

Re-wilding and Giving Ennerdale Arctic Charr a Helping Hand

Copy of a joint article by Gareth Browning (forestry Commission) and Peter McCullough (Environment Agency) published in the Institute of Fisheries Management magazine in 2015

Peter McCullough of the Environment Agency and Gareth Browning of the Forestry Commission describe a joint project to re-wild the River Liza and Ennerdale Water in the Lake District to benefit Arctic charr.

The last ice age

10,000 years ago during the last ice age, the English Lake District was enveloped in an icy mask of high peaks and glaciated valleys. The scars left on the landscape during the subsequent glacial retreat have given the Lake District its characteristic high fells, deep lakes and tumbling mountain spate rivers. As the glaciers retreated and left rivers where they had once gouged out paths to the sea, an invasion from the sea began in the form of Arctic charr. Much like their northern cousins still do today in Iceland, Greenland and Canada, the first pioneers of the newly formed river basins were anadromous invaders that spent much of their life at sea. Roll on to present day and the ancestors of these fish can still be found in the isolated pockets of the UK's deepest lakes and lochs. All UK populations of Arctic charr are now effectively 'environmentally landlocked', with conditions in the outlet rivers of such lakes, along with surrounding sea temperatures considered unfavourable for them. It is widely recognised that the majority of UK charr populations are in decline, with increasing temperatures considered to be one of the greatest threats to their existence in UK waters.

Last surviving Arctic char

The Lake District contains England's last surviving pockets of indigenous Arctic charr, and the population of charr that remains behind in the outpost of Ennerdale Water, is the most unique. In contrast to the populations in Windermere, Thirlmere, Wastwater and several other waterbodies, the Ennerdale population remains 'true to its roots' in the sense that these fish still maintain the urge to swim upriver to spawn. Two other Lake District populations in Ullswater and a genetic variant of the Windermere population also displayed this trait. Sadly however the Ullswater population became a victim of pollution due to lead mining in their spawning stream and the Windermere population shared a similar fate due to adverse environmental conditions.

During a handful of nights in November, shoals of Arctic charr gather at the mouth of the River Liza, which flows into Ennerdale Water, waiting for dark. When the light has dimmed sufficiently, 'waves' of charr begin to nervously push their way across the riffles and shallows of the river. As the light fades further and the vanguard pushes upstream, the fish seem to gather in confidence and push upstream en masse. Upon reaching the fine gravel beds in the cold, clear water of the river, the fish begin pairing up which can often lead to the spectacle of several males vying for the attention of a female charr. The cock charr display brightly coloured flanks in varying shades of vivid red and orange, and if this



warning tactic fails to deter their rivals they can employ a nasty bite in the form of their enlarged mouth which is armed with pin-like teeth and a kype (hooked jaw) that would shame a salmon (albeit in proportion as the fish tend to be typically 300-350 mm in length). When the victor has been decided the female then digs a redd in the gravel and lays her eggs. The eggs are then fertilized by the male. When all is complete the surviving fish slip silently back into the depths of Ennerdale Water and remain there until the following November.

Faced with extinction

Regrettably during the last few decades of the 20th century, Ennerdale's charr population seemed to drop off a cliff in terms of numbers of adult spawners, and the marked decline in this lake outpaced most other populations. Visual and hydro-acoustic surveys confirmed the fact that the population was in freefall. After several pieces of research into the fish were commissioned, it was widely acknowledged that a combination of environmentally detrimental factors had contributed to the decline of Ennerdale's charr population. Studies on the River Liza had given strong indications that periodic episodes of low pH values were leading to poor survival of ova. Some acid flushes happened during spate events in the crucial incubation period for charr eggs (November- May), and led to high mortality of ova and emerging alevins. Paired with this factor was the construction of two crude pipe bridges, one in the main Liza that dissected the historic charr spawning grounds, and one in Woundell Beck (an important feeder stream in terms of spawning gravel supply to the main River Liza). The bridges served as a double threat to charr in that they severely restricted upstream migration for salmonids in the Liza, and choked the gravel supply downstream to Charr Dub (the principal spawning ground).

Saving the Arctic charr

Faced with the possible extinction of the last remaining river spawning population of Arctic charr in England, a plan was hatched to save this important strain of fish. During 2005 the Environment Agency and Wild Ennerdale (a partnership between The Forestry Commission, National Trust, United Utilities and Natural England) set about developing a strategy to save and restore Ennerdale's charr population. The strategy centred around getting conditions right for fish in the valley and the employment of restoration stocking to compliment this approach.

Wild Ennerdale – wild water, forests and mountains

Wild land is a relatively new concept in the UK and involves giving natural process greater freedom to develop our future landscapes. Wild Ennerdale is one of the UK's largest wild land initiatives, which has been formed through a partnership led by the three main landowners in the valley: The Forestry Commission, National Trust and United Utilities with the support of Natural England. This is a great combination of two government agencies, a national charity, FTSE 100 company - and there is a fifth partner, who rarely turns up to meetings, is very determined and always operating in the valley even when we are on holiday - natural processes. For the central concept of taking a wild land approach is to work alongside natural processes in new and innovative ways relinquishing more of the



detail of the valleys management to this silent partner and operating at the landscape scale.

Wild Ennerdale's vision is: "To allow the evolution of Ennerdale as a wild valley for the benefit of people, relying more on natural processes to shape its landscape and ecology". It is very much forward looking and focuses on allowing the valley to develop as a wilder place for the benefit of people in a very broad sense including recreation, business, spiritual refreshment, learning, personal exploration and more. It's not trying to recreate a past point in time.

In addition to the vision, decision making is guided by a set of principles:

- Give freedom to natural processes allowing robust, functioning ecosystems to develop on a landscape scale
- Consider and respect the historical and cultural assets of the valley
- Protect and enhance the sense of wilderness
- Develop greater public enjoyment, engagement and social benefit
- Establish sustainable business opportunities
- Monitor change on a large scale and over a long period of time
- Share results and information as a demonstration to others
- Only intervene where complementary to the Vision or where a threat to the vision is proposed
- Focus management and decision making more at the landscape scale

Established in 2002, the initiative covers around 4,300 hectares. In managing the valley a philosophical approach is taken: with partners acting as if they were one land owner, balancing the needs of ecology and people and recognising that after 13 years this is just the beginning.

"After looking after this valley for over a decade, we are just starting to join up the dots of its DNA and realise some of the connections between the various processes that shape the valley", said Gareth Browning.

Extensive cattle reduced the tension

Early on in our wild quest we decided to reduce intensive sheep grazing and introduce extensive cattle as a dynamic natural disturbance factor. For this to be most effective we removed the river side fence to give the cattle freedom to roam across the valley. Whilst not intentional, we soon realised that this removed the tension between tenant farmer, river and landowner. Previously the tenant farmer's income was tied to the area of enclosed land, which was being eaten away as the river eroded its banks. To protect his income the tenant farmer would ask the landowner to shore up the banks with stone-filled gabions. By moving to extensive grazing across the valley the tenant farmer's payment boundary was no longer linked to the will of the river's meandering. There was no need to carry out expensive bank repairs and fight against the river's energy. Through taking a landscape scale approach the tenant farmer, landowner and river have all won.

Regenerating forest and the creation of a high friction landscape



As the river meanders down the valley and meets the forest edge, trees of all sizes are forced to yield to the river's erosive force and they become 'food' for the river.

The river may take a year or more to devour a tree or in storm events this process may last a matter of days or hours as the river jumps channels abandoning debris only half finished. Large stumps, whole trees and stripped limbs are all food for the hungry river. However, the river struggles to carry the debris far as the energy required to erode the next meander, flow through large debris piles and the scrubby riparian landscape, all encourage the river to drop its bed load. Once left behind the debris catches more debris helping to stabilise gravel movement and stop large debris making it down to the mature river near the lake.

Depending on the river's meandering the debris-stabilised gravel beds become colonised by nature's pioneer species including trees such as pine, larch and birch as well as spruce, cypress, gorse and more fragile flora such as harebells. If allowed enough time, these once naked gravel beds can become woodland again ready to provide food for the river and the cycle to begin again.

The regenerating forest is an integral part of this high friction landscape with dense thickets and woodland slowing the river down, taking away its energy and reducing its potential to erode. It also creates a myriad of habitats from banks of clean gravel that provide ideal spawning habitat for Arctic charr to woody debris filled channels that provide refuge for fry and deeper pools for adults to hide in.

The Great Storm 2009

During the Great Storm of 2009 the River Liza moved massive volumes of stone and produced multiple debris piles the size of SUV's all the way along its middle section.

New river channels were driven through the forest and scrub and then abandoned hardly used as the river meandered wildly. Trees were felled and left marooned and one of the valleys footpath bridges was torn off its foundations. The river has the same respect for legal designations as it does for established forest. Rather than trying to reinstate the old footpath, the Wild Ennerdale partnership with the help of our passionate and enthusiastic volunteer group established a new path higher up out of the river's grasp.

Lower down the valley the river saw huge volumes of water but very little debris made it out of the middle section and here we see the benefits of a regenerating forest supporting a high friction landscape. The Arctic charr spawning beds suffered no significant damage as potentially destructive large woody debris was held up in the high friction landscape of the middle valley. After the storm event Thirlmere and other North Cumbria reservoirs were unable to supply water as sediment and colour taint exceeded acceptable levels, however, Ennerdale's water remained clear and it was able to supply drinking water as normal. By working with natural processes and creating a high friction landscape habitats and drinking water supplies were protected under the most severest of tests.

Removing artificial barriers



On the bottom of the River Liza a concrete pipe bridge was identified as being a barrier to Arctic charr getting to their spawning grounds. It also acted a partial barrier to gravel movement, depleting the river reach downstream. The pipe bridge was removed and replaced with an improved design. A smaller pipe bridge was also removed on the Woundell Beck, a tributary of the Liza, and replaced by a clear-span bridge. Arctic charr are now able to utilise a much increased spawning area which bodes well for future recruitment.

In re-wilding the River Liza much has been learnt in particular: disconnecting the administrative boundary from the dynamic river boundary has removed the pressure to control the river; recognising the value of the forest to the river has changed our response to the river's constant hunger to take away the forest; and a regenerating forest provides food for the self healing river and enables it to recover after each flood event and be ready for the next.

"This high friction landscape of established and regenerating woodland is a velcro landscape that is a natural water filter, which slows down the river and reduces its energy and creates a mosaic of habitats. To some it may appear a mess but what is being established here is a wild river given freedom to evolve", said Gareth Browning.

Restoring stocks

During November 2005 Environment Agency fisheries officers along with partnership volunteers, conducted night time spawning surveys in the River Liza and Smithy Beck (another historic spawning stream). The surveys took place over several weeks and only a handful of spawning charr were found, but the results provided a crucial set of baseline data to compare any future fluctuation in spawning adult numbers. In order to obtain the limited broodstock needed to give the population a 'kick start', Environment Agency officers deployed fyke nets to intercept migrating charr. This continued for several weeks until sufficient ova and milt had been collected to begin rearing the young charr at the Environment Agency's Kielder hatchery. In the following June, the successfully reared fish, which had now reached the fry stage, were taken back to Ennerdale Water and reintroduced to the spawning streams in the hope that environmental imprinting with the scent of the Liza's waters would allow them to recognise their ancestral spawning streams. This process continued through to 2013 and several years after the helping hand was given, the charr population has showed a marked increase in spawning adults with redd counts revealing a large increase in spawning activity in the improved spawning gravels of the River Liza.

Now that the population is beginning to show the first green shoots of recovery, the project has entered a monitoring phase. New technological developments have allowed Environment Agency officers the ability to see the charr and count them in real time without the aid of intrusive torches and bright lights (to which the charr show an alarming aversion). The new technique being employed centres on the use of DIDSON, a multi-beam sonar that allows the operator to stealthily observe and record video-like images of fish during their nocturnal upstream migration. The primary benefit is that the fish don't even know it's there. Data recorded using this method can now be used in future to compliment the existing hydro-acoustic data series for the lake.



While the spectre of climate change remains a threat to the UK's charr population as a whole, work targeted at solving the issues on a local scale at Ennerdale Water has yielded extremely positive results. This should give the lake's charr the best possible chance of survival in the future and contribute to the wider biodiversity of this rather special area of wilderness.