Wellow Brook, Wellow, Somerset

An Advisory Visit Report by the Wild Trout Trust in May 2013

Introduction

This report is the output of a Wild Trout Trust visit undertaken on the Wellow Brook tributary of the Bristol Avon, on the Wellow Fly Fishing Club's (WFFC) water at Wellow (NGR: ST 72504 56474 to ST 73788 57746). The visit was requested by Mr. Allan Brook, who is the syndicate secretary. The visit was focussed on assessing the habitat and management of the water for wild trout *Salmo trutta* and identifying opportunities for natural recovery following a significant pollution incident. Comments in this report are based on observations on the day of the site visit and discussions with Mr. Brook.

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

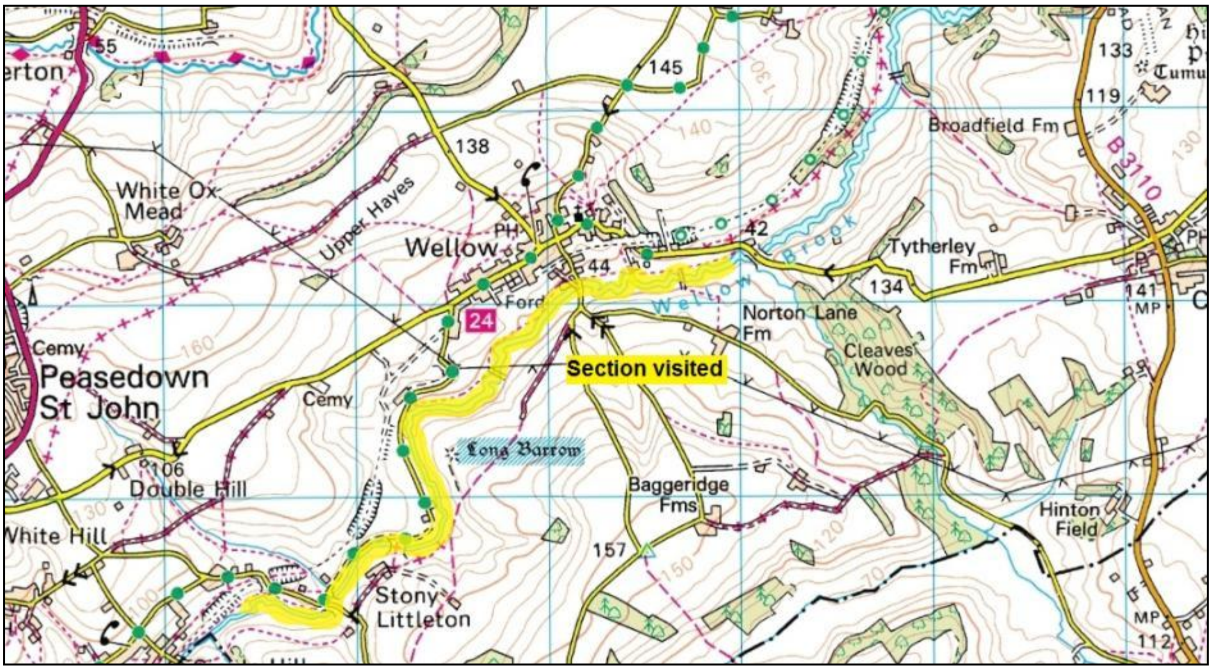

Figure 1: Map showing the section of the Wellow Brook visited

Table 1: Water Framework Directive information extract from Environment Agency website

Wellow Bk - conf Snails Bk to conf Lyde Bk	
Waterbody ID	GB109053022270
Waterbody Name	Wellow Bk - conf Snails Bk to conf Lyde Bk
Management Catchment	Bristol Avon and North Somerset Streams
River Basin District	Severn
Typology Description	Low, Small, Calcareous
Hydromorphological Status	Not Designated A/HMWB
Current Ecological Quality	Moderate Status
Current Chemical Quality	Does Not Require Assessment
2015 Predicted Ecological Quality	Moderate Status
2015 Predicted Chemical Quality	Does Not Require Assessment
Overall Risk	At Risk
Protected Area	Yes
Number of Measures Listed (waterbody level only)	-

In February 2013, a breach in a farm slurry container allowed hundreds of gallons of cattle slurry to enter Wellow Brook near Radstock. The pollution event caused significant fish mortalities along the length of the river.

Since then the Wellow Fly Fishing Club has made the commendable decision to allow the fish stocks to recover naturally without artificially stocking the water. The Wild Trout Trust was contacted to offer advice on how the club can best manage its water to maximise the opportunities for natural recovery.

Catchment and Fishery Overview

The Wellow Brook rises from springs in the Mendip Hills at Ston Easton, draining in an easterly direction through Midsomer Norton and Radstock. It then flows north east through Shoscombe and Wellow before turning north towards Midford, where it is joined by the Cam Brook and is known as Midford Brook for a short distance before its confluence with the Bristol Avon.

The brook rises from sedimentary bedrock geology of Blue Lias formation (undifferentiated mudstone and limestone) and flows over areas of sandstone and Mercia mudstone overlain by superficial alluvial deposits of clay, silt, sand, limestone oolite and gravel. The permeability of the ground varies through the catchment, with the higher land dominated by limestone, and mudstones more prevalent lower in the valleys. In general, a combination of clay soils and steep periglacial valleys cause the brook to be a relatively reactive spate river.

Environment Agency fish surveys have been undertaken along the Wellow Brook [see appendix] at White Bridge (2000, 2005, 2011), Welton (2000, 2004, 2011), Writhlington (2000), Shoscombe (2000), Stoney Littleton (2000), Wellow (2000), Mill Hill (2012) and Twinhoe (2000). Every survey has recorded wild brown trout, and most recorded European eel *(Anguilla anguilla)*. Bullhead *(Cottus gobio)*, 3-spined stickleback *(Gasterosteus aculeatus)*, Roach *(Rutilus rutilus),* and brook lamprey *(Lampetra planeri)* were also recorded. At Stony Littleton in 2000, 2 rainbow trout *(Oncorhynchus mykiss)* were recorded. These were most-likely stocked triploid fish.

The construction of the Radstock Branch of the Somerset Coal Canal, and the subsequent construction of a tramway and a section of the Somerset and Dorset Joint Railway in the 1800s, has had a remarkably low impact on the river plan form. The steep and difficult terrain ultimately led to the failure of the route as a financially viable method of transporting coal from the Somerset coal fields to Bath (and ultimately London). The steep valley has also helped the river to retain a natural planform, as powerful spates continue to shift and shape the river.

Apart from occasional small villages and hamlets, much of the Wellow Brook valley downstream of Radstock is undeveloped, and agriculture is mostly extensive. As a result, the river has been allowed to follow a relatively natural path.

The Wellow Fly Fishing Club manages the river as a catch-and-release wild trout fishery. Large sections of the river are inaccessible to livestock and the sparsely populated valley means that the habitat is largely undisturbed.

Habitat Assessment

The section of Wellow Brook visited provides a mostly well-balanced habitat.. A natural pool-riffle sequence ensures that a good variation in depth is maintained and that habitat is available for both juvenile and adult trout. Natural bank erosion also occasionally introduces pieces of large woody debris (LWD) in the form of fallen trees and branches.

Figure 2: A natural sequence of riffles and pools combined with an abundance of woody debris provides a good variation in depth and flow velocity

Woody debris provides habitat and food for a variety of invertebrate species and also helps to diversify the surrounding habitat by deflecting flows and scouring riverbed substrate. The complex river food web that ultimately supports the wild brown trout population is as reliant on habitat diversity as the trout are themselves. Different species of invertebrate thrive in different parts of the river; some shelter amongst submerged vegetation whilst others cling to gravel or burrow in fine sediment deposits. Many feed on woody detritus or graze on algae growing on submerged wood, stones and vegetation. For trout, fallen logs and branches provide overhead cover, scour out pools for lies and create gravel shoals that can be used for spawning. Brushwood and roots also provide shelter for juvenile fish where they can hide from predators.

In many spate rivers, the flashy nature of the water level, combined with a naturally meandering course and steep banks, has led to problems with erosion. Fortunately, the density of bankside trees along the Wellow Brook provides a matrix of tree roots that help to reinforce the banks and limit erosion to short sections of steep cliffing bank, which do also provide valuable habitat for sand martens *(Riparia riparia)* and kingfishers *(Alcedo atthis).*

Along with helping to protect the steep banks from erosion, bankside trees provide vital habitat through shade and cover over the river. Concerns over the possible effects of hot and dry periods, possibly exacerbated by the impact of climate change, have led to the development of the Environment Agency's *Keeping Rivers Cool* guide.

http://www.wildtrout.org/sites/default/files/news/Keeping_Rivers_Cool_Guidance_Manua.pdf

This advocates the use of shade from riparian trees for helping to regulate water temperature for freshwater species such as trout.

As important as shade is for keeping the river cool, direct sunlight can be equally as important for in-stream productivity. Water crowfoot *(Ranunculus spp.)* flourishes in direct sunlight and fast-flowing water. As a key primary producer, water crowfoot is the one of the most important pathways by which energy from the sun is introduced into the river ecosystem. In the Wellow Brook, a relatively good ratio of direct sunlight to dappled shade ensures that the river remains cool, whilst also providing a solid base to the ecosystem's 'trophic pyramid' (see figure 3) and ensuring enough food is available for top aquatic predators such as trout.

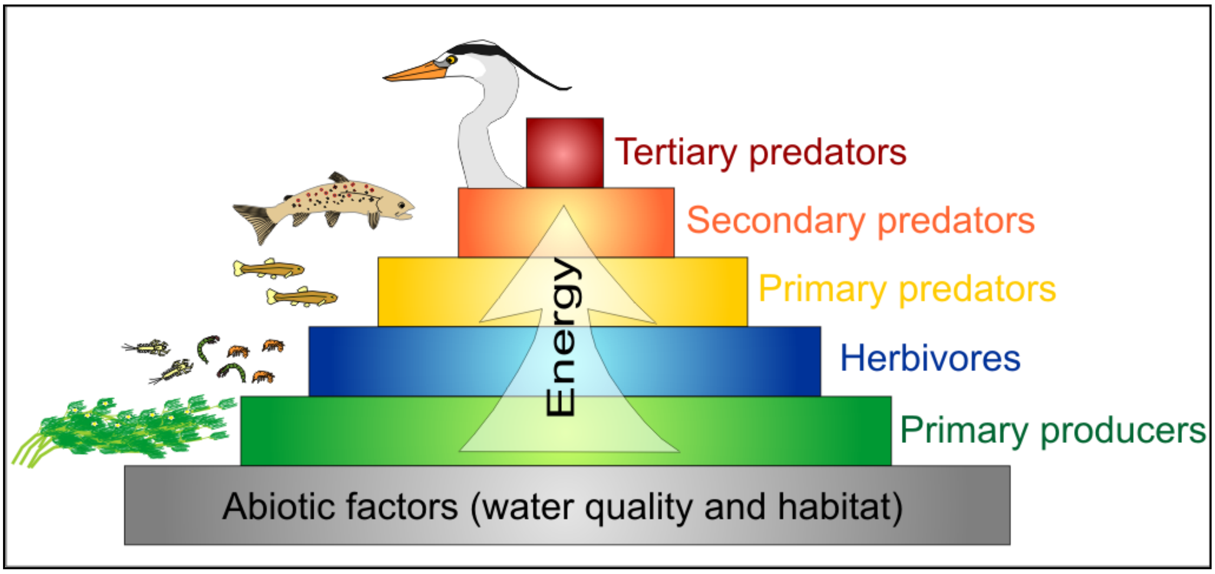

Figure 3: A simplified illustration of the river 'trophic pyramid' showing the importance of habitat in the flow of energy from primary producers to top predators

Figure 4: Water crowfoot flourishes in sections of fast flowing water with plenty of direct sunlight

Some of the most densely-shaded sections of the river are noticeably less abundant in important plant species such as water crowfoot *(Ranunculus spp.)*. Through these sections, occasional tree works should be undertaken in order to allow more light into the river. In many cases simply punching a few 'skylights' into the canopy will suffice, but through some of the darkest sections of river pollarding or coppicing of bankside trees may be required. Tree works should have an emphasis on trees located on the south side of the river with the goal of allowing more sunlight onto shallow, fast-flowing riffles. In order to prevent uniform grow-back, tree works should be undertaken in a 5 or 10 year rotation so that a diverse range of crown heights and densities are established. A roughly 50:50 mosaic of direct sunlight and dappled shade should provide ideal conditions.

In order to enhance natural recovery, adult trout will require access to good spawning gravels. Any clean, un-compacted and well oxygenated gravels, 10-50mm in diameter could yield a potential spawning site, but there are certain conditions which trout favour; in particular, the tails of pools where gravel lifted from the pool is naturally 'sorted'. The scouring action of flows through the pool lift gravels and transports them a short distance downstream. The larger stones, being heavier, drop out of suspension soonest, whilst the finest particles are carried further downstream. The result is a natural grading of the bed material and washing away of fine sediment. Sorted gravel is more attractive to gravel spawning fish and is more easily manipulated to create spawning nests (redds). In addition, sorted gravel free from fine sediment has a greater number of interstices between the stones. This means eggs are less likely to become smothered and newly hatched trout (alevins) can more easily shelter until their yolk sacks are depleted and their jaws and fins developed enough to leave the gravel and hunt.

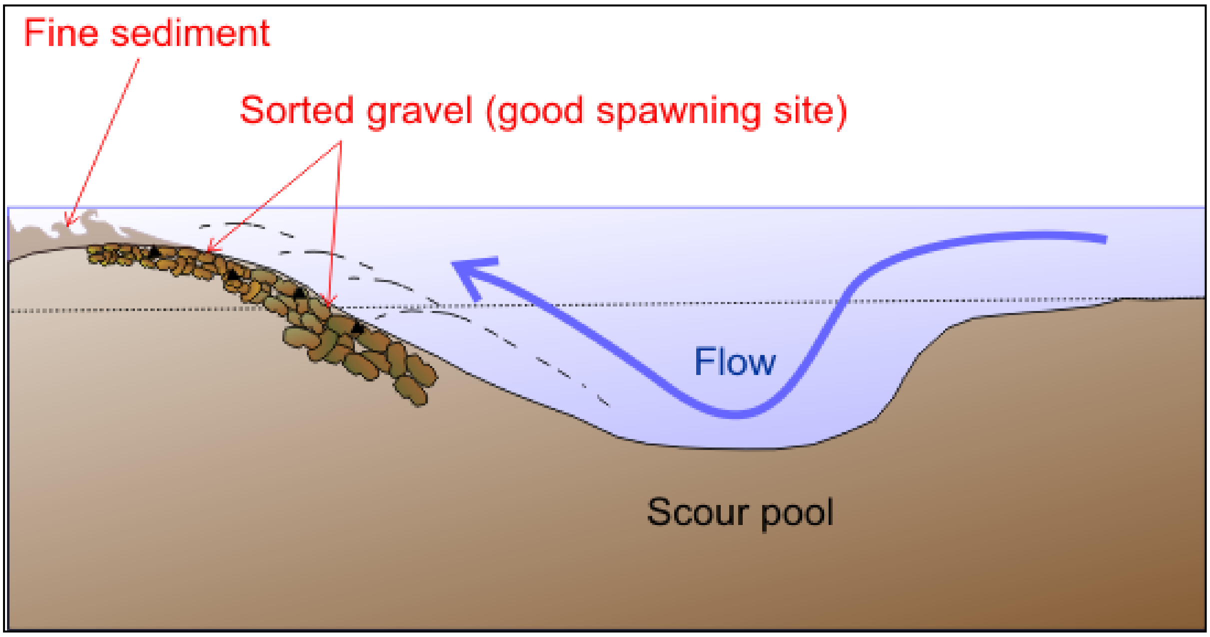

Figure 5: An illustration of how gravel scoured out from a pool is naturally graded and provides good spawning habitat

Throughout the WFFC waters a number of gravel shoals were observed. Being in depositional areas many were compacted with fine sediment. However, the edges of these shoals may provide spawning opportunities during high flows and opportunities may exist to enhance these areas via the introduction of some simple log deflectors.

Figure 6: Gravel shoals and bars may provide some additional spawning opportunities, especially if enhanced with some simple flow deflectors

The use of flow deflectors to enhance spawning opportunities is explored in the *Recommendations* section.

In order to support the recovery of the trout population, it may be worthwhile enhancing spawning sites via the introduction of coarse woody debris (CWD) in the margins of the river, immediately adjacent to spawning gravels. Brushwood in the form of hazel faggots or branches won from tree works make an excellent refuge for newly emerged fry and can boost the survival rate of this vulnerable life-stage. Brushwood fixed in the margin on the inside bend of a meander will also rapidly collect fine sediment. This will provide burrowing habitat for mayfly *(Ephemera danica)* and also help to keep gravels clean by storing sediments and naturally narrowing areas of the channel.

Considering the spate-prone nature of Wellow Brook, brushwood structures may not have a particularly long lifespan in the channel; therefore simple, easy-to-install brushwood structures that can be replaced every couple of years may be the best option.

Trout were observed rising throughout the club's water on the day of the visit, but all were relatively small. This corresponds with anecdotal reports from further downstream that the pollution may have proved most fatal to larger fish (having a greater susceptibility to low levels of dissolved oxygen).

At ST 73691 57551 and ST 73650 57514, boulder weirs have been constructed across the river. These structures were reportedly installed to help oxygenate the river and to create holding water upstream. These are two widely held misconceptions about weirs, with the negative impacts of impounding flow (decreasing velocities and oxygenation) and interrupting sediment transport (causing deposition and channel shallowing) far outweighing any benefits; besides, neither function is presently required as the river is well oxygenated with an abundance of natural pools and good holding habitat. These structures may be passable to larger fish, especially during spate flows, but may present a significant obstacle to small adults. Considering the high proportion of small fish in the surviving population, the weirs could hinder the recovery of the trout population.

There are many similar structures throughout Wellow Brook. Even the most passable of these weirs can contribute to a significant cumulative effect that can prevent trout from moving upstream to reach good spawning habitat.

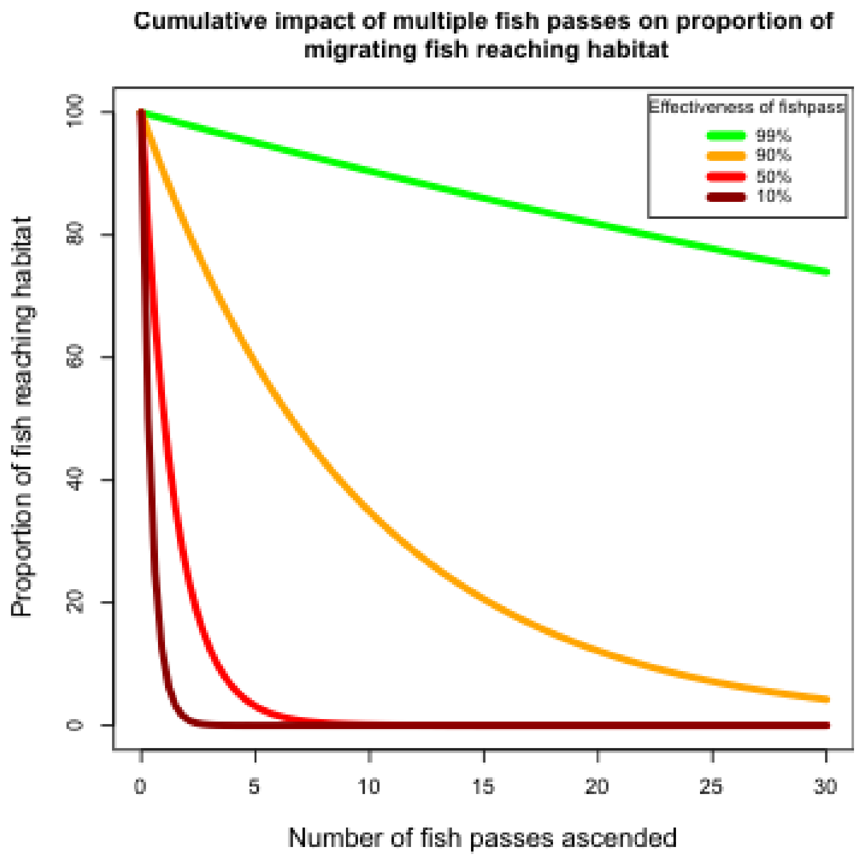

Figure 7: Graph showing the cumulative effect of multiple obstacles to fish passage on upstream migration (courtesy of Dr E Shaw, Catchment Science Centre, University of Sheffield).

In addition to inhibiting fish movements, weirs impound the river upstream. This creates an area of deep, slow flowing water. As the flow slackens, fine sediment drops out of suspension and deposits evenly across the bed. This smothers the gravel bed and creates a uniform habitat, reducing the number and diversity of habitat niches. A uniform habitat will result in a reduction in biodiversity and ultimately a reduction in the robustness of the food web that supports the resident trout population.

As trout are territorial, the more diverse the habitat, the more fish can comfortably occupy a section of river without feeling threatened by neighbouring fish. Large and uniform pools such as those found above weirs may be a territory for one or two large fish but will often hold fewer fish than a naturally diverse section of river. The depth of the impounded pools also reduces over time, as more and more fine sediment drops out of suspension and more coarse sediment is trapped by the weir instead of migrating downstream.

One similar weir, downstream at Poorfield Wood near Midford, was recently partially dismantled (with EA consent). This was undertaken by hand with volunteers and took only a few hours to do. By removing boulders from the centre of the weir but retaining the sides, the structure was transformed from a weir to a 'pinch point' whereby flow is accelerated through the structure and helps to retain scour through the old weir pool below. This technique allows significant improvements to fish passage to be implemented whilst retaining good fishing at what are often favoured angling spots. Wherever possible, weirs should be removed down to bed level, thereby facilitating natural scouring and sediment transportation.

Options to remove the weirs whilst retaining good fishing are explored further in the *Recommendations* section.

Figure 8: The boulder-constructed weirs provide no useful function and could hinder the recovery of the trout population

Through the middle reaches of the club's waters, where the river flows close to Littleton Lane, the land above the right bank rises steeply and is grazed by sheep. On the steep bank, grazing and sheep footfall, combined with the shade cast by bankside trees has left those banks bare of vegetation and exposed to erosion. This is likely to be a site of significant input of soil into the river, and the quantity of fine sediment entering the river may be an important limiting factor on the success of spawning and egg survival. Consequently, reducing the volume of sediment entering the river may help recovery of the trout population, particularly as the natural sediment input on a spatey system like the Wellow, with its light alluvial soils is already likely to be high.

A dialogue should be opened up with the land owner and/or tenant farmer to discuss the possibility of installing buffer fencing along the top of the bank to exclude livestock from the river. In addition, a programme of rotational tree works to allow more light onto the bank and encourage the growth of bankside vegetation to bind the soil together would be beneficial.

Figure 9: Livestock, heavy shading and steep banks combine to create a potentially significant input of soil into the river

A little further upstream, a section of the river is completely fenced-off from the adjacent grazing land. The result has been the development of a densely vegetated margin. This margin is helping hold the bank together and will also acts as a filter, helping to reduce sediment input from surface run-off and provide habitat for terrestrial invertebrates. Terrestrial bugs and beetles often fall from marginal plants and low-lying branches and supplement trout diet

Figure 10: Fenced river margins allow a dense margin to develop which helps reinforce the bank and reduce sediment input

Upstream of the fenced-off reach, near the Dairy Hill Bridge, cattle accessing the river have severely poached the bank. The contrast between these two sections clearly illustrates the value of a well-fenced bank.

Figure 11: Severely cattle-poached banks are vulnerable to erosion and input sediment into the river

Bank poaching can be a significant point-source of excess sediment and left unchecked can often cause the river to become over-wide and slow flowing. However, poached banks are not necessarily always bad for the river. A little poaching can introduce some shallow gradient habitat that can often be absent from steeply incised rivers. These shallow margins can be an important habitat for fry and for certain invertebrate and plant species. The creation of occasional formal, fenced cattle drinks, perhaps excavated slightly back from the river, may be beneficial. Examples of formal cattle drinks and alternative livestock-watering options are explored in the *Recommendations* section.

Recommendations

In order for the resident brown trout population in the Wellow Brook to recover to, and potentially improve on pre-pollution numbers, and for the river to perform to its full potential as a rich and biodiverse wild trout habitat, the following actions are recommended:

- The boulder weirs at ST 73691 57551 and ST 73650 57514 should be deconstructed in order to maximise fish passage and allow natural geomorphology to resume. Removing the central section of the weir down to the natural bed level and reinforcing the edges will create a 'pinch point' to accelerate flow through the structure and retain scour through the existing weir pool.

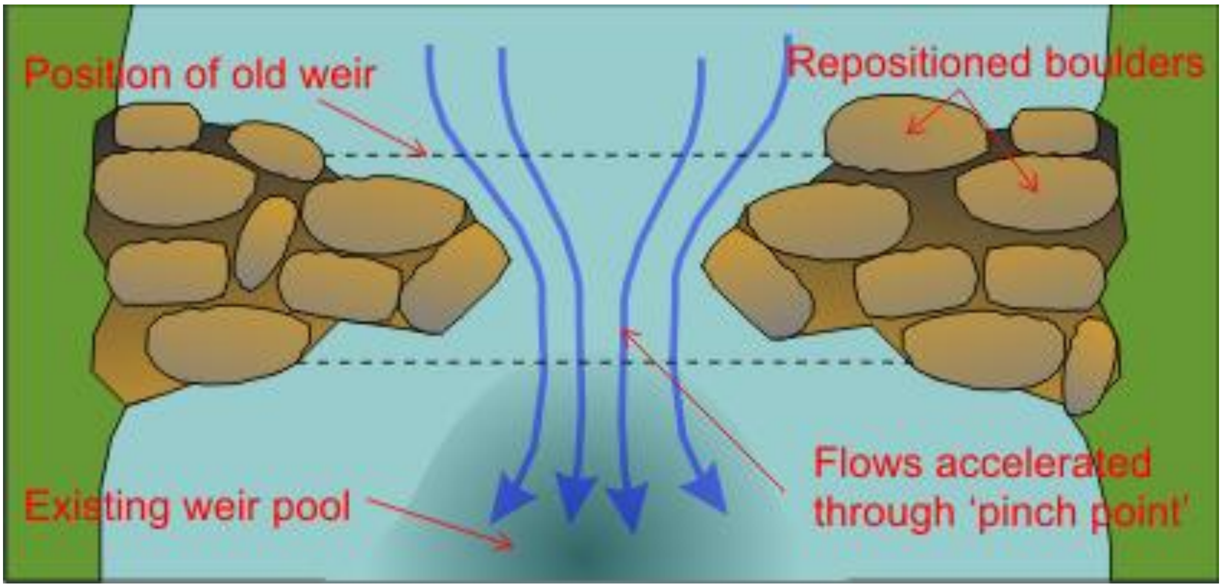

Figure 12: An illustration of how a boulder weir can be converted into a pinch point to retain scour through the existing weir pool

- Where tree cover is very dense and the river is over-shaded (indicated by a noticeable absence of aquatic vegetation, and or greater than 50% tree shading), instigate tree works to open up some occasional skylights in the canopy. If required, programme a rotation of pollarding/coppicing works focussing on the southern banks and with the aim of introducing light over shallow, faster-flowing sections. Try to retain as much low-lying cover as possible, especially over good lies.

- Boost the availability and quality of spawning habitat by installing some simple log deflectors to help 'sort' gravels. Installing deflectors to increase scour over known spawning sites could help improve egg/alevin survival and some additional deflectors at the edges of existing shoals and berms may help to broaden the opportunities for spawning.

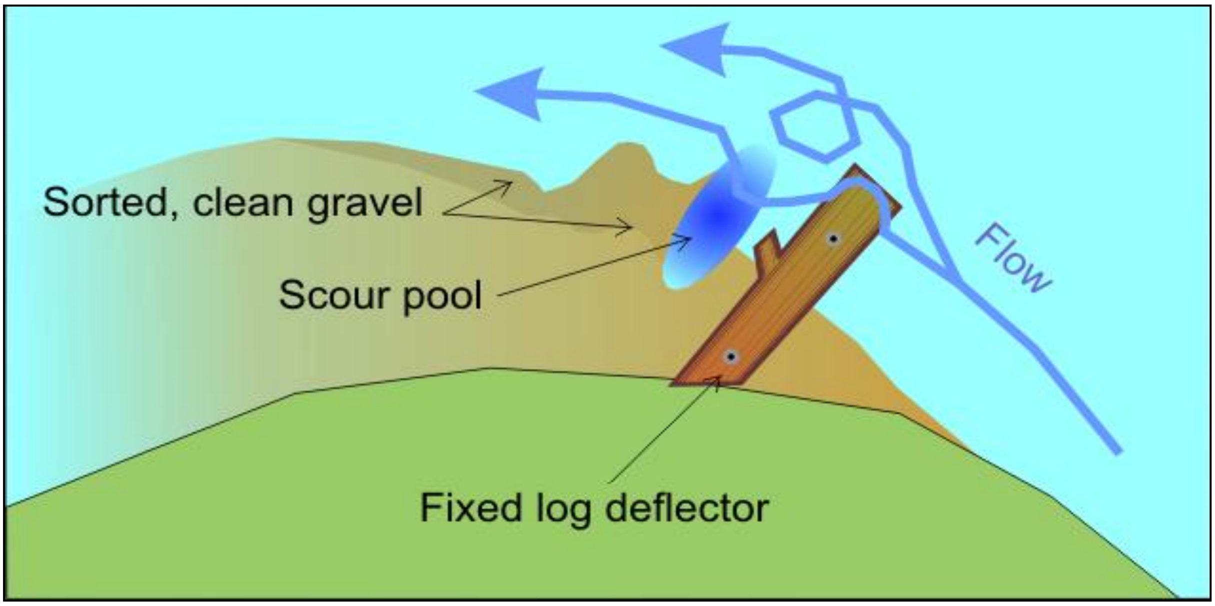

Figure 13: An illustration of a simple log deflector positioned at the edge of a gravel berm to help sort gravel and create better spawning opportunities

There are several techniques to choose from when installing flow deflectors. To begin with, simple logs solidly fixed to the bed at roughly 45 degrees upstream from the bank will probably yield the best results.

Upstream-facing 'V' formations can be used to increase scour through existing pools. This will improve gravel sorting and oxygenation at the tail of the pool where favourable spawning sites may be located.

With practice and increased confidence, more natural LWD (large boughs and branches), could be used as more a naturalistic alternative to simple log deflectors. In all cases, LWD and deflectors should be keyed into the banks in order to limit bank erosion.

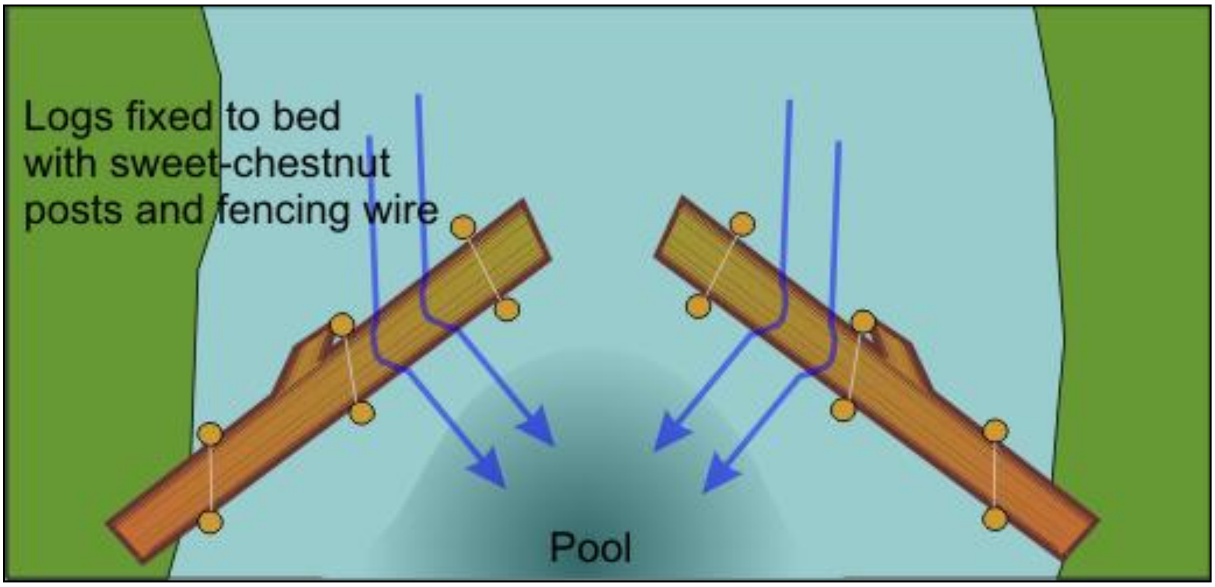

Figure 14: An illustration of log deflectors in an upstream-facing 'V' formation above a pool

- Where grazing and bank poaching is a problem, engage with local land owners/farmers to explore options for fencing off the banks. The construction of formal cattle drinks which allow much more controlled access to the river could help to limit bank erosion and sedimentation.

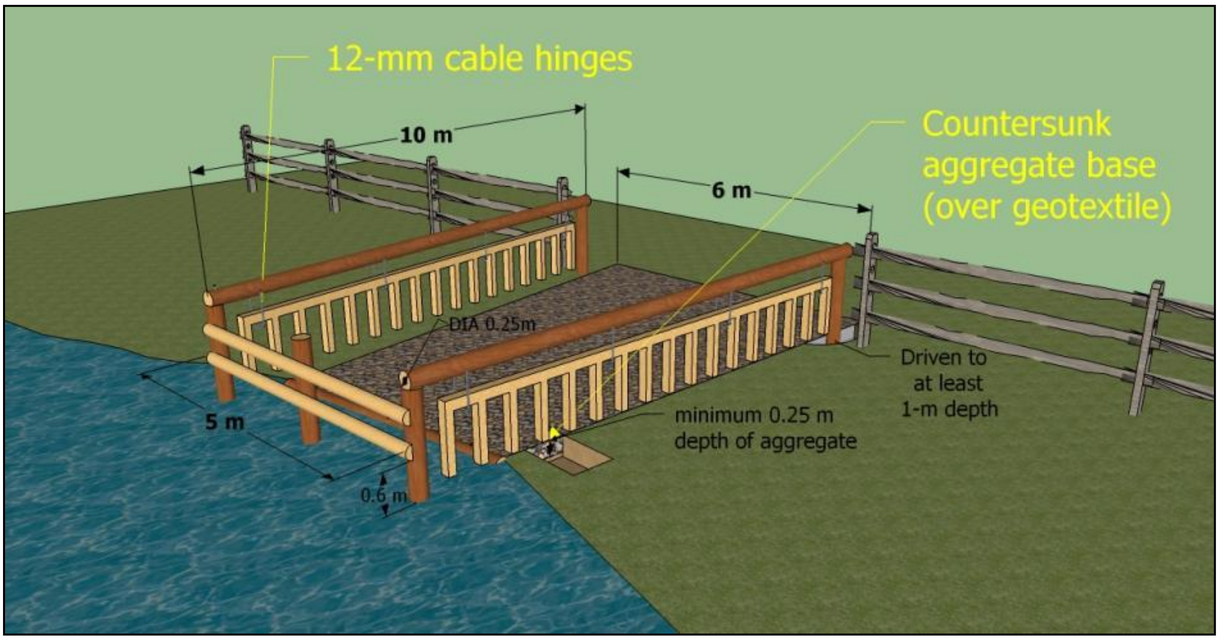

Figure 15: An example formal cattle drink design

Alternative watering options exist that do not require livestock to access the river at all. 'Pasture pumps' 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. A cautious approach may be to install a device in combination with a gate at the top of the cattle drink to allow access to the river in case of malfunction.

Making it Happen

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 to start a project via a Project Proposal (PP) or a Practical Visit (PV). PV's typically comprise a 1-3 day visit where approved WTT 'Wet-Work' experts will complete a demonstration plot on the site to be restored.

This will enable project leaders and teams 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 PV leader.

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 and not for specific advice; no liability or responsibility for any loss or damage can be accepted by the Wild Trout Trust as a result of any other person, company or organisation acting, or refraining from acting, upon guidance made in this report.

Appendix – Environment Agency fish survey data for Wellow Brook

Site Name: Stony Littleton

Survey Date: 08/06/2000

Catchment: Bristol Avon Catchment

Sub Catchment: Midford Brook

Midstream NGR: ST7320056800

Gradient (m/km): 4.5

Distance to Confluence (km): 7.7

Survey Length (m): 93

Survey Width (m): 7.7

Survey Area (m2): 716.1

Species	Min Length (IF)	Max Length (IF)	Mean Length (IF)	Min Age (IF)	Max Age (IF)	Numbers Caught	% of Catch by Number	Weight Caught	% of Catch by Weight
Brown / sea trout ***(Salmo trutta)***	161	394	263	1+>	4+	33	91.67	8330	84.41
Rainbow trout ***(Oncorhynchus mykiss)***	388	389	389			2	5.56	1244	12.61
European eel ***(Anguilla Anguilla)***	550	550	550			1	2.78	294	2.98

Site Name: D/S Of Wellow

Survey Date: 13/07/2000

Catchment: Bristol Avon Catchment

Sub Catchment: Midford Brook

Midstream NGR: ST7420058100

Gradient (m/km): 2.8

Distance to Confluence (km): 5.2

Survey Length (m): 94

Survey Width (m): 6.87

Survey Area (m2): 645.78

Species	Min Length (IF)	Max Length (IF)	Mean Length (IF)	Min Age (IF)	Max Age (IF)	Numbers Caught	% of Catch by Number	Weight Caught	% of Catch by Weight
Brown / sea trout (Salmo trutta)	157	307	238			26	86.67	4577	77.89
European eel (Anguilla anguilla)	385	740	530			4	13.33	1299	22.11

Site Name: Shoscombe

Survey Date: 27/06/2000

Catchment: Bristol Avon Catchment

Sub Catchment: Midford Brook

Midstream NGR: ST7170055800

Gradient (m/km): 2.9

Distance to Confluence (km): 10.1

Survey Length (m): 114

Survey Width (m): 6.52

Survey Area (m2): 743.28

Mean Survey Depth (m):

Species	Mini Length (IF)	Max Length (IF)	Mean Length (IF)	Min Age (IF)	Max Age (IF)	Numbers Caught	% of Catch by Number	Weight Caught	% of Catch by Weight
Brown / sea trout (Salmo trutta)	145	340	246	1+	4>	24	68.57	4924	52.97
Roach (Rutilus rutilus)	239	301	263			9	25.71	3007	32.35
European eel (Anguilla anguilla)	660	670	665			2	5.71	1365	14.68