Advisory Visit

Devoke Water

Cumbria

23/01/18

Undertaken by Gareth Pedley

Key findings

- Devoke Water already provides a naturally populated, wild trout fishery, as demonstrated by the numbers of healthy wild fish present within angler catches.
- There is potential to improve the habitat around the tarn with relatively simple but effective measures to promote the wild trout population whilst benefitting the wider ecology of the area.
- Reducing the input of fine sediment to the tributaries and, ultimately, the tarn, will improve all habitats for the native trout and invertebrates.
- A suite of measures could be employed to reduce fine sediment inputs on the catchment including improvements to paths and tracks, bridges and livestock exclusion/buffer fencing.
- If buffer fencing of the watercourses (and any other areas around the tarn) is undertaken, the greater diversity of vegetation and trees/shrubs that could be promoted would benefit a wide range of wildlife. Reinstatement of more, natural, high quality organic input such as leaf litter to the system is likely to also benefit many species, particularly invertebrates.

1.0 Introduction

This report is the output of a site visit to Devoke Water, which is the largest tarn in Cumbria. The visit was undertaken at the request of Millom Angling Association (MAA) to assist with their management of the water and inform decisions on the development of a wild trout fishery. Present on the visit were a representatives from MAA, the Lake District National Park and the local Environment Agency fisheries team.

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

2.0 Catchment/Site Overview

Devoke Water lies in the West Cumbrian Fells, draining an area in the middle of the Cumbrian River Esk catchment. The bedrock geology is largely igneous (granites, basalt and andesite) which are physically hard, imparting few nutrients to the water and providing little pH buffering. The superficial geology (soils) comprise predominantly peat and till which are naturally acidic. The actual pH of Devoke Water is therefore likely to be variable depending upon rainfall, runoff and erosion of the peat and soil.

Devoke Water is a high altitude, cold and naturally low productivity tarn where fish and invertebrate growth is naturally slow. These are conditions are ideal for the locally adapted, fit, wild trout which angler catches show thrive in the tarn and will continue to do so, providing other un-natural impacts can be limited (Fig. 1). Conversely, many of the hatchery reared trout that have historically been introduced to the tarn each season, do poorly, as confirmed by emaciated individuals caught towards the end of the trout season (Fig. 2). Now, understandably, the long-term cost:benefit of stocking the tarn is in question with attentions turning instead towards protecting and promoting the wild trout population. The tarn also supports populations of perch and minnow which provide both competition and food for trout (depending upon life stage), with the negative impacts almost certainly offset by the positives in the long-term.

Figure 1. A beautiful wild brown trout, in prime condition, caught from Devoke Water on the last day of the 2017 season (photo courtesy of MAA). Note the enormous pectoral fin (red circle) in relation to the fish's size, typical of a wild brown trout. **N.B.** To better safeguard the wild population, it is recommended that fish are retained within the water while photographing, to reduce the risk of damage and stress they are exposed to.

Figure 2. A skinny stocked trout also caught from Devoke water on the last day of the 2017 trout season (photo courtesy of MAA). Stocked fish tend to survive poorly in the harsh conditions of a natural lake or river but can still impact upon the wild fish – hence the requirement restock each year (see '**Wild vs Stocked Trout'** – p.18).

Water body classification

Select year: 2009 Cycle 1 ▾ Select year: 2016 Cycle 2 ▾

	2009 Cycle 1	2016 Cycle 2	Objectives
Overall Water Body	Moderate	Good	Good by 2015
Ecological	Moderate	Good	Good by 2015
Biological quality elements	-	High	Good by 2015
Phytoplankton	-	High	Good by 2015
Hydromorphological Supporting Elements	Supports Good	Supports Good	Supports Good by 2015
Physico-chemical quality elements	-	High	Good by 2015
Specific pollutants	-	-	Not assessed
Supporting elements (Surface Water)	Moderate	Good	Not assessed
Chemical	Does not require assessment	Good	Good by 2015

http://environment.data.gov.uk/catchment-planning/WaterBody/GB31229338

Under the Water Framework Directive (WFD), Devoke Water achieves 'good' ecological status, being natural (e.g. not classed heavily modified) and achieving 'good' or 'high' for all parameters assessed in 2016; this is an improvement from 'moderate' ecological status in 2009, which was driven by a 'moderate' classification for 'surface water'. It should be noted that the waterbody does not appear to have been assessed for 'fish' or 'invertebrates' under WFD.

3.0 Habitat Assessment

3.1 General issues

The waterbody was assessed from the carpark/boat house, working in a clockwise direction around the tarn. As the greatest potential for physical improvements is likely to be achievable on the watercourses feeding the tarn, some of the more major tributaries were also inspected.

It is apparent that the access track to the tarn creates a surface flow and fine sediment pathway to the tarn (Fig. 3). This could be addressed through proposals already in discussion between MAA and the National Park to improve site access. The work could incorporate gutters to catch surface flows and discharge to well vegetated soak-always areas on the adjacent land. Reducing the distance over which surface flow is gathered and transported along the track will also reduce the volume and erosive energy of those flows and therefore reduce future damage the track.

If the access improvements extend to the bridleway to the south of the tarn, the issues at multiple watercourse crossings (Figs 4, 5, 6 & 7) could also be addressed with areas of sub-soil track creation, hard-standing, and bridges as appropriate. All of these options would benefit from livestock exclusion around the watercourses, as would the general habitat of the area (Fig. 8).

It is therefore recommended that gated buffer areas are created around the boggy patches at the d/s end of the tributaries as a bare minimum.

Buffer areas would allow the development of 're-wilded' oases where more natural vegetation, shrubs (including the dwindling heather) and trees (as are naturally present on the island – away from sheep grazing) can re-establish, to enhance the currently impoverished biodiversity. This would provide benefits to native invertebrates, birds and mammals, while also reinstating natural terrestrial nutrient subsidies to the watercourses through the input of woody material, leaf litter etc. As such, buffers strips and planting should be sought, to extend as far up the tributaries as possible. Additional trees would also provide wind-shelter for invertebrates, birds and, of course, the livestock.

Figure 3. The access track to Devoke Water currently carries surface flow and fine sediment to the tarn, particularly after high rainfall. Cross drains/gutters could be installed to discharge this water and sediment at frequent intervals to soak-aways adjacent to the track.

Figure. 4. The first crossing point encountered on an unnamed watercourse (centre of shot). Much of the bed of this tributary was peat/ soil or grass, from a short distance u/s of the tarn, suggesting those areas are dry much of the time.

Figure 5. A typical watercourse crossing where footfall, vehicle access and livestock poaching combine to increase fine sediment inputs to the tributaries and tarn. Continued erosion from all three sources creates widening the channel, making crossing even more difficult for all site users.

Figure 6. Crossing point around Rigg Beck (right), with similar issues to those described on the other watercourses.

Figure 7. Crossing points on the several small watercourses towards the western end of the tarn all suffer similar issues.

Figure 8. There is a complete absence of trees right around the tarn which greatly reduces the habitat quality and diversity of the area for birds and invertebrates. A few individual trees have been planted in guards sporadically but more extensive planting would be beneficial in areas right around the tarn.

3.2 Hall Beck

Hall Beck appears to offer the greatest potential of the Devoke tributaries for salmonid spawning and juvenile habitat as it is the largest and supports the greatest range of habitats. Over 300m of the beck were inspected, in which the channel is relatively steep and so retains predominantly coarse substrate, with areas of larger boulders creating minor natural obstacles particularly in the steeper u/s areas (Fig. 9). The large average size of the substrate is better suited to larger trout spawning (Fig. 10), although there is potential for fish of most sizes to spawn in discrete areas.

The channel is steep but relatively sinuous with some deeper pool areas, all providing habitat of a naturally high standard for juvenile salmonids and invertebrates (Fig. 11). However, turning of stones on the beck failed to reveal a single caddis or mayfly (multiple species of each would be expected). This may indicate a lack of nutrients/food, as there is clearly a lack of trees and vegetation (other than grasses) along the watercourse. It is possible that, owing to the peaty, moorland nature of the catchment, periodic acidic flushes could be an issue, although this is probably less likely. As a first step to investigating the impoverished invertebrate communities, Riverfly monitoring could be undertaken. Depending upon the outcome, further water quality analysis may be beneficial.

Figure 9. Areas of boulder substrate create small natural obstructions (still passable by fish due to the varied nature of flows), although the substrate in some areas has been manipulated to create pools (as around the sheepfold).

Figure 10. The steep, high-energy nature of the watercourse inhibits the retention of smaller gravels but areas of potential spawning habitat for most trout sizes is present in discrete areas.

Figure 11. The steep but naturally sinuous channel provides a range of habitat niches for juvenile salmonids and invertebrates, but the impact of grazing and lack of bankside shade and cover is blatant.

At the confluence with the tarn, large gravel shoals provide further potential trout spawning areas and high quality invertebrate habitat (Fig. 12). Owing to the dissipation of flow energy as the beck meets the stillwater environment, finer gravels are deposited there and may provide additional spawning areas for smaller fish. Patches under the direct influence of the beck flow are subject to some scouring that will help to keep them free of fine sediment; however, outside of that influence, they will be highly susceptible to smothering by fine sediment. Wave action in shallow gravelly areas can help to oxygenate and incubate salmonid eggs on naturally cool, low nutrient, low sediment input waterbodies; however, addressing the sediment inputs to the tarn will be important if the substrate quality and spawning potential of the tarn are to be optimised.

Figure 12. The outflow area of the beck may provide further spawning areas for a range of fish sizes, providing fine sediment inputs can be minimised. Fluctuations in water level could impact upon the extent and success of spawning.

3.3 Rigg Beck

Rigg Beck is smaller and steeper than Hall Beck and provides high quality physical habitat for fish and invertebrates (Fig. 13), but there is a notable lack of gravel in many areas. Gravel inputs around natural bank erosion highlight the importance of such features in replenishing substrate to a watercourse and provides some spawning potential (Fig. 14). The lack of trees, and diversity of vegetation is obvious and limits habitat quality. Stone turning revealed only leeches, and a single caddis in areas where a greater abundance and diversity of invertebrates might be expected (Fig. 15).

Figure 13. The steep, high-energy nature of Rigg Beck creates a straighter, more rugged channel with naturally poor gravel retention. The habitat is, however, of a good basic quality for juvenile salmonids.

Figure 14. An area of natural bank erosion supplies some gravel to the watercourse. Owing to the steep nature and high rate of gravel transport, such features are important in maintaining substrate diversity.

Figure 15. Stone turning on Rigg Beck was slightly more productive, revealing several leeches (red circles) and a cased caddis (blue circle). This is still fewer invertebrates than might be expected. Many invertebrates rely upon inputs of organic material for food and shelter, with several species of cased caddis using that material to build their cases. This adds yet further weight to the argument for buffer fencing and diversification of the riparian vegetation/habitat.

3.4 Western end tributaries

At the western end, a cluster of small watercourses enter the tarn. The extent of coarse substrate (anything other than peat/soil) on these watercourses is short, generally only a few hundred metres u/s from the tarn, suggesting that the upper reaches are probably ephemeral which limits their potential from the fishery perspective. However, trout have previously been found running these watercourses within the sections that support a coarse gravel substrate and it is possible that they support some limited spawning in their lower reaches.

As for the other watercourses, the primary improvement would be to exclude livestock. Sparse heather shrubs (Fig. 16) are struggling to cling on and would be greatly assisted by respite from grazing, as would the other native species which may be able to re-establish if stock is excluded. Formalising more robust crossing points to reduce (ideally prevent) the associated fine sediment sources would also be highly beneficial. Stone turning on one of these tributaries did reveal a mayfly (Fig. 17), and a stonefly and cased caddis (Fig. 18).

Figure 16. One of the few area where heather appears to be clinging on despite sheep grazing. The shrubs are far from flourishing and would greatly benefit from stock exclusion.

Figure 17. A small mayfly nymph found during stone turning on one of the larger watercourses at the west end of the tarn.

Figure 18. Cased caddis nymphs (red circle) and an emerging stone fly (blue circle).

3.5 Lin Beck

The outflow from Devoke Water is the source of Lin Beck, which has clearly been heavily modified for at least the first 100m; it has been dredged deeper (Fig. 19) and straighter than would naturally occur, probably in past attempts to alter the water level of the tarn. The substrate of the beck provides no spawning potential as it comprises mainly large boulders, some of which have been used to create weirs/crossing points.

The upper section of the beck provides some reasonable quality trout habitat but a screen just d/s of the tarn creates a barrier, presumably as an attempt to constrain errant stocked fish. The risk of fish loss/straying would be less of an issue if the tarn is managed solely as a wild fishery as wild fish they have a far greater affinity to their territories, only straying when the habitat is overcrowded. For this reason, removing he screen is unlikely to see a loss of fish (as could occur in a stocked fishery) but it would be beneficial in allowing access to additional habitat that would benefit the overall population. Approximately 100m d/s of the tarn, there is a natural, almost impassable rock outcrop (Fig. 20). While some fish may occasionally ascend, it effectively isolates trout in the beck u/s and the tarn as a discrete population. As such, the screen could be removed to allow a greater use of the upper beck and free movement of the wild fish in both directions, should they need to.

Figure 19. The dredged, deepened channel of Lin Beck a short distance d/s of the tarn provides no potential spawning habitat although the trout habitat is of a reasonable quality.

Figure 20. A near impassable series of natural rock falls effectively isolates the trout population of the tarn. While this structure is feasibly passable, the photograph does not fully illustrate the scale of the obstruction it creates.

4.0 Recommendations/summary

- Liaise with the Lake District National Park, Environment Agency, Natural England and the landowners and tenants - and possibly the Angling Trust (who have funds for improving angling access) - in relation to improving angling access to the Tarn. This would include reparation of the main access track but also formalising crossing points on the tributaries to reduce the fine sediment inputs they create. N.B. any crossing points should be clear-span or flush to/set slightly below bed level so as not to create an obstruction on the watercourses and negatively impact upon land drainage.
- Liaise with the Lake District National Park, Environment Agency, Natural England and the landowners and tenants in relation to the installation of buffer fencing along as much of the watercourses as possible, to allow the diversification of vegetation and trees at the site. This would be greatly beneficial in reducing the fine sediment inputs in the boggy, lower reaches of the tributaries but also by encouraging greater in-channel structure and reinstating the lacking leaf litter to the upper reaches of these oligotrophic watercourses. Although excluded from the treed areas, the wind shelter they provide would also be highly beneficial to livestock. **N.B.** The size and location of any stock exclusion areas may be restricted by the designations and stewardship options currently in operation for the land and early discussions with Natural England advisers, in particular, would be beneficial.
- In addition to the watercourses, additional areas of fencing to create small copse areas would also be beneficial, particularly in areas around the windward side of the tarn. Again, each of these would provide shelter benefits to the livestock and should be sold to the graziers as such.
- If fencing is installed, undertake planting of a range of native tree species within the protected areas.
- Initiate a programme of Riverfly monitoring on the tributaries to improve understanding of the resident invertebrate populations - information and support can be found at (www.riverflies.org/). This will inform whether further water quality analysis is required. The low numbers of invertebrates observed on the tributaries may well be a consequence of natural low productivity, compounded by a lack of vegetation and natural organic input (leaf litter, woody material etc.).
- Cease stocking the tarn with hatchery produced fish to protect and promote the population of wild trout. Farmed fish (triploid or diploid – even if produced from wild broodstock) are poorly suited to the harsh conditions of the tarn but will compete for food and space (see 'Wild vs Stocked Trout Rationale' - p.18). Promoting high levels of catch and release will also help improve the abundance and size of the wild fish.
- Remove the screen on the outflow/Lin Beck to allow free movement of fish in and out of the tarn and maximise the useable habitat area.

Wild vs Stocked Trout

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 waterbodies. To compound these issues, direct interference with wild fish populations also increased, with large numbers of hatchery bred fish often being introduced.

The artificial mating that occurs within hatcheries bypasses vital chemical and visual aspects of mate selection; a process that exists to ensure mate compatibility and maximises the fitness of wild fish. Stocked fish (both diploid and triploid), are also affected by domestication and selection for the farm environment, even within one generation in the hatchery (<u>so this includes fish from wild brood-stock schemes</u>). 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. That 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 a negative impact upon the ecosystem; if they do survive long enough to breed, their offspring have much poorer survival than the offspring of wild fish. This poor survival is also why, even after a long history of stocking, the genetic integrity of the wild population often remains intact and, after cessation of stocking, the farmed fish genes are often quickly bred out of a population. However, stocked fish do still temporarily take up space and resource that could have been used by wild fish. Naïve, unfit stocked fish also make an easy target for predators. This potentially increases predator survival rates and the impact they create by artificially elevating the number of individuals an area attracts and supports.

Why introduce unfit stocked fish that are destined to do poorly in the wild when you fishery is already producing its own healthy wild fish populations for free?

So, what's the other option?

Natural trout waters (without stocking) have a far greater capacity to produce and hold healthy fish populations. 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 areas, 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 water 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, territories 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 areas in which they are stocked. A large proportion of stocked fish therefore leave the stocking location or lose condition and die within a short time. 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 within a few seasons post cessation stocking, many within the first year, 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 from any impact of stocking but increased catches of juvenile trout are often reported from year one.

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

To further improve wild trout populations, it is also recommended that catch and release (C&R) is promoted. C&R is an excellent way of ensuring trout are to achieve their full size potential, as demonstrated on numerous wild fisheries that now support many, many more large fish than have appeared in recent catches (past 100-150 years) when exploitation has suppressed the sizes attainable.

Consider that a take-able fish may on the tarn may be four or more years old (depending upon productivity and growth rates); a 0.5kg (1lb +) fish potentially even more. It is also a myth to think that just because some waters are less productive and the fish slower growing that they will not attain large sizes, they often just need to be allowed to live long enough to do so.

Once established, those larger wild fish are then the most valuable and hardest to replace but, as they attain larger sizes, their natural survival rate also improves. These fish will then continue to grow, attaining even larger sizes, contributing to the spawning population and improving angling opportunities for many years. Catch and kill fisheries on the other hand usually artificially limit the fish sizes within a population, so it is recommended that anglers consider the far greater benefits that wild fish being returned to the fishery will provide to anglers in the long-term.

This rational is intended as an introduction to the pitfalls of stocking. The fully referenced WTT official position paper can be found at - www.wildtrout.org/sites/default/files/library/Stocking_position_2012_final.pdf

5.0 Acknowledgement

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6.0 Disclaimer