WILD TROUT TRUST

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Advisory Visit
River Calder, Chantry Bridge

Advisory Visit by Paul Gaskell (pgaskell@wildtrout.org)

12/07/2021

River	Calder
Waterbody Name	Calder from River Chald to River Aire
Waterbody ID	**GB104027062632**
Management Catchment	Aire and Calder
River Basin District	Humber
Current Ecological Quality	Moderate
U/S Grid Ref inspected	SE3372620105
D/S Grid Ref inspected	SE3385420087
Length of river inspected	0.15 km

1. Summary

- *Though impacted by a large weir, diverse aquatic and riparian habitat exists on this section of the Calder in the midst of a heavily urbanised area*
- *Achieving greater control over invasive non-native plant species would be highly beneficial at this site*
- *Developing formal habitat custodianship and fostering sustainable angling activities (and pressure) are also recommended*

2. Introduction

The Wild Trout Trust were invited by interested local residents to give advice on the current (and potential future) condition of habitat on a heavily urbanised section of the River Calder. In particular, advice was sought on the suitability of current initiatives – and where improvements could be made. Throughout the report, banks are designated as right (RB) and left (LB) while facing downstream.

3. Background

At times heavily used by anglers, an urban reach around 150m in length seems to have the potential to support healthy and diverse populations of wild fish. With the decline of industry, water quality appears to have seen improvements over previous decades in this post-industrial river. Threats to water quality do still exist and, with human population increases and future urban development, may increase through the combined sewer network. However, there is certainly already valuable and diverse flora and fauna worthy of protection within this reach.

4. Habitat Assessment

The reach was assessed, sequentially, in a downstream progression from an upstream limit below a large weir at SE3372620105 (Fig.1)

Figure 1: Approximately a third of the total width of the weir marking the upstream boundary of the visited reach.

This structure is, in common with many comparable weirs, part of complex associated infrastructure, including historic (14th century) and modern road bridges. With that said, the Hepworth Gallery, built in 2011 has its footings and outer walls in the water of the river, directly downstream of the weir (Fig. 2).

Figure 2: The Hepworth Gallery (left and centre of frame) directly downstream of the weir.

Despite the likely costs involved – and changes to the local landscape – it would be wrong to ignore the huge potential biodiversity benefits of considering various weir-removal options.

Weirs: Impacts & Issues Summary

The most apparent issues with weirs impeding upstream migration of all species of fish are important – but perhaps not the most significant compared to less obvious effects. Of course, with reports of small numbers of salmon trying to return to this (and similar) rivers, the issue of upstream migration is crucial. Similarly, the less-frequently considered downstream migration of juvenile fish is every bit as important for the completion of migratory-fish lifecycles. Moreover, it is important to appreciate that many fish species migrate in order to complete their lifecycles: https://www.southeastriverstrust.org/how-weirs-affect-fish-communities/

In sections where water is held back behind an obstruction (or "impounded"), that downstream migration is significantly hampered. Firstly, the simplified and slow-flowing habitat greatly increases the efficiency of mobile predators (such as fish-eating birds). Secondly, because juvenile salmonid fish navigate downstream "tail-first" – they rely on the guidance of natural current-flows. Impounded sections of river cause a stalling of that downstream migration – *potentially creating delays that are long enough for the physiological window for "smolts" (juvenile salmonid fish capable of transferring into salt-water environments) to expire*.

Huge losses of smolt outputs from river-systems have been measured (including measurements of over 80% of total smolt output lost from the Tweed system) and assigned to impacts of low-head weir-impoundment (Gauld et. al 2013, Science of The Total Environment Volumes 458–460, Pages 435-443;

https://www.sciencedirect.com/science/article/abs/pii/S004896971300497X).

The variable performance of fish passage easements and technical fish passes, whose efficacy differs between fish species and also flow conditions, is essential to highlight. No fish pass is ever 100% efficient even for a single, target, species of fish. In fact, the efficiency (i.e. number of fish successfully ascending as a proportion of total attempting to ascend) varies widely for different species which have different preferences and swimming abilities. The above measure of efficiency also does not take into account the delays and exhaustion effects of multiple attempts made by fish which ultimately manage to ascend.

To that point, it is also important to take into account the cumulative effect of multiple barriers. Here's a simple illustration (based on the work of Dr. Ed Shaw during his PhD) showing the rate of attrition for 100 hypothetical salmon attempting to pass a series of barriers (Fig.3). For the sake of illustration, passage efficiencies of 99%, 75%, 50% and 20% are shown as if they were consistent for each barrier in the series.

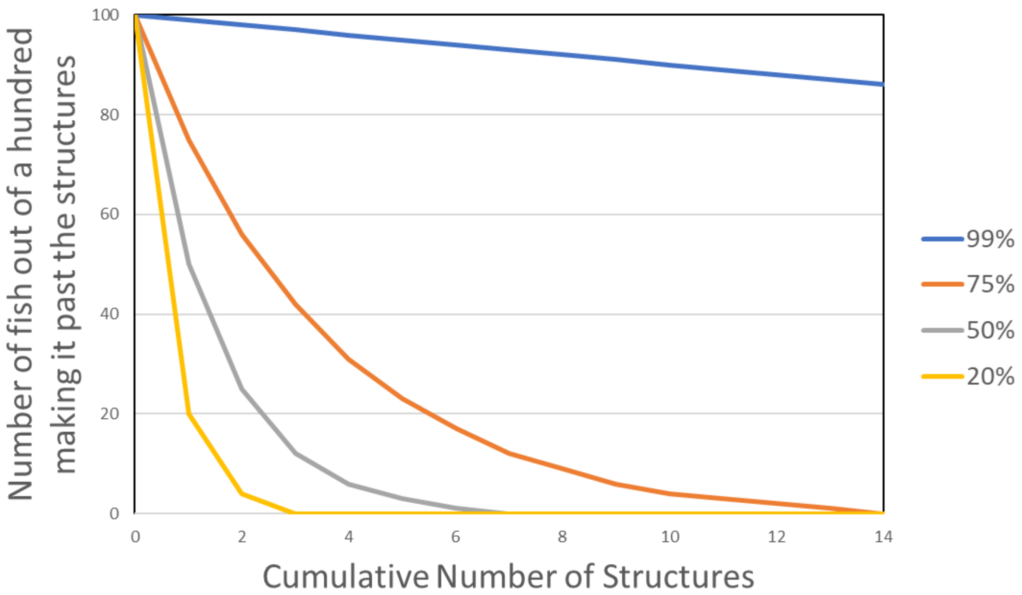

Figure 3: Cumulative impact of a series of barriers on the proportion of fish ascending to reach spawning grounds (plotted at different passage efficiencies for that series)

It is surprising (and sobering) to see how few structures it takes before the proportion of migrating fish tends to zero (especially in the context that 75% passage efficiency is hard to achieve in practice).

However, as mentioned previously, the less-commonly considered impacts of weirs on the quality of habitat within rivers is just as important as their effects on migration. In particular, the creation of simplified, slow-flowing habitat and the interception of riverbed material that would otherwise be transported downstream are two key effects.

In terms of maximising biodiversity and the resilience of aquatic communities, habitat needs to have structural variety – and that physical diversity needs to vary somewhat over time. On the one hand, massive structural upheavals that are too frequent will constrain biodiversity to "live fast/die young" only species. On the other, habitat that is locked in place will tend to become dominated by a smaller number of highly-specialised "climax community" species. Biodiversity is maximised somewhere in the middle of those extremes.

One of the key drivers that maintains structural variation over time is the transport of riverbed material from the upper to lower catchment. A very obvious example is the supply and turnover of spawning gravels.

Weirs interrupt the "conveyor belt" process of transporting broken-up/weathered rocks from the headwaters downstream. This hinders the creation of spatially and temporally-variable habitat; a good example of "locking habitat in place" (Fig.4).

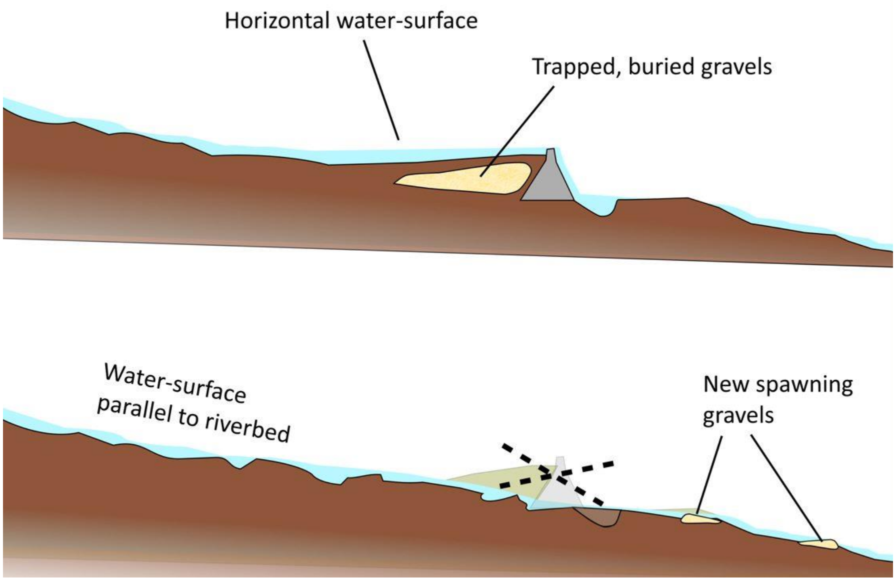

Figure 4: The stepped profile of a river created by impounding structures locks habitat in place by interrupting the natural transport of bed-materials (including gravel)

One consequence is a reduction in opportunity to form a balance of each of the three key habitat types needed for complete wild trout lifecycles (spawning, juvenile and adult habitats).

Another is impact on predator/prey interactions – with the efficiency of avian predators greatly increased in simplified, impounded sections of river (Fig.5). The risk of local extinctions of certain fish populations is greatly increased when mobile predation efficiency is substantially-elevated by such habitat simplification.

In contrast, where there is greater variety in both riverbed structure and the pace/depth of current flows within that channel, predation efficiency is reduced. An obvious example of this contrasting condition is found in unimpounded sections below weirs. This varied, complex habitat improves the chances that prey capture efficiency reduces to an unprofitable level for the predators *before* all prey is eradicated (Fig. 6).

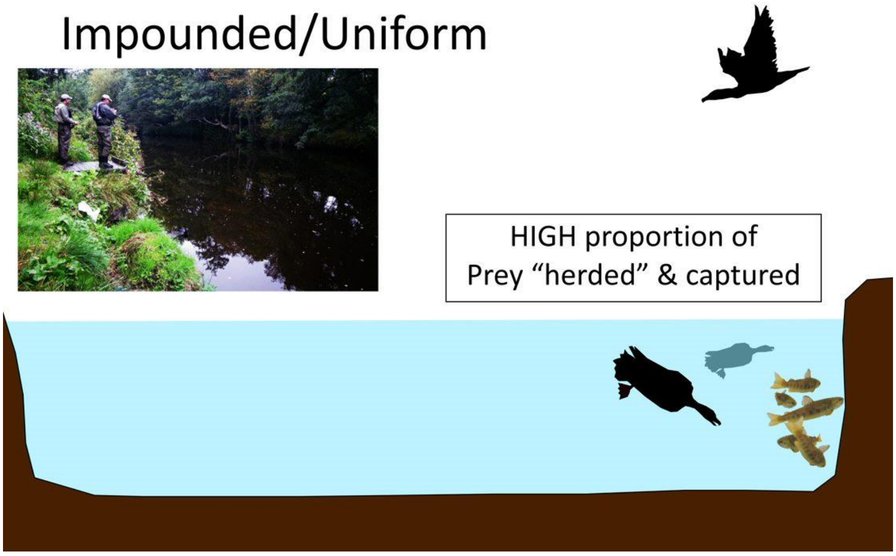

Figure 5: Simple, slow-flowing habitat increases prey-capture efficiency

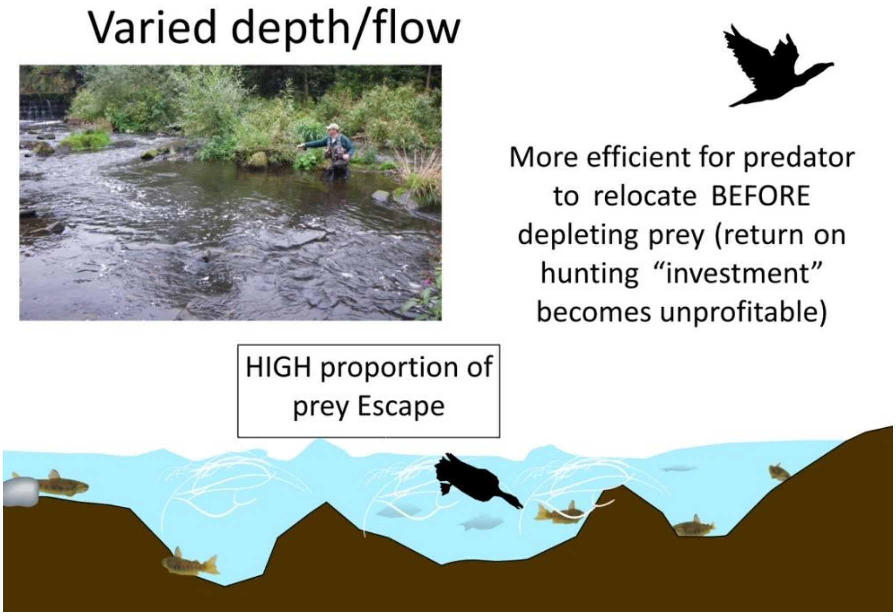

Figure 6: Complex habitat and currents rebalances predator/prey interactions in favour of more stable and persistent populations

A more detailed consideration of the issues pertaining to weirs is given in the article on the Wild Trout Trust website here: [Why Presume to Remove Weirs? (with River Dove Case Study) | Wild Trout Trust]

In the context of this report, it is important to highlight that the weir in Figure 1 (along with others on the Calder system) is one of the most significant impacts on the ecology of the river. The undoubted cultural significance of the Hepworth Gallery, constructed directly below the weir, came at a reported cost of £35 million. While the challenges of notching down to bed level (or complete/majority removal) are significant – the resilience of our ecosystems has far-reaching implications for society. Significant ecological gains (for now and the future) associated with weir-removal at this site are possible at a fraction of the above cost.

More complex (and more biodiverse) habitat was readily evident downstream of the weir – in the absence of an impounding effect (e.g. Figs.7-9).

Figure 7: Greater flow energy below the weir can redistribute bed materials – enabling colonisation by flora and fauna to further increase structural diversity.

Figure 8: Even with the presence of old and new bridges, the natural gradient and stream-bed promotes much more biodiverse communities than the impounded reach upstream.

Figure 9: Although supply is interrupted by the weir, gravels of the particle-sizes suitable for trout and salmon spawning were present.

Gravels (Fig.9), low “brush” cover (Fig.10) and deeper scour-pool habitat (Fig.11) were all noted to be present within the visited reach. Consequently, opportunities exist for wild trout to complete full lifecycles – pending water quality that is good enough over a sufficient duration.

Figure 10: Vegetation colonising gravel and cobble deposits (enabled by the lack of impoundment) has created good juvenile (and adult) trout habitat.

Figure 11: Localised bed scour associated with stable woody material.

As well as “sorting” or grading-out gravels that are both silt-free and of a size suitable for spawning, large woody material further diversifies the depth and current-speed (Fig. 11). The cover and deeper water are key resources for adult, flow-loving fish. Additionally, localised scouring action helps to prevent clogging of the spaces between each gravel particle. As a result there should be a better flow of oxygenated water through those gravel deposits – a vital factor for good egg survival in gravel-spawning species (such as trout and barbel).

This concept of localised scour driving the bed down to create depth is to be much preferred to the idea of holding water back for the same purpose. Consequently, the building of low depth-retaining weirs using cobble and boulder material from the riverbed (e.g. Fig.12) should be avoided, in favour of facilitating or preserving bed-scour.

Figure 12: Low cobble/boulder weir - while not creating a significant impoundment - is best to allow to degrade during subsequent spate events.

Non-native Invasive Plants

The extensive efforts of the AV recipients in hand-pulling Himalayan balsam at this site were clearly evident. In other comparable areas on the Calder, the vegetated mid-channel gravel bars and cobbled margins are blanketed with this invasive, non-native plant.

Maintaining a good degree of control over invasive plants such as balsam at a local scale are incredibly important in maintaining biodiversity at the landscape scale. Significant reductions in invertebrate diversity are reported in association with Himalayan balsam invasion (https://www.cabi.org/news-article/new-paper-and-infographic-himalayan-balsam-and-its-impact-on-uk-invertebrates/). Of course, in an ideal world, eradication of (for instance) balsam would proceed from the upstream source, down throughout the catchment. However, many people make the mistake of thinking that it is not worth creating smaller "fire-break" patches where invasive plants are controlled. This blog post gives some more substance to this argument: https://www.wildtrout.org/wttblog/volunteer-action-urban-river-corridor-biodiversity-it-works).

There was also evidence of control undertaken by external parties (either local council or Environment Agency staff) of the invasive and dangerous giant hogweed (Fig. 13).

Figure 13: Giant hogweed plant showing signs of chemical treatment.

However, the vegetated gravel bars towards the RB had several maturing giant hogweed plants that had not been treated (Fig. 14).

Figure 14: One of multiple untreated hogweed plants on site.

The photo-toxic (sunlight-activated) sap which causes chemical skin burns makes this plant extremely difficult for volunteer groups to deal with. Particularly dedicated group members may wish to go through the formal training and accreditation (including use of all the appropriate personal protective equipment) needed to tackle giant hogweed. However, this comes with full warning of both the legal and health and safety implications attached to that course of action. Campaigning to have the existing control efforts extended would be extremely worthwhile – particularly in the context of areas where this plant has got out of control. The sheer dominance and density this huge plant can achieve, coupled with the toxic sap, make it a significant priority to tackle while the problem is still relatively manageable.

Although lacking the chemical burn risk associated with giant hogweed, the large stands of Japanese knotweed noted on site (e.g. Fig. 15) also require specialist control to avoid inadvertent spreading of propagules (fragments from which whole new plants can grow).

Figure 15: Japanese knotweed stand on the RB – upstream of a large, fallen poplar tree.

Final observations

Also visible (left of frame, background) in Figure 15 is a large, fallen poplar which, due to its size and entanglement with standing trees on the bank, is stably-anchored. This is providing excellent cover habitat within deep water. It will also be contributing increased structural variety in the cross-section of the riverbed by encouraging localised scour and deposition during spate flows.

The acceptance of retaining stable, fallen woody material and the colonisation of gravel bars is a very important step in maximising the biodiversity within urban rivers. Similarly, in concert with habitat quality, monitoring and understanding water quality is likewise crucial. The presence of a large outfall on the LB (Fig. 16) is an obvious spot to maintain vigilance and report cloudy and/or foul-smelling discharges that occur outside periods of heavy rainfall. Establishing and maintaining monitoring of aquatic invertebrates is also an excellent way to detect pollution incidents that may occur when direct observation is not possible. Since aquatic invertebrates are exposed to whatever is in the water 24-hours a day, they provide ever-present detection. Therefore, even short-lived pollution incidents that would otherwise not be possible to either witness or obtain chemical samples for can be reflected in the loss of characteristic groups of invertebrates.

Figure 16: Outfall discharging to the river on the LB towards the lower end of the visited reach

While the visited reach is extensively used by anglers, there is a difficulty in ensuring sustainable use of this fishing amenity (either through angling pressure or the appropriateness of tackle and catch and release skills). One model which has seen some success in other Trout in the Town projects is for angling to be controlled by a free-to-join (or fee-paying) club whose members undertake care of the river and which is constituted as a subsidiary of a "friends-of" group. Both the adherence to agreed practices and direct contributions to the process of caring for the river can be made conditions of membership for the angling club component of such a group.

5. Recommendations

In the event that any habitat intervention work is undertaken, appropriate legal permissions must be sought before commencing work on site. These are not limited to landowner permissions but will also involve regulatory authorities such as the Environment Agency. Certain activities (including the use of herbicides) will also be subject to legal requirements for personnel to be appropriately qualified and/or registered – and the activity formally consented.

Assuming that all legal requirements have been met for relevant activities, a summary of the recommended actions are:

- Form a group dedicated to protecting and improving the Chantry Bridge section of the River Calder.
    - Add the group as a "First Contact" member of the Trout in the Town accreditation scheme.
    - Consider forming a "fishing club" sub-section of that interest group and approach the local authority and relevant landowners to broker access agreements (and control of access where necessary).
    - One option to maintain inclusive access to angling is to make the fishing club non fee-paying; but membership is contingent upon active contributions to river custodianship through events and activities run by the main group.
    - Group members to organise and run Himalayan balsam control events (starting during the initial spring growth period and ahead of the plants setting seed in late summer; see also subsequent recommendations on Japanese knotweed and giant hogweed).
    - Establish invertebrate monitoring (for instance as part of the Anglers Riverfly Monitoring Initiative: https://www.riverflies.org/ARMI) upstream and downstream of the outfall pictured in Fig. 16.
- Seek involvement and collaboration with local group(s) tackling the impacts of weirs in the Calder system (e.g. Calder and Colne Rivers Trust) – and use the rationale outlined in this report to urge greater consideration of weir removal options (including "partial" and "complete" options) ahead of fish pass installation which leads to the retention of impounded reaches.
- Explore options for control of giant hogweed and Japanese knotweed (to complement the excellent ongoing Himalayan balsam control) including:
    - Local authority and rivers trust control programme(s)
    - Consider seeking funding to train a number of group volunteers in stem injection for Japanese knotweed
    - Consider seeking funding to employ a specialist contractor to undertake giant hogweed control
- Replace the active construction of habitat features with a policy of retaining native vegetation colonising gravel bars and retaining fallen large woody material
- In the instance that woody material is removed from the river by other parties (or is otherwise lost from the reach), it may be appropriate to securely-anchor felled tree material into the margins. Similarly, a light-touch level of laying patches of sapling-stage growth into the margins may mitigate for excessive removal of naturally-occurring woody material.

6. Further information

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

- WTT Practical Visit
    - Where recipients require assistance to carry out improvements highlighted in an advisory 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(s) teaming up with interested parties to demonstrate habitat enhancement methods (e.g. tree kickers and willow laying etc.).
- WTT presentation/Q&A session
    - Where recipients are unsure about the issues raised in the AV report, it is possible that your local conservation officer may be able to attend a meeting to explain the concepts in more detail.

In these examples, the recipient would be asked to contribute to the reasonable travel and subsistence costs of the WTT Officer.

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 material, 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.

7. Acknowledgements

The Wild Trout Trust would like to thank the Environment Agency for their continued support of the advisory visit service, in part funded through monies from rod licence sales. The advice and recommendations in this report are based solely on the expert and impartial view of WTT's conservation team.

8. 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.