Habitat Advisory visit to the Rossnaree Fishery, River Boyne, Co. Meath, Eire

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1.0 Introduction

This report is the output of a site visit undertaken by Vaughan Lewis, Windrush AEC to the Rossnaree Fishery, River Boyne, Co.Meath, Eire on 26 and 27 November 2002. The visit was carried out on behalf of the owners of the fishery, Robert and Aisling Law and was financially supported by the Wild Trout Trust.

Comments in the report are based on observations on the day of the site visit and discussions with Robert Law. Throughout the report, normal convention is followed with respect to bank identification i.e. banks are designated Left hand Bank (LHB) or Right Hand Bank (RHB) whilst looking downstream.

2.0 Background

The River Boyne is a major migratory salmonid and brown trout fishery in Eire. Historically, substantial catches of both Atlantic salmon *Salmo salar* and sea trout *Salmo trutta* were made from the river. The presence of two large box traps constructed by Cistercian Monks c.1157, and a commercial draft fishery are indications of the size and value of the fishery. However, arterial drainage schemes undertaken during the 1960's and 1970's resulted in significant degradation of the instream habitat. In combination with other more global factors, (reduced sea survival of post smolts, impact of marine fishing etc) the salmon run and rod catches on the River Boyne have reduced significantly in recent years.

However, a robust brown trout fishery remains in place, with fish averaging 400g-500g. Specimens of up to 2kg are caught occasionally. Fly life is still strong, with good hatches of mayfly *Ephemera danica* and blue winged olive *Ephemerella ignata* reported.

Rossnaree is also very important in an archaeological and historical context. It is the site of Bru na Boine necropolis (a World Heritage Site), the location of King Cormac's grave and the place where Finn mac Cumhain "ate" the Salmon of Knowledge. More recently, it was the site of an important engagement in the Battle of the Boyne and was the location for the excavation of the world's shortest canal tunnel.

3.0 Key Issues

A number of key issues were identified with respect to the management of Rossnaree fishery:

- The river margins were significantly shaded in places by riparian tree growth. This shade was restricting the growth of marginal vegetation, with associated damaging impacts on the rate of erosion and the provision of marginal cover for brown trout fry. In order to reduce overshading whilst retaining the valuable erosion protection provided by tree root systems, thinning of the riparian tree canopy is required. Ideally, a programme of rotational coppicing should be implemented in order to create dappled shade along the river margins. The conservation value of the

existing trees should not be under-estimated and great care should be exercised in the selection of trees to be cut.

- Overhanging tree growth was preventing access to a salmon run adjacent to an island near the top of the fishery. Cutting back branches in order to allow anglers to cast baits into the run will not cause any significant problems. Branches should be "faced off" to a height of approximately 2.5-3m to allow adequate room beneath them.

- In a number of locations, the footpath for anglers ran very close to the bank top. Regular foot traffic along the path had suppressed vegetation growth, leaving sections of exposed soil. If no action is taken to reduce this damage, it is very likely that sections of the bank will be lost due to erosion during high flow events. It is recommended that the anglers' path is re-routed away from the river at vulnerable locations with the old path roped off in order to allow re-growth of protective marginal vegetation. In addition, considerable bank damage was noted due to angler movements at popular pools. It may be possible to partially reinforce these areas using brushwood arisings from the coppicing work recommended above. By pinning the brushwood as a "mattress" over the damaged areas, some protection from erosion will be achieved. Alternatively, the stone excavated during the canal construction could be used to create short sections of reinforced footpath for anglers.

- In areas where there has been excessive bank erosion or where there is danger of more erosion in the future, the excavated canal stone could be used as "rip-rap" to protect the toe of the bank. Other bank protection options include the use of faggot bundles and live willow reinforcement (spiling). The latter system requires routine maintenance in order to control the growth of willows. Photocopies outlining the use of "rip-rap", faggots and spiling are attached.

- The macroinvertebrate fauna at Rossnaree is believed to be diverse and abundant. However, interest was expressed in being able to monitor changes to the macroinvertebrate community over time. In order to do this, it is recommended that the Biological Monitoring Working Party scoring system should be used. This is an "industry standard" system, that uses the varied pollution tolerance of macroinvertebrates to monitor water quality in a watercourse.

In practice, the system involves "kick" sampling for three minutes using a hand net, of all major habitat types within the river. Collected invertebrates are then sorted by family and enumerated. A score is then ascribed to each family with those less tolerant of pollution receiving the highest score. The total score for the sample is then calculated; the higher the score, the better the water quality. A number of subtleties can be introduced to the system. For instance, seasonal variations in abundance of invertebrates can be corrected for, whilst predicted scores for the site assuming excellent water quality can be calculated from collected habitat variables. Any significant difference between the actual score recorded and the predicted score are likely to be due to water quality perturbations. An outline of the BMWP scoring system is provided in Appendix 2.

- The hydraulic head provided by the disused lock offers the opportunity to run a deep substrate incubation box in order to augment brown trout stocks in the river.

Basically, these are gravel filled boxes, approximately 0.6m in each dimension, that are filled with suitably sized gravel and seeded with 10,000 - 20,000 trout eggs. A water feed at the bottom of the box allows the eggs to incubate and hatch. Once they reach the swim-up fry stage, they leave the box via the overspill pipes, stocking themselves into the river. In effect, they are naturally reared fish without the unhelpful behavioural modifications associated with hatcheries. Such a system could be established using the head of water at the disused lock. Swim up fry could be allowed to remain in the lock channel where there is presently an abundance of cover or could be caught up in a small trap box and restocked into the backwater streams further down the fishery. Eyed ova from "wild-caught" brood stock fish could be used, thus preserving genetic diversity of the Boyne trout population. More details can be found on the Wild Trout Trust web site www.wildtrout.org A copy of an article on the use of incubation boxes that appeared in the Trust's magazine, *Salmo trutta* is reproduced in Appendix 1.

- The confluence of the canal with the Boyne is very heavily silted, with an associated growth of emergent vegetation. It may be possible to remove some of the accumulated sediment with a trash pump. However, it would be easier to do so using a 360 hydraulic excavator. This would allow the recreation of a wide, deep mouth pool at the confluence of the channels, with associated ease of access to and from the canal. Consent should be obtained from the river authority in Ireland before any excavation work to the river or canal is commenced.

- The canal itself is almost totally occluded by emergent vegetation and accumulated sediment. This could be removed by a combination of physical excavation and the herbicide glyphosate. Care should be taken if an excavator is used not to damage any puddle clay lining to the canal. A copy of details regarding the efficacy and use of glyphosate in or adjacent to watercourses is attached. Please note that use of this herbicide is likely to require the consent of the statutory river authority.

- At least 10 cormorants *Phalocrocorax carbo* were noticed whilst walking along the fishery. Cormorants have been shown under some circumstances to consume large numbers of trout and salmon.[1] Typically, a single cormorant may consume an average of 350g fish per day. Clearly, 10 or more cormorants have the potential to take a significant biomass of fish over the winter period. Given this, it is recommended that steps are taken to deter cormorants from feeding on the Boyne at Rossnaree. Non-lethal methods such as scaring using crow "bangers" should be considered first. In addition, attempts should be made to maximise available cover for fish in order to protect them from cormorants. For instance, large woody debris should be allowed to remain in the channel where possible. If these techniques have been tried and found to be unsuccessful, an application to employ lethal control methods (i.e. shooting) should be made to the statutory authorities. Cormorants are protected under the European Birds Directive. As such, shooting without an appropriate licence remains an offence.

- In order to maintain flow in the RHB channel downstream of the Fish Weir near to Rossnaree House during the summer period, a pipe feed into the channel from above the weir has been proposed. The pipe would be in the order of 1m diameter and would delineate the line of proposed restoration works aimed at reinstating a

section of badly eroded bank. There is a significant risk of the pipe becoming blocked over time. Provision of an access chamber to allow rodding of the pie should be considered if this option is pursued.

The upstream end of the reinstatement should be heavily armoured by large stone "rip-rap" to protect this very vulnerable area from erosion. In addition, the toe of the bank along the whole restored length should be protected by "rip-rap" in order to reduce the risk of undercutting. The reinstatement behind the pipe could usefully be achieved using brushwood packed into the void, overlain with granular sub-soil. A dense planting with willow cuttings would promote the development of a dense mat of roots that would provides long term protection to the bank. It would be essential to protect any reinstated area from agricultural stock by fencing.

- An alternative method of providing a supply of water to the backwater during the summer would be to create a new channel in the RHB field, distributing water from above the weir. The channel could be excavated along the line of the old watercourse/scrapes evident in the field. Such a channel would have great potential value as a spawning and nursery area for juvenile salmonids, whilst providing an opportunity for duck flighting on the adjacent flooded land during the winter period.

- Whichever option is pursued, careful planning is required to ensure success. At its most basic, this should include details of proposed discharge through the new channel/pipe, basic level surveys and detailed designs for bank protection.

- Access for fishing across some of the soft marginal areas is a problem at Rossnaree. A simple way to improve this is by the construction of willow walkways and platforms. These consist of parallel lines of live willow stakes driven vertically into the ground with approximately 1.5m between the rows and 0.4m between each stake in the respective rows. The gap between the rows is then infilled with layers of willow branches, with each successive layer placed at right angles to the preceeding one. Finally, lathes of willow should be nailed to the upright stakes, preventing wash out of the infill during high water events. The willow stakes and infill should root and provide a stable platform with excellent longevity.

- Water abstraction by the local water undertaker ,from the Boyne into the canal at the Newgrange Navigation weir for Drogheda's potable supply is a major issue. Flow over the weir in the Boyne is reduced to zero during some summer periods, with associated detriment to instream habitat quality and availability in the river. It is understood that little can be done at present to address this situation. However, it would be worth pursuing changes to abstraction patterns, with the goal of protecting ecologically acceptable flows in the Boyne at key times. The status of Atlantic salmon as Annex II species under the EU Habitats and Species Directive might be a useful lever in this respect.

- The possibility of stocking the canal with trout has been considered. A key consideration would be the genetic integrity of the existing stock in the Boyne, with any fish stocked into the canal able to enter the river with relative ease. In order to address this concern, triploid (i.e. sterile) brown trout could be stocked. It is recommended that a small (say 100), initial stocking of triploid trout should be undertaken in 2003 with consent from the fishery authority. All fish should be

marked probably with Alcian Blue dye applied by a Panjet, to enable monitoring of exploitation and movement within the system.

REFERENCES:

1. Fish-eating birds in and salmonids in Scotland The Scottish Office. Agriculture, Environment and Fisheries Department, 1998.

Appendix 1.

BOX OF DELIGHTS.

Stocking can damage your health! No ifs, buts or how's your fathers - mentioning the introduction of trout to a group of anglers guarantees raised voices and a similar effect on blood pressures. Entrenched positions form and battle-lines are drawn, with the "stockers" refusing to budge an inch, despite considerable pressure from the "self-sustainers". All too sadly familiar I guess and, as with many angling debates, parties depart muttering and unfulfilled in their desire to sway opinion. But, help is at hand - there is a third way (is Tony Blair an angler?) and as usual, the Americans went down it first.

Fundamentally, the problems of stocking revolve around several key issues, including:

- Genetics. Risks of genetic contamination have been well aired recently (see Dave Summer's excellent article in October 1998's Trout and Salmon - most of the points he makes apply just as much to brown trout as to salmon).
- Disease. There are concerns that stocking may introduce new strains of disease to wild trout. Interestingly, this does not normally seem to be the case in riverine fisheries, although the precautionary principle should still be applied.
- Cost. Pennies in pockets and all that stuff. Stock fish are expensive. Without doubt, for the mean and patient, the development of self-sustaining trout stocks represents a cost effective and ecologically acceptable strategy. And it is after all on this premise that the Wild Trout Society was formed.
- Behaviour and survival. In the rush to consider the impact of genetic contamination on native fish stocks, the behavioural impact of hatchery reared fish has often been overlooked. It is my contention that these interactions are of primary importance in our consideration of stocking and that the use of deep-substrate incubation boxes offers one way of overcoming many of behavioural problems associated with stock fish.

Brown trout are socio-phobes. Generally speaking, they spend their entire life trying to exclude all-comers from their little piece of piscatorial paradise. Poke your nose out from behind your little rock and it will be put firmly out of joint by your next door neighbour. Trout are programmed to hate the sight of each other (except for the opposite sexes at spawning time) and are fiercely territorial from an early age. So what do we do? Throw them by the million into collective hatchery tanks and rearing pools, where they have no option but to face up to their equivalent of the contents of Room 101. And we than expect them to behave normally! Hatchery reared fish have become so behaviourally modified, that they no longer interact in a natural manner. The consequence? - introduce them into a stream, step back and watch the mayhem. They indulge in inappropriate territorial aggression and disturb native fish, which then expend valuable energy on meeting these threats. Stock fish occupy energetically inefficient lies that inevitably result in a loss of condition. Consequently, later in the year, after attempting to spawn, a combination of poor condition and failure to select winter lies results in their passive migration downstream to oblivion or the sea, depending on which greets them first. This is not conjecture. Several studies have

examined behavioural modification of stock fish and overwintering success. They concluded that the long-term positive contribution of hatchery reared fish to river systems is minimal. Step forward the deep-substrate incubator or mini streamside hatchery.

At its simplest, the deep-substrate incubation box is a hollow cube, constructed from wood or plastic and situated by the side of a river. Water driven by a head difference, enters at the bottom of the box, passes through a false floor of fine mesh and rises through introduced gravel to leave the box via overflow tubes into the receiving watercourse. A tight fitting lid completes the kit. Now the clever bit - the gravel contains a number of layers of trout eggs (normally eyed ova), with each layer separated from the next by approximately 10-15cm gravel. The upwelling water washes over the eggs, incubating them until they hatch. At this point, the alevins being negatively photo-tactic (i.e. light avoiding) remain in the gravel. Interestingly, because they are supported by the gravel they expend little energy in remaining upright. This is not the case with hatchery reared fish that are constantly trying to right themselves and hence can waste significant amounts of energy. This results in generally larger, stronger alevins being produced by the deep-substrate box. Additionally and I believe critically, the alevins are to a large extent visually isolated from their immediate neighbours, thus preventing the behavioural modification so common in hatcheries. To all intents and purposes, the alevins are living in redd-like conditions. Once the egg sac is exhausted, the fry become positively photo-tactic "swimming-up" through the gravel in their search for light. This is provided solely by the water overflow pipes. Consequently, a combination of the light's attraction and the current draws the fish out of the pipes, which if correctly positioned stock the fry directly into the receiving watercourse.

What then of the practicalities? The incubator boxes can be constructed from a wide range of materials, ranging from the cheap and biodegradable marine plywood version through to the thoroughly modern (and inevitably more expensive) GRP or plastic model. The water supply can come from any source providing a head of pressure. To date, supplies have been obtained from small weirs, spring-heads, ram pumps and sluice board impoundments. What is important is that water quality is good, sediment loading is reasonably low (although pre-filters can be added if required) and that a sufficient volume can be guaranteed. Unless genetic considerations preclude their use, eggs are probably best obtained at the eyed ova stage from a reputable local fish farm. These should cost in the order of £10-15 per 1,000 eggs. A box with the dimensions 0.6m x 0.6m x 0.6m can easily hold 20,000 eggs, with an expected success rate of 50-60% (i.e. 10,000 - 12,000 alevins entering the river). In all cases, the Environment Agency should be contacted, as consent will be required for the introduction of the eggs under the Salmon and Freshwater Fisheries Act 1975.

When is it appropriate to use deep-substrate incubation boxes? The simple answer is that they only have a true fisheries benefit when the quality or quantity of available spawning habitat is limiting recruitment to the fishery. In other words, if your fishery has large areas of silt free spawning gravel, then incubators are not for you. However, if, as in many lowland streams, clean gravel areas are at a premium, then you should consider the use of boxes. But always remember that they represent at best a halfway house between stocking and naturally recruiting trout. There is ultimately no substitute for the restoration and enhancement of degraded spawning habitat.

Unfortunately this is often a very expensive operation, leaving incubation boxes as a cost-effective middle road.

One other point to consider in deciding whether to install boxes is their undoubted social value. They form a tremendous focal point for interested groups. What could be better than to get local schoolchildren to run their own box? The wonder of trout eggs hatching and the small alevins stocking themselves into a river gives a tangible face to exhortations to look after our rivers.

The use of deep substrate boxes is set to become more widespread - this year will see extensive trials on the River Tamar (for salmon), on the spawning streams of Costello and Fermoyle fisheries in Ireland and on the River Frome. If you feel that your club or syndicate could benefit from their use, then don't hesitate to contact me.

Appendix 2.

BIOLOGICAL MONITORING WORKING PARTY (BMWP) SYSTEM AND IT'S USE IN THE ENVIRONMENT AGENCY.

The history of the BMWP

In 1978 the BMWP system was created. A team of expert biologists (the Biological Monitoring Working Party) that first met in 1976 developed it. The aim of the BMWP system was to provide a biological classification for use in a national survey of river quality, then called the 'River Pollution Survey'.

What the biology tells us

The Biological Monitoring Working Party also considered methods for undertaking the survey and the relationships between biological and chemical classifications. Chemical and biological data are complementary but they tell us different things about a river. The chemical results are a measure of how much there is of any chemical in a water sample. A chemical sample represents a snapshot of the river at a point in time. The macroinvertebrates[1] and plants are affected by all the changes in the river over a period of time and integrate the effects of any pollutant present. So they tell us about the true ecological condition of the river.

How the BMWP system works

To apply the BMWP system, macroinvertebrate taxa[2] are identified to family[3] level (except for oligochaete worms, which are in a group of their own). The family level is chosen to make identification easier: most families can be identified in the field with a little practical experience. It also provides a spread of about 80 different groups and any detailed changes in taxonomy that take place as our understanding of the macroinvertebrate communities increase do not affect the system. The use of family level is at the expense of some of the power of the system to discriminate.

Each family is awarded a score from 1 to 10 depending on its tolerance to pollution. A score of 1 means the group is pollution tolerant and a score of ten means it is intolerant.

Discrete taxa found in a biological sample are identified. The scores that are associated with each are summed to give the BMWP score.

RIVPACS[4]

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[1] Macroinvertebrate: Small animals without backbones that make up most of the species, visible to the naked eye, that are found in a river.

[2] Taxon (plural: Taxa) is a grouping of animals, which unlike biological families, cam be at any level of organisation.

[3] A family is a grouping of related species.

[4] RIVPACS: The River InVertebrate Prediction And Classification System

The BMWP committee decided it was useful to express the score for a site as compared to the theoretical score that the site would achieve if unpolluted. At the time the knowledge and available technology precluded such an assessment. When that became available a computer-based program called was created. RIVPACS was initially developed in conjunction with the Freshwater Biological Association who provided the technical and computing skills to produce a functional system

How was RIVPACS developed?

A national survey was undertaken to find out which animals might be found in which rivers. It involved sampling 438 sites in pristine condition across the country using a standardised methodology. Measurements of approximately 60 environmental variables were made at the same time as the macroinvertebrates were sampled.

The macroinvertebrate fauna and the values of the environmental variables were measured at each site. The environmental variable data were processed on a computer to generate a series of characteristic river types to which the sites belonged. Eleven of the environmental variables created most of the characterisation of the river types.

The macroinvertebrate fauna of each of those sites was catalogued. When put together, the site types and the variety of animals relating to each site enabled the probability of any species being found in any site type to be calculated.

How is RIVPACS applied?

Having measured values for those eleven most important variables at any site, the river type can be assessed. From that information the predicted number of families, the predicted **BMWP**, and a predicted average score per taxon[5] (ASPT) can be calculated for the site.

The number of families, the ASPT and the BMWP score created by RIVPACS for any site can be compared to the actual score achieved at a site. The ratios (observed: predicted) are known as Environmental Quality Indices (EQIs). If the achieved value equals the predicted value in each case the EQI is 1.00 and the site is considered to be unpolluted.

Banding of the EQIs.

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5 Average score per taxon (ASPT): This is calculated by dividing the score by the number of scoring taxa. It avoids problems arising when poor habitat restricts diversity of families. *Example*: In a diverse habitat you may find 40 different BMWP scoring taxa producing a score of 200 with taxa spread across the range of BMWP scores from 1 to 10. A site with poor habitat but the same low level of pollution may have only 10 taxa. If they too are spread across the 1 to 10 BMWP range the total score may be 50. Both samples will have an APT of 5.00.

The Environment Agency has banded the EQIs into 6 bands. This banding is used for water quality assessment purposes. These are labelled from 'a', the best quality to ' f' the worst quality. This lower case label differentiates the bands from the chemical banding system that uses ‘A’ to ‘F’ (in upper case) for its six bands.