



# Meetings

## Dam removal The Sélune River free to run

*This document summarises the international symposium organised from 24 to 26 September 2019 by the European Rivers Network, in conjunction with the National Institute for Agronomic Research, the French Biodiversity Agency and its River Resource Centre, the French National Fishing Federation, the Seine-Normandy Water Agency and Dam Removal Europe. Meetings were held in Rennes, Avranches and the Sélune valley.*

What happens when a river is once again free to run? In the Sélune valley (Manche department in Normandy), the largest dam-removal project in Europe is being carried out in step with an unprecedented scientific programme aiming to better understand the changes in the ecosystem, monitor the return of migratory fish and participate in the future development of the valley.

The Vezens dam, 36 metres high, 278 m wide with a reservoir covering 200 hectares, was constructed on the Sélune River in 1932 to generate hydroelectric power. Located just 17 kilometres from Mont-Saint-Michel Bay, the dam was an obstacle to river continuity for almost a century. It blocked sediment transport, impacted water quality and made access to the upper section of the river basin impossible for salmon, eels and other migratory fish (Figure 1). In September 2019, once the reservoir had been emptied and the power station dismantled, the concrete arches of the dam itself were removed. The Roche-qui-Boit dam (16 m high), located five kilometres downstream, will encounter the same fate in the months to come.

This major initiative, first announced by the French government in 2009, then delayed due to strong, local opposition, is to date the largest dam-removal project in Europe. It also represents the key turning point in an unprecedented scientific and human adventure, namely a 15-year multidisciplinary research programme on the evolution of the valley before, during and after the restoration of river continuity. The programme is coordinated by the National Institute for Agronomic Research (INRA) in a partnership with the Centre for Migratory Fish, a part of

the French Biodiversity Agency (AFB). At the outset of the decisive, post-work restoration phase, INRA, AFB and the European Rivers Network (ERN), an NGO that has for years worked to remove dams in Europe, organised from 24 to 26 September 2019 an international symposium on the rebirth of the Sélune River. The meeting brought together over 150 participants (researchers,

managers, people from non-profits and local governments). Information, based on experience gained from around the world, was presented on an array of issues (ecological, scientific, political, social, etc.) concerning the Sélune and the discussions also looked at potential scenarios for the valley.



The Sélune running through what was previously the reservoir behind the Vezens dam, on 26 September 2019.

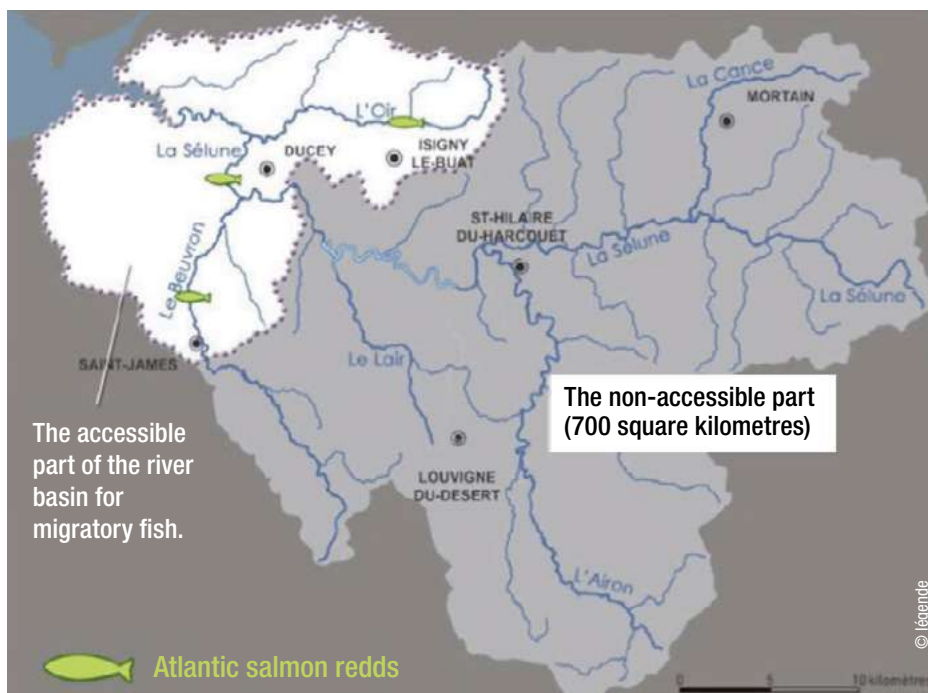


Figure 1. The Sélune basin. The part not accessible to migratory fish is shown in grey. (Source: Manche DDTM).

## An exemplary project in Europe

Over the past 20 years, due in part to the ageing of structures that in some cases are a century old, the elimination of dams and weirs has in many countries become one of the main techniques used to restore rivers, their good status, biodiversity and the services provided to society. These projects, though often controversial in a context of rising demand for energy and disagreements on the use of

water resources, are defended in Europe by a growing coalition, examples being the NGOs European Rivers Network and Dam Removal Europe. The projects are also supported by proactive public policies. The Water Framework Directive (WFD) in particular has made ecological continuity one of the prime criteria in achieving good status in rivers. The presentation by Claire-Cécile Garnier, from the Ecology ministry, during the introductory session, explained in detail French legislation on river continuity and stressed the

fact that fragmentation of rivers by dams, weirs and other structures was one of the main causes of the failure to achieve good status. On the national level, the Tenth work programme managed by the Water Agencies planned the “treatment” (ranging from enhanced management of gate systems to the partial or total removal of obstacles) of 4 620 structures between the years 2013 and 2018 in view of making them passable for migratory species and for sediment, and more generally restoring river habitats.

Due to its exceptional size, the Sélune project has become a showcase effort and a laboratory for similar projects. The two dams on the Sélune were not particularly profitable in terms of hydroelectric generation, suffered from eutrophication (development of cyanobacteria) and had been invaded by catfish (50% of the biomass when the Vezins reservoir was emptied). The local water commission voted in 2005 to eliminate the dams in the framework of the sub-basin management plan (SBMP) and the government confirmed the decision in 2009. The project was subsequently suspended by Ségolène Royal, Ecology minister, in 2014, then reinstated by her successor, Nicolas Hulot, in 2017. As of today, the decision to remove the two dams is definitive and the continuing project is being monitored by scientists ranging well beyond the borders of France. During the first day of the symposium, held at the Conference centre in Rennes, the project schedule and work methods were presented by Gilles Berrée, from the Manche Departmental Territorial and Maritime Directorate. They included emptying and dismantling of the Vezins dam, emptying and dismantling of the Roche-qui-Boit dam, and in both cases sediment management adapted to the particular reservoir (dredging and/or surface stripping, deposition on the banks of the future flood plain, reworking of the banks following evacuation of the excess water by the river).

**Roberto Epple**, president of the *European Rivers Network*

“The success of the three-day symposium on the emblematic Sélune project symbolises the great progress made in the fight to restore free and living rivers. Just 30 years ago, during the ‘Loire vivante’ campaign, the idea of removing dams and restoring river continuity was virtually unheard of. Today, that idea has been validated by scientific research and is a central feature in EU public policy. In France, the work by Onema/AFB was a decisive factor in that change. The Sélune project, unprecedented in size, is an ideal opportunity, at last, to monitor in the field the reaction of ecosystems to the removal of structures, thanks to the remarkable programme coordinated by INRA. Not everything was perfect, of course, and we regret our failure to better explain the project and to win over public opinion locally. In that field too, we must make progress in order to better succeed future projects. For the time being, it is necessary to create a new forum for discussion in the Sélune valley in order to work collectively on the future of this magnificent region. Perhaps the international symposium, that we definitely wanted to organise locally, was a first step in that direction.”

## 2012-2027, a four-part scientific programme

From Massachusetts to Scotland, from the Loire basin to South Korea, the number of structures removed throughout the world has increased greatly since the 1990s. By 2015, over 1 100 projects had been listed, though most dealt with relatively small

structures. Unfortunately, these projects and their ecological consequences have not been studied extensively by researchers and when they have been studied, it is often through a single lens and without any solid data on the initial state. Concerning the Sélune River, the scientific community entered into the project well in advance of the actual works in order to document the changes in the valley, in the framework of an ambitious research project that was outlined during the symposium by S. Fraisse, J-L. Baglinière and J-M. Roussel from INRA. The research project, coordinated by INRA and funded essentially by the Seine-Normandy Water Agency, comprises a study on the initial state prior to the works (2012-2018), monitoring during the works (2018-2021) and monitoring of the restoration process (2021-2027). Three major lines of research will be pursued in parallel, namely 1) river dynamics and water quality, 2) ecosystem functioning and evolution, 3) territorial dynamics and development trajectories. A number of scientific presentations during the symposium provided further information on the research work. Concerning the hydro-sedimentary aspects (A. Crave, CNRS), regular sampling of the water at different points in the system, in conjunction with measurements of hydrological and physical-chemical parameters, served to determine the impact of the dams on sediment transport. One main result was that the two dams retained between 70

and 75% of the sediment transported by the Sélune (only the finest particles could transit through the dams). Following the draining of the Vezins reservoir, initial observations indicated that the transit time for suspended solids between the upstream and downstream points in the system had been cut by a factor of four.

The studies carried out prior to the removal of the dam (Ch. Piscart, CNRS) revealed how the lakes had modified the ecological communities, i.e. by causing a drop in specific diversity (diatoms and invertebrates) and significant development of cyanobacteria (micro-algae likely to release toxins to the water).

Other presentations discussed the expected consequences of the removal for the populations of migratory fish (see below), the current studies on food webs in the Sélune, with and without the dams (J-M. Roussel, INRA), and the initial results of the study on the vegetative recolonisation (very rapid, see Figure 2) of the banks that were exposed by the draining of the reservoir (C. Thénail, INRA). The latter study is flanked by a wider monitoring programme on changes in agricultural landscapes in the valley as a whole. Studies in the field of the human and social sciences have also been undertaken (M.A. Germaine, University Paris-Nanterre) to identify, among other topics, the factors underlying the local opposition to the

project (see below). Above and beyond the three lines of research, the scientific programme includes the creation in 2019 of an observatory on the Sélune that will, for ten years, monitor and make available to the public information on changes in five compartments of the aquatic fauna and flora, namely migratory fish, invasive and native crayfish, benthic macroinvertebrates, aquatic plants and photosynthetic biofilms (i.e. the communities of microscopic algae that develop on the substrate), and on changes in physical-chemical flows (sediment, dissolved elements, hydrological characteristics). Over time, all of this monitoring and research work will result in an integrated understanding of the responses by the river to the removal of the dams, ranging from the physical functioning of the river to the plant communities and from the fish to the social geography. The research will make available an unprecedented amount of knowledge to assist other, similar projects in France and well beyond.

## Free passage for migratory fish

The Sélune basin, of which 77% was no longer accessible, was historically a site with very favourable habitats for migratory fish. On the Oir River, a tributary flowing into the Sélune downstream of the dams, scientists from INRA count each year



Figure 2. Changes in vegetation at the République bridge following the drop in the water level. (Source: INRA).

the numbers of salmon, sea trout and lampreys migrating upstream to reproduce, and the number of eels colonising the river or leaving it to return to the sea. One of the major benefits expected from the removal of the dams is the return of the threatened and legally protected species to the river basin as a whole. Past experience in France and abroad on various rivers, including certain projects presented during the symposium, has demonstrated that the return can be quite rapid. The removal of the Maisons-Rouges dam on the Vienne River in 1999 (N. Richard, University of Tours) resulted in the first year in the recolonisation upstream in the river of spawning grounds used by shad, in the return of lampreys to the head of the river basin and in the return of salmon to the Gartempe River. In the Orne river basin, not far from the Sélune, a series of projects to restore river continuity undertaken since the 1980s, including the removal of weirs, the creation of fish passes and modifications to structures (O. Fauriel, AFB; S. Le Vilain, SN Water Agency), produced spectacular results in terms of the counted numbers of adult salmon returning to reproduce (Figure 3). The same results were observed in Brittany on the Léguer River, that is once again a “salmon river” (see below), and on the Hem river in the Pas-de-Calais department in northern France where the removal of several mills between 2014 and 2016, in conjunction with restoration work on habitats, including the recreation of meanders, resulted in redds for migratory salmonids and river lampreys increasing in number by a factor of three starting in 2017 and spreading to virtually the entire river basin (M. Georgeon, FDPMA 62).

Other projects, some from distant lands, confirm the extraordinary resilience of migratory species and, more generally, the ecological improvements provided by the restoration of river continuity that benefit human societies. They range from the Elwha River in the state of Washington (G. Grant, USDA Forest Service), where hundreds of Chinook salmon now migrate upstream following the removal of a large dam in 2012, to the Hitolanjoki River in Finland. On the Vienne River, the removal of the Maisons-Rouges dam in 1999 (N. Richard, University of Tours) resulted ten years later in a clear increase in the diversity and abundance of macro-invertebrates,

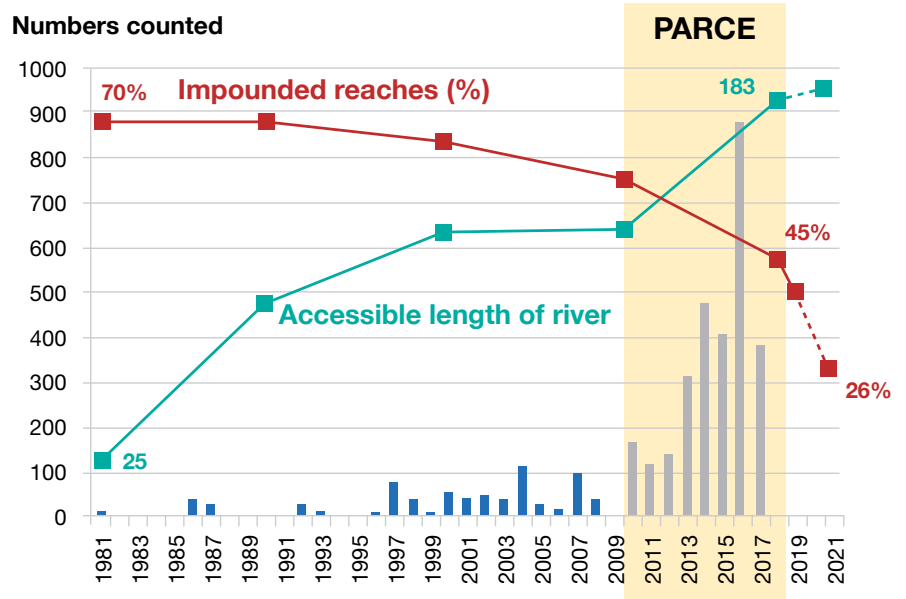


Figure 3. Response of salmon populations to the restoration of river continuity in the Orne basin. PARCE: National action plan to restore river continuity. (Source: Seine-Normandy Water Agency).

notably those of sensitive species which are indicative of good water quality. In the state of Maine, the Penobscot River offers another prime example (J. Royte, The Nature Conservancy, U.S.). When the basin was “reopened” in 2012, numerous diadromous species returned, including large numbers of alewife (*Alosa pseudoharengus*) that are a nutrient source for food webs throughout the river, estuarine and coastal ecosystems. In just a few years, the local populations of birds, marine and freshwater fish increased significantly... in step with human activities in commercial fishing, tourism, the lobster sector and restaurants.

## Ecological benefits leading to socio-economic benefits?

The various examples presented during the symposium made clear the diversity of benefits that projects to remove dams and weirs, when correctly implemented, can provide, including the return of migratory species, the restoration of balanced biodiversity, a return to natural sediment dynamics, improvements in water quality, reduced flood risks, etc. Those examples discussed methods used to design and implement projects, taking care to adapt them to each ecological context, but also to the social and institutional situation.

### Stéphane Fraisse, INRA, steering committee for the scientific programme

“In the Sélune valley, one of the largest dam-removal projects in the world has been combined with an equally extensive scientific programme. Over a 15-year period, more than 20 laboratories will participate in monitoring and analysing the changes in the ecosystem before, during and after the removal works, from an array of angles, including river dynamics and water quality, ecosystem functioning and evolution, and territorial dynamics and development trajectories. The dissemination of the data and knowledge gained by the programme is also an essential aspect. Dissemination will occur notably via a dedicated information system that will centralise all the information gathered over the 2015-2027 period in the Sélune Observatory. The information system will be managed by the INRA lab Ecology and Ecosystem Health (ESE). The raw data will be available for researchers and processed data for the general public.”



**Removal of the Sindi dam, 151 metres wide and 4.5 metres high, on the Parnu River, a salmon migratory route, in Estonia in December 2018.**

Finally, the cases presented showed how ecological improvements can generate more or less significant gains in ecosystem services. Concerning the Sélune, one of the factors in the renewed services would be the return of salmon and growth in tourism activities by sport anglers drawn by the legendary fish. Jean Allardi (International Atlantic Salmon Association) stressed in his presentation that the potential value creation (ecological, economic, cultural) due to the return of salmon requires an effort to explain and to discuss the matter in order to elicit a shared vision for the territory. The recent history of the Léguer valley (Côtes-d'Armor department), 23 years after the removal of the Kernansquillec hydroelectric dam, is a case in point (J-Y. Le Corre, Lannion-Trégor Communauté). In addition to the successful return of large migratory fish and fly-fishing enthusiasts, the valley was able to move beyond the initial social tensions and settle into its new identity, with the installation of organic farmers on the dewatered land, hiking trails and promotion of the industrial heritage, growth in tourism and in local activities with the Léguer festival in particular, organised each year.

For those interested in numbers, Kim Birnie-Gauvin (Technical University of Denmark) proposed another example, a proactive project in Denmark where over 10 000 small weirs have been eliminated

since the 1970s, in conjunction with a vast programme to reintroduce Atlantic salmon. In the Skjern basin alone, that empties into the North Sea, 41 obstacles were removed, freeing 98 spawning grounds for salmon, at a total cost of 52.7 million euros. From just a few hundred in 2002, the population rose to over 6 000 in 2017, in step with an increase in the number of anglers... and in corresponding income for local residents. According to a survey, each angler is said to be willing to spend, on average, 1 714 euros to catch a Skjern salmon (including transport,

fishing permit, equipment costs, room and board), of which 941 euros are spent locally. This fishing activity is estimated to represent an annual turnover of 918 000 euros and would increase considerably if the salmon stock were to double.

## A territorial project still in the making

To date, not all the residents of the Sélune valley are convinced by these favourable projections. When the participants arrived in Avranches for the second day of the symposium, approximately 30 demonstrators made clear their opposition to the removal of the dam. Anglers for carp or carnivorous fish, people from nearby villages, the owners of houses or huts along the reservoir were against the disappearance of the lakes, that were seen as natural and living sites, and against the loss of a precious source of water, all for a project that was being imposed "top-down" and "without discussion". Roger Lebourrier, from the "Friends of the dam" association, when invited to express these arguments at the podium, also highlighted the lack of a political project and of financial resources for the future of the valley.

M-A. Germaine (University Paris-Nanterre) introduced the social sciences

### Erick Goupil, vice-president of the Mont-Saint-Michel Normandy Urban Board (CAMSMN)

Looking beyond the current tensions that we will overcome with time, the central issue for stakeholders in the valley today is to make progress toward a territorial project that is meaningful for one and all. The general outline is clear and includes the creation of a network of hiking trails, promotion of the territory's identity and history, and use of the fertile land in the valley for grazing. But a great deal must be done to restart the project, following the halt imposed in 2014. The existence of a single local government, the Mont-Saint-Michel Normandy Urban Board, is of course a highly positive factor and the assurance of a consistent plan for the valley as a whole, but nothing truly worthwhile will be possible without the technical and financial assistance of the central government. A particular priority concerns the funding for a true project manager brought in to coordinate the various urban board services in the work to reorganise the Sélune. Another key condition for success will be to avoid fragmentation of the land holdings. To that end, we hope to obtain a temporary occupation permit for the entire public domain in the valley."

in a presentation detailing the changes in the positions of stakeholders concerning the Sélune.

The present situation can be traced back to a “golden age” along the banks of the Sélune, with lake-side cafés and the boating site. Then, starting in 1993, activities slowly fell off, bathing prohibitions were issued and certain groups tended to monopolise use of the sites. The local water commission voted to eliminate the reservoir in 2005. From that point on, the “Friends of the dam” association (founded in 1993 to promote activities on and around the Sélune lakes) turned into a group opposing the project and it was supported by a majority of the local elected officials. An important element in the sequence of events was the decision by the government in 2014 to halt the project, followed three years later by another about-face. The interruption killed the local movement in favour of a dam-free valley and it never recovered, thus deepening the worries concerning the future of the territory.

The joint presentation by Aurélie Jouée (Sélune Basin Board) and Érick Goupil (vice-president of the Mont-Saint-Michel Normandy Urban Board - CAMSMN) confirmed the difficulties in organising the project and in informing the public. With the removal of the dams under way, they called on the local stakeholders to look to the future. The existence of a single local government (CAMSMN) for the area and the capacity to avoid fragmentation of the land holdings are two major advantages in favour of an integrated, cross-cutting project that must include the local partners and take into account the desires of the local population so that people can again feel at home in the valley. With that in mind, a number of key issues have been identified (see also the box on the previous page), namely designation of high-value landscape, biodiversity and agricultural areas, creation of a continuous path along the Sélune, with off-shoots linking the valley to the plateaus, for different means of travel (hiking, cycling, canoeing, etc.), development of fishing tourism and management of fish populations (all species) across the entire basin, promotion of the



The visit to the dam-removal worksite in Vezins (Manche department) on the Sélune River, on 26 September 2019.

valley’s history and of the built heritage (old bridge, fishery and mill) revealed by the elimination of the reservoir, etc. But in all cases, a key condition for the success of the territorial project will be the calming of tensions and progress in moving beyond the divisions concerning the dams, now that their fate has been decided. The third day of the symposium consisted of a visit to the Vezins worksite and, on arriving via bus, the participants were again greeted by the opponents to the project. For almost a full hour, those for and against the project traded arguments in a calm

and mutually respectful atmosphere, while before them, the Sélune was slowly returning to its free-running way. We are confident that dialogue will progressively be restored and that renewed enthusiasm for the territorial project will enable each inhabitant to feel at home in the new environment. The scientific programme now under way will provide more factual data that should calm the tensions and encourage greater dialogue. ■

#### For more information:

- The presentations made during the symposium and the audio recordings (French and English) are all available on the *European Rivers Network* site: <https://www.ern.org/fr/colloque-international-selune/>
- The scientific programme and recent news may be consulted at: <https://programme-selune.com>
- Information on river continuity is available on the site of the River Resource Centre: [www.coursdeau.fr](http://www.coursdeau.fr) - [www.river-restoration.onema.fr](http://www.river-restoration.onema.fr)

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