Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

The 42nd Robson Meeting

9th – 10th February 2010

Abstracts / Proceedings

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The **Robson Meeting** is an annual meeting of Aquatic Biologists, Flood Defence Engineers and others, usually held in England and Wales. It is named after the first Head of The Aquatic Section of the Weed Research Organisation, Dale Robson. It is the only annual event dedicated to aquatic weed control issues and attracts over 120 people on a regular basis.

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THE 42ND ANNUAL ROBSON MEETING - AGENDA

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The Robson Meeting 2010

Agenda - Wednesday 10th February 2010

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12:10	Stuart Hemmings *Black Sluice IDB*	The use of herbicides by Internal Drainage Boards
12:30	Paul Carter *EA Exminster*	Self-build floating islands: A practical approach
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FLOATING PENNYWORT INVASION IN THE RIVER SOAR, LEICESTERSHIRE: TURNING THE TIDE?

Phil Harding

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Floating pennywort first appeared in the River Soar near Leicester City in 2004, and has continued to spread downstream through Leicestershire. For the last five years efforts to contain and control this invasive species have continued with varying degrees of success. Despite this floating pennywort has now become established in the River Trent, with the potential to spread more widely in the catchment.

Efforts to manage the invasion in the River Soar have focussed on sustainable management through partnership, in line with the Framework Strategy for invasive non-native species. Leicester City Council has progressively eradicated the plant in Leicester, British Waterways staff have managed outbreaks in navigable stretches, and the Environment Agency has undertaken monitoring and carried out control in non-navigable stretches.

Monthly fixed-point photography and aerial photography have proved effective in monitoring the progress of the invasion and the success of control measures. Whilst total removal from the system is impossible, downstream eradication in Leicester has proved to be achievable. Annual management through mechanical removal and herbicide application has also proved successful in containing the problem for particular river uses.

Monitoring over several years indicates that growth of floating pennywort is influenced significantly by temperature and flow. In a mild winter rafts may remain intact and consequently wash down the catchment as large masses, potentially posing an increased risk of flooding. Conversely, severe air frosts beds may cause fragmentation into small pieces which wash downstream. This may assist control efforts because the frosted beds take longer to re-establish in the following year. However, the fragmentation also produces thousands of potentially viable 'cuttings' which may accelerate downstream colonisation if not flushed out by high flows. This scenario may have led to the sudden appearance of floating pennywort in the River Trent in 2009.

FLOATING PENNYWORT ON THE RIVER WAVENEY: PROBLEMS AND SOLUTIONS WITH MULTI-PARTNER STAKEHOLDERS RESPONSIBILITY AND COORDINATION

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The River Waveney is 80 kilometres long, forming a large proportion of the border between Norfolk and Suffolk. It originates as a spring-fed stream near Redgrave and Lopham Fen, the largest remaining river valley fen in England, and one of the most important wetlands in Europe (status: SSSI, NNR, Natura 2000, Ramsar). The Waveney flows east to the Broads and passes through the town of Diss. At Bungay, the river enters the jurisdiction of the Broads Authority and the public right of navigation begins at Geldeston Lock, which extends downstream to Great Yarmouth.

The Waveney River Valley is designated as an Environmentally Sensitive Area, whilst the river and bank sides are a stronghold for otter and water voles. The Waveney is also a popular river for quiet recreational activities, including canoeing and angling, both important aspects of tourist revenue for the local economy. The risk of Pennywort spreading through the floodplain drainage ditches is high as the majority of drainage in this area is by gravity rather than pump drainage, so direct connection from main river channel to the wider floodplain exists.

In November 2007, an infestation of Floating Pennywort was discovered just downstream of the waste-water treatment works (WWTW) at Diss. A rapid response by local officers was instigated and several teams of EA and BA staff hand-pulled patches downstream from Diss. This initial winter hand-pulling work extended about 1 km downstream from the WWTW.

As part of our approach to tackling floating pennywort, surveys and repeat removals continued during 2008 & 2009. A July survey in 2008 found two small patches of Floating Pennywort downstream of Billingford Mill, about 8 km by river from the initial discovery in Diss. By late summer 2008, after a spate period, non-rooted fragments of Pennywort were discovered in the river at Needham, 14km downstream from Diss with rooted patches 10km downstream. The following year, in July 2009, pennywort had established at Syleham, 12km from the original outbreak.

Lessons learnt from tackling the pennywort in 2009 has resulted in the Norfolk Non-Native Species Initiative leading a partnership approach to eradication involving a Project Officer co-ordinating the control work. Partners include the Environment Agency, Broads Authority and the Upper Waveney Valley Countryside Project. . The approach aims to combine aggressive and immediate management throughout the 2010 growing season, with mechanical excavation, hand-pulling and herbicide spraying being used as appropriate. Continual monitoring and small-scale control work being

conducted by the Project Officer aims to eradicate the plant from the most upstream part of the infestation working downstream.

LUDWIGIA ERADICATION: A ROUGH MODEL FOR THE FUTURE

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When we are attempting to manage an established invasive non-native species it is a common lament that had we intervened early in the process we would only require a fraction of the resource to achieve a lasting management solution. We have lacked the capacity to identify threats before or soon after their arrival, preoccupying ourselves with established problems for which it is easier to mobilise resource, but harder to achieve sustainable management.

Our approach to creeping water primrose, Ludwigia sp. may provide a basic template for future rapid response programmes. Based on observations of invasive growth in France, Ludwigia was recognised as a potential threat to UK habitats soon after it became widely available in this country. The GB Programme Board, which oversees the implementation of the GB strategy for managing invasive species in GB, determined that Ludwigia should be eradicated from the wild. Coordination of this task was allocated to the Environment Agency. This programme provided the theme for the first Invasive Species Action Plan produced by the Non-Native Species Secretariat.

To date, the plan has worked well. A voluntary ban on sale has been agreed with two of the leading trades associations. The updated Schedule 9 of the Wildlife & Countryside Act 1981, due to be implemented from April 2010 will include Ludwigia. Thirteen sites have been identified in GB. Twelve of these sites are either under active management or are believed to have been eradicated.

Whilst the process we have followed isn't ideal, the outcome is considerably more effective than what has been achieved with regards rapid response to floating pennywort. Further development should provide GB with the means to address future invasive species before or soon after they pose a threat to our environment.

THE VECTORS, TIMING AND ECONOMIC COSTS OF FRESHWATER INVASIONS IN GREAT BRITAIN

David C. Aldridge[1], Philine zu Ermgassen[1], Reuben P. Keller[1,2], Matthew J.P. Oreska1

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Non-indigenous freshwater species cause large ecological and economic impacts in Great Britain. In response the government is in the process of implementing a broad, new non-indigenous species strategy. We assembled a list of all non-indigenous freshwater species that are or were established in Great Britain, their date of first record, and their vector of introduction. This list provides a baseline against which the success of new policies can be assessed. Because the biota of Great Britain has been well recorded, our results provide a highly resolved case study of the vectors and drivers of species transport and establishment. A total of 117 non-indigenous freshwater species are currently established in Great Britain; a further 17 species were once established but are now extirpated.

Between 1800 and 2000 the number of established species increased at accelerating rate, and this increase correlated with the growth in human population and gross domestic product. The construction of large reservoirs in Great Britain occurred over a short period and overlapped high rates of new species establishment, indicating that habitat modification may have been an important driver of establishment. Non-indigenous species now account for 24% of fish, 12% of plant, 54% of amphibian, and 88% of decapod crustacean freshwater species richness in Great Britain. The ornamental trades have been responsible for the greatest percentages of intentionally (73%) and unintentionally (34%) introduced species that have become established. Shipping and aquaculture have also been strong vectors. These vectors should be prioritized for management within the new non-indigenous species strategy.

We undertook a simple, survey-based approach to generate economic cost estimates for non-native freshwater invasive species (FIS) in Great Britain. The approach scales an average reported financial cost for each species by a ratio of management effort, thereby estimating the actual expenditures incurred per species across a variety of stakeholders.

From the survey responses, the Great Britain-wide cost of controlling FIS is estimated to be approximately £25 million year^{-1}; however, the financial costs of control could total £40 million year^{-1} if control efforts were undertaken at all infested locations. Control cost estimates are highest for Canadian pondweed (*Elodea canadensis*), a particularly widespread species, and for the zebra mussel (*Dreissena polymorpha*), which adversely impacts both industrial water users and boaters. This assessment of the relative economic impacts between species in Great Britain provides policy-makers with a consistent, monetary basis for rank-ordering species' economic costs and prioritizing management efforts. In addition, the cost assessment approach developed in this study could readily serve as a model for IAS impact assessments elsewhere.

HORIZON SCANNING FOR BRITISH FRESHWATER NON-INDIGENOUS SPECIES

Philine zu Ermgassen

Aquatic Ecology Group, Department of Zoology, University of Cambridge, UK

Understanding invasion patterns is central to risk assessment and effective management. We considered non-indigenous freshwater species in Britain, Ireland and the Netherlands. The proportion of new invaders to Britain that were first recorded in the Netherlands has increased following the UK ascension to the European Economic Community in 1973. This increase in non-indigenous species in Britain, which could be "predicted" by reviewing species established in the Netherlands, coincided with changing UK trade patterns, as well as the opening of canals connecting the Netherlands to the Ponto-Caspian region. In turn, freshwater non-indigenous species established in Britain are a good predictor of future invaders to Ireland. Over 86% of Ireland's non-indigenous species were established earlier in Britain. This study suggests that the presence of species in neighbouring regions is a good predictor of future invasions across all vectors of introduction, and that stronger international collaboration on non-indigenous species could provide considerable economic and environmental benefits. Furthermore these results highlight the need to consider current trends over long-term patterns of invasion.

THE NEW NON-NATIVE SPECIES SECRETARIAT WEBSITE AND PUBLIC AWARENESS CAMPAIGN

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"The Non-native Species Secretariat is responsible for coordinating work under the GB strategy for non-native species. As part of this role the Secretariat has set up a website, which has been relaunched this month.

On the new site you can find:

- over 60 non-native species I'd sheets (including the key freshwater invasives),
- all of the risk assessments which are in progress,
- our image gallery with over 1700 photos of non-native species,
- updates on news, events and alerts from across GB,
- a users project database with details of different non-native species projects being undertaken in GB
- and much more.

In February we will also be helping to launch the Be Plant Wise public awareness campaign, funded by Defra and the Scottish Government. The campaign will focus on encouraging pond owners to keep their plants safely controlled in their pond and not allow them to escape into the wild."

THE NATURAL LEVEL: BIODIVERSITY AND WATER MANAGEMENT IN THE MIDDLE LEVEL: A MARRIAGE MADE IN HEAVEN?

Bill Ransom and Cliff Carson

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The Middle Level Commissioners, (MLC) have been increasingly active in integrating management practises into their general maintenance operations that benefit wildlife and also contribute to improved channel protection on their catchment drains and rivers. Specific projects to fulfil national Biodiversity Action Plan aims for otters and water voles have also been initiated.

The Middle Level has a 70,000 hectare catchment that includes 35 Internal Drainage Boards. The focus of this presentation is on the 200 kilometres of main drains and rivers that convey IDB water to the MLC Main Drain pump at Wiggenhall St Germans.

Cliff Carson joined MLC as an environmental advisor in 2005 and revised and updated, in consultation with Bill Ransom, an Operations Manual based on an original produced by former Operations Engineer, Geoff Cave. One of the most beneficial new elements was the adoption of a three zone mowing regime for all banks, (except amenity areas in village and urban sections), designed to produce a diverse vegetation structure throughout the system. The bank tops and one swath down the side were mown early, (commencing pre 7th April) and regularly to create and maintain a short grass **health & safety cut zone** that also provided good hunting areas for barn owls and kestrels. In addition it provides safe and suitable conditions for walking access. The **main cut zone** extended from there to within one metre of the water margin and was cut after 15th July when the breeding season of bird species that might use it was over.

The most valuable zone for enhanced management for biodiversity was at the water's edge. A **natural margin protection zone**, one metre up the bank and one metre out from the edge into the channel was left uncut by flail mowing and weed cutting respectively. This resulted in a riparian habitat that allowed marginal plants including common reed, sedges, bur-reeds, reed mace and yellow flag to flourish. This in turn has benefited many species especially invertebrates such as

overwintering wainscot moth larvae that in turn provided a food source for reed warblers nesting in the new areas of reed growing in water. Other species seen to benefit from this management include emerging dragonfly larvae, nesting great crested grebes and harvest mice. The marginal plants also formed a protective barrier that prevents wave and flotsam erosion.

After four years non-management the marginal bank margin strip has been put into a trial two-year rotational cutting regime, (commenced after 1st September when reed warblers have completed second broods), that will control bindweed and prevent succession to woody species.

The marginal plant zones at the channel sides have proved attractive to spawning fish. No scientific study has been carried out but there appears to have been a reduction in the incidence of severe algal blooms since the policy has been adopted.

The Middle Level Otter Recovery Project, funded by £50,000 from SITA landfill tax and also supported by EA, NE and the Cambs Biodiversity Partnership, focuses on creating a network of resting and potential breeding sites throughout the system. So far 36 holts have been built, 24 of which have been underground, built into the side of MLC banks. Most have infra red video cameras installed to facilitate monitoring the inside of the holt. The cameras are only active when a digital recorder and power source are attached so although there have been signs of use, the first pictures of an otter inside a holt are still awaited.

The Middle Level Water Vole Support Project, funded by £50,000 from Biffaward landfill tax and also supported by EA, NE and the Cambs Biodiversity Partnership focuses on improvement of riparian habitat and the control of their main predator, American mink. The presence or absence of water voles is being monitored by placing 200+ indicator boards at one kilometre intervals on the main waterways. IDB members are being recruited to help with mink control as pumping stations, landing stages and bridges provide cavities and sites that are favoured by mink as dens.

Coir rolls, pre-established with native emergent water plants, sedges, grasses and rushes, have been installed at different trial locations as water vole friendly revetment and a soft engineering alternative to hard revetment. Hard revetment will always have its place in very demanding situations but soft revetment methods are more sustainable and becoming

more cost effective in comparison as stone and steel material costs rise.

Coir rolls give eroded bank margins an instant natural protection that develops into a self-sustaining barrier rooted to the bank. They are comprised of non-invasive plant species, especially sedges, selected to resist wave erosion that are also valuable habitats for native species.

Other initiatives include the provision of opportunities for kingfishers to find safe nesting sites by drilling holes in sheet piling at suitable locations and the design and installation of combined otter holts and kingfisher nest sites.

Future plans include the provision of elver access ramps at barriers such as the new St Germans Pumping Station, the direct planting of sedge plugs to speed 'self-heal' of eroded margins and the trial of a method of early and regular weed boat cutting to control invasive sweet reed grass, *Glyceria maxima* and promote its replacement by a more diverse riparian plant community.

THE LANTHANUM MODIFIED BENTONITE CLAY KNOWN AS PHOSLOCK®

Nigel Traill

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Phoslock® is a lanthanum modified bentonite product developed by the CSIRO of Australia for the reduction of filterable reactive phosphorus (FRP) from water bodies and sediments. By reducing the pool of bioavailable phosphorus, Phoslock can be used as an effective remediation tool for eutrophic waterways and control measure against blooms of cyanobacteria (blue green algae).

Phoslock® is operational and stable across a wide range of pH and redox conditions and its application to a water body has negligible effect on conductivity. From an ecotoxicological and human health point of view, extensive laboratory and field scale testing over the past decade have demonstrated that Phoslock® is safe to use.

Over the past three years, Phoslock® has been applied to more than twenty lakes in Europe, ranging in size from 1 to 300 hectares.

This presentation provides an overview of the performance characteristics of Phoslock®, the methods by which it is applied to water bodies and the results that have been observed from applications in the Netherlands and Germany.

USING PHOSLOCK® TO "KICK-START" THE RECOVERY OF SHALLOW LAKES FROM EUTROPHICATION

Bryan Spears[1] Sebastian Meis[1,2], Rupert Perkins[2] & Stephen Maberly[3]

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The ecology of many shallow lakes has been detrimentally affected by elevated nutrient (phosphorus and nitrogen) enrichment as a result of human activity. This process is known as cultural eutrophication and often leads to a loss of biodiversity, increased operational costs for water companies and expensive lake remediation work. As such, eutrophication management is one of the biggest challenges facing aquatic ecologists; a fact that is recognised within European environmental policy (*e.g.* WFD and Habitats Directive).

During cultural eutrophication, many shallow lakes change from a 'desirable' clear-water macrophyte dominated state to an 'undesirable' turbid phytoplankton dominated state. However, when nutrient inputs are reduced at source, a switch from phytoplankton dominated state to macrophyte dominated state may be delayed through internal feedback mechanisms. One example of a feedback mechanism is the cycling of sediment-bound nutrients, "stock-piled" during periods of elevated nutrient loads from the catchment, between the water column and the lake bed. This "internal nutrient loading" can maintain poor ecological water quality conditions at nutrient concentrations that were characteristic of good water quality before eutrophication; that is, the lake resists a change of state.

Disturbance events (e.g. extreme weather events and food web disruption) can often "tip the balance" between desirable and undesirable states and aquatic ecologists are currently attempting to understand means in which regulated system disturbance can be harnessed to enhance the restoration of shallow lakes across Europe. These studies require whole ecosystem manipulations and are, therefore, extremely expensive, labour intensive and rare.

We report on initial results from a pilot study whole lake manipulation in which the role of regulated system disturbance as a "kick-start" in the recovery process of shallow lakes is investigated. We used the P-binding agent Phoslock® to disrupt the internal load of phosphorus in a shallow reservoir (Clatto Reservoir, Dundee) by first

stripping phosphorus from the water column and subsequently preventing its release from sediments. This talk uses a case study to outline the principles of Phoslock® use in shallow lakes and discusses the effects of a whole lake application on a range of water column and sediment characteristics relevant to water quality management.

FACTORS DETERMINING *RANUNCULUS* COMMUNITIES IN CHALK STREAM HABITATS: UNRAVELLING THE MYSTERIES

Andy House and Fiona Bowles

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Ranunculus is a classic feature of chalk streams and plays an important role by providing habitat for a host of invertebrates and fish as well as maintaining water levels later in the year as river flow declines. It is also an integral part of the chalk stream habitat that is a designated feature in the River Avon SAC. Wessex Water was required to assess how reducing flows through ground water abstraction affected the *Ranunculus* community, which was reported in 2008 (Clarke, Clough and Bowles 2008). Strong responses to abstraction were not found through the two year study, although the community appeared to respond to seasonal flow variation. Therefore a long term data set of macrophyte cover from 237 sites on the Hampshire Avon and River Wylye was assessed against flow as measured at the gauging station nearest to each study site An analysis of the dataset against channel morphology factors including gradient was also undertaken.

A statistically significant relationship between *Ranunculus* cover and some aspect of flow was found in 44% of the sites studied. At these sites a positive relationship with the flow recorded in April, May and June was most frequently seen followed by a positive relationship with flow in the preceding autumn. Of the channel morphology variables tested, gradient was found to have the most significant effect on *Ranunculus* cover. Gradient was used in the analysis as a surrogate for velocity which is inherently difficult to measure in a vegetated river. The relationship with gradient was positive although there was some evidence that high gradient reaches may be more prone to scouring of *Ranunculus* in winter spate flows especially at shallower sites. The effect of structures such as weirs on the gradient and how this affects *Ranunculus* cover is displayed. The possible use of the findings in river management and restoration work is discussed.

HYDROCOTYLE RANUNCULOIDES GROWTH DYNAMICS AND IMPLICATIONS FOR MANAGEMENT

Manuel Duenas and Jonathan Newman

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Hydrocotyle ranunculoides continue to cause many problems in UK waterways. The estimated costs of control are about £500,000 per annum. In order to understand how the species responds to the environment we have surveyed one of the oldest infested sites at Pevensey levels in Sussex. The plant has spread across many different sized ditches, with different nutrient levels, resulting in different plant morphologies and growth responses. We carried out this work, partly to enable prediction of biomass in uninfested sites, and partly to contribute to the Euphresco project in collaboration with various Dutch organisations, who share the same problems with various non-native species. Understanding how plants react to their environment when management activities are undertaken is also important for non-native species, and we have monitored the success of various management regimes for the control of *H. ranunculoides*. This talk will describe the effects of various nutrient regimes on the morphology of the plant and report on the success of various management activities in 2009.

WEED BIOLOGICAL CONTROL PROSPECTS: *CRASSULA* AND BEYOND

Julien Lamontagne-Godwin

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Classical biological control of weeds is an under-utilised tool for the long term management of non-native invasive species practiced the world over. However, it is a relatively new concept to Europeans and as such has taken a while to become reality. The reduction in the number of active ingredients available for management on or near water as well as the tough requirements of the EU Water Framework Directive should have land managers crying out for alternatives. The paper will give an overview of the current state of play in the UK including the current use of the Azolla weevil, the imminent decision over the Japanese knotweed psyllid, the potential for Himalayan balsam and floating pennywort biocontrol as well as the recent promising findings of a survey for the natural enemies of Crassula in its native range down-under. The conclusion is drawn that this is an area of applied research that is increasing rapidly in Europe and one that is desperately needed.

KNOW THY ENEMY: PROGRESS ON A FIELD GUIDE TO THE INVASIVE PLANTS AND ANIMALS OF BRITAIN

Max Wade

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Invasive Plants and animals of Britain, a field guide to the invasive plants and animals will enable the identification of the range of invasive species of plants and animals now found in Britain. These species are of particular concern to professionals and amateurs alike but currently there is no single guide to their recognition, and many are typically given little space in the guides to the various groups, e.g. water plants, reptiles, amphibians and freshwater crustaceans.

Invasive non-native (or alien) species have achieved a high level of interest and relevance from an environmental viewpoint. They are considered to be the second largest threat to biodiversity after habitat loss, which makes their management a high priority. Prompt and accurate identification of invasive non-native species can facilitate rapid-response management and can assist in preventing their spread. In addition, records and sightings from amateur ecologists can assist in tracking invasive species as they expand their range.

The field guide aims to:

- provide a comprehensive guide to the identification of invasive non-native and native species of plants, animals and invertebrates in Britain;
- raise awareness of how to recognize invasive species of plants and animals;
- supply supporting advice and information to aid identification, including distribution maps; and
- direct users to more detailed information where relevant.

CABOMBA CAROLINIANA

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The first record of the species for The Netherlands goes back to 1989. It was recorded in the harbour at Maasbracht along the Meeuse River (erroneously as C. aquatica). Until this day Fanwort is still present there without causing any problems or out-competing any native macrophyte. At the second locality for The Netherlands it is

quite a different story. In 2006 the local water board at Loosdrecht realised that the macrophyte that was impeding recreational navigation and swimming was actually Cabomba caroliniana, a species they were until then only familiar with as an aquarium plant. A first attempt to eradicate the species by washing out the plant appeared promising but the water board did not sustain eradication efforts. In 2009 four different management methods were put to the test within the framework of the EUPHRESCO DeCLAIM project. The initial results of these tests will be presented as well as plans for 2010.

THE GB NON-NATIVE SPECIES INFORMATION PORTAL

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The Biological Records Centre (Centre for Ecology & Hydrology) is working with the Non-Native Species Secretariat (NNSS), British Trust for Ornithology (BTO) and Marine Biological Association (MBA) to produce an information portal on non-native species in Great Britain (funded by Defra). Core components of this portal are a database which holds information on all non-native species in Britain, a series of detailed fact sheets for a subset of these species and an alert list. The GBNNSIP is currently under development but is displayed within NNSS website (https://secure.fera.defra.gov.uk/nonnativespecies/home/index.cfm).
In this talk I will describe the portal and future directions.

ON THE DEFRA REVIEW OF THE WILDLIFE AND COUNTRYSIDE ACT

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In December Defra issued the Government response to the public consultation: Review of Schedule 9 to the Wildlife and Countryside Act 1981 and the Ban on Sale of Certain Non-native Species. A few observations on the changes including the addition of *Azolla* and *Elodea* will be made.

Within this document Annex A was included giving their guidance on Section 14 of the Wildlife & Countryside Act 1981 http://www.defra.gov.uk/wildlife-pets/wildlife/management/non-native/legal.htm . This guidance that has not been subject to consultation. It has been produced by Defra because the "*law itself has not been changed*" but as a result of "*the obvious lack of understanding about it that the consultation responses revealed.*" The guidance states what Defra would define as

"the wild". Those people who were involved in the production of the guidance were invited to make a joint presentation with the author.

The guidance itself states that it does not represent a definitive interpretation of the law, it states that "*it is intended as guidance for enforcement agencies, licensing authorities and other interested parties in England and Wales*". How can we expect regulators and the courts to view the guidance after that?

There are particular concerns for those involved in managing invasive plants in aquatic environments that are also used for amenity. Amenity areas are not wild but open environment is. Without further clarification and revisions to the guidance those with responsibility for managing open water systems for public benefit, including many public bodies such as local authorities and the Environment Agency, may be subject to excessive costs as a direct result of this guidance rather than primary legislation.

If you promote amenity use of the open environment you own and cannot rule out schedule 9 species ever occurring within your ownership perhaps you should look at the guidance and ask Defra what it means to you.

DEVELOPMENTS IN ULTRASONIC CONTROL OF ALGAE AND BACTERIA

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The control of algae accounts for about 80% of capital and annual expenditure on a global basis. From protection of water supplies due to cyanobacteria, to management of filamentous algae in fisheries. In Europe, there are no herbicides currently approved for control of algae, and there is unlikely to be any change in this situation until the Plant Protection Products Directive is reviewed at some time in the future. This has acted as a stimulus to companies involved in alternative management techniques, such as ultrasound, electromagnetism, dyes, bacterial nutrient amendments, nutrient scavenging systems and others.

Various ultrasound devices for control of algae and bacteria have been produced since the first use of ultrasound by the French to protect the surfaces of submarine hulls in the early 1900s. Marconi also patented the use of ultrasound for control of fouling on hull surfaces in the 1940s, but did not follow it up. In more recent times, the commercial stimulus caused by the lack of herbicides, for control of algae, and the growing public perception that nothing should be added to water, has lead to the development of new generation ultrasound devices designed to target algae.

EnviroSonic has conducted research over the last 5 years to understand how algae react to ultrasound exposure. Ultrasound is classed as sound above 20 KHz. Most algae react to ultrasound frequencies between 20 and 60 KHz, but exposure time and

pulse length are also important variables. The use of harmonic wave structures generated by the use of pulsed square wave frequencies has also improved the efficacy of the system. At the moment, EnviroSonic has equipment capable of controlling algae up to a range of 300 m for colonial green algae, and possibly to 700 m for cyanobacteria. We are testing systems for control of *Legionella* in air conditioning units and cooling towers. Ultrasound produces what we call micro-cavitation in the gas enriched boundary layer surrounding organisms that both photosynthesise and respire, causing actual physical damage to membranes and production of H_2O_2 in close proximity to susceptible membrane structures. Low dose H_2O_2 is responsible for the mode of action of barley straw on algae. We have shown that ultrasound can produce approximately three times the quantity of H_2O_2 under certain open water conditions, and this is probably the most likely mode of action

This talk will describe the research that has been undertaken on the mode of action of ultrasound in water, and identify further research requirements.

INTRODUCING AMEG: A GLOBAL ADVISORY GROUP ON AQUATIC MACROPHYTE ECOLOGY

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And

Gertie Arts, Alterra, The Netherlands; Michael Dobbs, Bayer Cropscience, USA; Peter Ebke, Mesocosm GmbH, Germany; Mark Hanson, University of Manitoba, Canada; Udo Hommen, Fraunhofer IME, Germany; Katja Knauer, BLW, Switzerland; Stefania Loutseti, DuPont, Greece; Lorraine Maltby, University of Sheffield, UK; Silvia Mohr, UBA, Germany; Angela Poovey, US Army Corps of Engineers, USA; Véronique Poulsen, AFSSA, France.

The registration of herbicides in the EU necessitates the demonstration of safety to non-target species, including algae and aquatic macrophytes. For this purpose, deterministic risk assessments are performed by calculation of a Toxicity Exposure Ratio (TER), which represents the ratio between the potential exposure, *i.e.* the predicted environmental concentration (PEC), and laboratory toxicity endpoints for *Lemna* and two algal species. Toxicity is expressed in terms of an EC_{50} value (concentration causing 50% effects) under existing legislation although use of a NOEC (no-observed effect concentration) or EC_{10} value is proposed under future legislation. TER values are compared with prescribed trigger values, or safety factors, which are necessary to allow for the uncertainty when using a single species laboratory test to indicate potential effects on a range of species under realistic conditions. When TER values exceed the appropriate trigger, the risk is considered to be acceptable whereas, when TERs fall below the trigger, further risk assessments, which may involve

generating additional toxicity data, are necessary. Registration is only granted when the appropriate regulatory authorities are satisfied that uncertainties within the risk assessment have been addressed, and that the necessary precautions are in place to prevent the entry of herbicides into watercourses at concentrations predicted to cause unacceptable effects.

In 2008, the adequacy of this risk assessment scheme was considered at a workshop on Aquatic Macrophyte Risk Assessment for Pesticides (AMRAP), held under the auspices of the Society of Environmental Toxicology and Chemistry (SETAC). The workshop brought together 41 scientists from regulatory authorities, industry and academia, with the objective of identifying areas of uncertainty within the regulatory framework and discussing the strengths and limitations of existing test methods. A number of areas of uncertainty were identified and tasks were initiated to develop recommendations for each of these areas. Key recommendations include the conduct of routine tests with *Myriophyllum* for certain herbicides, the development of a standard method for *Myriophyllum* species, the development of guidelines for the use of macrophyte data in risk assessment and actions to build regulatory confidence and provide education in the use of macrophyte data in risk assessment. Further details are provided in the recently published AMRAP Guidance Document (Maltby *et al*, 2010).

The on-going activities initiated from the AMRAP workshop inspired the formation of a global SETAC Advisory Group on Aquatic Macrophyte Ecotoxicology (AMEG). AMEG was established in June 2009 to provide scientific guidance on all aspects of aquatic macrophyte testing and risk assessment for chemicals. Although initially formed to facilitate activities relating to aquatic plant risk assessment for pesticides in the EU, AMEG enables extension of the original scope of AMRAP to consider the use of macrophyte data in pesticide legislation in other regions, legislation for general chemicals and other legislative processes that require a consideration of macrophyte data, *e.g.* retrospective risk assessment as prescribed under the EU Water Framework Directive and the US Clean Water Act. Furthermore, the remit of AMEG encompasses all topics relating to aquatic macrophyte ecology including the use of aquatic macrophytes for bioremediation and the restoration of impacted habitats, and the sustainable management of exotic and invasive aquatic macrophyte species in the context of flood defence and climate change.

AMEG will meet these objectives by providing a global forum for communication, discussion and collaboration between all stakeholders and building a global network of interested scientists and students from academia, industry and government. The advisory group will organise and facilitate sessions at SETAC and other scientific conferences as well as organize and actively participate in expert workshops. Membership of AMEG is open to all interested scientists and students. More information and joining instructions can be found on the SETAC web site: http://www.setac.org/node/363

THE USE OF HERBICIDES BY INTERNAL DRAINAGE BOARDS

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The use of herbicides to control the growth of weeds in IDB channels has decreased significantly over the past twenty years. The paper will document the affect of withdrawal of chemicals and how IDB's in Lincolnshire now keep watercourses fit for purpose. It will look forward at what opportunities there are in the future for alternative methods of control rather than cutting and removal by mechanical cutting.

SELF-BUILD FLOATING ISLANDS: A PRACTICAL APPROACH

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The benefit of installing floating islands in ponds has been widely recognised for a long time, particularly for their nutrient stripping potential. They are one tool available when giving advice to pond and fishery owners. This talk shows how to construct a "home build option" for the slightly less well off.

EXPERIENCE OF STANDARD RIVER MACROPHYTE SURVEY METHODS: SOURCES OF VARIATION IN COLLECTION OF MACROPHYTE DATA IN THE FIELD

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Comparative macrophyte surveys to investigate inter-surveyor, temporal and spatial variability were undertaken on the River Dee SAC on behalf of CCW, using both the LEAFPACS methodology (used by the EA and SEPA for WFD monitoring) and the JNCC macrophyte survey methodology (used by the conservation agencies for SSSI and SAC river classification and condition assessment). The data produced, together with EA, SEPA and NE datasets fed into a larger joint EA/SEPA/Conservation Agencies project investigating variability components for macrophyte communities in rivers (Davey *et al*. 2009*). This talk will discuss some of the main sources of variation noted in the field, such as survey effort, definition of bank and channel area, water levels and the use of species lists, along with the practicalities of application of the standard survey

methodologies on different river types. The conclusions from the larger project along with discussion and proposed actions from an associated workshop will be outlined briefly.

For more information on the larger EA project please contact Tim Johns ✍ tim.johns@environment-agency.gov.uk

*SC070051/R2 - Variability components for macrophyte communities in rivers
http://publications.environment-agency.gov.uk/pdf/SCHO1109BRHK-e-e.pdf

SC070051/R5 – Report of the macrophyte surveying and variability workshop 4 -5 June 2009.
http://publications.environment-agency.gov.uk/pdf/SCHO0110BRSX-e-e.pdf

CONSERVING AQUATIC PLANTS - THE DEVOLUTION OF THE UK BAP

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The way in which aquatic plants are addressed through the UK Biodiversity Action Plan has changed since it was introduced in 1994. Historically priority aquatic plant species and priority aquatic habitats benefited from specific individual action plans. The UK BAP structure has recently been revised, with devolved countries being tasked with implementing their own strategies. This talk aims to provide an explanation of how aquatic plants will be addressed through these devolved biodiversity strategies and a proposed UK level aquatic plant group, and will also highlight how habitat based actions will be delivered through the England Biodiversity Strategy.

AQUATIC WEED CONTROL – 50 YEARS OF HERBICIDE DEVELOPMENT WASTED

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Aquatic weed control has become a subject on which opinions are divided. It used to be seen as a necessity in the rural agricultural landscape, to protect water resource availability for irrigation and to protect from unpredictable flood events, while in more

urban environments, the need to remove vegetation was usually driven by complaints about the appearance of the waterway, or sometimes flood risk. Because everyone involved in aquatic weed control has been so good at it, the risk of unmanaged vegetation has largely slipped from the consciousness of those in charge, leaving research budgets to be optimised for other purposes. The importance with which Government Departments treat aquatic weed control can be tracked through the number of Government sponsored publications relating to the subject. This presentation aims to identify some of the reasons why chemical control of aquatic weeds is less popular now.

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