WILD TROUT TRUST

River Moy Habitat Assessment

and

Management Plan

East Mayo Angling Association, Co. Mayo, Ireland

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Key Findings

- The waters of East Mayo Angling Association (and associated tributaries) have been subjected to significant habitat degradation over the years, through straightening and dredging. Subsequent natural recovery has begun to restore habitat and will continue to do so if those watercourses can be protected from further degradation.

- In some areas, past habitat works like groynes may have improved conditions within the degraded channel, but many are now likely to be inhibiting the natural recovery of the channel.

- There is great scope for major channel restoration schemes on many areas of the tributaries, with options including realignment back to the original meandering course and installation of coarse bed material to create riffles and increased spawning habitat.

- As evident, through the habitat assessment site visits, most areas of watercourses visited held fish, with some supporting good numbers. Those fish populations are likely to be improved further through sympathetic management of their habitat and sympathetic angling practices.

- In addition to the existing salmon fishery, there is good potential to develop fishing for wild trout on both the main river and larger tributaries, providing that angler exploitation can be managed effectively through catch and release to allow fish to attain their full size potential – being productive limestone rivers, that is significant (>1.5kg) on some watercourses.

Contents

1. Background

The WTT was requested to undertake habitat assessment of the East Mayo Angling Association (EMAA) waters on the River Moy and provide recommendations to inform a plan for future management of the fishery. This report covers the ~18km of main river Moy under the control of the Association and many of the connected tributaries. Site visits were undertaken over five days (21-25/07/2022 inclusive) when river conditions were low and sufficiently clear for assessment.

Normal convention is applied throughout this report with respect to bank identification, i.e. the banks are designated left bank (LB) or right bank (RB) whilst looking downstream. Specific locations are described using latitude and longitude (decimal e.g. 54.45737, -1.306513), which can be pasted straight into Google Maps to identify exact locations. Figure references within the text of the report are hyperlinked, so holding Ctrl and left-clicking on them will move to that point within the document.

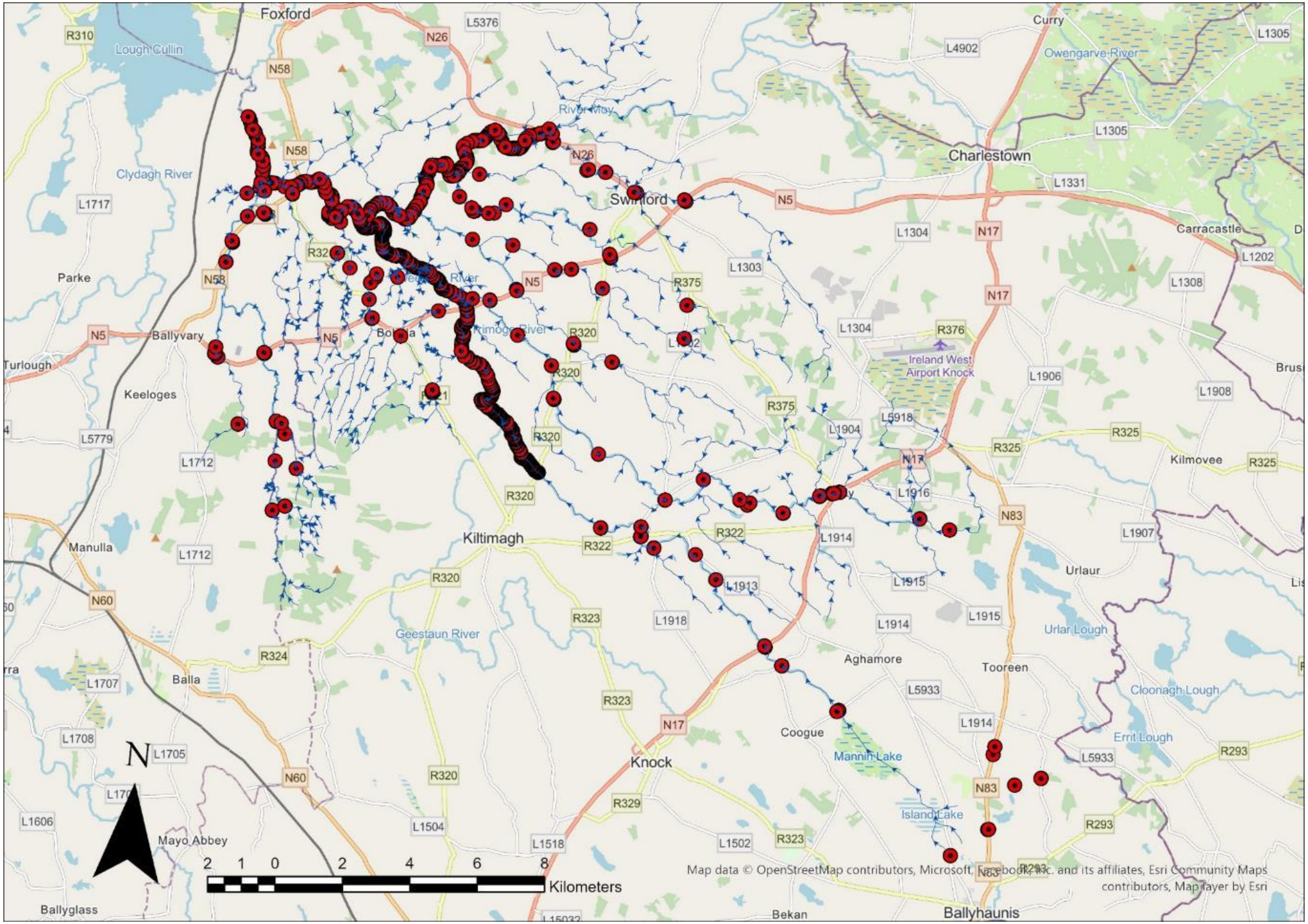
Photographs within the appendices of the report are coded with a number and abbreviation of the river name. For example: the River Moy is identified as **Mo**, and the first unknown tributary **(T)** of the Moy inspected is categorised as **Mo(T1)**. This should help with referencing locations in the report, if the photographs are used in conjunction with Geographic Information System (GIS) mapping at a later date. Not all photographs taken during the visit appear in the report, but they will be supplied to the recipient for reference.

The main River Moy and Gweestion River were assessed thoroughly via kayak survey, while the tributary assessments were undertaken via spot-checks at accessible locations (predominantly road bridges and track crossings), with additional walkovers of some sections. A separate WTT visit was undertaken to the Pollagh River sub-catchment (a larger River Gweestion tributary not covered within this report) in July 2021. The River Pollagh report and many others can be found on the WTT website River Pollagh.pdf and can be used in conjunction with this report for further habitat assessment and management advice.

The main body of this report includes observations and summary recommendations for the development and maintenance of a sustainable recreational fishery on EMAA waters. The appendices contain a more detailed survey report and full recommendations for improvements in each sub-catchment.

Table 1 – Water Framework Directive waterbody overview https://catchments.ie/

River	**Moy**	**Swinford**	**Spaddagh**	**Killeen**	**Trimoge**	**Gweestion**	**Carroward**	**Oughtagh**	**Strade & Little Strade**
Waterbody Name	Moy_080 & Moy_090	Swinford_010	Spaddagh_010	Moy_080	TRIMOGE_010 TRIMOGE_020 TRIMOGE_030	Gweestion_010 Gweestion_020 Glore_010 Glore_020	Carroward_010	Ougthagh_010	Strade_010 Little Strade_010
Waterbody ID	WE_34M020650 & WE_34M020750	WE_34S050300	WE_34S030200	WE_34M020650	WE_34T010200, WE_34T010300 & WE_34T010500	WE_34G030100 , WE_34G030200 WE_34G020010 WE_34G020200	WE_34C090700	WE_34O050400	WE_34S040800 & WE_34L020500
Catchment	River Moy	River Moy	River Moy	River Moy	River Moy	River Moy	River Moy	River Moy	River Moy
River Basin	Moy	Moy	Moy	Moy	Moy	Moy	Moy	Moy	Moy
Current Ecological Quality	080 – Good 090 – Good	Good	Good	080 – Good	010 – Moderate 020 – Good 030 – High	Glore_010 – Moderate (from Good) Glore_020 – Moderate (from Good)	Good (from Moderate)	Good (from Moderate)	Strade - High (from Good) Little Strade - Good
WFD Risk	N/A	Not at risk	N/A	N/A	010 – At risk (Extractive industry & Urban waste water)	Glore_010 – At risk Glore_020 – At risk Agriculture, Pasture & Channelisation	Not at risk	Not at risk	N/A
Length of river inspected (KM)	18km	Spot-checks over 5.5km	Spot-checks over 9km	Spot-checks over 17km	Spot-checks over 20km	12km + Spot-checks over 18km	Spot-checks over 4.5km	Spot-checks over 0.5km	Spot-checks over 25km



Map 1. Overview of the Moy catchment area covered during the WTT visit. Red circle icons represent the locations of photographs taken during the visit. The watercourses covered are marked in blue, with arrows indicating the direction of flow.

2. Introduction

This report aims to characterise habitat of the EMAA Moy fishery, along with many of the connected tributaries, to provide recommended actions for improving riverine conditions for a range of wildlife, including fish. Rather than focussing upon the fish species or fishery specifically, recommendations will focus on general improvements to catchment land use, natural river processes and habitat. This is invariably the best way to restore and maintain healthy river ecosystems - upon which the fishery relies. While recognising that the primary interest of the EMAA members on the Moy is angling for salmon, and to a lesser extent sea trout and brown trout, it is only by addressing the underlying local issues with river function and habitat degradation that optimal conditions can be provided within the riverine ecosystem.

2.1. Salmonids - basic habitat requirements

To better understand what might be required to move habitat towards optimal conditions, it is first worthwhile highlighting the basic habitat requirements of salmonids during their freshwater life stages, as these are the areas in which local changes can have the most significant influence. Starting with spawning, as in Figure 1, most salmonids (including salmon, sea trout and brown trout) require loose, well sorted coarse substrate (usually gravel and cobble) with a minimal fine sediment (sand and silt) component. Flow velocity and diversity in a river create discrete areas of bed scour which help to provide that sorting, as the finer bed material is carried away from the coarser material as it is mobilised (smaller particles are lighter and more easily transported by the flow, so get carried further).

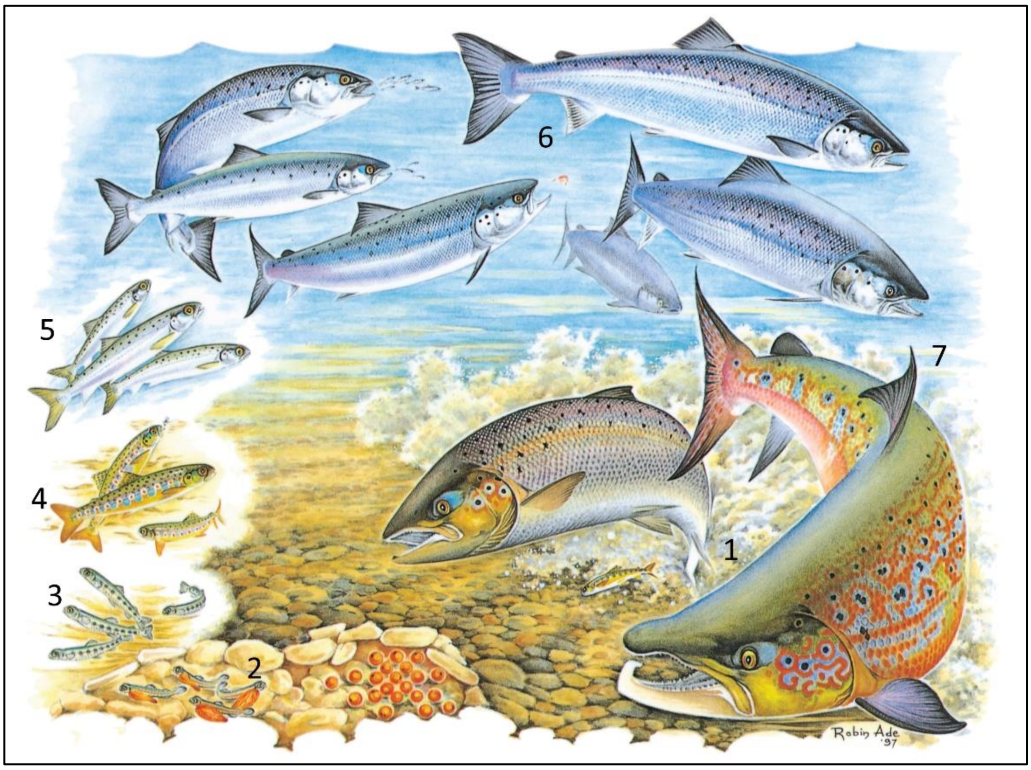


Figure 1. Atlantic salmon lifecycle. © Robin Ade and Atlantic Salmon Trust.

Upon finding an area of suitably sized substrate (usually around 20-60+mm for salmon and 10-40mm for trout; with the requirement for sea trout somewhere between), the hen (female) fish will create a nest(s) called a redd by driving flow onto the riverbed with her tail to displace the substrate. She then deposits her eggs into the depression while they are fertilised by the cock (male) fish before covering them over with coarse sediment displaced from upstream using the same process. Once complete, this generally leaves a characteristic depression in the bed with a horseshoe mound of gravel downstream that, when fresh, is relatively easy to identify.

A lack of coarse, well sorted substrate in a river can therefore lead to a lack of spawning habitat for salmonids. This can then limit salmonid populations in a river system through a lack of production, or overuse of the limited sites available, when existing redds will often be over-cut by later spawning fish (Figure 2). Additionally, too much fine sediment within a river system is highly problematic too, as once the eggs are within the gravel they, and later the newly hatched alevins (fry with yolk-sac still attached), must receive a constant supply of oxygenated water to survive until they emerge into the water column as swim-up fry; too high a proportion of fine sediment within the substrate, or subsequently deposited over the bed, can prevent the flow-through of water and cause asphyxiation of the eggs or alevins.

Figure 2. An area of redds (white ellipse) and significant over-cutting on the River Blyth in Northumberland, England. The weir upstream (right of shot) restricts access upstream, forcing numerous fish to spawn on the only suitable habitat downstream. This does not optimise recruitment within a river and can occur whenever there is a lack of habitat availability – whatever the cause.

Upon emerging from the riverbed, swim-up fry require shallow water with diverse flow and structure to provide space, food and cover (plenty of individual territories) for the young salmonids. A lack of those features means that fry will be displaced elsewhere (losing fish from a reach) and/or placing them at increased risk of predation from larger fish and other predators, reducing the numbers of fish that make it through each life stage.

One significant advantage salmonids have here is the fact they over-produce offspring, with salmon producing ~1500 eggs per kg of the female's body weight. In pristine conditions, where a river is at carrying-capacity (full of fish), this usually overloads the available habitat, with subsequent high mortality rates, but the river is already supporting as many fish as it can, so there is no issue. The same is true in a degraded system, where the reduced quality habitat is fully occupied, and many juvenile fish will perish. However, if the habitat quality and availability increases, it leaves the potential for a much higher proportion of the fry to survive. This process mitigates poor spawning years in pristine rivers and provides the ability for a population to rapidly repopulate when the limiting factor (usually habitat quality and availability/access) is addressed on a degraded one.

The benefit from over-production of juveniles carries on through the lifecycle until a bottleneck is encountered but, equally, can be inhibited at the first hurdle if there is insufficient returning fish or spawning habitat, for example (Figure 3). Clearly, the number of adult fish within a population will always be lower than the number of juveniles, owing to cumulative mortalities throughout the lifecycle, but the total number of adult fish returning to a fishery can potentially be improved by managing the easily controllable bottlenecks within the freshwater life stages. For these reasons, ensuring there is sufficient habitat quality and availability in river, along with managing angler exploitation of fish populations, is vital to maintain the quality and angling opportunities of a fishery.

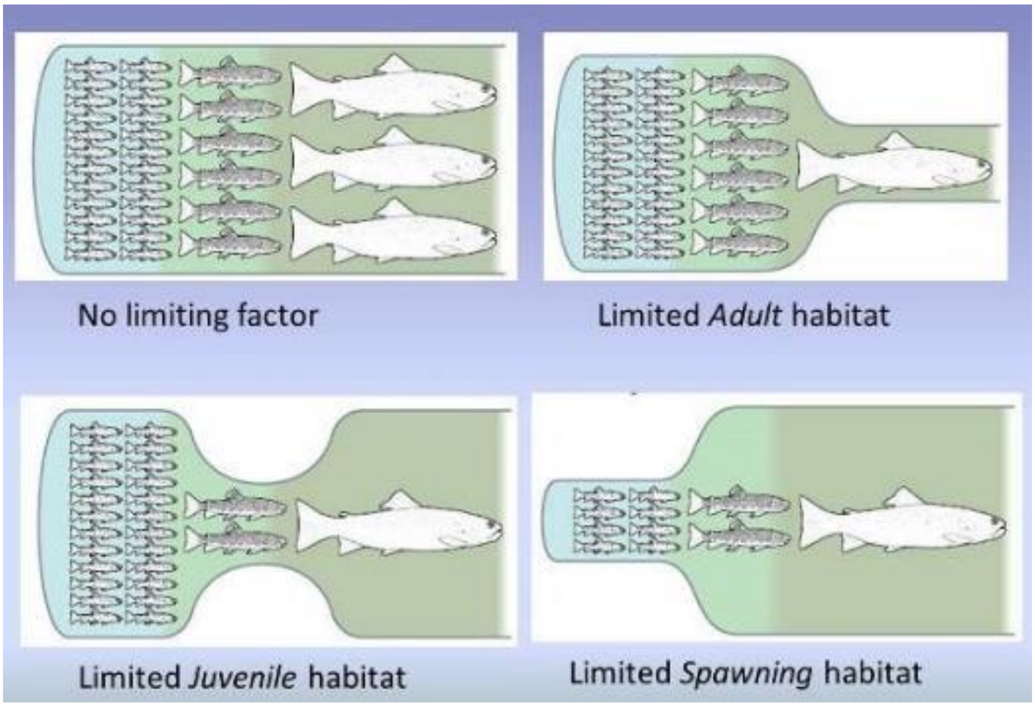


Figure 3. The impacts on wild salmonid populations with reduced survival at key lifecycle stages. This simple depiction shows how a shortfall in habitat quality or availability for any life stage, or increased mortality at any life stage, can lead to a lack of adult fish, reduced recruitment and reduced value rod fishery.

It is vital to consider water quality requirements. Being primarily natives of the temperate zone, salmonids have relatively specific water temperature requirements, with the upper lethal limit for salmon and trout being around 29^{o}C and 27^{o}C, respectively, and optimal growth occurring around 16^{o}C and 13^{o}C, respectively. However, both experience increased stress above 20^{o}C, particularly if the change occurs rapidly or continues over an extended period. At the extremes of temperature, both species will tend to be lethargic and less able or willing to undertake most usual activities, so issues like obstructions to fish movement become an increasing problem and even survival can become tenuous with additional stressors like environmental pollution or predation - or poor fish handling.

For this reason, in addition to the vital cover, woody material and nutrients that trees provide to a watercourse, their shade is a vital aspect of good trout and salmon habitat, not only in the reaches they inhabit, but also in tributaries upstream, where solar warming is a real risk. The high heat capacity of water means that although it is relatively resistant to warming, once it has warmed it carries a lot of heat energy which it is difficult to reduce, so ensuring tributaries support an appropriate amount of shade to prevent warming in the first place is the only realistic way of mitigating the issue. This problem can only worsen in an ever-warming world, further exacerbated in peaty areas with darker water or rivers with bedrock or exposed coarse substrate, where more of the sun's heat is absorbed then re-radiated.

2.2. Riverine Habitat

Having looked at the basic requirements of salmonids, it is now useful to look at how these could naturally be provided for in a river. Rivers by their very nature are moving water, their size, morphology and the speed at which they move governed by several factors: primarily, flow volume, bed gradient and catchment geology (bed and bank material), with those parameters generally changing little over time, other than natural annual/seasonal variations. Most species have therefore adapted to the conditions of a given river or area of a catchment over a long time and adopted catchments that fulfil their requirements. Salmon, for example, need the diverse flow and coarse substrate that should be naturally abundant in most high to medium gradient rivers – as highlighted in section 2.1 Salmonids - basic habitat requirements.

Many of those habitat requirements are provided by naturally sinuous channels with appropriate supply and transport of sediment, supported by natural rates of erosion on bends to supply material but minimal additional inputs of fine material from external sources like surface runoff exacerbated by land erosion from human activity or livestock. However, over a timeframe too short to allow species to adapt, human intervention has significantly altered the way rivers and their catchments function, changing the habitat they provide and leaving many rivers in a state that is often no longer optimal for production or survival of its native species.

Extensive watercourse modifications to increase land drainage severely degrade riverine habitat, removing the coarse substrate that is required to shape a channel, impart flow diversity and provide habitat for invertebrates and fish spawning. Associated bed lowering reduces the ability of watercourses to naturally spill onto their floodplain and dissipate peak flow energy, inhibiting the retention of coarse substrate. Straightening exacerbates the issues, increasing gradient and flow velocities while reducing flow diversity, which also impedes natural coarse sediment retention, bed scouring and sorting. The end result is often a lack of coarse bed material in many areas, with what remains being in a degraded state, either out of the main flow and poorly sorted or much coarser and less mobile than a reach should naturally provide. This is because it is the gradual, intermittent remobilisation and sorting of a diverse range of substrate sizes that is required to provide optimal, dynamic habitat. In addition to physical changes to the form and function of main watercourses, increased road runoff, field drainage and ditches all contribute to accelerated input, creating more rapid and higher intensity peak flow events and exacerbating the issues of coarse sediment retention and sorting.

Intensification of agriculture has also led to higher numbers of stock within many fields and a greater potential for impacts on riparian vegetation, bank destabilisation and increased fine sediment and nutrient inputs. Simply excluding livestock from a watercourse with buffer fencing can therefore be a great way of maintaining agriculture while limiting ecological harm to riparian habitat. However, allowing livestock into a watercourse to drink, even at designated drinking bays, has the potential to undermine a lot of that benefit. Drinking bays and small unfenced sections of watercourse are often viewed as a relatively benign way of watering livestock which at very low densities is probably true, but where large numbers of stock are present, they can create a major issue. All livestock will have to drink there, creating significant footfall in and around that area, with exacerbated land poaching and runoff of fine sediment in wet conditions. Even with reinforced access points, the runoff of excreta to the watercourse can be significant. Moreover, in hot, dry conditions, use of drinking areas increases, with animals actually spending a disproportionate amount of time in or crowded around the water feature – again, creating a direct input of faecal matter, urine and often fine sediment to the watercourse, as shown in an example from southern England (Figure 4).

Figure 4. Cows congregating along a watercourse – a common occurrence on unfenced watercourses and around drinking bays, where the input of excreta and fine sediment can be considerable.

Through undertaking the extensive survey (kayak or walkover) achieved on the Gweestion River, it has been possible to put the potential impact of drinking bays into perspective, with 22 individual issues of livestock access to the watercourse recorded between the Glore River (upstream) and the confluence with the River Moy. Even if the fine sediment and nutrient input at each of these points is relatively small, cumulatively, that mounts to a much larger issue downstream, particularly in wet conditions.

With these factors in mind, it is important to consider the condition of habitat of all watercourses connected to EMAA waters (including those upstream), because many of the negative impacts will originate well away from the areas fished. Addressing the overriding impacts upon river processes and land use must therefore form the basis of any sustainable fishery plan.

3. Habitat issues encountered

The following section provides an overview of the specific observations made and issues encountered along the main River Moy and areas of the sub-catchments inspected. More detailed picture/caption survey reporting and a recommendations table are included within the appendices.

3.1. River Moy (Mo)

The main River Moy was relatively well buffer fenced, with only a couple of sections requiring fencing (although drinking bays in several areas were creating a negative impact, with visible fine sediment accumulations over the bed downstream). The resulting well-vegetated banks with a healthy abundance of trees form the basis of good quality riparian habitat, providing river margin shade, cover and structure. However, the channel had been severely degraded by past dredging work removing large volumes of the river's coarse substrate and lowering the bed level, apparently even excavating into the bedrock in some areas. This had severely altered the channel morphology and natural substrate of the river in many areas, with a lack of gravel and cobble bed features observed, particularly in the upper half of the EMAA water.

At larger bends, and where trailing bankside tree branches or trunks increased flow diversity with some slacks, valuable deposition of coarse substrate was present, but many areas of the central channel lacked gravel and cobble bars. Aside from the myriad of habitat benefits from low and trailing tree cover, this highlights the great importance of such features in gravel retention, assisting natural recovery of the river from a reduced abundance and supply of coarse substrate through past dredging - and the need to retain those features within the channel. Marginal gravel deposition appeared to make a significant contribution to the spawning habitat of the river, with river margin redds observed in most areas where there was suitable gravel. The occurrence of river margin gravel and the trees that were assisting those features, along with the associated spawning activity, was deliberately highlighted throughout the habitat assessment section of the Appendices, to demonstrate how vital they are in facilitating recovery of the river and the health of the EMAA fish populations and fishery. The extent of gravel within the channel increased with progression downstream, which is likely to be in part owing to a natural reduction in gradient, but also coarse sediment contributions from the larger tributaries (Spaddagh, Killeen, Gweestion and Strade).

Numerous larger cobble and boulder groynes were observed in the river, presumably to diversify the relatively featureless channel post-dredging. In that scenario, they probably provided value, but they are more reminiscent of old-fashioned angling features than true habitat enhancements and their design and placement is not conducive to the restoration of natural river processes. In many cases, the structures are actually likely to be inhibiting natural flow diversity, with groynes just upstream of outside bends limiting the natural transition of flow from one outside bend to the next – effectively making the river cut the corners and reducing the value of the associated pool habitat. That inhibition of a sinuous flow pathway can further reduce energy dissipation at peak flow and inhibit the formation of gravel bars that would otherwise contribute to the maintenance of a diverse channel, maintain natural pool depth and provide vital invertebrate and salmonid spawning habitats. It is important to facilitate the natural development of habitat for all fish and invertebrate life stages, rather than promoting one habitat type at the expense of others.

One minor physical obstruction was present on the main River Moy channel in the form of Ballylahan Bridge footings, where the shallow water over a smooth, slightly elevated base may form a behavioural barrier in low flows (particularly for larger fish) and high velocities stop smaller fish in higher flow. It is certainly not a major barrier, but a needless obstruction when the footings should simply have been set below bed level, thereby also reducing the requirement for future maintenance.

The main recommendation for the Moy is to restore river processes and facilitate further natural channel recovery. Retaining the overhanging and trailing bankside trees will be vital, along with removing counterproductive groynes. It may be beneficial to prioritise the d/s groynes first as there is already more gravel in the river with progression downstream, so the positive impact is likely to be more rapid.

Invasive species were not observed to be a major issue along the river, but a significant stand of Japanese knotweed had become established downstream of Ballylahan Bridge, just upstream of the Strade River confluence. Stands of this highly invasive, non-native species have the potential to expand and spread rapidly, outcompeting native species only to die back in the winter, leaving bare banks at significant risk of erosion. Any stands should therefore be treated with herbicide by a licensed operative before they have chance to take over and spread.

3.2. Swinford River (Sw)

The Swinford River is a small tributary that should naturally provide good spawning and juvenile habitat for trout and sea trout, and possibly salmon in its lower reaches. However, it was straightened and heavily modified, right from the upper reaches inspected, where it resembled a ditch. Nonetheless, it still provided areas of habitat suitable for juvenile salmonids throughout. Habitat in Swinford town was typically urban, with walled channel sections and several bridges/culverts, although those inspected appeared to be passable. No fish were seen but, barring water quality issues, they should be present, based on the available habitat. Further walkover/investigation of the lower reaches upstream from the River Moy, would be beneficial to identify the locations and full extent of numerous low level weirs (observed at spot-checks); the removal of which would help to reinstate natural processes and restore free movement of fish of all sizes and access and spawning habitat. Juvenile salmon in particular (also trout and sea trout) will disperse around a catchment if free to do so and can utilise or re-colonise sparsely populated areas away from spawning sites, if that movement is afforded, thereby reducing juvenile mortality and maximising survival.

3.3. Spaddagh River (SP)

The Spaddagh river appeared to be an important tributary of the Moy for recruitment, with large numbers of juvenile salmonids seen in the middle and lower reaches where the watercourse appeared to increase in productivity through calcareous spring water input. Some low-level weirs were observed in the middle reaches which it would be beneficial to remove, and the straightened, dredged sections could be greatly improved with increased in-channel structure, gravel introduction and/or full channel restoration. The perched footings of a twin-arch bridge at the downstream end/confluence with the River Moy created an obstruction to fish access, with the RB side eased by a pool and traverse fish pass (viewed during the River Moy survey) and the other RB arch impassable in most flow, but with some attraction flow to the dead-end route remaining. Within the pass to the LB side, the ~1.5m long pools were smaller than recommended for larger migratory salmonids and they had partially infilled with coarse substrate. The steps between pools were also towards the upper limit of what would be recommended, particularly for smaller fish. Removal of the bridge to allow the channel to naturally regrade to the River Moy bed level would be beneficial. It is suspected that the access issue to the Spaddagh was created or at least exacerbated by the dredging and lowering of the River Moy bed level downstream.

3.4. Killeen River (Ki)

The upper reaches of the Killeen River were dry, although the channel size and shape suggested it should be a small watercourse and probably is at certain times of the year. It is not known whether this drying is a natural feature of the permeable limestone catchment or the result of excessive abstraction. In other wetted areas of the catchment, the watercourse appeared nutrient enriched, with the input of excreta at livestock access points observed likely to be at least part of the issue. Being a naturally productive calcareous watercourse, even small increases in nutrient input, especially phosphorous from cow manure can lead to a notably enriched state, with excess algal growth.

The uniform, over-capacity channel in the middle to lower reaches of the catchment may have potential for full restoration or at least riffle installation. Perched bridge footings around the confluence with the River Moy had been eased with boulder pre-barrages, but shallow water and jumps of >45 cm (outside recommended parameters for small salmonids and at the upper recommended limit in easements for larger fish) still inhibit access, limiting its passability to higher flows. This could certainly stop fry and parr spawned in the main river from getting to usable juvenile habitat upstream.

3.5. Glore, Gweestion and Trimoge (Gl, Gw & Tr)

The Gweestion (Glore and Trimoge) is a large, predominantly highly calcareous sub-catchment with great potential for both salmon and trout recruitment to the Moy. Even in its upper reaches, the main upper tributary, the Glore River, had reasonable potential for trout and despite channel degradation, nutrient enrichment, and a lack of riparian fencing in areas, it definitely held salmon parr in its lower reaches.

Straightening and dredging has greatly degraded habitat in most areas of the Gweestion catchment, but the raw potential remained, with good scope for riffle installation or full channel restoration that could undoubtedly increase the availability of salmon spawning habitat in the Gweestion and Trimoge, as well as possibly in the Glore. As with many other Moy tributaries, the removal of low-level weirs that are inhibiting natural processes would be beneficial, particularly so in the areas of highest alkalinity, where the substrate is likely to be bound together by tufa (calcium carbonate precipitate from high alkalinity water), further reducing its salmonid spawning potential. A long section of what appeared to be relatively recently installed weirs on the lower Glore, downstream of the R320 road crossing, are highly counterproductive. Areas of the middle and lower Gweestion have also been subjected to groyne installation, as on the main River Moy, which are similarly counterproductive to natural recovery of the channel post-dredging.

The calcareous nature and associated high productivity of the Glore, Gweestion and Trimoge offer great potential for development as a trout fishery if the habitat can be improved and providing that angler exploitation can be appropriately managed. If so, a 100% C&R policy for trout would be recommended to help preserve the fish population(s) and grow trophy-sized trout!

Further assessment of the Pollagh River (the other main tributary of the Gweestion) can be found in a separate, earlier Wild Trout Trust report produced for EMAA River-Pollagh.pdf.

3.6. Carroward River (Ca)

The Carroward River is a small tributary with a good supply of coarse substrate in many areas, making it likely to have been an important spawning tributary for trout/sea trout and possibly salmon in the lower reaches. Significant channel realignment and fine sediment inputs now reduce that potential, but the habitat is still likely to support at least some trout and sea trout recruitment. However, the degradation of tributaries like this is likely to have negatively impacted sea trout populations (particularly when undertaken at a catchment scale), but the burn presents a good opportunity for improvement if the channel could be restored, and the fine sediment inputs addressed. Perched bridge footings and shallow water at the upstream-most R321 road crossing create a small obstruction to fish passage which it would also be beneficial to address, with an easement.

3.7. Oughtagh River (Ou)

The Oughtagh River was very small and was not thoroughly investigated owing to time constraints. In its current degraded state, it is unlikely to make a significant contribution to fish populations, but it almost certainly supports some trout and naturally should be a spawning tributary. In comparison to many of the other Moy tributaries, the cost-benefit of restoration may be harder to justify in the short-term, but any such habitat degradation should be considered for reparation in the longer term if fish populations are ever to be restored to anything like their former abundances.

3.8. Strade River (St)

Being the furthest downstream of the tributaries inspected, and in a lower gradient area of the catchment, the Strade and its main tributary the Little Strade should be highly sinuous, with remnants of a meandering channel remaining in some areas and clear signs of straightening visible on most maps (Figure 5). This reduces the length and quality of watercourse available to both resident fish and the freshwater life stages of migratory fish, in what was almost certainly (and still probably still is to a point) an important sub-catchment for fish recruitment, with good supply and movement of coarse substrate noted in many areas. This assertion is supported by the good numbers of juvenile salmonids seen throughout the areas inspected, particularly the middle reaches; however, that should not distract from the fact that the habitat provided is severely below potential. As with most of the tributaries, drinking bays and livestock access were observed at several points.

Figure 5. Clear signs of a naturally sinuous channel (white dashed line), evident by rushes and a wet area remaining in the field alongside the current straightened channel of the River Strade (blue dashed line). This area was not inspected in person but was identified from aerial photography maps. Similar can be found elsewhere all over the catchment.

The middle reaches of the catchment were relatively open and lacking tree cover, so would benefit from fencing and tree planting, but this is something that should ideally be undertaken after investigating channel restoration/re-meandering options, particularly in the areas with lower quality agricultural land, where the owners may be more amenable. A long section just upstream from the Moy may also have restoration potential.

Japanese knotweed was observed on the Little Strade next to the N5 road crossing. Immediately downstream of the N5, unsympathetic bridge footing work may afford some fish passage but fell well short of best practice. The potential for fish passage improvement is something that should be considered whenever further infrastructure work is undertaken around the catchment, with appropriate input sought from fisheries specialists.

4. Discussion

4.1. Habitat

Many of the watercourses inspected have been significantly modified by straightening and dredging to remove natural, coarse substrate. To address this, the best course of action should be to undertake appropriate river restoration of those channels, reinstating meanders and/or returning a watercourse to its natural course or dimensions and, sometimes, reintroducing features like gravel bars and riffles - usually if realignment has not occurred, or where sufficient channel variability remains to support natural river processes and scour and sort coarse substrate. Some form of channel restoration is therefore a general long-term recommendation for most areas visited but may be a higher priority in certain areas (particularly the Gweestion and Strade).

In this regard, the Glore, Gweestion and Trimoge, as well as the Strade catchments warrant more specific investigation of restoration options and have been prioritised as such in the recommendations section of this report. Even restoring certain reaches of these rivers could deliver significant habitat improvements, with real potential to improve recruitment. It is often assumed that landowners will be averse to channel restoration and realignment, but usually at least some are amenable, so it is well worth investigating. Experience in the UK suggests that once some areas have been restored and landowners/tenants realise there needn’t be a significant detrimental impact upon their interests, opportunities for further restoration sites often arise.

When rivers are straightened, the engineers often move them away from the low point of a valley bottom, thereby reducing the efficiency of land drainage as some water will still seep down to the location of the old channel, which will have poor drainage back to the straightened watercourse. For this reason, many well designed river restoration schemes have been able to utilise the poorly drained, low value land of a river's original, natural channel for restoration/re-meandering and reinstate the area of the straightened channel, thereby creating little or no loss in workable land. The situation is complicated where there are multiple, small landholdings but if an appropriate level of buy-in can be achieved, such schemes can provide benefits to all parties. Further investigation of the potential of any sites for restoration and the willingness of landowners to accommodate such work would be highly beneficial.

Owing to its size, major improvements to the main River Moy may be harder to orchestrate, but channel recovery is clearly already occurring through the natural processes of scour and deposition, greatly assisted by river margin roughness from a healthy riparian zone. As previously described on page 13, the large immobile groynes previously installed on the main river are likely to be counterproductive to that process, narrowing the channel (often significantly), reducing flow diversity, reducing sinuosity and inhibiting natural coarse sediment deposition/retention. As such, groyne removal is recommended.

The River Dee Trust, in collaboration with Scottish Natural Heritage and riparian owners, removed 9 large boulder croys (groynes) from the River Dee in Scotland to reinstate more natural habitat and flow diversity. Of those, the materials from five were redistributed within the channel, reinstating large substrate features that had been denuded from the channel in sourcing material to create the croys. One of the main beats participating in this work is owned by the Chairman of the Dee District Salmon Fisheries Board and it may be beneficial to approach him (or the beat's Ghillie) or the River Dee Trust to discuss their views of the project, which had no detrimental impact upon the fishery.

Maintaining the presence overhanging and trailing branches along the Moy and it's tributaries will also be important. Low cover, flow diversity and even substrate retention and sorting could also potentially be increased by introducing structure to the channels. An excellent way of achieving this can be by hinging the occasional bankside willow tree into the channel (Figure 7) but retaining those already present or that naturally collapse in the future will be equally important.

Figure 6. Willow trunks pre-hinging.

Figure 7. Willow trunks hinged into the river channel during a WTT habitat workshop, to provide low cover and structure. Numerous juvenile salmonids were subsequently observed sheltering in and around the new habitat.

4.2. Fishery management

In addition to the habitat improvement measures and restoration of fundamental river processes, additional management of angling activity on the EMAA fishery has the potential to deliver improvements in fish populations and rod catches.

With global declines in Atlantic salmon populations and widespread local reductions in sea trout, catch and release angling (C&R) is an increasingly important fishery management practice, with many fisheries now realising the benefits that can be gained from conserving the vital spawning stock of a fishery. C&R rates for salmon and sea trout stocks of >90% are now commonplace on fisheries where stocks are in decline, but many progressive fisheries are also following suit, with some adopting 100% C&R voluntarily before statutory bodies impose measures or simply to optimise their fish populations. While detailed analysis of catch statistics would be required to fully assess the impact of the much higher exploitation rates in the EMAA (and broader Moy) fishery, it is self-evident that a reduction in angler exploitation can only help to increase spawning escapement and recruitment, particularly when in conjunction with habitat improvement work. It is therefore a strong recommendation that the anglers of EMAA waters be encouraged to improve on the current, relatively low C&R levels for salmon and sea trout, working towards a target of >90% return rate.

Well-practised C&R, seeking to maximise post-capture survival, requires sympathetic tackle usage. For example, for those fishing the worm, it would be beneficial to promote the use of circle hooks, which greatly reduce the likelihood of deep-hooking fish, easing the process of unhooking and reducing the damage and duration of fish-handling. Further, it would be beneficial to limit the size of treble hooks that can be used for spinning and promote the use of single hooks on lures. In a similar vein, the use of barbless or de-barbed hooks has the potential to greatly increase fish survival rates. The beneficial use of such methods is supported by many scientific studies, summarised on the WTT website www.wildtrout.org/content/catch-and-release.

The current mandatory bag limits for the fishery of "*1 fish per day up until May 11th and 3 fish per day up until August 31st unless Government Bye Laws state otherwise*" leaves significant room for reduction and in doing so could greatly increase spawning escapement.

The fisheries of the River Moy are currently viewed by many exploitative anglers as 'the place' to go and kill a spring salmon – a questionable accolade – especially when many of those anglers will also be fishing other fisheries where they return most, if not all of their fish. It would be far better to promote a new ethos of the fishery(s) being seen as 'the place' to go to catch spring salmon, safe in the knowledge that demographic of the salmon population is being appropriately conserved. Even one fish per day, per angler has the potential to mount up significantly over the early part of the season the requirement to permit killing so many fish to maintain the status of the fishery is highly questionable in light of the numerous world class fisheries that maintain their prime status even with 100% catch and release policies in place.

With this in mind, moving toward a target of at least 90% catch and release would not seem unreasonable. Many fisheries also incentivise the return of fish, which could be another way of encouraging voluntary fish release. Even a cash reward from the fishery for retuned salmon/tags or discounted fishing in future seasons would be in the interest of EMAA (and every angler) by conserving the fishery's most valuable commodity – each and every salmon retained within the river!

In a similar vein, there is real potential to develop an interesting trout fishery on the Moy and its larger tributaries if C&R could be promoted. There is currently no designated fishery for trout on EMAA waters and they are therefore likely to be viewed by many as an expandable bycatch or simply removed by free-fishing anglers. The natural alkalinity and high productivity of the area creates the potential for fish to grow large, providing they are allowed to live long enough to attain those sizes. This was confirmed during the course of the WTT surveys, with several trout over 1kg and one over 1.5kg seen within the less accessible areas. However, they were in much lower abundance than the rivers have potential to produce, which could highlight that even the existing levels of exploitation create an impact.

As such, it is recommended that a trout fishery is developed for the EMAA Waters to actually help conserve those fish. By formalising fishing arrangements with a 100% C&R policy put in place, the outlook for local wild trout populations could actually be improved, with no negative impact.

5. Further assistance

The WTT may be able to offer further assistance such as:

- Discussion with Association representatives and stakeholders around the subjects covered in this report.
- Further investigation of specific catchment areas to inform future projects.
- Planning and delivering river restoration and other large-scale habitat improvement schemes.
- Assistance installing LWM as workshops or practical days.

The WTT website library has a wide range of free materials in video and PDF format on habitat management and improvement:

www.wildtrout.org/content/wtt-publications

We have also produced a 70-minute DVD called 'Rivers: Working for Wild Trout' which graphically illustrates the challenges of managing river habitat for wild trout, with examples of good and poor habitat and practical demonstrations of habitat improvement. Additional sections of film cover key topics in greater depth, such as woody debris, enhancing fish populations and managing invasive species.

The DVD is available to buy for £10.00 from our website shop www.wildtrout.org/shop/products/rivers-working-for-wild-trout-dvd or by calling the WTT office on 02392 570985.

6. Acknowledgements

The WTT would like to thank Inland Fisheries Ireland and EMAA for providing the funding to undertake this work.

7. Disclaimer

This report is produced for guidance; no liability or responsibility for any loss or damage can be accepted by the Wild Trout Trust as a result of any other person, company or organisation acting, or refraining from acting upon guidance made in this report.

Legal permissions must be sought before commencing work on site. These are not limited to landowner permissions but will also involve regulatory authorities and any other relevant bodies or stakeholders. Alongside permissions, risk assessment and adhering to health and safety legislation and guidance is also an essential component of any interventions or activities in and around your fishery

River Moy (Mo)

&

River Moy Tributary 1 (Mo(T1))

Figure 8: Mo 002 (53.958977, -8.993277). The furthest u/s point inspected on the Moy was just u/s of the old N26 road bridge. At that point, the river was shallow with a predominantly bedrock and boulder bed, supporting good juvenile salmonid habitat, although a scarcity of smaller cobble and gravel limited salmonid spawning opportunities.

Figure 9: Mo 005. D/s of the bridge, deeper glide habitat was suitable for older parr. Coarse gravel and cobble substrate in the LB margin may have provided spawning habitat in the past but had become consolidated by aquatic vegetation as the channel adjusts its capacity to the natural variations in flow it receives.

Figure 10: Mo 006. Cobble deposits (exposed during the low flow) in the RB margin u/s of the new N26 road bridge appeared to show signs of more recent signs of remobilisation, possibly spawning activity/redds.

Figure 11: Mo 008. Moving d/s, bankside willows trailing into the river offering valuable refuge, shade, cover and flow diversity, the latter also encouraging valuable coarse sediment retention in the river margin.

Figure 12: Mo 012. Aquatic vegetation within the channel enhanced habitat for juvenile fish and the invertebrates upon which they feed.

Figure 13: Mo 016. Valuable overhanging/trailing bankside trees providing cover, flow deflection and lies for adult fish in higher water. Some uneducated anglers may complain such features are snags and require pruning, but these features are the main reason fish will hold there – remove the features and you run the risk of removing the fish.

Figure 14: Mo 019 (53.955967, -9.003405). Fine sediment and nutrient input from drinking bay (RB).

Figure 15: Mo 030 (53.953675, -9.008127). Fine sediment and nutrient input from drinking bay (RB).

Figure 16: Mo 031 (53.953657, -9.00812). A mature willow tree could be beneficially hinged down into the channel to provide increased flow diversity and fish-holding, while also facilitating deposition and retention of gravels in the channel.

Figure 17: Mo 032 (53.953598, -9.008362). Raised gravel mounds that were likely to be old salmon redds along the LB margin.

Figure 18: Mo 034. Larger pools provided resting areas for larger adult salmonids which will be further enhanced as the bankside willows grow out further into the channel, providing additional shade and cover.

Figure 19: Mo 036 (53.953498, -9.01064). Livestock access LB. While the grazing appeared to be at a relatively low intensity, the pressure was sufficient to reduce the diversity of bankside vegetation and suppress natural tree regeneration. Buffer fencing would be beneficial.

Figure 20: Mo 038. Regular faster-flowing areas d/s of the pools provided good juvenile habitat, but the gravel lifts that would usually be associated with them were often lacking owing to past substrate dredging. This had undoubtedly reduced habitat diversity/quality and main river stem salmonid spawning opportunities in many areas.

Figure 21: Mo 052. Where inside bends were sufficiently acute, gravel and cobble substrate were often retained (white ellipse). In this instance, further aided by bankside willows u/s that dissipate flow energy along the bank. As the river recovers from past dredging, these areas provide some surrogate habitat for gravel riffles lost mid-channel, until they fully recover.

Figure 22: Mo 054. Branches and other organic debris accumulating on a trailing bough. Far from being an issue, features like this created valuable, natural fish-holding lies and food and habitat for a diversity of invertebrate species.

Figure 23: Mo 062 (53.955217, -9.022028). A collapsed crack willow bough trailing in the water, the kind of highly valuable habitat that is often removed on many fisheries to keep a reach 'tidy', but in doing so greatly reduces habitat quality. Any such features should be retained.

Figure 24: Mo 063. Further gravel accumulation (white ellipses) assisted by the bankside willows. This gravel retention and accumulation is a vital part of the channel's natural recovery process to reinstate more natural dimensions and morphological features following the past dredging.

Figure 25: Mo 068. Exposed bedrock at many locations is likely to be a combination of natural outcrops and a result of past dredging to remove mobile substrate.

Figure 26: Mo 070 (53.953703, -9.029193). Low, trailing branches are often seen as a snag to lose tackle on, but they provide massive enhancement to a fishery through terrestrial insect input, increased fish-holding areas and refuge from predators. Remove the feature: remove the fish from that area of the pool (possibly the pool entirely).

Figure 27: Mo 075. Further gravel retention at a bend, although it was largely lacking mid-channel. These areas create valuable storage of gravel, the sloping profile of which helps to concentrate lower flows to the deeper outside of the bend, maintaining depth in low water conditions.

Figure 28: Mo 080 (53.951163, -9.029812). Numerous groynes were observed along the river, presumably installed as fishery enhancements following the degradation of in-channel habitat by dredging. However, unlike natural depositional features, they cannot adjust and often reduce flow sinuosity within the channel, inhibiting gravel retention in other areas.

Figure 29: Mo 084. Bank erosion was not a major issue on the Moy, and areas where it was occurring (often likely to be a response to the past dredging/bed-lowering) were helping to re-supply some of the lacking coarse sediment to the river. N.B. This is very different to the detrimental elevated fine sediment and nutrient inputs from livestock access and drinking bays.

Figure 30: Mo 086 (53.948825, -9.028517). Note how valuable areas of gravel retention on this relatively gradual bend had been greatly enhanced by channel roughness created by bankside willow.

Figure 31: Mo 088 (53.948318, -9.028927). Maintaining a rougher, uncut vegetated fringe along the river side of a narrow access track would offer improved protection. Further protection could be provided with brash (live or dead) to dissipate the energy of flow hitting the bank face and/or the planting of willow whips.

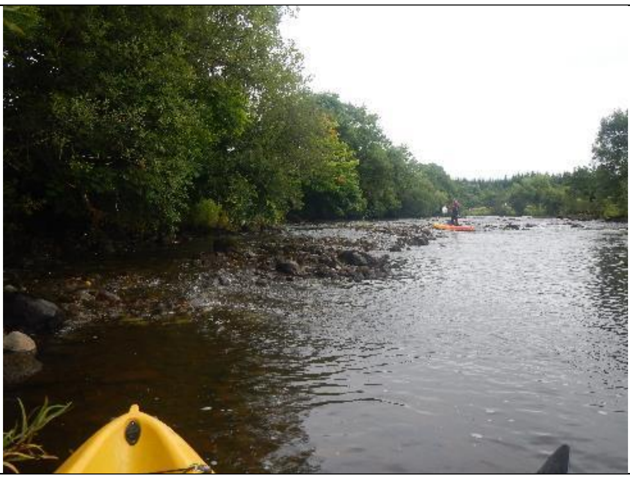


Figure 32: Mo 093 (53.946867, -9.031037). One of the few large, in-channel gravel and cobble bars in the upper section, d/s of a large bend and pool. This creates valuable channel diversity and hints at the long-term recovery occurring post-dredging.

Figure 33: Mo 096 (53.946202, -9.031598). The low boughs of this tree were festooned with lures. Although many anglers don't appreciate low branches, they often inadvertently know their value as fishing features to fish too. Sadly, many then also want them removing to ease access, but without the branches there'd be fewer fish.

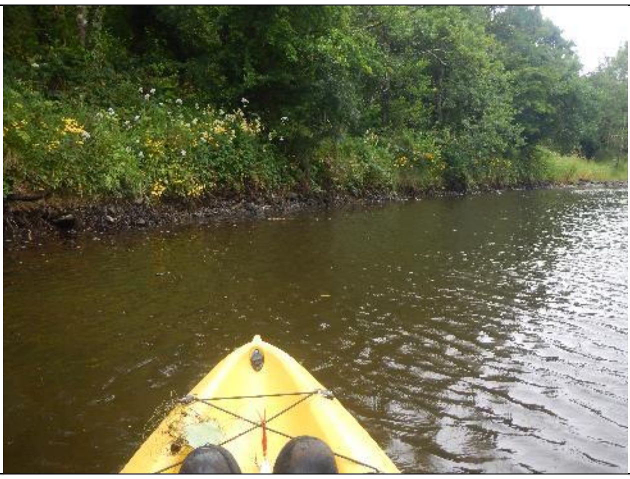


Figure 34: Mo 100. Further valuable gravel input from a gradually eroding bank. Note how the trees and vegetation were maintaining the erosion at an acceptable rate.

Figure 35: Mo 102 (53.94561, -9.03198). Deposition at a tributary (Mo(T1)) and then a short distance d/s at the Spaddagh River confluence created valuable sloping gravel bars and fish-holding features protruding into the channel (white ellipse). Groynes are an attempt to emulate these features, but usually fail as they are immobile structures that can't adapt to river flow.

Figure 36: Mo 106 (53.945018, -9.03295). Two access routes exist to the Spaddagh, the first via perched bridge footings that are impassable in most flows but may attract and delay fish. Note the gravel deposition, which is likely to at least in part be material supplied by the Spaddagh.

Figure 37: Mo 110 (53.944942, -9.033042). The second access to the Spaddagh is via an old-fashioned fish ladder. This will ease access, but the steps are larger than ideal for smaller fish and the pools are too small (~1.5m long is 50% of recommended) and shallow owing to sediment accumulation. The ideal solution would be to remove the disused bridge and footings u/s to reinstate free passage.

Figure 38: Mo 113. Gravel material partially infilling the pools of the fish ladder. This reduces depth and energy dissipation within the pools, thereby also reducing the ease with which fish can jump from pool to pool. The ideal solution would be to remove the old bridge and footings to allow free access to all fish in all flows.

Figure 39: Mo 115. The pool d/s offers valuable holding water for any fish there waiting to ascend the tributaries. The increased channel width was facilitating valuable gravel deposition on the inside bend and mid-channel, providing significant habitat enhancement over the unnaturally bedrock sections.

Figure 40: Mo 124 (53.94624, -9.03671). Poorly located groynes (white ellipses), focussing flow along a straighter course and detracting from the natural value of the bend. This was a common issue with many of the groynes, when the majority of flow should pass around the outside bend. The deflection had facilitated some gravel deposition d/s (dashed ellipse), but not in a useful of natural location.

Figure 41: Mo 127 (53.946995, -9.0372). One of the 'better' placed groynes, on an inside bend. These were probably installed when the channel was significantly uniform and degraded post-dredging and benefits to channel morphology where probably achieved, but longer-term, it would be beneficial to remove them allowing more natural features to develop - which these groynes inhibit.

Figure 42: Mo 130 (53.947492, -9.037477). Fine sediment and nutrient input from drinking point (RB). These seemingly small issues mount up and could have a disproportional impact on a river where significant spawning activity occurs in the river margins owing to a lack of gravel mid-channel from dredging.

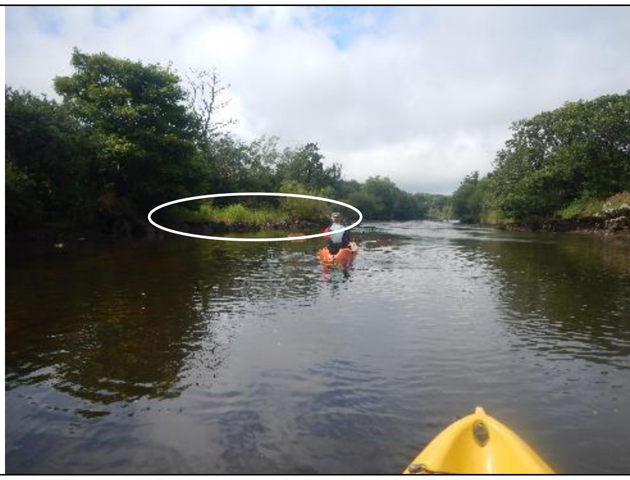


Figure 43: Mo 137 (53.947268, -9.039593). Another groyne preventing flow from passing round the outside of the bend (white ellipse), artificially and detrimentally straightening the flow pathway down the river.

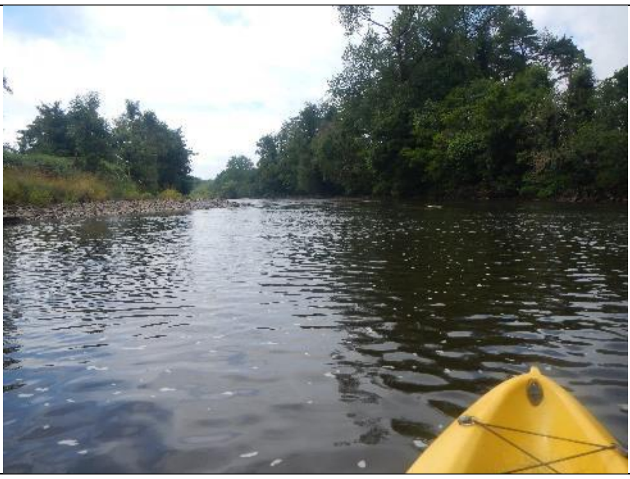


Figure 44: Mo 141. Gravel deposition on an inside bend, possibly aided by disintegration if an old groyne. These temporary storage areas for gravel provide valuable diversity to the channel morphology and a supply of gravel to areas d/s in higher flows, rather than the majority of gravels being flushed straight through the degraded river section.

Figure 45: Mo 142 (53.94636, -9.044632). Paired groynes provide some flow deflection and acceleration but, ultimately, the habitat recovery of the river Moy would be better served by maintaining a channel free from man-made structures, that facilitates natural depositional features of coarse sediment, wherever the flow dictates (not artificial, static groynes).

Figure 46: Mo 153 (53.94224, -9.04578). Boulder weirs may have created a feature in a channel lacking coarse sediment, but they now interrupt natural geomorphological processes, inhibiting sediment transport and ultimately creating a shallow, uniform channel upstream through the gravel trapped there. It would be worth at least notching (ideally removing) each weir.

Figure 47: Mo 154 (53.942063, -9.045462). Livestock access and light poaching. The area would benefit from buffer fencing.

The wider more open channel and floodplain here benefits the retention of gravel. This is in contrast to the more incised areas elsewhere.

Figure 48: Mo 157 (53.941458, -9.045385). A treelined section of RB should naturally facilitate areas of gravel and cobble storage along the RB, which was inhibited by cobble and boulder groynes.

Figure 49: Mo 161 (53.93989, -9.046507). A section of past tree pruning had left a short section of channel (LB) lacking low and trailing cover. This work was almost certainly to improve angler access, but it would be far better to encourage anglers to fish the natural features that develop than removing habitat to improve access.

Figure 50: Mo 169 (53.9372, -9.04782). Two sets of paired groynes in a long straight channel section were inhibiting natural channel recovery by focussing flow down the centre of the channel.

Figure 51: Mo 173 (53.937012, -9.047843). Flow was again encouraged to cut the corner d/s owing to the groynes.

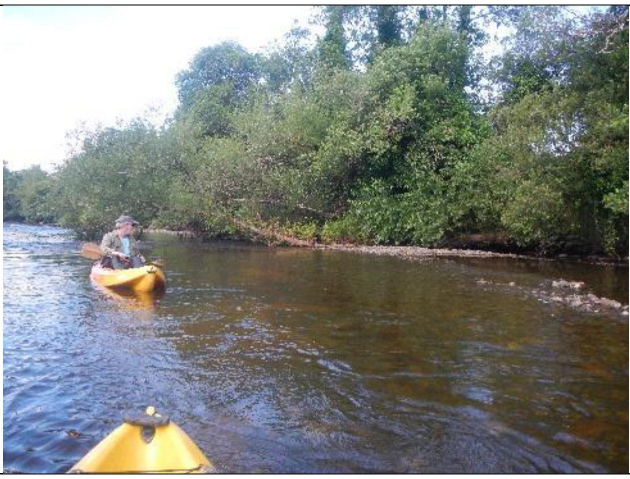


Figure 52: Mo 179. Gravel deposition facilitated by trailing willows. Features within the gravel were old salmonid redds. In the absence of gravel riffles, a significant portion of the main river's salmonid spawning appeared to be in the river margins, those being the main areas with suitable substrate. However, such areas are more susceptible to fine sediment degradation.

Figure 53: Mo 182 (53.934547, -9.050158). Access from the Moy to the Killeen River is inhibited by a series of boulder weirs. It was not evident whether these were scour protection for the bridge footings u/s or an attempt to ease fish passage over the footings, but access remains restricted.

Figure 54: Mo 185 (53.934508, -9.050283). Where groynes are paired but slightly offset (white ellipses), they provide some more positive lateral flow deflection, but in most scenarios, it would still be preferable to simply allow natural depositional/gravel bed features to dictate the flow diversity.

Figure 55: Mo 188 (53.933728, -9.051042). An overhanging willow that will undoubtedly fall into river at some point (white outline). When it does, it should be retained as a valuable habitat feature. High flow may push it round to lie along the bank ultimately. Alternatively, it could be hinged into the river to accelerate the process.

Figure 56: Mo 190 (53.933152, -9.051283). Large gravel bar with signs of extensive spawning activity (probably late 2021).

Figure 57: Mo 193 (53.932118, -9.052833). Significant boulder revetment along the LB, which is far from ideal. Bankside (rather than set-back) trees and vegetation should be promoted (including planting) so that when the revetment fails, natural stability will be provided. The revetment should not be reinstated. Planted trees could be trained over the river to increase cover.

Figure 58: Mo 197 (53.93275, -9.05625). Although enclosed by boulders, this drinking bay was clearly supplying fine sediment, with deposits evident in the margin d/s (white ellipse).

Figure 59: Mo 198 (53.93283, -9.056618). Two sets of paired boulder groynes constricting flow to the channel centre. The u/s groyne on the RB had been colonised by willows, offering some potential cover (which could be hinged over/into the channel in the short-term), but the groynes should be removed in the long-term.

Figure 60: Mo 201 (53.933418, -9.059275). A large, mature willow showing signs of previous limb collapsing, which provides a natural habitat enhancement through increased in-channel structure and should be retained when it occurs.

Figure 61: Mo 205. Around the mid-point of the EMAA waters, the gradient reduced and the gravel component of the bed began to increase, with a corresponding increase in the diversity and quality of invertebrate habitat and more salmonid redds in the margins (probably also mid-channel but more easily smoothed over in high flow).

Figure 62: Mo 209. Significant gravel deposition mid-channel and as a sidebar, creating a fast run beneath a bankside willow. Further signs of natural channel recovery.

Figure 63: Mo 212 (53.935698, -9.065408). Coarse substrate on the apex of a bend appeared to be the remains of a low groyne. Such features should be encouraged to disintegrate further and adjust to high flows to facilitate the deposition of a naturally transient feature instead. Loosening the leading edge/key stones may be all that is required.

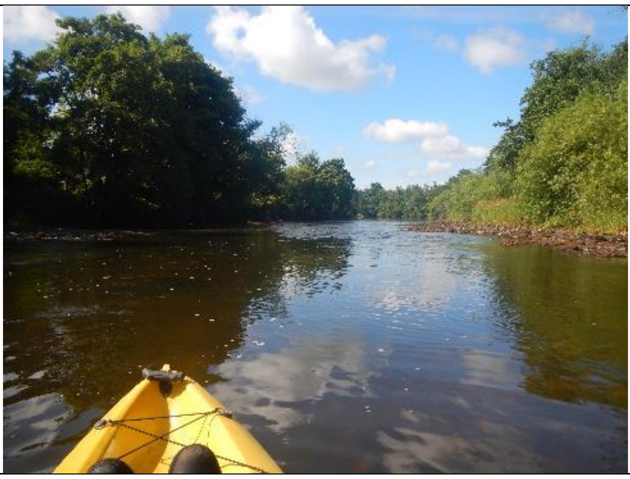


Figure 64: Mo 217 (53.935038, -9.067275). Lower level/disintegrating groynes created some flow diversity but are still a poor second to natural depositional features within the channel. This is again a case that they may have delivered greater benefit in a more recently degraded/dredged channel but will be an increasing inhibition to natural processes as the channel recovers.

Figure 65: Mo 219. A leaning willow that will ultimately fall into the channel. This could be deliberately laid in to ensure a strong hinge is retained that will secure a valuable habitat feature. Such features provide habitat for fish and a range of invertebrates, along with invertebrate food and refuge from high flows and predators.

Figure 66: Mo 222. Not all depositional gravel areas appeared to be used for spawning and this is primarily owing to the flow the area receives and the fine sediment component, which increases in lower-flow/lower-gradient areas. Fine sediment can block the spaces between gravel particles that are required to supply oxygenated water to incubating ova.

Figure 67: Mo 223. While completely treelined banks can prevent access, on non-fishing banks they create highly valuable shade, structure and cover for fish and a range of other wildlife. The trailing underwater branches are particularly important as refuge in which fish can evade predators like piscivorous birds and seek respite from high flow.

	
Figure 68: Mo 224. Bankside willows facilitating gravel deposition (white ellipse) that in turn diversifies the channel, pushing flow from the RB to the LB. This is the sort of natural habitat improvement that can be encouraged by retaining protruding bankside willows, providing all of the benefits of artificial groynes, plus a many, many more.	*Figure 69: Mo 225 (53.931938, -9.070647). Although enclosed by boulders, this drinking bay was clearly supplying fine sediment and should be replaced with offline watering facilities.*
	
Figure 70: Mo 231 (53.93049, -9.073755). Extensive gravel bars and bed at the junction pool with the Gweestion River. The larger capacity of the channel, more significant meandering and larger pools in the middle reaches of EMAA waters further increases coarse sediment retention. The tributaries also play an important role in resupplying gravel and cobble to the main river channel.	*Figure 71: Mo 233. The gravel riffle at the d/s end of the junction pool offered an example of what more areas might have looked like pre-dredging, with a far greater potential for main river spawning and a greater abundance and diversity of invertebrate habitat.*
	
Figure 72: Mo 236 (53.932092, -9.075058). A large willow that could be hinged into the river. Failing that, it should be allowed to remain when it ultimately collapses in, as crack willows invariably do.	*Figure 73: Mo 239. With the reduced gradient and a greater degree of meandering d/s of the Gweestion, emergent vegetation growth increased, beginning to pinch the channel in from the margins in over-capacity areas. However, there was also slight signs of erosion into the vegetation, demonstrating how natural features can adapt to the prevailing flow conditions.*

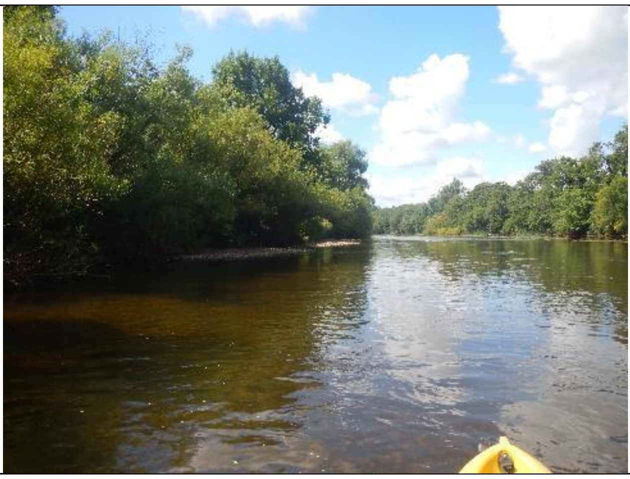


Figure 74: Mo 241 (53.933777, -9.080035). Where dense trees (willow) predominant on a fishing bank, it would be beneficial to accept the reduced access or only create occasional, discrete access points down to the water from an access track set well back from the river, rather than removing branches from over the channel to allow easy access along the river margin.

Figure 75: Mo 243. In many areas, aquatic vegetation was growing in undulating areas of the bed. These areas were likely to be old reds that had subsequently been colonised. While they are therefore of lower quality for spawning, the consolidation of the bed created will assist with the establishment of beneficial bed features; in turn, these may well facilitate deposition and develop spawning areas.

Figure 76: Mo 245 (53.93091, -9.084545). Although steep and shallow, access to the Carroward River appeared relatively free (no major barriers). Accessibility was probably reduced though by the dredging and lowering of the main river channel.

Figure 77: Mo 247. Large pool on a significant meander providing good adult fish-holding water. Willow trees on the LB should continue to grow out over the water to creating valuable cover, if left alone.

Figure 78: Mo 251. Large volumes of gravel were being naturally retained around the inside of the larger bends, demonstrating a reasonable supply of that material, which appeared to be passing through much of the upper reach inspected and/or is supplied from lower tributaries.

Figure 79: Mo 261 (53.931833, -9.088253). The largest groyne observed extended ~1/2 way across the channel and as with many others, will disrupt the natural transition of flow between two natural bends, but focussing flow hard along the LB after a large RH bend and before a LB bend.

Figure 80: Mo 267 (53.934953, -9.087362). Although dry at the time of the visit, poaching at this drinking bay clearly supplied fine sediment (LB).

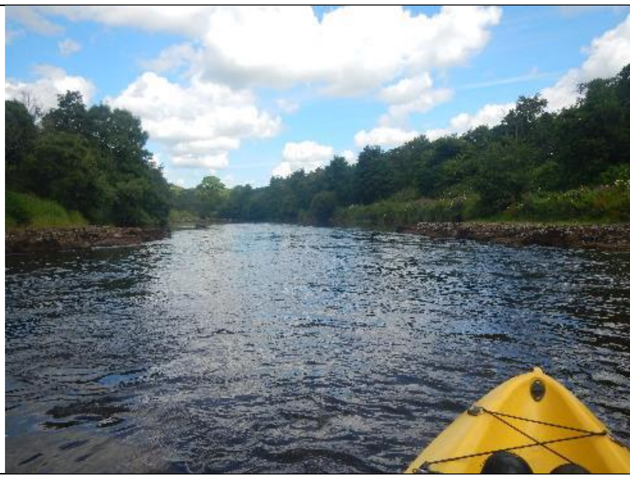


Figure 81: Mo 268 (53.935097, -9.087385). Paired groynes u/s of a single groyne on the inside bend (LB). The single groyne does push flow towards the outside bend, but the paired groynes u/s focus flow to the centre of the channel, inhibiting a more sinuous flow pathway down the channel.

Figure 82: Mo 275 (53.936768, -9.089532). Further poorly located groynes forcing flow to unnaturally zig-zag in the run up to a natural bend.

Figure 83: Mo 276 (53.936883, -9.090152). Fine sediment and nutrient input from drinking bay (LB).

Figure 84: Mo 281 (53.938118, -9.091017). Fine sediment and nutrient input from drinking bay (RB).

Figure 85: Mo 285. Bank destabilisation, likely to be contributed to by past dredging and bed-lowering. In this instance, the erosion still appeared to be acceptable and was supplying valuable coarse sediment. It is not a major concern for the fishery, but the landowner would be advised to establish a treelined buffer along the watercourse to stabilise the bank longer-term.

Figure 86: Mo 289. With the wider, lower gradient channel, areas of fine gravel formed a bar in the reach upstream of Ballylahan Bridge. Much of the material was too small for large salmon spawning, but may offer some substrate for smaller grilse, sea trout and resident trout, providing the fine sediment inputs from u/s do not infiltrate or smother the gravel.

Figure 87: Mo 290 (53.940312, -9.093848). The larger of two small RB tributaries u/s of Ballylahan Bridge appeared accessible and of suitable size to act as a spawning tributary, making it worthy of further investigation (accessibility, fine sediment inputs etc.).

Figure 88: Mo 299. In the over-capacity (likely to be a result of the dredging and impoundment from the bridge footings) channel section u/s of Ballylahan Bridge, aquatic vegetation increased, with what are primarily stillwater species dominating the margins. This is no real issue as the habitat currently is not suitable for the native riverine species and it at least provides some habitat diversity.

Figure 89: Mo 303 (53.938742, -9.102193). Partially submerged trees in the channel u/s of the bridge create valuable shelter and refuge for fish and should be retained. Such features will greatly aid fish when attempting to evade predators in the otherwise relatively featureless pool.

Figure 90: Mo 307 (53.93815, -9.103298). Ballylahan Bridge footings do not create a major obstruction, but they are raised and likely to create a behavioural barrier, particularly in low flow, inhibiting fish movement through the catchment. Best practice would be to have sunken the structure well below bed level. This would also prevent impounding flow u/s.

Figure 91: Mo 311 (53.937997, -9.103875). Two sets of paired groynes d/s of the Ballylahan Bridge focussed flow to the centre of the channel, inhibiting natural processes. It is also possible that scour at the focus (<1/2 channel width) could have driven the bed down (unless the level is governed by bedrock), leaving the bridge footings u/s more perched.

Figure 92: Mo 314 (53.937468, -9.106233). Access to the Cloonlee River was slightly obstructed by branches but appeared to be accessible as a spawning tributary, and the cover will offer some security for juvenile fish descending into the main river.

Figure 93: Mo 315 (53.937448, -9.106362). The furthest d/s of the paired groynes (d/s of Ballylahan Bridge) disrupted flow around the outside of the bend. These structures appeared very much to be attempts at fishing structures, rather than river habitat enhancements. Reinstatement of a more natural channel/allowing natural channel recovery would be a better solution.

Figure 94: Mo 320 (53.938025, -9.118282). Japanese knotweed on the LB also required treatment. D/s of Ballylahan Bridge was uniform and lacking flow diversity, with minimal juvenile salmonid habitat (should be punctuated by riffles, had it not been dredged). Adult fish will hold there, but it is an extended section of river that is not functioning properly or providing the habitat it should.

Figure 95: Mo 322 (53.93852, -9.11949). Although significantly realigned in its lower reaches, free access was possible to the Strade River, the size and substrate of which makes it a potentially important spawning tributary.

Figure 96: Mo 325 (53.940722, -9.119825). Log pilling of the LB. This is counterproductive as the hard, immobile feature will simply deflect erosive forces to the adjacent bed and bank. Moreover, the prevention of tree and vegetation growth among the bank face means that when it fails, there will be nothing to hold the bank together (unlike a naturally well-vegetated bank).

Figure 97: Mo 326. In one small area, gravel deposition along the inside bank (white ellipse), d/s of a bend and aided by roughness from bankside trees, demonstrated some of the slow recovery of morphological features that will happen over (a long) time within the degraded channel.

Figure 98: Mo 329 (53.942755, -9.119817). Where present, bankside willows could be hinged into the channel to increase flow diversity and potentially facilitate more areas of deposition. This should be done on the inside of bends, to work with natural processes. The result would be very different to immobile boulder groynes. Any naturally occurring windfallen trees should also be retained.

Figure 99: Mo 328 (53.942332, -9.119678). Fine sediment and nutrient input from drinking bay (LB).

Figure 100: Mo 336 (53.945288, -9.122455). At one of the few sections where livestock had access to the main riverbank, vegetation was denuded, and erosion and fine sediment input were occurring.

Figure 101: Mo 338 (53.945742, -9.123047). At the d/s end of the uniform section, a bedrock outcrop marked the start of return to more varied habitat. The outcrop may have been what reduced the impact moving d/s, although some of the rock did appear to have been broken out (as appeared to have been undertaken in areas u/s and on the Gweestion catchment).

Figure 102: Mo 345 (53.949115, -9.12321). Bank erosion addressed with spilling. Rather than weaving the willow, it is usually beneficial to simply pin down a rough matrix of brash that traps fine sediment and create a growing medium. Horizontal spilling effectively hangs in the air, so will never grow, as the cross pieces receive no water or nutrient, and they create less roughness.

Figure 103: Mo 350. D/s of the overcapacity section the river returned to a more dynamic character, with valuable pools and gravelly riffles and glides. Spawning should take place in these areas but owing to the naturally reducing gradient with progression d/s, they are susceptible to smothering from elevated fine sediment input u/s.

Figure 104: Mo 353. With the wider, less incised channel and lower gradient towards the d/s end of the fishery, varied habitat and high-quality gravel riffles offer a glimpse of what other areas of the river may have been like pre dredging/degradation.

Figure 105: Mo 362. The very lower end of the fishery becomes over capacity again, but bankside trees create specific fish-holding features. A good-sized grilse crashed alongside the willow in this shot as it was passed, demonstrating the fish-holding potential.

River Moy Tributary Mo(T1)

Figure 106: Mo(T1) 001 (53.945853, -9.02228). A spot-check from the first bridge crossing u/s from the Moy revealed a straightened watercourse with healthy riparian zone. Although degraded, this could provide spawning and juvenile areas.

Figure 107: Mo(T1) 002. Looking down from the bridge revealed excess algal growth (white ellipse), indicative of enrichment and nutrient inputs u/s.

Figure 108: Mo(T1) 004 (53.945848, -9.022352). The footings of the bridge were slightly perched, but passable. They could potentially be improved with an easement.

Figure 109: Mo(T1) 006. Habitat d/s of the bridge was similar to that u/s and certainly held juvenile salmonids, as observed.

Figure 110: Mo(T1) 007. Livestock access at one point was causing bank slumping and erosion.

Photo	Observation	Recommendation	Lat/Long	Priority
Mo 016	Overhanging/trailing branches providing fish-holding features	Retain any such features	53.956577, -9.002998	1
Mo 019	Drinking bay/fine sediment input	Exclude livestock and provide alternative water	53.955967, -9.003405	2
Mo 030	Drinking bay/fine sediment input	Exclude livestock and provide alternative water	53.953675, -9.008127	2
Mo 031	Mature willow at bankside	Lay into the channel to increase structure, flow diversity and gravel retention	53.953657, -9.00812	1
Mo 036	Livestock access	Buffer fencing	53.953498, -9.01064	3
Mo 062	Crack willow trailing within the river	Retain as valuable habitat feature	53.955217, -9.022028	1
Mo 088	Erosion/threatened access track	• Maintain bankside vegetation (do not cut on river side) Optional • Install brash mattress to bank face along waterline and/or plant willow whips	53.948318, -9.028927	3
Mo 096	Low, overhanging branches	Retain as valuable habitat feature	53.946202, -9.031598	1
Mo 110	Poor access to the Spaddagh River	Remove bridge and footings	53.944942, -9.033042	1
Mo 127	Boulder groyne on outside of bend	Remove groyne to promote natural geomorphological processes	53.946995, -9.0372	1
Mo 130	Livestock access	Install buffer fencing	53.947492, -9.037477	2
Mo 137	Boulder groyne on outside of bend	Remove groyne to promote natural geomorphological processes	53.947268, -9.039593	1
Mo 153	Low boulder weirs	1. Remove the weirs or 2. At least notch the weirs to bed level at a point that works with the natural transit of flow downstream to maintain sinuosity	53.94224, -9.04578	1
Mo 154	Livestock access	Buffer fencing	53.942063, -9.045462	2
Mo 157	Several cobble and boulder groynes (RB)	Remove if artificial groynes, to allow natural features	d/s of 53.941458, -9.045385	3

Photo	Observation	Recommendation	Lat/Long	Priority
Mo 161	Past tree maintenance/pruning	Resist calls by anglers to prune trees and retain low and trailing branches to improve habitat and fish-holding features	53.93989, -9.046507	1
Mo 169	Paired groynes	Remove groynes	53.9372, -9.04782	1
Mo 182	Poor access to the Killeen River	Investigate fish easement options. Likely solutions in priority: 1. Replacement rock ramp 2. Additional pre-barrages	53.934547, -9.050158	1
Mo 185	Offset groynes	Remove to facilitate more natural processes	53.934508, -9.050283	2
Mo 188	Mature bankside willows	1. Hinge branches/trunks into the river 2. Retain any naturally collapsed trunks/branches	53.933728, -9.051042	2
Mo 193	Boulder revetment (LB)	1. Plant bankside trees 2. Train trees over river margin 3. Do not reinstate boulders if/when they fail	53.932118, -9.052833	2
Mo 197	Drinking bay/fine sediment input	Fence off and provide alternative watering	53.93275, -9.05625	2
Mo 198	Two pairs of boulder groynes	• Short-term - hinge willow into the channel • Long-term – remove groynes	53.93283, -9.056618	2
Mo 201	Mature willow naturally collapsing into the channel	Retain any collapsed limbs	53.933418, -9.059275	1
Mo 212	Disintegrating groyne	Encourage disintegration through further loosening of key stones	53.935698, -9.065408	2
Mo 217	Boulder groynes	Encourage disintegration through further loosening of key stones	53.935038, -9.067275	1
Mo 219	Heavily leaning willow	• Ensure tree is not pruned or removed from the channel • Could be hinged to control the process	53.934313, -9.068462	1
Mo 225	Drinking bay/fine sediment input	Exclude livestock and provide alternative water source	53.931938, -9.070647	2

Photo	Observation	Recommendation	Lat/Long	Priority
Mo 236	Large mature willow	Hinge into channel or retain when it naturally collapses	53.932092, -9.075058	1
Mo 241	Willows lining the primary fishing bank	Accept reduced access for better habitat Create discrete access points, only if required	53.933777, -9.080035	2
Mo 061	Boulder groyne	Remove groyne. Removing key stones may allow the structure to disintegrate.	53.931833, -9.088253	2
Mo 267	Drinking bay/fine sediment input	Exclude livestock and provide alternative water	53.934953, -9.087362	2
Mo 276	Drinking bay/fine sediment input	Exclude livestock and provide alternative water	53.936883, -9.090152	2
Mo 281	Drinking bay/fine sediment input	Exclude livestock and provide alternative water	53.938118, -9.091017	2
Mo 285	Acceptable erosion	Establishing a backstop of trees would be beneficial	53.939553, -9.091975	3
Mo 290	RB tributary u/s of Ballylahan Bridge	Further investigation of potential as a spawning tributary	53.940312, -9.093848	2
Mo 307	Raised bridge footings/potential barrier	Flow could be baffled and consolidated between fewer of the bridge spans to reduce velocities and increase depth	53.93815, -9.103298	2
Mo 315	Boulder groynes	Remove groynes to allow natural flow diversity and rive processes	53.937448, -9.106362	1
Mo 320	Japanese knotweed	Treatment with herbicide by licensed operative	53.938025, -9.118282	1
Mo 325	Log piling along LB	Remove logs to allow revegetation of the bank and natural stability	53.940722, -9.119825	2
Mo 328	Drinking bay/fine sediment input	Exclude livestock and provide alternative water	53.942332, -9.119678	2
Mo 329	Mature bankside willow	Hinge this and other large willows into the channel to improve flow diversity and aid recovery. N.B. only on inside bends where they will aid sinuosity of flow.	53.942755, -9.119817	1

Photo	Observation	Recommendation	Lat/Long	Priority
Mo 330	Extended uniform/over-capacity channel section	• Long-term – preventing any further dredging should allow some recovery through sediment deposition • Short-term – coarse sediment features (riffles) could be installed to diversify habitat. The reduced sediment supply and transport through the reach means that they are only likely to provide flow diversity and some invertebrate habitat, rather than fish spawning (except the first season) until the sediment supply/transport reaches equilibrium.	53.943557, -9.120157	1
Mo 336	Livestock access and degradation of the riparian zone	Fence out livestock and provide alternative watering	53.945288, -9.122455	2
Mo 345	Willow spilling	Consider the use of a brash matrix, rather than spilling for bank protection	53.949115, -9.12321	3
Mo(T1) 002	Elevated nutrients	Further investigation on tributary	53.945847, -9.02226	2
Mo(T1) 004	Perched bridge footings	Install baffles and nappe to step	53.945848, -9.022352	3
Mo(T1) 007	Livestock access	Exclude livestock and provide alternative water	53.94583, -9.022353	2

Swinford River (Sw)

Figure 111: Sw 001 (53.944032, -8.928502). At the u/s limit checked on the Swinford it resembled more of a field drain, but was free from livestock, although fields further u/s appeared to be pasture.

Figure 112: Sw 005 (53.944378, -8.929267). The N5 road culvert was appropriately sunken and provided free fish access. The substrate appeared to have an elevated fine sediment load, but juvenile salmonids were observed there. Further investigation of sediment sources u/s would be beneficial.

Figure 113: Sw 008. Reasonable quality urban stream habitat was available in Swinford village, although continued fine sediment coating on the substrate highlighted elevated inputs u/s.

Figure 114: Sw 011. An extended section of walled channel provided poorer habitat quality, but the coarse substrate retained was still capable of supporting flow diversity and invertebrate communities, along with some juvenile salmonids. In such an artificial channel, alternate deflectors could encourage sediment retention and the formation of more discrete gravel bars.

Figure 115: Sw 012 (53.945103, -8.952145). A culvert beneath the road bridge appeared passable, although detailed inspection was not undertaken. Note the fine sediment accumulation within the wider culvert channel. N.B. not all watercourse crossings around Swinford were inspected, so others may pose obstructions.

Figure 116: Sw 013 (53.949647, -8.965877). D/s of Swinford, the river is similarly straightened to areas u/s and lacked flow diversity but was buffered.

Figure 117: Sw 016 (53.949645, -8.965913). Although shallow with fast flow, fish passage beneath the N26 road bridge appeared possible.

Figure 118: Sw 019 (53.949982, -8.973625). D/s of the Lagcurrach road bridge, a paired groyne and low-level weir were present just, with dredging having been undertaken recently, possibly because of sediment accumulation from the weir. The weir and at least LB groyne should be removed and drinking bay replaced with a pasture pump. Preventing further dredging would be highly beneficial.

Figure 119: Sw 022 (53.956188, -8.990864). Further small weirs were observed from the new N26 road bridge. The geomorphology of the stream could be greatly improved by removing or at least notching the weirs. From the substrate observed it is likely that the river was capable of supporting large salmonid spawning and could be important for recruitment if naturalised.

Figure 120: Sw 026. The N26 road bridge was clear-span, creating minimal impact upon the river and no issues for fish passage.

Figure 121: Sw 027. The river appeared to increase in alkalinity throughout the lower reaches, likely to be owing to spring water input from a limestone aquifer. The uniformly dredged channel could be improved by a larger buffer and more in-channel structure to scour and sort the bed.

Figure 122: Sw 030. The lower section to the River Moy provided good juvenile salmonid habitat, but the slower areas were negatively impacted by fine sediment deposition.

Photo	Observation	Recommendation	Lat/Long	Priority
Sw 005	Elevated fine sediment	Investigate sources u/s of N5 road bridge	53.944378, -8.929267	2
Sw 011	Uniform, artificial channel	Alternate flow deflectors	53.945075, -8.952102	2
Sw 012	Groynes, low weir and dredging	• Remove low weir (reducing the impoundment of flow and sediment and hopefully the desire to dredge) • Remove at least the LB groyne to allow flow round the outside bend • Provide alternative water • Seek cessation of dredging that will be inhibiting channel recovery	53.945103, -8.952145	2
Sw 013	Numerous small weirs disrupting sediment transport and sorting	1. Remove weirs 2. At least remove the outside bend side of the weirs down to bed level to increase flow sinuosity and allow sediment transport/sorting	53.9497, -8.965723	2
Sw 027	Uniform channel, lacking bankside vegetation and trees	• Increase buffer • Install woody material features to sort the substrate	53.958412, -8.991405	2

Spaddagh River (Sp)

Figure 123: Sp 001 (53.91656, -8.923395). At the u/s limit inspected, the Spaddagh provided reasonable habitat for juvenile salmonids. However, the channel was realigned and the substrate coarse and poorly sorted, but it would support some invertebrate species.

Figure 124: Sp 003 (53.916563, -8.923492). The Derryronan Road crossing was passable by fish.

Figure 125: Sp 005 (53.927077, -8.95976). U/s of the N5, the watercourse was realigned, and armoured, but habitat quality was relatively good for a uniform channel, enhanced by vegetation.

Figure 126: Sp 007 (53.927365, -8.95989). The road culvert appeared to be appropriately sunken and passable by fish.

Figure 127: Sp 010 (53.928007, -8.960362). An older bridge just d/s also appeared passable, but the narrow aperture was accelerating flow velocities.

Figure 128: Sp 014 (53.934095, -8.970302). A cattle drink u/s of the next spot-check was supplying fine sediment.

Figure 129: Sp 016. Emergent vegetation added valuable flow diversity to the artificial channel habitat d/s.

Figure 130: Sp 018 (53.938485, -9.00906). Reasonable quality habitat for juvenile salmonids within a uniform channel, u/s of the next spot-check bridge. Woody material installation could enhance such channel sections.

Figure 131: Sp 019. D/s of the bridge, emergent vegetation enhanced the habitat for fish and invertebrates. The bridge structure was passable by fish. Again, the uniform channel could be enhanced by installing habitat features.

Figure 132: Sp 021 (53.935952, -9.014033). At the next crossing inspected, the gravel riffles provided good opportunities for salmonid spawning, although a low-level weir u/s created an unnecessary impediment to gravel transport and should be removed. It may be worth a more detailed walkover to ascertain whether further weirs also require removal.

Figure 133: Sp 024 (53.935768, -9.016543). Although clearly dredged to a uniform capacity, habitat at the next location remained reasonably good for juvenile salmonids, particularly fry and 0+ parr, but lacked shade and cover. This area could be greatly enhanced with woody material/flow deflectors and a treelined strip.

Figure 134: Sp 025 (53.935967, -9.022673). Livestock access to the watercourse at a drinking bay.

Figure 135: Sp 028 (53.93591, -9.023483). The straightened and uniform channel continued at the next location (u/s and d/s) but was protected from livestock and still provided juvenile salmonid habitat, if lacking shade and cover. Numerous juvenile fish were observed.

Figure 136: Sp 030 (53.936725, -9.024245). Gravel deposition at one of the few sharper bends observed demonstrates the high potential value as a spawning tributary.

Figure 137: Sp 031 (53.936628, -9.024292). Poaching at a cattle drink d/s of the bridge. Cover from the low-lying alder bough on the RB greatly improves the pool habitat.

Figure 138: Sp 035 (53.936628, -9.024292). Poaching at a cattle drink. Although ideally requiring re-meandering, the channel could be enhanced with in-channel structures.

Figure 139: Sp 038. The channel was buffered but remained uniform capacity at furthest d/s spot-check. Increasing the availability of in-channel structure (trailing branches, woody material etc) would be beneficial.

Photo	Observation	Recommendation	Lat/Long	Priority
Sp 014	Drinking bay/fine sediment input	Exclude livestock and provide alternative water source	53.934095, -8.970302	2
Sp 018	Uniform channel	Woody material installation	53.938485, -9.00906	2
Sp 019	Uniform channel	Woody material installation	53.938497, -9.009037	2
Sp 021	Weir and uniform channel	• Weir removal (likely by hand) • Woody material installation N.B. this area is a higher priority owing to the existing potential of the habitat for salmonid spawning	53.935952, -9.014033	1
Sp 024	Uniform channel	• Woody material installation • Tree planting	53.935768, -9.016543	1
Sp 025	Drinking bay/fine sediment input	Exclude livestock and provide alternative water source	53.935967, -9.022673	2
Sp 028	Uniform channel	• Woody material installation • Tree planting	53.93591, -9.023483	1
Sp 031	Drinking bay/fine sediment input	Exclude livestock and provide alternative water source	53.936628, -9.024292	2
Sp 035	Uniform channel	Woody material installation Tree planting	53.939335, -9.030243	1
Sp 038	Uniform channel	Woody material installation Tree planting	53.939438, -9.03034	1

Killeen River (Ki)

and

Killeen Tributary (Ki(T1))

Figure 140: Ki 003 (53.899595, -8.954577). The upper reaches of the Killeen River were dry but appeared to carry a reasonable sized watercourse at times (by the channel morphology). The map shows the watercourse extending further u/s for another 5km, with two small tributaries. Ephemeral watercourses are common in limestone areas, but this can also be due to groundwater abstraction.

Figure 141: Ki 006 (53.903065, -8.97238). Livestock poaching and fine sediment input at a drinking bay/ford.

Figure 142: Ki 007 (53.903313, -8.97271). D/s of the ford, cattle had clearly been inside the buffer strip, trampling the bed of the watercourse and denuding the bankside vegetation.

Figure 143: Ki 010 (53.90355, -8.972723). Further poaching was occurring d/s of the R320 road bridge (passable by fish).

Figure 144: Ki 015 (53.915988, -9.000402). The N5 crossing was passable by fish. Note the significant algal growth/enrichment.

Figure 145: Ki 017 (53.928357, -9.022538). By the next checkpoint the watercourse was certainly capable of supporting juvenile salmonids, but was uniformly over-capacity and lacked a buffer strip on the LB u/s.

	
Figure 146: Ki 022 (53.928447, -9.022527). The road crossing/culvert was passable by fish.	*Figure 147: Ki 025 (53.928437, -9.022557). Uniform, straightened channel and livestock access and poaching d/s of the bridge (RB).*
	
Figure 148: Ki 030 (53.928437, -9.022557). The footings of the furthest d/s road crossing created a small obstruction. However, a series of three boulder weirs/pre-barrages d/s may well be an attempt to ease a bigger step and fish passage issue, probably created by the dredging and lowering of the Moy. Baffles could slow and deepen flow over the footings to ease passage.	*Figure 149: Ki 033. Three boulder weirs d/s of the road bridge. The Moy flows past right to left (white arrow). These still represent an obstruction in most flows but are an improvement over a much larger step. A continual rock ramp easement/bed regrade would be more in keeping with best practice, offering passage in a broader range of flows. This could unnecessarily delay fish entering the trib.*

Killeen Tributary (Ki(T1))

<table>
<tr><td></td><td></td></tr>
<tr><td>Figure 150: Ki(T1) 005 (53.907705, -8.923238). At the first location the Killen tributary was realigned and incised but protected with a buffer strip; the substrate was coarse, and the watercourse was capable of supporting juvenile salmonids.</td><td>Figure 151: Ki(T1) 007 (53.918813, -8.962095). U/s of the R320, where impounded by vegetation, a scummy film observed on the surface of the watercourse was indicative of organic enrichment. This kind of encroachment and impoundment is usually the result of past dredging, creating an over-capacity channel that then infills with sediment and vegetation.</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Figure 152: Ki(T1) 008 (53.918818, -8.962088). immediately d/s of the R320 crossing, excess algal growth was observed on the bed, again highlighting an enrichment issue.</td><td>Figure 153: Ki(T1) 013 (53.923122, -8.976833). At the crossing u/s of the N5, although uniform, the channel provided substrate of a suitable size for salmonid spawning. Greater scouring and sorting would improve its quality and more in-channel structure would be beneficial.</td></tr>
</table>

Figure 154: Ki(T1) 014. A culvert observed at the next spot-check was passable by fish.

Figure 155: Ki(T1) 020 (53.927917, -9.004203). In the lower reaches, the Killeen tributary offered habitat for juvenile salmonids, despite being realigned and incised. Re-meandering would be highly beneficial. If this is not possible, the addition of woody material could provide improvement, along with the planting of more trees.

Figure 156: Ki(T1) 023. The substrate was coarse, but the buffered banks provided valuable cover from marginal vegetation – again, re-meandering or at least additional in-channel structure would be beneficial

Photo	Observation	Recommendation	Lat/Long	Priority
Ki 006	Drinking bay/fine sediment input	• Exclude livestock and provide alternative water source • Prevent access to the buffer strip	53.903065, -8.97238	2
Ki 010	Drinking bay/fine sediment input	Exclude livestock and provide alternative water source	53.90355, -8.972723	2
Ki 017	Uniform channel	• Woody material installation • Buffer fencing • Tree planting	53.928357, -9.022538	2
Ki 025	Uniform channel	Woody material installation Buffer fencing	53.928437, -9.022557	2
Ki 030	Shallow flow over bridge footings	Install baffles	53.934505, -9.049812	1
Ki 033	Pre-barrages d/s of perched bridge footings	Replace pre-barge/weirs with rock ramp/more natural channel	53.934518, -9.049792	2
Ki(T1) 007	Suspected nutrient enrichment	Further investigation on tributary	53.918813, -8.962095	2
Ki(T1) 013	Uniform channel	Woody material installation	53.923122, -8.976833	2
Ki(T1) 020	Uniform channel	1. Restoration/re-meandering 2. Woody material installation	53.927917, -9.004203	2
Ki(T1) 023	Uniform channel	1. Restoration/re-meandering 2. Woody material installation • Tree planting	53.927932, -9.004157	2

Glore River (Gl) & tributary (Gl(T1)), Gweestion River (Gw) & tributaries (Gw(T1-3))

and

Trimoge (Tr)

Figure 157: Gl 003 (53.807545, -8.766337). At the furthest u/s point inspected, the Gweestion already provided good juvenile salmonid habitat. The uniform, over-capacity channel was beneficially narrowed by emergent vegetation, providing valuable flow diversity. The channel here could potentially be re-meandered within the unused ground adjacent.

Figure 158: Gl 009 (53.797818, -8.755807). Further d/s, the over-wide and over-deep watercourse resembles a canal but was improved by aquatic vegetation and is still capable of supporting fish.

Figure 159: Gl 010 (53.785467, -8.765615). At the N83 road crossing, the presence of substrate suitable for salmonid spawning highlights the contribution the watercourse could make. However, the channel dimensions and flow were not conducive to spawning.

Figure 160: Gl 015 (53.777528, -8.781548). Poaching on both banks at drinking bays/fording point u/s of the L1912.

Figure 161: Gl 020. Improved juvenile salmonid habitat d/s of the L1912, although the RB could be improved by a larger buffer and greater cover and in-channel structure would be beneficial.

Figure 162: Gl 022 (53.813142, -8.83771). U/s of Coogue South Road, the channel was straightened and canal-like. The RB was well buffered, but the LB was sheep-grazed through the fence, denuded of vegetation and suffering erosion/slumping. One field u/s the river appeared to pass through lower grade, boggy land with potential for channel restoration.

Figure 163: Gl 027 (53.813167, -8.837828). D/s of the road bridge, the channel was partially choked with vegetation, but note the lack of excess algae (also see d/s - Figure 166 - where algae is a significant issue).

Figure 164: Gl 031. Progressing d/s, the LB was unfenced and slumping (white ellipse).

Figure 165: Gl 033. U/s of the next bridge the LB was buffered, with a close coniferous plantation on the LB. ideally, a 10m deciduous tree buffer should be maintained alongside the watercourse.

Figure 166: Gl 038 (53.823533, -8.86525). D/s of the crossing, signs of significant enrichment were observed by the swathes of floating algae. This enrichment appears to have occurred between this location and the spot-check u/s, where no excess algae was observed (Figure 163).

Figure 167: Gl 039 (53.828098, -8.87353). U/s of the N17 crossing, the channel appeared less incised, with more natural features and shallow areas. Numerous juvenile salmonids were observed.

Figure 168: Gl 044 (53.828303, -8.87376). D/s of the N17, livestock were gaining access to the LB buffer strip.

	
Figure 169: Gl 046 (53.84461, -8.898523). The bridge crossing at the next spot-check posed no issues for fish passage and the slight narrowing and shade gave a glimpse of the higher quality habitat that could be achieved with a more naturally varied channel.	*Figure 170: Gl 048. Habitat u/s was of a reasonably good quality, although the channel remained realigned and over-capacity, with some natural vegetation narrowing/recovery. Although not observed, aerial photography suggests that there may be weirs around this area. If so, their removal would be beneficial.*
	
Figure 171: Gl 049. Habitat d/s was slightly higher quality owing to increased gradient.	*Figure 172: Gl 0051 (53.851462, -8.927617). These straightened sections could be greatly enhanced by restoration/re-meandering or, at the very least, increasing variability in flow diversity and channel width with woody material.*
	
Figure 173: Gl 0054. Where trees provided cover/structure and emergent vegetation pinched the channel, habitat diversity greatly improved.	*Figure 174: Gl 055 (53.85405, -8.93411). With an increased number of bankside trees providing cover and shade, habitat was further improved around the R322 crossing, but the channel remained uniform.*

Figure 175: Gl 060 (53.854466, -8.933487). Significant cattle poaching at a drinking bay.

Figure 176: Gl 061 (53.856677, -8.934283). Some good-sized adult fish were observed in the deeper sections, demonstrating opportunities for a well-managed trout fishery, but those areas often lacked shallower juvenile and spawning habitat for extended sections, which could improve salmon and trout prospects if improved.

Figure 177: Gl 066 (53.855282, -8.9523). Livestock access (LB). The uniform habitat and lack of flow here means the habitat is greatly underperforming for salmonids and many beneficial invertebrates.

Figure 178: Gl 067 (53.855302, -8.952265). Livestock poaching at a drinking point. Much of this area was protected by high, steep banks and/or buffer fencing, but some conspicuously weren't. The placement of stone within the channel does little to mitigate the issue.

Figure 179: Gl 071 (53.855377, -8.952435). The realigned uniform channel continued at the next crossing and would benefit from channel restoration or at least installation of woody material habitat features. There was also a small obstruction created by a cobble weir immediately d/s of the bridge – its removal would be beneficial.

Figure 180: Gl 072 (53.860299, -8.966197). Reasonably well recovering habitat, although still degraded by straightening/dredging and weirs. Gravel riffle reinstatement or, ideally, re-meandering could promote a high-value trout fishery here. Tufa (calcium carbonate precipitate) became increasingly prevalent from around this area, often forming barrages.

Figure 181: Gl 073 (53.860391, -8.966263). Although not inspected in detail, Google Maps aerial imagery shows a 1.5km section u/s of the R320 road bridge is fragmented by weirs. A possible offtake/abstraction is also worth further investigation.

Figure 182: Gl 074. Salmon parr are known to be in this area of the catchment, as demonstrated by several that were caught accidentally by the author while fly fishing for trout.

Figure 183: Gl 077. From the R320 road, the Glore and then Gweestion were surveyed by kayak. Immediately d/s of the R320, in-channel habitat work had been undertaken, including stone groynes (white ellipse) and weirs.

Figure 184: Gl 089 (53.86989, -8.985915). Numerous weirs created (apparently relatively recently installed) pools in a long uniform section but, in conjunction with the long section of weirs u/s will have a significant detrimental impact upon sediment transport and habitat utilisation, forming behavioural and in some cases physical barriers.

Figure 185: Gl 098. From its mid/lower reaches, the Glore became even more calcareous, with extensive calcium carbonate precipitate smothering the bed and any static structure. Weirs exacerbate the binding of substrate by tufa as they reduce the ability of the stream to scour and mobilise the material regularly.

Glore Tributary 1 - Gl(T1)

Figure 186: Gl(T1) 001 (53.80036, -8.744247). At the u/s spot-check on the Glore tributary, the channel was overcapacity with little flow diversity, but the culvert appeared to be passable by fish.

Figure 187: Gl(T1) 002. Emergent vegetation choked the channels u/s of the bridge, as often occurs when a channel is dredged wider than the flow can naturally maintain.

Figure 188: Gl(T1) 004. Habitat d/s, where there was greater flow diversity provided much higher quality habitat, further enhanced by valuable trailing vegetation. Even in the upper reaches, this tributary was likely to support juvenile salmonids and could be enhanced for spawning habitat.

Figure 189: Gw 006. The Gweestion River begins at the d/s end of the Glore River, therefore having the same highly calcareous character. Where not completely impounded and the substrate was still mobile, the river offered good spawning habitat for salmonids.

Figure 190: Gw 011. In a deeper impounded section, adult and older trout habitat was enhanced by bankside trees, but still lacked flow diversity.

Figure 191: Gw 015 (53.872012, -8.991125). Weirs became less frequent progressing d/s but were present, with some gravel availability, but it would be far higher quality if the weirs were removed or at least notched to allow more natural sediment transport and flow diversity, and to prevent the substrate from becoming unnecessarily consolidated by tufa (preventing salmon

Figure 192: Gw 021 (53.872908, -8.991167). A sprouting willow stump, suggesting someone may have been unnecessarily pruning valuable bankside trees. Alternatively, someone could have planted it as a stake.

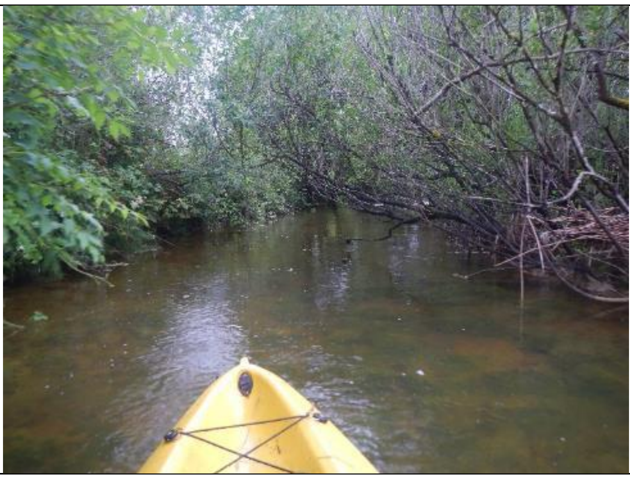


Figure 193: Gw 025. Occasional treelined and enclosed sections offered valuable habitat diversity and sanctuary for larger fish which were seen among the structure.

Figure 194: Gw 029 (53.874827, -8.993235). A track and vehicle access point to the river created a small input of fine sediment. Vehicles use in the watercourse could also lead to pollution.

Figure 195: Gw 030 (53.874828, -8.993243). Drinking bay, bank erosion and associated inputs.

Figure 196: Gw 034 (53.876387, -8.994587). Drinking bay, bank erosion and associated inputs. Note the plume of earth/fine sediment washing d/s (white ellipse).

Figure 197: Gw 038 (53.87696, -8.995015). Unfenced section, with a corresponding lack of bankside vegetation. This over-wide and uniform channel could be greatly improved with in-channel structure like large woody material and/or gravel, even if full re-meandering isn't possible.

Figure 198: Gw 041. In more open areas, the productivity of the stream showed in the diversity and abundance of bankside vegetation, with faster-flowing areas providing good juvenile salmonid habitat.

Figure 199: Gw 050 (53.879515, -8.997023). The disused railway line crossing posed no major habitat issues, other than being an artificial bank structure.

Figure 200: Gw 055. Heaps of spoil (white ellipse) previously dredged from the channel were a common occurrence along the river in adjacent fields.

Figure 201: Gw 061 (53.881442, -9.00089). Drinking bay, bank erosion and associated inputs. Also note the dredged spoil in the background (red ellipse).

Figure 202: Gw 066. The stark contrast in water quality between the highly calcareous River Gweestion (with tufa barrages) and the darker River Pollagh (background), which although having significant limestone in its catchment also has a greater influence of peat, sandstone and shale.

Figure 203: Gw 069 (53.882535, -9.002925). Drinking bay, bank erosion and associated inputs.

Figure 204: Gw 071. Remains of a large salmonid redd in the river margin. The reduced impoundment, greater substrate supply and mobility all mean that spawning opportunities in the Gweestion improved d/s of the Pollagh confluence, but this doesn't preclude the upper Gweestion and Glore and as important nursery areas, particularly with removal of the weirs.

	
Figure 205: Gw 074 (53.88313, -9.004902). Lack of buffer fencing and consequent bank erosion.	*Figure 206: Gw 081 (53.884068, -9.007188). Drinking bay, bank erosion and associated inputs.*
	
Figure 207: Gw 082 (53.88415, -9.007507). Drinking bay, bank erosion and associated inputs.	*Figure 208: Gw 086 (53.884665, -9.008967). Lack of buffer fencing and increased bank erosion.*
	
Figure 209: Gw 088. As in areas on the Pollagh (and main river Moy), the uniformly dredged and often incised channel appeared less recovered and/or capable of retaining coarse substrate mid-channel in many areas, but deposition in the river margins had supported spawning activity.	*Figure 210: Gw 092. Depressions in the gravel bars often appeared to be the remains of old redds, which were usually distinguishable from the shape/form of purely depositional features.*

	
Figure 211: Gw 098 (53.8873, -9.007168). Debris at the L1919 road bridge may elevate flood risk somewhat but posed no real issue for fish passage.	*Figure 212: Gw 100. Despite being less calcareous than the upper river, areas of tufa (likely facilitated by calcareous springs in the bed and banks) did facilitate some tufa growth.*
	
Figure 213: Gw 106. Where the river was incised into the bedrock, occasional springs were visible, some with a significant flow (white ellipse).	*Figure 214: Gw 122. Roughness of the river margin that helped facilitate gravel deposition (white ellipse).*
	
Figure 215: Gw 125 (53.89642, -9.01836). Livestock access/unmaintained field boundary and bank erosion.	*Figure 216: Gw 126 (53.897113, -9.019465). Drinking bay that appeared to be reasonably protected with a gravel bed, but as water levels rise, any fine sediment and excreta will wash into the river.*

Figure 217: Gw 141. In straighter sections, gravel deposition helped to add flow diversity and provided reasonably good habitat for juvenile salmonids. Further roughness within the channel (low/trailing branches and woody material) could facilitate additional deposition.

Figure 218: Gw 142 (53.904398, -9.023517). Drinking bay, bank erosion and associated inputs.

Figure 219: Gw 144 (53.904545, -9.023667). Lack of buffer fencing and increased bank erosion.

Figure 220: Gw 145 (53.904588, -9.023648). Lack of stock-proof fencing and increased bank erosion. The increasing land management issues in the lower Gweestion are not conducive to optimising the habitat quality of what is likely to be an important spawning area.

Figure 221: Gw 148 (53.905565, -9.023078). Lack of buffer fencing and increased bank erosion.

Figure 222: Gw 149. Very occasional wider channel sections facilitated more natural gravel deposition as riffles, creating high quality salmonid spawning and juvenile habitat, but they were far fewer than would occur on a channel of more natural sinuosity and dimensions.

Figure 223: Gw 150. The quality of gravel/cobble substrate in the more natural channel areas was well sorted and relatively free from fines.

Figure 224: Gw 156 (53.906933, -9.021245). Lack of buffer fencing, reduced vegetation and increased susceptibility to bank erosion.

Figure 225: Gw 160 (53.90941, -9.02183). Drinking bay, bank erosion and associated inputs.

Figure 226: Gw 165. Glide and riffle habitat with areas of spawning substrate suitable for salmonids.

Figure 227: Gw 174 (). A small LB tributary may provide salmonid spawning and juvenile habitat, but was heavily straightened and incised, reducing its value. Further investigation would be beneficial as fish spawned in the main Gweestion may move up smaller side-streams to take advantage of the available habitat.

Figure 228: Gw 178 (53.914165, -9.031747). Drinking bay. Although not appearing to be in use at the time, it would be beneficial to replace this with alternative watering if the field is grazed.

Figure 229: Gw 180 (53.914493, -9.033745). Drinking bay, bank erosion and associated inputs.

Figure 230: Gw 183. Note how trailing willow boughs greatly assisted the retention of gravel within the river margins, which had then clearly supported spawning activity.

Figure 231: Gw 185. Most of the redds observed were within the river margins. Others may have been washed out from the mid-channel areas, but the sheer numbers observed within the margins suggest that they provide an important contribution to the overall spawning within the Gweestion – especially as many areas of the channel were not even retaining much gravel.

Figure 232: Gw 190. Wider sections in the lower river, where the gradient reduced, were also retaining more of the coarse substrate, providing improved invertebrate habitat, even in areas too deep for optimal salmonid spawning.

Figure 233: Gw 192 (53.91717, -9.037095). Artificial groynes had been installed in several areas and as on the Moy, while they may have provided some habitat diversity within the more recently dredged channel, they are now more often likely to inhibit natural deposition and channel recovery.

Figure 234: Gw 195 (53.917498, -9.038495). Drinking bay, bank erosion and associated inputs.

Figure 235: Gw 203 (53.919413, -9.046042). Lack of buffer fencing, increased bank erosion and sediment input.

Figure 236: Gw 232. The wider, less incised channel and associated gravel deposition at the furthest d/s bridge on the river offered good salmonid spawning habitat, with areas of juvenile habitat nearby.

Figure 237: Gw 244 (53.927367, -9.062973). Lack of buffer fencing and increased bank erosion.

Figure 238: Gw 250. Throughout the lower reaches of the Gweestion, river margin spawning appeared to have occurred. The overhanging tree boughs greatly enhance the area, offering cover and increased security to vulnerable spawning fish.

Figure 239: Gw 261. In some areas, slow, natural erosion should be seen as a positive process, providing additional coarse substrate to the river. This is in stark contrast to the exacerbated erosion around drinking bays and unfenced banks.

Figure 240: Gw 273. In the lower gradient areas of the lower Gweestion, high quality gravel bars were observed – along with the remains of redds.

Figure 241: Gw 287. Bankside shrubs in the lower Gweestion enhancing spawning areas by increasing gravel retention and providing low cover for fish. These features also enhance the flow diversity and angling interest of the area.

Figure 242: Gw 294. A recently fallen willow (white circle) on the RB at the confluence with Moy provides valuable trailing cover in the river margin and should be retained. Such features have traditionally often been removed from fisheries but in doing so, habitat is degraded along with the fish-holding potential of that area.

Gweestion Tributary 1 Gw(T1)

Figure 243: Gw(T1) 003. Although long, the natural substrate of R321 culvert provided reasonable fish passage

Figure 244: Gw(T1) 005 (53.887487, -9.033818). The channel and substrate supported opportunities for salmonid spawning but would benefit from more woody structure to assist natural morphological recovery.

Figure 245: Gw(T1) 008 (53.898557, -9.022697). Substrate capable of supporting salmonid spawning was also observed in the lower reaches, although greater sorting would increase the likelihood of it being used.

Figure 246: Gw(T1) 010. The lower reaches towards the Moy provided good juvenile habitat (for a straightened channel).

Gweestion Tributary 2 (Gw(T2)

Figure 247: Gw(T2) 001. It was difficult to gain access to the second tributary, which was inspected from the R321, where it appeared to be small but potentially capable of holding salmonids in more natural channel sections.

Figure 248: Gw(T2) 002. A scour pool d/s of the road offered habitat for larger juvenile salmonids.

Figure 249: Gw(T2) 004. Further d/s, the channel was lower gradient and uniform, but almost certainly capable of supporting fry and parr. Emergent vegetation encroachment was beginning to win back some sinuosity and flow diversity, but the channel required re-meandering.

Figure 250: Gw(T2) 005 (53.908555, -9.03464). The road culvert posed no issues for accessibility from the main Gweestion.

Gweestion Tibutary 3 (Gw(T3)

Figure 251: Gw(T3) 001. The third small tributary of the Gweestion that was inspected was of a similar character to the lower reaches of the second (Gw(T2), being similarly straightened and set within the lower gradient areas of the valley. Again, emergent vegetation somewhat improved a uniform, over-capacity channel that really required major restoration.

Figure 252: Gw(T3) 002 (53.916445, -9.054422). The tributary appeared to be accessible from the main river at the points observed, although shallow water over a smooth (presumed to be concrete) bed created a small obstruction at one of the road crossings.

	
Figure 253: Tr 001 (53.86378, -8.795908). The Trimoge River is a sizeable lower tributary of the Gweestion that should provide good spawning and juvenile areas, but was severely dredged, uniform and degraded at the furthest u/s road crossing inspected.	*Figure 254: Tr 004. D/s of the road, raised bridge footings created a small obstruction but were rough and passable by fish. The turbulence they created gave hint of the flow diversity regular riffles and a more morphologically diverse channel should support. Lower grade land along the LB may offer the greatest potential for restoration/re-meandering but both banks have potential.*
	
Figure 255: Tr 008 (53.865933, -8.809827). The next spot-check revealed similar habitat to the first. Even the installation of alternating structures within the channel (like woody material) to increase flow diversity would be an improvement, but channel restoration, riffle installation or woody material installation should be the hierarchy of options, respectively.	*Figure 256: Tr 010 (53.87095, -8.846848). U/s of the N17 road, the channel was slightly more sinuous but similarly uniform capacity. A blue excavator was observed along the riverbank a short distance further u/s (red circle).* *The road crossing/culvert appeared to be appropriately sunken, allowing free fish passage.*

Figure 257: Tr 015 (53.870595, -8.849042). In Kilkelly, a sizeable discharge appeared to be negatively impacting upon the river, with sewage fungus and excess algal growth observed on the gravel bar(s) d/s.

Figure 258: Tr 016. Habitat work immediately d/s: but as with many of the groynes on the Moy catchment, some were paired, reducing their benefit by unnecessarily constraining flow to the centre of the channel, rather than promoting sinuosity; they are also too closely spaced longitudinally. In this highly modified channel, they are an improvement, but the impact could be far more positive.

Figure 259: Tr 018. Occasional gravel bars had formed, demonstrating the requirement for width to facilitate coarse sediment retention, as well as narrower areas to create scour and depth. This demonstrates an issue with channel uniformity, rather than excess capacity. Increased flow sinuosity would facilitate more natural diagonal riffles that would better accommodate a range of flows.

Figure 260: Tr 023. D/s of the village, the channel was still significantly modified, but had begun to improve naturally, with depositional features diversifying the bed and healthy bankside vegetation. The habitat continued to improve d/s. Numerous juvenile salmonids were observed u/s and d/s, demonstrating the potential value of this tributary.

Figure 261: Tr 028 (53.864027, -8.871305). The river retained some sinuosity u/s of the next spot-check, with a semblance of a pool and riffle sequence, if still straighter and more uniform than natural. The higher value improved pasture in this area may reduce the potential for channel restoration, but it would be worth investigating, along with tree planting.

Figure 262: Tr 030. The habitat d/s was also reasonably good, with the first pool capable of supporting adult trout and valuable riffle features d/s. However, note the uniform width and incision of the channel below the adjacent land, strongly suggesting it had been dredged to those dimensions.

Figure 263: Tr 032 (53.865175, -8.88761). At the next spot-check, clear signs of past channel dredging were evident by the numerous spoil heaps alongside the river.

Figure 264: Tr 036. Someone appeared to be attempting to trap mink at the site. If so, the trapping of mink is commendable, but it is generally beneficial to trap within a tunnel/under cover to disguise the trap and increase the likelihood of mink entering. A 100mm restrictor should also be installed at the entrance to prevent otters inadvertently being trapped, constituting an offence.

Figure 265: Tr 037 (53.865813, -8.88662). Signs of a small defunct hydropower installation, coupled with the mink trapping, suggests the landowner has an interest in the environment and may be open to river habitat improvements. Even removing the weir would be an improvement.

Figure 266: Tr 041 (53.866442, -8.891247). At the next spot-check d/s, significant poaching of cattle drinks at both bank sides created an issue. The perched bridge footings also created an obstruction which could be eased with baffles and/or a rock ramp d/s.

Figure 267: Tr 046 (53.870838, -8.908473). U/s at the next spot-check, the uniform and over-capacity channel had great potential for improvement through gravel riffle installation. D/s the channel was incredibly straight and would benefit from re-meandering but could still be improved with gravel introduction.

Figure 268: Tr 052 (53.86442, -8.924645). The next location was very similar and could be greatly improved with strategic riffle installation, being careful to work with the remaining bends and in-channel features. Removing the low-level weir would also be beneficial.

Figure 269: Tr 055 (53.874825, -8.95656). Looking u/s: by the next location the channel supported coarse cobble features and provided some reasonable quality juvenile salmonid habitat. The rougher, less improved ground further u/s may provide increased potential for restoration.

Figure 270: Tr 058. D/s, the habitat was similar and although juvenile salmonid habitat was present, it appeared that there was a shortage of smaller gravel/spawning substrate – likely to be owing to a lack of retention within the modified channel and probably a lack of supply.

Figure 271: Tr 061. Around the R320 road crossing, gravel substrate was observed, with the potential for supporting salmonid spawning, although the lack of channel diversity and scouring/sorting had allowed moss and emergent vegetation to colonise many areas.

Figure 272: Tr 065. D/s, habitat had recovered about as well as could be hoped for within the confines of a straightened channel and will improve further as bankside trees grow in. However, what looked like lower, wet ground on the RB d/s could offer restoration potential. Failing that, some trees could be hinged into the channel to aid flow diversity/gravel retention.

Figure 273: Tr 072 (53.904217, -8.998083). Towards the lower end of the Trimoge catchment, where the gradient was lower and the channel was much wider and less incised, with a few more bends, more gravel substrate was present and the river had a more natural feel. Increasing the channel sinuosity would still be beneficial to make the most of the improved sediment resource.

Figure 274: Tr 082. Although the channel remained uniform, numerous trout were observed at the furthest d/s bridge (and indeed throughout the catchment).

Photo	Observation	Recommendation	Lat/Long	Priority
GI 003	Straight channel with unused ground adjacent	Potential for re-meandering project	Around 53.807545, -8.766337	1
GI 009	Straight channel with unused/low grade ground adjacent	1. Potential for re-meandering project 2. Installation of gravel riffles 3. Woody material and/or flow deflectors would be beneficial 4. Even strategic willow planting could increase flow diversity	Around 53.797818, -8.755807	1
GI 015	Drinking bay/fine sediment input	Exclude livestock and provide alternative water	53.777528, -8.781548	2
GI 020	Uniform channel, lacking cover	• Increase unmown buffer • Tree planting • Woody material installation	53.777547, -8.781653	2
GI 022	Livestock access, denudation of vegetation and erosion (LB)	• Investigate opportunities for channel restoration/re-meandering on lower grade land u/s • Install sheep-proof buffer fence • Possible riffle installation within straightened channel	53.813142, -8.83771	1
GI 031	Livestock access, denudation of vegetation and erosion (LB)	Buffer fencing	53.813153, -8.837868	2
GI 033	Conifer plantation too close to river	Fell to a minimum 10m back from the river and provide deciduous tree buffer	53.82353, -8.865158	2
GI 038	Significant algal growth/enrichment	Investigate source (53.813167, -8.837828 to 53.823533, -8.86525)	53.823533, -8.86525	1
GI 044	Livestock access in buffer (LB)	Reinstate livestock exclusion	53.828303, -8.87376	1
GI 048	Uniform channel and possible weirs	• Further investigation to identify and remove weirs • Habitat improvements (gravel riffle installation, woody material etc)	53.844618, -8.898388	1

Photo	Observation	Recommendation	Lat/Long	Priority
GI 051	Straight, uniform channel	1. Investigate restoration potential 2. Riffle installation would be beneficial 3. At least install more structure/woody material	53.851462, -8.927617	2
GI 060	Drinking bay/fine sediment input and livestock access into the watercourse (LB)	Exclude livestock and provide alternative water source	53.854466, -8.933487	1
GI 061	Straight, uniform channel	1. Investigate restoration potential 2. Riffle installation would be beneficial 3. At least install more structure	53.856677, -8.934283	1
GI 066	Uniform channel with livestock access (RB)	Buffer fencing and alternative water source	53.855282, -8.9523	2
GI 071	Straightened, uniform channel	1. Investigate restoration potential 2. Remove weir 3. Riffle installation would be beneficial 4. At least install more woody material/structure	53.855377, -8.952435	1
GI 072	Straightened, uniform channel	1. Investigate full channel restoration potential 2. Weir removal 3. Riffle installation would be beneficial 4. At least install more woody material/structure	53.860299, -8.966197	1
GI 089	Large number of weirs	• Remove weirs to reinstate free fish movement and reduce the potential for sediment to become bound by tufa • If only notching to bed level is possible, it should be done on alternating sides, to maximise flow sinuosity	53.86989, -8.985915	1
GI(T1) 004	Dredged, uniform channels	Potential to reinstate habitat through bed raising or riffle installation	53.800245, -8.744338	3

Photo	Observation	Recommendation	Lat/Long	Priority
Gw 015	Continued weirs	Remove to reduce the potential of substrate consolidation by tufa	53.872012, -8.991125	1
Gw 029	Access track/surface runoff (LB)	Reduce use of vehicular access	53.874827, -8.993235	3
Gw 030	Drinking bay/fine sediment input (RB)	Alter fence line to exclude livestock and provide alternative water source	53.874828, -8.993243	2
Gw 034	Drinking bay/fine sediment input (LB)	Exclude livestock and provide alternative water source	53.876387, -8.994587	2
Gw 038	Unfenced (LB), over-wide channel	• Install buffer fencing • Undertake tree planting • Install in-channel structures/material	53.87696, -8.995015	1
Gw 061	Drinking bay/fine sediment input (LB)	Exclude livestock and provide alternative water source	53.881442, -9.00089	2
Gw 069	Drinking bay/fine sediment input (LB)	Exclude livestock and provide alternative water source	53.882535, -9.002925	2
Gw 074	Livestock access (LB)	Exclude livestock and provide alternative water source	53.88313, -9.004902	2
Gw 081	Drinking bay/fine sediment input (LB)	Exclude livestock and provide alternative water source	53.884068, -9.007188	2
Gw 082	Drinking bay/fine sediment input (RB)	Exclude livestock and provide alternative water source	53.88415, -9.007507	2
Gw 086	Livestock access (RB)	Exclude livestock and provide alternative water source	53.884665, -9.008967	2
Gw 125	Livestock access (RB)	Exclude livestock and provide alternative water source	53.89642, -9.01836	2
Gw 126	Drinking bay/nutrient input (RB)	Exclude livestock and provide alternative water source	53.897113, -9.019465	2
Gw 142	Drinking bay/nutrient input (LB)	Exclude livestock and provide alternative water source	53.904398, -9.023517	1
Gw 144	Livestock access (RB)	Exclude livestock and provide alternative water source	53.904545, -9.023667	2
Gw 145	Livestock access (RB)	Exclude livestock and provide alternative water source	53.904588, -9.023648	2

Photo	Observation	Recommendation	Lat/Long	Priority
Gw 148	Livestock access (RB)	Exclude livestock and provide alternative water source	53.905565, -9.023078	2
Gw 156	Livestock access (LB)	Exclude livestock and provide alternative water	53.906933, -9.021245	2
Gw 160	Drinking bay/nutrient input (LB)	Exclude livestock and provide alternative water source	53.90941, -9.02183	2
Gw 178	Drinking bay/nutrient input (RB)	Exclude livestock and provide alternative water source	53.914165, -9.031747	2
Gw 180	Drinking bay/nutrient input (RB)	Exclude livestock and provide alternative water source	53.914493, -9.033745	2
Gw 192	Artificial groynes	Remove groyne to facilitate more natural recovery	53.91717, -9.037095	2
Gw 195	Drinking bay/nutrient input (LB)	Exclude livestock and provide alternative water source	53.917498, -9.038495	2
Gw 203	Livestock access (LB)	Exclude livestock and provide alternative water source	53.919413, -9.046042	2
Gw 244	Livestock access (LB)	Exclude livestock and provide alternative water source	53.927367, -9.062973	2
Gw 294	Willow collapsing into the channel	Retain such valuable habitat features	53.929942, -9.073555	1
Gw(T1) 005	Lack of woody material in channel	Install woody material	53.887487, -9.033818	3
Gw(T1) 008	Lack of woody material in channel	Install woody material	53.898557, -9.022697	2
Gw(T2) 004	Highly degraded channel	Restoration/re-meandering low priority owing to cost-benefit	53.908543, -9.034637	3
Gw(T3) 001	Highly degraded channel	Restoration/re-meandering low priority owing to cost-benefit	53.916402, -9.054425	3
Gw(T3) 002	Shallow water over smooth concrete created an obstruction	Install baffles to slow flow and increase depth	53.916445, -9.054422	3
Tr 004	Uniform, realigned channel	Investigate potential for channel restoration (particularly lower value LB land)	U/s and d/s of 53.863782, -8.796017	2
Tr 008	Uniform, realigned channel	Investigate potential for channel restoration (particularly lower value LB land)	53.865933, -8.809827	2
Tr 010	Uniform, realigned channel	Investigate potential for channel restoration (particularly lower value LB land)	53.87095, -8.846848	2

Photo	Observation	Recommendation	Lat/Long	Priority
Tr 015	Polluting/high-nutrient discharge	Investigate the source and seek improvement to water quality	53.870595, -8.849042	1
Tr 016	Groynes	Adjustment to improve flow characteristics	53.870488, -8.849417	3
Tr 028	Uniform, realigned channel	• Investigate potential for channel restoration • Undertake tree planting	53.864027, -8.871305	2
Tr 036	Unenclosed trap	Cover the trap to improve efficacy Restrict the entrance to prevent otters being trapped	53.865812, -8.886607	1
Tr 037	Boulder weir	Remove	53.865813, -8.88662	2
Tr 041	Drinking bay/nutrient input (RB)	• Exclude livestock and provide alternative water source • Install fish easement	53.866442, -8.891247	2
Tr 046	Uniform, realigned channel	Investigate potential for channel restoration Install cobble and gravel riffles	U/s and d/s of 53.870838, -8.908473	1
Tr 052	Uniform, realigned channel	Investigate potential for channel restoration Install cobble and gravel riffles	U/s and d/s of 53.86442, -8.924645	1
Tr 055	Uniform, realigned channel	Investigate potential for channel restoration	Particularly u/s but also d/s of 53.874825, -8.95656	1
Tr 065	Uniform, realigned channel	Investigate potential for channel restoration Tree hinging into the channel	53.88847, -8.979288	1
Tr 072	Uniform, realigned channel	Investigate potential for channel restoration	53.904217, -8.998083	1

Carroward River (Ca)

Figure 275: Ca 001 (53.904818, -9.064223). U/s of the N5 road, the Carroward River was significantly straightened but appeared to be buffered and the abundant coarse sediment provided potential salmonid spawning alongside reasonable juvenile habitat.

Figure 276: Ca 002. The abundance of mobile, coarse substrate observed in places means that this watercourse can more readily adapt to the past channel degradation and provides areas of improved spawning habitat in contrast to many other tributaries inspected. However, the dimensions of the straightened channel are not conducive to the maintenance of optimal pool and gravel riffle.

Figure 277: Ca 003. Despite being a large structure, the N5 road culvert was appropriately sunken and passable, with a somewhat natural bed.

Figure 278: Ca 009 (53.909758, -9.066288). By the next spot-check, turbidity had significantly increased, suggesting a notable issue/input (53.904957, -9.063948 & 53.909758, -9.066288), where further investigation would be worthwhile. The raised footings of the bridge/culvert created an obstruction to fish passage in most flows.

Figure 279: Ca 015 (53.914232, -9.066365). By the next road crossing d/s, there was an obvious impact of fine sediment deposition and algal growth upon the substrate.

Figure 280: Ca 017 (53.914252, -9.066257). D/s of the crossing, livestock had access to the watercourse, leading to poaching.

Figure 281: Ca 023. At bends in the river, where more natural coarse sediment retention was facilitated, gravel bars suitable for salmonid spawning were present. Also note the fine sediment reducing substrate habitat quality.

Figure 282: Ca 025 (53.929545, -9.082583). The furthest d/s road crossing was passable by fish, meaning that the only obstruction observed was at the u/s most R321 road crossing.

Carroward Tributary 1 (C(T1))

Figure 283: Ca(T1) 001 (53.91763, -9.076283). Low flow in the first tributary inspected reduced its value for fish, particularly low summer flow, but the natural coarse substrate it supplies to the system will contribute to habitat d/s.

Figure 284: Ca(T1) 002. The tributary was accessible by fish, so spawning could occur there and some utilisation as a juvenile nursery area is possible.

Figure 285: Ca(T1) 003. The overgrown vegetation offered a good balance of light and shade, and it may be capable of supporting trout in the deeper areas.

Carroward Tributary 2 (Ca(T2)

Figure 286: Ca(T2) 001 (53.921173, -9.082703). The second Carroward tributary was similarly small, but with less coarse substrate visible.

Figure 287: Ca(T2) 002. Accessibility for fish was not good owing to a pipe culvert with shallow water.

Figure 288: Ca(T2) 003. In the more natural sections, the tributary may have potential to support low densities of juvenile trout, particularly early in the year when flows are elevated. The riparian habitat was relatively good, and the watercourse appeared to be reasonably well protected from fine sediment inputs.

Photo	Observation	Recommendation	Lat/Long	Priority
Ca 001	Uniform, realigned channel	Investigate potential for channel restoration	53.904818, -9.064223	2
Ca 009	Increased turbidity and raised bridge footings	Investigate water quality between (53.904957, -9.063948 & 53.909758, -9.066288) Install fish easement (ideally small rock ramp d/s)	53.909758, -9.066288	2
Ca 017	Drinking bay (RB)	Exclude livestock and provide alternative water source	53.914252, -9.066257	2

Oughtagh River (Ou)

Figure 289: Ou 001 (53.935622, -9.105347). At the first spot-check, the Oughtagh River was uniform and over-capacity, with emergent vegetation encroaching into the channel. While this is a symptom of the issues, the channel narrowing was accelerating flow velocities and the watercourse would be expected to hold some juvenile trout.

Figure 290: Ou 004 (53.935812, -9.105405). Where visible, the substrate was coarse, but with a similar gravel component to the Carroward (as it should), it could provide salmonid spawning and juvenile habitat.

Figure 291: Ou 005. The Oughtagh appeared to be reasonably well buffered, with at least some riparian strip and vegetation, but even in the lower reaches it was a small watercourse.

Photo	Observation	Recommendation	Lat/Long	Priority
Ou 001	Uniform, realigned channel	Investigate potential for channel restoration. N.B. low priority owing to minimal cost-benefit in comparison to larger watercourses.	Entire catchment, particularly immediately u/s and d/s of 53.935622, -9.105347	3

Strade River (St),

Strade River Tributaries (St(T)),

Little Strade (LiSt)

&

Little Strade Tributaries (LiSt(T))

Figure 292: St 002 (53.873292, -9.119395). At the first spot-check, the Strade was small but protected by woodland u/s and supported valuable coarse substrate. When flows are elevated, sea trout often spawn in minor tributaries, from which fry disperse d/s as water levels reduce through the spring/summer. Similarly, juvenile salmonids may also disperse up tributaries.

Figure 293: St 005 (53.890502, -9.131433). By the second site, where the watercourse was straightened alongside the N5 road, it had gained flow and juvenile salmonids were observed in the vicinity.

Figure 294: St 009 (53.891185, -9.132725), Livestock were gaining access from the LB, via a drinking bay.

Figure 295: St 012 (53.891553, -9.133018). Livestock had access to both banks d/s of the N5 road, via a drinking bay/fording point. Keeping livestock away from the watercourse and providing alternative watering would be beneficial.

Figure 296: St 013. The river was buffer fenced u/s of the Old Road bridge and habitat appeared capable of supporting juvenile salmonids, although the channel was straightened and substrate was coarse and poorly sorted, with and increased algal covering. Livestock access at one or two drinking bays/crossings u/s could cause this enrichment on such a small watercourse.

Figure 297: St 016 (53.893105, -9.132817). D/s of the Old Road, the river remained straightened and lacked buffer fencing, but the banks appeared to be reasonably well vegetated, apart from at crossing points. Fencing would be beneficial and restoration could be a possibility within the unimproved grassland.

Figure 298: St 018 (53.915868, -9.132168). Significant poaching and fine sediment input were occurring at the L17141 road crossing. A long section u/s was inaccessible, in which water from the larger Little Strade River had bolstered the flow. Aerial photography shows past river channels in wet ground around 53.9025143, -9.1307923 may offer potential for restoration.

Figure 299: St 024 (53.921438, -9.130137). With the additional flow, the river was capable of supporting good numbers of salmonids, although the river was clearly at a low summer level. It is likely that fish from u/s (or d/s) had moved into deeper pools like this, where >20 juvenile salmonids were observed - showing the river's importance and potential.

Figure 300: St 025. Areas of unconsolidated gravel bed suggests that scouring and active sediment transport occurs at higher flows; an important factor in keeping gravels free from fine sediment and maintaining habitat quality.

Figure 301: St 030. D/s of the N58, the substrate was largely coarse cobble and boulder (likely owing to significant straightening and steepening d/s), with fewer opportunities for spawning, but pool and riffle habitat suitable for adult trout, parr and fry was available.

Figure 302: St 035 (53.92857, -9.12446). Habitat remained similar around the u/s most of L1715 road crossings, with a predominance of cobble and boulder, with pools holding good numbers of older juvenile salmonids. The lack of gravel retention could be at least partially addressed by increasing structure like woody material within the channel or full restoration.

Figure 303: St 036 (53.936575, -9.120133). Around the d/s L1517 crossing, the channel was incredibly straight, uniform and lacking diversity. The entire lower ~800m of the Strade was straightened, degrading prime lower tributary salmon spawning areas. Paleo channels in the wet, LB fields (visible on aerial photography) offer opportunities for channel restoration.

	
Figure 304: St 039. The lower reaches of the channel were reasonably accessible for fish, with the road culverts set at an acceptable level and retaining natural substrate; however, an extended shallow section (without pools or resting areas) had resulted from the channel realignment, straightening an increased gradient. This is likely to create some behavioural barrier in lower flows.	*Figure 305: St 042 (53.937713, -9.120028). A clear impact of livestock at a drinking bay. While this is towards the lower end of the Strade River, the negative impact from fine sediment input will still affect the main river Moy.*

Strade Tributary 1 (St(T1))

	
Figure 306: St(T1) 002 (53.92984, -9.117228). U/s and immediately d/s of the N58 road, this small RB tributary of the Strade was straightened and uniform, with minimal flow diversity and emergent vegetation encroaching into the channel. There were also signs of excess algal growth on the bed.	*Figure 307: St(T1) 006 (53.929953, -9.11738). At a second road crossing, just d/s of the N58, increased gradient and the presence of coarse substrate provided improved juvenile salmonid habitat. Further d/s the channel was significantly straightened. Both road crossing points appeared to be reasonably passable in higher flow.*

Figure 308: St(T1)7 (53.935737, -9.118042). Excess algal growth was regularly observed in slower flowing areas suggesting nutrient enrichment of the tributary.

Figure 309: St(T1)10 (53.935777, -9.118007). The L715 road crossing was passable but shallow water and a step posed a small obstruction to fish passage.

Strade Tributary 2 (St(T2))

Figure 310: St(T2) 001 (53.934632, -9.125823). Only seen from one point on the L1715 road, the second tributary appeared to be little more than a weed-choked, straightened ditch draining Lough Cat, but it was largely buffer fenced.

Figure 311: St(T2) 002. D/s of the road, the channel was weed-choked and barely discernible.

	
Figure 312: LiSt 003 (53.851408, -9.100147). The little Strade appeared larger than the Strade on maps, comprising two reasonably large, branched tributaries. Even at the furthest u/s point inspected around an area of forestry, it appeared capable of supporting juvenile salmonids.	*Figure 313: LiSt 004 (53.864535, -9.101107). At the second spot-check (L1713 road crossing), deposition at the wider channel cross section demonstrated the availability of gravel substrate and the river's potential as a spawning tributary.*
	
Figure 314: LiSt 008 (53.874942, -9.102335). Overwide channel at the next spot-check further demonstrating the habitat and spawning potential of this river if the channel could be returned to a more naturally variable width. The substrate was still likely to support salmonid spawning.	*Figure 315: LiSt 009 (53.875122, -9.102458). The significant size of the bridge may suggest that the watercourse supported greater flow before extensive drainage of the catchment and may still do during wetter months of the year.*

	
Figure 316: LiSt 012 (53.892647, -9.110872). Japanese knotweed was observed on the banks of the river, at a particularly straight section of channel along the N5 road. This highly invasive non-native species should be treated with herbicide by a licensed operative to prevent it spreading.	*Figure 317: LiSt 017 (53.892908, -9.110955). Recent work at the N5 bridge footings may afford some fish passage but could have been fish friendlier if the rock armouring had simply been finished to the height above that of the footings. Access was not possible d/s, but increased sinuosity in the lower reaches may offer improved habitat quality worthy of further investigation.*

Little Strade Tributary 1 (List(T1))

	
Figure 318: LiSt(T1) 002 (53.852845, -9.094737). At the u/s spot-check, the first Little Strade tributary was little more than a trickle.	*Figure 319: LiSt(T1) 003. Even in higher flow, fish access further u/s would be inhibited by infrastructure associated with e road crossing, but the habitat d/s appeared to have potential for juvenile salmonids, particularly in higher flow months.*

Little Strade Tributary 2 (List(T2))

<table>
<tr><td></td><td></td></tr>
<tr><td>Figure 320: LiSt(T2) 001 (53.863023, -9.091295). At the u/s point inspected, this tributary was straightened, very overgrown and overshaded, but was therefore reasonably protected by the bankside vegetation.</td><td>Figure 321: LiSt(T2) 004. Although the flow was minimal, the substrate was coarse and relatively free from fine sediment, suggesting much higher flows at other times.</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Figure 322: LiSt(T2) 0005 (53.871932, -9.09791). Much of the adjacent land through the middle reaches (poorly accessible by road) appeared to be improved grazing, where areas of wet ground, boundaries on maps and aerial photography suggest significant straightening of the watercourse had occurred.</td><td>Figure 323: LiSt(T2) 007 (53.874682, -9.100033). At the furthest d/s spot-check, discolouration of the water and excess algal growth strongly suggested enrichment issues (and likely livestock access to the watercourse) on what could be a spawning tributary.</td></tr>
</table>

Photo	Observation	Recommendation	Lat/Long	Priority
St 009	Drinking bay (RB)	Exclude livestock and provide alternative water source	53.891185, -9.132725	2
St 012	Livestock access	Exclude livestock and provide alternative water source	53.891553, -9.133018	2
St 013	Uniform, realigned channel	Investigate potential for channel restoration. N.B. low priority owing to minimal cost-benefit in comparison to larger watercourses.	53.893103, -9.13288	2-3
St 016	Uniform, realigned channel	Investigate potential for channel restoration. N.B. low priority owing to minimal cost-benefit in comparison to larger watercourses.	53.893105, -9.132817	2-3
St 018	Drinking bay (RB)	• Exclude livestock and provide alternative water • Investigate restoration options	53.915868, -9.132168 53.902514, -9.130792	1
St 035	Uniform, realigned channel	Investigate potential for channel restoration	53.92857, -9.12446	2
St 036	Uniform, realigned channel	Investigate potential for channel restoration. N.B. Low grade, wet ground in the 800m u/s of this point appeared to offer significant potential for channel restoration in a high priority area.	53.936575, -9.120133	1
St 042	Drinking bay (LB)	Exclude livestock and provide alternative water	53.937713, -9.120028	2
St(T1) 002	Excess algal growth/enrichment	Investigate sources	u/s of 53.92984, -9.117228	2
St(T1) 006	Uniform, realigned channel	Investigate potential for channel restoration. N.B. medium to low priority owing to minimal cost-benefit in comparison to larger watercourses	U/s and d/s of 53.929953, -9.11738	3
St(T1)10	Perched bridge footings and shallow water	Install easement. N.B. Low priority owing to small size of the watercourse.	53.935777, -9.118007	3
LiSt 012	Japanese knotweed	Report to landowner Treat with herbicide	53.892647, -9.110872	1

Photo	**Observation**	**Recommendation**	**Lat/Long**	**Priority**
LiSt 017	Missed opportunity for freely passable bridge footings Sinuous channel in lower reaches of the river	• Ensure expert fish passage advice is sought for all in-channel structures • Install further easement to footings • Undertake further investigation to ascertain potential for habitat enhancement	53.892908, -9.110955 and d/s	2
LiSt(T2) 005	Uniform, realigned channel	Investigate potential for channel restoration. N.B. medium to low priority owing to minimal cost-benefit in comparison to larger watercourses	53.871932, -9.09791	2
LiSt(T2) 007	Excess algal growth/enrichment	Investigate sources	53.874682, -9.100033	2