Catchment-scale river restoration on a freshwater pearl mussel river in Northern Ireland

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Introduction
The Ballinderry River lies at the heart of mid-Ulster and is one of only six rivers in Northern Ireland that still supports a population of the globally endangered Freshwater Pearl Mussel (Margaritifera margaritifera) (Reid et al. 2013). Threats include siltation of habitat increasing mortalities of juvenile mussels and declines of suitable trout hosts.

The Ballinderry freshwater pearl mussel is genetically distinct from all the other Northern Irish populations (Wilson and Roberts, 2011). There are less than 1000 individuals remaining in the wild (Preston 2011), mostly confined to the upper river which has been designated an SAC and an ASSI. At its current rate of decline the population faces extinction by 2098 (Wilson and Roberts, 2011).

Ballinderry Rivers Trust has been breeding freshwater pearl mussel since 1998. The captive breeding programme has produced thousands of juveniles, however the problems in the river prevented them from being released.

The catchment scale silt problem required a catchment scale response.

Ballinderry Rivers Trust’s Freshwater Pearl Mussel Rescue Project was launched in 2013; adopting a catchment-based approach to the conservation and rehabilitation of freshwater pearl mussel and associated habitat and builds on strategies recommended by Zuzañov et al. (1994). The Rescue Project aims to: 1) improve habitat and water quality of the Upper Ballinderry SAC; 2) Create a sanctuary site for freshwater pearl mussel; 3) Establish a new on-growing facility; 4) Improve the hatchery-based captive breeding programme for freshwater pearl mussel and 5) Raise public awareness of the plight of the freshwater pearl mussel.

Improving habitat and water quality

Methodology
Redox loss and proximity to downstream pearl mussel beds were used to rank and prioritise tributaries in order of their impact on the main river channel. Once prioritised, critical silt source areas were identified using a combination of SCIMAP modelling (Lane et al. 2009) and walkover surveys to record the location and condition of diffuse and point sediment sources, such as livestock watering points and eroding and failing river banks. Appropriate remediation measures were selected for each of the sediment sources identified.

Results

78 landowners were engaged in the project, 22 Km of fencing has been erected and 60 livestock drinking bays closed; alternative livestock water points have been provided by installing pasture pumps. Over 4000 cattle and sheep have been excluded from the river channel. Three kilometres of eroding bends and bank failures were recorded; a combination of hard and soft engineering schemes were implemented to combat these failures, such as rock revetment (hard) and Christmas tree revetment (soft). Willow was planted at all sites to stabilise banks.

Conclusion

Over £160,000 of silt remediation and river restoration works over 22 kilometres to improve the river to a standard in which freshwater pearl mussels can naturally reproduce and survive to adulthood. Of this £40,000 was donated by in-kind contributions. Already, farmers living in the upper catchment have reported that the riverbed appears cleaner than in previous years.

New growing facility for juvenile mussels

Methodology

Mussel silos (Chris Bamhart; Missouri State University) were used to release 240 juvenile freshwater pearl mussels ranging from 4 to 21 mm into the Ballinderry catchment. Silos were deployed at two sites, one on the main Ballinderry channel and the second on a small tributary, in September 2013. At each site there were 10 silos; five of the silos contained sediment and five were empty. 12 mussels were placed into each silo. Silos were cleaned weekly, checked for mortalities monthly and measured for growth every 6 months.

Results

A significant difference was found between survival and size, with mussels under 10 mm having significantly higher mortalities (p<0.05). The main channel was found to have significantly higher survival and growth than the mussels in the small tributary (p<0.05; p=0.001). No significant difference was found between survival and growth across the two treatments.

Conclusion

Data suggests mussels over 10 mm have a higher chance of survival across all sites, with the main channel showing the higher level of success. Larger mussels have probably made the change from pellet to filter feeding. No difference was found in survival and growth across the treatments; it would be recommended that empty silos are used as they require less monitoring.

General Conclusion

Initial survival and growth rates of released mussels suggest that mass-release would be successful. By releasing these mussels we have already changed the extinction curve for the Ballinderry population. An independent mussel expert, Dr Evelyn Moorkens, has been quoted as saying that “the input of as little as 10 surviving juvenile mussels a year has the net effect of maintaining the population eventually at current levels”, we have far exceeded this target by releasing 770 mussels over the last two years. These numbers will shift the date of total extinction of the population far beyond the prediction (2098) and continued releases will avoid extinction entirely.

Education and Volunteering

Methodology

A Teaching Advisory Group was established to inform the development of education resources in line with the Northern Ireland Revised Curriculum. The Trusts River School was redesigned and refurbished to provide a centre for teaching and an interactive learning space for school children and the wider community. An outreach programme has been developed delivering investigative learning about the river, the freshwater pearl mussel and other wildlife.

Results

The River School has been used by over 600 school children from schools across the catchment. “Hatchery in the Classroom” has allowed children to watch the development and growth of fish eggs and emerging baby trout in their classroom and then release them into the river. This project has run in 15 schools involving over 600 children.

Over 80 volunteers have been involved and we could not have delivered all the proposed objectives without their support. To date they have contributed £49,000 worth of time in-kind, not to mention the skills they bring to the project.

Conclusion

Education with wider stakeholder engagement is generating significant volunteer input allowing the implementation of remediation measures over a larger area than would be possible with limited financial input. Engagement and education provides the local community with a better understanding of the habitat requirements of Margaritifera margaritifera and international obligations for its conservation. This community “buy-in” provides a long term and sustainable future for the conservation of the freshwater pearl mussel in the Ballinderry catchment.