Freshwater Pearl Mussel Survey of the Doonbeg, Annageeragh and Creegh Rivers, Co. Clare

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Comhairle Contae an Chláir Clare County Council

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Summary

This report presents the results of Freshwater Pearl Mussel (*Margaritifera margaritifera*) surveys in three rivers in Co. Clare. The surveys were commissioned by Clare County Council who received funding from the Heritage Council for the project. The surveys are an action under the County Clare Heritage Plan 2011-2017. A stage 2 survey of a c.2km stretch of the Doonbeg River between Cooraclare and Aughagarna Bridge was undertaken to establish the population of freshwater mussels within this stretch of the river in order to further define the distribution and abundance of FPM in the Doonbeg catchment. In addition, a Stage 1 survey of the Greygrove River, the main tributary of the Doonbeg, was undertaken by examining four separate locations. Stage 1 surveys were also undertaken on the Annageeragh and Creegh Rivers by surveying a suite of locations along both watercourses. While both rivers have been surveyed previously, there were no records of FPM from either watercourse despite the potential suitability of the water chemistry and habitat.

Previous records of Freshwater Pearl Mussels exist from the Doonbeg River dating back to the early 2000's. The current study aimed to augment the current knowledge of this system by undertaking a Stage 2 survey of mussels within an approximate 2km section of channel downstream of Cooraclare village. A total of 1,147 mussels were counted, all of which were adult sized. Earlier surveys of the lower 4km in the catchment by EirEco in 2012 counted a total of 3,290 live mussels over the entire survey area. When the areas not surveyed due to dense pondweed growth or poor visibility is taken in to account, this suggests a population approaching 5,000 mussels for the 4km stretch. A survey in the upper catchment in 2014 by McCarthy Keville O'Sullivan Ltd. counted 1,851 mussels (including a small number of individuals from the Greygrove). A total of 21 mussels were recorded in a 20m stretch of the river upstream of Cooraclare in 2007 by Eugene Ross. This gives a total absolute minimum population for the Doonbeg system of approximately 7,000 mussels. The current survey found no mussels in the Greygrove and the population there as evidenced by the earlier records, is considered to be highly fragmented and at high risk of extinction.

Sections of the Annageeragh River have been surveyed previously by ASU (2014) but recorded no evidence of mussels. Inland Fisheries Ireland reported recently (2016) finding a single mussel during a site visit to bridge maintenance works at Lissyneillan Bridge on the N67 (Michael Fitzsimmons, pers. comm.). During the current survey a total of 5 adults were counted. The Annageeragh River has some suitable substrate and may historically have been a reasonably good pearl mussel river. Much of the river has been modified by drainage and engineering works, both historically and recently. The Annageeragh FPM population is considered to be critically endangered and without considerable intervention in reducing silt and nutrient loading, is likely to become extinct in the very near future.

Two previous surveys for FWM were undertaken in the Creegh River (2014 and 2016) but found no evidence of mussels. The current survey found a single large adult present. The Creegh River was almost certainly once a good, perhaps a very good, mussel river. However, it appears that in all likelihood, owing to severe historical and ongoing drainage along most of its main channel, there may only be this one remaining mussel in the river. The species can thus be considered effectively extinct in the Creegh catchment.

1. Introduction

This report details the results of Freshwater Pearl Mussel (*Margaritifera margaritifera*) surveys in three rivers in Co. Clare. The surveys are an action under the County Clare Heritage Plan 2011-2017. A stage 2 survey of a c2km stretch of the Doonbeg River between Cooraclare and Aughagarna Bridge was undertaken to enumerate the population of freshwater mussels within this stretch of the river as part of a gap-filling exercise in order to establish the population of freshwater mussels within this stretch of the river and further define the distribution and abundance of FPM in the Doonbeg catchment. In addition, a Stage 1 survey of the Greygrove River, the main tributary of the Doonbeg, was undertaken by examining four separate locations. Stage 1 surveys were also undertaken on the Annageeragh and Creegh Rivers by surveying a suite of locations along both watercourses. While both rivers have been surveyed previously, there were no records of FPM from either watercourse despite the potential suitability of the water chemistry and habitat. The surveys were commissioned by Clare County Council who received funding from the Heritage Council for the project.

The surveys were undertaken by EirEco Environmental Consultants in conjunction with staff of the Aquatic Services Unit, University College Cork. Instream survey work was undertaken by Paul Murphy of EirEco operating under NPWS Licence No. C114/2016 and Lauren Williams of ASU operating under NPWS Licence No. C028/2016. Gerard Morgan and David Gillespie of ASU operated as bankside "managers" (recorders) during the stage 2 survey on the Doonbeg, while Derek Casey (also ASU) provided the GIS mapping input.

2. Methodology

2.1 Field Surveys

Standard Stage 2 Freshwater Pearl Mussel survey methodology was utilised for the 2km stretch of the Doonbeg River at Cooraclare as detailed in Anon (2004). The river in this stretch is 6-8m in width, requiring two surveyors in the water while a third person recorded findings from the bank. The river was waded in an upstream direction using bathyscopes. Deeper sections, which were very slow flowing, were snorkelled in an upstream direction. It was necessary to always work in an upstream direction as there was a considerable amount of fine detritus in slow flowing sections that was disturbed, affecting downstream visibility, during wading and snorkelling. All mussels were recorded along the survey reaches examined. Locations of mussels were recorded using handheld GPS. Where possible, an annotation of where they were found in the channel was used as presented in Table 1 and presented in the results provided in Appendix 1.

| Left margin | Left of centre | Centre | Right of centre | Right margin |
|-------------|----------------|--------|-----------------|--------------|
| LHS | LC | С | RC | RHS |
| | 4 4 14 1 | | 1 1 1 141 | |

Table 1. Annotation used to define location of mussels recorded within the river.

Surveys were carried out on October 12th and 13th 2016 under ideal conditions. There had been no rain in the preceding week; water levels were low and the days were bright and calm. Visibility was excellent.

The Greygrove River was surveyed on October 21st by surveying 4 separate locations covering a distance of approximately 300m at each location. The river was surveyed by wading in an upstream direction using a bathyscope.

The Annageeragh River survey was carried out on August 11th 2016 under ideal conditions. There had been no rain in the preceding week, water levels were low and the days were bright and calm. Water visibility was good. The Creegh River was surveyed on the 1st September under similar optimal conditions.

2.2 Mussel Abundance Scale

For GIS and mapping purposes, river reaches surveyed on the Doonbeg River were divided into 100m sections and mussel numbers per 100m linear reach were analysed. Mussel density per 100m linear section was categorised according to a modified ACFOR scale. A condensed version of the scale is applied for pearl mussel monitoring purposes as per Freshwater Pearl Mussel Sub-basin Management Plans (NS2, 2009).

The ACFOR categories used for GIS mapping purposes is as follows:

- 1. Abundant (over 250 per linear 100m of channel, but may be up to 250/m²)
- 2. Common (100 250 per 100m)
- 3. Frequent (21 99 per 100m)
- 4. Occasional (3-20 per 100m)
- 5. Rare (1-2 per 100m)
- 6. Absent

3. Overview of Existing Data on Freshwater Mussels in the three Rivers

3.1 Doonbeg River System

The earliest record of FPM in the Doonbeg system dates from the early 2000's when Dr Enda Mooney of the National Parks and Wildlife Service recorded their presence upstream of Cooraclare. On foot of this, Dr Eugene Ross was commissioned by NPWS to undertake a rapid assessment of FPM in the Doonbeg River in 2007. This study was a rapid assessment and undertaken in August when macrophyte growth was well developed. Despite surveying at various sections of the lower river, Ross only recorded mussels at Cooraclare Bridge (R04053 62042). A Stage 1 survey was carried out by EirEco Environmental Consultants under licence (CO24/2011) in April 2011 to determine the presence of freshwater pearl mussel within the lower reaches of the Doonbeg River from Danganella downstream to the estuarine reaches at Doonbeg village. The survey examined three separate stretches along the river using a combination of Bathyscope and snorkelling dependant on water depth. The survey found mussels to be present throughout the river in the vicinity of the site downstream to the village of Doonbeg. Adult mussels were present in good numbers at the bridge to the north of Mountrivers Bog while scattered individuals were recorded at the bridge immediately upstream of Doonbeg village and in the vicinity of Mountrivers Bridge.

Following on from that, a Stage 2 Survey undertaken by EirEco in May 2012 focused on the stretches of the Doonbeg River downstream of a proposed Windfarm development at Shragh to its confluence with the sea, a distance of approximately 4km. The survey area was divided into 4 separate sections which were further sub-divided into sub-sections according to variation in the characteristics of the river (see Figure 1). While efforts were made to survey the entire stretch of river, complete coverage of the river was hampered by the rafts of pondweed which occurred at a number of locations along the survey area. The dense nature of the weed growth in combination with the shallow water and heavy silt loading on the vegetation when attempting to snorkel in it rendered these areas inaccessible for detailed enumeration. A total of 3,290 live mussels were counted over the entire survey area. When the areas not surveyed due to dense pondweed growth or poor visibility is taken in to account, this suggests a population approaching 5,000 mussels for the 4km stretch. The overall density of mussels in each stretch is presented in Table 1.



Figure 1. Sections surveyed along lower Doonbeg River in 2012.

| Section No | Length of section (m) | Total No. of Mussels | Mean density of Mussels (No. of Mussels per square metre) |
|------------|--------------------------|----------------------|---|
| 1 | 1,345 | 593 | 0.44 |
| 2 | 982 | 977 | 0.99 |
| 3 | 597 | 800 | 1.34 |
| 4 | 685 | 920 | 1.34 |
| Total | 3,609 | 3,290 | 0.91 |

Table 1. Numbers and densities of freshwater pearl mussel recorded in the lower DoonbegRiver in 2012.

McCarthy Keville O'Sullivan Ltd. (2014) undertook a Stage 1 and 2 Survey for FPM in the Doonbeg catchment including parts of the Greygrove River, Ballyduneen River and Doonbeg River in May 2014. Approximately 5.5 kilometres of channel within the Doonbeg catchment was surveyed from a point upstream of Greygrove Bridge to Derrycrossaun Bridge looking at 10 different sections. A total of 1,851 live mussels and 93 dead shells were found in the stretches of River surveyed. Two mussels were recorded on the Greygrove River at a station approximately 1km downstream of Greygrove Bridge and a further single live mussel and dead shell were recorded at a station near Knockalough. A total of 4 live mussels were recorded a further 1km downstream at the Ballyduneen Bridge on the N68, with a further 1,844 live mussels recorded between this point and Derrycrossaun Bridge.

3.2 Annageeragh River

The Aquatic Services Unit, UCC, was commissioned in 2014 to carry out a Stage 1 Freshwater Pearl Mussel survey in the Annageeragh River as part of a proposed windfarm development in the Slaghbooly / Booltiagh area. Three sections of the River were surveyed in 6km of channel downstream of Doo Lough, which represents a distance of between 4 and 10km downstream of the proposed development site. Spot checks were carried out at two bridges further downstream. The lake outlet and the headwater streams upstream of the lake did possess some habitat potential for the species, the best of which was located upstream of Knockahila Bridge.

There was no evidence of freshwater pearl mussels recorded at any of the sites. Conditions were good for surveying at all except the Annageeragh Bridge, where a combination of high turbidity and high water colour made visibility poor. From what could be seen at that site, the habitat was largely unsuitable for the species, owing to embedded substrates and fine siltation.

No further surveys were undertaken on the river prior to the current survey, though a record of a live mussel was reported by Michael Fitsimmons of Inland Fisheries Ireland in early 2016 at Lissyneillan Bridge on the N67 during bridge maintenance works.

3.3 Creegh River

Ryan Hanley Ltd (2014) undertook a Stage 1 survey of the Creegh River on behalf of the Office of Public Works in relation to maintenance dredging activities. There were no previous records for Freshwater Pearl Mussels on the Creegh River but the water chemistry was considered suitable for the species. Ryan Hanley identified 3 sections with potentially suitable habitat which were surveyed intensively but found no evidence of mussels present.

The Aquatic Services Unit, UCC, was commissioned to carry out a Stage 1 Freshwater Pearl Mussel survey in the Creegh River in 2016 (ASU, 2016). This survey targeted stretches not surveyed previously by Ryan Hanley in 2014, but failed to find any evidence of mussels.

4. Results

4.1 Doonbeg River

The Stage 2 survey focussed on a stretch of the Doonbeg River between Cooraclare and Aughagarna Bridge which had not been previously surveyed for Freshwater pearl mussels. Raw data showing mussel locations and abundance are presented in Appendix 1. Photographs of representative river reaches are presented in Appendix 2. Figure 2 illustrates mussel abundance in the stretch of the Doonbeg River surveyed according to the ACFOR scale applied.

On October 12th 2016, 800m of river channel was surveyed working in an upstream direction from Aughagarna Bridge. A total of 812 mussels were recorded in that reach. On October 13th 2016, c.1,100m of channel was surveyed, beginning about half way between Cooraclare Bridge and Aughagarna Bridge. A total of 335 mussels were recorded in that reach. Overall, a total of 1,147 mussels were recorded in the two reaches surveyed, covering about 1.9km of river channel. Mussels were much more abundant in the 800m upstream of the 1st bridge downstream of Cooraclare (average = 1.02 mussels per linear metre of channel) compared to the 1100m reach downstream of Cooraclare village (average = 0.3 mussels per linear metre of channel).

The stretch of river between grid ref. 102219 162091 and 102791 161819 was characterised by deep slow flowing section of river, where snorkelling was necessary. It was difficult in this reach to accurately record every mussel given the combination of water depth, high water colour and turbid conditions. It is estimated that mussel numbers in these deeper reaches may be 10-20% higher than those recorded. It was only possible to dive for a short time and very difficult to maintain a uniform coverage of the river bed snorkel. Continuous diving also disturbed silty deposits further reducing the already poor visibility.

The stretch of river between 102791 161819 and 103144 161933 was not surveyed as this remained consistently deep and it was assumed that mussel density over this stretch would not alter significantly from that recorded in the similar section of channel immediately downstream.

A sewage input was noted just downstream of Cooraclare village, comprising a grey, strong smelling discharge. Patches of sewage fungus were present on some substrates and decaying leaf litter up to 100m downstream of the input. There was no defined outfall pipe: it appeared to be septic tank seepage, perhaps a combined group septic tank as shown in Plate 7, Appendix 2.



Figure 2. Mussel abundance in Doonbeg River downstream of Cooraclare using the ACFOR scale.

4.2 Greygrove River

Figure 3 shows the location of the Stage 1 survey locations on the Greygrove River. A total of four stations were surveyed, the lowest at Knockalough, the next at Lackan, the third at Greygrove Bridge and the last at Sorrel Island Bridge. All stations were centred on bridges to facilitate ease of access. The Greygrove River varies from approximately 7-8m in width at the lower stations to approximately 3-4m width in the upper station at Sorrel Island Bridge. The lower section of the river has been subject to some recent instream fisheries enhancement measures. Substrates throughout were dominated by cobble with frequent boulders and pockets of gravel and coarse sands. Dense growth of willow-moss (*Fontinalis antipyretica*) was present throughout which obscured large amounts of the substrate. Small amounts of filamentous algae were recorded in the vicinity of Lackan, but overall the water quality appeared high, though the water has a very high tannin content which limits visibility in water over 30cm depth. The flow regime was typically riffle with fast glide and occasional slow glide and pool conditions. Despite the potential suitability of the habitat, no evidence of mussels was recorded during this survey.



Figure 3. Stretches of the Greygrove River surveyed (in red).

(Source: NPWS Mapviewer)

4.3 Annageeragh River

Figure 4 shows the reaches of the Annageeragh surveyed in August 2016 along with locations of the 5 adult mussels recorded. The sites were selected to supplement previous surveys undertaken by ASU staff (ASU, 2014).

The Annageeragh River has very low numbers of mussels, but does have some suitable substrate and may historically have been a reasonably good pearl mussel river. Much of the river has been modified by drainage and engineering works, both historically and recently. The lower reaches, including just upstream of Annageeragh Bridge and downstream of Lissyneillan Bridge have a greater proportion of suitable substrate for mussels compared to reaches further upstream. These reaches, however, have been the most affected by historical drainage and recent engineering works and also have high levels of filamentous green algal growth (*Oedogonium* spp.); fine silt and detritus: at levels that exceed freshwater pearl mussel regulation thresholds (S.I. 296 of 2009). Detailed results of the Stage 1 survey are presented in Appendix 3.



Figure 4. Survey reaches on Annageeragh River (in pink) with mussel location and total numbers

4.4 Creegh River

Figure 5 shows the reaches of the Creegh surveyed in September 2016 along with the location of the single adult mussel recorded. The sites were selected to supplement previous surveys undertaken on behalf of the Office of Public Works (Ryan Hanley, 2014) and ASU (2016).

The Creegh River was almost certainly once a good, perhaps a very good, freshwater pearl mussel river. However, it appears that in all likelihood, owing to severe historical and ongoing drainage along most of its main channel, there may only be one remaining adult mussel in the river. The large size (and therefore apparent advanced age) of the mussel (150mm) suggests that it probably escaped the dredging bucket during original drainage operations and has survived until 2016. The species can thus be considered effectively extinct in the Creegh catchment. Detailed results of the Stage 1 survey are presented in Appendix 4.

Many habitat patches that have recovered in the lower reaches of the Creegh, between Drumellihy and Coomacreehaun Bridges in particular, possess flow types and substrates that are very suitable for freshwater pearl mussel. The absence of mussels in this part of the river was quite surprising. It was not entirely surprising to finally find the one large adult observed given the quality of the habitat. It is very likely that spoil heaps forming the river embankments (previously dredged from the river) contain many degraded mussel shells, in similar fashion to a midden.

The Creegh had reasonably high levels of filamentous green algal growth (*Oedogonium* spp.); fine silt and detritus in more slow flowing lower reaches: at levels that exceed freshwater pearl mussel regulation thresholds (S.I. 296 of 2009).



Figure 5. Survey reaches on River Creegh (in pink) with mussel location and total abundance.

5. Conclusions

Previous records of Freshwater Pearl Mussels exist from the Doonbeg River dating back to the early 2000's. A number of surveys have since being undertaken in sections of the river system but there still remain gaps in the overall assessment of distribution and abundance of mussels throughout the catchment. The current study aimed to partially fill this gap by undertaking a Stage 2 survey of mussels within an approximate 2km section of channel downstream of Cooraclare village. A total of 1,147 mussels were counted, all of which were adult sized. Earlier surveys of the lower 4km in the catchment by EirEco in 2012 counted a total of 3,290 live mussels over the entire survey area. When the areas not surveyed due to dense pondweed growth or poor visibility is taken in to account, this suggests a population approaching 5,000 mussels for the 4km stretch. A survey in the upper catchment in 2014 by McCarthy Keville O'Sullivan Ltd. counted 1,851 mussels (including a small number of individuals from the Greygrove). A total of 21 mussels were recorded in a 20m stretch of the river upstream of Cooraclare in 2007 by Eugene Ross. This gives a total absolute minimum population for the Doonbeg system of approximately 7,000 mussels. Owing to the background turbidity of the river coupled with sections of dense macrophyte growth, the surveys undertaken will invariably not pick up on all mussels.

The current study found no juvenile mussels indicating no recent recruitment in the population. The river shows evidence of high silt loads and nutrient input along with widespread modification to river banks and modification to flow regime through drainage activities. These combined stressors are evidently affecting the survival of juveniles and without recruitment the future prospects for the freshwater pearl mussel in the Doonbeg River does not look favourable. The river supports salmon, sea trout and resident brown trout, all of which are suitable fish hosts for the glochidia. However, the juveniles are unable to withstand the smothering combination of silts loads in sediments and filamentous algal growth from nutrient enrichment. The current survey found no mussels in the Greygrove and the population there as evidenced by the earlier records, is considered to be highly fragmented and at high risk of extinction. The Greygrove River represents an important part of the upper catchment of the Doonbeg River. The loss and fragmentation of the pearl mussel population in this section reflects the effects of upper catchment intensification and drainage which increases the nutrient and sediment loading on the lower sections. This also results in an increase on spate flows and subsequent bankside erosion downstream.

The Annageeragh River has been surveyed previously by ASU (2014) which reported no evidence of mussels. During the current survey a total of 5 adults were counted. The Annageeragh River has some suitable substrate and may historically have been a reasonably good pearl mussel river. Much of the river has been modified by drainage and engineering works, both historically and recently. The lower reaches, including just upstream of Annageeragh Bridge and downstream of Lissyneillan Bridge have a greater proportion of suitable substrate for mussels compared to reaches further upstream. These reaches, however, have been the most affected by historical drainage and recent engineering works and also have high levels of filamentous green algal growth (*Oedogonium* spp.); fine silt and detritus. The Annageeragh FPM population is critically endangered and without considerable intervention in reducing silt and nutrient loading, is likely to become extinct in the very near future.

Two previous surveys for FWPM were undertaken in the Creegh River (2014 and 2016) but found no evidence of mussels. The current survey found a single large adult present. The Creegh River was almost certainly once a good, perhaps a very good, freshwater pearl mussel river. However, it appears that in all likelihood, owing to severe historical and ongoing drainage along most of its main channel, there may only be this one remaining mussel in the river. The large size (and therefore apparent advanced age) of the mussel (150mm) suggests that it probably escaped the dredging bucket during original drainage operations and has survived until 2016. The species can thus be considered effectively extinct in the Creegh catchment.

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Appendix 1.

| East | North | LHS | LC | С | RC | RHS | Totals | Comment |
|--------|--------|-----|----|---|----|-----|--------|--|
| 102122 | 162117 | | | | 1 | 1 | 2 | 1st Bridge d/s Cooraclare |
| 102142 | 162116 | 1 | | | | | 1 | |
| 102147 | 162116 | | 2 | | | | 2 | |
| 102150 | 162116 | | | | 3 | | 3 | |
| 102152 | 162116 | 1 | 1 | | | | 2 | |
| 102155 | 162116 | | | | 1 | | 1 | |
| 102158 | 162117 | | | | | 2 | 2 | |
| 102166 | 162116 | | | 1 | | | 1 | |
| 102168 | 162116 | | | | | 1 | 1 | |
| 102169 | 162116 | | | | | 1 | 1 | |
| 102170 | 162116 | 1 | | | | | 1 | |
| 102173 | 162115 | | | | 2 | | 2 | |
| 102174 | 162115 | 1 | | | | | 1 | |
| 102176 | 162114 | | | 1 | | | 1 | |
| 102180 | 162113 | 1 | | | | | 1 | |
| 102188 | 162110 | | | | | 2 | 2 | |
| 102192 | 162108 | | | | | 2 | 2 | |
| 102193 | 162107 | | | | | 2 | 2 | |
| 102196 | 162108 | 2 | | | | | 2 | |
| 102217 | 162094 | | | 2 | | | 2 | |
| 102220 | 162092 | | 1 | 0 | | | 1 | |
| 102219 | 162091 | | | 1 | | | 1 | Deeper sluggish reaches upstream of here |
| 102229 | 162084 | | | | 1 | | 1 | |
| 102227 | 162086 | | | | | 5 | 5 | |
| 102229 | 162085 | | | | | 2 | 2 | |
| 102234 | 162078 | | 1 | | | | 1 | |
| 102235 | 162076 | | | | | 1 | 1 | |
| 102242 | 162069 | | 1 | | | | 1 | |
| 102245 | 162067 | | | | | 1 | 1 | |
| 102251 | 162060 | | | 2 | | | 2 | |
| 102248 | 162063 | | | | 1 | | 1 | |
| 102254 | 162057 | | | 1 | | | 1 | |
| 102265 | 162051 | | 2 | | | | 2 | |
| 102283 | 162052 | | | | 1 | | 1 | |
| 102286 | 162051 | | | 1 | | | 1 | |
| 102308 | 162046 | | | 1 | | | 1 | |
| 102296 | 162050 | | | | 1 | | 1 | |
| 102316 | 162041 | | | | 1 | | 1 | |
| 102318 | 162041 | | | | | 2 | 2 | |
| 102322 | 162037 | | | | 1 | | 1 | |

Abundance and Location Data from FPM Survey on Doonbeg River between Aughagarna Bridge and Cooraclare, October 2016.

| 102324 | 162032 | | | | | 1 | 1 | |
|--------|--------|---|---|---|---|---|---|--|
| 102329 | 162028 | | | | | 1 | 1 | |
| 102344 | 162018 | | | 1 | | | 1 | |
| 102353 | 162013 | | | 1 | | | 1 | |
| 102360 | 162010 | | | 1 | | | 1 | |
| 102364 | 162008 | | | 1 | | | 1 | |
| 102369 | 162006 | | | 2 | | | 2 | |
| 102351 | 162014 | | | | | 3 | 3 | |
| 102355 | 162013 | | | | | 1 | 1 | |
| 102373 | 162006 | | | 1 | | | 1 | |
| 102375 | 162005 | | | 1 | | | 1 | |
| 102362 | 162010 | | | | | 1 | 1 | |
| 102368 | 162008 | | | | | 2 | 2 | |
| 102370 | 162007 | | | | | 1 | 1 | |
| 102375 | 162005 | | | 4 | | | 4 | |
| 102381 | 162003 | | | 1 | | | 1 | |
| 102388 | 161998 | | | | | 3 | 3 | |
| 102390 | 161997 | | | 1 | | | 1 | |
| 102392 | 161992 | | | | | 3 | 3 | |
| 102395 | 161993 | | | 1 | | | 1 | |
| 102399 | 161991 | 1 | | | | | 1 | |
| 102404 | 161989 | 1 | | | | | 1 | |
| 102404 | 161989 | | 1 | | | | 1 | |
| 102407 | 161988 | | 2 | | | | 2 | |
| 102414 | 161986 | | 5 | 1 | | | 6 | |
| 102416 | 161986 | 2 | 3 | | | | 5 | |
| 102416 | 161988 | | | | | 2 | 2 | |
| 102418 | 161985 | 4 | | | | | 4 | |
| 102418 | 161985 | | | 5 | | | 5 | |
| 102417 | 161985 | | | | | 1 | 1 | |
| 102417 | 161985 | | | | | 1 | 1 | |
| 102419 | 161985 | 2 | | | | | 2 | |
| 102419 | 161985 | | | | | 1 | 1 | |
| 102421 | 161985 | | | 4 | | | 4 | |
| 102421 | 161984 | | | | | 7 | 7 | |
| 102421 | 161985 | | 1 | | | | 1 | |
| 102422 | 161984 | | | | | 6 | 6 | |
| 102422 | 161982 | | | 3 | | | 3 | |
| 102423 | 161982 | 3 | | | | | 3 | |
| 102425 | 161983 | | 1 | | | | 1 | |
| 102425 | 161983 | 3 | | | | | 3 | |
| 102425 | 161983 | 2 | | | | 3 | 5 | |
| 102426 | 161982 | | | | | 2 | 2 | |
| 102427 | 161982 | | | 1 | | | 1 | |
| 102428 | 161982 | | | | 1 | | 1 | |

| 102431 | 161983 | | | | | 1 | 1 | |
|--------|--------|---|---|---|---|---|----|--|
| 102432 | 161983 | | 2 | | | | 2 | |
| 102435 | 161982 | 1 | | | | | 1 | |
| 102435 | 161982 | | | 2 | | | 2 | |
| 102436 | 161983 | | | 7 | | | 7 | |
| 102438 | 161982 | | | 4 | | | 4 | |
| 102439 | 161982 | 1 | 1 | | | | 2 | |
| 102442 | 161981 | | | 5 | | | 5 | |
| 102442 | 161981 | | | | | 1 | 1 | |
| 102444 | 161980 | | | 6 | | | 6 | |
| 102445 | 161980 | 2 | 2 | | 1 | | 5 | |
| 102446 | 161980 | | 2 | | 3 | | 5 | |
| 102446 | 161980 | | | 4 | 1 | | 5 | |
| 102448 | 161980 | | | 2 | 3 | | 5 | |
| 102452 | 161978 | | | 7 | | | 7 | |
| 102452 | 161978 | | | 3 | | | 3 | |
| 102454 | 161978 | | | 9 | | | 9 | |
| 102454 | 161978 | 3 | | | | 5 | 8 | |
| 102455 | 161978 | | 3 | | | | 3 | |
| 102458 | 161977 | | 2 | | | | 2 | |
| 102455 | 161978 | | | | | 3 | 3 | |
| 102459 | 161977 | 5 | | | | 5 | 10 | |
| 102456 | 161978 | 4 | | | | 2 | 6 | |
| 102456 | 161979 | | 4 | | | 1 | 5 | |
| 102464 | 161975 | | 2 | | 5 | | 7 | |
| 102464 | 161975 | | 2 | | | | 2 | |
| 102464 | 161975 | | | | | 2 | 2 | |
| 102469 | 161973 | | | | 1 | | 1 | |
| 102471 | 161973 | | | | 1 | | 1 | |
| 102465 | 161975 | 3 | | | | | 3 | |
| 102473 | 161971 | | | 1 | | | 1 | |
| 102465 | 161975 | | 1 | | | | 1 | |
| 102475 | 161970 | | 2 | 4 | | | 6 | |
| 102476 | 161970 | | 1 | | 1 | | 2 | |
| 102477 | 161970 | | | 3 | | | 3 | |
| 102478 | 161970 | | 2 | | | 1 | 3 | |
| 102478 | 161970 | | 1 | | 1 | | 2 | |
| 102481 | 161969 | | 2 | | | | 2 | |
| 102481 | 161968 | | | 5 | | | 5 | |
| 102483 | 161968 | | | 2 | | | 2 | |
| 102505 | 161948 | | | | | | 0 | |
| 102495 | 161960 | | | | | 1 | 1 | |
| 102508 | 161948 | 1 | | 1 | | | 2 | |
| 102512 | 161947 | | | 1 | 1 | | 2 | |
| 102509 | 161948 | | 1 | | 2 | | 3 | |

| 102513 | 161945 | 1 | | | | 2 | 3 | |
|--------|--------|---|----|---|----|---|----|--|
| 102514 | 161941 | | 1 | | 1 | | 2 | |
| 102514 | 161941 | | | 1 | | | 1 | |
| 102516 | 161941 | | 2 | 3 | 7 | | 12 | |
| 102516 | 161941 | | | | 13 | | 13 | |
| 102517 | 161941 | | | | 1 | | 1 | |
| 102516 | 161942 | | | | | 4 | 4 | |
| 102516 | 161941 | | | | | 2 | 2 | |
| 102516 | 161940 | | | | | 2 | 2 | |
| 102516 | 161940 | | 5 | | | | 5 | |
| 102517 | 161939 | | 2 | 1 | | | 3 | |
| 102517 | 161939 | | | 2 | | 1 | 3 | |
| 102518 | 161937 | | | 3 | | | 3 | |
| 102520 | 161936 | | | 0 | 2 | | 2 | |
| 102521 | 161933 | | | 1 | 0 | | 1 | |
| 102522 | 161932 | | | | 4 | 1 | 5 | |
| 102523 | 161931 | | | | 6 | | 6 | |
| 102524 | 161930 | | | | | 5 | 5 | |
| 102524 | 161930 | | 1 | 3 | 10 | | 14 | |
| 102526 | 161926 | | | | 2 | 7 | 9 | |
| 102527 | 161924 | | 2 | | | | 2 | |
| 102528 | 161923 | | 0 | | | 3 | 3 | |
| 102529 | 161921 | | 1 | 1 | 4 | | 6 | |
| 102531 | 161919 | | | | | 2 | 2 | |
| 102533 | 161918 | | | 1 | 2 | | 3 | |
| 102534 | 161915 | | 3 | | | | 3 | |
| 102534 | 161914 | | | 1 | 2 | 1 | 4 | |
| 102535 | 161913 | 1 | 5 | 3 | | 3 | 12 | |
| 102538 | 161909 | | | 3 | | | 3 | |
| 102538 | 161909 | | 2 | | | | 2 | |
| 102538 | 161909 | | 2 | | | | 2 | |
| 102582 | 161904 | | | 5 | | 1 | 6 | |
| 102586 | 161903 | | 2 | 4 | | | 6 | |
| 102588 | 161901 | | 10 | | | | 10 | |
| 102590 | 161900 | | | 8 | | | 8 | |
| 102589 | 161900 | | | | | 2 | 2 | |
| 102592 | 161899 | | 3 | | | | 3 | |
| 102590 | 161900 | | | | | 3 | 3 | |
| 102592 | 161899 | | | | | 4 | 4 | |
| 102593 | 161898 | | | | | 7 | 7 | |
| 102594 | 161896 | | | | | 3 | 3 | |
| 102604 | 161892 | | | | | 9 | 9 | |
| 102610 | 161888 | | | | | 2 | 2 | |
| 102624 | 161885 | | | | | 4 | 4 | |
| 102638 | 161883 | | | | 5 | | 5 | |

| 102644 | 161884 | 9 | | | | | 9 | |
|--------|--------|---|---|---|---|----|----|--|
| 102649 | 161886 | 4 | | | | 2 | 6 | |
| 102652 | 161886 | 2 | | | | 3 | 5 | |
| 102656 | 161886 | 2 | | | | 2 | 4 | |
| 102658 | 161886 | 9 | | | | 16 | 25 | |
| 102662 | 161887 | | | 5 | | | 5 | |
| 102665 | 161887 | | | 3 | | | 3 | |
| 102665 | 161887 | | | | 4 | | 4 | |
| 102665 | 161887 | | | 5 | | | 5 | |
| 102668 | 161886 | | 5 | | | | 5 | |
| 102673 | 161888 | | 4 | | | | 4 | |
| 102684 | 161875 | | | | | 1 | 1 | |
| 102686 | 161871 | | | 3 | | | 3 | |
| 102688 | 161868 | | 2 | | | | 2 | |
| 102688 | 161864 | | | 1 | | | 1 | |
| 102690 | 161856 | | | 3 | | | 3 | |
| 102690 | 161854 | | | 3 | | | 3 | |
| 102710 | 161832 | | | 2 | | | 2 | |
| 102707 | 161833 | | | | | 1 | 1 | |
| 102716 | 161829 | | | 1 | | | 1 | |
| 102710 | 161832 | | | | | 2 | 2 | |
| 102717 | 161829 | | 3 | | | | 3 | |
| 102711 | 161831 | | | | | 3 | 3 | |
| 102719 | 161828 | | 2 | | | | 2 | |
| 102722 | 161827 | | | 2 | | | 2 | |
| 102713 | 161830 | | | | | 7 | 7 | |
| 102723 | 161826 | | | 1 | | | 1 | |
| 102715 | 161829 | | | | | 11 | 11 | |
| 102724 | 161826 | | | 3 | | | 3 | |
| 102716 | 161830 | | | | | 5 | 5 | |
| 102729 | 161824 | | | 2 | | | 2 | |
| 102718 | 161827 | | | | | 2 | 2 | |
| 102731 | 161823 | | 2 | | | | 2 | |
| 102719 | 161826 | | | | | 4 | 4 | |
| 102720 | 161826 | | | | | 9 | 9 | |
| 102736 | 161821 | | | 2 | | | 2 | |
| 102736 | 161821 | | | 3 | | | 3 | |
| 102738 | 161821 | | | 1 | | | 1 | |
| 102741 | 161821 | | | 4 | | | 4 | |
| 102734 | 161822 | | | | | 4 | 4 | |
| 102735 | 161821 | | | | | 1 | 1 | |
| 102742 | 161820 | | | 1 | | | 1 | |
| 102740 | 161821 | | | | | 6 | 6 | |
| 102744 | 161819 | | | 3 | | | 3 | |
| 102741 | 161821 | | | | | 3 | 3 | |

| 102742 | 161820 | | | | | 3 | 3 | |
|--------|--------|----|---|----|---|---|----|---------------------------------|
| 102743 | 161820 | | | 0 | 3 | 8 | 11 | |
| 102746 | 161819 | | | | | | 0 | |
| 102752 | 161817 | | 6 | | | | 6 | |
| 102747 | 161819 | | | | | 5 | 5 | |
| 102756 | 161816 | | | 6 | | | 6 | |
| 102757 | 161816 | 2 | | | | | 2 | |
| 102749 | 161817 | | | | 2 | | 2 | |
| 102759 | 161826 | | | 15 | | | 15 | |
| 102762 | 161816 | | 7 | | | | 7 | |
| 102752 | 161819 | | 0 | | | 9 | 9 | |
| 102793 | 161818 | | | | | 2 | 2 | |
| 102760 | 161817 | | | 2 | | | 2 | |
| 102755 | 161817 | | | | | 4 | 4 | |
| 102765 | 161816 | 2 | | | | | 2 | |
| 102757 | 161817 | | | | | 2 | 2 | |
| 102765 | 161816 | | | 5 | | | 5 | |
| 102759 | 161816 | | | | | 3 | 3 | |
| 102768 | 161815 | | 4 | | | | 4 | |
| 102763 | 161815 | | | | | 1 | 1 | |
| 102769 | 161816 | | | 2 | | | 2 | |
| 102773 | 161816 | | | 2 | | | 2 | |
| 102769 | 161816 | | | | | 3 | 3 | |
| 102776 | 161817 | | | 3 | | | 3 | |
| 102788 | 161819 | | | | | 2 | 2 | |
| 102790 | 161819 | | | | | 1 | 1 | |
| 102791 | 161819 | 2 | | | | | 2 | U/S end of Day 1 survey |
| 103144 | 161933 | | ~ | | ~ | | 0 | Day 2 survey beginning location |
| 103146 | 161944 | 2 | ~ | | ~ | 2 | 4 | |
| 103149 | 161953 | 3 | ~ | 4 | ~ | 4 | 11 | |
| 103150 | 161958 | 6 | ~ | 6 | ~ | 2 | 14 | |
| 103152 | 161963 | 5 | ~ | 2 | ~ | 2 | 9 | |
| 103155 | 161969 | | ~ | | ~ | | 0 | |
| 103159 | 161973 | 2 | ~ | 1 | ~ | 1 | 4 | |
| 103164 | 161979 | 4 | ~ | 15 | ~ | | 19 | |
| 103174 | 161988 | 19 | ~ | 57 | ~ | | 76 | |
| 103184 | 161992 | 16 | ~ | 15 | ~ | 4 | 35 | |
| 103193 | 161995 | 9 | ~ | 4 | ~ | | 13 | |
| 103206 | 161998 | 2 | ~ | | ~ | | 2 | |
| 103221 | 161997 | | ~ | | ~ | | 0 | |
| 103228 | 161996 | | ~ | | ~ | 1 | 1 | |
| 103234 | 161995 | | ~ | 1 | ~ | | 1 | |
| 103255 | 161998 | | ~ | 3 | ~ | | 3 | |
| 103284 | 162004 | | ~ | | ~ | | 0 | |
| 103293 | 162004 | | ~ | | ~ | | 0 | |

| 103304 | 162006 | | ~ | | ~ | | 0 | |
|--------|--------|----|---|---|---|---|----|--|
| 103312 | 162007 | 4 | ł | 3 | ~ | | 7 | |
| 103323 | 162007 | 2 | ۲ | 4 | ~ | | 6 | |
| 103340 | 161995 | 2 | 1 | | ~ | 2 | 4 | |
| 103347 | 161996 | | 2 | | ~ | | 0 | |
| 103355 | 161990 | | 1 | | ~ | | 0 | |
| 103368 | 161991 | | ۲ | | ~ | | 0 | |
| 103378 | 161991 | | ۲ | | ~ | | 0 | |
| 103389 | 161993 | 2 | ۲ | 3 | ~ | | 5 | |
| 103405 | 161997 | | ۲ | 1 | ~ | | 1 | |
| 103413 | 162002 | | 2 | 1 | ~ | | 1 | |
| 103426 | 162006 | | ł | | ~ | | 0 | |
| 103436 | 162008 | | 1 | | ~ | | 0 | |
| 103445 | 162009 | | 1 | | ~ | | 0 | |
| 103445 | 162006 | | 1 | | ~ | | 0 | |
| 103464 | 162004 | | ~ | | ~ | | 0 | |
| 103476 | 162007 | | ~ | | ~ | | 0 | |
| 103484 | 162013 | | 1 | 1 | ~ | 1 | 2 | |
| 103492 | 162016 | | 2 | | ~ | 1 | 1 | |
| 103501 | 162021 | | 2 | | ~ | 2 | 2 | |
| 103510 | 162027 | | 1 | | ~ | | 0 | |
| 103523 | 162044 | | ~ | | ~ | | 0 | |
| 103520 | 162041 | | 1 | | ~ | | 0 | |
| 103534 | 162044 | | 1 | | ~ | | 0 | |
| 103556 | 162055 | | 1 | | ~ | | 0 | |
| 103592 | 162065 | | ~ | | ~ | | 0 | |
| 103607 | 162078 | | ~ | | ~ | | 0 | |
| 103631 | 162093 | | ~ | | ~ | | 0 | |
| 103666 | 162142 | | ~ | | ~ | | 0 | |
| 103667 | 162169 | | ~ | | ~ | | 0 | |
| 103675 | 162173 | | ~ | | ~ | | 0 | |
| 103710 | 162183 | | ~ | | ~ | | 0 | |
| 103712 | 162184 | 14 | ~ | 1 | ~ | | 15 | |
| 103727 | 162180 | 4 | ~ | | ~ | | 4 | |
| 103731 | 162178 | | ~ | | ~ | | 0 | |
| 103739 | 162174 | | ~ | | ~ | | 0 | |
| 103745 | 162171 | | ~ | | ~ | | 0 | |
| 103757 | 162167 | | ~ | | ~ | | 0 | |
| 103768 | 162162 | | ~ | | ~ | | 0 | |
| 103790 | 162158 | | ~ | | ~ | 2 | 2 | |
| 103798 | 162161 | | ~ | | ~ | | 0 | |
| 103833 | 162173 | | ~ | 1 | ~ | | 1 | |
| 103873 | 162165 | | ~ | | ~ | | 0 | |
| 103885 | 162159 | | ~ | | ~ | | 0 | |
| 103904 | 162133 | | ~ | | ~ | | 0 | |

| 103915 | 162120 | | ~ | 1 | ~ | | 1 | |
|--------|--------|-----|-----|-----|-----|-----|------|--|
| 103929 | 162105 | | ~ | 5 | 1 | | 5 | |
| 103932 | 162102 | 2 | ~ | | 1 | | 2 | |
| 103940 | 162095 | | ~ | 1 | 1 | | 1 | |
| 103941 | 162095 | | ~ | | ~ | | 0 | Sewage input: grey discharge/sewage fungus |
| 103948 | 162089 | | ~ | | 1 | | 0 | |
| 103953 | 162086 | 1 | ~ | 1 | ~ | | 2 | |
| 103965 | 162083 | | ~ | 16 | ~ | | 16 | |
| 103967 | 162083 | | ~ | 5 | ~ | | 5 | |
| 103971 | 162081 | | ~ | | ~ | 13 | 13 | |
| 103974 | 162079 | 6 | ~ | 28 | 2 | | 34 | |
| 103981 | 162073 | | ~ | | ~ | | 0 | |
| 103996 | 162061 | | ~ | | ~ | | 0 | |
| 103997 | 162059 | | ~ | | 1 | 3 | 3 | |
| 104003 | 162055 | | ~ | 1 | 1 | | 1 | |
| 104009 | 162048 | | ~ | 1 | ~ | | 1 | |
| 104007 | 162053 | 2 | ~ | | 2 | | 2 | |
| 104013 | 162050 | 1 | ~ | | ~ | | 1 | |
| 104019 | 162052 | | ~ | | ~ | 5 | 5 | Just d/s Cooraclare Bridge |
| тот | ALS | 187 | 127 | 410 | 102 | 321 | 1147 | |

Appendix 2.

Photographic Plates from FPM Survey on Doonbeg and Greygrove Rivers 2016.



Plates 1 & 2. Surveying in typical, wadeable reaches of the Doonbeg River (13/10/16)



Plate 3. View u/s from Aughagarna Bridge where scattered adult mussels in the 'Frequent' abundance category were recorded.



Plate 4. Typical deep, sluggish section of the Doonbeg, up to 1.5m depth with substrates of clay, and mixed cobble/small boulder with silty detritus. Surprisingly (because this habitat would not be considered typical for the species) these reaches had mussels up to 'Common' in abundance category, with patchy distribution. There were occasional, quite dense clusters of mussels.



Plate 5. Typical glide/riffle section about 500m downstream of Cooraclare village where mussels were 'Absent'.



Plate 6. Typical shallow riffle section about 550m downstream of Cooraclare village where mussels were 'Rare'. A few mussels were confined to more stable gravel patches just d/s of the riffle head under bankside trees on left.



Plate 7. Concrete covers, possibly over large septic tanks in fields on south bank of river with associated discharge to the river, located just downstream of Cooraclare village.



Plate 8. Stretch of the Greygrove River near Knockalough.



Plate 9. Greygrove River showing cobble substrate and dense willow moss growth.

Appendix 3

Detailed Results of FPM Survey on Annageeragh River 2016

| Location | Reach upstream of R483. Annageeragh Bridge |
|------------|--|
| Irish Grid | DS: R02993 70990 / US: R03102 70942 |
| X, Y (ITM) | DS: 102993 170990 / US: 103102 170942 |
| Habitat | Slow glide (~to riffle at bridge). 5m width, mean 0.5m depth (at |
| | low flow). Slight-moderate water colour (humic), slight |
| | turbidity. Substrates in reach comprised mainly of cobble with |
| | some finer interstitial material. Patches of smooth bedrock. |
| | Brown filamentous diatom growth and a layer of fine |
| | silt/detritus on all substrates. Filamentous green algae |
| | (<i>Oedogonium</i> sp.) 40% coverage – long trailing form. |
| Mussels | 2 large adults located around 25m upstream of bridge. |



Reach upstream of Annageeragh Bridge (11/8/16) showing approximate location of 2 adult mussels.

Oedogonium sp. (11/8/16)

| Location | Reach upstream of disused railbridge d/s of Lisseyneillan Bridge |
|------------|---|
| Irish Grid | DS: R02370 71171 / US: R02579 71114 |
| X, Y (ITM) | DS: 102370, 171171 / US: 102579, 171114 |
| Habitat | Riffle/run/glide sequence – more glide/run than riffle. Historically |
| | drained (deepened). 5m width, mean 0.3m depth (at low flow). |
| | Slight-moderate water colour (humic), slight turbidity. Substrates in |
| | reach comprised mainly of cobble and pebble with some finer |
| | interstitial material. Patches of smooth bedrock and also some |
| | dense mineral clay. Layer of fine silt/detritus on substrates in slow |
| | flows. Mussels found in pebbly riffle at river margins. Filamentous |
| | green algae (<i>Oedogonium</i> sp.) 30% coverage – long trailing form. |
| | Myriophyllum < 5%. |
| Mussels | 1 large adult @ R02449 71160; 2 large adults @ R02475 71165. |



Reach downstream of Lisseyneillan Bridge (11/8/16) showing approximate locations of 3 adult mussels. Note cattle access in foreground on True Right bank.

| Location | Reach upstream of Lisseyneillan Bridge |
|------------|--|
| Irish Grid | DS: R02694 71053 / US: R02845 71087 |
| Х, Ү (ІТМ) | DS: 102694 171053 / US: 102845, 171087 |
| Habitat | Riffle/run sequence. Highly disturbed by drainage and |
| | channelization. 3-6m width, mean 0.3m depth (at low flow). Slight- |
| | moderate water colour (humic), slight turbidity. Substrates in reach |
| | comprised mainly of bedrock and larger cobble with some finer |
| | interstitial material. Layer of fine silt/detritus on substrates in slow |
| | flows, but clean in fast flowing riffles. Anecdotal evidence of |
| | mussels around Lisseyneillan Bridge as a result of recent bridge |
| | works. Filamentous green algae (<i>Oedogonium</i> sp.) present in slow |
| | flows, but generally free of algae otherwise. |



| Location | Reach downstream of Knockahila Bridge |
|------------|--|
| Irish Grid | DS: R05048 71069 / US: R05306 71016 |
| Х, Ү (ІТМ) | DS: 105048, 171069 / US: 105306, 171016 |
| Habitat | Glide/run sequence, with limited rapid/riffle. Historically drained with spoil heap/embankment at TR bank and evidence that bed level was incised into bedrock. 5m width, mean 0.35m depth (at low flow). Slight-moderate water colour (humic), slight turbidity. Substrates in reach comprised mainly of bedrock and larger cobble with very limited fine interstitial material. Layer of fine silt/detritus on substrates in slow flows, but clean in fast flowing riffles. <i>Phormidium</i> common, <i>Myriophyllum</i> and <i>Fontanalis antipyretica</i> present. but generally free of algae otherwise. |



Typical flow type downstream of Knockahila Bridge (11/8/16)

Phormidium - common on substrates in this reach (11/8/16)

| Location | Reach upstream of Knockahila Bridge |
|------------|--|
| Irish Grid | DS: R05906 71175 / US: R06020 71084 |
| X, Y (ITM) | DS: 105906, 171175 / US: 106020, 171084 |
| Habitat | Glide/run sequence, with limited rapid/riffle. Historically drained with |
| | spoil heap/embankment at TR bank and evidence that bed level was |



Appendix 4.

Detailed Results of FPM Survey on Creegh River 2016.

| Location | 300m reach upstream of Coomacreehaun Bridge |
|--|---|
| Irish Grid | DS: R00250 66056 / US: R00500 65912 |
| Х, Ү (ІТМ) | DS: 100250 166056 / US: 100500 165912 |
| Habitat | Series of riffle- glides with the occasional pool. Historical drainage means that pools and meanders are probably less frequent than expected for the river type. Steep, uniform banks with limited tree cover of willow and alder. Clear evidence of spoil heap forming embankments as a result of historical drainage. Low flow: 6m average width, mean 0.45m depth. Moderate water colour (humic), clear (no turbidity). Substrates in reach comprised mainly of cobble with reasonably frequent patches of finer interstitial material including gravel and coarse sand. Silt at some margins and sluggish pools, but not excessive. Filamentous green algae (<i>Oedogonium</i> sp.) up to 25% coverage overall, but patchy distribution. Overall there was considered to be up to 25% habitat potential for mussels in this reach (very good, stable pockets of gravels and finer bed material) and it was not surprising to find one in the end. |
| Evidence of Mussels | 1 large adults located at R 00432 66002 in cobble/gravel riffle near |
| | large alder on TL bank. |
| | |
| Reach upstream of Coomacre (1/9/16) showing approximat large adult mussel. | e location of 1 River. Shell length 150mm. |

| Location | 300m reach upstream of Mount Rivers (N67) Bridge |
|------------|--|
| Irish Grid | DS: Q 99123 66019 / US: Q 99375 65716 |
| Х, Ү (ІТМ) | DS: 99375 165716/ US: 99375 165716 |
| Habitat | Riffle/run/glide sequence – more glide/run than riffle. |
| | Historically drained (deepened). Low flow: 6m width, |
| | mean 0.40m depth. Moderate water colour (humic), water |
| | column clear (no turbidity0. The reach is clearly influenced |
| | by historical drainage. Substrates comprised a high |
| | proportion of bedrock, clay and cobble/gravel embedded in |
| | clay. Overall there was <5% habitat potential for mussels. |

| | Very limited patches of finer bed material suitable for |
|---------------------|---|
| | mussels. Silt was not excessive. Some fine silt/detritus on |
| | substrates in slow flows. Filamentous green algae |
| | (<i>Oedogonium</i> sp.) 40% coverage – long trailing form. |
| | Myriophyllum < 5%; Fontanalis antipyretica (+) |
| | Potamogeton crispus (+); Potamogeton natans (+); Phalaris |
| | arundinacea (+ ~ at margins). |
| Evidence of Mussels | None |



Typical riffle - glide flow type in the survey reach. No mussels (1/9/16).

Set-back embankments on the Creegh River near Mount Rivers Bridge (1/9/16).

| Location | 300m reach downstream of bridge in townland of |
|---------------------|---|
| | Cloonenagh |
| Irish Grid | DS: R 06967 66617 / US: R 07303 66827 |
| Х, Ү (ІТМ) | DS: 106967 166617 / US: 107303 166827 |
| Habitat | Reasonably fast, shallow riffle/run sequence. Historically |
| | deeply drained with steep, uniform bank slopes and |
| | reduced flow diversity. No tree cover along reach with |
| | improved grassland on both banks. Low flow: 4.5m |
| | average width; 0.15m mean depth. Slight-moderate |
| | water colour (humic); clear (no turbidity). Substrates in |
| | reach comprised mainly of gravel with some cobble, with |
| | a few patches of exposed clay. Very little instream |
| | vegetation: Fontanalis antipyretica (+); Chiloschyphus spp. |
| | (+); Oedagonium spp. (+); Sparganium emersum (+). |
| | Gemerally free of silt owing to fast flows. |
| Evidence of Mussels | None |



| Location | Bridge near townland of Cloonwhite South |
|---------------------|--|
| Irish Grid | R 08809 66814 |
| Х, Ү (ІТМ) | 108809 166814 |
| Habitat | Habitat similar to the reach at Cloonenagh (above). The river has been historically drained in this part of the catchment also, as evidenced by steep uniform bank slopes and limited riparian tree cover. Given that mussels were absent from parts of the river with much more ideal habitat, and were absent from similar drained habitat c.2km downstream, this upstream reach was not surveyed. |
| Evidence of Mussels | None |



bridge (1/9/16)

Creegh River - view d/s from Cloonwhite South bridge (1/9/16)