Rivers Exe and Haddeo, Dulverton, Somerset

An Advisory Visit by the Wild Trout Trust, June 2014

Contents

Introduction

This report is the output of a Wild Trout Trust advisory visit undertaken on the River Exe (National Grid Reference: SS 93305 27819 to SS 93535 26770 and SS 93494 25985 to SS 93525 25860) and the River Haddeo (SS 94186 27074 to SS 93737 26580) near Dulverton, Exmoor, Somerset in June 2014. The visit was requested by Mr. Julian Capps of Dulverton Angling Association (DAA) and primarily focussed on assessing the river and identifying options to improve habitat for wild trout (*Salmo trutta*).

Comments in this report are based on observations on the day of the site visit, and discussions with Mr. Capps, Mr. Alistair Langford and Mr. Andrew Caldwell of DAA.

Throughout the report, normal convention is followed with respect to bank identification i.e. banks are designated Left Bank or Right Bank whilst looking downstream.

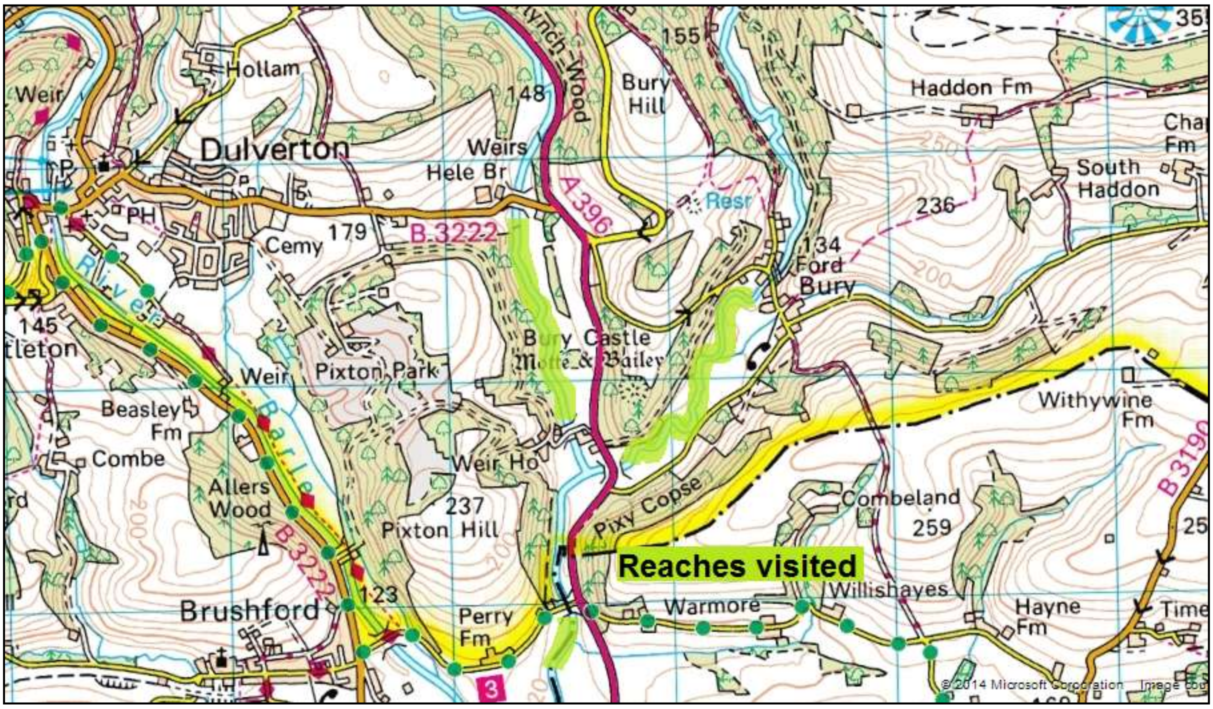

Figure 1: A map showing the section of the Rivers Exe and Haddeo visited

Catchment and Fishery Overview

The River Exe rises at Exe Head near Simonsbath on Exmoor and flows for over 50 miles almost completely bisecting the Westcountry peninsula from north to south. Beginning only 5 miles from the Bristol channel, the river eventually reaches the sea below Exeter. The source is around 450 metres above sea level and descends with an average gradient of 5.2m/km. Although many examples of ancient oak woodland are present, overall Exmoor is sparsely wooded with steep sided, V-shaped valleys. Surface water run-off is rapidly transported downstream resulting in flashy spate flows. The geology of Exmoor is predominantly a mix of Devonian slate and sandstone which act as a minor aquifer and supply the base flow to the river. The lower reaches of the river flow over a predominantly mudstone geology through generally wider and less steep valleys.

The Exe is joined by the River Haddeo and the River Barle close to the southern boundary of the National Park near Dulverton. Whilst the Barle drains parts of Exmoor to the west of the upper Exe, the Haddeo drains land to the east, rising in the Brendon Hills. The Haddeo is dammed at Wimbleball Lake. Regulated discharge flows from the lake and interruption of natural gravel transport have affected the abundance and quality of spawning habitat in the river. Gravel washing (with high pressure water pumps and hand-held lances) and a gravel introduction programme have been undertaken to improve spawning gravel for salmon (*Salmo salar*) with some success.

The Dulverton Angling Association has access to long reaches of the Upper Exe, the Barle and the Lower Haddeo. All are predominantly trout and grayling (*Thymallus thymallus*) rivers with runs of salmon. Both the Exe and Barle are classified as 'good' under the Water Framework Directive for both water quality and fish populations. The Haddeo is designated as a 'heavily modified waterbody' and is classified slightly differently; the best classification possible being 'good potential' rather than 'good quality'. At present the Haddeo is classified as having 'moderate potential' for fish and so is failing under the Water Framework Directive.

Table 1: Water Framework Directive Information for the River Exe (Environment Agency)

EXE	
Waterbody ID	GB108045020890
Waterbody Name	EXE
Management Catchment	East Devon
River Basin District	South West
Typology Description	Mid, Small, Siliceous
Hydromorphological Status	Not Designated A/HMWB
Current Ecological Quality	Good Status
Current Chemical Quality	Does Not Require Assessment
2015 Predicted Ecological Quality	Good Status
2015 Predicted Chemical Quality	Does Not Require Assessment
Overall Risk	At Risk
Protected Area	Yes

Table 1: Water Framework Directive Information for the River Haddeo (Environment Agency)

HADDEO	
Waterbody ID	GB108045015090
Waterbody Name	HADDEO
Management Catchment	East Devon
River Basin District	South West
Typology Description	Mid, Small, Siliceous
Hydromorphological Status	Heavily Modified
Current Ecological Quality	Moderate Potential
Current Chemical Quality	Does Not Require Assessment
2015 Predicted Ecological Quality	Moderate Potential
2015 Predicted Chemical Quality	Does Not Require Assessment
Overall Risk	At Risk
Protected Area	Yes

Habitat Assessment

For the purposes of this report, each river visited is described from the upstream extent of the water visited, to the downstream extent. The Exe and Haddeo reaches are described separately.

River Exe: Hele beat

An impounding weir forms the upstream boundary of the fishery just downstream of the bridge crossing on the B3222 (Jury Hill). This weir will impact on fish migration under a wide range of flow conditions. The original function of 'Helebridge Weir' as it is marked on pre-WWII maps is unclear but the structure may have been constructed to divert water through a nearby mill or water meadow system. In either case the structure does not appear to perform any useful function and the river would benefit from its removal.

Figure 2: Helebridge Weir (highlighted by yellow box)

Downstream from the weir, the river has a good diversity of depth and flow conditions which provide a good range of habitat features. Gravel shoals readily form in the lee of bankside shrubs and tree roots, hinting at the high energy of the river during spate flows. The RB is densely wooded and casts a uniform shade over the riverbank, inhibiting the establishment of true marginal plant species. Much of the woodland is a coniferous plantation which casts shade over the ground year-round and probably has a localised effect on pH and the run-off profile of the land (possibly increasing the flashiness and erosive potential of spate flows). This will further limit plant diversity. A rich and diverse marginal and riparian habitat can be important in supporting a healthy upland river ecosystem. The greater the abundance and diversity of bankside plant species, the greater the abundance and diversity of habitat for terrestrial invertebrates and adult river flies. In upland rivers where strong spate flows often inhibit the establishment of aquatic plants such as water crowfoot (*Ranunculus spp.*), terrestrial invertebrates that accidentally drop into the river provide an important dietary supplement for fish. For hatching riverflies, emergent and marginal plants provide a good interface between the aquatic and terrestrial habitats. For mayfly (*Ephemera danica*), marginal and bankside grasses and shrubs provide a resting spot to hatch from subimago (dun) to imago (spinner).

Figure 3: The RB is densely wooded and consists of a mono-culture of conifers in places. This limits bankside biodiversity

The LB consists of grazed pasture. The bank is stock-fenced to prevent livestock from accessing the river but unfortunately the fence line has been positioned very close to the river. This has allowed grazing right up to the top of the bank which both weakens the bank (by reducing the density of root structure), leading to increased erosion, and compacts the soil, increasing the rate of surface water run-off and potentially adding to the volume of diffuse fine sediment entering the river.

Fencing so close to the riverbank on high-energy systems such as the Exe can be expensive for the land owner /tenant farmer as bank erosion often causes the fence to collapse into the river.

Figure 4: The fence line on the LB is situated very close to the river

At SS 93426 27323 the mangled remains of a steel footbridge wrecked by winter flows were observed. The power of the river at bank-full flow is an important consideration in the planning of future habitat enhancements.

Figure 5: Powerful spate flows have destroyed a steel footbridge

Continuing downstream, a number of bankside trees were observed leaning at precarious angles. In upland rivers, tall bankside trees often topple into the river. This helps to drive the morphology of the river as flow is forced around the tree and scours the bed and bank. Fallen trees also provide important cover and refuge habitat for fish as well as a food source for a range of freshwater invertebrates. However, these are normally only temporary features as the tree is either carried downstream by strong currents or removed by land owners or the Environment Agency for flood defence purposes.

Trees that are likely to soon topple into the river may provide an opportunity to create more permanent habitat enhancement features. These opportunities are discussed further in the *Recommendations* section.

Figure 6: Leaning bankside trees may provide opportunities for habitat enhancement

Some excellent examples of woody debris bank protection works were observed towards the downstream extent of the Hele beat. In the example below (Figure 7) a bankside alder has been hinged (partially cut through and dropped) along the toe of the bank. As the tree has survived, the subsequent re-growth has protected the bank by locally absorbing energy and slowing flow. This technique appears to have proven very effective in protecting the bank and also has the added benefit of providing coarse 'shaggy' marginal cover habitat. This will provide excellent protection for juvenile trout as well as providing a refuge during high flows.

Figure 7: Hinged alder re-growth is protecting the bank and providing important marginal habitat

At SS 93494 26895 an informal cattle drink is a point source of fine sediment. Formalising the drink with better fencing and laying down a crushed limestone hard standing would reduce the volume of fine sediment entering the river at this point. An example of good practice cattle drink design is given in the *Recommendations* section.

Figure 8: An informal cattle drink is a point source of fine sediment into the river

River Exe: Perry beat

A short section of the Perry beat was visited downstream of Perry New Road. The DAA has undertaken extensive bank protection works in this reach which are now well established and working well. Hinged and cabled bankside trees are combined with faggot bundles of brushwood secured against the bank (Figure 9) and saplings growing up through the bundles will help ensure that the bank protection gets stronger with time (Figure 10).

Figure 9: Hinged trees are also cabled to their original stump for extra security.

Figure 10: Saplings growing through the bundles will strengthen the bank over time.

The Perry beat has some good habitat features but is comparatively uniform in width (Figure 11). There is scope to further enhance the Perry beat by the creation of one or two cabled 'kickers' to introduce some flow diversity as well as functioning as trout lies. These structures are explained further in the *Recommendations* section.

Figure 11: The Perry beat provides some good habitat but could perhaps benefit from additional diversity of width and flow conditions

River Haddeo

The River Haddeo is cut-off from its headwaters by the reservoir dam at Wimbleball Lake. Connectivity with one of the rivers major tributaries, the River Pulham is also hindered by a weir near its confluence with the Haddeo. Although not visited during the walkover, A photograph of the weir (Figure 12) suggests that the weir is a significant obstacle to fish passage and an impediment to substrate transport. Trout have been observed passing upstream via a notch in the weir (pers. comm. DAA) but the structure is likely to be a complete barrier to small fish under most flow conditions and even large fish during periods of lower flow.

Figure 12: The weir on the River Pulham is a significant barrier to fish passage

At the upstream extent of the Haddeo beat, a small tributary enters the river on the LB. This small tributary could be an important spawning stream and refuge during high flows. The stream was not investigated on the day of the visit and so further assessment may be required to characterise its potential. Ensuring that good quality spawning habitat is present in these small streams could be an important factor in protecting and possibly even boosting trout recruitment on the river. Trout sometimes preferentially select small side streams and tributaries for spawning, often resulting in increased juvenile survival as these small, protected sites offer a good protection from predation pressures fromfish-eating birds and larger fish.

Figure 13: A small tributary could be a potential spawning stream

Throughout the Haddeo beat the landscape is dominated by large pheasant rearing pens. These are managed for the large Haddeo shoot. Unfortunately the intensity of the pheasant rearing operation appears to be having a negative impact on the river. In some places the pen fence line runs directly downhill towards the river. The cleared ground soil around the base of the fence line acts as a runnel for fine sediment (soil) to enter the river.

Figure 14: Cleared ground around the base of pheasant pen fences leave the soil exposed. Where the fences run down the valley side, soil is washed directly into the river

In addition, a number of drainage ditches flow out from the pens and discharge directly into the river. These ditches are point sources of fine sediment and potentially point source inputs of excess nitrate and phosphate. Further investigation into the water quality impacts of these ditches may be required.

Figure 15: A drainage ditch runs directly out from a pheasant pen and into the river

As flow in the Haddeo is largely reliant on controlled discharges from Wimbleball Lake, it is possible that the river's natural ability to flush fine particles downstream may be compromised by the artificial flow regime. The volume of fine sediment that any river can carry before habitat is degraded is difficult to quantify. However, a thin coating of silt could be easily seen coating the gravel bed in several locations suggesting that the river may be suffering from an overabundance of fine sediment.

Figure 16: A fine layer of silt can be clearly seen coating the gravel in the river margins

Most of the river channel observed was physically diverse with a wealth of habitat features. A natural pool-riffle-glide sequence is present throughout with no impounding structures to interrupt the transport of bed material.

Natural Large Woody Debris (LWD) habitat was abundant and this was adding further complexity to the shape of the bed and the diversity of flow patterns (Figure 17).

Figure 17: Natural LWD features help to further diversity the river habitat

At SS 94092 26968 a dense series of burrows were noted within a muddy berm. No obvious signs of water voles were observed and from the squat shape of the burrows and the fact that the berm had probably spent much of the winter submerged, it is likely that they indicate an infestation of invasive signal crayfish (*Pacifasticus leniusculus*). Signal crayfish can cause a variety of problems in rivers. Apart from the devastating effect on native crayfish populations through competition and the transmission of crayfish plague (a disease to which native white-clawed crayfish *Austropotamobius pallipes* are thought to have no resistance), signals can cause extensive damage to the wider river ecosystem. Known to burrow up to 1.2m into banks, signal crayfish can cause erosion problems and accelerate rates of fine sediment input. They also eat the eggs of gravel-spawning fish as well as small fish such as bullhead or trout fry. In addition, crayfish compete directly with fish for food such as smaller freshwater invertebrates and can seriously impact densities of slow moving invertabrates such as caddis.

Ascertaining the species responsible for the burrows, and if signal crayfish are present, ascertaining the extent of the infestation, could be important for the health of the fishery and the Haddeo ecosystem as a whole.

Figure 18: Burrows in the berm at SS 94092 26968 could indicate a signal crayfish infestation

A short distance downstream a small eroded bay has formed. Whilst the erosion is not necessarily a significant problem for the river, it could pose a health and safety or access problem for anglers. Patching up the erosion with a sloping brushwood revetment using material won from a nearby tree would be a relatively simple solution.

Figure 19: A small eroded bay could be patched with a brushwood revetment if required

Examples of the DAA's previous erosion control/habitat enhancement brushwood structures (Figure 21) indicate that the association is sufficiently experienced to undertake such works.

Coarse woody debris (CWD) such as brushwood provides a variety of functions to the river ecosystem. As mentioned earlier in the report, CWD in the river margins provide important refuge habitat and absorb energy from high velocity flows. CWD is also important for trapping fallen leaf litter. In upland rivers where in-stream productivity is often limited by powerful flows which hinder the establishment of aquatic plants, fallen leaves form the main input of energy into the food chain. A debris dam observed towards the lower end of the reach (Figure 20) is an example of CWD trapping leaf litter and other detritus. Invertebrates feeding on the trapped material will in turn become food for fish.

However, debris dams can sometimes impound flow and even become barriers to fish passage. It is important to assess these structures on an individual basis and where necessary, partially dismantle them so that they do not cause excessive sedimentation or obstruct salmonid migration.

Figure 20: The natural debris dam observed during the visit. Whilst important for the river food chain, debris dams should be individually assessed for fish passage and their impact on upstream habitat.

Figure 21: At the downstream extent of the Haddeo beat is another good example of the club's marginal habitat works.

Conclusions

Overall the DAA waters on the Exe and Haddeo provide a good habitat for wild trout.

The Haddeo beat in particular presents a physically diverse environment with plenty of variation in depth, width and flow patterns and an abundance of woody debris. The Haddeo beat also consistently produces a good abundance of fly life (Pers comm. DAA). However, the Haddeo may be at greater risk of impacts from an oversupply of fine sediment. This could diminish the quality of spawning substrate as fine particles can smother the interstices between the gravel and suffocate eggs. Whilst habitat for adult fish is abundant and the CWD habitat works undertaken by the club are likely to improve survival rates for fry and parr, it is possible that Hele beat may suffer from a 'population bottleneck' at the egg/alevin lifestage.

The Exe Hele beat could benefit from better bankside management. Much of the fence line on the LB is positioned too close to the river and this is impacting marginal biodiversity as well as bank stability and possibly the rate of surface water run-off. The densely wooded RB casts a uniform shade over the bank which also hinders marginal biodiversity. The abundance of trees does however give rise to the opportunity to introduce LWD habitat features which would create additional trout lies and diversify flow patterns.

The Exe Perry beat contains some great examples of bank protection/marginal habitat improvements. The introduction of one or two LWD features or flow deflectors would help to introduce some extra habitat variety but otherwise this beat appears to be in very good condition.

Recommendations

In order for the DAA's waters on the Rivers Exe and Haddeo to achieve their full potential as a good quality habitat for resident brown trout and sea trout, the following actions are recommended:

River Exe: Hele beat

1. Engage with land owners/tenant farmers on the Left Bank and explore options to improve land management regarding the river. Ideally, the bank should be stock-fenced at least 3 metres back from the top of the bank, perhaps with gated access so that cattle can graze the buffer once or twice a year to manage bankside vegetation and retain biodiversity. Moving the fence line back from the river will also reduce the risk of the fence collapsing into the river and reduce the associated wasted expenditure on replacement fencing.
   (https://www.youtube.com/watch?v=00tcTY_UEk4)

2. Engage with the land owner on the Right Bank to explore options to introduce a greater diversity of light conditions by implementing a 5-10 year rotation of tree works. Tree limbs and brushwood arising from these works could be used for bank protection or habitat enhancement structures.
   http://www.wildtrout.org/content/how-videos#tree
   Ideally, a wide buffer of deciduous woodland should be instated between the river and the conifer woodland. Guidance on forestry management in relation to rivers is offered by the Forestry Commission.
   http://www.forestry.gov.uk/pdf/FCFC001.pdf/$FILE/FCFC001.pdf

3. Capitalise on the abundance of bankside trees and introduce further flow diversity and cover habitat by hinging bankside trees into the river downstream and fixing them to the river bed by drilling a one or two holes through the trunk and driving a steel reinforcing bar (rebar) through the hole and into the bed.

Figure 22: An example of a hinged bankside willow on the River Monnow in Herefordshire

Figure 23: An example of rebar driven through a pre-drilled hole to secure LWD to the bank. One at each end of the trunk should suffice if the tree is hinged (still attached to its trunk)

As an alternative to hinging, fell bankside limbs into the river and secure with braided steel cables attached to a solid anchor (the original stump or another tree) on the bank to make a 'kicker'.

http://www.wildtrout.org/content/how-videos#tree kicker

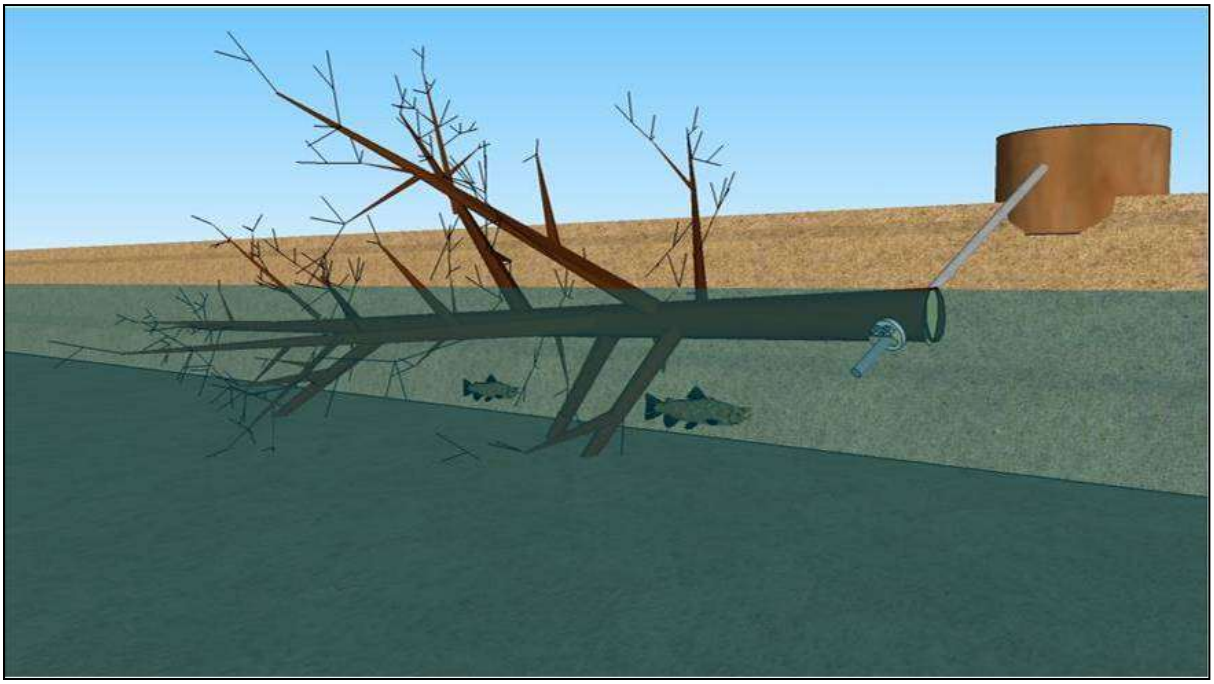

Figure 24: An illustration of a marginal kicker cabled to an existing tree stump

The kicker will provide valuable cover for fish and food/habitat for freshwater invertebrates without increasing flood risk. During high flows the kicker will be swept against the bank and out of the strongest current. The cable also allows the wood to rise and fall with changing water levels

Figure 25: An example of a marginal kicker during high flows

4. The cattle drink at SS 93494 26895 could be improved by the introduction of a hard standing and more formalised fencing. This would reduce the amount of bank poaching and the area of bare soil within the drink. This

would therefore reduce the volume of fine sediment washing into the river at this location.

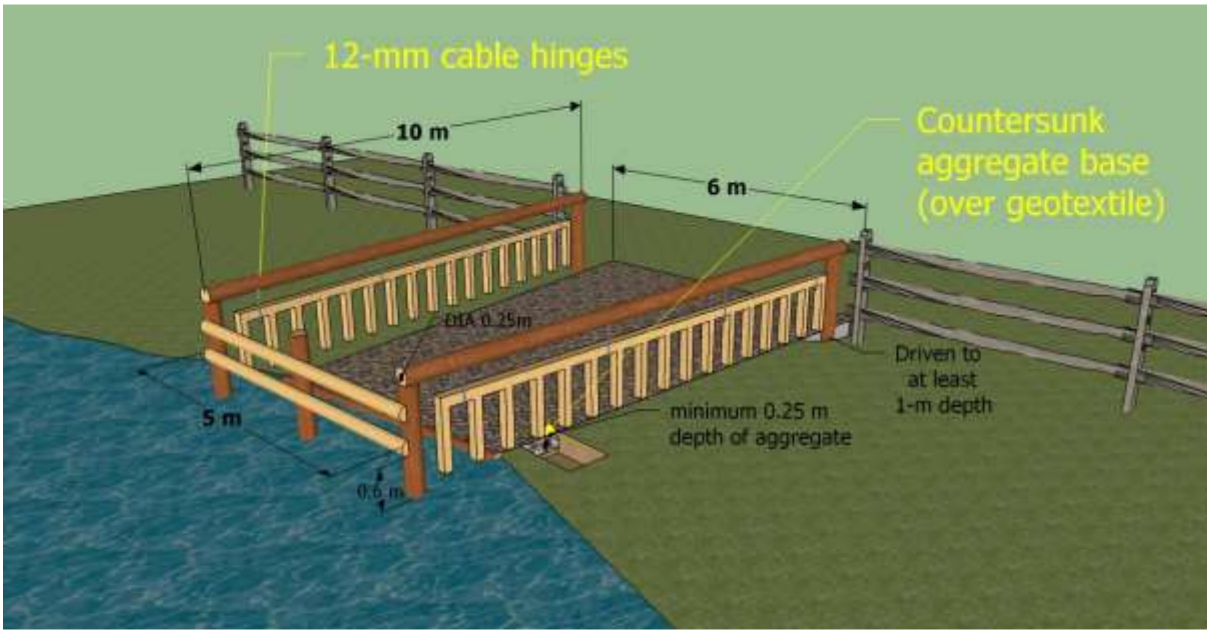

Figure 26: An illustration of an example of a bank-sensitive cattle drink design

It may also be worthwhile engaging with the land owner/tenant farmer and considering alternative means of providing water for livestock such as pasture pumps. These are small portable devices that do not require power and allow cattle to pump their own water supply up to 50 metres. Photovoltaic (solar) pumps and 'ram pumps' can also be a good alternative to cattle drinks and like the pasture pumps require no mains power to operate. All of these devices have allowed farmers to water cattle where riverbanks are completely fenced off.

River Exe: Perry beat

1. Identify and capitalise on opportunities to introduce some additional flow diversity by creating one or two small kickers. Ensure that the cable length is long enough to allow some movement so that the kicker can be pushed against the bank during high flows but not so long as to allow the kicker to be swept up onto the upper bank.

Haddeo beat

1. Engage with the land owners and management of the Haddeo shoot to explore options to minimise the risk of excess fine sediment and nutrients entering the river from in and around the pheasant pens. Diverting

drainage flow into some purpose-built settlement lagoons near the outfalls of the pen drainage ditches could be a cost-effective solution. The outfall from these lagoons could be bunded with heather (or similar) bundles to filter drainage water before it enters the river. Routing drainage water through some well-vegetated wetland scrapes (shallow ponds) may have a similar effect.

2. Investigate the small tributary shown in Figure 13 and any other small tributaries for their suitability as spawning streams for resident brown trout and sea trout. If required, carry out gravel cleaning works on locations within the small streams and the main river at locations likely to be used for spawning.
   Also look to increase the complexity of shallow parr habitat by introducing CWD immediately downstream of potential spawning sites

   http://www.wildtrout.org/content/how-videos#gravel

   As more permanent and less labour-intensive method of retaining good quality spawning gravel is to introduce LWD features that create pockets of localised bed scour. For example when flow is deflected down into the bed, the resulting scour will often 'sort' the bed material. Finer particles are washed downstream whilst larger material is graded by size as the larger (heavier) cobbles are moved only a short distance and smaller (lighter) gravel is transported a little further. This will create a small area of gravels of the appropriate size (approximately 10-50mm) for spawning, free from fine sediment.
   The power of the river during bankfull flows will dictate which LWD/flow deflector structures will be the most successful. The easiest way to determine this is to look for examples of natural LWD which have remained in place after one or more bankfull flow events and also caused a scouring effect on the bed. Mimicking existing LWD features will ensure that introduced structures are able to work with the flow regime of the river and are not torn out during spate flows.

3. Work with Westcountry Rivers Trust and the owner of the weir on the River Pulham to explore options to improve fish passage. Ideally, the weir

should be removed to optimise fish passage and natural sediment transport. However, Should this option prove unfeasible at present, a low cost fish passage easement could improve habitat connectivity in the short-medium term.

4. It is recommended that the club continues undertaking regular riverfly monitoring kick-sampling on the Haddeo (as well as its other waters). Regular monitoring of invertebrates in the Haddeo will help ascertain if there are any water or sediment quality issues impacting river ecology. In addition, if crayfish are present, they will often end up in kick sampling nets. This will give the club the chance to gauge the species and relative density of any crayfish population.

5. Assess natural debris dams on an individual basis. Leave these structures in place unless any are deemed to be significantly impounding flow or presenting a significant obstacle to fish passage. If a debris dam is deemed to be a problem, attempt to carefully dismantle a short section of the dam to allow flow through without the whole structure breaking apart.

Making it Happen

The creation of any structures within the river or with 8m either side will require formal Flood Defence Consent (FDC) from the EA. An FDC application will have to be submitted to the EA, usually along with a methodology and drawings detailing the proposed works. This enables the EA to assess possible flood risk, and also any possible ecological impacts. Contacting the EA early and informally discussing any proposed works is recommended as a means of efficiently processing an FDC application.

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

The Wild Trout Trust has 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.

There is also the possibility that the WTT could help via a Practical Visit (PV). PV's typically comprise a 1-3 day visit where WTT Conservation Officers will complete a demonstration plot on the site to be restored.

This enables recipients to obtain on the ground training regarding the appropriate use of conservation techniques and materials, including Health & Safety, equipment and requirements. This will then give projects the strongest possible start leading to successful completion of aims and objectives.

Recipients will be expected to cover travel and accommodation (if required) expenses of the WTT attendees.

There is currently a big demand for practical assistance and the WTT has to prioritise exactly where it can deploy its limited resources. The Trust is always available to provide free advice and help to organisations and landowners through guidance and linking them up with others that have had experience in improving river habitat.

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.