Advisory Visit

River Aire

08/04/2015

1.0 Introduction

This report is the output of a site visit to the Coniston Estate on the River Aire, undertaken by Gareth Pedley and John Grey of the Wild Trout Trust. The visit was requested by Roddy Bannister as an initial step towards improving the wild fish populations of the river.

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. Upstream and downstream references are often abbreviated to U/S and D/S, respectively, for convenience. 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	Aire	Aire
Waterbody Name	Aire from Malham Beck to Otterburn Beck	Aire from Otterburn Beck to Eshton Beck
Waterbody ID	GB104027063100	GB104027063050
Management Catchment	Upper Aire	Upper Aire
River Basin District	Humber	Humber
Current Ecological Quality	**Good** – All supporting elements being 'good' or 'high'	**Moderate** - A drop from Good, driven by a change from Good to Moderate for Macrophytes and Phytobenthos (2009-2013). **Not high** - for hydromorphological Supporting Elements
U/S Grid Ref of reach inspected	SD 90823 56897	
D/S Grid Ref of reach inspected		SD 91155 54387
Length of river inspected (km)	0.4k	3k

(http://environment.data.gov.uk/catchment-planning/WaterBody/GB112069061340)

Under the Water Framework Directive (WFD) classification, most of the ecological and chemical parameters for both waterbodies have been scored as 'good' or 'high'. However, the drop to a 'moderate' score for macrophytes and phytobenthos between the 2009 and 2013 assessment has brought down the overall classification of the lower waterbody (D/S of Otterburn Beck) to moderate. In this same timeframe, the Otterburn Beck has improved from 'moderate' to 'good' status due to an improvement in the classification for fish. The Aire upstream of the confluence has remained at 'good' status for both WFD cycles.

2.0 Catchment / Fishery Overview

The River Aire rises near Malham in North Yorkshire in a landscape dominated by the underlying carboniferous limestone geology. Limestone has a significant influence on the River, providing good primary productivity that further supports a diverse ecology, including abundant invertebrate populations, and where habitat allows, fast-growing abundant fish stocks.

The reach visited is located near Coniston Cold and extends from an U/S limit, above Bell Busk, to a D/S limit approximately 1km D/S of the A65. The section lies within the Yorkshire Dales Natural Area (www.naturalareas.naturalengland.org.uk/Science/natural/NA_search.asp); the profile of which states that: "Most Dales' rivers have been affected by drainage and heavy stock grazing in both the catchments and floodplains, resulting in high peaks and troughs of flow, excessive erosion and a scarcity of wetland features". The profile outlines visionary objectives which include the restoration of natural river processes (natural catchment hydrology and less intensively managed floodplains) and enhancing the populations of 'flagship' species including bullhead, brown trout and native crayfish. Restoring a more natural flow regime and geomorphology to the river will certainly assist in fulfilling the ecological aspirations for the upper Aire, which suffers obvious impacts from past land drainage and channel realignment.

The section visited closely conforms to the above assessment, with much of the surrounding land used for medium-high intensity livestock grazing, predominantly sheep and cattle, but also including horses.

In the last round of the Common Agricultural Policy - Countryside Stewardship Scheme (up to 2014), much of the land surrounding the

River Aire was in a Higher Level Stewardship (HLS) target area, with some land already signed up to Entry Level Stewardship (www.magic.gov.uk). With this in mind, it is hoped that the next round of new schemes (2016) will also target these areas, and that subsidies may be available to landowners/tenants prepared to enter land into stewardship options such as buffer-fenced river margins. It may also be that Catchment Sensitive Farming initiatives are running on this land and this is well worth investigating with the local EA and Natural England. Such schemes may assist with funding for improvements in riparian land management.

3.0 Habitat Assessment

3.1 River Aire

One of the issues affecting many upland rivers is the impact of livestock grazing upon the banks, and this section of the Aire is no exception. From the very upstream limit, a significant lack of trees and herbaceous vegetation along the banks was apparent. Different levels of grazing intensity were present in different areas, e.g. Figure 1, where the lower grazing pressure on the true LB has allowed a slight increase in vegetation cover as compared to that on the RB. Both banks, however, demonstrate the inhibition of herbaceous vegetation and self-set shrub establishment that occurs with any riverbank grazing. This is because such higher nutrient vegetation is actively sought out by browsers and grazers, in addition to being eaten off as an unintended consequence during grazing.

As a result of the lack of vegetation, the riverbanks are more susceptible to erosion because they have less physical protection and root structure below the ground; and a lack of shade, cover and structure means the river margins are a much less hospitable place for fish. Decreased bank stability has also led to over-widening of the channel in many areas, which in turn leads to a shallowing of the channel and loss of adult trout habitat; the quality of spawning gravels can also be compromised as the reduced flow fails to actively sort the bed materials and keep the gravel free from fine sediment.

Superficial deposits of boulder clay within the floodplain do offer some greater bank stability, which has facilitated the formation of deeper pool areas along the outside of bends by deflecting flows downwards into the river bed, rather than allowing lateral scour of the bank. This means that, even though the river has been significantly straightened from its original paleo-channel (still visible within many areas of the floodplain), there are pockets of deeper habitat capable of holding adult trout with the potential to support reasonable trout populations and angling prospects. Increasing channel sinuosity, re-establishing a more natural hydromorphology, and reintroducing in-channel features and structures will all further improve the capacity of the river to produce and support a healthy, diverse ecology.

Stone turning, and cursory inspection, revealed relatively healthy invertebrate assemblages are present in the river and more than capable of supporting wild fish populations. However, these too could be improved by increasing cover and reducing erosion to improve the general river habitat quality.

Figure 1. Looking upstream at a general lack of trees and herbaceous vegetation along grazed river banks. Even the more lightly grazed LB (right of shot) fails to support regeneration of trees/saplings and has a low diversity of riverbank plant species.

A medium sized weir (Figure 2) c.200m U/S of Mark House Lane creates a potentially serious impact upon the river, both in terms of compromising the natural geomorphology and by creating a barrier to fish passage. Upstream of the bridge, the walled, overly wide channel cross-section has already started to naturally adapt and narrow itself, but the impact upon sediment transport and channel gradient remain. Equally, the significant barrier to fish migration both U/S and D/S is likely to prevent optimal habitat utilisation and increase the susceptibility of fish stocks to predation around the structure because of the barrier adjoining deeper water with no refuge. The location of the weir just U/S of the property on the LB also potentially places that property at a greater risk from flooding if the weir forces flows out of bank towards the property.

Also of relevance to flooding is the increased 'flashiness' of flood events arising from compacted pasture (and associated runoff of nutrients and sediment). Increased tree cover in the catchment, along with well vegetated (tree-lined) buffer strips greatly increase the rate of water infiltration to the ground and can attenuate flood peaks, reducing flood issues downstream.

A large tree stump lodged on the weir demonstrates its potential to accumulate debris, which could also increase the risk of localised flooding. Rather than complete removal of the stump, it could be better employed as in-channel large woody debris (LWD) by securing it in place along the LB downstream. Erosion to the RB of the pool (Figure 3), where a tree has been washed out, and failure of the bank to naturally re-grade is another symptom of the livestock grazing. <u>Had the bank been better vegetated, the slumped material would be more likely to remain in place as and stabilised, resulting in far less land loss.</u>

Figure 2. Medium sized weir that poses an increased risk of fish predation in the impounded section, impacted geomorphology and, potentially, flooding of nearby property. The stump can be employed as valuable habitat along the LB downstream.

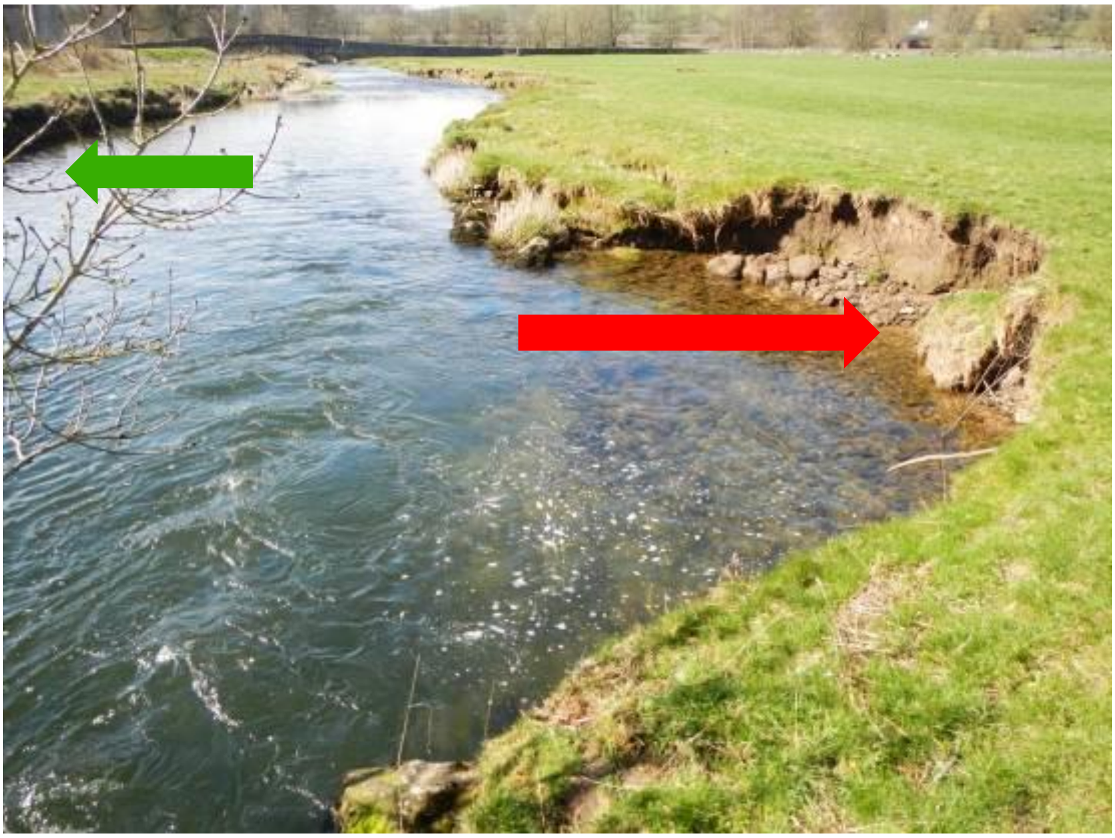

Figure 3. Erosion where a tree has washed out and the bank, lacking in vegetation, has eroded and failed to naturally re-grade (red arrow). If removed from the weir U/S, the tree stump would be beneficially employed as LWD along the LB of the pool (green arrow).

Downstream of Mark House Lane, the available habitat improves greatly, with good low-level cover and trailing branches (Figure 4). The cover, structure and bank stability provided are not the only benefits of such habitat, as the leaf litter and woody material that they introduce to the river channel also increase its productivity and the species it supports. For example, stone turning in the upstream, nearly treeless, section to observe the invertebrate life revealed mayflies, caddis flies, and midges in abundance but low diversity, whereas freshwater shrimp (*Gammarus*) and a greater variety of net-spinning caddis flies reliant upon detritus (leaf litter and associated fungi and bacteria) as a source of food were found within the tree-lined section. This demonstrates another further benefit, in addition to shading, which helps to keep the river cool in low flows and bright conditions.

Figure 4 shows that grazing along the grass bank is still causing issues with the bank stability and habitat; there are still far fewer shrubs along that bank. Furthermore, erosion around the base of the existing shrubs, exacerbated by grazing and trampling, jeopardises their future as they are likely to be washed out in subsequent high flows. Also note how, in a more natural width river cross-section, a deeper channel is maintained by the flow and fine sediment has a lesser impact upon the overall substrate.

Figure 4. Higher quality habitat through a greater abundance of trees and cover. A narrower channel facilitates better sorting of the substrate, but grazing on the true LB still compromises bankside trees and shrubs (red arrow), and thus bank stability. Left unchecked, this is likely to lead to channel widening and habitat degradation.

Throughout the less intensely grazed or wooded sections of the river, bankside trees and shrubs provide vital fish holding features (Figure 5) but there is potential for further improvement. Where present, the pliable species such as willow (*Salix* spp.), hazel (*Corylus avellana*), elm (*Ulmus minor var. vulgaris*) and hawthorn (*Crataegus monogyna*) can be laid into the channel (parallel to the bank, or at an angle of up to 40º from it), like laying a hawthorn hedge, keeping the shrub alive but increasing valuable low-level and trailing cover. Note the mound of garden waste that has accumulated on the LB, probably over many years, and poses a potential impact on the river as a source of sediment and pollution. This should be stopped – many individuals see a river as a conveyor for rubbish with no regard to the potential impacts upon its ecology.

Figure 5. A good range of trees and shrubs which provide valuable habitat and could further enhance the area if a few specific shrubs were laid into the channel (e.g. red arrow). The dumping of garden waste on the LB which is ending up in the channel should be stopped.

The woodland extends downstream for the length of one extra field on the RB compared to the LB; further downstream, grazing then resumes on both banks – causing the suite of attendant issues previously highlighted. However, some willows have established on the LB and are at a stage where they could be beneficially employed as in-channel cover and structure in an otherwise open pool by laying every other tree into the channel at an angle of 40^{O} or less to the bank (Figure 6). The same treatment to small shrubs on the RB would also create additional fish holding habitat. Small habitat enhancements such as these will greatly increase the river's fish carrying capacity.

Figure 6. Mature willows that can be laid into the channel to take up capacity, increase bed scour and provide cover (green arrow/brown outlines). Small shrubs that could be laid/trained over to provide low cover and fish holding lies (yellow arrow).

The willow laying is designed to replicate the natural process which occurs with certain willow species as they grow and break/fall into the watercourse, as has naturally occurred on the LB (Figure 7). Also note that, in the absence of grazing, the willow has been able to become established, and how the better vegetated bank is a naturally sloping profile (low susceptibility to erosion). This is in contrast to the heavily grazed RB with little vegetation and ash tree (*Fraxinus excelsior*) which is likely to fall into the channel and destabilise the rock-lined bank.

Just downstream, there was obvious evidence of historic detrimental tree management where many of the low-lying branches have been removed (Figure 8). This is usually undertaken to improve angler access and aid casting, but is catastrophic for habitat, removing the vital trailing and low-level branches that enable areas to hold fish. The exposed roots and bare earth on the near bank also indicate that the area is actively eroding and the inhibition of vegetation becoming established on the depositional material (gravel bar) is preventing the channel from narrowing to an appropriate width. As a consequence, the over-wide channel creates a water depth that is insufficient to hold adult fish.

Figure 7. Well-vegetated far bank with self-set willow and naturally graded bank. The near bank is walled and grazed, making it susceptible to erosion. In time the tree is likely to fall into the channel and due to the wall, destabilise a large area that will then continue to erode into a large scar (as has happened in Figure 3).

Figure 8. Slightly over-wide section lacking in water depth where grazing and associated inhibition of gravel bar stabilisation and erosion are preventing natural channel narrowing.

Downstream, fencing resumes on the RB (Figure 9) and continues along a short wooded section. Again, the contrast between grazed and un-grazed land is clearly evident, with a much greater erosion on the grazed areas, less cover and a lack of trees. This is despite the fact that the un-grazed tree-lined bank is much steeper, and without the root structure within it should be more susceptible to erosion. Planting willow whips in the banks and along the waterline would greatly enhance the fish-holding capacity – but would require protection from livestock grazing to allow them to establish.

Figure 9. Grazing in the foreground (RB) and background (LB) seriously denude bankside habitat, which is in contrast to the well-vegetated fenced area and woodland (background RB).

Cobble and boulders along the bank toe of the woodland, partly natural and partly maintained, has prevented tree and vegetation colonisation of the bank although shading from the trees on the steep gradient above may also be preventing light from reaching new growth. Laying suitable species of bankside trees down into the water would increase the holding capacity of what is otherwise good quality, deep-water habitat. Figure 10 demonstrates a similar enhancement occurring naturally, where two ash trees have fallen into the channel but remained rooted and alive. This is exactly the kind of habitat that should be promoted and preserved, and not 'tidied up'.

Where dual bank grazing resumes (Figure 11), habitat quality drops dramatically, and although deep water is present, capable of supporting large adult fish, it is unlikely to support many due to the absence of cover. The open nature of the pool there makes fish an incredibly easy target for piscivorous birds (goosander were observed). Buffer fencing and planting would easily rectify the situation.

A lack of fencing and, consequently, a general lack of natural bankside vegetation continues for the remainder of the fishery, with only the occasional trees providing very localised, improvement to habitat quality, shelter/cover and holding spots for larger fish. Erosion is also a continued issue.

Figure 9. Good quality pool habitat but lacking in cover. Laying the hawthorn (centre of shot – red outline) down into the channel would enhance the fish holding features.

Figure 10. Naturally occurring LWD – a natural enhancement to the river that will greatly increase the fish holding capacity.

Figure 11. A significantly underperforming section of river that could support good numbers of adult fish, with the installation of fencing, and tree planting. Planting willow whips along the far bank as indicated with red arrows would start the improvement, with each shrub (once established) capable of holding an additional fish.

Approximately 150m downstream of the A65, another weir creates problems (Figure 12) and, in conjunction with the weir upstream of Mark House Lane, affects the entire fishery by restricting fish movements into and out of the short c.2.5km length of river between them. The impact of this is even more significant when considering that the habitat within the 2.3km length is currently sub-optimal and there is only limited spawning potential on the main river and two notable tributaries (Gill Syke & Otterburn Beck).

Removal of any redundant weir is always greatly beneficial to river geomorphology and ecology, but removal of these two particular weirs would be of great benefit to the fishery. Some of the impounded pool habitat upstream of the weirs would be lost, but by reinstating the natural scour and depositional features in that area, natural pools would form and be maintained. This is in contrast to an impounded pool which accumulated sediment, progressively filling in and shallowing over time.

Figure 12. Major obstruction to fish passage – a seemingly redundant weir c.150m D/S of the A65. This should be removed if at all possible.

3.2 Otterburn Beck

Otterburn Beck is the most significant Aire tributary within the length of river visited. A brief inspection of the lower 400m of the Beck revealed a similar history to that of the main river, with obvious signs of straightening and long-term grazing pressure that has denuded and de-stabilised the banks, leading to significant erosion (Figure 13). The section upstream of the road bridge is subject to recent improvements, with a fenced buffer zone installed along the watercourse.

Providing that this riparian strip is maintained free from livestock, noticeable improvements are likely to occur very rapidly; the sediment input should reduce, the channel is likely to naturally narrow in places, and the bed is likely to become better sorted, with coarse substrate maintained free from fine sediment. This will greatly enhance the tributary as a spawning and nursery area. It will be worth monitoring the improvements to vegetation and bankside stability over the up-coming growing season; improvements that should be aspired to on all other grazed land around the fishery. In the absence of livestock, planting of willow whips in the eroded bank faces and along the waterline is also encouraged to accelerate bank consolidation.

Figure 14. Obvious signs of heavy grazing, but, with the exclusion of livestock, the area should rapidly re-vegetate and the habitat greatly improve.

Downstream of the road bridge, to its confluence with the Aire, the banks of Otterburn Beck are more stable, predominantly due to greater root matrices from a good number of mature trees. However, this is not a reason for complacency and not fencing-off the river. The impact of even the current, light grazing is still evident, with a lack of grass, vegetation and tree regeneration, and several areas of bank susceptible to erosion; this in turn that may compromise the bankside trees, which will lead to much greater erosion rates and extent.

The general form of the Beck does provide some valuable juvenile habitat, with good glides and riffles (Figure 15), although considerable sediment input from upstream was very evident, coating many of the rocks and accumulating in between (Figure 16). It may be that erosion further up the Otterburn Beck catchment is also contributing and it is recommended that an investigation is made into the possible extent of erosion and fine sediment input upstream.

Addressing any such issues will be key in not only increasing juvenile trout output from the beck, but also increasing the quality of habitat for their potential prey, the invertebrates. Again, fenced buffer zones along the watercourses are likely to be the key action.

Figure 15. The lower section of Otterburn Beck – some good juvenile habitat but would benefit from fencing to protect trees and allow natural regeneration.

Figure 16. Obvious signs of sediment deposition across the bed of Otterburn Beck.

3.3 Gill Syke

Gill Syke, the watercourse that drains the Coniston Estate Lake, also offers potential as a salmonid spawning and juvenile area, despite the fact that the Lake dam prevents access to the upper catchment, the channel has apparently been straightened, and the presence of notable obstacles in its lower reaches. The channel through the wood D/S of the lake is tree lined, creating beneficial features that have led to scouring of pools and deposition of gravel bars (Figure 17). The LWD present also greatly assists this process. Due to the modification, the channel is, however, still straighter, wider and steeper than would naturally occur, and for these reasons any additional LWD entering the channel should be preserved and actively added to, along with willow whip planting. Felling trees into and across the channel will help establish natural logjams that would force bed scour, create further pools, and sort/clean potential spawning gravel, as demonstrated in Figure 18.

Figure 17. Relatively good quality habitat with many of the required features that are naturalising following historic channel realignment and modification. Further assisted naturalisation will be of great benefit.

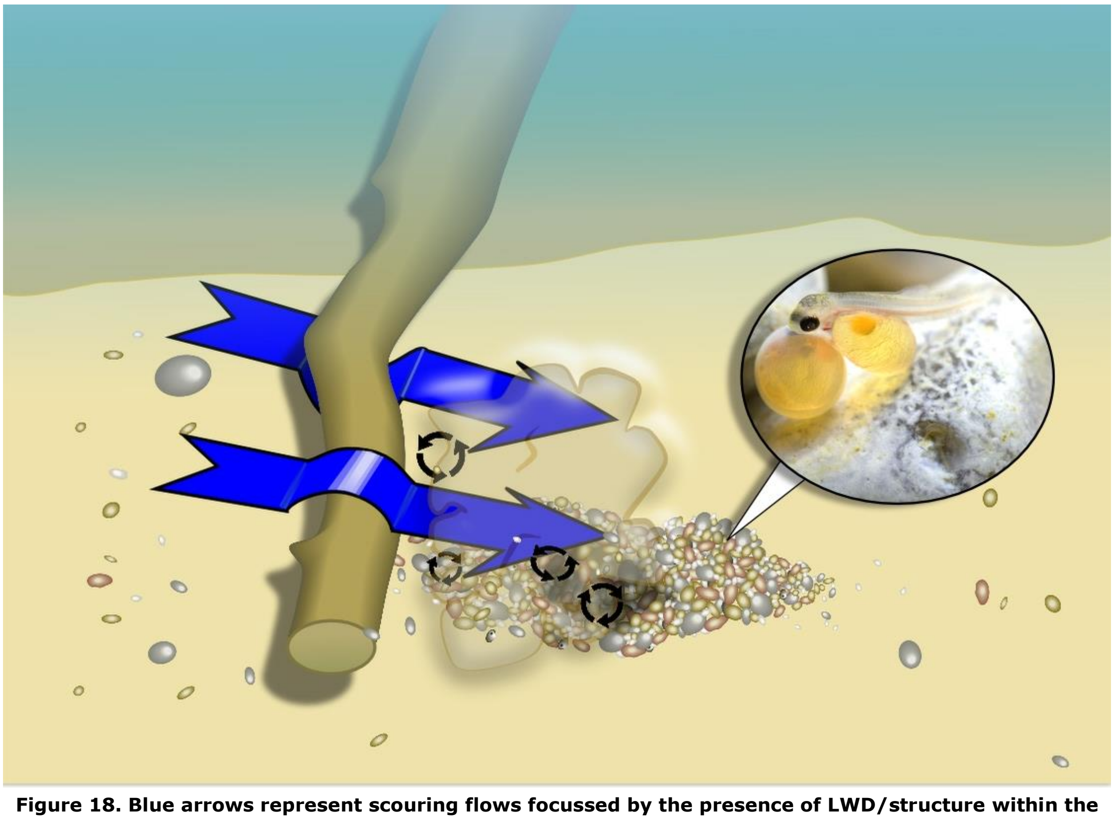

Figure 18. Blue arrows represent scouring flows focussed by the presence of LWD/structure within the channel; these flows mobilise the substrate and sort it by size and maintaining spawning gravels clear from fine sediment.

At the downstream end of the wood, a large crack willow has fallen (Figure 19) and creates a great source for pieces of LWD that could be staked into the channel at various points U/S, and being crack willow, are likely to regrow. Cutting this tree as a low coppice should also allow the stump to be righted, reinstating valuable in-channel habitat.

Figure 19. Fallen willow creates a great source for LWD and, if coppiced (red arrow), could be righted to reinstate valuable in-channel habitat.

Downstream of the wood, the channel continues in a straightened course, but at a more natural width (Figure 20). Buffer fencing either side in most areas also demonstrates the major benefit to habitat from stock exclusion as the channel does provide some good juvenile habitat. In areas where the fence has not been maintained and stock are gaining access a significant drop in habitat quality was noted – this should, ideally, be addressed by full stock exclusion. Increasing cover would further benefit the area, and mixed deciduous planting (or even willow whip planting) within the buffer to provide shade and structure in which fish can shelter from high flows would be worthwhile.

In the lower c.200m, three notable obstacles to fish migration were observed. These, although not complete barriers to fish migration, greatly reduce the potential benefit of Gill Syke as a vital spawning tributary. They also inhibit the movement of juvenile trout, to which they are an even greater barrier, preventing them naturally dispersing to take advantage of available juvenile habitat.

Figure 20. Narrower (but still straightened) channel D/S of the wood with improved bankside vegetation as a result of buffer fencing. Additional planting would be beneficial to create shade, cover and structure/shelter.

The farthest upstream obstacle is the road bridge, which is blocked by debris on a gate employed to exclude live stock from going under the bridge (Figure 21). This could easily be rectified by installing a water gate, but in the short-term, by regular clearing of the debris.

Downstream of the bridge, two sections of pipe culvert that enclose the watercourse for a much greater distance than is required further obstruct fish passage. As there are two, it is hard to actually understand their full purpose, when one short section would have been sufficient to provide stock and vehicular access. The culverts have not been installed in an environmentally sensitive manner; they should be over-capacity to allow installation at least 1/3 below the bed level, to reduce unwanted bed scour (can leave the pipes perched) and to allow formation of natural bed material within the culvert.

Figure 21. Looking upstream, under the road bridge at a debris clogged gate. U/S and D/S fish access here should be maintained.

Figure 22. The upstream one of the two pipe culverts where the confined nature of the pipe and steep, smooth bed restricts access for fish of all sizes, at all flows.

The downstream culvert has much the same issues as the other, although is slightly less of an obstacle owing to the fact that it is shorter, on a shallower gradient and extends progressively below the bed towards the D/S end (Figure 23). It is, however, still an obstacle and far from ideal. High flows fluming through the pipe will impede fish passage, potentially right at the times when fish require access upstream for spawning.

Figure 23. The downstream culvert. Slightly less of an issue, but far from ideal. At least the D/S end is sunk below bed level.

Removal of any unnecessary culverts, un-natural channel sections or obstructions is always advisable. In this case, it may be that removing the larger, upstream culvert could be undertaken, retaining the shorter, less obstructive one downstream for access. This would be a great improvement to Gill Syke and could greatly improve spawning opportunities and wild fish stock recruitment in the area.

4.0 Recommendations

4.1 Fish stock management

There is enormous potential to enhance the fishery as the raw ingredients are *in situ* to support excellent wild fish populations on the River Aire. It is only the habitat which is underperforming, and so it is recommended that effort and funds are directed towards habitat restoration on the estate.

The native trout 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 (without human interference) and they should continue to do so in the future if we can limit our impact upon them and their habitats. However, in the latter part of this period (last 50-100 years), the 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, direct interference with wild fish populations also increased, with large numbers of hatchery fish introduced to rivers. Stocked fish (both diploid and triploid), are affected by domestication and unnatural selection, even within one generation in the hatchery (so this includes fish from wild brood-stock schemes). 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.

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 (including crosses with wild fish) 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 available (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)**

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).

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).

4.2 Fencing

Effective fencing to exclude livestock from the riverbank is one of the two greatest improvements that could be made to habitats on the river; the other being weir removal. Excluding livestock from the watercourse via buffer fencing will be key to major improvements in wild fish stocks. Ideally, fencing should completely exclude livestock from the river bank which may then require solar pumps (Figure 24) or pasture pumps (Figure 25) to supply water for drinking at several locations.

Existing areas of fencing should be maintained/improved to ensure that they fully exclude stock, particularly sheep, which will gain access through the smallest of gaps. Sheep, although small, can cause significant issues due to their browsing/grazing style, which crops any growth back almost to ground level, leaving very little ground coverage or root structure remaining.

Negotiations regarding fencing will have to be undertaken with the tenant farmers, but it would be hoped that if they are helped to understand the major impact that grazing is having upon the watercourse they would be supportive, although some incentives may also be required.

It is recommended that the Aire Rivers Trust is contacted as an ally in initiating any fencing schemes. Trust staff have an understanding of the potential funding that may assist with fencing and are likely to be involved with similar work within the catchment. It would also be beneficial to include the Environment Agency and Natural England in any discussions as they too may too have funding, and Catchment Sensitive farming officers may be able to assist. The next round of Countryside Stewardship (2016) could also provide tenants with subsidies for land placed into buffer strips etc.

Photograph 24. Cattle excluded from a riverbank and watered via a pasture pump. The cattle draw water from the river through a pump which they activate themselves by pushing it with their nose.

Photograph 25. Solar panel powered pumps employed to fill standard water troughs. Photograph courtesy of Ribble Rivers Trust.

4.3 Tree Work

4.3.1 Planting

Planting is recommended wherever there is a lack of low cover and structure along the river margins, which is much of the fishery. It will be of particular use if trees are trained over into the channel. Most native deciduous species would be beneficial but willow is by far the easiest to transplant and manipulate. Fencing is likely to be key, as without grazing-exclusion, any planting will probably be eaten off by 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.

Small bundles (faggots) of freshly cut willow can also be employed to rapidly increase marginal cover. If they are staked into sections of softer river bank, along the waterline, they have a good chance of rooting and becoming valuable, dense cover.

4.3.2 Laying

Where trees 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. The method is usually limited to willow, elm, hazel, hawthorn and small alder, but some others can be laid carefully. Small to medium shrubs tend to work best, although quite large willow such as those in Figure 6 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 26 & 27). 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 26. Hinged willow.

Photograph 27. Hinged hazel.

4.4 Obstruction removal

The two weirs noted during the visit both appear to now be redundant. This being the case, it is strongly advised that their removal is seriously investigated. The impact of these structures upon the natural function of the river is high, inhibiting natural sediment transport and causing an impoundment to flows. The barriers create ideal conditions U/S and D/S for predators to hunt fish in, locally increasing the impact of predation.

The barrier to fish movement is an even greater impact limiting beneficial fish movements in and out of the reach. This prevents upstream migration, to take advantage of spawning and juvenile habitat, but also prevents fish from downstream (and to an extent upstream) moving into the reach to take up new residency, which is one of the ways riverine fish stocks naturally achieve optimal habitat utilisation. Free fish movement up and downstream will not only enhance waters on the Coniston Estate but also greatly improve the fish populations in the surrounding catchment that will then help maintain the Estate's wild fish numbers.

Weir removal is likely to be costly (£5k-20k depending on contractor and how the process is managed), but funding may be available through the Environment Agency or Rivers Trust to assist, and it should be recognised that the structures are a long term liability that will degrade over time, potentially causing greater issues in the future. The weir upstream of Mark House Lane may also be creating an added flood risk to local housing but elevating water levels and diverting more water down the mill race area towards the property.

Removal of the culverts on Gill Syke should also be investigated, as it would greatly improve spawning potential on that watercourse. At the very least, the more obstructive upstream pipe could be removed, opening up the channel and still leaving access across the remaining culvert.

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