Sherford Stream, Taunton

An Advisory Visit Report by the Wild Trout Trust

Contents

Introduction

This report is the output of an advisory visit carried out on the Sherford Stream tributary of the River Tone in Taunton, Somerset - national grid reference (NGR) ST223230 to ST223245. The Visit was requested by Miriam Woolnaugh of Somerset Wildlife Trust and was focussed on assessing the quality of the brook habitat and identifying possible habitat enhancement opportunities. Comments in this report are based on observations on the day of the site visit and discussions with Dr Katie Sumner and Francis Farr-Cox of the Environment Agency.

Normal convention is applied throughout the report with respect to bank identification, i.e. the banks are designated left hand bank (LHB) or right hand bank (RHB) whilst looking downstream.

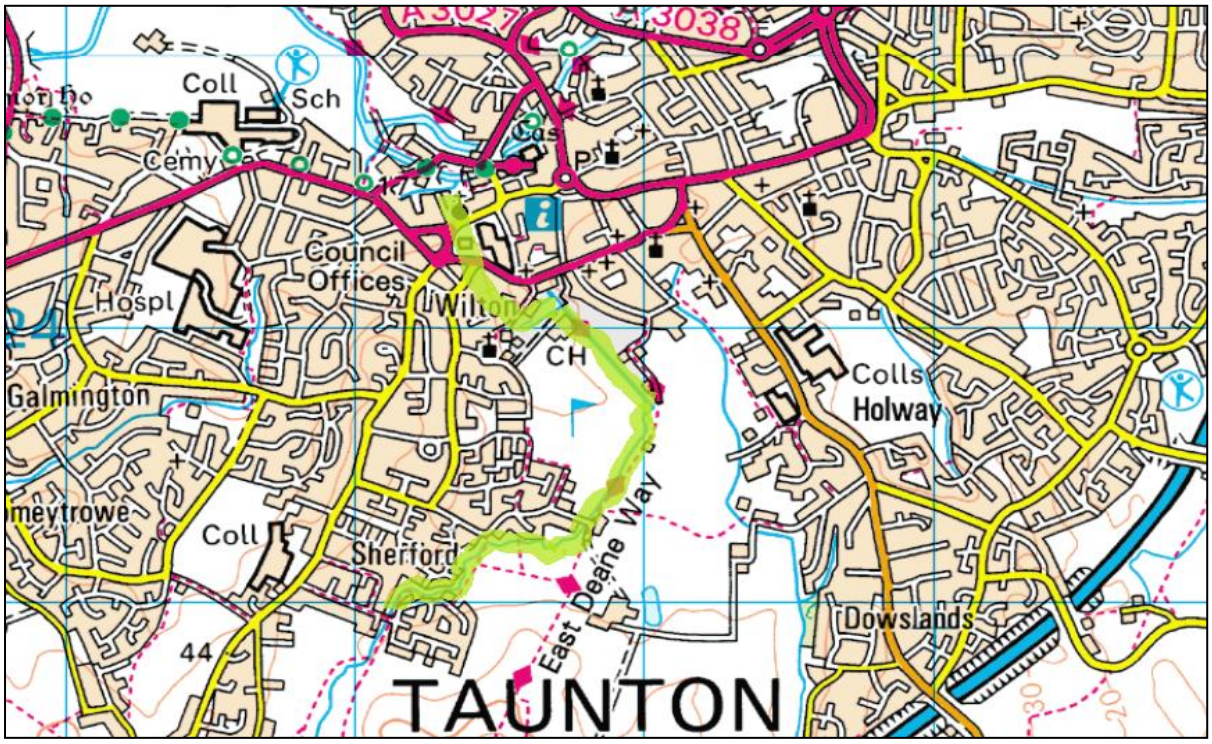

Figure 1: Map showing section of stream visited

Sherford Stream is currently designated as Moderate Status under the Water Framework Directive (WFD). However, no comprehensive fish surveys have been carried out and the current ecological condition of the stream has not been fully appraised.

SHERFORD STR	
Waterbody ID	GB108052015410
Waterbody Name	SHERFORD STR
Management Catchment	South and West Somerset
River Basin District	South West
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)	-

An excerpt of WFD summery information for Sherford Stream

Catchment and Fishery overview

Sherford Stream flows over a superficial *diamicton-colluvium* geology i.e. a wide range of non-sorted sand and stone sediment suspended in a mud matrix that has collected in the stream valley. The underlying mudstone formation of the area is largely impermeable, which contributes to the responsiveness of the stream. The short lag-time between rainfall and water level rise in the southern tributaries of the River Tone has been a driving factor in much of the flood defence planning of the Lower Tone catchment.

The bed of the stream consists of sandy sediment and a wide size range of limestone cobbles and gravels with some flint.

The stream's source is at Hawks Moor on the Blackdown Hills South of Taunton. The upper reaches of the stream are tree-lined and flow through mostly agricultural land. The stream is however, heavily modified through Taunton and significant channel modifications are known to have been made as long as 700 years ago.

Wild brown trout *(Salmo trutta),* bullhead *(Cottus gobio),* stone loach *(Barbatula barbatula)* and brook lamprey *(Lampetra planeri)* have been reported to inhabit the stream but no formal fish surveys have been undertaken. Pollution events have been recorded including a slurry spill in the 1990s that caused widespread fish mortalities. It is uncertain how successfully populations have recovered.

There are no sewage treatment works connected to the waterbody but there is one combined sewerage outfall (CSO) and several private discharges.

Habitat Assessment

Sherford Stream through Taunton is characterised by pockets of natural river habitat fragmented by man-made impoundments and sections of heavily modified channel. Connectivity between sections of good quality habitat is impeded by impassable barriers to fish passage.

The upstream extent of the section of the Sherford Stream visited was at NGR: ST223230 near Pikes Crescent. The stream is heavily impounded by a tall stepped weir that slackens flows upstream and fragments the river habitat by acting as a barrier to fish passage.

Figure 2: A tall stepped weir at ST223230 is impassable to fish

Downstream of the weir, natural geomorphology has shaped the stream into a physically diverse habitat that follows a sinuous meandering path through a tree-lined river corridor. Naturally-formed pools and riffles provide a wide range of water depths and woody debris and tree roots have helped to provide a diverse variety of habitat features. It is these very features that are prevented from forming *upstream* of the weir due to the impoundment of flow.

Figure 3: Tree roots and woody debris enhance a pool habitat

The bankside trees also provide shade over the channel and low lying branches provide cover for adult fish. However, in many places tree canopies from both banks are 'tunnelling' the channel and casting too much shade. Although shade is important in keeping rivers cool during summer months, helping to conserve levels of dissolved oxygen and protecting certain temperature-vulnerable species, an over-abundance of shade can limit the growth of marginal and aquatic plants and reduce the overall productivity of the ecosystem.

The quality of bankside habitat varies considerably along the reach depending on the proximity of private properties and infrastructure, and the consequent engineering works installed to control erosion. Where the banks are heavily modified, small outfalls were frequently observed discharging into the stream. Further investigation may be required to ascertain whether or not such discharges are affecting water quality.

Figure 4: An engineered gabion basket bank revetment and small outfall

Fortunately, in some locations where the banks are heavily modified, the flashy nature of the catchment means that sudden energetic flows have scoured a sequence of pools and riffles on the bed, retaining a level of physical diversity.

Figure 5: A scour pool against a heavily engineered bank

Sudden high-energy flows have augmented geomorphological processes creating occasional small, sandy gravel shoals that provide marginal habitat for plants unable to colonise the steep, shady banks.

Figure 6: A sandy gravel shoal provides marginal habitat

Natural processes have shaped a diverse brown trout habitat. Resident fish populations are however fragmented by impassable weirs that obstruct access to the full range of available habitat.

Figure 7: One of the smaller weirs on the Sherford Stream

As the stream flows from the suburbs, towards more urbanised centre of Taunton, it flows through Vivary Park (NGR ST228239). Here the character of the stream changes entirely.

Vivary Park takes its name from the medieval fish farm or *vivarium* that once stood on the land in the 13th and 14th century. It is thought that during the 1800s the causeway dam that once held up water for the large fish ponds was cut through and the straightened section of the stream known as Sherford Leat was created to power a silk manufacturing mill.

Figure 8: A straightened section known as Sherford Leat runs through Vivary Park

The straightened leat is a homogenous habitat. The over-wide channel has caused flows to be sluggish, allowing fine sediment to drop out of suspension and uniformly smother the bed. Natural geomorphology no longer functions and there is a paucity of marginal wetland habitat. Some cover is provided by overhanging branches and brambles on the left bank.

In the past century, the lower end of the leat has been filled-in and the stream diverted west and then northeast to join the Tone. The diversion consists of a large sloping crest weir on the LB. This structure is a severe barrier to fish passage.

Figure 9: A sloping crest weir diverts the stream west through an online lake

The weir diverts water into an ornamental online lake retained by an even larger sloping crest weir.

Figure 10: A larger weir holds water in the ornamental lake

Even in high flows it is very unlikely that either of these weirs is passable for fish.

Downstream of the lake the stream resumes a more appropriate width but flows through a heavily-engineered, canalised channel. A small weir poses an obstruction to fish passage but is probably passable during high flows. The stream flows between vertical brick and stone flood walls and is virtually inaccessible.

Figure 11: The stream is canalised by tall brick and stone walls

Near the police station at NGR ST224241, the stream enters a very long culvert passing under the A38 and the County Court building.

Culverts are often barriers to fish migration. Excessive water velocity or turbulence, drops at culvert outlets, physical barriers inside the culvert such as debris caught in the culvert barrel, and low flows can all make culverts difficult to traverse. In addition, the longer the culvert, the greater the energy exertion required for fish to swim through.

Even if none of these issues affect the culvert, the sheer length of the structure means that the stream is kept in perpetual darkness. Research suggests that salmonids may be dissuaded from entering dark culverts (Kemp *et al*., 2006), (Weaver *et al*., 1976).

Figure 12: The downstream end of a roughly 180-m culvert

Downstream of the culvert, the stream flows unimpeded into an old mill leat known locally as Mill Stream. The leat runs parallel to the River Tone, joining upstream above French Weir and downstream near The Museum of Somerset.

At the upstream confluence, flow enters the leat via a hatch control structure known locally as the 'barrier wall'. Adjacent to the barrier wall a small weir structure discharges into the Tone. This structure allows the Mill Stream to discharge into the Tone at both ends, effectively allowing the Mill Stream to flow in both directions and quickly drain the Galmington and Sherford catchments during high flows.

French Weir is impassable for fish. A stepped fish pass structure has been constructed on the left hand side of the weir but was not operational. The fish pass functions when boards are dropped into position to raise water level in a series of steps. None of the boards were in position on the day of the visit.

Figure 13: French Weir is impassable to fish

Figure 14: Fish pass not in operation

At the downstream confluence, a series of small weirs are barriers to fish passage in most flow conditions but may be passable during high flows. Fish passage into the Mill Stream from the Tone could be improved by the removal or alteration of these weirs.

Figure 15: One in a series of weirs at the downstream confluence of the Mill Stream and Tone

Figure 16: A series of small weirs can be a serious energy drain for fish

Despite the heavily modified and fragmented nature of the river, Sherford Stream supports a population of wild brown trout. Occasionally throughout the visit, wild brown trout were briefly observed before they quickly darted out of sight. The presence of trout in reaches of the stream partitioned between impassable impoundments suggest that either viable spawning habitat is present

within a number of the fragmented sections of the stream, or that juvinile trout are migrating downstream from the upper reaches. Considering the steep gradient of Sherford Stream south of Taunton and the reactiveness of the catchment, it is also possible that trout fry could be washed downstream during spate flows.

The number of impassable weirs on the stream makes it highly unlikely that the trout populating the stream have migrated upstream from the River Tone. Research suggests that even the most passable of obstructions can have a considerable impact on fish migration, particularly if fish must overcome consecutive obstacles to reach an upstream habitat.

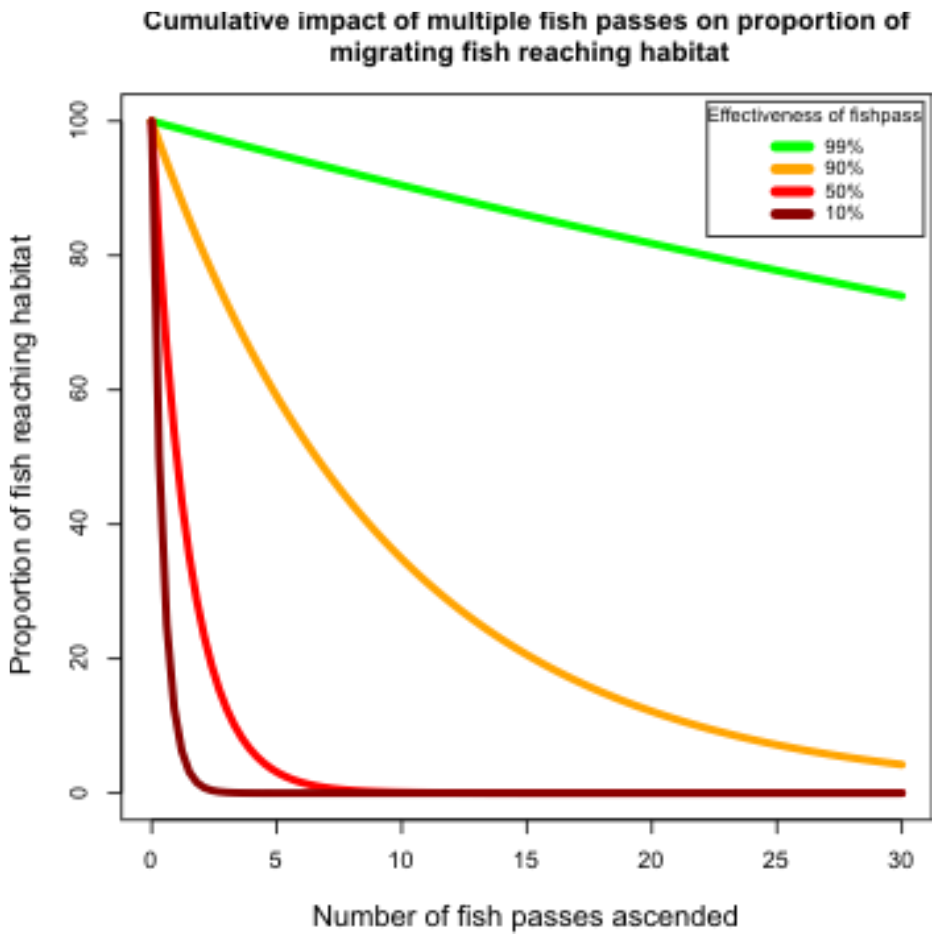

Figure 17: Graph showing the cumulative effect of multiple obstacles to fish passage on upstream migration (courtesy of Dr E Shaw, Catchment Science Centre, University of Sheffield).

Conclusion

Sherford Stream is effectively cut-off from the River Tone. Fish passage is extremely poor and the resident trout populations are fragmented by the numerous barriers to fish passage. The stream above Vivary Park consists of fragmented sections of relatively high-quality habitat but from Vivary Park downstream, the habitat has been heavily modified for centuries and provides a significantly poorer habitat for wild trout and other flow-loving fish species.

The lower sections of Sherford Stream could be significantly improved for adult trout and attendant improvements in connectivity to the higher quality spawning and juvenile habitat upstream could support better thriving wild trout populations along with other species such as eel *(Anguilla anguilla) and brook lamprey* and a greater diversity of invertebrate species.

Recommendations

In order for Sherford Stream to function as a healthy and biodiverse habitat, the following actions are recommended:

1. Surveys should be undertaken to ascertain the current status of fish and invertebrate communities.
   Identifying which sections of the stream currently support the various life-stages of brown trout will facilitate a better understanding of the Sherford as a wild fish habitat. This would best be undertaken by the Environment Agency.
   Invertebrate surveys conducted at various locations will help evaluate water quality. This can be undertaken by volunteers conducting a kick-sampling survey following the following the Biological monitoring working party (BMWP) scoring system
   http://www.fba.org.uk/recorders/publications_resources/sampling-protocols/contentParagraph/01/document/CourseInvertSamplingProtocol.pdf

   http://www.cies.staffs.ac.uk/bmwptabl.htm

BMWP score	Category	Interpretation
0-10	Very poor	Heavily polluted
11-40	Poor	Polluted or impacted
41-70	Moderate	Moderately impacted
71-100	Good	Clean but slightly impacted
>100	Very good	Unpolluted, unimpacted

In order to reduce the effects of human error (i.e. differences in sample size, sampling effort and efficiency), the Average Score Per Taxon (ASPT) should also be taken into consideration. This is obtained by dividing the BMWP score by the total number of taxa (families) in the sample.

Average Score Per Taxa	Category
Over 5.4	Very good
4.81 – 5.4	Good
4.21 – 4.8	Fair
3.61 – 4.2	Poor
3.6 or less	Very poor

Riverfly Partnership training may be beneficial to aid with identification and understanding of stream invertebrates, their life-cycles, position in the food web and sensitivities to water quality.

http://www.riverflies.org/

2. The poor connectivity throughout the stream from Sherford to the confluence with the Tone needs to be addressed. It may be the case that many of the weirs observed during the visit are redundant and could be removed.

The sloping crest weirs within the ornamental lakes at Vivary Park are a major barrier to fish passage. It may be possible to bypass the weirs by creating a new sinuous stream around the lake. Bypassing the weirs with a new naturalistic channel would be an opportunity to create some high-quality habitat amidst a heavily modified section of the river that would

benefit local wildlife and also help to connect the people of Taunton with the natural river habitats of Somerset

Naturalistic bypass channels have been created in other parts of the country with some impressive results:

http://www.cainbioengineering.co.uk/case-studies/mill-leat-bypass-river-loddon/

This scale of project would probably need to be undertaken as a partnership of Somerset Wildlife Trust, Taunton Deane Borough Council, and the Environment Agency and may attract WFD funding or funding from the Catchment Restoration Fund (CRF).

http://www.environment-agency.gov.uk/research/planning/136182.aspx

Figure 18: A possible location for a naturalistic bypass channel around the lake at Vivary Park

The ideal scenario is a fully-connected river ecosystem with all obstructions to free movement removed.

A project to remove weirs on should be initially focussed on connecting sections of river where fish surveys locate populations of resident trout. Subsequent weir removals can then be undertaken with a goal of expanding this habitat until all such barriers have been eliminated.

Such a project could significantly alter the flow dynamics of the stream and may require flood modelling and assessment before works could be undertaken.

It is strongly recommended that a feasibility study be undertaken by the Environment Agency to assess the possibility of removing weirs along the Sherford Stream. If for any reason a barrier cannot be removed i.e. for reasons of flood defence, disproportionate costs or planning constraints; then a secondary substitute may be to ease fish passage over the structure.

There are a variety of techniques by which weirs can be made more passable; which appropriate technique to use will depend on the particular circumstances of each individual weir.

The Wild Trout Trust may be able to assist with a project proposal to ease passage over barriers that for any reason cannot be completely removed.

3. A project of hands-on habitat enhancements works should be instigated along Sherford Stream.

Through the most over-shaded sections, selective tree works should be undertaken to create a dappled mosaic of light conditions with an approximate 50:50 ratio of shade to direct sunlight.

Tunnelling tree branches should be cut back in a few spot locations to create occasional south-facing skylights and selected riparian trees should be coppiced or pollarded to create occasional areas of sunlit bank. Sunlight should be focussed over shallow riffles and shallow-gradient banks in order to encourage aquatic and marginal plant growth.

Creating and maintaining optimum light conditions over a small stream can be a challenge. It is important not to be overzealous with tree works and to resist the temptation to pollard bankside trees to a uniform height. A rotational programme of tree management should be established whereby an uneven age and size structure is maintained throughout the river corridor in order to maintain variation in light conditions throughout the day.

A 5-year rotational programme of tree works is recommended with the aim of maintaining a diverse range of light conditions over the water.

Sherford Leat would benefit from the introduction of some physical variation in terms of both flow diversity and habitat features. In particular, the introduction of some marginal cover would greatly enhance the habitat for adult trout.
A recent habitat enhancement project was undertaken on a mill leat on the River Frome in Dorchester in partnership with Dorset Wildlife Trust.
http://www.riverfrome.com/wp-content/uploads/2011/08/Mill-Stream-in-Photos.pdf

This project was aimed at slightly narrowing the channel and introducing sinuosity and varied flow patterns. The works have since had a dramatic impact on wild salmon
http://www.bbc.co.uk/news/uk-england-dorset-16682494

Considering the heavily landscaped character of Vivary Park, a more subtle project to introduce marginal cover and habitat to Sherford Leat may be better received by local people; a project that also incorporated nesting habitat for ducks and moorhens may also have a greater chance of being supported by park visitors.

A sweet chestnut post revetment back-filled with brushwood and topped with a geotextile 'grow bag' filled with dredgings from the leat; could be planted with marginal plants. Occasional branches protruding from the brushwood structure could be wired to the posts to provide sub-surface marginal cover for trout.
This structure would enhance the biodiversity and visual aesthetics of Sherford Leat without clashing with the manicured character of Vivary Park. The brushwood marginal cover would be barely visible below the surface and the marginal vegetation could provide nesting habitat for local waterfowl.

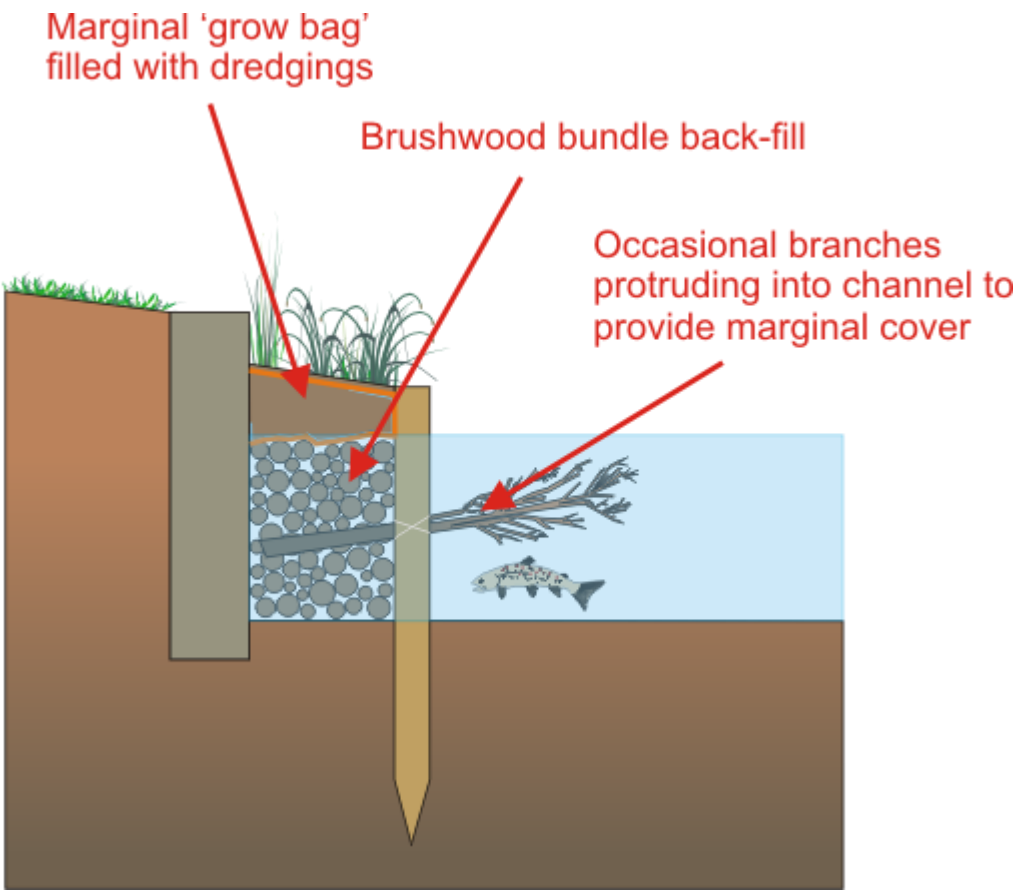

Figure 19: An example cross-section of a marginal revetment with sub-surface cover for trout

Making it Happen

There is the possibility that the WTT could help to start a project via 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 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.

Acknowledgement

The WTT would like to thank the Environment Agency for supporting the advisory and practical visit programmes.

Disclaimer

This report is produced for guidance only and should not be used as a substitute for full professional advice. Accordingly, 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 comments made in this report.

References:

Weaver, C.R., C.S. Thompson, and E. Slatick. 1976. “Fish Passage Research at the Fisheries- Engineering Research Laboratory May 1965 to September 1970.” *Rep. No. 32*, North Pacific Division, U.S. Army Corps of Engineers.

Kemp, P.S., M.H. Gessel, B.P. Sandford, and J.G. Williams. 2006. The behavior of Pacific salmonid smolts during passage over two experimental weirs under light and dark conditions. *River Research and Applications*, 22(4), 429-440.