River Lea - Amwell Magna Fishery

An Advisory Visit by the Wild Trout Trust March 2015

1. Introduction

This report is the output of a site meeting and walk-over survey of the Amwell Magna Fishery, a loop in the River Lea system, downstream of Ware in Hertfordshire (map 1).

The club was established in 1841 and is thought to be the oldest fishing club in the world with a continuous tenure on the same section of water. The club was historically run as mixed fishery, where the members could catch coarse fish as well as wild trout, many of specimen size. Much has changed over the intervening years and the club is now run exclusively as a fly-fishery, with both stocked and wild trout the main quarry.

The club were the recipients of an advisory visit and report, produced by Windrush Aquatic Environmental Consultancy back in 2005, where the focus for the advice was mainly targeted towards improving opportunities for trout spawning. The club have implemented many of the recommendations suggested in the report.

Issues to resolve low flows associated with abstraction pressures have also been high on the agenda and it is understood that some progress has been made in discussions with the Environment Agency (EA) and the Water Company.

The request for the WTT visit came from Mr. Bob Dear who is the Fishery Manager for the club. As well as seeking some thoughts on current habitat quality, the club are keen to review their management options in light of the EA's policy preventing the introduction of fertile stock fish from this season. Although the trout fishing at Amwell Magna is very much underpinned by stocking, the club are passionate about developing improved wild stocks and to provide a more challenging, interesting and ultimately more sustainable trout fishery.

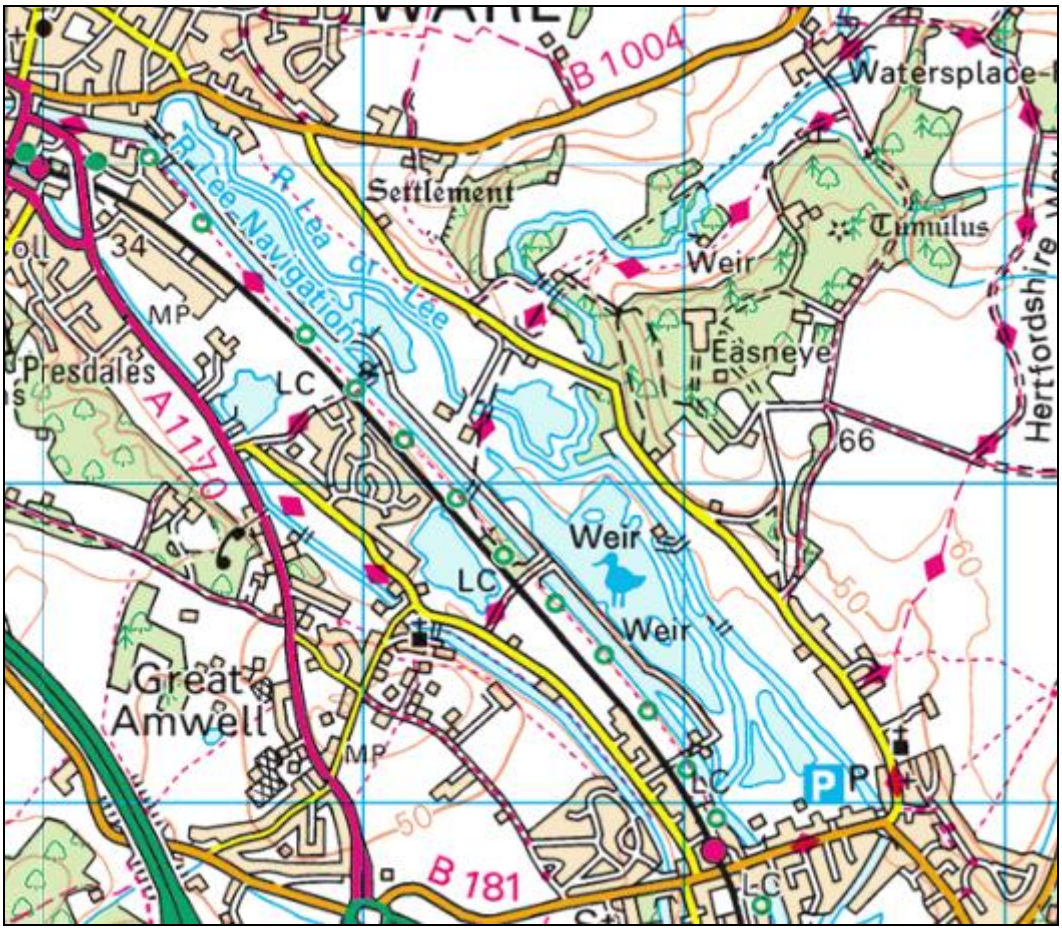
In recent years the club has seen a slight increase in the number of small naturally spawned fish caught at the fishery and have evidence of large fish spawning on the fishery, including the presence of obvious redds and video footage of large brood fish in the act of redd cutting. The assumption is, that if the club were to be restricted to stocking only with sterile stocks that the spawning activity would cease and that the naturally spawned component of the stock would collapse. This issue is discussed in more detail in section 4 of this report.

The fishery comprises approximately 3 km of channel, including sections of natural "old Lea" channel, as well as an old milling leat and a section of the lower River Ash which joins the upper reaches of the fishery from the left bank (LB). The reach inspected during the visit comprised of approximately 1km of channel running from a point at National Grid Reference TL 373132 downstream to the confluence of the mill leat with the lower main channel at TL 381125.

The river here is classified as being part of the Lea Navigation under the Water Framework Directive (Waterbody ID no. GB106038033240) and is listed as a Heavily Modified Waterbody of "moderate potential" on the EA website.

Comments in this report are based on observations on the day of the site visit and discussions with key members of the Amwell Magna club.

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



Map 1 Amwell Magna Fishery. ©streetmap

2. Catchment and fishery overview

The River Lea rises from the chalk aquifer in the Northern Chilterns near Luton and flows for 68km south east to join the tidal Thames between Blackwall and Canning Town. The river flow is augmented with numerous tributaries, several of which, including the Beane and the Mimram are synonymous with having once supported high class fisheries, but which have suffered from excessive abstraction pressures during the latter half of the 20th century.

The River Lea has been extensively modified, canalized and abstracted ever since Roman times and the urban development of Luton, Harpenden, Welwyn Garden City, Hertford and Ware all impact on the quality and quantity of water available for the middle and lower reaches of the river. In addition to the water

quality and quantity issues, the Lea has been extensively modified for milling power and navigation, with the Lee Navigation linking Hertford with the tidal Thames at Limehouse.

The Lea has a long and famous history as a fishery and is still highly regarded for producing specimens of outstanding quality. Intense avian predation pressures throughout the Lea Valley and the arrival of the non-native signal crayfish *Pacifastacus leniusculus* in the 1980s have added to the pressures on native Lea fish populations.

Campaigns to raise the profile of Lea Valley chalk streams has led to a review of abstraction licences under the Catchment Abstraction Management plans and lobbying by angling clubs, consultatives and groups, like the World Wide Fund for Nature, have all helped to focus attention on this highly pressurised system.

3. Habitat assessment

Habitat availability for all life stages of the brown trout *Salmo trutta* are comparatively scarce, with the majority of the fishery consisting of comparatively deep glide habitat (photo 1). Opportunities for spawning coupled with suitable nursery sites in close proximity were considered to be limiting factors. The 300-m section of channel running downstream from the main weir (photo 2) did support some areas where wild recruitment is possible, as did short reaches of the top section of channel above the Ash confluence, where areas of suitable gravels and associated shallows can also be found (photo 3)

Photo 1. Long sections of the Amwell Magna fishery consist of deep glide habitat. Acceptable for supporting limited numbers of adult trout and in particular stocked fish but not particularly productive for recruiting wild fish.

Photo 2. Section of channel downstream of the weir with some gradient providing some opportunities for trout recruitment.

Photo 3. Upstream reach which has been improved via the introduction of gravels as well as localized channel narrowing to quicken flow velocities.

Evidence of redd cutting was seen at various locations; however, the lack of very shallow, well covered margins will compromise fry to yearling survival rates and very limited shallow riffle habitat will also mean that any juvenile trout present will have to share space with larger fish, or other predatory species. Generally when juvenile habitat is limited, or already occupied, the rates of mortality are usually very high, although it is often difficult to assess mortality against juvenile trout simply vacating the reach, usually in a downstream direction to look for a suitable niche. The net result for a fishery is the same – very few wild fish coming through to adulthood.

The top reach apparently does not perform as well for angling as some of the more benign reaches downstream, which is surprising, as there are some decent holding lies for adult trout available throughout this upper reach. The work the club have undertaken in introducing large woody debris (LWD) flow deflectors, in addition to big pieces of imported stone, all help to create much needed diversity in the overall shape of the river bed. This is particularly important in years when submerged weed growth is limited.

LWD flow deflectors can be extremely effective in helping to sweep away fine sediments and drive the river bed down to create water depth and a safe lie for a trout. Fine and coarse sediment blown from these pots or lies will then form into ramps of sorted bed material, providing sites for spawning and habitat for juveniles. In addition, the diversity promoted in a habitat that supports a variety of bed depths and substrate types will also yield diverse flow velocity patterns and an environment which can then support a wider range of aquatic plants and invertebrates.

Flow deflectors are much more effective when introduced into un-impounded reaches, where the flow velocities are sufficient to bite against the deflector and blow out bed sediments as well as promoting surface up-welling. Long sections of the Amwell Magna fishery are under the influence of impounding weir structures which slows upstream flow velocities, promoting bed accretion, reducing river bed gradients and ultimately the power of the river to shape diverse and attractive habitat.

As a rule of thumb, it is always better to run rivers low and fast and locally drive the bed down by squeezing the channel with flow deflectors, rather than attempting to hold up water levels behind impoundments. Even on sections which have great potential for wild trout (photo 1) low "summer weirs" made of stone have been introduced, presumably in an attempt to hold up water. This is of course a perfectly understandable response to managing a river which has suffered more than most from over abstraction and low flows. The net result however, is to lock the river into a series of steps which severely limits the development of high quality trout habitat. A good compromise is to remove a central section in the low weirs to flume the water into the pool below but also to reduce the impounding effect above.

A key issue for the Amwell Magna club to wrestle with is the overall impact the two main weirs have on habitat quality. On the one hand, having the high level milling channel (photo 4), held up by the downstream labyrinth weir does provide more linear bank to fish. The downside is that this route also takes a considerable percentage of the flow away from a section of the lower, un-

impounded channel, which seriously impacts on its potential to create optimum trout habitat. It is understood that the impounded milling channel holds stock fish well and provides good sport for the members. This is surprising because the complete lack of any gradient within the mill leat compromises habitat quality for both wild and stocked trout and would normally be expected to offer a poor environment for holding trout.

Photo 4. Mill leat. Some excellent attempts have been made to add some sinuosity to the Mill leat channel; however, the revetments require more brushwood, or gravel backfill with planting and possibly tree work to let in more light and maximize marginal emergent plant growth potential.

Cutting a big notch in the crest of the labyrinth weir would create some energy in the mill leat, however a corresponding lowering of the main weir adjacent to the club house will also be required if the current flow split between the two channels is to be maintained.

One possible option is to accept that the mill leat is impounded and treat its management and maintenance as it were a linear still water fishery. Holding up levels in the mill leat but lowering the main weir impoundment would send more flow and energy into the low level channel, bringing huge benefits for trout habitat in this reach. The mill leat could still be lightly stocked, perhaps with the rainbow trout that the club currently introduce. Rainbow trout, even in river environments are far more mobile than browns and there is a chance that rainbows will still patrol up and down the leat, even without additional flow. It should be recognised; however, that these fish might migrate up and out of the mill leat if the flow was throttled right back. This is a debate the club can have and potentially there is the option of experimentation to see if a change in flow splits and impounding levels provides improved opportunities for the fishery as a whole.

There is no question that if the production of increased numbers of wild fish is a priority then complete weir removal of the main river weir should be high on the agenda. This action would transform the reach adjacent to the club house, potentially improving habitat quality right up to and possibly beyond the Ash confluence.

Overall the fishery has been very sensitively maintained. Low, scrubby overhanging cover has been retained in many areas and there was lots of evidence of active works designed to pinch the channel and energise water velocities. When selecting areas of river bank to narrow, it is essential to ensure that soft brushwood revetments are well packed with woody materials and if necessary back filled to create a low, boggy shelf, ideal for emergent plants to colonise. Making sure there is sufficient light penetration is key when planning this type of work.

In general the river appeared to have decent amounts of shade, which is also vital, particularly on any enriched system such as the River Lea. Planting low, overhanging species like thorn, elder and sallow could provide much needed low-level shade in the margins without creating total channel shading. These low bushy trees are often a source of cover and food for trout which often gravitate to such sites. Maintaining the balance between helping to make a fish feel comfortable and providing the angler with at least some chance of catching is the fishery manager's dilemma!

Some opportunities exist to develop mid-channel islands (photo 5). These habitats, if developed, could help to energise flow velocities either side by constricting the channel width but also provide the opportunity to create biologically rich margins for both invertebrates and fish.

Photo 5. A potential site for the development of a mid-channel island

4. Stocking

A key element of the visit was to discuss the club's recent stocking programme and to explore options for the future in light of the regulations now in place under the EA's National Trout and Grayling Fisheries Strategy.

Catch records and observations confirm that small naturally-spawned fish are present and the club are desperately keen to build on this small but apparently increasing local population. Evidence of spawning activity on the fishery has been confirmed, both in terms of redds observed and video footage taken of large brood stock spawning on key sections of favourable habitat.

The assumption from those in the club that have observed the spawning activity is that the small fish that are now being caught are the progeny from the previously stocked fertile fish. This may, or may not be the case. From conversations on the bank, it would appear that peak spawning time on the fishery is usually the first week in November. This is consistent with spawning activity from domesticated, farm-reared, fertile strains in many other southern stocked fisheries and is in the order of two to three months earlier than would normally be expected for wild brown trout in a chalk river environment.

Why does this early spawning take place at Amwell Magna and why is it potentially an issue?

The reason this early spawning activity in fertile stocked fish is simply due to artificial selection by the fish farmer. Stocked trout with a long history of line rearing tend to spawn very early because the fish farmer only has a short window for growing fish onto a size fit for sale. It makes economic sense for the farmer to maximise growth rates to ensure that fish can be shipped out quickly to a size specified by the customer. Over 10, 20, perhaps even 50 years of picking up one hen fish to test if it is ready and then popping it back because it won't strip and then going for the ones where eggs can be procured will inevitably influence the ripening time of any offspring that are reared from that selected hen. These days, ripening is often accelerated with the use of hormone treatments but the net result is the same – early ripening fish.

When these early maturing fish are stocked into the wild they will cut redds very early, sometimes even before the fishing season has ended. From conversations on the bank at Amwell Magna it would appear that bonfire day is a great time to go and watch fish red cutting. In this scenario, during a mild winter, where average water temperatures might be approximately 8^{o}C then you would expect alevins to pop out of the gravel 60 days later on the 4th January. Even in a cold winter, where mean water temperatures might be as low as 4^{o}C the fry would hatch approximately 100 days later, possibly around mid-February. The question is, what will those fry eat once the egg sac they carry has been used up, at a time of the year when very small natural food items are simply unavailable?

November spawning is perfectly viable for many northern, surface-fed, spate rivers where mean water temperatures are much lower than for those rivers with either a big groundwater component, or rich in warm, treated effluent. Obviously the Lea would be considered to be a warm river by any standards and I would suggest that fish spawning on bonfire night have virtually a zero chance of

recruiting any stock for the next generation. If any of those stocked fish are responsible for small wild born Lea trout then it can only be from those fish that are hanging on and spawning much later.

The issue of early maturation and spawning are not the only inherited traits that would give cause for concern. Even one generation of line rearing in a fish farm can fundamentally change the way a fish behaves in the wild. A fish's ability to survive at each stage of its life cycle will depend on adapted and inherited traits ranging from feeding behaviour through to predator avoidance and, if lucky enough to survive to adulthood, the ability to find a suitable spawning location, select a mate and successfully spawn in a wild environment. Every single one of these incredibly important survival strategies is not required in a fish farm environment and the fish's ability to deal with survival in a wild river environment is simply unnecessary and as a result can be easily be lost in a few generations. These fish still look fantastic because what we see is all we have to go by in assessing whether or not the stocked fish meets with our approval. They are selected and bred to look fantastic but for wild survival it is the traits that we can't see that are far more important.

Fish farmers do not use wild broodstock in their production process. Using wild broodstock brings a massive range of risks and issues for the farmer to deal with. It is much easier to work with the line-reared, domesticated strains in a strictly controlled and managed environment. In the same way that domesticated stocked fish are ill equipped for wild survival, then wild fish are notoriously difficult if kept in a farmed environment and often suffer from stress related issues and more often than not, huge mortality.

If the issues associated with stocking farm reared strains into the wild environment were simply that every fish would die before spawning then there would be very little or no recruitment and therefore why should we really be concerned?

The big problem is that the inherited traits that render stocked fish less than ideal for wild survival can and do get passed onto the wild population, with the net result that rather than the population becoming gradually fitter and stronger and more able to locally adapt to a changing environment, the opposite effect can occur. We also know that if wild and stocked fish are present in the same environment then wild x stocked spawning interactions take place which are known to compromise the fitness and viability of the stock. This is particularly an issue when stocking mixed sex diploids when the cock fish will often be repeat spawners, often interacting with natural, late spawning wild fish.

This issue of stock fitness and local adaptations is described in much more detail in a number of articles and videos on our website at www.wildtrout.org

These are just some of the reasons why the stocking policy introduced by the Environment Agency is considered by many wild trout enthusiasts to be long overdue and very necessary if we are going to protect and build fitter wild populations in the future.

So how can we explain what we see with our own eyes at Amwell Magna?

It is possible that the small, wild-born fish that are caught on the Lea are the offspring of stocked diploids, but the chance of this is, in my opinion, highly remote. Other scenarios are possible and on similar stocked fisheries, where the very same questions have been asked and research has been commissioned, then the results have very often challenged the hypothesis that it is the stockies that are building the population.

It would be very surprising if true wild Lea fish are finding their way down the system, via the Lee Navigation, to end up as residents in the Amwell Magna Fishery. Surprising but certainly not impossible. Possibly more likely, is the chance that small wild fish spawned in the River Ash, where the EA have confirmed the presence of a recruiting wild population, are dropping out into the Lea and taking up residence in favourable habitat.

Another possibility is that some of the small fish seen in recent years on the fishery are benefitting from catch and release tactics and some are coming through to spawn locally and have been responsible for building the population that is now evident.

Potentially all of these questions could be answered through a genetic typing project. DNA samples from small fish captures on Lea surveys have already been sent by the local EA team for genetic analysis as part of the Atlantic ARC project managed by the West Country Rivers Trust and delivered by scientists from Exeter University. The aim of the project was to have an in-depth look primarily at sea trout stocks right across the south and west and identify any linkage between populations, both of migratory and resident (brown) trout. Potentially, DNA samples taken from fish caught at Amwell Magna could be analysed and compared against genetic material from other sites and from Leckford broodstock.

A club in Suffolk is currently going down this very path and have put in place arrangements with Exeter University to fund the analysis of rod-caught samples from the River Lark. The Amwell Magna Club might wish to travel a similar path but an early discussion with Philip Bellfield from the EA is recommended to explore options and ideas for helping to answer some of these critically important questions.

In deciding an approach for future stocking programmes the club must consider several important factors.

The amount of high quality trout fry and parr habitat is very limited at Amwell Magna. It is highly likely that every single habitat niche that might be suited to a very small trout is already occupied by a very small trout! Even if the magic wand were available to conjure up many thousands of fry and hundreds of parr, where would they find any viable habitat? This issue may well be the bottleneck to building a bigger population of true wild fish. A single redd can be responsible for fully populating several hundred metres of channel, particularly when much of the channel is only suitable for mainly big fish. Running the river shallow and

faster could help to create more opportunities for wild recruitment by freeing up more space for fry and parr.

If most of those suitable juvenile niches that do exist are currently occupied by a small, naturally spawned fish then simply adding in more small trout via for example an incubator box programme, would be wasted effort and counterproductive. The very first step is to end any speculation as to the provenance of these small fish and try and answer the fundamental questions posed.

Stocking with larger adult stocked fish is going to be required at Amwell Magna to satisfy the aspirations of the members. It is understood the club have tried a batch of sterile triploid fish and found issues with the way they performed. Hence a desire to continue with diploid stocking. In studies on other fisheries, where blind trials have been conducted and the rods did not actually know whether they were pitching a fly at a stocked triploid or diploid, they simply could not tell the difference between the two.

There is no doubt that in homogenous habitat that triploids can clump into shoals but in rivers with well-defined and broken up lies then this does not seem to be so much of an issue, especially when efforts are made to spread the stock out during the stocking operations.

Much speculation in the angling press has also been given to the triploids ability to over-winter. Yes, there is no doubt that fish that do not lose condition via sexual maturation do persist longer through the autumn and early winter than stocked diploids. The condition that triploids hold through the autumn and early winter is due to not losing condition rather than "voracious feeding" which appears to be another myth that has been widely circulated in the angling media. A study looking at gut analysis of stocked fish on the Itchen found no difference in the gut contents of triploids over diploid stocks.

Another complaint levelled at triploids is that they won't feed at the surface. The reality is that diploids also won't feed at the surface unless there is sufficient fly on the water. Again in separate, controlled scientific studies, the surface feeding preferences of diploids over triploids simply could not be detected. When assessing the pros and cons of triploids v diploids we believe that even if there are some proven downsides to triploids over diploids then the potential rewards for building a stronger wild stock would outweigh any slight concerns over performance.

Many long established and famous fishing clubs, including the Houghton Club on the Test have been using triploids now for well over a decade, with absolutely no issues and are seeing the benefits with strong year classes of wild fish to be found where there is suitable habitat. The imperative for using triploids in this case was not necessarily to protect wild fish but a business decision based on the farmers' ability to produce better quality stocked fish.

The one thing we do know about triploids is that they won't move onto shallow spawning habitat in the autumn, potentially disturbing or displacing fish that will actually spawn successfully and provide locally adapted stock for the next generation.

If any stocked triploids are not 100% triploid should we be concerned?

Not in the least because it is a simple risk assessment. The fewer numbers of fertile fish stocked then the lower the risks of any genetic introgression and the fitter the population becomes.

It is possible that batches of triploids will performed poorly just as some batches of stocked diploids will perform badly. Our advice would be to discuss the stocking programme with your supplier and try the triploids again. There are wild-born Lea fish on the Amwell Magna fishery. These are like gold and must returned when caught and be left to spawn with each other to find that local adaptability which will see the population grow. If the club seeks to improve habitat further and the regulators do their job and protect water quality and quantity then the fishery can only improve.

5. Conclusions.

The Amwell Magna Fishery is a very special fishery with a great history and a reputation for providing high quality sport for the members. The management committee have undertaken a huge amount of work in recent years and are now benefitting from some of the extensive habitat improvements delivered.

The club are rightly proud and excited that wild born fish are returning to this section of the Lea. Many assumptions, by all parties, have been made as to their provenance. Understanding how, why and where these wild born fish have appeared from is of fundamental importance to the future management of the fishery.

Currently the fishery has only limited amounts of habitat available for juvenile trout. Opportunities exist to create more interesting and varied habitat by continuing with the programme of works already being implemented. A debate as to the purpose and function of the two main weirs on the fishery is of critical importance and could be the key to unlocking further extensive improvements to trout habitat.

A key message in deciding how to improve habitat for holding adult trout revolves around water depth. If too much of the river length is run low and fast then it could compromise its ability to hold large adult trout. This statement is undoubtedly true but there is always the opportunity to drive the river down to create local depth when there is the scope to harness the rivers natural gradient and energy. Simply holding up water levels to impound the river results in homogenous, slow-flowing water over what will inevitably be a silt laden river bed – perfectly ok for many coarse fish but not ideal for a trout fishery.

5. Recommendations

- **Open a dialogue with the local EA about possible support for a genetic study of Amwell Magna trout stocks.**

- **Until the answers to questions regarding the provenance of small wild fish has been resolved it is recommended to move towards stocking non-fertile trout.**

- **Open up a debate about the function and purpose of the two level control weirs. River bed levels could be raised over long lengths of channel through strategic gravel introduction, rather than single step impoundment if holding up levels in key locations is deemed necessary.**

- **The principles of running the river low and fast and driving the river bed down should be an over-arching goal.**

- **Creating shallow, well covered margins will boost opportunities for small trout.**

- **Explore options for securing more flow for the lower channel over the milling leat. More flow in a channel that is un-impounded will create improved habitat for trout.**

- **Consider managing the leat as a linear still water fishery with stocked rainbows as opposed to browns.**

- **Continue with the programme of habitat works on those sections where flow and gradient bring the greatest rewards.**

- **Developing some additional low scrubby cover over deeper holding lies will make fish feel more comfortable, even if it makes fishing difficult. A few "Impossible lies" on any fishery are to be considered valuable.**

Note: All work within 8m of the top of the bank will require a consultation with the EA and may require a formal written Flood Defence Consent prior to any work being carried out.

Acknowledgement

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

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