Advisory Visit

River Esk (North Yorkshire)

13/06/2017

Undertaken by Gareth Pedley

Key findings

- Danby and District Angling Association waters offer great potential for the development of wild trout populations, both resident and migratory, with areas of good quality habitat observed throughout the section of fishery inspected.
- Allowing bankside trees and vegetation to naturally develop, in the absence of pruning and maintenance, has really benefitted the habitat quality.
- Bank erosion and fine sediment input to the river creates an impact on the habitat quality but work is already being undertaken by other local organisations to tackle the issue, with visible improvements achieved. Further buffer fencing/livestock exclusion from the river bank would be beneficial.
- The River Esk has a range of fish passage issues, from minor obstructions, up to major issues like Danby Weir. Addressing all of these issues would be beneficial for the wild fish populations of the river but supporting initiatives to achieve improvements at the major structures like Danby Weir could have major benefits for the fish populations of the whole river.
- Keeping accurate catch records would be beneficial in monitoring the general fishery performance but would also help to assess the benefits of promoting wild fish populations (as opposed to stocking) and the wider benefits of catch and release (if adopted).

1.0 Introduction

This report is the output of a site visit to Danby District Angling Association (DDAA) section of the River Esk in North Yorkshire at the request of Colin Adamson (DA committee member); also present on the visit were David Tyreman (DDAA Chairman and tenant farmer), Ben Adamson (DDAA committee member), and Kate Bailey and Simon Hirst (North Yorkshire Moors National Park (NYMNP)). The purpose of the visit was to provide a general habitat assessment and offer recommendations of how the river could be developed as a wild trout fishery following the clubs decision to cease stocking farm reared trout.

Normal convention is applied throughout this report with respect to bank identification, i.e. the banks are designated left bank (LB) or right bank (RB) whilst looking downstream. The Ordnance Survey National Grid Reference system is used for identifying specific locations and references to upstream and downstream are often abbreviated to u/s and d/s, respectively, for convenience.

2.0 Catchment and fishery overview

Table 1. Overview of the waterbody details for the section of River Rede visited

	Waterbody details
River	Yorkshire Esk
Waterbody Name	Esk from Sleddale Beck to Ruswarp
Waterbody ID	GB104027068150
River Basin District	Humber
Current Ecological Quality 2015	**Moderate** – driven by 'moderate' classification for fish, biochemical oxygen demand, dissolved oxygen and supporting elements (surface water)
U/S Grid Ref of reach inspected	NZ 70808 08305
D/S Grid Ref of reach inspected	NZ 71504 08114
Length of river inspected (km)	1.5

Water body classification

	Select year: 2009 Cycle 1	Select year: 2015 Cycle 2	
	2009 Cycle 1	**2015 Cycle 2**	**Objectives**
Overall Water Body	Moderate	Moderate	Good by 2027
Ecological	Moderate	Moderate	Good by 2027
Biological quality elements	Moderate	Moderate	Good by 2027
Hydromorphological Supporting Elements	Supports good	Supports good	Supports good by 2015
Other Substances	-	-	-
Physico-chemical quality elements	Good	Moderate	Good by 2027
Specific pollutants	High	High	High by 2015
Supporting elements (Surface Water)	Moderate	Moderate	Good by 2027
Chemical	Fail	Good	Good by 2015
Other Pollutants	Good	Good	Good by 2015
Priority hazardous substances	Fail	Good	Good by 2015
Priority substances	Good	Good	Good by 2015

(**http://environment.data.gov.uk/catchment-planning/WaterBody/GB104027068150)**

3.0 Catchment / Fishery Overview

The River Esk rises on the North Yorkshire Moors, flowing in an easterly direction to discharge into the North Sea at Whitby. Once resembling open woodland/heathland, deforestation by Neolithic man cleared large areas of the catchment. This clearance started degeneration of the thin soils, which became depleted of nutrients and prone to erosion once the woodland cover was removed, leading to a collapse of upland farming. Now, woodlands do exist, but most are associated with the river valley and in many cases only form a narrow band along the riparian corridor.

The upper reaches of the river, including many of the upper tributaries, now originate in relatively open moorland, with little vegetation, other than heather, gorse and grass. The predominant land use in the upper areas is grouse moor, transitioning to unimproved sheep grazing, then improved grazing for sheep and cattle further down the catchment as the altitude lowers and land productivity increases.

The geology of the catchment is dominated by sandstones, siltstones and mudstones of various periods, with some limestone in discrete areas. Outcrops of bedrock influence the topography and gradient of the catchment, with the upper reaches being typical steep moorland streams. In the middle sections, the gradient lowers and the channel becomes more meandering before increasing again in the lower third of the catchment.

The surface geology comprises predominantly of till and alluvium. Glacial impoundments once formed a large lake over much of the catchment, leading to deposition of fine material across much of the floodplain. This creates sandy, in-cohesive soils which, along with the comparatively low gradient, create a relatively mobile, sinuous channel with high banks

(www.naturalareas.naturalengland.org.uk/Science/natural/NA_search.asp)
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Much of the catchment lies within Natural England's (NE) Countryside Stewardship Target Area. This means that there may be the possibility of agreements between NE and landowners/tenants to adopt more environmentally sympathetic land management practices, and compensation for adopting less intensive farming e.g. lower stock densities, reduced fertilisation or the creation of buffer strips along watercourses (http://magic.defra.gov.uk/MagicMap.aspx).

The River Esk supports populations of both sea-run and resident brown trout (*Salmo trutta*), salmon (*Salmo salar*) and, reportedly, the occasional grayling (*Thymallus thymallus*), although these have been less prevalent in recent years. In addition, the river also supports European freshwater eel (*Anguilla anguilla*), brook, river and sea lamprey (*Lampetra planeri*, *L. fluviatilis*, and *L. lampetra*, respectively), bullhead (*Cottus gobio*) minnow (*Phoxinus phoxinus)* and sticklebacks (*Gasterosteus aculeatus*). The river also supports a population of Pearl Mussel (*Margaritifera margaritifera*).

DDAA historically stocked the river with farm-reared brown trout and the Environment Agency stocked the river with salmon propagated from River Esk fish and reared in the hatchery at Kielder. Both of these stocking practices have now ceased, creating a great opportunity to allow the wild fish to flourish.

4.0 Habitat Assessment

The river was assessed in a d/s direction, from Danby Bridge to the railway crossing approximately 1.5 km further down the valley. Of particular note to this fishery is the fact that it lies immediately downstream of the highest man-made barrier on the river system (Danby Weir), a major obstruction to fish movement (both up and downstream) that undoubtedly limits the potential of fish populations with the river. This is particularly important for those species more heavily reliant upon spawning and juvenile habitats in the headwaters such as salmon, sea trout and brown trout. A brief assessment of the weir at Danby, and Russwarp Weir further downstream, can be found on the Wild Trout Trust website - www.wildtrout.org/sites/default/files/private/River%20Esk%20-%20Ruswarp%20Weir.pdf. Addressing this major barrier to fish movement will be an important factor in optimising the River Esk's fish populations.

Towards the upstream end of the fishery (upper 0.2 km - d/s of Danby Bridge), the gradient of the river is relatively steep and typical of an upland river, with fast, shallow riffles providing high quality juvenile habitat, some potential spawning areas for salmonids and deeper adult-holding water (Fig. 1). Much of the spawning habitat in this area is particularly suited to larger migratory fish owing to the relatively coarse size (c. 40-60mm +) of the substrate (Fig. 2). Smaller resident trout resident trout tend to require smaller substrate (10-40 mm dia. range), which was also present in the area but not as abundant, largely being transported through this higher energy section on high flows.

Large volumes of fine sediment were also noted in the river margins and slower-flowing areas indicating excess input from upstream. This finer material often becomes trapped among the coarse substrate, locking the bed together, reducing the availability and quality of habitat many invertebrate species, including pearl mussels. It also degrades potential salmonid spawning habitat by inhibiting the cutting or redds (fish nests) within the gravel and reducing the flow-through of water within the gravels that is required to oxygenate incubating eggs. Fine sediment input is already a recognised issue on the River Esk and something that the NYMNP have been working hard to address through buffer fencing schemes to protect the vital river bank vegetation from livestock.

Figure 1. *Good quality adult and juvenile salmonid habitat.*

Figure 2. *Potential sea trout and salmon spawning habitat. However, the substrate also contains a large amount of finer material, somewhat reducing its quality.*

A medium sized sewage treatment works (STW) is located on the LB, which ultimately discharges to the river. While the discharge appeared to be of a low volume at the time of the visit, the water emanating from the plant had a definite greyish tinge, symptomatic of a high particulate loading and excess nutrients (Fig. 1). A smaller, presumed overflow pipe, also appeared to be discharging low volumes of high nutrient effluent to the river (Fig. 2), along with periodic flushes of sewage litter, as observed by remnants caught within vegetation around the outflow pipes.

Both of these discharge points should be monitored by the club and if any further elevation of turbidity or obvious eutrophication (increased algae or grey or brown biofilm/slime) is noted around the outfalls, the Environment Agency should be contacted on their Pollution Prevention Hotline - 0800 80 700 60. Likewise, sanitary litter should be screened from any discharge to the river and if such items are observed along the river, the water company should be contacted to undertake a litter pick-up.

Immediately d/s of the STW a large area of bank armouring has been undertaken, presumably to protect the railway line (Fig. 5). Fortunately, the roughness of the armouring has trapped fine sediment at high flows, allowing vegetation to become established between the boulders and improving bankside habitat.

Figure 3. *Greyish water emanating from the STW discharge. Also note the sewage litter caught on the trailing vegetation.*

Figure 4. *Increased biofilm growth around a suspected overflow pipe from the STW.*

Figure 5. *Rock armouring has trapped fine sediment in high flows and facilitated some revegetation of the area. A small willow shrub (Salix sp.) was also retained which enhances habitat in that area of bank (red circle).*

The River Esk will always be prone to adjusting its course owing to the very friable nature of soils within the catchment (Fig. 6). However, grazing pressure further exacerbates erosion, reducing the abundance and diversity of vegetation that would naturally stabilise the banks (grasses being one of the few species that can withstand regular grazing). With more growth expended upon replacing lost foliage than developing root stock, and a fewer root systems, less bank protection is provided. This reduces the capacity of the banks to naturally regrade as any slumped bank material is less consolidated and more easily disintegrates, often washing into the river (bad for habitat quality and for the landowner/tenant).

Livestock grazing also greatly inhibits natural tree regeneration and the bank protection that the trees would provide, as saplings are usually browsed before they can develop. This is bad news for bank stability but has knock-on impacts upon in-channel habitat, as trees provide vital cover and shelter for fish and invertebrates through their roots and trailing branches. The greater bank stability trees provide also deflects erosive flows downwards into the river bed, naturally creating and maintaining deeper pool areas, rather than allowing lateral erosion that would lead to an over-wide channel. Trees therefore often provide, create and maintain the main fish-holding features within a pool.

Figure 6. *Where livestock have access to the river bank the reduction in vegetation leaves those areas at a far greater susceptibility to erosion. Note how shallow the roots of the grazed grasses are alone (c. 10 cm), in contrast to the diverse, extensive root matrices of ungrazed bank on another section of the River Esk depicted in Fig. 6 (below).*

Figure 7. *In the absence of grazing, the species composition and range of root systems is far more diverse, penetrate much more extensively into the ground and offering far greater bank protection (and habitat potential).*

Woody material within the channel plays a vital role in creating and maintaining fish habitat. The localised flow pinching and scouring that it promotes helps to scour and maintain deeper pool habitat, while the structure and diversity of flow increases the range of habitat niches that are provided for both fish and invertebrates (Fig. 8). Structure provides vital refuge, allowing fish to shelter during floods and areas in which they can more effectively evade predators (Fig. 9). It is far easier for fish to swim amongst branches and obstacles than is for predators like goosanders (*Mergus merganser*), cormorants (*Phalacrocorax carbo*) etc., so fish will utilise such structures in evading whatever is chasing them.

It is therefore vital to retain as much in-channel structure as possible. Doing so will not only increase the number of fish that the river can support (providing more fish habitat) but will also increase the survival rate of those fish. Structure also provides interesting features to cast to, making angling slightly more challenging in terms of accessing the fish but also better, as there will be more fish to target.

Figure 8. *Valuable in-channel structure provided where a willow tree has collapsed into the river. A great example of natural fish-holding habitat and refuge.*

Figure 9. *A seemingly worthless, dead tree; however, the this will not only provide additional habitat in what is a relatively featureless area but will also offer structure to assist fish in evading predators. Also note the fine sediment trapped along the near bank highlighting the excess fine material supplied form u/s and the benefit of rough vegetation along the banks to trap and consolidate this material into new bank.*

An interesting area of habitat was observed where large bankside trees have been left to encroach out over the channel and trailing branches from a sycamore (*Acer pseudoplatanus*) on the RB have accumulated a raft of debris (Fig. 10). This area may be tricky to access for traditional wet fly techniques but is exactly the kind of habitat that is vital for resident trout and will provide great features to fish to with a nymph or dry fly. Retaining some less accessible areas also creates locations in which larger river resident fish are likely to grow on.

Recently scoured bed material (sorted by size and relatively free from fine sediment) at the bend d/s provides valuable trout and sea trout spawning habitat and demonstrates that main river spawning opportunities are available, even for resident trout (Fig. 11). Such riffles and substrate provide important habitat for many of the key invertebrate species that form part of the trout’s diet and hatches fished by anglers.

Figure 12 shows the condition of the next bend d/s before a fencing and tree planting scheme undertaken by the NYMNP. Figure 13 brilliantly demonstrates how easily the issue was addressed with the installation of a buffer fence to exclude livestock.

Figure 10. *Excellent shade and cover for resident trout that is likely to support some larger specimens. This area also provides holding water for migratory fish ascending the river.*

Figure 11. *Relatively silt free, size-sorted gravels, providing good potential salmonid spawning and invertebrate habitat.*

Figure 12. *How the riverbank depicted in Figure 12 looked before livestock were excluded and planting was undertaken.*

Figure 13. *High quality habitat and stable river bank observed during the visit, following buffer fencing. Note the far greater diversity of vegetation achieved.*

In some areas, sympathetic tree management might be beneficial. Figure 14 shows a slumped alder tree that has fallen partially across the channel. While this feature provides valuable habitat and should ordinarily be left in place, it could increase erosion of the adjacent bank and the landowner tenant may wish to have it removed. In that instance, coppicing the tree to allow it to be retained in place while reducing the impact upon flow conveyance and the bank could be a mutually agreeable compromise. However, if this work is undertaken, the requirement for future maintenance should also be considered as coppicing or tree maintenance has the potential to encourage vigorous regrowth.

Figure 14. *A leaning alder that may require coppicing in the future. If the structure does not cause excessive erosion issues it may be better left untouched.*

Towards the d/s end of the fishery, the remains of low-level boulder weirs were observed. Such structures were historically used all over the country in attempts to improve habitat but, in fact, weirs create more issues than they solve, impounding flow, interrupting sediment transport and often increasing bank erosion locally. For this reason it is far better to allow natural cover and flow diversifying features like fallen trees and overhanging branches to develop. Fortunately, the weirs have are largely disintegrated and now pose a minimal issue. However, the localised impacts on bank erosion can still be seen in some places (Fig. 15).

Figure 15. *The localised bank erosion immediately d/s of a now defunct boulder weir. The interruption of sediment supply downstream (and associated bed lowering) and turbulence and lateral scour often leads to accelerated bank erosion d/s of a weir. Fortunately in most cases the weirs have largely disintegrated and their impact upon the banks should continue to reduce as they degrade.*

At the d/s limit of the reach walked, what appeared to be rock armouring of the bed around the railway line creates an un-natural but reasonably well passable obstruction in the channel. The raising of the bed level created also impounds the river upstream. Ideally, structures near watercourses should be set well back from the channel (or buried well below) to allow the establishment of a natural channel width and gradient through the area. That would be the best practice standard today, but was often not the case historically and the legacy of past channel alterations and in-channel structures often remain.

On the walk back up the river, a fenced area (pig pen) enclosing a small tributary/drain was observed. This watercourse discharges into the river and any increased erosion and fine sediment input entering that watercourse will end up in the river, particularly following heavy rainfall. Ideally areas where livestock have access to water and have the potential to increase sedimentation should be offline (e.g. an enclosed pond) so that fine sediment pollution of watercourses does not occur. This is something that should be discussed with the owner of the livestock to ascertain whether the sediment input to the watercourses can be prevented.

Figure 16. *Rock armouring of the river bed. The obstacle created is not great (similar to a steep rock ramp type fish easement) but the impoundment created upstream reduces habitat quality. Possibly one of the reasons for the past attempts to improve habitat with weirs which, sadly, only exacerbates the problem.*

Figure 17. *The pig pen and small tributary/drain. Ideally if livestock, particularly pigs, are given access to water it should not be connected to the river.*

5.0 Obstructions

Following the river walk, brief inspection of two potential barriers to fish movement was undertaken. The first structure, a farm access bridge/culvert at NZ 72713 07336, does pose an obstruction, particularly for the u/s passage of smaller fish with low swimming ability (Fig. 18).

The best practice when installing any crossing of a watercourse is to make it clear-span and of sufficient capacity to accommodate all flows received (e.g. much greater capacity than the current structure). Additional overspill pipes have already been required at either side to handle flood flows and this further demonstrates the poor suitability of the structure. Where a clear-span structure is not possible, an oversized, sunken culvert should be the alternative option (as opposed to an undersized perched one in this case). Before any further maintenance is undertaken on this structure it is strongly recommended that replacement with the aforementioned options is considered. Either option would not only alleviate the fish passage issues but also reduce the access issues that will currently occur during floods owing to the lack of capacity under the track. Allowing sediment transport past any structure would also prevent it from becoming perched and greatly reduce the requirement for future maintenance.

Short term, it may be possible ease fish passage at the site. The LB side of the structure is lower, reducing the jump required to enter the culvert and this is likely to be the preferred access route, although the narrow width within the culvert creates quite high flow velocities over a smooth bed which smaller fish will struggle to pass. Culvert passability is usually improved by bolting baffles or baulks onto the bed of the culvert to increase turbulence and often the depth within the structure. Here, lack of depth is not a particular issue as the flow is already pinched within a narrow channel. Any proposed improvements must bear this in mind, ensuring not to overly restrict the channel width and further increase flow velocities.

Short baffles could be installed into the culvert to dissipate flow energy at either side and create resting areas for fish ascending the structure. More detailed dimensions and, ideally, flow measurements would be required for a detailed design, but a simple array of alternating baffles is likely to be a suitable solution. Each baffle would increase turbulence on the u/s and d/s side of it, creating resting areas from which structure could be traversed in several small steps, rather than one prolonged burst. The design would have to take into account the natural access point at the lower, LB side and ensure not to reduce impede passability there. The air cavitation occurring under the water, along the d/s edge of the culvert also poses an issue, making it difficult for fish to swim straight in. This issue could be greatly reduced by grading out the step or by chamfering the corner of the step / installation of an adherent nappe.

Figure 18. *A relatively low obstruction but the step and air cavitation, coupled with high flow velocities with the smooth bedded culvert, and the prolonged burst swimming speeds required to pass make this structure an issue for fish passage.*

The second structure observed is a culvert variation of a piped ford, at NZ 71957 07747 (Fig. 19). While this structure is far from ideal, the fact that it has been created using reasonably large-sized culverts, which have been sunken well into the bed, reduces its impact. This has allowed the river bed to regrade through the culverts, making it almost as passable as a natural river section at low-medium flows. At higher flows the constriction of the channel created is likely to render it less passable, especially as debris becomes accumulated on it, but this structure is considered to be less of an issue than many others on the catchment and will be passable in most conditions.

Figure 19. *Two sunken culverts employed to create a kind of pipe ford. While this is not ideal, it has been installed in a reasonably sympathetic way and does not pose a significant obstruction.*

6.0 Recommendations

In general DDAA waters on the River Esk provide good quality habitat for salmonids with a natural abundance of pools and in-channel features. Resisting any temptation to prune bankside trees or remove in-channel structures will be vital in preserving the already good quality salmonid habitat.

6.1 Buffer fencing

Fine sediment input to the system is a known issue, although one that is already being addressed by organisations like the NYMNP, with already visible results. One of the most significant improvements to habitat would be achieved through further buffer fencing to exclude livestock from the river bank, wherever fencing is not already present. This would facilitate greater diversity of bankside vegetation and shrubs, providing improved habitat and bank stability and reducing erosion/fine sediment input, along with beneficial in-channel structure.

6.2 Barriers

Addressing the barriers to migration on any catchment is vital in optimising natural fish production and, as such, it is recommended that DDAA push for improvements to be made at all known obstructions on the river, particularly Danby Weir. This may involve liaison with local Environment Agency fisheries officers and collaborative approach with other fisheries interests on the river and the NYMNP and the Yorkshire Esk Rivers Trust.

6.3 Tree Laying

Where trees of a suitable species are already established along the banks, habitat improvements can be quickly and easily achieved by laying the trunks, or branches down into or over the watercourse. However this should be undertaken sparingly as the habitat available in most places is already good.

Laying is usually limited to pliable species, predominantly willow (*Salix* spp.), hazel (*Corylus avellana*), elm (*Ulmus minor*) and small alders (*Alnus glutinosa*), but some others can be laid carefully when they are small. Willows are the best species' to lay into the water as they will thrive in the wet conditions, other species are usually better laid along the bank / water interface, so the majority of the canopy is not submerged.

The laying method involves cutting part way through the stem/trunk, a little at a time (ideally while it is under light tension), until it can be forced over into the river (Fig. 15). The depth of the cut should be limited to only that which is required to bend the limb over, as this will maintain maximum size and strength of the hinge and the health of the tree/shrub. Fast growing trees like willow can even be strategically planted in anticipation of employing this technique once they become established.

Figure 20. *Willow hinged into the river margin to increase cover and structure.*

6.4 Planting

In fenced areas lacking trees and as part of any future fencing, it is recommended that planting with some locally native, deciduous tree species is undertaken. Saplings could be purchased or possibly obtained from the Woodland Trust (or possibly through NYMNP), to provide a natural variety of species.

However, the quickest and easiest way of establishing trees is by pushing short sections of freshly cut willow whip into areas of wet ground, ideally close to the waterline. This can be undertaken at any time of the year, but will have the greatest success during the dormant season, shortly before spring growth begins (ideally late Jan-March). Whips should be planted into the ground so that there is a greater length ($^{2}/_{3}$) within the ground, to minimise the distance that water has to be transported up the stem and planting them on a shallow d/s angle will also ease water transport within the developing shrub and reduce the potential for it catching debris and being ripped out. Leaving 300-400mm of whip protruding from the ground is sufficient (providing this reaches past the surrounding vegetation, to allow access to light). Whips of 5mm-25mm diameter tend to take best, but even large branches can be used. Care should be taken not to leave excessive amounts of foliage on the whips as these greatly increase the rate of transpiration and can lead to their dehydration.

The species of willow whip used will depend upon the required result. Small shrub willow / sallow species, particularly grey willow and goat willow (*Salix cinerea and S. caprea*) tend to be best for creating low, dense fish holding cover, with larger individual trees eventually growing out into the channel which can also be ideal for laying into the river margin. The larger tree species like crack willow (*Salix fragilis*) tend to grow fast and collapse under their own weight, so creating a great method of naturally introducing woody material and structure into a channel, but they can require maintenance in areas with flood risk. The desired outcome and array of species naturally present should dictate what are used.

6.5 Fish population management

The decision of the angling club to stop stocking is to be commended as it is not always one that initially meets the approval of all anglers but it will undoubtedly benefit the native fish stocks of the river. The following section will cover basic rationale behind the promotion of wild fish populations over simply stocking.

The native trout populations of Britain possess great genetic diversity, being the product of several separate colonisations following the last ice age. Many are now further distinct from each other, having adapted to their local environments over time. The natural genetic variability of these populations makes them amazingly resilient and adaptable to changing environmental conditions, which they should continue to do providing human impacts upon them and their habitats can be limited.

However, over the last 150 years, human impacts upon fish populations has increased exponentially, with major issues arising from the way in which we manage land and rivers. To compound these issues, direct interference with wild fish populations also increased, with large numbers of hatchery bred fish being introduced to rivers. The artificial mating that occurs within a hatchery bypasses vital chemical and visual aspects of mate selection; a process that exists to ensure genetic compatibility and maximise the fitness of wild fish. Stocked fish (both diploid and triploid), are also affected by domestication and natural selection for the farm environment, even within one generation in the hatchery (so this includes fish from wild brood-stock schemes). After all, farmed fish are the individuals that have survived within a concrete raceway, earth pond or tank etc. and are therefore poorly adapted for the very different conditions of a natural river. Adaptation to a farm environment is cumulative, with genetic diversity, natural behaviours, and survival rates when released to the wild all decreasing with each generation in captivity.

Stocking fish therefore produces a *'no-win'* situation: if they don't successfully reproduce in the wild, or are infertile (triploids), they are simply an impact upon the ecosystem; if they do survive long enough to breed, their offspring have much poorer survival than the offspring of wild fish. However, stocked fish do still temporarily take up space and resource within a river that could have been used by wild fish. Naïve stocked fish also make an easy target for predators, potentially increasing predator survival rates and increasing impact they have on a river.

So, what is the other option?

Natural rivers (without stocking) have a far greater capacity to produce and hold healthy fish populations. As stated, they were successfully producing an abundance of fish for a long time before we started interfering.

A major key to the success of wild salmonids is their life strategy: over-production of offspring that are then subject to density-dependant mortality. The greater the habitat availability in any year, the greater the number of trout that will survive, thereby mitigating for mortalities and annual fluctuations in the population. This also means that underperforming populations can be easily increased by simply improving habitat quality.

As soon as they emerge from the gravel, trout fry disperse throughout the available habitat, constantly competing to maintain territories. This ensures that the fittest, dominant fish control the best lies, with easy feeding for low energy expenditure. They will remain there until they challenge for a new territory or are displaced by a more dominant individual. Wild fish production therefore ensures habitat is fully utilised and a river holds the optimal number of fish, with the available space being naturally repopulated each year. Such efficient habitat utilisation is impossible to achieve through artificial stocking or even alongside stocking, because stocked fish disrupt the wild population structure and hierarchies.

Wild fish constantly defend their adopted territory and strive to stay within it, while stocked fish have little affinity or suitability to the arbitrary reach in which they are stocked. A large proportion of fish stocked into rivers therefore leave the stocking location or lose condition and die within a short time (particularly during high flows). Consider where the thousands of fish stocked in previous years are at the beginning of each season, and why there is even a requirement to restock. In contrast, un-stocked wild fisheries provide some of their best fishing early season, as fish take advantage of early-season hatches to regain condition after the winter.

Consequently, most angling clubs actually report increased catches after ceasing stocking, as demonstrated by the ever-increasing number of case studies on the WTT website - www.wildtrout.org/content/trout-stocking. There is sometimes a lag period as the wild fish population begins to recover but increased catches of juvenile trout and grayling are often reported from year one. Anecdotal evidence from an increasing number of fisheries suggests that grayling stocks often also proliferate once trout stocking ceases.

An excellent video produced by Wild Fish Conservancy North West documents how the state of Montana in North America ceased stocking after realising the major negative impact it was having – www.youtube.com/watch?v=U_rjouN65-Q&app=desktop

To further improve the river's wild trout populations, it is also recommended that catch and release (C&R) is promoted. C&R is vital if resident trout are to achieve their full size potential, as demonstrated on numerous wild C&R fisheries that now support many more large fish than appeared in recent catches (past 100 years).

Consider that a take-able fish on an upland river may be three or more years old (depending upon growth rates); a 0.5kg fish (1lb +) probably four or more. These larger fish are the most valuable and hardest to replace but, as they attain larger sizes, their survival rate also naturally improves, making them more likely to remain in the river long-term. These fish will then continue to grow on, attaining larger sizes, contributing to the spawning population and improving angling opportunities. Catch and kill fisheries on the other hand often artificially limit the sizes fish can attain.

To help monitor the fishery, it would also be beneficial to collect catch records, to help understand what is being caught and how the fish population is performing. Collecting the information needn't be onerous, just recording the number caught per hour fished, ideally with approximate lengths for the fish. From this, an assessment of the sizes (particularly, average and maximum) and relative abundance could be easily ascertained and compared from year to year.

7.0 Making it Happen

WTT may be able to offer further assistance such as:

- WTT Project Proposal
    - WTT can devise a more detailed project proposal (PP) report. This would usually detail the next steps to take in initiating improvements, highlighting specific areas for work, what exactly is required and how it can be undertaken. The PP report could then form part of any required consent applications.
- WTT Practical Visit
    - Where recipients are in need of assistance to carry out the improvements highlighted in an advisory visit report, there is

the possibility of WTT staff conducting a practical visit. This would consist of 1-3 days' work, with a WTT Conservation Officer(s) teaming up with interested parties to demonstrate habitat enhancement methods (e.g. tree kickers and willow laying etc.). The recipient would be asked to contribute to the reasonable travel and subsistence costs of the WTT Officer.

In addition, 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/index

We have also produced a 70 minute DVD called 'Rivers: Working for Wild Trout' which graphically illustrates the challenges of managing river habitat for wild trout, with examples of good and poor habitat and practical demonstrations of habitat improvement. Additional sections of film cover key topics in greater depth, such as woody debris, enhancing fish populations 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.

8.0 Acknowledgement

The Wild Trout Trust would like to thank the Environment Agency for their continued support of the advisory visit service with funding from rod licence sales.

9.0 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.