WILD TROUT TRUST ADVISORY VISIT TO LOCH EYE (EASTER ROSS) and PRELIMINARY OBSERVATIONS ON THE RIVER TAIN, 28 March 2011

Frontispiece: Loch Eye brown trout, sampled March 2011

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1.0 BACKGROUND

The Wild Trout Trust (WTT) was invited to undertake an advisory visit to Loch Eye and to the River Tain in Easter Ross, by Marcus Walters, Project Officer, Moray Firth Sea Trout Project (www.mfstp.co.uk) and Iain McMyn, Kyle of Sutherland District Fishery Board. The Moray Firth Sea Trout Project (MFSTP) is one of several sea trout initiatives that WTT is sponsoring throughout the UK and Ireland. It is a three year collaborative project, combining the efforts of District Salmon Fisheries Boards, Fisheries Trusts and Angling Associations around the Moray Firth, to address the current widespread decline in sea trout stocks. Sea trout are the anadromous form of our native trout (*Salmo trutta* L.). Therefore, WTT considers that the health and status of sea trout should be considered together with that of freshwater-resident brown trout populations where they share freshwater habitat.

The Wild Trout Trust (www.wildtrout.org) was established in 1997 by a small group of people dedicated to the idea that ailing populations of wild trout can be given a helping hand by restoration and conservation of their habitat. It provides practical guidelines and encourages riparian owners, angling clubs, fishery regulatory bodies and community volunteer groups to instigate habitat projects, not only to protect and improve stocks of wild trout, but also to deliver many other gains to local bio-diversity. The visit to Loch Eye and the River Tain is another example of this approach, targeted in this instance mainly towards perceived spawning and nursery habitat constraints.

2.0 THE ADVISORY VISIT

The visit took place during a dry but cool day on 28 March and was accompanied throughout by Marcus Walters. Iain McMyn, who has first-hand local knowledge, was present at first but unavoidably was engaged elsewhere for most of the day. However, he took a full part in subsequent discussions. A preliminary visit was made to Gregor Macleod of R. Macleod and Son, Tain, who had arranged for a boat to be available for Loch Eye and who provided limited catch records, two previous scientific reports and other useful background information. From an angling perspective, Loch Eye appears to be relatively lightly fished and can provide excellent fly-fishing for wild brown trout, although annual reported catches are variable. Specimen trout weighing well in excess of one kg are regularly caught. Periods of poor fishing success occur in years when there is excessive blooming of planktonic algae, although it was also stated that extensive rooted aquatic plants can become very dense during summer, reducing effective fishing area and causing hooked fish to be lost. The central question, however, was whether there was adequate spawning habitat to ensure sustainment of the wild trout population.

2.1 Site Description

Plate I: OS Map of Loch Eye and Surrounding Area

Loch Eye (OS: NN 831798) is a large (196 ha), nutrient-rich, shallow depression (<3 metres), lying to the north of Fearn, between the Dornoch and Cromarty Firths, on the north-east coast of Scotland. It is an important wetland habitat of international significance, an SSSI, SPA and a RAMSAR Site, having been a Bird Sanctuary since 1994. It supports in excess of 10,000 wintering wildfowl, especially Icelandic greylag geese and whooper swans. There are three small tributaries, each heavily modified for drainage, the Garrick, Loinnbuie and Erracht Burns and a long-established sluice gate controls the outlet which flows from the south shore between Mounteagle and Rhynie. Sea trout are believed to be unable to enter the loch. According to previous reports, there are five riparian owners. There are anecdotal reports of limited stocking (fry and fingerlings) having been carried out, but no details were provided and it is assumed that most or nearly all of the current trout population came from natural spawning. It is locally speculated that the loch is partially spring-fed. However, Tony Bailley-Watts (1991), working on behalf of the Institute of Ecology, reports his findings from stream flow measurements suggesting that all of the outflow discharge may be accounted for by the three small inflows. However, he notes the practical difficulties he had at that time in obtaining accurate flow data. Bailey-Watts used Loch Eye in a case study of eutrophication, providing a substantial report. He notes that algal blooms first appeared in the loch in the 1980s, coincident with a decline in the fishing quality. He estimated that the largest single input of phosphorus (P) is from goose faeces, amounting to about 50%. It appears likely that this is still the case. Gregor Macleod mentioned that the loch was clearer and fishing improved last year, which he believed could be due to much reduced nocturnal roosting of geese in the cold winter of 2009/10 because of prolonged ice cover. The loch was frozen again for at least as long last winter (2010/11). At the time of our visit, most of the geese had flown off to feed in the fields, but there were large numbers of swans and other bird species.

2.2 Fish Sampling

Plate II: Gill-netting Catch at Loch Eye

Limited sampling of the fish population was carried out during the advisory visit using a 50 metre long by 1.5 metre deep monofilament gillnet (60mm stretched mesh), set in the afternoon from the north-west shore (approx. NN822799) for two and a half hours. This provided seven brown trout ranging in fork length from 245 to 545mm (image shown above). These fish were killed for internal examination and scale sampled for ageing and estimated age at migration into the loch. Information about migration age could have been inferred from juvenile electro-fishing and length frequency analysis, but no such surveys have been carried out. Also, multi-mesh nets set to fish in darkness should have provided a better representation of the size and age structure of the stock, assuming an adequate catch and an even spread of the fish population. However, most of the trout that were sampled would have died if the nets were left overnight without lifting and only a small sample was required on this occasion.

It was impressive to catch such high quality trout in such a short time. The catch details were as follows:-

Loch Eye Gillnetting 28.3.11 (13.30m -16.00)

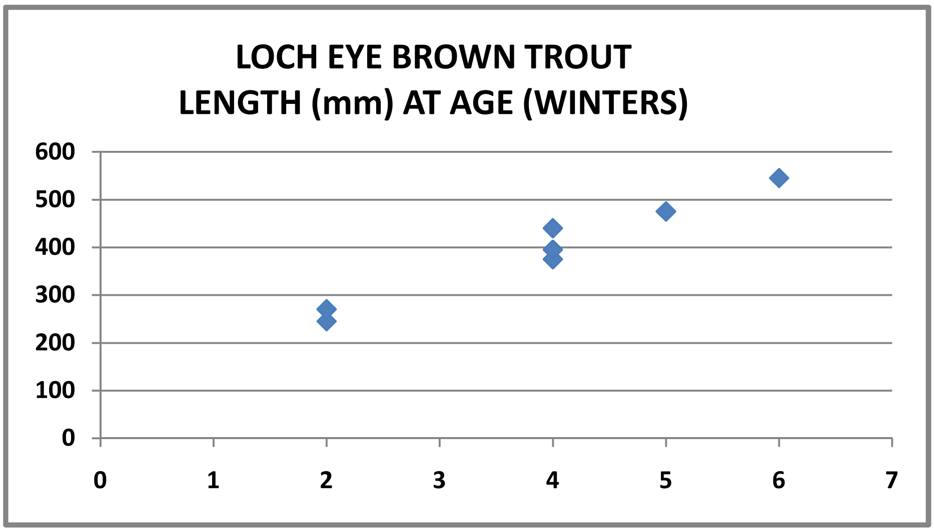
Length (mm)	Weight (g)	Sex	Maturity	Age (winters)	Stomach Contents
245	170	F	Imm	2+	Corixids
270	250	M	Imm	2+	Corixids
375	500	F	Spent	4+	leech, Chiro.pupae. Ephem.nymphs
395	640	F	Spent	4+	Gammarus, Asellus, Planorbis
440	780	F	Spent	4+	Corixids, Asellus, Planorbis
475	1120	M	Spent	5+	Corixids, Asellus, Planorbis
545	1350	M	Spent	6+	Corix, Ephem.nymphs, Sticklebacks

The three male and four female trout ranged in age from 2+ to 6+ winters and showed small amounts of growth after last winter. The most common dietary item, found in five of the trout, was small water boatmen (*Corixa*). Freshwater shrimps, hoglice, small sticklebacks, a large leech and small snails (Planorbis) also were found. The mayflies (Ephemerids) were not identified to species. The mature fish had not recovered fully from spawning and were slightly thin, justifying the April start of the angling season on the loch. The largest two specimens also had fairly large burdens of cestode (tapeworm) cysts, a common phenomenon in loch trout. Internal build-up of parasite burdens with increasing age is an important factor affecting eventual senescence and mortality. Wild trout in Scottish lochs often die by about six years of age, although some fish are able to survive much longer, notably specialist fish-feeders (ferox) and others present in waters at very low densities, where there is little competition for food.

Plate III: Cestode cysts in the larger trout

2.3 Growth of Loch Eye Trout

The annual growth of Loch Eye trout can be inferred by plotting the observed lengths at age of the small sample. This suggests rapid and sustained growth, with individual fish reaching about 400 mm in length after four growing seasons (a bit less than two pounds). Trout measuring more than 500mm (weighing three or four pounds) are likely to be aged five or six winters. Most of the fish sampled had entered the loch from a spawning burn before completing one growing season, or soon after. Limited extent of parr habitat in the burns could be a factor leading to early migration age.



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In a previous study of the Loch Eye trout carried out in July 1994 by Willie Duncan on behalf of Scottish Natural Heritage (SNH) three survey gillnets (55m * 1.5m deep) with several panels of different mesh sizes were fished overnight at three sites, obtaining 136 brown trout (29, 33 and 74). These nets also caught four rainbow trout, some of this species having been stocked at that time. This much larger sampling effort by SNH in terms of total net length and hours fished also found a range of ages from 1+ to 6+ and a similar growth rate to the above plot. Willie Duncan showed that the growth of Loch Eye brown trout was high by Scottish loch standards, similar to that of the trout in Loch Leven, Kinross-shire and he stated that the trout population was only lightly exploited and that dense algal blooms restricted angling success, based on catch returns. These conclusions still appear to be valid.

2.4 The Spawning Burns

The flat land surrounding Loch Eye means that the inflow burns have little gradient in their lower reaches that would sort channel substrates and provide clean gravel areas suitable for spawning. However, extensive channelling for agricultural drainage purposes has made this situation much worse, to the extent that few if any ova are likely to be deposited and incubate successfully in the lower reaches of each burn.

Plate IV: Garrick Burn above road (showing deep trenching and smooth flow)

This was exemplified in the **Garrick Burn** in the first two kilometres from the loch. Here, the straightening and re-alignment of the channel and lowering and scraping of its bed have resulted in a silty, featureless environment that must severely adversely affect its ecology and use for spawning and nursery production of trout (Plate IV).

Plate V: Lower reaches of Garrick Burn (low flows, but showing here some woody trash creating a build-up of gravel, some current deflection and bank erosion, but also cover for fish)

There were very occasional points where tree roots and accumulated debris had caused some stream deflection and a brief return to pool and riffle conformation and stream sinuosity, but otherwise the channel was very uniform and severely lacking in cover for trout of all sizes.

Further upstream is a relatively new conifer forest that Gregor Macleod described as "the Christmas Tree Plantation." He was concerned that this was likely to further reduce the already low ambient flow regime in the Garrick. This may well be so, particularly if wet ground has been drained for planting. However, at least the plantation had been set back a reasonable distance from the burn and there were some planted and well as naturally growing riparian hardwoods, helping to mitigate the potentially harmful effects of planting conifers too close to the channel (For forestry best practice guidelines, refer to http://www.forestry.gov.uk/pdf/FCGL002.pdf/$FILE/FCGL002.pdf and article in 2011 *Salmo trutta*, the WTT annual magazine)

Nevertheless, this newer forestry section lies beside the long length of severely straightened and excavated channel and the benefits accrued to juvenile trout production from the more sensitive approach to tree planting shown here may be limited.

Plate VI: Christmas tree plantation below Calrossie Woods (showing wide buffer zone)

Based on our walking survey, reasonable conditions for spawning only begin in the upper, medium-gradient, section, where the burn passes through Calrossie Woods and they continue at least as far up as the old and the new A9 road (ca. 0.75km).

Plate VII: Garrick Burn in Calrossie Woods

Use of areas of better spawning habitat further upstream will depend on whether the loch trout can negotiate the culverts beneath the roads. The long piped culvert beneath the old A9 looked passable because of its low gradient and established gravel bed, although it must carry a strong, laminar, flow at times of heavy rain and it may be a barrier to migration at such times. In this case, baffle boards could be installed to break the flow and ease passage (see article in *Salmo trutta* 2011). It was not possible to inspect culverting beneath the new A9 carriageway, which may be longer than that shown below, because of limited time. Electro-fishing to establish juvenile densities above and below these potential obstacles would show whether Loch Eye trout can pass them and, if they cannot, consideration should be given to ways of improving passage.

Plate VIII: Culverts under the new sections of roadway may be a problem for upstream access of spawning trout (this one has a gravel substrate and seems okay)

Options are fairly limited for restoration of the lower part of the burn without a change in land-use and a cessation of periodic drainage operations that prevent the re-establishment of a natural stream morphometry (see DISCUSSION).

The same stark conclusions were reached after a brief look at the lower reaches of the **Loinnbuie Burn**. On the other hand, the **Erracht Burn**, situated at the east end of Loch Eye, had a ‘chuckling’ flow as it passed underneath a minor road, some 400 m from the loch and it appeared to be less silted than the other two tributaries. However, apart from a few metres length below this point, the burn flows down to the loch through a boggy area of scrub woodland, difficult to penetrate on foot. Apart from just below the bridge, there seemed to be little or no spawning habitat in that section and its low gradient there is not conducive to easy creation and maintenance of good spawning conditions, although there might be some possibilities near the bridge.

Plate IX: Erracht Burn above road (looks unpromising, but the channel is steeper upstream)

Above that bridge, there is a low-gradient, boggy and straightened section (see above), but the channel is steeper further up, although still deeply trenched and shallow, with few larger stones, or overhanging vegetation (partly or mainly due to the early time of year). Hence there is very little cover for parr and none for adult fish, although there is extensive, shallow, potential spawning gravel.

Plate X: Erracht Burn further upstream contains better spawning habitat (but is still sub-optimal for depth and cover)

Adult trout should be able to reach this section this section through the shallow double-boxed culvert under the road, but must do so when water flows are high enough to provide some cover from heron predation. Again, the use of this upper section by adult loch trout should be confirmed by electro-fishing for juvenile density data above and below the bridge.

Plate XI: Erracht Burn below road bridge

3.0 DISCUSSION

There is only limited scope for considering spawning habitat improvement in the three spawning burns entering Loch Eye because of their low gradients near the loch and the severity of past channelization for agricultural drainage which has removed all sinuosity, pool/riffle conformation and natural stream morphology. Restoration of adequate spawning and incubation conditions in these lower sections of the burns could be attempted using techniques explained in the Wild Trout Trust publications “The Wild Trout Survival Guide” (supplied) and the Upland Rivers Habitat Manual (available as a PDF download from the WTT website). These techniques include dropping large woody debris into selected bare parts of the channels, and by this means restoring elements of hiding cover and depth/flow diversity for trout juveniles and upstream migrant spawners. Cross-channel logs, plus some less formal structures, such as tree limbs “hinged” into the watercourse, would be appropriate here. In-stream structures should be spaced no closer than five to seven channel widths apart, the natural spacing between pools and riffles. Gravel suitable for spawning and selected larger stones may need to be reintroduced into sections where the flow can be pinched and accelerated.

On the other hand, it could be argued that much of this work is unnecessary. Adult loch trout can swim further up the Garrick and probably also the Erracht to find better conditions for spawning (the Loinnbuie Burn may be similar). Fry from these upper areas can then disperse downstream and utilise lower parts, or migrate straight to the loch. In spite of the poor nursery conditions in the burns, natural recruitment seems to be providing adequate numbers to maintain the Loch Eye trout population, to the extent that it continues to provide excellent wild brown trout fishing by international standards, when water clarity conditions are favourable to angling success. The latter conditions are difficult to predict from year to year since Loch Eye is biologically highly-productive. This is because of favourable local geology and the basic water chemistry and productivity are substantially enhanced by bird droppings, especially from wintering greylag geese and whooper swans, and by agricultural/forestry run-off. Planktonic algal blooms are common under summer conditions. Previous studies have suggested adding barley straw bales around the shallows and encouraging weedy lagoons near the foot of the inflow burns to encourage phosphate stripping. Moving on the large goose and swan population is not an option! Some simple and low-cost remedial work may be carried out to try to create extra spawning redds and better living conditions for ongrowing of fry and parr in the lower parts of the burns. Realistically, however, the best approach for preserving the high quality of the fishery is to continue with a fairly low key approach, maintaining fishing effort, bag and size limits as at present and, where possible, improving the continuity of the annual catch records for monitoring purposes, unless clear evidence emerges of a downward trend in the stock of trout.

BRIEF VISIT TO THE RIVER TAIN

The attractive little River Tain flows to the sea through an undulating section by the town of Tain and has a sandy estuary. The lower reaches which are in open farmland were not examined because the main problems in this river appear to be in afforested headwaters in Glen Aldie.

Plate XII: River Tain in Glen Adie (OS NH760797)

Plate XIII: River Tain (upstream of previous image) showing bedrock area with overhanging mature conifers

In the section of upper reaches visited, the river flows over sandstone bedrock, with mixed cobble and gravel and appears to be base-rich by Highland standards. Iain McMyn has previously reported finding high densities of juvenile trout by electro-fishing in lower sections of the river. However, we found that the conifer trees in part of the upper area that we visited had been planted up to the edge of the river without leaving a twenty metre buffer strip, or a hardwood belt, on each bank, as advised by current forestry planting guidelines. In addition to buffer strips, consideration should be given to mixed planting of hardwood trees and conifers well back into the plantations. The presence of deep-rooted hardwoods which can be left in place during felling will buffer against sediment and nutrient mobilisation when conifer felling takes place. With harvestable trees growing very close to the river channel, problems of erosion and heavy siltation are likely to occur downstream when they are removed. Also, many of the forest drains entering the river run down steep valley sides and can discharge considerable quantities of silt.

It would be worth consulting with the owners of the forest about their plans for harvesting and ways to mitigate harmful effects of timber extraction upon the river. Ideally, the whole of the upper half should be surveyed on foot, using a hand-held GPS and digital camera images to fix coordinates and identify positions so that problems sites can be scheduled into a detailed programme of action. Sections where the old trees are too close to the river need to be specified for remediation as soon as possible. Small side burns must not be neglected as they may contain potentially excellent habitat for trout spawning. Eroding drainage ditches may be blocked in flatter areas, well back from the point of discharge to the river, to act as silt traps. In-river woody debris that is not blocking fish migration should be left in place as cover. Natural barriers to fish migration need to be recorded and assessed in conjunction with juvenile salmonid electro-fishing surveys carried out upstream and downstream. Some may be suitable for easing. Similar surveying has been carried out recently on the River Peffery by Dingwall, with practical help from the Wild Trout Trust, in conjunction with The Moray Firth Sea Trout Project and the Conon District Fishery Board. Lessons learned there will be transferable to the headwaters of the River Tain. The Peffery project is a good example of an ecologically holistic and multi-partner approach to solving problems in and around river corridors, where everybody gains.

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