INSTITUTE OF FISHERIES MANAGEMENT

IFM Annual Conference: November 15-17th 2005
The Lowry Centre, Salford: Fisheries on the edge

Tuesday 15th November - Compass Room

09:15	Welcome			John Solbe Keith Hendry
09:25	Opening Address			Walter Menzies
09:50	Keynote Address Fisheries on the Edge – An American Perspective			Gary Saul
10:15	Sir Hugh Fish Memorial Lecture Fish Climate and Life			Brian Moss
10:40	Coffee	Quays Bar		
	River Restoration		Chair	Dafydd Evans
11:10	Towards an understanding of river restoration for fish and fisheries			Andrew B Gill
11:35	Restoring fishery features in the floodplain of the River Trent			Keith Easton
11:55	Is woody debris beneficial to fish populations or just another fashion?			Terry Langford
12:15	The importance of habitat heterogeneity to fish diversity and biomass			Adrian Williams
12:35	Discussion			
12:45	Lunch	Quays Bar		
	Fish and Flows – CIWEM		Chair	Alasdair Harry
13:50	Save Water: Use it More!			Clive Gaskill
14:10	Living without water: Setting environmental flows for coarse fish			Ian Cowx et al.
14:30	Brown trout populations dependent on compensation flows in the Mersey Catchment			Kevin Nash et al.
14:50	Fish Passes – the good and the bad			Mike Beach
15:10	Discussion			
15:20	Tea	Quays Bar		
	Fish and Flows – British Hydrological Society		Chair	David Cragg-Hine
15:45	Walking the tightrope - balancing abstraction, river flows and fisheries			John Sanders
16:05	Two low flow 'tools' in the Northwest - Introduction			Jane Atkins
16:10	Transferable low flow targets based on width			Jane Atkins
16:30	Estimating low flow requirements for rivers based on ecological criteria			Andy Gill
16:50	Discussion			
17:00	**Annual General Meeting**		**Compass Room**	
19:30	**Poster Reception and Buffet**		**Compass Room**	

Opening Address

Walter Menzies
Mersey Basin Campaign

England's Northwest was the cradle of the industrial revolution, transforming the region and changing the world. But the damage caused by unregulated industrialisation means that its environmental legacy is a huge challenge for the Northwest.
The Mersey Basin Campaign works within the catchments of the River Mersey and River Ribble, in the counties of Lancashire, Merseyside, Greater Manchester and Cheshire. Much of our work is to repair the damage done to the region's rivers by industrialisation and to foster a future that is modern and prosperous with an improved environment

The Campaign's mission is to:

- Improve water quality so that all rivers, streams and waters in the Mersey and Ribble catchments are clean enough to support fish by 2010.
- Encourage waterside regeneration.
- Actively engage the public, private, community and voluntary sectors in the process.

The Mersey Basin Campaign was established as one of a series of initiatives, launched in the wake of riots in Liverpool, that were designed to kick start the regeneration of England's Northwest. At the time, the then Secretary of State for the Environment, Michael Heseltine called the River Mersey "an affront to the standards a civilised society should demand of its environment." It was recognised that a combination of public, private and voluntary sector action was necessary, leading to the Mersey Basin Campaign partnership being formed in 1985. This partnership has developed since its inception, with changes in the governance structure of the Campaign creating wider participation from business, academia, community and voluntary groups. The partnership of the Mersey Basin Campaign brings together disparate groups and sectors to work together towards a shared mission. Today, the Mersey and its tributaries are cleaner than at any time since the end of the industrial revolution. The transformation of the River Mersey has been supported by a combination of major investment and genuine partnership working at regional and local level.

Keynote
Fisheries on the Edge – An American Perspective
Gary Saul, Deputy Director, Inland Fisheries, Texas Parks and Wildlife Department

Fish, climate & life
Brian Moss, School of Biological Sciences, University of Liverpool

Understanding of how to restore shallow lakes from turbid, algal-ridden states to clear, diverse, plant-dominated states has been revolutionised by the concept of alternative stable states, and the combined tools of nutrient control and biomanipulation of fish communities. Until recently it has been thought that deliberate biomanipulation was essential in effecting a return to clear water and that similar techniques would apply in warm as well as cool regions. The stimulus of climate change, and the maturing of some long-term restoration experiments, is subtly changing this picture as spontaneous natural increases in piscivorous to zooplanktivorous fish ratios effect an internal biomanipulation in cold lakes when nutrient availability has become markedly reduced. Application of the model to present western technological and alternative sustainable human societies may give greater hope of change to real sustainability without violent intervention.

Towards an understanding of river restoration for fish and fisheries
Andrew B. Gill, Institute of Water and Environment, Cranfield University at Silsoe

The success of many river restoration projects lies in the setting of specific and achievable objectives. River restoration objectives for fish can be relatively focused and straightforward such as providing greater spawning substrata availability to increase the abundance of single species which are of conservation concern. Or they can be more holistic and complex such as increasing functional habitat diversity and complexity which will, amongst other things, increase feeding, refuge and reproductive opportunity for multiple species. Objectives for fisheries may be addressed by similar management activities but will be more focussed on the type of species and the size and structure of the species populations of interest.

There are a number of examples of successful river restoration for fish and fisheries however the extent of the success will depend on the context within which it is viewed. For example, an increase in spawning activity, hatching and recruitment for a threatened species following restoration of reproductive habitat can be viewed in isolation as a major achievement. However if as a result functional habitat for benthic invertebrates is lost or the hydromorphological character of the river downstream is altered then the success may be questioned. Therefore a wider appreciation of how the restoration activity may affect both the local and downstream environment is necessary for the proper determination of success. This wider context is not only important for assessing the outcome of river restoration for fish and fisheries, it will become mandatory with the future EU political and ecological drivers which will come to dominate the management of the waters that fish and fisheries depend on.

Restoring fishery features in the flood plain of the River Trent
Keith Easton, Environment Agency

River restoration of large lowland rivers is inhibited in channel due to flooding and navigation interests. Reconnection of flood plain features or creation of new ones is a viable solution . A range of habitats from gravel pits to silted up old meanders have been connected by channels or pipes to the Trent and have resulted in large numbers of fry growing and surviving along a stretch of the Trent from Derby to Gainsboro. The larvae of coarse fish colonise the sites following downstream drift in July and various assemblages of size and species remain in the refuges during different times of the year. The refuges provide fisheries for sport at different times of the year and different water flow conditions. A large range habitats valuable to conservation results from this work as well as increased fish stocks.

Is woody debris beneficial to fish populations or just another fashion?
Terry E. L. Langford, University of Southampton

Over the past decade the presence and introduction of ‘large woody debris’ has become almost synonymous with river restoration and the perceived improvement of habitat for fish. How far has woody debris or indeed river restoration proved to benefit fish populations? Where is the science and what are the biological facts? The paper analyses data from UK and other studies to show how far the benefits are real and how far just another fashionable myth?

The importance of habitat heterogeneity to fish diversity and biomass
Adrian E. Williams, Keith Hendry, David C. Bradley, Rachel Waterfall & David Cragg-Hine
APEM Ltd

Between 1995 and 2001 large scale coarse fish population surveys were undertaken on two artificial channels running through Heathrow Airport. Both rivers have areas of naturalised habitat together with featureless shallow canalised reaches. Hence, the 1km study area presented difficulties in terms of site selection for representative habitat. Consecutive habitat types were isolated with stop nets and electric fished. Each section was around 40m in length. Three stop nets were deployed, the first two isolating the section to be fished whilst the third isolated the downstream end of the next section. On completion of a section, the first of the three nets was ‘leap-frogged’ above the upper net isolating a further section and so the process continued along the rivers. This was undertaken to overcome problems associated with herding / frightening fish away from a study section. Fish habitat surveys were undertaken in conjunction with the fish surveys with in-river and littoral vegetation identified and mapped.

Fish diversity and biomass varied between river sections and years. A total of 16 species of coarse fish were caught and biomass within sections, ranged from 0 to 780 kg ha^{-1}. There was a consistently strong relationship between fish species diversity and biomass and the distribution of emergent and submerged macrophytes. In all vegetated stretches the surveys produced substantially higher catch estimates relative to unvegetated sections. Overall the lack of habitat appears to limit fish production. Structural features such as macrophytes and bridges increase habitat and flow heterogeneity providing a range of spawning, feeding and refuge options for fish. Furthermore the study revealed important information for general survey design in

coarse fish systems, confirming the need for larger sites encompassing all habitat types and suggesting that intra site habitat partitioning will result in more representative biomass and diversity estimates.

Save Water: Use it More
Clive Gaskell, Environment Agency

Water is taken for granted in modern western society without thought for its origins in nature. In itself it is recognised as a valuable part of the landscape offering both casual and more vigorous recreational opportunities, and is a much sought after backdrop to modern urban redevelopment. There is a pressing, and possibly surprising, need to save water and ensure the sustainability of urban living and pastoral recreation. There is also a need to prepare for a future where famine and feast may be the norm!

Living without water: setting environmental flows for coarse fish
I.G. Cowx, R.A. Noble & R. Welcome
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The potential role of flow and water level criteria on fish species and populations in English and Welsh rivers was determined to provide, for various river reach types, generic seasonal flow and water level regime requirements for key life stages of freshwater fish species to advise and influence the management of flow regimes. Fish community types in rivers were modelled based on the Environment Agency fisheries data and complementary environmental data. The models discriminated eight major fish community types that broadly followed the classical zonation theory with river gradient from upland salmonid to lowland cyprinid communities It is was concluded that the influence of flow and the potential impacts of abstractions and releases should be considered within the context of each of these main fish assemblages, linking key species per community type to their functional ecology and flow requirements. The relationship between the rate of flow, the rate of change of flow, the duration of high/low flow events and their seasonal timing, and their influence over the functioning of fish populations (spawning, recruitment and growth) therefore needs to be considered more fully when evaluating anthropogenic changes to flow patterns, and establishing environmental flow regimes.

Brown trout populations dependent upon compensation flow in the Mersey Catchment
Kevin Nash, Katherine Causer, Dawn Grundy & Oliver Southgate
Environment Agency

Numerous watercourses downstream of upland reservoirs in the Mersey catchment support wild brown trout populations dependent upon compensation water. The Environment Agency has a duty to evaluate Drought Order requests to reduce compensation flows, but a likelihood of brown trout losses was identified following a review of drought orders granted in 1995/96. To better inform future evaluations the Environment Agency has collected baseline environmental data since 2000 on five streams downstream of reservoirs and one on a naturally flowing stream.

Periods of low flow variability were observed on streams associated with reservoirs during the summer months. Brown trout habitat was of a better quality on the natural stream and juvenile brown trout densities were higher. Changes in juvenile density

during the first winter, second summer and second winter of development were compared to mean daily flow measurements. The use of these data sets when evaluating drought orders is discussed and their transferability to other watercourses considered.

Central to this work is the monitoring of actual drought orders and none have yet been requested for the monitored streams, despite the low flows observed in the summer of 2003.

Fish passes – the good and the bad
Mike Beach, Fish Pass Consultant

Obstructions to the passage of fish in rivers are evaluated and fish pass solutions proposed. Various types of fish passes are considered to take account of site constraints, water availability, fish species and economics of construction.

Walking the tightrope – balancing abstraction, river flows and fisheries
John Sanders, United Utilities PLC

Water abstraction and sensitive water environments are never far apart in North West England. As the water company for the region, United Utilities PLC (UU) has a responsibility to provide high quality, reliable water supplies whilst protecting the river environment – a balancing act that increasingly requires an integrated approach.

Various environmental studies in support of water abstraction, drought permits, low flow alleviation projects and environmental improvement schemes have been carried out by UU over the last five years. These studies have increasingly demonstrated that achieving a balance requires multi-disciplinary scientific assessment and modelling, high quality data, an integrated catchment approach and active stakeholder consultation. The studies have also shown the need to challenge some traditional views on river flow protection and abstraction regimes in order to try and achieve benefits for both water supply and the river environment.

This paper explores these various issues drawing upon specific case-studies of salmonid rivers in North West England.

Two low flow 'tools' used in the Northwest for the HD review of consents: 1. Transferable low flow targets based on width
Jane Atkins [1], David Cragg-Hine [2], Andrew Gill [3], Chris Kilsby [4] & Claire Walsh [4]
[1] Environment Agency, [2] APEM Ltd, [3] Atkins Water, [4] University of Newcastle upon Tyne

To review abstraction licences for the Habitats Directive it is necessary to assess the suitability of hands-off and compensation flow conditions for SAC species. Two methods have been developed that have assisted our judgements and should help with setting new licence conditions where necessary. This paper describes the second method.

The Environment Agency has undertaken work in collaboration with University of Newcastle to assess whether flow requirements could be defined in terms of flow per metre width of stream/river. This followed an approach taken by Leslie Stewart of the Lancashire River board during the 1960s and 1970s when he used flow per metre width to define flows suitable for salmon migration.

The work used electro-fishing data and flow data from Low Flows 2000, a model from which flow can be estimated for un-gauged sites. Specific values have been derived for salmon from certain rivers and these appear to be transferable to other rivers locally. Further work is being undertaken to verify these findings for salmon and to assess whether values can be derived for other species.

Two low flow 'tools' used in the Northwest for the HD review of consents: 2. Estimating low flow requirements for rivers based on ecological criteria

Andrew Gill [1], Jane Atkins [2] & Brian Cox [1]
[1] Atkins Water, [2] Environment Agency

To review abstraction licences for the Habitats Directive it is necessary to assess the suitability of hands-off and compensation flow conditions for SAC species. Two methods have been developed that have assisted our judgements and should help with setting new licence conditions where necessary. This paper describes the first method.

Atkins Water and the Environment Agency have developed a methodology that assesses the effects of water abstractions on river flow and the suitability of hands-off and compensation flows, based on specific ecological requirements. This method attempts to be a middle ground between simple historical flow methods and more complex hydraulic and habitat methods. It provides quantitative recommendations in determining the minimum flows needed to support a healthy and sustainable river ecosystem based on the needs of the species of interest.

The approach uses site-specific flow and physical habitat data together with information on habitat requirements for the species of interest. The results express a range of environmental flows rather than a single value for environmental minimum flow on the assumption that a sharp cut-off or single minimum flow does not exist. The approach has been successfully applied a number of rivers across the United Kingdom as part of the EU Habitats Directive abstraction licence reviews.

Anthropogenic influences on chalkstream temperature

David J. Solomon, R. Acornley & G. W. Lightfoot
Fisheries Consultants

Consideration of the results of radio tracking of adult salmon in the Avon, a review of the thermal biology of salmon, and scenarios of climate change, suggest that conditions may be becoming marginal for the species in southern chalk streams. From 2004 we have been deploying a series of temperature loggers throughout the catchment to examine the temperature regime of the river in detail.

Preliminary results from the Avon and published work leads to a tentative conclusion that a number of human activities are having an impact on river temperatures. The greatest impact is likely to have been the historic removal of tree cover throughout the catchment. Other contributing activities include abstraction, fish farming, sewage treatment works effluent, and water-meadow operation. Climate change is likely to be exacerbating the situation, and future projections suggest conditions will become more critical. The scope for managing the temperature regime of the river is discussed.

The Effects of Global Warming on the Freshwater Fish, *Gasterosteus aculeatus* (L.) (the Three-spined Stickleback).

Kathryn Hopkins (Professor Brian Moss, Dr Andrew Gill)
School of Biological Sciences, University of Liverpool

The three-spined stickleback is native to much of the Northern Hemisphere. During the breeding season, the male builds a nest, courts a female, then fertilises the eggs, oxygenates them with a vigorous movement of the tail and pectoral fins (fanning), and maintains the nest until the fry are independent.

This research questioned whether at higher water temperatures the male's parental behaviour might be less effective, resulting in fewer successful incubations, or whether the extra effort the male might expend in parental care would be too energetically expensive to be sustainable. To test these assumptions, sticklebacks from the wild were assigned randomly to treatments in line with predictions for the increase in globally averaged surface temperature before the year 2100. The animals were observed directly for nest building rate, number of days of nest maintenance, number of days of survival, incubation success, and length of incubation. They were also video-recorded to observe the nature of parental care and the quality and frequency of behaviours such as maintenance of the nest and fanning.

With increased temperatures there were significant differences in the number of fish which built nests, which maintained nests, which successfully incubated eggs, and the number of fish which survived until the end of the experiment. Analysis of the videotapes showed that fin-beat rate during fanning (fanning tempo) increased significantly with temperature as did length of fanning bouts. Fish which successfully produced live young spent more time at their nests, more time fanning, and fanned more often.

Adult stickleback survival and the ability to reproduce are likely to be impaired by increases in mean annual water temperature, even if they are as little as 2ºC. Fish help maintain the stability of aquatic systems and therefore the disruption of a population may have negative impacts on the health of the local environment. Wider concerns include the possible effects of global warming on fish populations and species that are of economic importance.

Potential impact of climate change on river flow regimes affecting Atlantic salmon (*Salmo salar*)

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Focusing on the Eden catchment, Cumbria, UK, the potential impact of climate change on river flow regimes and the Atlantic salmon (*Salmo salar*) are investigated. A hydrological model (SHETRAN) enables reconstruction of flow time series on an hourly time-step, along a 1-km network representing the rivers of the catchment. Subsequently, predicted changes in precipitation and temperature by UKCIP02 Medium-High emissions scenario are applied to the input series of the model, to allow projections of future flows (2080s) in the catchment. Both current and future flow regimes are interpreted in terms of channel hydraulic parameters of the catchment (i.e. as flow depths, flow velocities, Froude number and discharge per metre width). Such parameters are compared with suitable habitat flow parameters at various life stages in the literature to determine at what percentage of time these are met. Results show that future climate will decrease the percentage time the ideal minimum parameter requirements will be met. GIS applications are used to analyse these changes catchment wide. Such changes will have implications for the species under the Water and Habitats Directive and for catchment ecological flow management strategies.

The response of sea bass populations to climate change

Mike Pawson, CEFAS

Information from fisheries taking sea bass, *Dicentrarchus labrax* L. around England and Wales and tagging studies have shown that adult bass move to the south and west prior to spawning offshore in the English Channel and eastern Celtic Sea, and appear to return to the same (usually inshore) feeding area each summer. This has been verified by planktonic egg surveys and studies on geographical and seasonal patterns of feeding, condition and gonad development of bass sampled around England and Wales. Movement between the respective areas appears to be relatively rapid and takes place in the spring at the end of spawning (April/May) and as the water cools in the autumn (October-December) when adult female bass seek out water above approximately 9 °C.

Bass larvae resulting from offshore spawning recruit from June onwards into coastal and estuarine nursery habitats, where they remain until age 3-6 years, depending on growth, before dispersing along the adjacent coastline, and it appears that there is substantial mixing of bass at this stage throughout large parts of the populations' distribution range. After 4-7 years, or at approximate lengths of 35 cm for males and 42 cm for females, bass attain maturity, though ambient water temperatures in winter strongly influence the onset of maturity in female bass.

It is hypothesised that the movement of bass to spawning areas will occur later and be over shorter distances from summer feeding areas during warmer winters, when survival of first-year bass might also be expected to be enhanced. One consequence of this is that self-sustaining bass populations may become established in “new” areas if climate warming occurred.

This presentation uses the results of a tagging study in 2000 – 2003, when over 4000 adult sea bass were tagged and released on the offshore spawning grounds in winter

and in summer and autumn inshore around the coasts of England, Wales and Southern Ireland, to show how climate warming may have contributed to an expansion of the distribution range of sea bass. It also demonstrates that bass stocks around the English and Welsh coasts have increased in abundance since the early 1990s, and links these findings with temperature influences on the reproductive biology of sea bass.

Climate change in England and Wales: implications for the establishment of non-native species

Robert Britton, Gareth Davies, Nigel Hewlett & Melinda Beck
Environment Agency

Catfish in the River Thames, sunbleak in the Ribble, largemouth bass in the Severn; will these scenarios come to fruition with the onset of climate change? This paper explores how climate change scenarios may facilitate the establishment of non-native fish species introduced into England and Wales, and their likely impact on native fish populations. It draws on case studies of pumpkinseed *Lepomis gibbosus*, wels catfish *Silurus glanis* and the common carp *Cyprinus carpio*, identifying how elevated temperatures may open up their invasive pathways by assisting successful reproduction, furthering opportunities for sustainable populations in the wild.

Climate change scenarios and non-native species must also consider parasites and disease vectors, for these may also cause major problems in native fish populations. Many introduced non-native parasites have yet to establish due to ambient temperatures being too low. For example, the *Lernaea* genus has been recorded sporadically, but has yet to establish widely, for reproduction is temperature dependent and optimal at 25^{o}C. With elevated temperatures, reproduction rates may increase, producing heavy infections on affected fish, causing lesions, necrosis and secondary infections.

However, such threats to our fisheries may only be realised if inappropriate fish introductions occur. Whilst prevention is possible through an existing legislative framework, success requires effective education, regulation, enforcement and the co-operation of managers and anglers to protect the environment.

The North Atlantic Oscillation

David Bradley
APEM Ltd

Long-range cycles of climate change effect ecosystems globally. In the Northern Hemisphere, the North Atlantic Oscillation (NAO) affects marine ecosystems, lakes and some terrestrial ecosystems, but evidence for effects on rivers is limited. Using existing long-term data for fish and riverine invertebrates, evidence for links between river ecology and the NAO is growing. These relationships remain mostly correlative and the underlying mechanisms are largely equivocal and untested. They do, however, provide useful models for predicting the likely effects of future climate change on fish and river ecology.

Fisheries on the edge in Cumbria, U.K.: where salmonids, cyprinids and climate change collide

Ian J. Winfield [1], Janice M. Fletcher [1], J. Ben James [1] & Ben D. Bayliss [2]
[1] Centre for Ecology & Hydrology, [2] Environment Agency

The lake fish communities of the English Lake District in Cumbria, north-west England, U.K., are naturally dominated by salmonid-percid assemblages. This has led to local histories of commercial or semi-commercial fisheries for species including perch (*Perca fluviatilis*), whitefish (*Coregonus lavaretus*) and Arctic charr (*Salvelinus alpinus*), the latter of which persist on Windermere and Coniston Water as the U.K.'s only fisheries for this holarctic species. However, in recent years the lakes of Cumbria have been subjected to a number of cyprinid introductions, e.g. roach (*Rutilus rutilus*) and dace (*Leuciscus leuciscus*) in Bassenthwaite Lake and Derwent Water, or population explosions, e.g. roach in Windermere, which have resulted in increased coarse fishing activities. At the same time, long-term observations have revealed a significant increase in lake temperature in recent years, an environmental shift which is likely to benefit cyprinids and disadvantage salmonids. Recent changes in the natures and performances of commercial and recreational fisheries in the lakes of Cumbria are described and discussed in this context of local and global environmental pressures.

Chemicals in the aquatic environment: are they of concern?

John P. Sumpter
Institute for the Environment, Brunel University

There has been concern about the effects of chemicals on aquatic organisms for a long time. Until relatively recently, this concern was focused on high volume chemicals, such as oils, tars, and detergents, that due to poor disposal procedures could be present in the aquatic environment at quite high concentrations. As gross pollution has been brought under control (to a large degree), and sewage treatment works have been improved, there has been a switch in emphasis from the 'older' pollutants mentioned above to biologically active chemical pollutants that are present at much lower concentrations. Probably the best example of this change in emphasis has been endocrine disruption. Chemicals such as natural and synthetic oestrogens which are very biologically active, but are usually present at very low concentrations, have been shown to "feminize" fish. In the worse cases, all males have shown "feminization" to varying degrees. There is some information available on how well these fish can reproduce, but essentially nothing is known about the consequences of endocrine disruption to whole populations of fish. Very recently, other biologically-active chemicals, such as many pharmaceuticals, have been found in effluent and rivers. Whether these affect fish and other aquatic organisms, and if so how, is not known presently, but under intensive investigation. Finally, after discussion some examples of the effects of chemicals on fish, I will try to put that threat into context, but comparing it to the many other threats that aquatic organisms face.

Current trends in the biological recovery of streams from acidification

Steve Ormerod
Cardiff School of Biosciences, Cardiff University

Although there is now unequivocal evidence for chemical recovery from stream acidification, trends among organisms are less clear. One of the major needs in acidification research is to explain these non-convergent patterns, and there are several candidate hypotheses. One increasingly favoured is that acid-sensitive species are prevented from recolonising recovering streams because of the continued effects of acid episodes – transient periods of reduced pH generated during rainstorms or snowmelt. I examine some predictions required to support this hypothesis, and provide clear evidence from many British hillstreams of continued episodic effects on biota in areas receiving acid deposition. In other cases, even base-flow chemistry is still sufficiently acid to retard biological recovery. There is a surprising dearth of data assessing consequences for fish.

The use of rotenone to eliminate topmouth gudgeon from a Lake District tarn

Matt Brazier & John Martin
Environment Agency

One of the Key responsibilities of the Environment Agency Fisheries Function under the Salmon & Freshwater Fisheries Act & the Import of Live Fish Act is the management of non-native fish species.

The Topmouth Gudgeon or TMG is a small freshwater fish of the cyprinid family. It isn't indigenous to Europe, being originally native to Asia. Following its introduction to Romania the species has dispersed rapidly throughout mainland Europe. Its physiological and life history characteristics make TMG one of the most potentially damaging fish species to invade Western Europe. Under the Import of Live Fish Act or ILFA they are classified as a species of highest risk. Management of the species to minimise that risk is essential.

The focus of the Agency's first management operation was a coarse fishery in Cumbria. The lakes provide some of the best public recreational coarse fishing in the National Park and sit within the River Kent catchment, a river system designated at a European level for rare & endangered species including Atlantic Salmon, Lamprey, Crayfish and Otter. TMG had severely impacted the native fish populations in the tarn.

A review of management methods produced one viable option – the use of a piscicide. A rotenone based piscicide (2.5% active rotenone) was applied in liquid formulation using a range of methods to achieve a species specific dose derived from bioassay. The operation was successful, survey indicating the application achieved 100% efficacy with minimal impact on non-target species and rapid recovery. Native fish were restocked and angling resumed at the site six weeks after treatment. Monitoring will continue for the next 3 years to validate these findings.

The impact that the Agency's first piscicide operation has had demonstrates the value of this tool for fisheries management and more operations are planned. However, the future use of piscicides as a fisheries management tool in Europe is uncertain. Such substances must comply with the EU Biocides Directive; without which their use will be prohibited throughout the EU in September 2006. The Agency, in collaboration with its European partner organisations is working to secure that future.

Effects of juvenile exposure to endocrine disrupting chemicals on reproductive performance in the three-spined stickleback *Gasterosteus aculeatus*

Richard J. Maunder [1, 2], Peter Matthiessen [1], John P. Sumpter [2] & Tom G. Pottinger [1]
[1] Centre for Ecology & Hydrology, [2] Institute for the Environment, Brunel University

Widespread concern regarding the effects of endocrine disrupting chemicals on fish has increased over the past decade. Male fish exposed to estrogenic chemicals in the wild or under laboratory conditions have been shown to undergo varying degrees of feminisation. The most widely reported effects of exposure to estrogenic chemicals are vitellogenin induction, gonadal intersex, subdued reproductive behaviour or altered sperm characteristics. While it may be intuitive to suggest that effects such as these in the individual fish would cause population-level changes, actually conducting experiments to investigate this issue has proved difficult. It is however these types of study which need to be addressed if the long term ecological significance of the individual-level effects are to be identified. To tackle this problem, we have used mesocosms to assess the reproductive performance of free-spawning sticklebacks exposed, as juveniles, to environmentally relevant levels of model estrogens. Results from preliminary studies indicated that reproductive output was adversely affected in groups of estrogen-exposed fish, compared to their unexposed siblings. This was reflected in several measures of reproductive performance. These data will be presented and discussed in the context of their possible ecological significance.

Achieving a rapid Assessment of the river environment: what can remote sensing do to help?

Lucy J. Dugdale [1, 2], Stuart N. Lane [2] and Alastair Maltby [1]
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It is widely acknowledged that a catchment scale approach to river and fisheries restoration is now required, yet identifying the exact spatial extent and location of environmental problems at this scale still proves problematic. This paper aims to evaluate the contribution technological advancements in aerial surveying, digital terrain models, and Geographical Information Systems (GIS) can make to the assessment of river habitat condition at the catchment scale.

The paper presents results for the River Eden catchment, in Cumbria, demonstrating how these techniques are being employed to extract valuable information, such as the distribution of bank erosion due to stock poaching, channel shading, channel slope and flow type. The paper reports on the accuracy of these techniques and evaluates them in the context of the traditional walkover survey.

Fish counting on the edge

Jim Gregory
Environment Agency

Fish counting systems are important monitoring tools for managing salmon fisheries across the world. But as river types, species and locations vary, so do fish counting methods, the technology and its application. However, many of the issues that face each technique remain the same and yet there has been little or no communication or contact between fish counting groups other than through the manufacturers of counting systems. An examination of how fish counting has evolved and what developments may be applicable to the UK was the basis of a Winston Churchill Memorial Fellowship to Norway, Iceland, Alaska and Canada in July 2005, made by the presenter.

The aim of the Churchill Fellowship was to examine fish counting techniques for sustainable fisheries management and specifically to investigate:

1. The technology being used around the world to enumerate adult salmonid migration.
2. The processes applied to raw data generated by a fish counting system to produce a meaningful output.
3. How this information is used to manage fisheries.
4. The applicability of these systems to UK fisheries and identify opportunities to improve fisheries monitoring in the UK.

This presentation is a visual romp through the fish counting methods used to monitor salmon in Norway, Iceland, Alaska and Canada. Potential applications and benefits for UK fish counting are highlighted and illustrations given of fisheries monitored by cutting edge technology, fisheries monitored near the edge of collapse and of fisheries being monitored on the edge of the world.

A review of large and small scale hydroelectric developments in Ireland with particular reference to fish and fisheries

Tom L. Shaw [1] & Martin. M. O'Farrell [2]
[1]Shawater Ltd, [2] Aztec Management Consultants

The current extent of large- and small-scale hydroelectric development in Ireland is described. The impacts on fisheries in representative catchments are reviewed and an assessment made of mitigation measures. Case studies are described which detail generating protocols designed to facilitate upstream and downstream migration past large-scale (greater than 4MW) hydroelectric generating stations.

The potential for new small-scale (less than 4MW) hydroelectric development in Ireland is discussed, as is the legal and planning framework associated with these developments. The results of fisheries monitoring programmes on upland rivers fuelling new small-scale hydroelectric developments are presented.

On rivers with potential for hydroelectric development, and where this potential lies in the path of anadromous and catadromous fish species, the continuing absence of accurate information on the flows needed for upstream and downstream migration is a serious obstacle for the rational planning process.

The part development of a commercial fishery and its challenges

Steve Griffiths
British Waterways

In 2000, British Waterways was looking at the potential of a site near the Lancaster Canal at Carnforth for development as a commercial fishing complex. British Waterways were unsuccessful in the acquisition of the site, a 30 acre flooded gravel pit set in a further 30 acres of rough grazing, but approached the new owner who expressed an interest in leasing or selling the water-body. After protracted negotiations it was agreed that British Waterways would rent the fishery for 25 years on an annual rent, subject to the owner carrying out works to divide the lake to create a further 8 pools in total. British Waterways would then stock the pools and construct car parks, paths, fishing pegs and welfare facilities. Delays were experienced in this division of the lake due to planning and environmental issues and to ground conditions. Eventually part of the site (Phase One) was handed to British Waterways in 2003 whilst work continued on the remainder (Phase Two). British Waterways stocked the whole complex with fish in April 2004 and opened Phase One of the site for angling at Easter 2004 with temporary on site facilities. It also obtained planning permission for construction of a café. The site was publicised and well attended, easily passing its projected angler attendances for Summer 2004. However involvement of British Waterways engineers in planning construction of the on-site facilities raised concerns about British Waterways' ability to operate the site to its interpretation of Health and Safety Standards within budget. In addition measures to deter Cormorant predation on the smaller pool attracted disapproval from the RSPB. British Waterways declined to take possession of Phase Two and closed Phase One for fishing in September 2004. The site was heavily predated by cormorants over the winter of 2004-2005. The owner subsequently restocked some of those pools still in his control on Phase Two and opened these for fishing in 2005 when they have been, and continue to be, well attended. The contractual arrangements are now the subject of legal proceedings which will not be discussed. The talk will discuss in general terms, issues encountered in developing a commercial fishing re facilities required, stocking policy, planning permissions, environmental conflicts, Health and Safety and commercial viability.

The Management of Intensively Stocked Stillwater Fisheries – Code of Practice.

A.R. Girdler – Chairman IFM Training Committee.

Coarse fisheries in the UK are diverse in both size and the fish communities that they hold. In recent years there has been a tremendous increase in the number of stillwater coarse fisheries, many being specifically built for the purpose. In a natural situation the habitat and environmental factors will determine the species and numbers of fish that exist in a stillwater.

Many stillwater coarse fisheries support greater fish stocks than would occur in a natural situation. Often termed 'commercial' or 'intensive' coarse fisheries these waters when correctly managed can provide consistently good sport for anglers and increased income for fishery owners. When these fisheries are poorly managed the sport will diminish as the fish community maladapts as a response to all manner of environmental and physical stressors.

High stock densities and the bait needed to sustain them can degrade the water environment. This in itself can have consequences for the welfare of the fish but in addition these coarse fisheries may be subject to intensive fishing pressure. Because of these factors, intensive coarse fisheries require careful management.

The IFM Codes of Practice set out the fisheries management standards that are required to ensure the welfare of fish communities stocked into these fisheries. Owners and managers of intensive stillwater coarse fisheries are advised to follow the guidance set out in these codes.

Role of the River Trusts

Alastair Maltby
Eden Rivers Trust

River Trusts are a relatively new addition to the UK fisheries scene and range in size from the smallest of volunteer groups, to organisations employing over twenty people. They are 'bottom-up' movements who represent local people with an interest in managing their river. They are 'doers' rather than representative organisations and have become highly respected for efficient and often very inventive solutions for river restoration and protection. Always 'not for profit' and often fully registered charities, River Trusts, Improvement Groups, Foundations, call them what you will, are a way for every angler to get involved with managing their river fishery.
Alistair Maltby is Director for the North of England of the Association of Rivers Trusts. ART is supported by WWF and HSBC and exists to support River Trusts and similar organisations from establishment onwards. Alistair is also Director of the Eden Rivers Trust and has first hand experience of all the work associated with setting up and maintaining a Trust.

Developing Fisheries – Focus On People

Steve Chambers, Fisheries Development Manager (NE & NW)
Environment Agency, 21 Park Square South, Leeds, LS1 2QG

The purpose of this paper is not to demonstrate how to create new fisheries, or even to improve existing ones. It does not deal with the legal requirements such as consents, permits etc. which may be needed but rather looks at the need to involve and engage people in all aspects of the work. The paper looks at the question of what is a fishery, why we should develop them and what needs to be done to bring people together to ensure the successful delivery of improved fisheries.

Manchester Ship Canal fish populations and oxygenation

Rachel Waterfall

The primary aim of the Manchester Ship Canal (MSC) oxygenation injection project has been to reduce the aesthetic problems associated with anoxia by maintaining bottom water oxygen levels above 4mg/l within the treated area (South Bay to Mode Wheel Locks). This has been achieved during the past 4 summers and has resulted in a reduction of the excessive bubbling, foul odours and sediment mat generation. However, a positive impact of the project has been the pronounced increase in macro-invertebrate diversity and fish presence, condition and growth through improved oxygen levels.

Once a grossly polluted aquatic system characterised by a poor and stressed ecology, the upper MSC now provides habitat for a substantially more diverse collection of biota. Ongoing studies have revealed further increases in macro-invertebrate diversity including the presence of several pollution sensitive species, which is reflected in the BMWP scores. The total number of invertebrate taxa has increased from around 5 pollution tolerant species in the early 1990s to 36 taxa in 2004. Furthermore fish growth

rates remain high, being above the Hickley Growth Standard. Gudgeon in particular, a benthic species once not present at all in the upper MSC, has become ubiquitous and dominates recent catches.

Continued monitoring during the next 5 years of the project will no doubt demonstrate further water quality and ecological improvements in the upper MSC as the ecosystem matures, which would not have been possible without the assistance of the oxygenation project.

The Atlantic Salmon
Malcolm Greenhalgh

POSTER PRESENTATIONS

Surveillance and poaching on inshore reefs of the Great Barrier Reef Marine Park

Katy L. F. Davis [1], G. R. Russ [2], D. H. Williamson [2] & R. D. Evans [2]
[1] Environment Agency, [2] School of Marine Biology and Aquaculture, James Cook University, Australia

Abstract. The Great Barrier Reef (GBR), Australia, is managed under the GBR Marine Park Act (1975) and is seen as a shining example of marine resource management. The principle tool of management is zoning for multiple-use. We examined surveillance and illegal fishing around two inshore islands (Magnetic and Orpheus) of the GBR Marine Park in 2000/2001. Both islands are near Townsville, the largest city adjacent to the GBR. Surveillance effort was low, with vessels present on only 16% of days of the year. Measurable but low levels of illegal recreational fishing occurred within no-take zones. Levels decreased with increasing surveillance effort. Thus zoning was not completely successful in protecting fish targeted by fisheries, even within the most highly enforced sections of the Park. The expansion of no-take zones in 2004 from 4.6% to 33.4% of the area of the 358,000 km2 Park represents a considerable challenge for future surveillance and enforcement.

Colonisation of a man-made flood relief channel (the Jubilee River) by juvenile coarse fish, comparisons with the River Thames and the use of seine-netting as a quantitative method for the evaluation of juvenile coarse fish abundance

Toby Coe Department of Life Sciences, Kings College London

The quantification of juvenile fish abundance and growth is an important part of the management of freshwater fisheries. Juvenile surveys were undertaken in the lower River Thames and Jubilee River between 1998 and 2004 in an attempt to discern whether the construction of the Jubilee River flood relief channel has had an effect on the juvenile coarse fish populations in the Lower River Thames.

The results show that juvenile fish populations in the Jubilee River appear to be ‘impoverished’ when compared to those in the Thames, having a lower diversity, density, ‘biotic integrity’ and fewer species. The results also show that fish assemblages are significantly different in the two rivers, with substantial spatial and temporal variability. Perch and gudgeon display enhanced 0+ growth rates in the Jubilee, compared to the Thames.

There appears to have been a decrease in the density of juvenile fish in both rivers (particularly chub in the River Thames) over the period 1998-2004, and in the number of species in the River Thames. The decreases in density and the number of species suggest that the construction of the Jubilee River has had a negative effect on juvenile fish populations in the Lower River Thames.

The findings are discussed with regards to the unavoidable methodological errors and analytical and statistical limitations of the data generated by seine-netting surveys. It is recommended that if seine-netting is to be continued as a technique for the quantitative sampling of juvenile fish, these problems are addressed.

An RHS Evaluation of the Teign Catchment, Devon for Salmon Habitat Management

Lindsey Syme, Environment Agency

The project focused on the Teign catchment in Devon, where habitat provision for salmon is an important management issue. The River Teign Salmon Action Plan was produced in 2003, the same year a strategic River Habitat Survey was conducted in the catchment. River Habitat Survey (RHS) is a means of assessing physical habitat characteristics and habitat quality. It was used in this study to investigate the pressures and impacts on the catchment in relation to salmon habitat. GIS was used to produce maps allowing a visual recognition of current habitat availability and highlighting areas of good and bad quality that could be preserved or improved upon. This was useful for showing to the managers and users of the catchment to quickly illustrate both problems and solutions and give them more of an understanding of the catchment and the ecological processes within it. An assessment was also made of the use of RHS in salmon habitat management in line with current legislative requirements.

Protecting Flows For Migratory Fish: **Habitats Directive Review Of Consents In The Rivers Usk & Wye.**

McCoy, Gillian.L., Environment Agency, Rivers House, St Mellons Business Park, Fortran Road, St Mellons, Cardiff, CF3 0EY.

The Environment Agency (EA) has a statutory responsibility through the Habitats Regulations (otherwise known as the Conservation (Natural Habitats & c.) Regulations 1994) to review the impact of currently permitted abstraction licences on designated features within the Special Area of Conservation concerned (in this case the Rivers Usk and Wye in south east Wales).

There are nine species designated for each of these two rivers: Atlantic salmon, sea lamprey, river lamprey, brook lamprey, allis shad, twaite shad, bullhead, otter and communities of *Ranunculus* vegetation, plus the native white-clawed crayfish for just the River Wye. This poster illustrates how the habitat and ecology of each species form the foundations of the assessment process, and lead to the protection of the migratory species concerned: salmon, sea lamprey, river lamprey, allis shad and twaite shad. These species are all anadromous, entering the freshwater environment to find suitable habitat for spawning and juvenile development.

Abstraction from the river and its tributaries can threaten the designated features if too much water is taken, or if that water is taken at the worst times of the day or year or for too long a period. All life stages can be affected including eggs, juveniles, and adults migrating upstream. Potential conflict between water abstraction and species lifecycles can therefore occur at various times of the year for each species and will depend upon the ecological requirements (such as flow, depth and velocity) of the species and lifestage concerned.

In order that the EA can assess the impact of each of our water resources licences upon these designated features, we utilise all available information on the habitat, river flow, and water quantity requirements of each species to maintain or restore its favourable status in each river. Much of this information has been drawn together by English Natures' LIFE in UK Rivers project, but additional local information brings greater confidence in the accuracy of data and research projects are instigated where time permits to fill the gaps.

Fighting for pure waters, making polluters pay.
Mark Lloyd, Anglers' Conservation Association

The ACA, as it is widely known, was founded in 1948 to fight pollution and protect the interests of anglers. It remains true to these aims more than 50 years on. In particular, it employs a legal team to win compensation for its member angling clubs who have been affected by pollution and other harm to their fisheries. At present it has over 60 civil cases ongoing, ranging from sheep dip to sewage.

Its entire income is derived from membership subscriptions, donations and legacies, which contribute to a fighting fund. This allows it to take on big companies and to pass all the damages it wins back to the affected parties for environmental conservation work. For example, the ACA won £415,000 in damages which was used to set up the Eden Rivers Trust. It has only ever lost 3 cases and has won millions of pounds in damages. This combination of deterrent and compensation creates a virtuous circle which benefits all aquatic wildlife.

The Association also works alongside other angling bodies to lobby government for changes to legislation and for more funding to protect and restore water environments. Its membership comprises 12,000 individuals, about 700 clubs and 300 riparian and fishery owners. It is embarking on a major campaign to double these numbers by the end of 2006 and is particularly keen to see riparian and fishery owners attending the IFM conference benefit from the unique protection offered by membership. Mark Lloyd, the new Director, will be available to answer any questions.

Humber Lamprey Project
Dr David Hopkins,
Environment Agency, Coverdale House, Clifton Moor, York YO30 4GZ . Tel. 01904 822564.

The Humber Lamprey Project was instigated in 2003 to improve knowledge of river and sea lamprey stocks and factors affecting them in the Humber Basin. River and sea lamprey are listed features of both the River Derwent (Yorkshire) Special Area of Conservation and the Humber Estuary proposed Special Area of Conservation. Under the Habitats Directive, consents issued by the Environment Agency were due to be reviewed for possible impact on these lamprey populations by 2008.
Various studies have been carried out including: collation of existing information; tracking of migrating adult river lamprey; assessment of adult river lamprey exploitation for the angling bait market; surveys of spawning river and sea lamprey; impingement at power station and potable water intakes; and a survey of juvenile stocks at selected sites.
Information has been obtained concerning: approximate population sizes; spawning areas; spawning behaviour; migratory behaviour; habitat requirements at different life stages; and their roles in the ecosystem.
Threats to river and sea lamprey stocks have been evaluated. This process has revealed that certain treats, particularly exploitation, are difficult control using existing legislation.
Despite progress, there is need for additional information to facilitate rational management. Requirements include: quantitative, long term data sets; knowledge of behaviour in the vicinity of intakes and obstructions; and the geographical extent of population units.

The Occurance and Impact of Koi Herpes Virus in Carp Fisheries in England and Wales

J.Z. Snow, C.F. Williams and N. Hewlett
Environment Agency National Fisheries Laboratory, Huntingdon, England.

Koi Herpesvirus (KHV) is a highly pathogenic virus of common carp and koi carp (*Cyprinus carpio*). The virus was first isolated in the UK in 2000, from a fish farm using cell culture techniques. The subsequent analysis of retrospective samples with more sensitive diagnostic tests (PCR), suggest the virus has been present within England since 1996. The Environment Agency investigates approximately 150 mortality events annually where disease is the suspected cause. In the last three years, a total of 16 mortality events involving common carp have resulted in the detection of KHV, however live virus has only been isolated in eight of these events. The extent of losses and severity of pathological changes have varied between waters. These events have raised concern over the impact and spread of the disease to carp fisheries. The characteristics of these mortalities, pathological changes observed and implications for future management are discussed. KHV represents a significant threat to the development of carp fisheries which requires the implementation of strict disease controls to minimise future environmental and socio-economic impacts.

Argulus poster - abstract currently with Stirling (collaborative). I will get this to you asap - prob early next week latest - is this too late?

RECENT ADDITIONS TO THE PARASITE FAUNA OF THE BRITISH ISLES - IMPLICATIONS FOR FISHERIES.

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The number and diversity of parasites recorded from freshwater fish within the British Isles has increased considerably in the last 30 years. This has been attributed to a number of factors, including improved detection effort, better taxonomic expertise and increasing numbers of species imported with infected hosts. Awareness of this changing parasite fauna represents an important area of fishery science, especially when pathogenicity, host preferences and environmental requirements of these species are poorly understood. With growing socio-economic value placed upon freshwater fisheries throughout the UK, understanding the dangers posed by these species is essential if disease risks to native fish populations are to be appropriately managed.

In the last 20 years, over 5,000 fish health check examinations have been conducted by the Environment Agency to support fish movements under Section 30 of the Salmon and Freshwater Fisheries Act, 1975. These have resulted in new parasite records for the British Isles including representatives of the cestoda, monogenea, protozoa, digenea, nematoda and crustacea. The parasitic nematode *Philometroides sanguinea*, monogenean *Pellucidhaptor pricei* and digenean *Paracoenogonimus* sp* are used as recent examples to highlight issues surrounding the detection and management of non-native parasites within England and Wales. The importance of such findings and the future implications of invasive pathogens to fisheries are discussed.

(* - tentative identification based upon a single specimen)

CONSERVATION SPECIES - POPULATION SURVEYS

Standardised sampling strategies and methodologies for condition assessment of sea, river and brook lamprey, bullhead and spined loach within SAC rivers.

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Abstract
A standardised protocol was developed by means of controlled field experimentation in order to optimize sampling efficiency for sea lamprey (*Petromyzon marinus* L.), brook lamprey (*Lampetra fluviatilis* L.) and river lamprey (*Lampetra planeri* L.), bullhead (*Cottus gobio* L.) and spined loach (*Cobitis taenia* L.). It was observed that discontinuous electric fishing provided the most effective method of capture for both lamprey and bullhead in shallow water, whilst spined loach were most efficiently sampled by means of hand trawling. When applied to a range of habitats this protocol contributes to species condition assessment in water- ways which are designated for protection under the EC Habitats and species Directive.

Key words: Condition assessment; conservation status; special areas of conservation

Going Full Circle – improving salmon survival through the use of circle hooks

Simon Toms,
Environment Agency, **Sir John Moore House**, Victoria Square, **Bodmin**, Cornwall, PL31 1EB.

Salmon in many river systems are taken as broodstock. However, salmon taken on worm display a variable degree of mortality when being held under hatchery conditions. Worm caught fish hooked in the mouth can survive well up to the time they are stripped, approximately 2 months. However, if the fish is a deeply hooked worm caught salmon, it slowly deteriorates in condition and typically dies after a 2 to 3 week period.

Postmortem analysis of deeply hooked worm caught fish showed that significant internal damage had occurred during the setting and playing of the fish. This included damage and penetration of the gut wall, bacterial infection of the peritoneal cavity caused by rotting worm held in situ by the hook and in one instance damage to the heart muscle following the hook penetrating the trachea.

As a consequence a number of expert salmon anglers on the rivers Camel and Fowey agreed to take part in a trial using circle hooks. These hooks are specifically designed to catch fish in the mouth. The hooks trialed were Size 2 VMC circle hooks model no 7381BN. In total, 15 salmon were captured using these hooks of which only 1 was deeply hooked. This compares with around 50% for traditional "J" hooks. The Agency, River Associations and Anglers concerned all agree that these hooks provide a significant benefit to salmon conservation.

Following this result the River Camel and Fowey River Associations, at the request of the Agency, have implemented a mandatory rule throughout each river requiring the use of circle hooks when fishing with worm from 30 September to the season end on 15 December.

The combined use of acoustic tracking and echosounding to investigate the spatial distribution of bream (*Abramis brama*) in the River Trent, England.

Jim Lyons[1,2] and Martyn C. Lucas[2]
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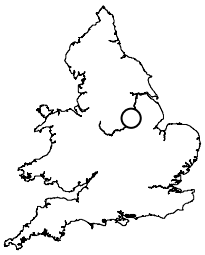
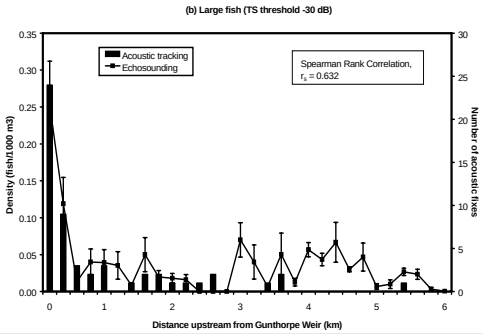
A better understanding of the spatial behaviour and distribution of fishes in modified, lowland rivers is necessary for ecosystem restoration and fisheries enhancement in these systems. Integrated approaches to measuring patterns of space use by key fish species are needed. Telemetry of tagged fishes is a preferred method of measuring habitat use and movement of fishes. However, the small sample sizes achieved are often criticized. Mobile horizontal beaming echosounding is increasingly used for determining fish abundance in large rivers and can be used to do so at a sample size approaching that of the population. We seek to combine both approaches, firstly with respect to bream *Abramis brama* in the River Trent, England.

Fieldwork was carried out on a 7.6-km reach of the lower River Trent, England (Box 1). This section is mostly 80-m wide and 3-m deep and is bounded by two navigation weirs. Nine adult bream were acoustically tagged and tracked in summer 2000, in sessions stratified into 6-h periods. Fish exhibited clear movements between a daytime resting

area to which the whole group homed daily, followed by night-time excursions, presumably for foraging, when the group split up. Horizontal-beaming mobile echosounding surveys were carried out at night on three occasions and the targets were counted and fish size estimated, assuming perpendicular insonification. Distribution of tagged bream locations and fish targets > -30 dB (mostly adult bream in this stretch) shows concordance (Box 2), suggesting that in this reach, in summer, bream can be identified from echosounding surveys. A similar analysis for all fish, including small fish targets (> -55dB), gave a significant negative rank correlation, suggesting that adult bream use space differently to small fish. To date, direct video observation and fish capture in the main channel at night has not been possible. Further testing of the utility of combining these approaches is necessary, but early results are promising. In the future further use of telemetry and echosounding may enable better interpretation of space use by fishes than either approach alone. The imminent advent of coded acoustic tags that can be interrogated during echosounding surveys would enable direct overlay of known fish identities on echosounding traces.



Box 1. ***Study area. Tracking and echosounding on the***



Box 2 - Density of fish targets > -30 dB and locations of tracked bream at night in 200-m sections of the Trent

The Role Of the Fish Health Inspectorate

Peter White
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European and National Legislation puts in place a framework to monitor and control some of the most serious and devastating diseases found in Fish and Shellfish. The Fish Health Inspectorate, based at the Cefas Weymouth Laboratory, is responsible for enacting this legislation; this is achieved by having in place a programme of visits to farm sites, monitoring imports and exports of fish, licensing and controlling sites holding non-native fish and investigating outbreaks of diseases. Because of this England and Wales are largely free of these serious diseases and, where they have been found and eradication is not possible, controls are put in place to prevent the spread of these diseases.

The aim of this presentation is to give an insight into the role of a Fish Health Inspector; the variety of duties undertaken by them and the beneficial effects the Inspectorate has on the industry.

Estimating smolt output derived from natural reproduction and stocking of Atlantic salmon (*Salmo salar* L.) in a recovering river.

Tom Worthington[1] and Tim Jacklin[2].
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Salmon were once abundant in the River Trent, but declined from the mid-1800s until after the Second World War when the species effectively became extinct as a self-sustaining population. A combination of gross pollution caused by rapid industrialisation, the building of navigation weirs and electricity generation are thought to have been the main causes of the loss of the species from the river. However from the 1960's water quality in the Trent improved and sightings of salmon started to increase. A charitable trust was formed to raise money for the project and since 1998 1 million salmon parr from the Environment Agency's Kielder hatchery have been stocked into the River Dove, a major Trent tributary. Since 2001 adult salmon have been observed leaping at weirs on the Trent and in the Dove and electric fishing surveys have showed that they have spawned successfully and produced the first native salmon in the Trent catchment for about 70 years.

The main aim of this project was to determine the size, timing and age composition of the salmon smolt run on the River Dove, with a view to determining the origin of smolts (hatchery or naturally spawned) in future studies. This was done using a rotary screw trap located just upstream of the Dove's confluence with the River Trent. Environmental data were collected and tested for correlation with the size of the daily smolt run.

The main outcome from the project, was the confirmation that salmon smolts are leaving the River Dove system. A total of 227 salmon smolts were caught during the study period. As well as salmon, the smolt trap caught a total of 18 other fish species, including migrating sea trout. Scale analysis done from a selection of the captured fish, aged the majority of the smolts as 1+, this coupled with the relatively fast, first year growth rate, suggests these fish are likely to be naturally recruited River Dove salmon.

Back from the Dead - The Tail of the Mersey Salmon

Oliver Southgate, Andy Goodwin, Dawn Grundy, Simon Hirst, Kevin Nash,
Environment Agency, Appleton House, 430 Birchwood Boulevard, Birchwood,
Warrington.

This poster views some current challenges to establishing a sustainable salmon population in the Mersey. Numbers of stray salmon entering the river have been increasing over the last 5 years, and a fish pass in the lower reaches of the river has been modified for improved salmon passage and trapping.

Once salmon have entered the river system, they are faced with many barriers to upstream migration. Not least is the Manchester Ship Canal, which has large industrial locks, poor water quality and low flow rates. Nevertheless two sub-catchments, the Bollin and upper Mersey, feed into that stretch of Ship Canal currently available to the fish. Salmon migration into the Bollin has generally been accepted as the most likely event, as it is immediately available to salmon wishing to leave the canal.

Entry into the upper Mersey sub-catchment was thought unlikely, as it requires salmon navigate 11 km of Ship Canal and then jump the large Mersey Weir. However juvenile salmon were identified in this sub-catchment during routine Environment Agency monitoring. Successful spawning in the Mersey means that some of these adult salmon may not be strays. A current radio tagging study is investigating salmon migratory preferences, which will help target future fish pass developments.

A leap of faith – the return of Atlantic salmon to the River Mersey.

Katherine Causer[1] , Chris Harrod[1,2] and Dawn Grundy[1]

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2. Zoology Department, National University of Ireland, Galway, Galway, Ireland

The River Mersey has had a pivotal role in the development of the North West of England. The river was central to the industrialisation that brought prosperity to both the region and the UK, but only at the cost of acute environmental damage. By the early 20th century migratory fish stocks, including Atlantic salmon (*Salmo salar*), were totally extirpated from the catchment. In 1982, water quality had degraded to a level where a senior UK Government minister described the river as an affront to a civilised society. Ecologically, the river was extremely degraded and fish were absent from large sections of the river. However, following two decades of environmental improvements (cost ca. £1 billion) led by the Environment Agency and partners, water quality has recovered markedly, and during 1999 migratory salmonids were observed attempting to leap an obstruction 12 km above the tidal limit. This poster describes a trapping study conducted during the autumn and winter of 2002, the results of which revealed that the River Mersey was again supporting a significant run of Atlantic salmon. The implications of the return of salmon to this once-grossly polluted system are explored - including the options available for the restoration and long-term conservation of salmon and other migratory fishes.