



Sustainable land use management for the conservation of the Freshwater Pearl Mussel: sediment flux and provenance

K. A. O'Neill^{1,2}, J.S. Rowan², J.A. Finn¹, P. Phelan³ and D. Ó hUallacháin¹

¹. Teagasc, Environment Research Centre, Johnstown Castle, Wexford, ². University of Dundee, ³. KerryLIFE Project (LIFE13 NAT/IE/000144), Kerry

karen.oneill@teagasc.ie

Introduction

The Freshwater Pearl Mussel (FPM) is a long-lived aquatic invertebrate listed as Critically Endangered (IUCN) and protected under the Habitats Directive (Annex II and Annex V). In Ireland, the FPM has experienced a 96% decline in recruiting populations over the last century, due in part to sediment losses from agricultural land and forestry. Sediment losses are thought to affect the FPM at the post-parasitic stage in their life cycle, by clogging interstitial gravels which juveniles inhabit, leading to oxygen starvation and death.

One of the key improvements needed for the restoration of juvenile habitat is the mitigation of excessive sediment inputs. Therefore, this project will employ sediment provenance and flux methods within representative sub-catchments to further the understanding of the effect of land use on sediment dynamics extensive Irish catchments.

Objectives

1. Assess the annual sediment yields and load flux of three rural sub-catchments with FPM. This will develop understanding of the effect of land management on sediment pollution
2. Identify the critical source areas (CSAs) of sediment in study

catchments through in-depth soil analysis and sediment fingerprinting

3. Investigate historical trends in sediment yields in catchments dominated by extensive agriculture and forestry



Figure 1. An adult Freshwater Pearl Mussel in the Caragh catchment

Materials and Methods

The study is part of an EU LIFE funded project, KerryLIFE, and is being conducted in three sub-catchments within the Kerry Blackwater and Caragh SACs i.e. the Kealduff (having evidence of juvenile recruitment); the Owenroe (having relatively lower levels of FPM); and the Bridia (Upper Caragh) (supporting just a small number of adult mussels).

Catchment sediment yields are being estimated using a continuous turbidity monitoring programme; the results of which will be calibrated to instream sediment concentrations using a combination of low-flow manual water samples and auto-sampling in flood events. River discharge is being ascertained through continuous level readings and acoustic Doppler profiling. Continuous sediment concentration and river discharge records will be compiled to produce high-resolution sediment trends and yields for the catchments.

Time-integrated samples of suspended and deposited sediment are being collected using time-integrated suspended samplers (TISS) and bed sediment samplers respectively. The natural tracer signatures of time-integrated sediment samples will be compared with those of soil samples from a range of land uses and actively eroding areas, identified during catchment walkovers (poached field entrances, eroding channel banks, forestry tracks etc.). Analyzed tracers will include magnetics, radionuclides and inorganic/organic trace metals. Uncertainty-inclusive un-mixing models will be used to assess the optimal combination of tracers as well as to determine the relative contribution of each source.



Figure 2. Inlet of a TISS (left); bed sediment samplers

FPM populations are thought to have declined particularly severely over the last century. Local lake core analysis, as well as the study of land-use records (ortho-photography etc.) will be used to

elucidate historical sediment yields in the study region.

Expected Benefits

An understanding of the quantity and timing of sediment delivery to these sensitive habitats should inform future sediment mitigation strategies. We will assess the role sediment fingerprinting can play in determining the relative impact of different land uses on sediment load. If effective, this should help to optimise the efficiency and effectiveness of mitigation strategies in extensive Irish catchments. Increased knowledge of the effect of modern intensification of land use on sediment dynamics may provide valuable insight into the future of biodiversity conservation in endangered fluvial ecosystems.

The delivery of efficient management plans for catchment-scale pollution is essential to the conservation of the Freshwater Pearl Mussel, and can contribute to sustainable land management on a broader scale.



Figure 3. Eroding channel bank and poaching damage in FPM catchment

Acknowledgements

This project is funded by the Teagasc Walsh Fellowship Programme.

We acknowledge support from KerryLIFE LIFE13 NAT/IE/000144.