



Reconciling divergent energy and environmental needs The example of the Dordogne river

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Salmon are migratory fish that serve as indicators of river quality. Their current situation is not good. On the Dordogne river, the second river basin in France in terms of hydroelectric generation, local stakeholders have made major efforts in favour of salmon for 20 years, including releases of juveniles, population surveys and monitoring, modifications to obstacles in rivers, reductions in hydropeaking, etc. Epidor, EDF, the Adour-Garonne water agency, departmental territorial agencies, Migado and Onema have all joined forces to experiment new river-management techniques that attempt to reconcile the survival of the species and hydroelectric generation. The results show that a concerted effort by local stakeholders can help in restoring rivers to good ecological status.

The Dordogne river flows a total of 450 kilometres, through six departments (Gironde, Dordogne, Lot, Corrèze, Cantal and Puy-de-Dôme) and four regions (Aquitaine, Midi-Pyrénées, Limousin and Auvergne), and serves a number of uses, including boating, commercial and recreational fishing, drinking water, irrigation and hydroelectric generation. The river basin as a whole is of national importance for hydroelectric generation with over one billion cubic metres of water stored and a total power rating of 1.8 GW, equivalent to almost two nuclear reactors. The Dordogne is also home to all the large diadromous fish of Western Europe, including eels, Allis shad, lampreys, sea trout, European sturgeon and Atlantic salmon. All these species must be saved while maintaining a balance between occasionally divergent interests, economic, primarily hydroelectric, interests on the one hand and environmental issues on the other.

Constant regression of salmon in France and in the Dordogne river

The Atlantic salmon is certainly one of the most emblematic migrators, covering thousands of kilometres in rivers and the ocean before returning to spawn where it was born. Shortly after 1900, the species began to fall sharply in numbers to the point of disappearing from certain rivers

such as the Dordogne. The main cause was often the construction of dams downstream of spawning grounds, however other anthropogenic pressures came to bear progressively, i.e. increased draw-offs that reduced water levels, degradation of habitats, etc. In 1975, public authorities launched a national salmon plan to restore the stocks in the most heavily impacted rivers. Then in 1981, the plan became the national plan for migratory fish.

In the Dordogne river, starting around 1950, the Mauzac, Bergerac and Tuilières dams were built on the lower section of

the migration route for navigation or hydroelectric generation. The result was the rapid disappearance of salmon. Development of the river basin continued in the 1950s with the construction on the upper sections of some of the largest hydroelectric dams in France. They implement hydropeaking, i.e. they store water when energy demand is low, then release it suddenly when demands increase. This operating mode results in major changes in downstream water levels that damage aquatic environments, e.g. dewatering of spawning grounds, death of juveniles, etc.



Salmon trapped at the Tuilières dam for a «passability» study during upstream migration.

The large dams also significantly reduce sediment transport, which in turn progressively reduces spawning grounds. According to Matthieu Chanseau, an engineer at the Onema regional office, «*the Dordogne and its main tributaries (Cère, Maronne, Vézère) are so heavily developed in their lower and mid sections that over 50% of the river basin as a whole is no longer accessible to migratory fish and salmon. And over 75% of the remaining sections are affected by hydropeaking.*»

The salmon reintroduction policy, a step in the right direction

The Migado* association was founded in 1989 to participate in the salmon restocking project in the Dordogne river. The association set up the Castels fish farm, followed in 1995 by the salmon production centre in Bergerac where it has a stock of over 100 reproducers that spawn between 500 and 700 thousand eggs each year. «*We trap the wild reproducers near the Bergerac and Tuilières dams*»,

explains Dominique Sage, a technician at the production centre. «*In the natural environment, a salmon often reproduces just once, then dies shortly thereafter. At the production centre, we have succeeded in having them reproduce for at least three years. We have also set up a semen bank with 4 000 straws that represent the genetic identity of over 70 male salmon. In this manner, we have achieved a 50 to 70% success rate.*»

To assist the salmon reintroduction project, EDF, the national electricity company, carried out work on dams around Bergerac to improve passability. The company joined forces with the Ecohydraulic research centre in Toulouse and notably with Michel Larinier to develop fishways for upstream migration. The Bergerac and Mauzac dams were equipped in 1985 and 1986 with pool-type fishways. In 1989, an elevator (trap and transport) fishway was installed at the Tuilières dam. EDF continues to work extensively on the fishways. For example, on the Tuilières dam, a device, unique in Europe, for the downstream migration of smolts was installed in 2009 and will be tested for at least two years.

Viewpoint

Guy PUSTELNIK

Director of the Epidor public river-basin territorial agency

In 1991, the local elected officials decided to set up the Epidor public river-basin territorial agency, a novel form of governance at that time. Our role is to mediate between stakeholders, lead local discussions and take a new look at the conflicts between different water uses in order to solve them on the relevant territorial scale, i.e. the Dordogne river basin. A perfect example of this role is the hydropeaking challenge. Since 1997 at the request of the Adour-Garonne water agency, we have held numerous discussions with elected officials, fishing federations, EDF, etc. and led collective field work including sociological, hydrological and biological research. As a group, we devised first the hydropeaking challenge, then the multi-year contract that runs until 2012. This collective effort induced EDF to test how to better manage changes in flow rates while taking into account other water uses. Today, after 15 years of local efforts, it is important to include the hydropeaking problem in the negotiations on the renewal of dam concessions and make sure it is a criterion in the choice of the new dam manager.

Viewpoint

Laurent Dumée

Head of the Onema Corrèze office

During the winter of 1997, thanks to a number of activist fishermen, the Onema local office visited the Maronne river to observe that salmonid* spawning grounds had been dewatered. For over ten years, including on weekends and holidays, during the winter low-water months, we mobilised our forces with the Migado association and the Argentat AAPPMA association. A total of 52 citations were drawn up against EDF for «*acts leading to the destruction, alteration and degradation of special environments, notably reproduction sites of protected fish species*»**.

Thanks to our efforts and open discussions with the State prosecutor in Tulle, we succeeded in having a judge appointed to the case. A legal enquiry, the first in France for this type of offence, was opened and the concerned parties were summoned.

«An out-of-court settlement that was unique in France»

On 6 May 2009, the procedure resulted in an out-of-court settlement between the State prosecutor in Tulle, the departmental territorial agency, the Corrèze fishing federation, the Adour-Garonne water agency, Epidor and EDF. The agreement halted the legal proceedings against EDF and, in return, EDF must pay 180 000 euros over

five years (2008-2012) to the fishing federation and Epidor for work to avoid dewatering the spawning grounds. This agreement was facilitated by the signature, at the same time, of a multi-year contract to follow up on the hydropeaking challenge. Ten years is a long time. But it proves that the water and environmental police can be an important means in changing behaviours. So, what is our next challenge? Above all, keep an eye peeled.

*Saumon atlantique et Truite fario.

**Articles L411-1 and L411-2 in the Environmental code.



The Dordogne river at Bergerac.



Onema personnel working on the Dordogne river.



The Tuilières dam.

Other systems to count and monitor fish during upstream migrations have also been operational for a number of years. David Clavé explains, «at Migado, we assess changes in salmon stocks using either video-monitoring stations, monitoring of natural reproduction or electric fishing, sometimes in conjunction with Onema.» Up until 2003, the results were encouraging with over 1 000 salmon migrating upstream from 2000 to 2002. But over the last few years, the numbers plummeted to just a few hundred each year.



A visit to the Castels fish farm.

Local cooperation and knowledge of the environment, the driving forces of change

The sudden worsening of the situation in 2003 showed that efforts to reintroduce salmon are a difficult task, particularly in areas that have been heavily modified by human activities. The constant improvements in fishways and restocking operations were apparently not sufficient to restore a population to previous levels. It was deemed important to look more closely at hydropеaking, suspected of significantly reducing natural reproduction. The phenomenon started to be studied and understood in the 1990s. Awareness has grown since, in step with a local desire to modify the operating mode of dams and adapt it to environmental needs. In 1991, the elected

officials created a new management structure for the Dordogne river basin, the Epidor public river-basin territorial agency. Then in 1992, the charter for the Dordogne valley, the groundbreaking document for basin management policy, highlighted the effects of dam operation on the natural environment. Finally, over 15 years of local cooperation culminated with the hydropеaking challenge, an experimental project during the years 2004-2007, and the contract on hydropеaking management signed in 2009.

What were the keys to success? Epidor succeeded in mobilising local stakeholders and users, and in organising cooperative efforts, notably by calling on the knowledge and skills of Migado and Onema. The reports on dewatered spawning grounds by the Onema Corrèze local office since 1997 and the 52 citations against EDF were the starting point for the various operations and monitoring subsequently set up. From 1997 to 2003, a number of studies were carried out that raised general awareness on the importance of reducing hydropеaking. Olivier Guerri, the policy officer for migratory fish at Epidor, notes, «at that time, environmental issues were not yet a part of local management. Proving and evaluating the negative impacts of hydropеaking on migrators was also a powerful means of making local stakeholders understand the harm done to the river and the need to take action.» The financial support provided by the 8th programme of the Adour-Garonne water agency was also a decisive factor in the negotiations. EDF accepted to test new management guidelines for its dams over three years because the Water agency reimbursed 50% of the lost generation revenues. The agency also participated in the environmental-engineering work and contributed to the studies run by Migado. As a result, minimum flow rates were increased from November to June, maximum flow rates were cut and

the gradients in water-level changes were reduced during the period when the juveniles emerge. This made it possible to determine more precisely the impact of these parameters and to propose a flow-rate schedule for the Dordogne and Maronne rivers that reconciled energy and environmental issues.



On-site presentation of the Epidor public river-basin territorial agency.

Viewpoint

Bernard Laviolette

Manager of the Dordogne valley for EDF (Centre hydraulic production unit)

In compliance with the contract signed following the hydropеaking challenge, the initial measures taken by EDF addressed minimum flow rates during key reproduction periods of certain species and maximum flow rates to avoid filling riparian side channels and trapping juveniles during sensitive environmental periods, given that it is also necessary to take into account energy-production factors and unpredictable weather conditions. Other measures include the gradual shutdown of the turbines by the production department. Finally, users and stakeholders are informed on hydropеaking schedules, a measure long awaited by users and now relayed by the Epidor site. The contract is based on two main elements, knowledge and experiments, i.e. it will be modified over time. The terms of the contract will evolve to take into account the results of experiments and any knowledge acquired during its implementation.



The Mauzac dam.



The Dordogne river at Argentat.



The Chastang dam.

Reconnecting tributary channels of the Maronne et Dordogne rivers

Management of flow rates was clearly not sufficient, so work was also done on the rivers. The work consisted of reconnecting the main tributary channels of the Maronne and Dordogne rivers. They are ideal reproduction and growth sites for juveniles and, depending on the variations in flow rates, occasionally found themselves disconnected from the main river. The work was carried out first by the Argentat and Beaulieu AAPPMA associations, with the Corrèze fishing federation, then by the Corrèze departmental territorial agency. «*The work is relatively simple, but it requires an in-depth study phase first to ensure that it will be durable and produce the desired effect*», explains Emmanuel Bestautte, deputy head of the Environment, water police and hazards department. «*The first step, using a hydraulic model, is to calculate the minimum supply level, i.e. the depth at which the tributary channels will be supplied with water even at the lowest flow rates in the Dordogne. On some sites, we created salmonid spawning grounds by laying gravel. On others, we attempted to diversify habitats by installing rocks.*»

Between 2005 and 2009, 14 work projects were carried out. In 2008 and 2009, six tributary channels** were reconnected for a total cost of 120 thousand euros (project management, civil work and lumber jacking). Initial monitoring demonstrated the effectiveness of the work, notes Matthieu Chanseau. Fish mortality dropped from approximately 1 000 fish found dead on a given site one year before the work to just a few individuals afterwards. The dewatering of spawning grounds was reduced and even eliminated (e.g. on two reproduction sites, dry periods varied between 15 and 100% of the time, depending on the year, but after the work, dry periods dropped to 0 to 5%). Finally, high numbers of young salmonids were

observed, sometimes over 9 000 fish per hectare. The work continues, coordinated in part by Onema. For example, last August, the Onema Adour-Garonne migrator unit, with Lionel Taillebois and Jérôme Lafargue, organised fishing campaigns on the Maronne and Dordogne rivers with Migado and Epidor to measure the effectiveness of the work carried out.



The results of the past 20 years of efforts to find a balance between two societal issues are encouraging and demonstrate the need to pursue the work undertaken by all the partners. Five components made it possible to achieve a new form of governance in the Dordogne river basin, namely local collaboration, in-depth knowledge of the natural environment, financial support, regulatory measures and civil-engineering work. Today, the feedback from these efforts is all the more useful that France must restore its waters to good status by 2015. Public policies once again are addressing the problems of migratory fish via the plan to restore ecological continuity, the signing of the sustainable-hydroelectricity agreement and the upcoming national migrator strategy.

* Association for migrators in the Garonne-Dordogne river basins.

** Peyriget channel (Brivezac), Chambon channel (Bassignac le Bas), Champagne channel (Brivezac), Andolie channel (Allillac), île Duchamp (two channels, one on the right bank and one on the left of the island), Plaine channel, placing of rocks in the Peyriget channel.



Peyriget tributary channel reconnected to the Dordogne river in 2009.

Viewpoint

Benoit Wibaux

Adour-Garonne water agency -
Deputy director of a regional office

The contract, signed in 2009, is a win-win agreement that resulted from remarkable interaction between stakeholders in which everyone could take part and learned to speak the same language. For our part, we used financial support to lever regulatory and technical efforts. During the hydropeaking challenge prior to the contract, we funded the experimental work by EDF to reduce the amplitude and speed of change in water levels with a direct subsidy of 580 k€ covering 50% of the lost energy production. Since the signing of the contract, EDF has continued its work, with improvements each year, taking advantage of a clause in the 2006 Water law that lowers the hydroelectrical royalties paid to the State for dams that participate in projects to reduce the amplitude and speed of change in water levels caused by hydropeaking. Between 2005 and 2007, the agency injected over one million euros in the hydropeaking challenge. In the years to come, the competitive call for tenders for the concession covering all the dams on the Dordogne and Maronne rivers represents an extraordinary opportunity to insert our new knowledge into the technical specifications and consolidate the novel governance system of the Dordogne river, which has enabled all stakeholders to participate in optimising dam management in terms of energy produced, economic results and the environment.



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