

Focus area – where shall dams be removed?

Our campaign focus lies on the Alpine and the Balkan regions, since the highest number of dams are located in the Alps (have a look on the map of hydropower plants and other barriers on the alpine rivers) and we have the best set of data for these regions at our disposal. Furthermore, we have an extensive network of local experts and river organization in these two regions. However we are open to include dam removal candidates also from other countries in our list.

Time frame

The campaign will officially start in autumn 2017. The end is open.



Grayling in their natural environment © Michel Roggo

REMOVE THE DAMS
FREE OUR RIVERS

Dam Removal: A new method for river restoration

Hydropower plants are continued to be constructed in Europe – small and large ones – particularly in the Balkan region, where over 2,700 projects are known. Even in countries such as Austria, Germany, Switzerland, Portugal etc. where every creek and river is already dammed or its natural water flow is altered, many new hydropower plants are planned. Numerous environmental NGOs, civil society initiatives – including Riverwatch – are protesting vehemently against this hydropower overdevelopment.

With our dam removal campaign "Remove the Dams – free our Rivers!" we want to take a new direction in river protection. We want to initiate the removal of particularly harmful old dams and hydropower plants.

This can only come true, if we **critically assess existing dams, hydropower plants, weirs and other artificial obstacles** and take their removal not only into serious consideration but also put it into practice.

As already enough hydro power plants exist in Europe; in fact, we have far too many of them. We don't need more dams but more vibrant rivers, with more Danube salmons, more graylings, more kingfisher, and more natural recreation areas for people.

Example of dam removal in France: Photo BEFORE removal of Brives dam, 2-3m high, on the upper Loire © ERN

Photo AFTER Removal (in 2003) of the Brives dam: The upper Loire River is free flowing again at the former Brives dam section © ERN

REMOVE THE DAMS
FREE OUR RIVERS

Dense fragmentation of our rivers!

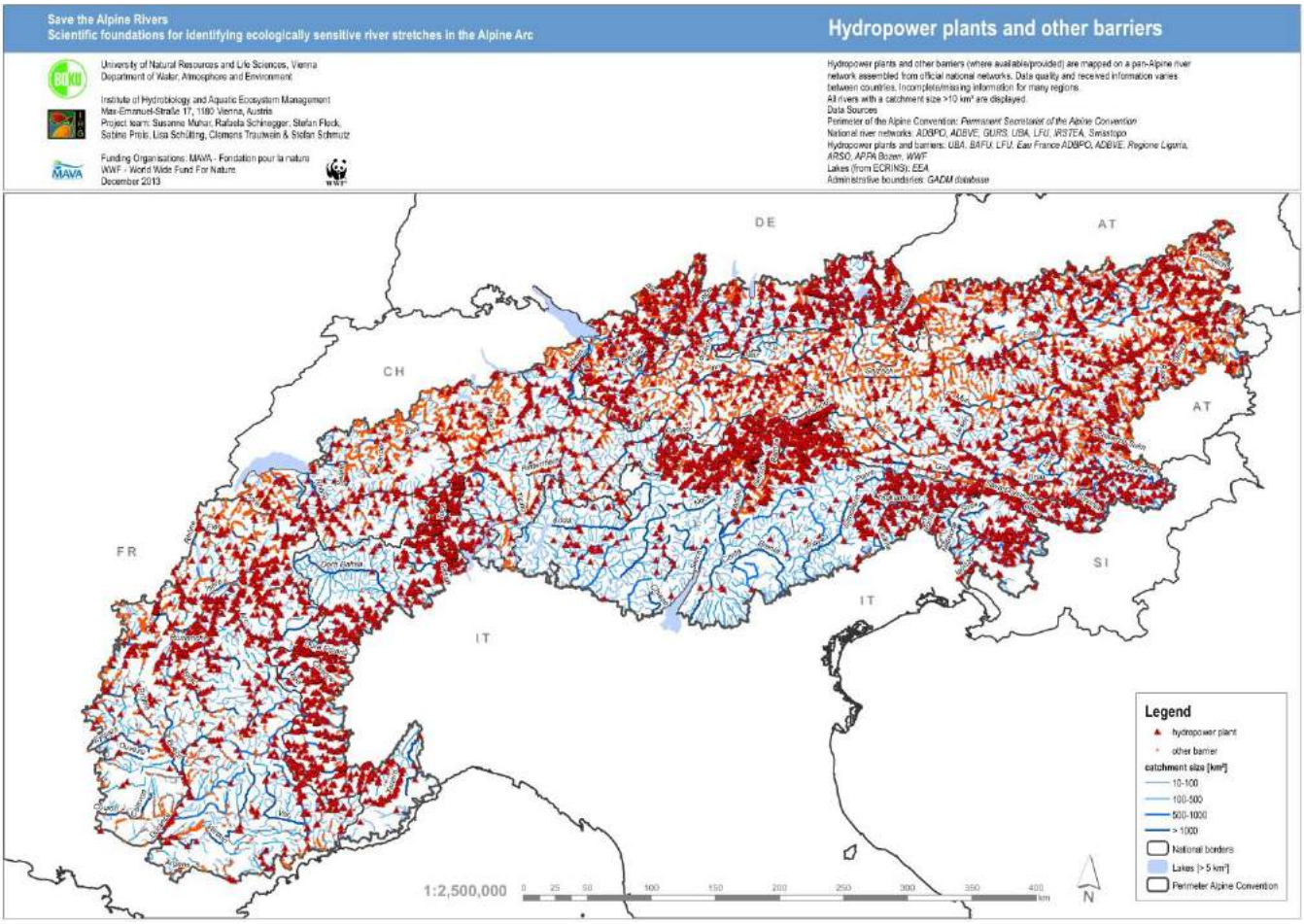
Hundreds of thousands dams and other transversal barriers exist in European Rivers.

These dams are interrupting the free water flow, retain sediments and block migration of fish and other water organisms.

Presently, our rivers are overwhelmingly chopped up by dams, every:

- **4000m** there is a **barrier** in **France** / 120,000 transversal barriers (estimation ONEMA 2011, EEA European River Status Report 2012)
- **2000m** there is a **barrier** in **Germany** / 200,000 transversal barriers (UBA, Germany 2016)
- **900m** there is a **barrier** in **Austria** /30,000 transversal barriers (NGP 2015)
- **650m** there is a **barrier** in **Switzerland** / 100,000 transversal barriers (EAWAG, 2010, EEA European River Status Report 2012)

A dynamic river system, composed of wetlands that are connected with the river, is degraded to a chain of still standing artificial water ponds.



Dams and hydropower plants are spread all over the Alps: 72% of alpine rivers are impaired by hydro power plants
© BOKU, WWF: Save the Alpine Rivers 2014

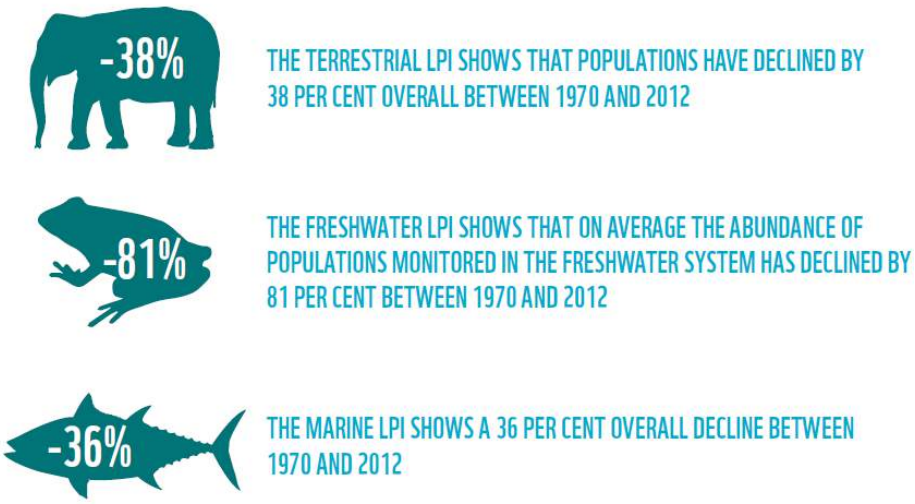
REMOVE THE DAMS
FREE OUR RIVERS

Our Rivers: The most threatened ecosystems of the world!

Almost anywhere, where free-flowing rivers remain, they are home to vulnerable freshwater biodiversity. Dams and other infrastructure threaten these natural ecosystems as they create barriers, causing fragmentation and alteration to flow regimes. Dams also affect migratory fishes by obstructing their migratory pathways, making it difficult or impossible for them to complete their life cycle. Scientific studies and monitoring programs like the LPI prove that our rivers are increasingly losing their biodiversity and are the most threatened ecosystems in the world.

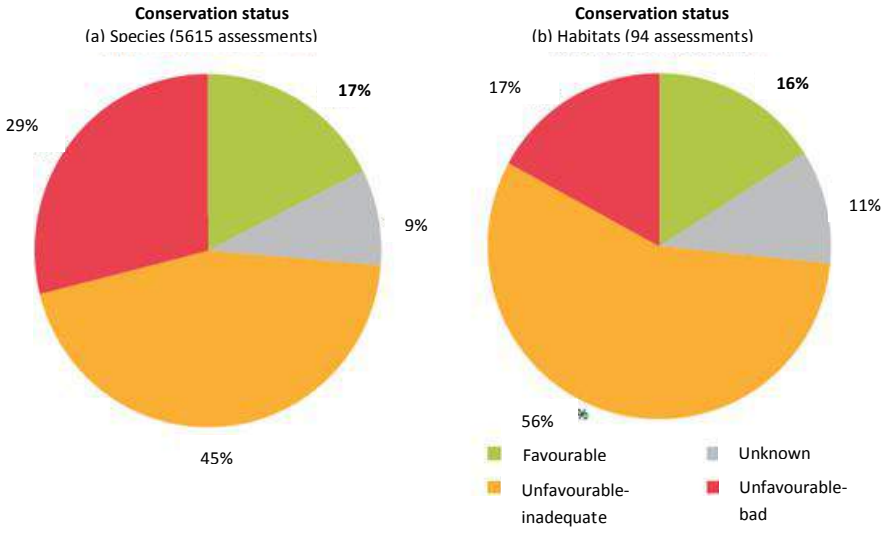
The **Living Planet Index (LPI)** is a measure of the state of the world's biological diversity based on population trends of vertebrate species from terrestrial, freshwater and marine habitats. The LPI is based on trends of thousands of population time series collected from monitored sites around the world.

The Living Planet Index (LPI) has recorded extreme declines in animal populations of rivers and lakes. Since 1970, **a decline of freshwater organisms by 81% has been monitored globally** (WWF LPI 2016). The most common threats are habitat loss due to **fragmentation caused by artificial barriers such as dams and weirs, regulation and over construction as well as artificial water abstractions and water pollution.**



Graphic: LPI - Living Planet Index 2016, WWF

In the countries of the European Union the status of freshwater species and their habitat is to a large extend (more than 70%!) in an unfavorable, inadequate or bad condition (EEA, 2012).



Nearly half (47%) of European waters did not achieve the "good ecological status" of the EU Water Framework Directive in 2015 (EEA 2012).

Answers to FAQs

Answers to questions !

The removal of dams sounds crazy or provocative to many people, especially in light of the current climate debate, which is fuelling the construction of many new large and small hydropower plants.

However, the idea of dam removal is not a utopian concept, but an important tool for the restoration of our rivers. So far, dam removal is still a very new concept, but this will change with this campaign.

In the following pages we want to give answers to the most frequently asked questions, such as:

1. ***Don't we need more, not less hydropower plants?***
2. ***Can't we just green up hydropower by adding fish ladders?***
3. ***Removing dams – is that already being done somewhere?***
4. ***Is it legal to take down dams?***
5. ***Why even bother to remove dams, what are the advantages?***

During the Clinton presidency (1993 to 2001), a dam removal movement emerged in the US and since then over 1300 have been removed. In Europe, some large dams have already been removed in France and Spain, and in Germany and Sweden dam removals are in the pipeline. European and US dam removal case studies can be found in the Annex.

With the "Remove the Dams" campaign Riverwatch and the Manfred-Hermsen-Stiftung want to promote and broaden this movement in Europe so that the removal of dams is applied for restoring our rivers on a larger scale.

Dams are not for eternity!

We must dare to take them down!

What seemed to be a crazy idea of some environmentalists 20 years ago came true: The Glines dam (64m high!) was removed between 2012-2014 allowing the Elwha River (USA) to run free again

© John Gussman / Return of the River / Patagonia

1. Don't we need more, not less hydropower plants?

Too many hydropower plants in Europe!

In the European Union, around 23,000 hydropower plants are recorded (EU Commission, 2015). About 91% are small facilities (21,000) with installed capacities below 10 MW, generating only 13% of the total production. Larger hydropower plants represent only 9% of all hydropower facilities but generate 87% of the total production.

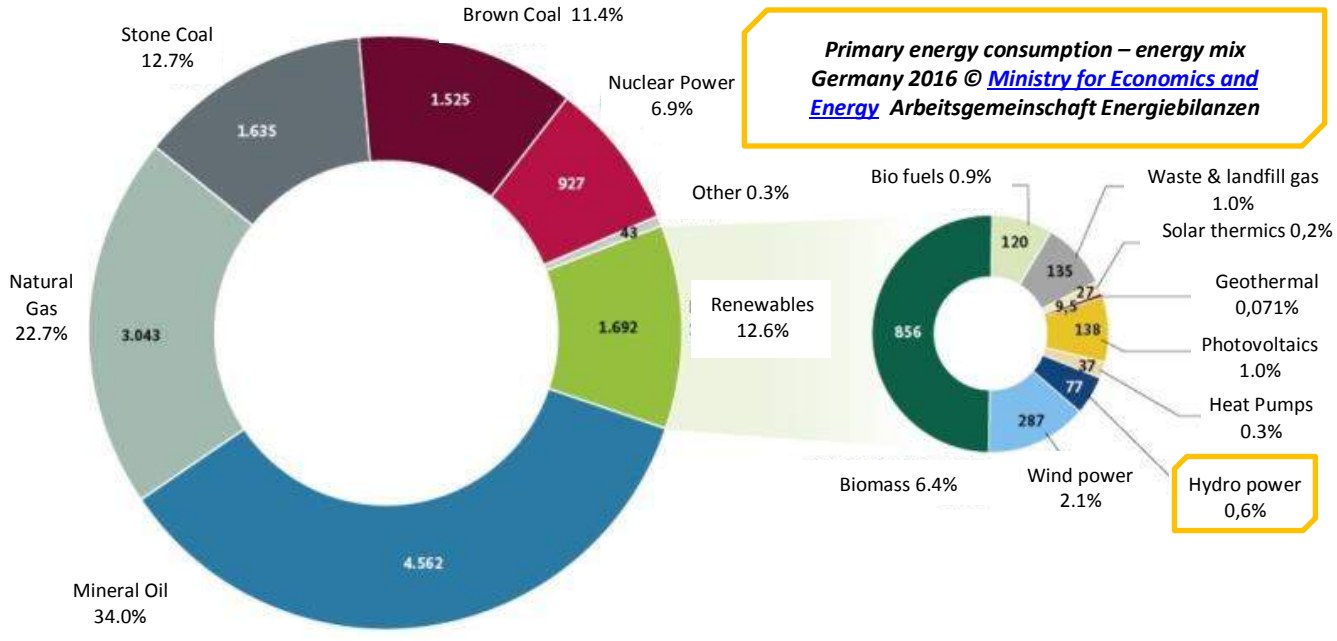
A closer look at the data reveals that the number of very small hydropower plants (< 1MW) is enormous but their contribution to the country´s energy production is negligible. Nevertheless, they have the same detrimental impact on small rivers and streams as large plants have on major rivers: their dams and weirs are of several meters in height, making it impossible for fish and water species to migrate, or sediments to be transported.

Germany

Approximately 7,700 HPPs are registered in Germany. The 400 largest plants are generating 90% electricity and the remaining 7,300 HPPs produce only 10% of hydropower electricity (UBA and Kampa 2011). In fact, the share of hydropower in the country´s total energy mix is very low (only 0.6% in 2016 - see graphic below). **Thus, these 7,300 small HPPs are contributing only 0.06% to the country´s energy mix, while rivers and the species living in and around rivers are impaired or destroyed 7,300 times! That is simply absurd!**

Austria

Another example is Austria, a country in which hydropower makes up a rather high share of about 25% of the national energy mix (primary energy production - Statistik Austria 2015). In Austria 2,619 hydropower plants are registered in the public energy network, **but out of these 2,202 hydropower plants are producing only 4% (!) of the hydropower electricity (BOKU, 2011) but are destroying our rivers 2,202 times!**



REMOVE THE DAMS
FREE OUR RIVERS

Integrated planning creates new solutions!

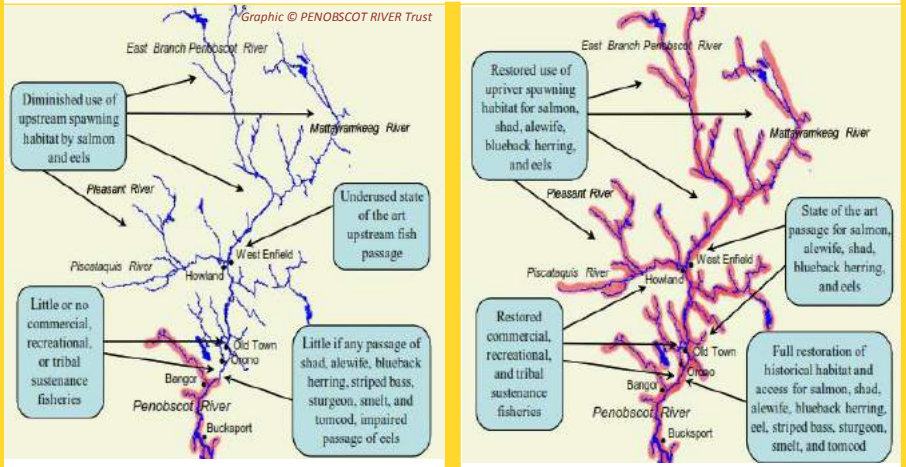
The Penobscot river restoration project has been widely acclaimed as one of the most innovative river restoration projects in the USA. It likely offers the last best chance to save native Atlantic salmon from extinction.

Three hydropower plants were removed or converted on the Penobscot. Thanks to an integrative planning approach, the lost energy production has been compensated by efficiency improvements at existing hydropower plants.

At the Penobscot´s confluence with the sea, two hydropower plants used to block the access of fish to their spawning grounds. Over decades this has led to a massive collapse of fish stock in the upstream Penobscot river basin.

After years of campaigning and negotiations, the two large hydropower dams (Veazi dam und Great Works dam) were removed in 2012 to 2013. A third hydropower plant (Howland) was converted, so that a portion of the river is bypassing the dam which is improving fish passage.

PENOBSCOT RIVER RESTORATION PROJECT



BEFORE removal: dams are blocking the access to fish grounds upstream
Accessible river section for migrating fish

AFTER removal: large dams close to rivers' confluences were removed
Accessible river section for migrating fish: 3200km !

With broad public and private support, the project achieved that 3,200km of historic river habitat is now accessible again. Fish stock is recovering amazingly well: only two years after the dam removal, river herring such as alewife and blueback herring have increased stunningly from merely thousands to 1.8 million individuals! Rare species such as Atlantic salmon, eel, shad, sturgeon and sea lamprey are coming back by thousands and find their way up again to their original spawning grounds.

One third of the total energy production of the Penobscot watershed was lost due to dam removals. This loss was compensated by efficiency improvements at other existing hydropower plants in the Penobscot watershed. These **efficiency measures were so successful that the loss could not only be compensated but a slight increase in energy production could even be achieved! Find more information on this encouraging river restoration project here**.

In summary, the following conclusions can be made:

1. **When it comes to hydropower „small is NOT beautiful" – small hydropower plants often make no sense ecologically and economically.**
2. **In Europe, we could potentially remove thousands or even ten thousands of small hydropower plants without triggering any tangible negative economic consequences.**
3. **Energy losses generated by dam removals can be easily compensated by extending solar power production and/or efficiency improvements at existing hydropower plants.**

OR we can just stop our wasteful consumption of energy - this would be the most sensible way! LET´S GET RID OF THE DAMS!

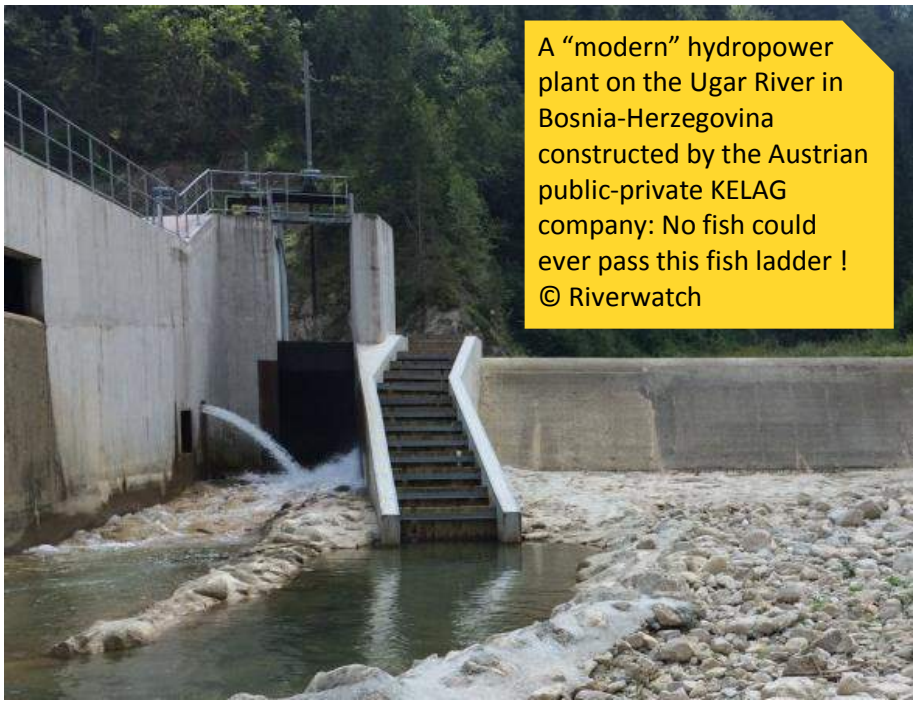
2. Can't we just green up hydropower by adding fish ladders?

The whole truth of Fish ladders!

People tend to believe that hydropower is, creating "green" a green source of energy causing only a minor environmental damage which can be compensated easily by fish ladders. Unfortunately, this is not true!

On the one hand, the majority of hydropower plants are not equipped with fish ladders. In Austria, 70% of hydropower plants do not have fish ladders (NGP 2015) and in Germany, 90% of dams are without fish ladders (Adam and Schwevers, 2005)!

On the other hand, fish ladders, fish lifts and bypasses are not effective in the most cases.



A "modern" hydropower plant on the Ugar River in Bosnia-Herzegovina constructed by the Austrian public-private KELAG company: No fish could ever pass this fish ladder ! © Riverwatch

In Germany, an assessment of 212 fish ladders concluded that **only 10% of fish ladders met the criteria that fish can detect them, and only 5% fulfilled the criteria that fish are able to pass the fish ladder** (Schwevers et al. 2005 und Lachsverein Deutschland). In Austria only 28 out of 57 assessed fish ladders (BOKU 2007) were fully functional.

While fish can barely migrate upstream, they also cannot go downstream as most of them get sucked into the turbine channels and are hit or killed during their passage. Furthermore, many water insects have no way of passing fish ladders.

Young Salmons were chopped by turbines © J. Schneider

Struggle for survival of a young coot chicken at the turbine channel rake; the chick drowned an instant after the photo was taken © Winfried Klein

Even if a fish ladder meets all the criteria like being detectable and passable for fish, only few individuals really succeed in surmounting this artificial structure. American studies (Brown 2013 and Noonan 2012) have analysed the success rates of fish ladders. For strong swimmers like the species from the salmonid fish family about 60% of fish succeed in passing over the fish ladders. For weaker swimmers the success rate is only 20%.

A short calculation exercise:

How many out of 100 fish will succeed in reaching their spawning grounds, if they have to pass 4 hydropower plants (HPP) that are equipped with fish ladders with a theoretical success rate of 50 %?

Only 50 out of 100 fish will remain after the first HPP, only 25 after the second , 12 after the third, and after the forth, only ***6 (!!) fish would remain (in theory) to reach their spawning grounds!***

BOX: Fish ladder example in Austria, River Kamp

At the Kamp River in Lower Austria a chain of hydropower plants is fragmenting the river flow: 11 hydropower plants (HPP) are located on the Kamp at a river stretch of only 40km between the hydropower plant Rosenburg and the Kamp´s confluence with the Danube. **All HPP are equipped with fish ladders**. **So in theory, the full range of Danube fish species (approx. 50 species) could be expected to live in this river**. In reality, only 17 species were found in the river section between HPP Rosenburg and the confluence during fish monitoring measurements in 2004 (BMLFUW/BOKU Studie MIRR, 2007).

10 years later in **2014**, fish populations were monitored again, this time upstream the HPP Rosenburg. The results were disillusioning – **only 5 (!) species were found**: trout, bullhead, stone loach, chub und gudgeon (EVN/Knoll, 2015).

Conclusion: The RIVER´S CONNECTIVITY CANNOT be reestablished by fish ladders!

The license of the hydropower plant in Rosenburg will expire in 2027. Instead of reconstructing the HPP and even increasing the height of the dam as planned, the HPP should better be removed. This would create new river habitat for threatened species and allow the river to thrive once more within at least this section.

Further information on the Rosenburg dam-removal campaign can be found here: http://lebendiger-kamp.at/

Fish are killed by turbines when they try to pass a hydropower plant despite new equipment and are thrown out by the conveyor belt, HPP Kostheim, Deutschland © Winfried Klein

If there is now nearly every 500m to 5km a migration barrier, such as a dam, weir or sill that is in most of the cases not equipped with a fish ladder, what is the consequence for our migrating fish species?

The sad answer is: They will disappear! Rivers, which used to be home and spawning grounds for thousands of fish of different species, are now empty. Despite improved water quality, fish hatcheries and fish ladders, European migrating fish species like sturgeon, eel, salmon, grayling, barbel and brook lamprey have either become extinct or are close to extinction (Table 1, BMLFUW/BOKU Studie MIRR, 2007).

Instead of removing dams, money is invested in green-washing hydropower by constructing fish ladders here and there. These ecological fig leaves cost the tax payer several million euros, but they practically change nothing for fish and water organisms. It may be time for our decision makers and river engineers to admit the failure of fish passage and hatchery-based restoration programs and acknowledge that significant migrating species restoration is not possible without dam removals (Brown 2013).

In conclusion, it can be stated that:

1. **Fish ladders are more an illusion than a real solution. They should not be used as fig leaves for hydropower.**
2. **The removal of dams is the best solution to ensure free organism and sediment movement.**
3. **Without systematic dam removal it will not be possible to secure or to improve the biodiversity in our rivers for the next generation!**

Barbel – threatened mid distance migratory fish species of the cyprinids family © Michel Roggo

3. Removing dams – is that already being done somewhere?

USA: Pioneer in Dam Removal

In Central and South Eastern Europe, dam removal is a completely new, unthinkable - yes even a provocative -approach, not only for the administrations but also for many environmental protection organisations.

However, dam removal is working: in the US, dam removal for river restoration has been implemented on a large scale for many years. During the Clinton presidency (1993 to 2001), environmental protection has gained political popularity and dam removal was recognized as a viable river restoration method (Klein, 1999). Over 1300 dams and weirs have been removed until 2016 (Dam Removal Database) and every year the list is getting longer with 50 – 100 removed dams per year. In the beginning, mostly small dams were dismantled, but large dam removals followed – like on the Elwha River in Washington DC (33m and 64m high dams).

Further large dam removals are in preparation, such as the Matilija Dam (48m) on the Ventura River in California or the four large dams on Klamath River in Oregon (50m high dams). You can find more information about the US dam removal movement in the US case studies in the Annex.

USA: Ventura River, Matilija dam (48m), dam removal was ordered by a federal state decision © Ben Knight, Patagonia

USA: Klamath River, Iron Gate dam, which is one out of four dams to be removed, start of removal works 2020 ©Matt Stoecker, Patagoni

REMOVE THE DAMS
FREE OUR RIVERS

Dam Removal in Europe

In Europe, some countries such as France, Spain, Portugal, Sweden, Finland and the UK, have understood the benefits of dam removal and are starting to dismantle some old dams.

In **France,** the dam removal movement started in the 1990s. Especially in the Loire River basin, larger dams were removed or modified in order to open important fish migration ways for Atlantic salmon.

In **Spain,** over 200 dams have already been removed so far. The focus is on dams with expiring operation licences or which are so old that renovation would be uneconomic.

In **Germany,** dam removal is also in its starting blocks. Recently, some larger dams and weirs have been removed. An example is the restoration of the Altenau River.

In the Annex you will find further information for European dam removals. A map of dam removal locations in Europe can be found at **Dam removal Europe databank of removed dams**.

France: Vezins dam, 36m high, Sélune river – Normandy, removal planned for 2017/2018 © Eau Rivières Bretagne and ERN

Spain: Inturia dam, 12,5m high, Leitzaran River, removal 2013 – 2016 © Basque Water Authority

Germany: Altenau river dam removal and restoration project, removal 2002-2016, photo of the former artificial reservoir © Michael Weber

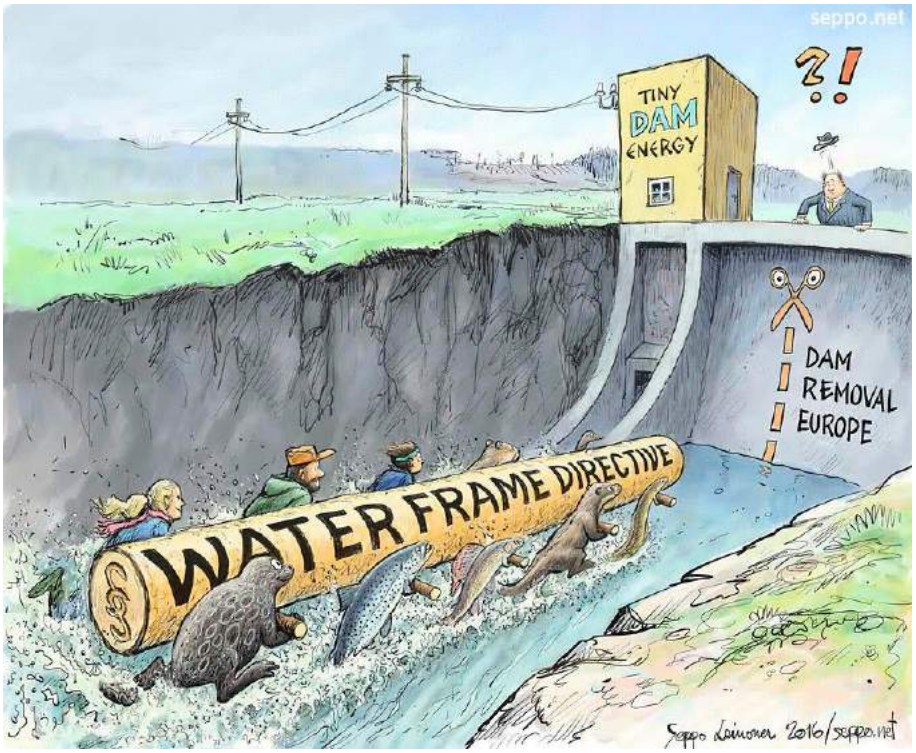
4. Is it legal to take down dams?

EU Water Framework Directive

European member states have committed themselves to set measures in order to reach the good ecological status for their surface water bodies by 2027. The legal basis for this ambitious objective is the EU Water Framework Directive EU – WFD. In addition to a good chemical and biological status, a good hydro-morphological status must also be achieved. This includes a natural water flow (hydrology), the river´s continuity and the natural structures in and around the river (morphology) (WRRL, Article 4, Annex 5).

Since the implementation of the EU water framework directive in the year 2000, the EU member states have only achieved a modest progress in regards to the good ecological status: **in 2009, only 43% of surface waters had a good ecological status, six years later it was 53%** (EU WFD).

The reasons for these rather modest results are sever alterations in the river´s natural run – so-called hydro-morphological pressures: artificial embankments, interruption of rivers by dams and weirs, water abstraction or other technical structures in and around a river. 48% of European rivers are exposed to these hydro morphological pressures (EU WFD).



Free our rivers from obsolete dams!
The EU WFD (Water Framework Directive) is the legal basis for dam removal
© Seppo Leinonen, Dam Removal Europe

Without a drastic change in surface water planning it will be impossible to reach the good ecological status of our rivers by 2027.

The removal of dams would be the most important and effective measure of river restoration projects. **Interestingly, the removal of artificial barriers is mentioned as a planned measures in 2/3 (!) of River Basin Management Plans that have been submitted to the Environmental Agency by the EU member countries** (EEA European River Status Report 2012).

In reality, unfortunately, EU countries are hardly putting any of these set measures into practice. If at all implemented, it is mostly just the removal of some ground sills. Large dams and weirs or even hydropower plants are still taboos for dam removal, especially in the Alpine region.

REMOVE THE DAMS
FREE OUR RIVERS

5. Why even bother to remove dams, what are the advantages?

Dams are NOT forever!

As any other artificial structure, dams have a certain technical lifetime and expiration date. Depending on the type and use of the dams this can be between 60 - 100 years whereas electro mechanical equipment needs to be upgraded already after 30 - 40 years. Most of our dams were constructed either before or after the Second World War (World Commission on Dams Report, 2000).

So in the near future there will be a veritable wave of medium-sized and large dams that need to be revised and assessed according to modern legal environmental standards.

We want to use this unique opportunity to take down old and obsolete dams, especially those that are very harmful to the environment.

In addition to ecological benefits, this would also provide economic advantages, as the removal is often cheaper than renovation and upgrading with fish ladders (Hart 2002, Brown 2009).

Furthermore, through dam removal we could recreate the ecological free passage for migrating fish and debris, and sediments could be transported naturally without costly sediment management plans.

After the REMOVAL of two large dams on the Elwha River in the US, the sediments are flowing back to the see and a new river delta is formed again © John Gussman, Patagonia

There are 4 main reasons why dam removal makes sense:

(1) Ecological advantages

- **Rivers will return to be rivers again**, with natural dynamics, rather than artificial, stagnant impoundments. Natural water flow and water level fluctuation will come back, which are essential for the survival of wetlands and alluvial forests (American River).
- **Fish and other animals will be able to migrate freely** again, as more living space and spawning areas for endangered fish species and other rare water animals will be available (Hart 2002 and Lindloff, 2000).
- Natural transport of **sediments**, debris and nutrient will be possible again (Lejon 2009).
- **Water quality will be improving** and the natural water temperature will be readjusted (American Rivers).

(2) Legal aspects

- Implementing dam removal will enable compliance with the objectives of the EU Water Framework Directive (WFD), which is stipulating the good ecological status of rivers. The EU-WFD implies that rivers have to be reconnected by 2027 (WFD 2000).
- Compliance with the objectives of the EU Habitat – FFH - Directive (EEA, State of Nature in EU, 2015) will be reached.

(3) Economics

- The removal of old dams was in several cases more economic than the renovation, maintenance and the retrofitting with fish ladders (Born *et al* 1998, International Rivers 1999).
- No more costs for security and maintenance measures.
- Dam removal can generate revenues from local fishery and tourism and creates new jobs (Jewell 2016, Kruse and Scholz 2007, Nature Conservancy, Leon 2016). The value of recreation will be boosted, as a natural free flowing river is more attractive for humans than an artificially impounded reservoir.

(4) Security

- Removed dams will not break anymore (list of dam breaks).
- Free-flowing rivers will be more resistant to climate change than impounded rivers (Palmer, 2008).

BEFORE and AFTER Dam Removal: The removal of the Condit dam (38m) opens the access for kayaks and salmons to upstream sections in the White Salmon River in the US © Ben Knight, Patagonia

Case studies

Examples of dam removal projects

France

Loire

Spain

Basque Water Agency

Germany

Altenau

USA

Elwha River

USA

Chronology of dam removal movement

CASE Study - FRANCE

Loire

REMOVE THE DAMS
FREE OUR RIVERS

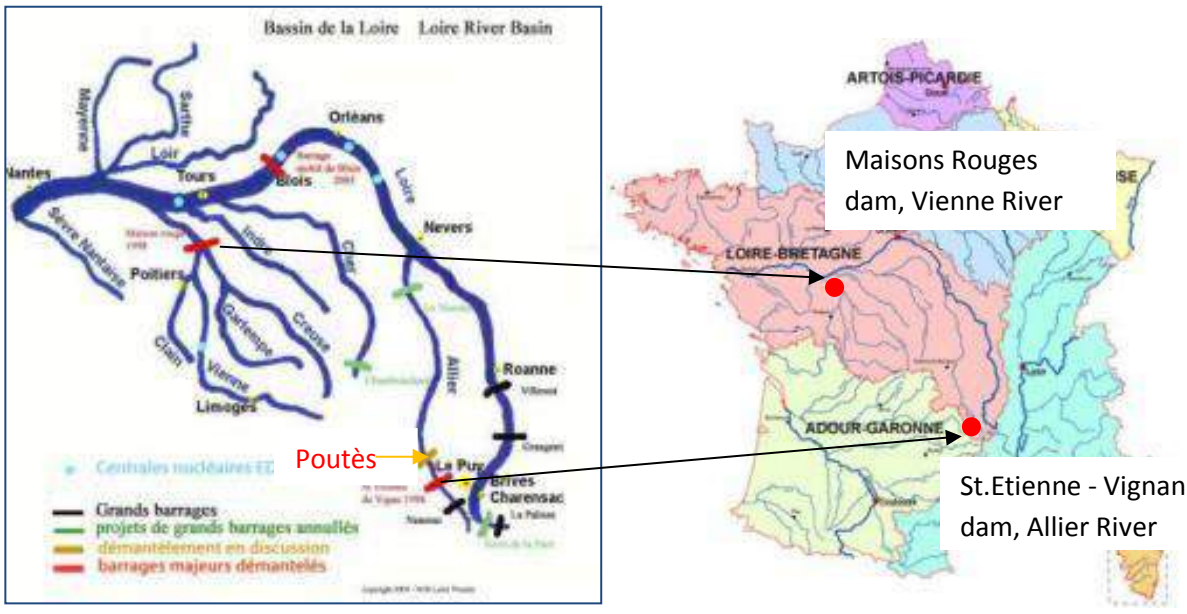
Saint Etienne du Vigan and Maisons Rouges dam removals

The construction of a dam in the village of Saint-Etienne-du-Vigan was authorised in 1895 to supply electricity to the town of Langogne (Lozère). Being approximately 14 m high and having no special fish pass for migratory fishes, the dam had sterilised the excellent Upper-Allier salmon spawning sites. At the time of construction, strong protests were uttered, in vain, by the rural people for whom the fishing supplied a considerable additional income.

Under the implementation of the "Plan Loire Grandeur Nature " (the Natural Loire River Plan) in 1994 by the French Government, the removal of existing dams was considered as a necessary measure to recreate free flowing rivers.

The French Government requested EDF to remove the dam at their own expense in order to restore the free running flow. River salmons were coming back the winter after the dam removal and results were encouraging.

Technical Data	(Source, ERN and ONEMA 2010)
Country	France / Normandie
Name of River	Allier and Vienne river, tributaries of Loire River
Name of Dam:	St. Etienne-du Vigan (Allier) Maisons-Rouges (Vienne)
Year of construction	1895 St.-Etienne-du-Vigan 1923 Maisons-Rouges dam
Year of removal	1998 St.-Etienne-du-Vigan 1998 Maisons-Rouges dam
Cost of removal:	1,3 Mio.€ St.Etienne-du-Vigan 2,6 Mio.€ Maisons-Rouges
Type of dam	hydropower
Power capacity	35MW : St.Etienne-du-Vigan no data : Maisons-Rouges
Height / Length	14m : Saint-Etienne du Vigan 4m/200m: Maisons Rouges
Volume	No data
Freed river km	44km Allier River, St.Etienne 35km Vienne and Creuse
Dam owner:	EDF



Location: Loire River Basin : Saint-Etienne-du-Vigan Dam at Allier River and Maisons Rouges Dam at Vienne - Creuse River confluence (Source ERN)

An initiative of

RiverWatch and Manfred Hermsen Stiftung für Natur und Umwelt

CASE Study - FRANCE

Loire

REMOVE THE DAMS
FREE OUR RIVERS

The other major dam removal in the frame of the Natural Loire River Plan, was the Maisons-Rouges dam, on the Vienne river, another tributary of the Loire river.

The Maison rouge dam was located at the confluence of Vienne and Creuse River and is only a view kilometers upstream the confluence to the Loire River. The Maison Rouge dam was dismantled in 1998 and the removal was an undoubted success. From 2004 to 2007 an automatic counting station on the Vienne River, 20 kilometers above the Maisons-Rouges site, registered 3,500 to 9,500 allice shads, 8,300 to 41,600 sea lamprey, 2-12 brown trout and 2 to 11 adult wild salmon, which was not found there since 100 years!

Alone in the Creuse river in 2007 around 9,000 allice shad, 51,000 sea lamprey, 4 brown trout, 60 salmon were sighted in Descartes 12 kilometers upstream Maison Rouge. So dam removal was proven to be an efficient approach for migratory fish restoration and also showed a huge reduction in the sedimentary deficit in the course of the Vienne, with benefits extending even into the Loire main branch.

Source of Information and links:

Saint-Etienne-du-Vigan, Allier River, Haute-Loire, 1998

Maisons-Rouges, Vienne River, Indre-et-Loire, 1998

Further major dam removals in France:

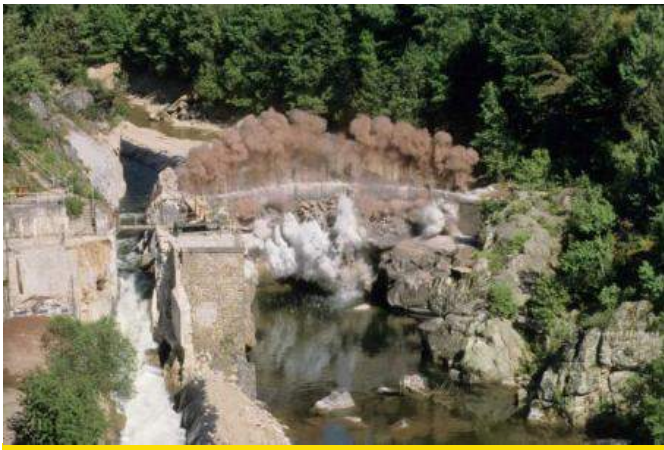
Kernansquillec, 15m, Léguer River, Cotes-d'Armor, removal 1996

Brives-Charensac, 3m high, Loire River, removal 2003

Blois, 1m high/ approx. 300m large, Loire River, removal 2005

Fatou, Beaume River, upper basin of Loire River, 6m high, removal 2007

Saint-Etienne-du-Vigan dam before removal
© ERN, Roberto Epple



Saint-Etienne-du-Vigan dam removal works 1998
© ERN, Roberto Epple

Unchained Allier, photo taken at previous St.Etienne du Vigan dam section 19 years after removal © Riverwatch

CASE Study - FRANCE

Loire

REMOVE THE DAMS
FREE OUR RIVERS

Dams planned to be removed in France:

The Poutès **-Monistrol dam** is the cause of almost the complete loss of the Loire wild salmon in the Allier river. This dam used to be a major drawback for the salmon conservation programme set up by the "Plan Loire Grandeur Nature" where several Mio Euros were invested for salmon reintroduction all in vein due to this dam. **After 20 years of heavy protests the partial removal of Poutés Monistrol dam was conceived**: from 17m to 4m height. Furthermore the plant will be equipped with a multi-species fish way for upstream and downstream migration. Works are scheduled for 2017 – 2022. Further information on this ongoing dam removal project can be found on the following websites:

http://www.ern.org/en/poutes-barrage/

http://www.nouveau-poutes.fr/fr/vers-le-nouveau-poutes/du-combat-a-la-concertation

https://www.barrages-cfbr.eu/IMG/pdf/1.04.barrage_de_poutes.pdf

The Roche qui Boit dam and Vezins dam (36m and 15m high) on the Selune River (91km) are currently the largest ongoing dam removal projects in France. The dams of the hydropower plants Roche qui Boit (15m an 1,6 MW) and Vezins (36m and, 12,8 MW) are located about 20km from the confluence of the Selune to the sea. These dams can be called an ecological disaster as the Selune River is the third best Salmon River in France but number of migrating fish went down significantly over the last decades. Thanks to this high ecological value the Selune river was profiting from specific protection and salmon restoration programs, which were the major reasons, besides economic and juridical judgements why the renewals of the hydropower concessions were denied to EDF.

As fish traps were impossible to install, the decommissioning was decided and enacted by the ministry in 2009. Before the go ahead of removal works, in-depth studies of sediment pollution and flood protection were implemented. The former environmental ministry Ms Ségolène Royal tried in 2014 to stop the dam removal but local NGOs and angling associations were mobilizing all their efforts to fight back this decision and succeeded finally. The works are scheduled for 2017/2018. Further reading here: http://www.selunelibre.org

All the French dam removal case studies can be consulted on the European Rivers Network (ERN) website

Allier River, Poutès - Monistrl dam, partial removal from 17m to 4m height is planned 2017 – 2022 © ERN - EDF

Selune River: the Vézins dam (36m, 12,8MW) is blocking fish migration, the dam is located 20km upstream the confluence with the sea © Eaux et Rivières de Bretagne

Maisons-Rouges dam removal works 1998 © ERN, Roberto Epple

CASE Study - SPAIN

Basque Water Agency

REMOVE THE DAMS
FREE OUR RIVERS

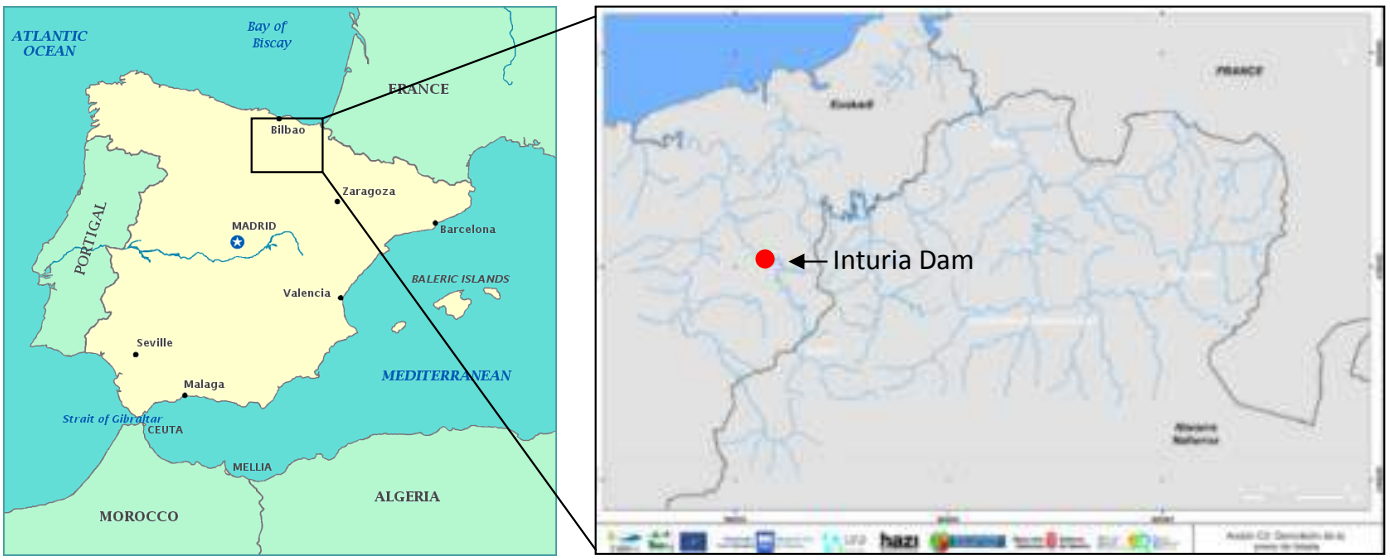
Inturia dam removal in the Oria River Basin

In 2001 the Gipuzkoa Provincial Council has implemented an inventory on existing river obstacles such as dams and weirs. The result was: 700 identified obstacles, out of these 510 were not in use. Ever since 30 dams were removed.

The largest dismantled dam was the Inturia dam with 12,9m height. The Inturia dam was located at the Leitzaran River which is part of the Natura 2000 area and catalogued as a protected biotope.

The Inturia dam was constructed in 1913 for hydropower generation and flow regulation in summer. During the dam life span sediments were piling up behind the wall. In the years 1990 the dam was out of use and considered as an industrial ruin. The structure needed to be completely renovated or dismantled. Technical and economical analysis came to the conclusion that demolition was the most economic and best ecological option.

Technical Data	(Source, EU Dam Removal and Basque Water Agency)
Country	Spain/Basque Country
Name of River	Leitzaran River tributary of Oria River -
Name of Dam:	Inturia dam
Year of construction	1913
Year of removal	2013-2016
Cost of removal:	130.000€ (phase 1+2) 50.000€ (phase 3+4)
Type of dam	Flow regulation and reservoir for hydropower
Power capacity	na
Height / Length	12,9m
Volume	na
Freed river km	na
Dam owner:	State owned



Location: Inturia dam at Leitzaran River in the Oria River Basin (Source EU Dam Removal and Basque Water Agency)

An initiative of

RiverWatch and Manfred Hermsen Stiftung für Natur und Umwelt

CASE Study - SPAIN

Basque Water Agency

REMOVE THE DAMS
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In 2009 the Gipuzkoa Provincial Council drafted the demolition project which was successfully implemented in 4 stages during 2013-2016.

The first and second phase were done from 2013 - 2014 and financed via the GURATRANS (EFA221/11), transboundary project of Spain-France-Andorra Cooperation and co-funded by FEDER, with the collaboration of Navarra, Atlantic Pyrenees and Basque Country entities.

The third and fourth phase were implemented between 2015 - 2016, and were part of the IREKIBAI LIFE project, a collaboration of Gipuzkoa Regional Government, Navarra Regional Government, the Basque Water Agency, GAN (Environmental Management of Navarra) and HAZI.

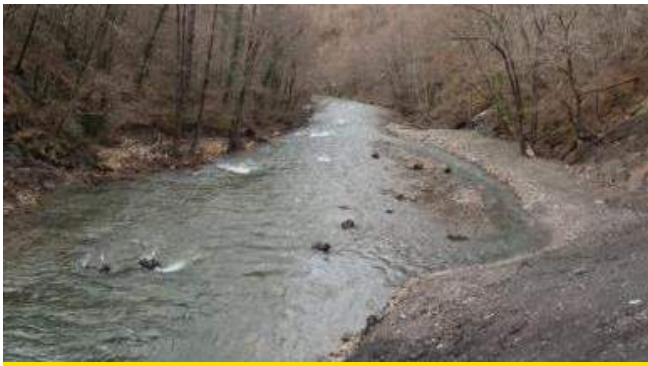
The demolition works were carried out by the Basque Water Agency. So far fish community has recovered and new spawning area was created.

Source of Information and links:

Basque Water Agency, presentation, European Dam Removal Workshop, Leon, Spain, 2016

Information of the IREKI Bai EU LIFE project and Factsheet

Inturia dam before removal © Basque Water Agency



Leitzaran River after dam removal © Basque Water Agency

4 Phases of dam removal

© Basque Water Agency

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CASE Study – Germany

Altenau River

REMOVE THE DAMS
FREE OUR RIVERS

Restoration of the Altenau River

The Altenau River restoration project is a striking and educational example of several small dam removals and dam conversions implemented in the frame of a river restoration project.

The Altenau is a 28 kilometre long creek in the department Paderborn in Nord Rhine Westfalen Germany. During a flood catastrophe in 1965 seven people died and a damage of several Million German Marks occurred. As a consequence it was decided to regulate the creek and to construct several flood retention basins. In 1985 the Altenau was dammed and a large retention basin was created upstream the village Husen.

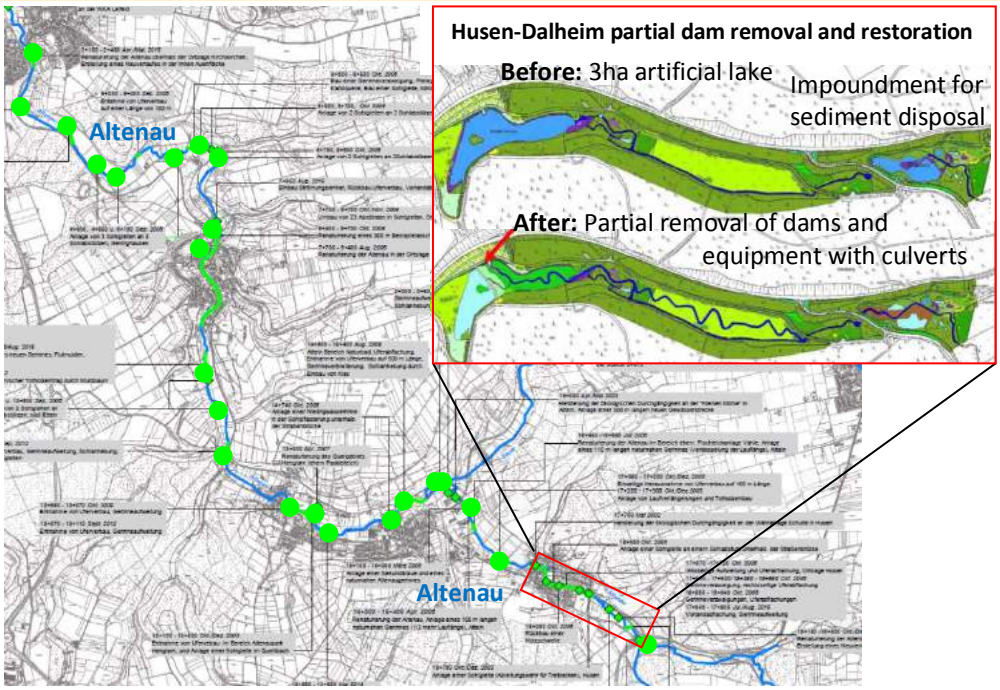
The intention of this 3ha large artificial lake was to promote regional tourism. Upstream this retention basin another artificial lake was created for sediment disposal.

The environmental impacts of these artificial lakes were disastrous: In 1990 it was the first time as anyone can remember that the Altenau fell dry. It turned out, that about 80% of the impounded Altenau River was drained into the underground beneath the artificial retention basins, as these were situated above a karstic soil.

Technical	**Data** (Source:WOL)
Country	Germany
Name of River	Altenau / tributary of Alme and Rhine
Name of Dam:	Husen-Dalheim dam and 51 weirs and ground sills
Year of construction	1985: Husen-Dalheim dams 1965 -1985: weirs
Year of removal	2002-2009: weirs and sills 2014-2017: partial dam removal of Husen-Dalheim dams
Cost of removal:	1,7 Mio. € for Husen-Dalheim partial dam removal and restoration
Type of dam	Flood protection
Capacity	-
Height / Length	4-5m Husen-Dalheim dams 0,5 -1,5m weirs and sills
Volume	-
Freed river km	45,8km (Altenau and tributaries)
Dam owner:	Wasserverband Obere Lippe (WOL)

● Location of project
● Removal of 51 weirs and sills

☐ Husen-Dalheim dams: partial removals and restoration at Altenau River



Source: Water Authority Obere Lippe - Wasserverband Obere Lippe - WOL

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CASE Study – Germany

Altenau River

REMOVE THE DAMS
FREE OUR RIVERS

Since that time every year the same misery was recurring: In summer the Altenau River was falling dry. Besides the reduced quantity of water also the water quality was impaired. In summer the water discharge was so reduced downstream the dams leading to a 6 degree higher water temperature which was much too warm for trout and Co. The higher water temperature resulted in lower oxygen rates and less capacity for self-purification and a worse water quality in general.

Despite this environmental disaster in 1990, this dry fall of the river was also a salutary shock. People from the Altenau valley, foremost the local heritage association (Heimatverein) started the initiative „Die Altenau soll leben!" (The Altenau should live!) with the objective to release the impounded Altenau.

In the next ten years demonstrations, TV broadcast in the German television, postcard campaigns, music events („Rock-Wadi- Nights") and other actions for raising awareness followed. But, these artificial lakes had also supporters, notably the anglers, who had got used to catch carp and perch, or the local residents who enjoyed walking next to the artificial lakes. These groups were against the emptying of the artificial lakes resulting in delays and throwbacks for the river restoration initiative.

After all people understood the benefits of dam removal and dam conversion and in 2001 nearly every mayor, angling and local heritage association of the Altenau valley undersigned the Altenau Memorandum, called „ Ein Tal will seinen Fluss zurück " (A valley wants its river back!). Therein the supporters of the memorandum requested the government and water authorities for the upper Lippe Riverbasin to restore the Altenau River and to empty the artificial lakes. Finally this request was allowed and the river has been progressively restorated in a 9,5km stretch.

By 2009, 51 barriers mostly ground sills and old wind mill weirs had been removed. From autumn 2014 to June 2017 the dam conversion works of the artificial lakes were carried out. The artificial reservoirs were emptied and the large dams of the reservoirs were partly removed or equipped with culverts, which is nothing else than a hole in the dam, enabling the Altenau river to flow through freely. The works were undertaken under the

Former artificial lake of Altenau © Michael Weber

Photo taken during emptying of artificial lake 2014-2015 © NZO

Restored river stretch between the two artificial lakes one year after emptying of the lakes © NZO

CASE Study – Germany

Altenau River

REMOVE THE DAMS
FREE OUR RIVERS

leadership of the Water Board for the Upper Lippe area (Wasserverband für das Obere Lippegebiet).

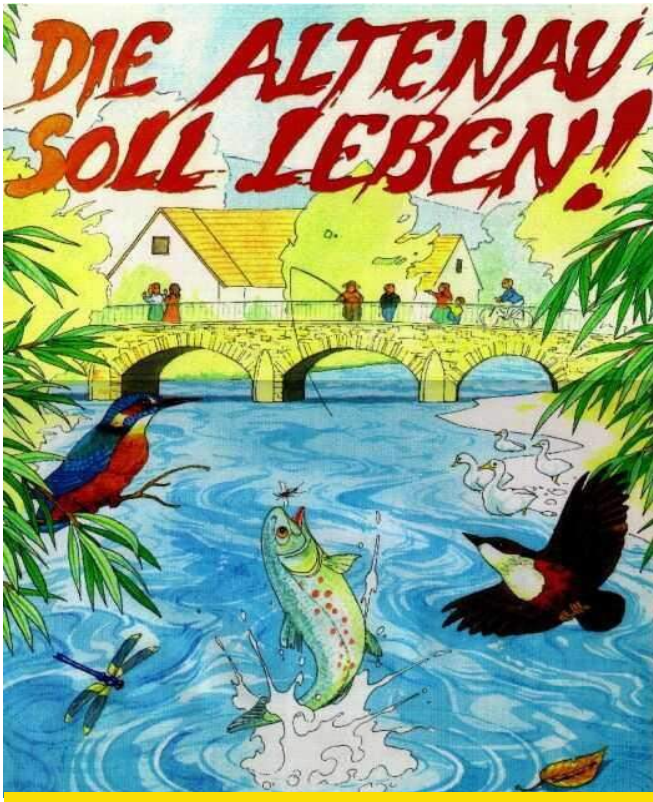
The flood protection function is not affected by the conversion of the dam. In case of heavy rains the amount of water that is not running through the culvert can be retained behind the dam and inundate the former artificial reservoir. The rest of the year the river is flowing free without a barrier blocking the flow.

Since June 2017 fish like grayling can migrate again from the confluence of Altenau with the Alme until the upper reaches of the Aletnau. This is the first time since the middle age!

The story of the Altenau restoration shows that dam removal is possible and that a long breath is needed to persevere the long negotiations.

More information about the Altenau river restoration story can be found here:

http://www.altenau-nrw.de
http://www.atteln-online.de/altenau.htm



Postcard for the river restoration campaign
© painted by Domenique Gröbner

Section of the Altenau before and after restoration and removal of ground sills © WOL

An initiative of

RiverWatch and Manfred Hermsen Stiftung für Natur und Umwelt

CASE Study - US

Elwha River Dam Removals

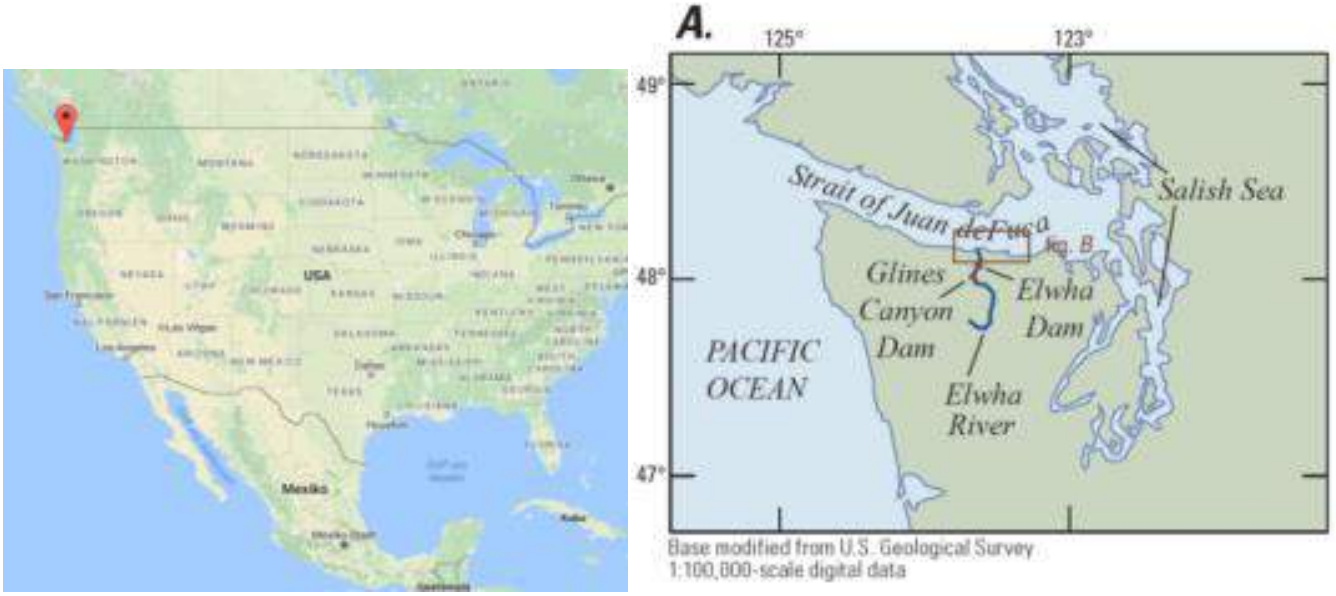
REMOVE THE DAMS
FREE OUR RIVERS

Elwha River dam removal: the largest dam removal in US history so far

The largest dam removal and ecosystem restoration project in America up to now was the removal of the Elwha dam (33m height) and the Glines Canyon dam (64m height) on the Elwha River in the Pacific North West / Washington in 2009-2014. The upper portion of the Elwha river basin is located within Olympic National Park, and the lower basin is in the Klallam Indian reservation, here the Elwha dam was located 8km upstream from the river's confluence to the Pacific Ocean (Gelfenbaum, et al. 2011).

For the Klallam tribe the Elwha River formed an integral part of their spiritual heritage and was also a fishing ground and source of revenue. The dams were constructed in 1913 and 1927 without fish ladders, although fish passages were required by law, but the project owner (Thomas Aldwell) circumvented the law by building an unsuccessful fish hatchery (Wunderlich and others. 1994).

Technical Data	
Country	US/ Washington State
Name of River	Elwha River
Name of Dam:	Elwha Dam Glines Canyon Dam
Year of construction	1913 Elwha Dam 1927 Glines Dam
Year of removal	2009 - 2014
Cost of removal:	185 Mio. USD
Type of dam	hydropower
Power capacity	14,8MW Elwha Dam 13.3 MW Glines Dam
Height / Length	33m Elwha 64m Glines
Volume	-
Freed river km	113 km
Dam owner:	US Department of Interior



Location: Elwha Dam and Glines Canyon Dam (source: Gelfenbaum, et al. 2011)

An initiative of

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CASE Study - US

Elwha River Dam Removals

REMOVE THE DAMS
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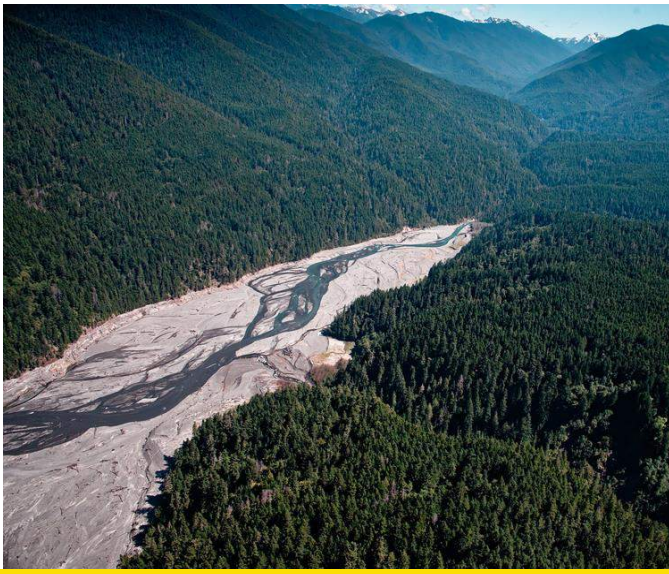
In 1978 the Elwha dam failed to pass safety inspections and catastrophic flood risk would have been the consequence if the dam would not have been removed or renovated. Confronted by this risk the tribe has claimed their right to remove the dam, which was the first time in US history. Furthermore the efficiency of hydropower production was low and investment costs for upgrading the existing dams to current environmental legislation were higher than the removal of the dam. However to prove this with technical and economical studies a decades-long effort was necessary by the tribe and conservation groups.

In 1992, Congress passed the Elwha River Ecosystem and Fisheries Restoration Act, authorizing dam removal to restore the altered ecosystem. After two decades of planning, the largest dam removal in U.S. history began in September, 2009. The reservoirs were emptied gradually over a two-year time period and works were finished in 2014.

Endangered salmon, trout and other fish have since then again access to more than 113 km of their historic migration and spawning habitat. Fish stock is recovering quickly and bears, cougars, bobcats, mink, otter, and other wildlife sustained by the renewed food source have increased in abundance. Native plants are reclaiming riverbanks and silt and sand are moving downstream to rebuild the beach at the river's mouth.

The Elwha River Restoration project provides a rare opportunity for scientists to learn what happens when a dam is removed and salmon return to a wild, protected river. These studies help informing future dam removal and restoration projects.

The film "Return of the River" by John Gussman & Jessica Plumb is putting on scene the group of people who were behind this success story of dam removal, who attempted the impossible to change the public opinion of a town and eventually of the US nation to bring a dam down. The dam removal movie DAMNATION also brings overwhelming pictures and background stories of this stunning victory of environmental and tribal forces.



Former shore line of artificial reservoir of Elwha river© Jason Jaacks

Gradual water release from artificial reservoir during removal works of Elwha river© Jason Jaacks

CASE Study - US

Elwha River Dam Removals

Source of Information and links:

Duda, J., S. Brenkman, C. Orgersen, J. Dunham, R. Hoffman, R. Peters, M. McHenry, and G. Press. 2008. Impending removal of Elwha Dam holds promise for salmon, researchers. People, Land and Water.

Lejon, A. G. C., B. Malm Renöfält, and C. Nilsson. 2009. Conflicts associated with dam removal in Sweden. Ecology and Society 14(2)

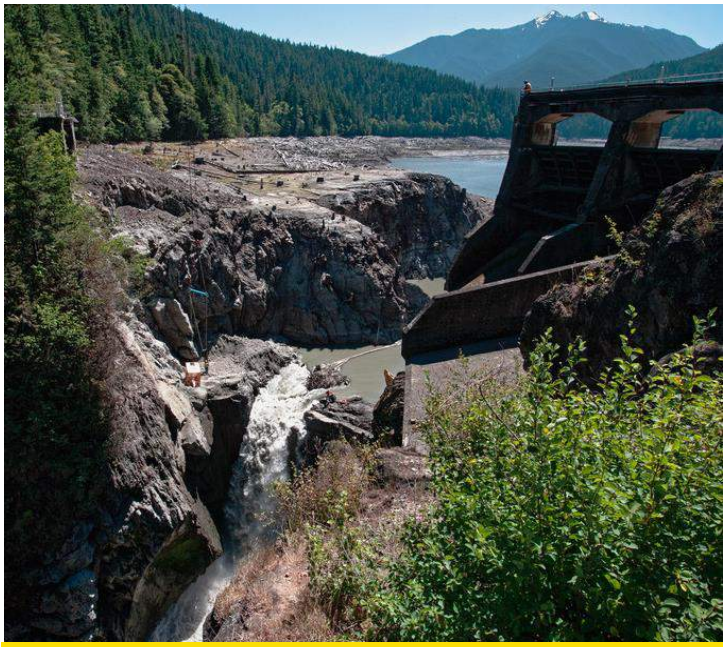
Official site of Olympic National Park: Elwha River Restoration

USGS Science to Support the Elwha River Restoration Project

https://www.americanrivers.org/river/elwha-river/

Lower Elwha Klallam Tribe

Glines dam before removal Elwha River© John Gussman, Return of the River / Patagonia



Removal works at Glines dam, Elwha River© Jason Jaacks

Restored coastal line after dam removals © John Gussman, Return of the River / Patagonia

An initiative of

RiverWatch and Manfred Hermsen Stiftung für Natur und Umwelt

CASE Study - US

Chronology of US Dam Removals

REMOVE THE DAMS
FREE OUR RIVERS

Milestones in US Dam Removals

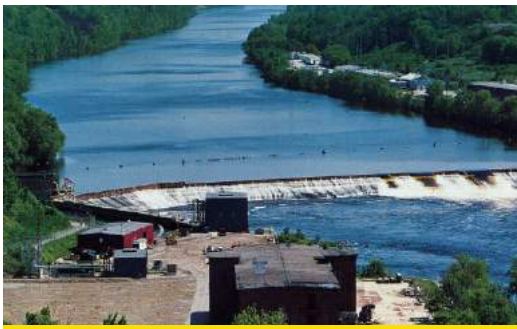
1991 -1999 Prairie River, Dells Dam (13m height) and Ward Paper Mill Dam (5,5m high and 25m length), Wisconsin

In the US the state of Wisconsin can be considered as one of the pioneers in dam removal which was due to a relatively aggressive state agency dam safety program which has lead to the removal of 30 dams already in the past few decades before 1999. Rivers like the Prairie River were opened again for fish migration. However the major reasons for dam removal were the costs of repairing old dams which averaged more than three times the cost of removal (Born 1998). The effects of Wisconsin dam removal also of small scale dams had positive impacts on fish, macro invertebrates and vegetation (Doyle 2005).

Ward Paper Mill, Prairie River © ERN

1999 Kennebec River, Edwards Dam (7 m), Maine

The removal of the Edwards Dam on the Kennebec River Maine is considered as the trigger of the dam removal policy in the US. It was the first time that the federal government ordered the destruction of a dam (Klein 1999) despite the objection of its owner. After the successful dam removal the Kennebec River flowed unimpeded to the ocean or the first time in 150 years. This allowed the free passage of fish from the Atlantic to spawn upstream in headwaters tributaries. Within a year after the removal large numbers of American eel, alewife, Atlantic and shortnose sturgeon, and striped bass were observed in upstream habitats (Hart et al 2002). The success of the Edwards Dam removal led to increased interest in dam removal and an accelerating number of proposals for river restoration (BLUMM and ERICKSON, 2012).



Edwards Dam, Kennebec River © ERN

2011 White Salmon River, Condit dam (38m), Washington

The Condit removal was a result of a 1999 settlement between the Yakama Nation and other tribes, the dam's owner operator PacifiCorp, federal agencies, and environmental groups, regarding salmon access to traditional fishing areas upstream. In 2011 the 38m high Condit Dam (constructed in 1913) was dismantled by blasting a 5m wide hole into the base of the dam. 53km of river habitat were opened and White Salmon River is once again home to abundant wild salmon and steelhead fish (American River).

Condit Dam, White Salmon River© Wikimedia, GFDL

CASE Study - US

Chronology of US Dam Removals

REMOVE THE DAMS
FREE OUR RIVERS

2009 -2014 Elwha River, Elwha (33m) and Glines dam (64m), Washington

The largest dam removal and ecosystem restoration project in American history was the removal of the Elwha Dam (108feet or 33m) and Glines Canyon Dam (210feet or 64m) on the Elwha River in Washington in 2009-2014. This has given endangered salmon, trout and other fish access to more than 113 km of their historic migration and spawning habitat. Read more on: Case study US Dam Removal – Elwha River. Watch the Elwha dam removal movie "Return of the River" and the US Dam removal movie "Damnation".

Elwha Dam, Elwha River© Ben Knight, Patagonia

2013 Penobscot River, Veazie Dam (8m high / 275m long) and Great Works Dam (6m high / 330m long), Maine

The Penobscot River was fragmented by a chain of HPPs these severely decreased fish stock upstream the dams. Back in 1999, government agencies, Penobscot Indian Nation and conservation groups, decided to explore the development of a comprehensive solution for hydropower relicensing, migratory fish passage, and ecological restoration. After more than 10 years of negations 2 large dams close to the river´s confluence were removed 2012 - 2013: Veazie dam (275m long and 8m high) and Great works dams (330m long and 6m high). A third dam (Howland dam, 34m long and 12m high) was was converted, so that a portion of the river is bypassing the dam which is improving fish passage. Thanks to these measures more than 3200 river kilometers were opened. Sea run or diadromous fish that access the upper headwaters include river herring (alewife and blueback herring), American eel, Atlantic salmon, American shad, Eastern brook trout, and sea lamprey. Some of the species were thought to be gone, but came back after removal. River herring for instance, counted less than 1000 individuals prior removal and numbers raised up to more than 1,8 Million (!) in 2016 and generating 200.000 USD local fishery revenues. While power production was removed with the removal and bypassing of the these three dams, the hydro energy production was increased at other location, resulting in a slight increase in overall energy production compared with before the implementation of the project (Royte, 2016, DRE Conference).

Great works dam removal 2012-2013 © Penobscot River Trust

Removal of the inefficient fish ladder at Veazie dam © Penobscot River Trust

CASE Study - US

Chronology of US Dam Removals

REMOVE THE DAMS
FREE OUR RIVERS

Dams to be removed soon:

Klamath Dams, Klamath River (OR, CA) – 7m to 50m (25 to 162 feet)

After a twenty year long fight for removal, the start of dismantling works of four hydropower dams is scheduled for 2020. Read more on: https://www.americanrivers.org/river/klamath-river/

http://news.nationalgeographic.com/2016/04/160411-klamath-glen-canyon-dam-removal-video-anniversary/

Klamath River, IronGate ©Matt Stoecker, Patagonia

Matilija Dam, Ventura River (CA) – 48m (160 feet)

The Matilitja dam an out of service drinking water reservoir is trapping sediments and blocking fish migration. The Surfrider Foundation and the Matilija Coalition, along with other agencies and organizations, have developed three dam removal concepts which focus on reducing the removal cost and also maximizing benefits. Ventura County official set the course for removal of the dam as early as 1998, currently (2016) still no funding for removal works is available. Read more on: http://matilija-coalition.org/

Ventura River, Matilija Dam © Ben Knight, Patagonia

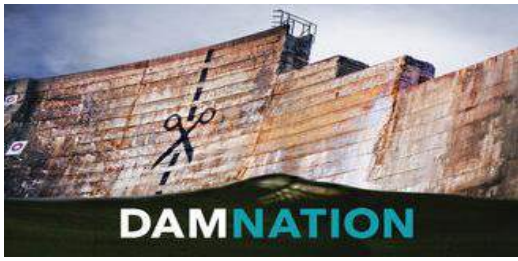
Lower Snake dams, Snake River (WA) – 30m (100 feet)

Conservation and fishing groups have gone to court and challenged federal fish restoration plans which have cost billions of dollars but not one fish species has recovered. In March 2016 the court has rejected the federal plans. Now the government must change course and remove: Ice Harbor, Lower Monumental, Little Goose and Lower Granite Dams. Read more on: http://earthjustice.org/features/remove-four-lower-snake-river-dams

Lower Snake Dams © Patagonia

US Dam Removal Movie DAMNATION

The award winning **environmental documentary film DAMNATION** (Matt Stoecker, Ben Knight and Travis Rummel, produced by Patagonia) is a powerful movie raising awareness on river ecology and highlighting dam removal stories in the US.



An initiative of RiverWatch and Manfred Hermsen Stiftung für Natur und Umwelt

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