Translocation of freshwater pearl mussels (*Margaritifera margaritifera*) before habitat rehabilitation project : case study on the the Dronne River

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Introduction

The Dronne River shelters one of the largest freshwater pearl mussels (FPM - Margaritifera margaritifera) populations in France, with more than 20,000 mussels. To preserve this population, Périgord-Limousin Regional Natural Park coordinates a European LIFE + program (LIFE13 / NAT / FR000506). An old dam located in the town of Saint-Saud-Lacoussière had several impacts on the mussels' habitat, as shown by a preliminary diagnosis (fig. 1): disruption of the ecological continuum, habitat loss caused by substrate clogging upstream of the dam (fig. 2), rise of temperatures in summer, risk of sudden rupture of the dam. In this particular instance, the habitat rehabilitation project consisted in the dam removal. In order to avoid their destruction, the mussels located on the construction site, on the downstream side of the dam, were moved before starting the works.

Figure 1 : Dam before restauration

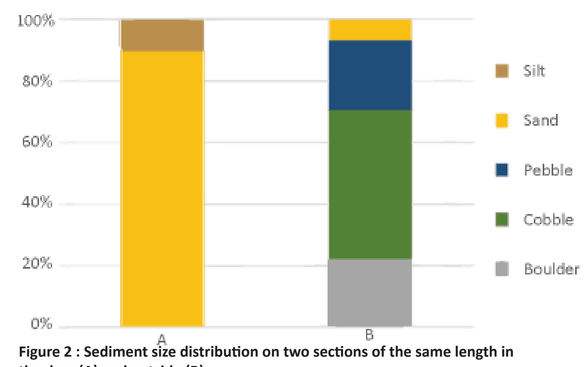

Figure 2 : Sediment size distribution on two sections of the same length in the dam (A) and outside (B)

Figure 3 : Collection and hanlding in donor site (A), tagged mussels (B), placing mussels in plots in receptor site (C)

Results

On the construction site, 180 mussels were counted during the preliminary diagnosis. During the collection phase, 582 mussels were collected for translocation. Among those mussels, 576 were located at the foot of the dam (over an area of 544 m², which represents a density of 1.06 individuals/m²) and the 6 remaining mussels were in the reservoir (distributed over an area of 2,010 m², which represents a density of 0.003 individuals/m²). The density observed downstream of the dam was similar to that observed on areas of the Dronne River which were not impacted by a dam.

Forty-five mussels were tagged and placed on the 3 control plots where 5, 4 and 3 local mussels had previously been marked, respectively. After 6 months, 37 out of the 45 translocated and marked mussels were observed on the plots - this observation ratio was comparable to that of the mussels already on the plots (Tab. 1). After 18 months and a 10-year flood, 35 translocated and marked mussels were found on the same plots. During the same period, only 7 of the 12 mussels already present and marked were observed again. At 6 months and 18 months (snorkelling survey), we recorded respectively 17 and 16 unmarked mussels on the plots.

Concerning the habitability of the rehabilitated section, the redox potential measurements before the works were below 300 mV at 5 and 10 cm depths (Fig. 4); these values indicate anoxic conditions. After rehabilitation, the values are above 300 mV and indicate oxygenated conditions.

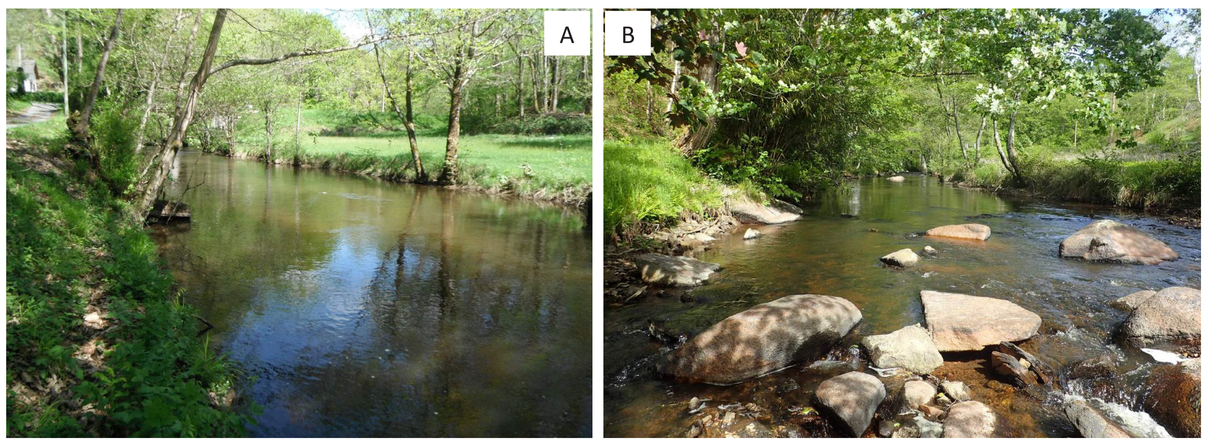

Figure 5 : Sediment accumation section before projetc (A) and the same section after restoration(B)

2. Materials and Methods

Characterisation of the donor site and river segment to be restored

The first step was to characterise the donor site on the entire area of the works (upstream and downstream of the dam) : flow patterns, water levels, speed, granulometry and shading. Then, the bottom of the riverbed was divided into two-metre-wide corridors to make the counting of FPM easier with a bathyscope. Upstream of the dam, habitability for juvenile mussels was assessed via measurements of the redox potential (Eh) at the free-flowing water surface and 5 cm and 10 cm deep in riverbed, according to the method proposed by Geist and Auerswald (2007).

Selection of the translocation site

According to Dunn et al. (2000), similarity between donor and translocation sites is a very important factor. A number of field investigations were carried out. Once the translocation site identified, three 4 m² plots were geolocated and marked out using four 30 cm wood sticks sunk into the substrate. On these three plots, all the FPM already present on the surface of the riverbed found with the bathyscope were marked with small vinyl tags and repositioned one by one on their original location.

Collection, handling and transportation

Two-metre-wide corridors are marked out on the donor site to enable a good coverage of the area. The surveys were carried out in two stages: all mussels detected using the bathyscope were collected and then, the substrate was carefully searched, with tools and by hand, to remove buried mussels. Part of the sediments was also sieved using 4 mm mesh); the process was repeated five times. Ten per cent of the translocated mussels were tagged. Mussels were then wrapped in a damp cloth and placed in a cool box to avoid shocks, dehydration and thermal shocks. The short distance to the translocation site (600 m upstream) was covered on foot. The mussels were placed in the substrate, in a natural position, using a trowel to open up a space in the gravels. Tagged mussels were distributed between the three plots on the translocation site, making sure not to destabilise the mussels already in place.

Monitoring

Monitoring of translocated mussels was carried out on the three plots after 6 months and 18 months by snorkelling. Thanks to this technique, tags could be read without handling the mussels. Furthermore, new redox potential measurements were taken 20 months after the works, in the former sediment accumulation area of the dam..

Table 1 : Observation conditions and nomber of mussels marked translocated, marked already in plots and unmarked mussels in control plots counted (and percentage of initial number)

	t 0	*t + 6 months*	*t + 18 months*
Underwater visibility conditions	Excellent	Excellent	Moderate
Material	Aquascope	snorkelling	snorkelling
Mussels translocated in plots	45 *100%*	37 *82%*	35 *78%*
Mussels already in plots	12 *100%*	10 *83%*	7 *58%*
Unmarked mussels	0 -	17 -	16 -

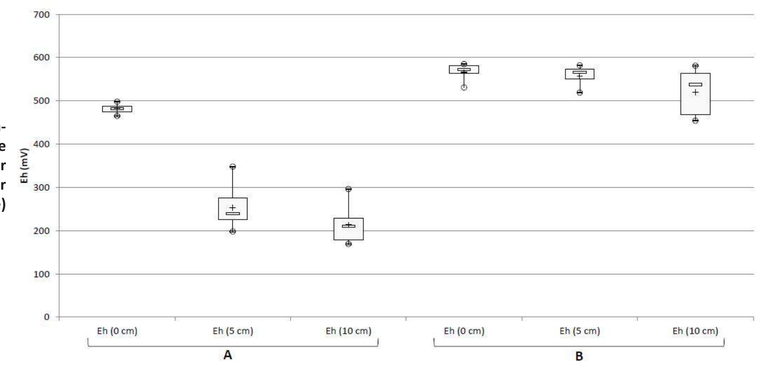

Figure 4 : Redox potential in freeflowing water at the surface and at 5 and 10 cm in the bed, before project (A) and 20 months after projetc (B) on restorated section (n=45 for each measure)

Discussion

We found that only 31% of the mussels could be observed on the surface of the riverbed with a bathyscope; 69% were buried or hidden.

The observation conditions during the follow-up at 18 months were not optimal. Additionally, counting the mussels visible on the surface of the riverbed is never exhaustive because it does not take into account buried or hidden mussels. The observation at 18 months of 4 marked mussels that were not observed at 6 months is a good example. It is also possible that mussels moved outside the monitoring plots. Considering all these elements, observing nearly 80% of the translocated control mussels 18 months after the works (within the small plots in which they were reimplanted) is an encouraging result. Survival rate will probably be higher for the above-mentioned reasons.

The sieving of sediments was not conclusive because sediments are not very suitable for shovelling. It seemed more efficient to lift all the coarse elements (pebbles and stones) one at a time and search in the sediments while maintaining an underwater vision.

The rehabilitated river section after the dam was removed seems to offer good conditions for FPM juveniles (fig.5). The presence of several hundred mussels immediately upstream suggests a rapid recolonisation of the rehabilitated section.

References

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