Advisory Visit

River Irt

28/10/2015

1.0 Introduction

This report is the output of a site visit to the Gosforth Anglers' waters on the River Irt, in West Cumbria, at the request of Chris West of West Cumbria Rivers Trust (WCRT) and Dave Mason of Gosforth Anglers. The purpose of the visit was to assess habitat on the river and make recommendations on how it could be improved for the benefit of the native trout and sea trout (*Salmo trutta*), and salmon (*Salmo salar*) stocks.

Normal convention is applied with respect to bank identification, i.e. banks are designated left bank (LB) or right bank (RB) whilst looking downstream. Upstream and downstream references are often abbreviated to u/s and d/s, respectively. The Ordnance Survey National Grid Reference system is used for identifying locations. This report covers observations made on the day of the visit and discusses options for future fish stock and riparian management.

Table 1. Overview of the waterbody details for the sections of river visited

	Waterbody details Upper Section	**Waterbody details Lower Section**
River	Irt	Irt
Waterbody Name	Irt (u/s Bleng confluence)	Irt (d/s Bleng confluence)
Waterbody ID	GB112074070100	GB112074070070
Management Catchment	South West Lakes	South West Lakes
River Basin District	North West	North West
Current Ecological Quality	**'Moderate'** – although 'Good' or 'High' for 'Biological quality elements'. 'Hydromorphological supporting elements' 'not-high'	**'Good'** – all aspects being 'good' or 'high' except 'Hydromorphological supporting elements'
U/S Grid Ref of reach inspected	NY 11169 04296	NY 10481 02543
D/S Grid Ref of reach inspected	NY 10291 03722	NY 11052 01938
Length of river inspected (km)	1.1	1.1

(http://environment.data.gov.uk/catchment-planning/WaterBody/GB112074070100)

Under the Water Framework Directive (WFD) classification the biological parameters assessed on for both waterbodies have been scored as ‘good’ or ‘high’, with ‘fish’ improving from ‘Moderate to ‘Good’ between the 2009 and 2014 classification in the lower waterbody. The upper waterbody ‘Irt u/s Bleng’ fails for ‘Lead and its compounds’ and is ‘Moderate’ for ‘Supporting elements (Surface Water)'; the ‘Hydrological Regime’ ‘Does-not-support-good’.

2.0 Catchment / Fishery Overview

The River Irt originates on the Western edge of the Lake District Mountains, in the Cumbria Fells and Dales Natural Area.

“*This is the most rugged and mountainous part of the Natural Area and is situated in the central and northern part of the Lake District. The rocks of the Borrowdale Volcanics and the Skiddaw Slates have been sculpted and shaped by the last glaciation into a landscape of U-shaped valleys, steep-sided mountains, corries and tarns. The area supports a rich variety of upland habitats both above and below the limit of tree growth.*

The highest mountain summits support some of the only remnants of montane moss and lichen heaths found in England. Below these areas are cliffs, screes and rocky habitats; where these are inaccessible to grazing sheep they are some of the least modified habitats in the area. Springs and flushes can also emerge here and they support diverse arctic-alpine plant communities. Gills link the two zones above and below the treeline.

The lower slopes of the open fell support heather moors, acidic grasslands with areas of bracken and blanket bogs. These vegetation communities have been strongly influenced by grazing stock. High altitude woodland is scarce but valley and slope woodlands are more common especially in Borrowdale, Ennerdale, Longsleddale and north of Ambleside. Stands of juniper occur throughout the area. The major lakes are dominant features in the landscape and there are numerous smaller tarns” (www.naturalareas.naturalengland.org.uk).

Bedrock within the catchment is, predominantly, insoluble igneous rock types which impart few chemical compounds to the water. Correspondingly, the river is relatively low-nutrient and has little pH buffering capacity. Wast Water, in the upper catchment, naturally provides attenuation of peak-flows, reducing the ‘spateyness’ of the river and the abstraction from Wast Water further regulates river levels giving the Irt a mid-lowland appearance in many areas of its lower reaches. However, straightening and dredging has greatly increased the gradient in some areas, altering the river's appearance and nature. Despite human interference, the River Irt remains an important river for salmon, sea trout and brown trout and freshwater pearl mussels (*Margaritifera margaritifera*), among other species.

3.0 Habitat Assessment

3.1 D/s of Crag House Bridge

The first section walked was on the lower beat, from Crag House Bridge, d/s to the lower limit at Santon Bridge Weir. The pool below the bridge provides good deep fish-holding water, where channel restriction caused by the bridge accelerates flows (Fig. 1); however, the associated back-eddying, in conjunction with grazing of the banks, has allowed lateral erosion, with the pool becoming wider and shallower in areas over time.

Grazing is detrimental to river bank stability; physical damage is caused by trampling and poaching and grazing itself reduces the foliage cover that ordinarily provides protection. Reduced root structures within the banks occur as the vegetation is primarily restricted to grasses, which can withstand grazing as they can continually re-grow rapidly from their base, unlike many plants.

Where allowed to establish, saplings and herbaceous vegetation, combined with grasses, provide much deeper and wider-ranging root structures than grass alone. The prevention of natural tree regeneration by grazing also means that, as trees are washed out through bank erosion or die through old-age, they are not replaced. Much of the LB in this section is now fenced, with beneficial marginal vegetation becoming established. WCRT plan to undertake further buffer fencing along the RB.

Bankside trees and vegetation along river margins provide vital cover and shade from low and trailing branches, as well as complex structure within the channel from those branches and tree root systems. Fallen trees and low or trailing branches should be retained wherever possible (Figs. 2 & 3). They greatly increase the fish holding capacity of an area, and although making some places more difficult to fish, they improve the overall quality of angling on the river by increasing the number of fish it can produce and hold. Pruning low branches, as shown in Fig. 4, should be avoided.

Figure 1. A good fish-holding area where water is accelerated through the bridge and scours/maintains the pool d/s. Historic grazing of the banks has allowed lateral erosion, leading to over-widening of the pool.

Figure 2. High quality trailing branch cover, provided by a slumped alder tree (red oval), that greatly increases the fish-holding capacity of that area of the pool. This type of structure should be retained and, wherever possible, promoted. It is important to avoid the temptation to trim or prune such structures.

Figure 3. The head of the bridge pool where low-hanging sycamore branches enhance the habitat quality and increase the fish holding capacity. While such features may restrict access from one bank they provide excellent features to fish towards from the other bank.

Figure 4. All of the low branches of the alder trees have been pruned, leaving a very open area with reduced fish-holding potential (red circle). With the low branches still attached, this area would have been a likely resting spot for both resident and migratory fish. It is now very open and exposed and of much lower habitat quality.

The island d/s shows how a river with an active geomorphology will adjust its features and dimensions to the flows it receives, scouring the bed in areas of accelerated flows and depositing materials in lower energy areas, possibly where the channel is over-capacity as a result of the historic dredging (Fig. 5). The geomorphology of a river thereby ensures that is always adapting towards appropriate dimensions (except where grazing/accelerated erosion disrupts the process). In this instance, the narrowing created by the island serves to pinch the flows either side, greatly improving the flows in the RB channel that scour the bed and naturally maintain the depth. In this location, woody material in the channel also provides cover and lies for fish where they can evade predators.

Fallen trees and trailing branches are relatively penetrable structures for fish, which can swim quickly through them, while many of their predators (cormorants, goosanders, otters, etc.) are obstructed. This allows fish to put more distance between them and their predators, increasing their chances of escape and making life harder for the predators. Reducing the efficiency of predators in this way is an effective means of naturally regulating their impact upon fish stocks.

Figure 5. The island represents a depositional feature that occurs when the channel is overly wide for the flows it receives and the reduced flow energy results in beneficial deposition; this narrows the channel and provides increased flow energy in the resulting channels at either side. Woody material in the channel also greatly increases the fish holding potential with cover and structure in which they can evade predators.

Historic dredging u/s may have also contributed to the bank erosion issues being experienced d/s (Fig. 6), by interrupting the sediment supply, lowering of the river bed and destabilisation of the bank. Once destabilised, a river bank can take time to re-establish a more stable structure and gradient. Willow trees on top of the bank provide some stability through their roots but this area would greatly benefit from willow planting (and laying) along the water line and bank face. As well as stabilising the bank to reduce erosion rates, the willow will provide valuable cover that will improve the number of fish that reside along that bank and create a great fishing feature. In this instance, it may be the angling club on the RB (not in Gosforth Anglers' control), but the increased bank stability will benefit Gosforth Anglers, as will the generally improved habitat of the area.

It should be remembered that, although in-channel structure and trailing branches increase the risk of losing some fishing tackle and the occasional fish, the increased number of fish present (often in locations that would hold not hold fish otherwise) make the cover a significant benefit to the fishery and angling prospects. As interventions are likely to be required on both banks, it is recommended that an agreement is made with the adjacent angling club to accept that the benefits will even out over the reach.

Figure 6. Eroding bank (probably exacerbated by the dredging u/s) that could be reduced by willow planting along the bank face. The willow would also greatly enhance angling prospects in that area by increasing the number of fish that hold there.

Approximately 50m d/s, a good example of the give-and-take principle exists, where a deep channel is forming along the RB, facilitated by the presence of willow trees (Fig. 7). This area requires additional tree planting and, possibly, laying along the adjacent club's bank to prevent further erosion and loss of their land but will maintain the quality of the pool that can be fished from Gosforth Anglers' bank.

Figure 7. Tree planting and laying (to recreate the structure and bank protection provided by the fallen willow) on the adjacent angling club's bank would reduce their erosion issues but benefit the fishing on Gosforth Anglers' water. This demonstrates how the angling potential lost on one bank is soon compensated by enhancements in other areas.

Opposite, the steep bank and lack of trees/root structure on Gosforth Anglers' bank is leading to accelerated erosion. This could be addressed by installing a living willow brash toe and / or mattress along the bank face. The technique creates roughness along the bank that slows flow and reduces the erosive energy. The structure could be easily tied in to the willow tree at the d/s end, which could itself be laid into the channel to enhance habitat.

However, it should be considered that the erosion is developing more sinuosity to the channel and it may be beneficial to allow it to develop into a pool. The over-capacity pools immediately d/s will trap much of the sediment originating from the erosion, with higher flows in other areas d/s keeping the finer material mobilised and limiting its impact. A compromise could be simply to plant trees, well back from the present bank line, as a back-stop that limits the extent of erosion.

Figure 8. Long section of bank erosion that threatens the Gosforth Anglers' bank. Soft engineering/brash revetment could be employed to stabilise this section. The willow tree (right of shot) provides a good tie-in point for the revetment at the d/s end and could be laid into the water to improve the habitat there.

Fallen trees a short distance d/s that have been trimmed and dragged into the RB provide a good example of how to manage fallen trees, minimising the intervention required while optimising the habitat gains (Fig. 9). The structure these trees now provide within the channel is high quality habitat for fish and invertebrates and provides protection to the RB bank by slowing the flow. Willows on the LB opposite the structure could also be laid into the channel to increase the in-channel cover and habitat quality.

Figure 9. Fallen trees (red circle) that have been dragged into the RB to provide bank protection that enhances in-channel habitat. Willows opposite could be laid into the channel to enhance LB habitat.

The benefits of providing a buffer strip along the LB can be seen in many areas by the increased vegetation diversity and small, self-set saplings that are beginning to colonise, in addition to formally planted ones (Fig. 10). From a fish holding perspective, further benefit could be gained by planting shrub willow whips (*Salix caprea*, *S. cinerea* or any other small local species) along the water line and training them/laying them over and into the channel as they grow. In the particularly long, straight and featureless section immediately d/s (Fig. 11), the use of faster-growing crack willow (*Salix fragilis*) that will attain a large size, rapidly and then collapse into the river would be greatly beneficial to naturally increase structure habitat diversity over time.

Providing in-channel structures will increase its output of smolts to sea and the overall number of fish the river can support, while also increasing the residence time of migratory fish during their u/s migration by providing more inviting resting areas. Spreading these fish out though the system will reduce the stress that they incur. Predation, stress levels and susceptibility to disease all increase when fish reside in close proximity to one another. Spreading the fish out over a greater length of the fishery will also mean that more of the river is productive for angling.

Figure 10. The near (RB) is protected by being at the edge of a wood and the LB is protected by a buffer strip. Both have healthy bankside vegetation but could benefit from additional shrubs/willow whips (red) to increase fish-holding capacity.

Figure 11. A long, straight, uniform pool that is lacking in-channel structure. Planting crack willow here that will eventually grow and fall into the channel would help to increase the fish holding capacity and enhance angling prospects.

Where grazing resumes on the LB, it returns to a near monoculture of grasses (with only mature trees) and the associated bank-loss and erosion bays between the alder roots leaves the trees greatly exposed (Fig. 12). In some cases the erosion bays between trees are so great that they are left protruding into the channel where they are even more susceptible to erosion and loss. If fencing can be undertaken to reduce bank erosion rates (and protect tree re-growth), some of the precarious trees could be beneficially coppiced to reduce the leverage they are exerting on the bank, and the bank loss could be greatly reduced.

Figure 12. Ordinarily it would be recommended that only 1 in every 3 or 4 alder trees, or branches of a tree, are coppiced, to maintain habitat diversity. However, if fencing is installed to protect any regrowth, it may be beneficial to coppice all of the precarious alders along this section in the hope that they can be retained.

At the d/s end of the over-capacity channel section, remnants of past bank protection is evident and could form a useful anchor point for living willow tree kickers to be installed (Fig. 13). Cutting large willow branches from areas where they are numerous, and provide limited habitat benefit, and securing them between/alongside the existing posts should allow them to stay in place for long enough to become rooted. Backfilling any remaining gaps behind the posts with living willow and securing it all in place would also provide increased protection for that area of the bank once they start to grow.

Figure 13. The remnants of past bank protection could be used as a handy anchor point for securing living willow that would protect the bank and enhance habitat.

The section d/s, to the weir is very straight (probably also straightened) and relatively shallow. This provides some good juvenile trout and, in particular, salmon habitat, but is likely to be more of running area than holding water for most larger fish (Fig. 14). With this in mind, encouraging a few more trees to grow out over, and ideally into the water would be beneficial, to provide shade, structure in which to evade predators and resting areas as they migrate through the section. Increasing resting areas will, again, potentially increase the residence time of fish within the length and, therefore, improve the angling prospects of the reach.

The weir at the d/s end of the section provides a small barrier to fish movement, one that u/s migrating fish may not ascend in low water conditions (Fig. 15). It is also likely to delay d/s migration of smolts and effectively forms a corral type structure that predators can trap fish against, greatly increasing the risk of predation. The weir also acts as a sediment trap (as all weirs do) interrupting the natural transport of coarse sediment, denuding the channel d/s of material and continually shallowing the pool u/s. With all of this in mind, the ideal situation would be to remove the weir, or at least a proportion of it ($^{1}/_{4}$– $^{1}/_{3}$ of its length), down to bed level. Increased structure (trailing branches, etc.) within the channel u/s will provide higher quality habitat than that which is lost by removing the weir.

Figure 14. The long, straight, relatively shallow section u/s of Santon Bridge Weir. The area provides some good quality juvenile salmonid habitat and fishing water, but it could be improved by providing a few more over-hanging/trailing branches that come further out into the channel to provide cover and structure and respite from the high velocity flows.

Figure 15. Santon Bridge Weir. A barrier to sediment transport and fish passage. At least the central $^{1}/_{3}$ of the weir should be removed to improve fish passage, reduce the potential for predation and reinstate natural sediment transport through the reach.

3.2 Gaterigghow Bridge, u/s, to Kick Beck

Much of the channel around Gaterigghow Bridge has been straightened, with obvious signs of the man-made channel apparent by the bunds of spoil that flank the river. These are now well-vegetated and tree-lined, indicating that the work was undertaken some years ago, but the negative impact remains in many areas, with the natural paleo-channels evident alongside. Continuous sections of relatively straight, fast-flowing riffle and rapids provide poor quality fish habitat (Fig. 16). The slower areas that do exist in these sections may support some juvenile salmonids but are generally pretty inhospitable. They also pose the challenge of extended exertion for fish trying to migrate u/s, be it on spawning migrations, for adult fish, or dispersal of juveniles trying to establish new territories.

The tree-lined nature of the channel is actually inhibiting natural recovery of the channel in many areas with roots serving as effective bank revetment and inhibiting the river from eroding laterally to reinstate a more natural channel course and in-channel features (as will occur naturally in the long-term, if allowed). As lateral erosion in many areas is likely to be unwelcome (e.g. around valuable fields and the bridge) the only habitat improvement feasible in this location is increasing the structure within the channel by laying trees and branches into the margins, to at least provide some slower water.

Figure 16. Relatively inhospitable habitat requiring extended periods of exertion to move u/s.

Some less sensitive areas, away from the bridge or grazing land, offer a realistic opportunity to allow the river to re-naturalise and develop much higher quality habitat. Figure 17 depicts one of two areas in particular, where lateral erosion is occurring and, if allowed to continue, could reinstate much needed sinuosity to the channel. It is understood that this area is owned by the National Trust and appears to be managed as a deciduous woodland, with a harvest recently having been undertaken. Although erosion of land is rarely an easy concept for land managers to accept, in this instance, it is recommended that it is allowed; especially if, as suspected, the wood on both sides of the river is owned by the Trust and therefore it would actually represent no net loss of land.

Figure 17. Significant erosion that is actually a very positive thing for the river and should, if at all possible, be allowed to continue.

Other areas u/s demonstrate how natural erosion and deposition are invaluable in creating fish holding water and restoring features along the once straightened channel. Combined with overhanging and trailing cover, this creates ideal holding water for both resident and migratory salmonids (Figs. 18 & 19). In addition, the variation in width and depth, sinuosity and structure within the channel provide reduced gradient and flow dissipation that allows deposition of smaller substrate (gravel) suitable for salmonid spawning (Fig. 20) – this material is simply too mobile through the straighter, steeper, faster flowing sections.

Figure 18. High quality cover on the far bank with deposition in the shallower water on the near bank naturally maintaining the channel width and depth at lower flows. The depositional areas also provide valuable substrate variation that benefits a range of invertebrates and lamprey, among other species.

Figure 19. The start of a bend where the channel is naturally reinstating its sinuosity. Trees along the far bank naturally control the erosion rate and force scoring flows towards the bed, developing a valuable fish-holding pool.

Figure 20. The reduced gradient and increased variation in channel width, resulting from a more sinuous channel and the dissipation of flow energy created by the pools and in-channel structure, allow valuable gravel and cobble substrate to be deposited, on which salmonids can spawn.

3.3 Gaterigghow Bridge, d/s, to the footbridge

D/s of the Bridge, the gradient decreases slightly but straightening of the channel remains a major impact. As with u/s, the river is constrained within a tree-lined channel of relatively uniform width and depth for long sections. The slight reduction in gradient has allowed some gravel and smaller cobble substrate to deposit (Fig. 21) but in most areas the high flow velocities limit the value of habitat for anything other than spawning. Even for spawning, the lack of cover and structure within the channel to provide resting areas and security mean that it is sub-optimal. In these areas, laying some of the bankside trees (particularly pliable species such as willows, hazel *Corylus avellana* and elm *Ulmus minor var. vulgaris*) into the channel to provide cover and flow dissipation would be beneficial (Fig. 22).

Figure 21. Slightly lower gradient d/s of the bridge provides improved habitat and some spawning potential, but the lack of cover and uniform channel dimensions remain an issue.

Figure 22. Laying some of the bankside trees into the channel would provide in-channel structure and enhance the habitat quality.

Where bends occur they naturally create pools, with the higher velocity flows on the outside of the bend scouring the bed and banks and often leading to a beneficial input of trees/woody material to the channel (Fig. 23). Again, in such sections where the river has been straightened, the erosion and loss of bank is of great benefit to the river habitat and should be allowed/encouraged wherever possible.

These pool areas will hold fish but are far less abundant and, often, not as deep as should naturally occur, due to the channel straightening. This means that some of the pools may not hold fish for as long as they would with improved cover. The lack of pools also means that fish have long sections of fast flowing water to ascend between resting areas, making life harder for them. Increasing structure within the straightened sections would, again, be of great benefit in easing the fish passage and improving habitat to a state that would support more juvenile or resident fish. Natural examples already exist in some areas, demonstrating the benefits of flow dissipation, improved resting areas for migratory fish, and better resident fish habitat (Fig. 24).

Figure 23. Bends provide increased depth and improved fish-holding water, and an input of woody material to the channel. Lateral erosion in these areas should be allowed wherever possible.

Figure 24. In-channel structure provides areas of flow dissipation (red circle) and slacker water (blue circle) where migratory fish can rest or resident fish can lie.

A bend in a lower gradient section further d/s, coupled with abundant overhanging cover, provides high quality habitat for resident and migratory fish (Figs. 25 & 26), and is representative of what the river might look like without the channel straightening. This was one of the few areas in which fish were observed during the visit to this upper section.

Erosion to the bank that effectively forms the boundary of the wood, before the start of pasture land is, again, beneficial to the development of habitat (Fig. 27). However, this is less likely to be acceptable to the landowner/tenant than allowing erosion within the confines of the block of woodland.

Towards the d/s limit of the section walked, a small tributary enters the river (NY103037) and provides ideal spawning habitat for smaller sea trout and resident trout, along with valuable juvenile habitat. Woody material within the channel further enhances this habitat by creating discrete areas of scour and deposition, naturally cleaning the gravel by sorting the substrate into different particle sizes (Fig. 27).

Figure 25. A lower gradient bend with abundant low/trailing cover provides high quality habitat and was one of the few area in which fish were observed.

Figure 26. Erosion to the bank at the edge of the woodland is beneficial from a habitat perspective, but may not be acceptable to the landowner/tenant.

Figure 27. Good quality spawning and juvenile habitat on the small tributary.

4.0 Recommendations

4.1 Fencing

Buffer fencing along a watercourse is one of the best ways to allow a healthy riparian zone to develop that will be of great benefit to the entire ecology of the river. WCRT are currently working on a project to protect and enhance river habitats for the freshwater pearl mussel, part of which involves increasing the extent of buffer fencing and stabilising the banks to reduce fine sediment input. It is strongly recommended that full support is given to the Trust on this matter as it will be of great benefit to the fish stocks and fishing on Gosforth Anglers' waters.

4.2 Tree management

4.2.1 Planting

Planting is recommended wherever there is a lack of low cover and structure along the river margins, or where erosion threatens bank stability. Increasing the numbers of most native deciduous species would be beneficial but willow is by far the easiest to transplant and manipulate. N.B. Planting is only likely to be worthwhile within fenced areas as planted shrubs will be readily eaten livestock.

The quickest and easiest way of planting is with willow, by pushing short sections of willow whip into the ground. This can be undertaken at any time of the year, but will have the greatest success if undertaken within the dormant season, shortly before spring growth begins (ideally late Jan-March). Whips should be planted into soft, wet earth/sediment so that there is a greater length within the ground than out of it, to minimise the distance that water has to be transported up the stem; 30-40cm of whip protruding from the ground is sufficient.

Prime locations for willow whip planting are those depicted in Figures 10 and 11. Anchoring cut branches along the posts of the now failed bank revetment (Fig. 13) would also be beneficial.

4.2.2 Laying

Where easily manipulated tree species are already established along the bank, habitat improvements can be easily achieved by laying the trunks, or selected branches down into the watercourse to increase low cover and in-channel structure. Ideal locations include those depicted in Figures 6, 7, 8, 9 & 22. Small to medium shrubs tend to work best, although quite large willow such as those in Figure 28 can be successfully laid.

The process involves cutting part way through the stem/trunk, a little at a time (like laying a hawthorn hedge), until it can be forced over into the channel (Figures 28 & 29). The depth of the cut should be limited to only that which is required to bend the limb over, as this will retain maximum strength in the hinge and maintain the health of the tree/shrub. Alternatively, on smaller shrubs cutting the stem/trunk at a very shallow angle and then putting an axe blade into the cut and hitting it with a hammer can also help the laying while retaining a good strong hinge.

Photograph 28. Hinged willow.

Photograph 29. Hinged hazel.

4.2.3 Pruning/coppicing

It is recommended that general pruning of bankside trees ceases wherever possible, to allow the development of beneficial low-level and trailing cover habitat that will increase fish-holding potential. Pruning should be limited to discrete areas where specific access is required with branches retained as features that can be fished towards, from other areas.

Where trees are present but the canopy is well above the water level due to past pruning (e.g. Fig. 4), coppicing could be undertaken to encourage low-level re-growth and rejuvenate the tree. The treatment should be undertaken sparingly, as tree canopies also provide habitat for many other species, create valuable shade over a watercourse and supply terrestrial invertebrates and leaf litter to supplement food webs in the river. An exception to this might be the trees on the RB (Fig. 12), the retention of which could be assisted by coppicing all of the precariously leaning trees to reduce the weight acting upon their root structure and hopefully prolong their life.

When undertaking coppicing, existing low cover should also be retained and care should be taken to ensure that work does not disturb bats or nesting birds, as this would constitute an offence under the Wildlife and Countryside Act 1981. In the area u/s of Santon weir (Fig. 14), the current programme of continual re-coppicing should be varied to allow some of the trees to develop into larger, fish-holding features, rather than maintaining them at a small size.

4.2.4 Woody material

It appears that, in the majority of cases, woody material that enters the river channel is being left in place and, as with low and trailing branches, it is highly recommended that the retention of such fish-holding features is continued. The presence of such structure within the channel provides valuable, natural habitat and enhances scouring and bed sorting, along with facilitating areas of natural deposition.

4.3 Geomorphology

Historic realignment of the River Irt has heavily impacted upon the channel morphology and the ideal solution would be to reinstate the natural, more sinuous river course and improved habitat. However, the cost involved with full channel restoration and the associated impact upon infrastructure and land use means it is likely to be infeasible in many areas, so enhancing the impacted channel in the ways suggested previously may be the only realistic option.

Exceptions to this may exist, particularly in areas like the woodland around Gaterigghow Bridge, particularly u/s, where the river is already eroding and developing a more sinuous course within the woodland. In this area, and wherever else it is possible to let the river naturally adjust, it is recommended that it is allowed to do so. The short-term impact of sediment resulting from the erosion will be far outweighed by the long-term habitat gains. The recommendation in this location is to enter into discussion with the landowner to try and develop a plan that facilitates this.

It is understood that the National Trust may be the owners of this land on both banks and, particularly if it is being managed by the Trust (rather than tenants), they may be amenable to allowing the natural river restoration to occur. Chris West (WCRT) may also be able to assist with these discussions or even, possibly, seek to incorporate the area into WCRT's river restoration strategy.

4.3.1 Barriers

The only man-made barrier encountered on the river was the weir u/s of Santon Bridge. While this is not a major barrier to fish passage it is still a barrier that is likely to delay fish migration and place them at increased risk of stress and predation. It also negatively impacts upon sediment transport and will be resulting in continual shallowing of the impounded pool reach u/s. For this reason it is strongly recommended that at least the middle $^1/_4$– $^1/_3$ is removed.

4.3.2 Bank protection

In areas where bank erosion is not likely to be acceptable or is resulting in excessive fine sediment input to the river, soft bank revetment techniques such as installing a brash toe (Fig. 30) and / or brash mattress (Fig. 31) may be beneficial to protect the bank and improve marginal habitat. This could be applied to the location depicted in Figure 8; however, a much less intensive and more natural solution could be to simply undertake tree planting well back from the current, eroding bank line. Those trees would then form the future, higher habitat quality bank line when the channel migrates to them. Over-capacity pools d/s of the erosion are likely to trap much of the eroded material and limit any negative impacts it may cause.

Figure 30. A volunteer on a Wild Trout Trust practical workshop installing a live willow brash bank toe protection.

Figure 31. Conifer brash mattress bank protection.

4.4 Fish stock management

Although under significant pressures in recent years and, potentially, in lower numbers than historically, the wild fish stocks on the river remain and enhancing the habitat upon which they rely will be the surest way to safeguard future fish stocks.

The native salmonid populations of Britain possess great genetic diversity, making them amazingly resilient to changing environmental conditions and able to adapt to a wide range of habitats. This has enabled them to thrive in our rivers since the last ice age. However, in the latter part of this period (last 50-100 years), human impact upon those fish populations has increased exponentially, with major issues arising from the way in which we manage riparian land (e.g. significant intensification of agriculture) and how we manage rivers (e.g. dredging to increase flood conveyance, and denuding vital habitat to reduce perceived flood risk or to ease angler access to rivers). All of these factors have a significant detrimental impact on the wild fish populations that rivers can support.

To compound the habitat related issues, the threat of direct interference with wild fish populations also increased, with hatcheries seemingly providing a simple solution for increasing fish populations in a river. However, this is rarely the case.

Stocked fish (both diploid and triploid), are affected by domestication and unnatural selection, even within one generation in the hatchery (<u>so this includes fish from wild brood-stock schemes</u>). Having grown and survived in an unnatural captive environment (concrete raceway, earth pond or tank) they are poorly adapted for the very different conditions of a natural river. Adaptation to a farm environment is cumulative, with the wild traits (genetic diversity and behaviours), and survival rates in the wild decreasing with each generation in captivity. The forced mating that occurs in a hatchery also bypasses vital chemical and visual aspects of wild selection that exist to ensure mate compatibility and maximise the fitness of wild fish. Free mate choice has been measured to directly and significantly increase disease resistance and survival rates.

It's a *'catch 22'* situation: if stocked fish don't survive long enough to reproduce in the wild, or are infertile (triploids), they are just an additional impact upon the ecosystem (as the river only has a limited amount of food and space); if they do survive long enough to breed then they have the potential to suppress wild fish production through ‘hybridisation’, as their offspring (<u>including crosses with wild fish</u>) have much poorer survival than the native, wild fish.

Well managed, natural river habitats (without stocking) have a far greater capacity to produce and support healthy fish populations, at all life stages. From emerging out of the gravel, wild trout disperse throughout the available habitat to find territories appropriate to their individual size and dominance. They constantly compete to maintain a “pecking order” which ensures the dominant fish maintain priority over the best lies, where drifting food is the easiest to intercept for the least energy expenditure. They will remain (often for years in the case of a large, dominant fish) until displaced by another more dominant individual or until they die (or are removed).

This ensures that the available habitat is always used to best effect. In addition, as salmonid survival is density dependant, the greater the habitat variation and abundance (cover and in-channel structure), the greater the number of trout that will survive each year and the more fish a reach can hold. For this reason, maximising the occurrence of those features and avoiding unnecessary tidying/pruning ensures that the river holds the maximum number of fish possible under the given conditions (something not possible through stocking).

In contrast to wild fish, stocked fish are often transient and select less energy-efficient lies; they, therefore, lose condition and tend to leave or die within a few months (sometimes weeks) of being stocked. In the meantime however, they cause increased competition and potentially displace the wild fish.

It must also be remembered that, even without stocking, the river will be naturally re-stocked. Wild trout spawning and recruitment means that new fish are produced within, and enter into a river section each year for anglers to catch. The naïve fish may often be the smaller ones, but the overall greater population will provide sport for all sizes of fish. **(N.B. Introducing stocked fish can easily disrupt this balance - e.g. the habitat required for five 0.5kg stocked fish may have originally supported many more wild fish, in a range of sizes from parr upwards).**

So, although it may appear counterintuitive, for all of the above reasons, stocking can often lead to less fish within a river by suppressing the wild population (particularly if undertaken year upon year), whereas wild fisheries have the potential to support much greater overall fish populations. Consequently, many angling clubs actually report increased catches after ceasing stocking (see case studies on the WTT website link below). All we really have to do is limit the impact of humans upon the fish and their habitats.

To further safeguard natural fish stocks, catch and release fishing is also advisable, for both resident and migratory stocks. This need not be mandatory but will greatly assist in preserving valuable wild spawning stock and improving natural trout production. Also consider the fact that the larger fish caught possess the characteristics necessary to survive well in the wild and, if these fish are returned, they have a good chance of attaining even larger size and further enhancing angling opportunities.

A more detailed, referenced explanation of this rationale can be found on the Wild Trout Trust website in the Trout Stocking section (www.wildtrout.org/content/trout-stocking).

More information on the measures discussed and many other enhancement and restoration techniques can be found in our various publications on the Wild Trout Trust website, under the library tab (http://www.wildtrout.org/content/library).

5.0 Making it Happen

WTT may be able to offer further assistance such as:

- WTT Project Proposal
    - Further to this report, the WTT can devise a more detailed project proposal report. This would usually detail the next steps to take and highlighting specific areas for work, with the report forming part of a land drainage consent application.
- WTT Practical Visit
    - Where clubs are in need of assistance to carry out the kind of improvements highlighted in an advisory visit report, there is the possibility of WTT staff conducting a practical visit. This would consist of 1-3 days work, with a WTT Conservation Officer teaming up with interested parties to demonstrate the habitat enhancement methods described above. The recipient would be asked to contribute only to reasonable travel and subsistence costs of the WTT Officer. <u>This service is in high demand and so may not always be possible.</u>

- WTT Fundraising advice
    - Help and advice on how to raise funds for habitat improvement work can be found on the WTT website - www.wildtrout.org/content/project-funding

The WTT officer responsible for fundraising advice is Denise Ashton: dashton@wildtrout.org

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

http://www.wildtrout.org/content/index

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 stocks and managing invasive species.

The DVD is available to buy for £10.00 from our website shop http://www.wildtrout.org/product/rivers-working-wild-trout-dvd-0 or by calling the WTT office on 02392 570985.

6.0 Acknowledgement

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7.0 Disclaimer

This report is produced for guidance and not for specific advice; 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.