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1 day report on methods of enhancing and developing the Penstone fishery on the River Yeo

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For:
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Report and visit sponsored by The Wild Trout Trust

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Introduction

This one day visit was made to Penstone Barton on the 29th January 2003 and was sponsored by the Wild Trout Trust. The aim of the visit was to offer impartial advice on methods of improving this stretch of the river Yeo both as a wild trout fishery and, on a larger scale, its contribution to the Exe system. At the time of the visit the river was flowing at low winter flow following a period of sustained high water.

1. The River Yeo

The river Yeo is the principle tributary of the River Creedy which is one of the two main tributaries of the lower Exe. It rises on the rolling hills of mid Devon and drains a mixed farming catchment. The Yeo rises on the Carboniferous Limestone series but within 2 kilometres the geology changes to the Devon Old Red Sandstone. This weathers to create sandy, free draining soils, ideal for many arable operations but prone to capping and soil loss if left exposed during heavy rainfall. It is also a moderate aquifer that will ensure a relatively high base flow when compared to other South Western streams. These base flows, in conjunction with high levels of calcium from the lower Carboniferous rocks, a moderate gradient and a well developed pool riffle sequence, mean that the Yeo at Penstone has all the correct ingredients for a productive trout stream. There is no survey data from the vicinity but the nearest site gives encouraging numbers of large adult trout although a lack of trout fry. None of the EA electro-fishing sites in the system indicate successful trout spawning and although this may be due to the location of the sites (with most trout spawning taking place in the unsurveyed 1st and 2nd order streams) it does give cause for concern. The upstream and downstream sites to Penstone Barton show reasonable to good numbers of adult trout (Tables 1 and 2) but there does appear to have been a decline. Unfortunately there are only two data points and it is an insufficient number from which to draw meaningful conclusions.

Table 1. Trout numbers per 100m2 at upstream and downstream electro-fishing sites. (EA 2000)

Site	Fry	Parr and adults
Butsford Barton	3.1	22.9
Keymelford	0.00	12.3

This was a significant drop on the previous survey data of 1994 (Table 2)

Table 2. Trout numbers per 100m2 at upstream and downstream electro-fishing sites (EA 1994)

Site	Fry	Parr and adults
Butsford Barton	4.0	42.3
Keymelford	0.0	26.9

The invertebrate community when sampled briefly showed no signs for concern with 4 mayfly families, 3 cased caddis, 2 caseless caddis families, leeches, chironomids, tilipuds, freshwater limpit, alderfly and large numbers of freshwater shrimps being present. The large number of shrimps is indicative of high levels of calcium and

suggests efficient processing of leaf-litter etc. entering the river through the detrital food chain. The absence of stoneflies is possible explained by the high pH as several pollution intolerant mayfly species were present in good numbers.

The Yeo has at least three important EC Habitats Directive Annex II species present.

White Clawed Crayfish (*Austropotamobius pallipe)*
Listed under Appendix III of the Bern Convention and Annexes II and V of the EC Habitats Directive. It is classed as *Globally Threatened* by IUCN/WCMC. The Creedy system has the last surviving population of White Clawed Crayfish in the South West of England. This species has serious problems and is heavily threatened in the Exe due to the presence of Signal Crayfish in the upper catchment. It has been the spread of Signal Crayfish that has lead to the demise of this species. Recommended management actions in section 3 are intended to benefit both Trout and Crayfish.

Atlantic Salmon (*Salmo salar*)
Ashfield weir on the Lower Creedy was only passable to salmon during a limited range of flows. This weir ensured that despite the Exe being the premier salmon river in the Westcountry the Creedy system only had reasonable numbers of salmon present in its lower reaches although occasional fish were recorded in surveys from further up the river. In the summer of 2000 the EA constructed a fish pass on the face of the weir and the high flows of that Autumn then destroyed the weir. Since the summer of 2000 salmon will have been straying in increasing numbers into the Creedy system and the expected repopulation of this reach, in the next 5 years, needs to be taken into account.

Bullhead (*Cotus gobio*)
The Yeo, and the whole of the Exe system supports a healthy population of bullhead. Unlike White Clawed Crayfish and Salmon the population of this species is not giving any cause for concern in the South West.

It is likely that Brook and River Lamprey which are also Annex II species will also be present but their presence or absence could not be confirmed.

2. Principle issues

The following are put forward as the principle issues limiting the potential of the Penstone beat as a trout fishery.

2.1 Habitat

The habitat within the reach is fair with a few areas of high quality habitat. The principle controlling variables in this reach appear to be woody debris and the amount of shading. The amount of stock access is negligible and there are no problems with invasive weeds or channel instability. The distribution of habitat is shown on the map at the end of this document.

Much of the beat is starting to show signs of overshading. This is when the tree canopies get so thick that they deprive the bank of light and therefore vegetation. The water then has access to parts of the bank not protected by tree roots. Where the banks

are not made of bedrock it erodes bays between the trees widening and shallowing the channel, so degrading the habitat. Eventually the bays develop to the point that the tree is undermined and it falls in. Although this is a natural phenomenon it is exacerbated by previous but abandoned coppicing that has lead to many multi-stem trees of similar age and hence denser canopies. Once the riverbank has been coppiced, then it is beneficial to the river's ecology that the practice continues whilst multi-stem trees remain.

Plate 1 30 year old multi-stem alder at Penstone Barton

There is a functional guild of herbivorous invertebrates within streams that rely on epilithic algae for their nutrition; these invertebrates, both as aquatic nymphs and adult flies, provide food for all ages and types of fish and other larger aquatic and terrestrial invertebrates, birds and bats. The majority of these 'grazing' invertebrates are found on the stones in well-lit riffles. This is because, unlike most pools, riffles have hard, relatively stable beds, suitable for algal growth, provided there is sufficient light. Pools generally have dynamic, silty beds, which accumulate via the deposition of finer particles from the slow flowing water in the pool. They have their own suite of invertebrates, which live mostly within the sediment and are specialised towards collecting and eating fine particles. It is beneficial to leave shade over the pools and deeper sections to provide fish with refuge and to keep the pool areas cool in the summer allowing higher concentrations of dissolved oxygen, as preferred by salmonids. However, the fine sediments in pools are suitable rooting areas for larger aquatic plants, which also provide habitat for invertebrates and fish. A 'dappled light' over pools will therefore be most beneficial.

Parr and adult trout are extremely territorial when feeding, and in streams with sufficient cover the size of the territory that is occupied is related to available food. Although salmonids will feed on substrate-associated prey, surface drift and suspended drift items, the majority of their diet is taken from suspended drift and the degree of intraspecific competition and territoriality reduces with increasing food availability in this form. Although this effect is most pronounced in salmon fry it also occurs in adult trout.

As stated, increasing in-channel (autochthonous) primary production through a reduction in the shading in suitable sites promotes a response of the invertebrate community with a shift from detritus shredders to scrapers, grazers and collector gatherers, which rely heavily on algae or algae derived detritus. These groups are more likely to drift, as it is part of their feeding strategy and they inhabit the upper

layers of the bed where flow velocities are higher, and provide the suspended drift required by salmonids.

This effect was confirmed by Martin O'Grady in Eire, who compared 26 paired open and tunnelled sites. The sites tested were comparable to the Yeo system with channel widths of 1.6-19.7m and pH's of 5.8 – 7.2. The adult trout populations in the open areas were 351% higher than the comparable shaded sites with, on average, the largest trout being 31% bigger (length not weight) in lit sections compared to shaded ones. Although this data relates to the Summer-Autumn period only this is a period in which significant natural population reductions occur after the initial post emergence mortality.

Implementing a shade reduction programme (See section 3) is likely to significantly improve the beat as a trout fishery and will provide niches for light-loving riparian plants, increasing the beat's biodiversity. This work has already been started with a number of sections being coppiced in spring 2000.

As previously stated, to retain biodiversity it is important that shaded sections are left. These help to regulate water temperature, which is very important in the South West, and provide feeding, resting and nesting areas for bats and birds.

The following three plates are representative images of the stretch and show how the bank side habitat changes with decreasing incident light.

Plate 2 Well lit channel.
4 % of stretch
Channel width 1.5-2m
Stable banks
Lots of bankside cover
Loose banks for crayfish
Excellent trout habitat
Prone to high water temperatures in summer

Plate 3 Balanced shade
8 % of stretch
Channel width 2 - 3m
Stable banks
Good bankside cover
Loose banks for crayfish
Good trout habitat

Plate 4 Over-shaded channel.
- 88 % of stretch
- Channel width 2.5 - 4m
- Eroding banks
- Limited bankside cover
- Limited habitat for crayfish
- Poor trout habitat
- Keeps water temperatures down in summer
- Supplies Woody debris to the channel

Within the shaded sections the quality habitat is associated with coarse woody debris in the channel and trailing root systems that provide structure, cover and diversity in the channel (Plates 5 and 6) In any management option that is prosecuted these features should be retained

Plate 5. Woody debris dam at upper end of beat

Plate 6. Trailing tree roots providing excellent cover

2.2 Sedimentation

As mentioned in the introduction, the catchment is prone to excessive soil loss due to the combination of moderate slopes and the sandy nature of the soils. When these soils are left as bare seedbeds and exposed to rainfall they tend to cap which creates an impermeable crust on the surface leading to overland flow and sediment delivery to the channel. Once in the channel these sands and silts infill spawning redds cutting down the oxygen supply to the incubating eggs and eventually killing them. Additionally the high levels of sand infill the niches between the stones and reduce the amount of refugia in the bed, lowering invertebrate populations and filling in the habitat of trout and salmon fry.

2.3 Invasive plants

In the correct conditions, high levels of light and an adequate supply of nutrients, almost all freshwater plants can be invasive and cover over, or fill in, freshwater habitats. The two ponds at the top of the tributary have problems with both Duckweed (Plate 7) and Canadian Pondweed in the areas left clear. The Duckweed limits the productivity and diversity of the pond by depriving the bed of light and the Canadian pondweed can choke the pond making management difficult and fishing impossible. Management options are discussed in section 3.

Plate 7. Duckweed covering 75% of the pond surface area in January

2.4 Water Quality

There are other areas of concern especially relating to water quality. Although the invertebrate community is indicative of current good water quality the intensive farming in the area, particularly the dairy, provides a risk that an accident will kill off the stream. Recent research by the Westcountry Rivers Trust and others has shown a remarkable genetic diversity in wild trout stocks and it is likely that the Yeo has its own Evolutionary Significant Unit (ESU). It is sensible to try and protect this strain as it will be uniquely adapted to the river. Options are discussed in section 3.

3. Recommendations

3.1 Habitat improvement

As discussed in section 2 the limiting factor on this stretch for adult trout numbers is the dense shading regime exerted by the abandoned coppice on the banks. This shading regime and low branches makes fly fishing over most of the stretch impossible. Reinitiating a coppicing or singling programme would be beneficial to the fishery both in terms of increasing fish numbers but also in terms of ease of fishing

A two stage coppicing programme is recommended to stabilise banks, improve habitat and improve access to the stretch. There will be overlap between these purposes, in that a stretch coppiced for access will also improve habitat.

Stage one should be the pruning out of branches leaning across the river where only one bank is treed (See plate 3). Be aware that branches reaching down to within 50cm of the water surface provide cover in their own right and try to balance the requirement to make the water fishable with the fishes habitat requirements.

Stage two should be to instigate a rolling coppicing and singling programme along the entire stretch. The areas for initial targeting are shown on the map. This should ideally be done on a 10 year rolling programme with a little done each year. In reality it is accepted that it might be easier to take 40% in year 1, 20% in year 2 and 5% per year thereafter. By staggering the programme you will retain diversity in the canopy and maintain and improve biodiversity along the riparian strip.

For improving habitat, the Trust recommends a stop-start approach to coppicing. There is little point in removing every other tree as the remaining canopies simply overlap. It far better to open a 20m hole in the canopy over a riffle area and then leave the pool below with dappled shade and so on. Preferably trees removed should be of lower wildlife value such as the fast growing non-native sycamore and alder.

For improving access to the pools it is simply a case of removing the problematic branches or, in extreme circumstances, trees.

Do not remove the woody debris that is in the channel or trim the root systems of the bank side trees as they provide valuable cover.

Plates 8 and 9 show examples of streams post thinning.

Plate 8. 15m holes have been opened in the canopy to promote primary production, diversity and bank side cover. Note the collapsed bankside vegetation at the upper end providing excellent trout habitat

Plate 9. Multi-stem trees have been singled to leave the remaining stem facing up or away from the river. A limited number of stems have been removed completely. Note the explosion of bank side vegetation.

3.2 Protecting your trout stock

Major Copper expressed an interest in stocking his ponds. It is suggested that the stock can be obtained from the river through angling. For 1 or 2 seasons fish less than 7" or so, being moved by bucket up to the lakes following capture in the river. This would require a Section 30 consent from the EA but would help to preserve a stock of the Yeo Trout in the event of a serious pollution and provide a free stocking that could be harvested by rod and line when they are large enough. The stock would be self sufficient if a spawning bed, as described in 3.3, is put in on the inflowing stream above the lake.

3.3 Aiding spawning

The electro-fishing data suggests that trout spawning in this reach is limited. The good marginal trout habitat in the lit sections is being underutilised. The tributary that joins from the East half way down the section (plate10) would be an ideal trout spawning stream. Maj. Copper owns the entire watershed and has fenced off extensive buffers on both sides to protect the stream.

Plate 10 The tributary stream

Currently there are no suitable spawning areas on this stream due to past channelisation to improve drainage. The spawning opportunities in the main stem are limited to one glide/riffle towards the lower end of the beat that is probably more suited to large trout and salmon. Access to the stream from the river is good and it is recommended that this summer at least two spawning weirs are constructed on the tributary between the bridge and the river. Hatched fry would then utilise the stream and drop back into the 'newly improved habitat' of the river.

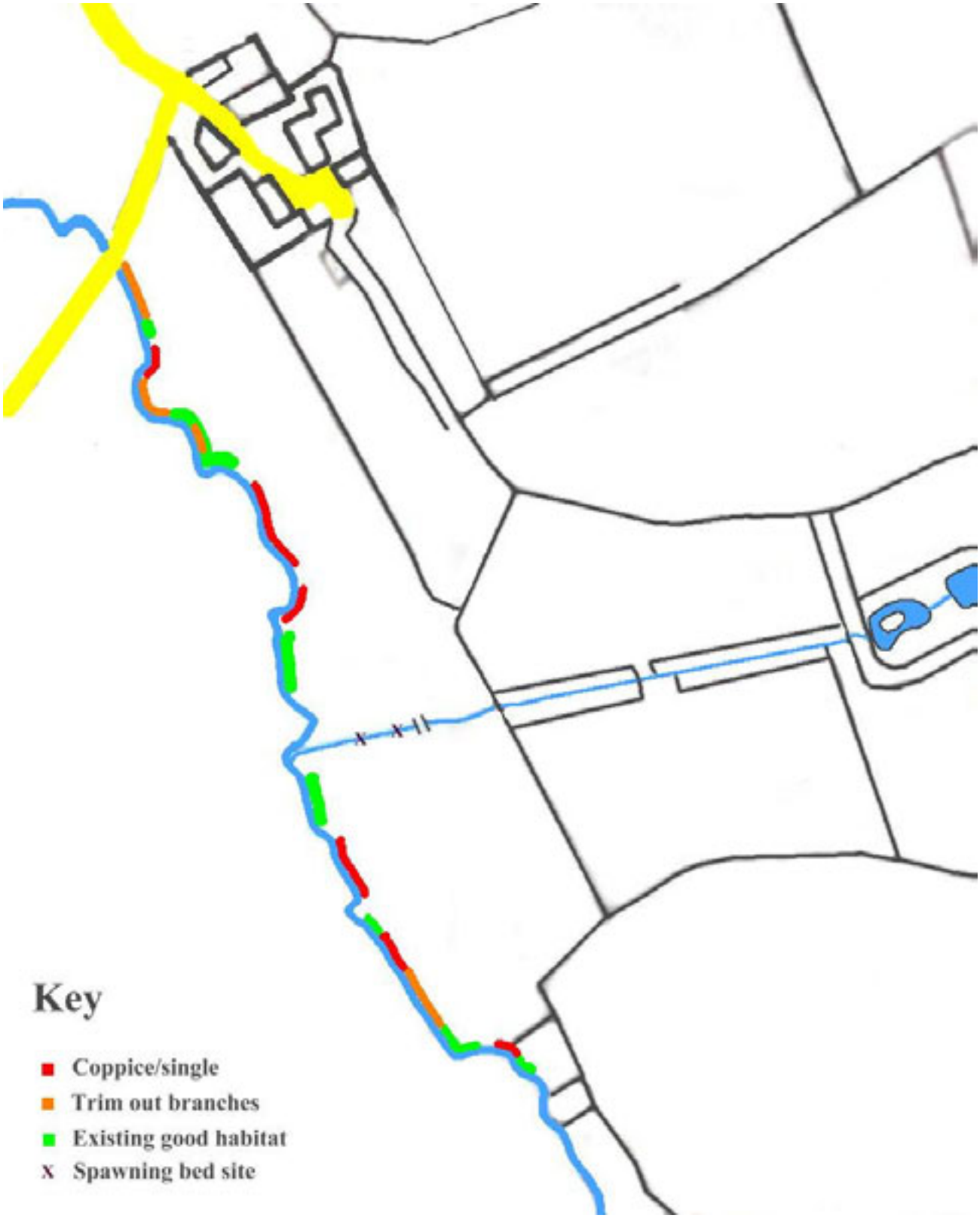
To create a spawning bed on this stream it is suggested that a line of 5kg rocks/boulders are arranged across the channel in an upstream U and buried in the bed so that the tops are just under the surface. Above this point introduce rounded gravel of 10-25mm diameter to a depth of 20cm 1.5m upstream. Slope the gravel to give the effect of a pool tail. Each of these beds should be able to support two redds. To ensure fish utilise these beds it is important that there is adequate cover upstream of the bed. Laying a 60cm length of 15cn diameter concrete piping on the bed adjacent to the margin and allowing grasses to grow over will achieve this

As this is a defined river channel it is necessary to consult the EA as to whether they require consent to do this work.

3.4 Managing aquatic plants

The ponds currently contain Canadian Pondweed and Duckweed which are causing problems. The two principle choices are either chemical treatment in which case consult the EA and speak to a BASIS trained member of staff and they will guide you through which compound to use and the consenting process, or mechanical removal. This is the preferred option. Duckweed cannot be eradicated by this method but can be kept under control. As the Duckweed is controlled the Canadian Pondweed will become more problematic. Mechanical removal of this plant is often ineffective as the stem snaps leaving the root system in-situ which then quickly re-grows. A cunning solution is to lay black silage wrap on the bottom of the pond and weigh down with rocks. This rapidly covers with silt and the pondweed will grow on it. However due to the wrap, the roots cannot penetrate the sediments and when mechanically removed the whole plant comes out. This reduces the need to clear to once every two years or so and allows a substantial area of water to be kept clear.

Map of surveyed reach



Appendix 1 - Code of good practice for coppicing

1. Only coppice where there is evidence of overshading. (ie an overwidened channel or baying between tree root systems)

2. Where Rhododendron and Laurel are present, these should be removed. However, to control these species effectively, stumps need chemical treatment. Advice must be sought from Environment Agency staff (see contact details below) before dealing with these two shrubs.

3. Concentrate work in fast flowing 'riffle' areas rather than at pools and glides.

4. Try to open 10m + holes in the canopy. Singling multi-stem trees can usually do this.

5. It is better to take 5 stems and then leave 3 than it to take every other stem.

6. Try to leave most of the remaining shading on the south bank along glides.

7. Coppice trees only from October to March. Where machinery needs access or time is constrained coppicing in September is acceptable.

8. Preferentially leave ivy covered stems where possible.

9. Leave old and dead tress unless dangerous. These provide valuable habitat for a variety of wildlife.

10. Do not take mature timber > 60 years old unless it is in danger of falling into the river.

11. Do not use machinery in the river. There are risks of pollution from fuel, oils and silt associated with use of machinery, which could result in prosecution.

12.Do not damage river banks with machinery as this may lead to additional erosion. Try to avoid the use of machinery within 2m of the bank edge except in very dry situations.

13. Do not work **in** the river between 30 September and 31 March to prevent disturbance to spawning fish, fish eggs and newly hatched fry.

14. Coppiced timber and brash can form valuable habitat for a wide variety of wildlife. Where possible, it should be stacked and secured in such a way so as to avoid it washing away and either endangering fences downstream or accumulating on obstructions (bridges etc) and causing a flood risk. If material cannot be securely stacked then it should be removed from the floodplain completely. In no circumstance should burning take place in the river channel. Ash must not be allowed to enter the watercourse.

15. Leave the stumps in the bank as they help to protect the bank from erosion and provide valuable habitat for fish.

16. Do not work in areas with wildlife designations - Sites of Special Scientific Interest, National and Local Nature Reserves - without first consulting the relevant authorities.

If the total amount of wood cleared in one year is over 20 m^3 or more than 5 m^3 per calander quarter then you will need a felling license from the forestry commission.

BATS

Bankside trees form important habitats for bats. Check trees for signs of bat roosts:

- obvious holes, cavities and splits
- dark staining on the tree below a hole
- staining around a hole caused by the natural oils in bats' fur
- tiny scratch marks around the hole from bats' claws
- droppings below a hole - they look similar to those of rodents but crumble to a powder of insect fragments
- noise (squeaking or chittering) coming from a hole
- check holes by inserting a mirror and watching the hole at dawn or dusk
- bats will also roost behind loose bark which should be checked similarly.

Whether bats are found or not, any trees with good holes, cavities, splits, or loose bark should be retained.