Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

THE ROBSON MEETING 2007

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 38TH ANNUAL ROBSON MEETING

Agenda

Tuesday 20th February 2007

Session 1:	**AQUATIC PLANT MANAGEMENT**	
2.00	Jonathan Newman *CEH Wallingford*	The Aquatic Plant Management Group
2:20	Owen Mountford *CEH Edinburgh*	Predicting aquatic plant diversity in arable ditches
2:40	Matthew O'Hare *CEH Dorset*	Improving predictions of macrophyte performance in conveyance estimation
3:00	Stuart Hemmings *Black Sluice IDB*	Mechanical weed control in drainage ditches
3.15	Discussion	
3:30	TEA	
Session 2: **Chairman:**	**MACROPHYTE ECOLOGY** **David Noble**	
4:00	Stephen C. Maberly *CEH Lancaster*	Physiology and the ecology of freshwater plants
4:20	Linda May and Laurence Carvalho *CEH Edinburgh*	Maximum growing depth of macrophytes in Loch Leven, Scotland, in relation to historical changes in phosphorus loading
4:40	Iain Gunn *CEH Edinburgh*	Use of aquatic macrophytes for site condition monitoring & biodiversity trend assessment in UK standing waters
5:00	Claire Maynard *St Andrews University*	Comparison of sediment deposition between created and natural marsh on the Eden Estuary, SE Scotland
5:20	Discussion	
5:30	Meeting closes	
7.30 for 8.00 CONFERENCE DINNER		

Wednesday 21st February 2007

Session 3: **ALIEN INVASIVE SPECIES** **Chairman:** **Jonathan Newman**		
09:00	Olaf Booy *RPS*	Non-Native organism Risk Assessment (NNRA) in Great Britain
09:20	Fiona Bowles *Wessex Water*	The effect of drawdown on *Crassula helmsii* and *Elodea nuttallii*
09:40	Kevin Ackerman *Kingcombe Aquacare*	Removal of Floating Pennywort from Exminster Marshes, Devon
10:00	Lindsey Defew *CEH Edinburgh*	The current status of *Crassula helmsii* in Derwentwater
10:20	Discussion	
10:30	COFFEE BREAK	
Session 4: **NOVEL METHODS** **Chairman:** **Pip Barrett**		
11.00	Sarah Clarke *APEM*	Trials with ultrasound and establishment of *Egeria densa*
11.20	Jonathan Newman *CEH Wallingford*	Ultrasound for the control of algae – pros and cons
11:40	Dick Shaw *CABI Bioscience*	Biological control of *Hydrocotyle ranunculoides* in Europe – a realistic possibility?
12:00	Jonathan Newman *CEH Wallingford*	Herbicide selection for Japanese Knotweed
12.20	Discussion	
1.00	LUNCH and Close of Conference	

PROGRESS AT THE AQUATIC PLANT MANAGEMENT GROUP

Jonathan R. Newman

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The project work at the Aquatic Plant Management Group has been varied as usual this year. The change of name from Centre for Aquatic Plant Management was inevitable, but is still misleading as it consists of a group of one. This is being remedied as soon as possible, with a 100% increase in staff numbers expected soon.

The loss of all herbicides for the control of algae will have a dramatic effect on our ability to manage late season blooms this year. I have continued to work on the retention of diquat as an aquatic herbicide, and have investigated the alternatives if no progress on reinstatement is achieved.

The use of ultrasound for control of algae is developing very fast. There are still institutional concerns about non-target effects on some invertebrate species, most of which will be answered by an EU project undertaken at Leuven University in Belgium due to report this summer. More details on our research will be given tomorrow in the specialist talk.

The increasing importance of biological control is emphasised by the work undertaken in collaboration with CABI Bioscience on finding a suitable control agent for *Hydrocotyle ranunculoides*, more of which on day two.

I have undertaken work on control methods for various new invasive species, including *Lysichiton americanum* and *Ludwigia grandiflora* (?) which will be presented in a brief form in this talk. I have also looked at combinations of herbicides on Japanese Knotweed, with some mixed success, again more details tomorrow.

Optimisation of glyphosate and dichlobenil is a relatively long term study as you do not know if the optimisation has made things better until about a year later. The Midstream GSR formulation I still, in my opinion, the best to use in aquatic situations, the herbicide is absorbed more rapidly in to the sediment and produces lower water concentrations than the other formulations. Glyphosate has been combined to good effect with 2,4-D amine for control of some species, and has been applied at high concentrations through very low volume nozzles for good control of *Hydrocotyle ranunculoides.*

We have looked at mechanical control and will be undertaking more work on the comparative merits of various machines in 2007.

PREDICTING AQUATIC PLANT DIVERSITY IN ARABLE DITCHES

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For 30 years or more, the drainage channels of grazing marsh have been studied and valued as an important refuge for aquatic macrophytes and invertebrates. Attention on ditches in arable land has been much more limited. However, there is growing evidence that these channels too can have an important role in biodiversity conservation. This talk describes a study commissioned by Natural England to assess the published, manuscript and database information on arable ditches, and to characterise those environmental features associated with arable ditches that support a diverse macrophyte flora. The study not only produced a review, but also a protocol for predicting where such ditches might occur and research hypotheses for testing.

IMPROVING PREDICTIONS OF MACROPHYTE PERFORMANCE IN CONVEYANCE ESTIMATION

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Estimation of conveyance is a core component of flood management, water level prediction and flood defence and drainage design. Defra / EA has now produced the Conveyance Estimation System (CES) to enable managers to quantify the effects of riverine and floodplain vegetation and its management (and options for this) on drain and flood levels.

Significant data have been assembled, notably by CEH Dorset, to support the CES. There is however a need to further improve the data on vegetation and its flow resistance, occurrence and growth.

The objectives of our future research in CEH will be to develop the information base in the Conveyance Estimation System to improve predictive capacity by:

- Providing time series data for all major categories of submerged and emergent vegetation morpho-types.
- Refining time series data to reflect regional differences in growth patterns of plants
- Providing further refinements on the vegetation types likely to occur at sites:

- Using predictive modelling using parameters already in the CES, e.g. grid reference, plan form, depth and substrate type.
- Providing a plant colour and form recognition system which allows existing aerial photographic data to be used to provide site vegetation data.
- Providing information on the likelihood that plants will be present at a site at all

Other potential objectives could include:

- Identifying periods and conditions when aquatic plants could produce 'back water effects'
- Providing information on discharge regimes and channel modifications likely to encourage excess weed growth
- Looking at the interaction between vegetation and channel sinuosity.

Instream plant distribution often reflects and can exaggerate channel sinuosity. As discharge increases and plants bend, this relationship is likely to be overridden and alternative models may need to be examined.

A brief review is given of the current use of macrophytes in flood conveyance estimations with the focus on further means of improving estimates. There are a number of ways this can be done; by improving the provision of regional growth curves, by verifying the use of macrophyte morpho-types and by considering the ability of macrophytes to 'back-up' channels. The focus of the talk will be on the different responses of macrophyte species to increasing discharge based on their morphology and ability to reconfigure.

MECHANICAL WEED CONTROL IN DRAINAGE DITCHES

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Black Sluice IDB is the drainage authority that undertakes the water level management for an area of 175 square miles of low level fenland in South Lincolnshire. This entails the maintenance of 34 pumping stations and 800km of drainage channels.

A greater part of the work is carried out by annual process of mechanical removal of weed growth. Some chemical control is used, but this now is only around 2% of the expenditure.

The basic operation of the equipment has changed little over the last twenty years, but now there is much greater emphasis on mitigation against damage to birds' nests, water vole habitat and other environmental features.

Boards have devised guidelines for operators of the machinery, but the output depends very much on the operator following these guidelines. This year the work has been more closely monitored and operators have been regularly advised on their method of work.

The presentation will demonstrate how it is possible to mitigate the environmental damage without compromising the flood management standards within the Board's area.

PHYSIOLOGY AND THE ECOLOGY OF FRESHWATER PLANTS

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Most freshwater plants have evolved from terrestrial ancestors. On their invasion into water, problems of water loss were replaced by problems linked to obtaining resources such as light and inorganic carbon for photosynthesis. Freshwater plants have evolved a range of physiological mechanisms to deal with these resource-supply problems. These mechanisms will be briefly reviewed and related to ecological distribution, ecosystem function and plant invasiveness.

MAXIMUM GROWING DEPTH OF MACROPHYTES IN LOCH LEVEN, SCOTLAND, IN RELATION TO HISTORICAL CHANGES IN PHOSPHORUS LOADING

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Loch Leven is a shallow, eutrophic loch in lowland Scotland, which has been a key focus of CEH's long term monitoring activities for almost 40 years. One of the many parameters that have been recorded here is the maximum growing depth of macrophytes, for which records date back to 1910. These values have been analysed in relation to estimates of the annual phosphorus load to the loch over the same period, which range from 7 tonnes to 14 tonnes. The data suggest a strong inverse relationship between the maximum growing depth of macrophytes and the annual phosphorus load the loch.

COMPARISON OF SEDIMENT DEPOSITION BETWEEN CREATED AND NATURAL MARSH ON THE EDEN ESTUARY, SE SCOTLAND

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Established marshes are a natural protection system for low coastlines which help buffer the landward side from wave impact. Unfortunately in Scottish estuaries this function has been severely compromised due to the fragmentation and degeneration of marsh fronts. Although there is no immediate threat the future cost of replacing the marsh buffer with hard engineering solutions will be considerable. A remedial marsh-planting project was therefore carried out at the front of degenerating marsh stands on the Eden Estuary with the aim of quantifying and comparing the depositional environment of mature marsh, planted marsh and non-vegetated upper tidal flat. Short-term sediment deposition (24hrs) was measured using filter paper discs, and vertical accretion taken at monthly intervals using depth-of-measure ceramic tiles. The highest rates of sediment deposition were associated with both mature and planted *Scirpus maritimus* marsh (1.38g. m^{-2} d^{-1} and 1.15g. m^{-2} d^{-1} respectively) despite differences in tidal elevation; while the lowest rates of sediment deposition were on mature stands of *Puccinellia maritima* (0.1g. m^{-2} d^{-1}) and bare tidal flats (0.22g. m^{-2} d^{-1}). These results demonstrate that it is possible to enhance sediment deposition by planting native plant species in front of a degenerating marsh front and that marsh planting is a potential method of protection of relatively sheltered coastal systems in which natural materials and processes are manipulated at low cost and with no damage to the environment.

NON-NATIVE ORGANISM RISK ASSESSMENT (NNRA) IN GREAT BRITAIN

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The Defra Review of Non-Native Species Policy (2003) made 8 key recommendations, one of which was to develop a standard method of risk assessment that could be carried out for non-native organisms and pathways of their introduction. In response, the Non-Native Risk Assessment scheme (NNRA) was developed in 2004/5.

The scheme is designed to assess any non-native organism that could enter, or has already entered, Great Britain. In addition, the scheme was designed to quantify risk

associated with any pathway of introduction, such as ballast water in ships or horticultural trade.

The methodology works by, in the first instance, posing a short series of questions to establish whether a more detailed assessment is required. If further assessment is required, an expert or experts in the organism or pathway is consulted to answer a series of more in depth questions. These are then used to calculate a 'risk rating' for each. The purpose is to provide a clearly objective assessment of risk, which can then be used to develop and prioritise appropriate management.

The NNRA is currently coming to the end of its first trialling and review period, undertaken by RPS. Recommendations from the review will be considered by the GB Non-Native Species Programme Board and used for further development of the scheme. Once complete, the scheme will be part of an overall risk analysis mechanism that will be implemented by the Non-Native Species Secretariat, in conjunction with a specialist panel of risk assessment experts (the Non-Native Risk Analysis Panel). The whole process will be carried out for and directed by the GB Non-Native Species Programme Board.

This presentation provides an introduction to the current NNRA and considers how experts in water plants could interact with the overall framework of the scheme. Findings of the RPS review relevant for specialists in the water industry will also be reported.

The key areas for interaction by experts are considered to be:

- developing a shortlist of organisms and pathways for assessment;
- carrying out the risk assessments themselves;
- filling gaps in risk assessments by additional research;
- providing recommendations for control and management;
- providing feedback for improvement and further development;
- monitoring, and
- surveillance / horizon scanning.

A key recommendation by RPS is that training should be provided for those keen to participate in the risk assessment scheme. Appropriate training would serve to facilitate each of the above bullet points. This would not only greatly improve the efficiency of the scheme's functioning, but also improve comparability and objectivity in the data collected.

THE EFFECT OF DRAWDOWN ON *CRASSULA HELMSII* AND *ELODEA NUTTALLII*

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As part of the Environment Agency's review of consents, under the Habitats Regulations 1994, Wessex Water is undertaking an assessment of the potential impact of water supply operations within Blashford Lakes, a public water supply complex within the Avon Valley Special Protection Area. Potential impacts may arise through:

- Changes in the distribution of *Crassula helmsii* (New Zealand Pygmyweed or Australian Swamp Stonecrop) an alien invasive species;
- Impacts (through depth and nutrient changes) on plants which constitute food for the designated bird species, *Elodea nuttallii* (Nuttall's water weed);
- Changes to native or rare plant distribution through draw down.

The paper summarises the results of two years of monitoring carried out on behalf of Bournemouth and West Hampshire and Wessex Water companies, and draws initial conclusions as to potential impact of operations on the favourable condition of the lake complex.

REMOVAL OF FLOATING PENNYWORT FROM EXMINSTER MARSHES, DEVON

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The project began four years ago with over four kilometres of ditches being dredged. These slubbings were buried along the field edges and then re-instated. Over the last three years Kingcombe Aquacare Ltd. has been implementing a regime of hand removal throughout the marshes. Over the course of the last three years we have seen the number of individual sites fall from over three hundred to the region of fifty. There has been a significant shift in the pattern of sites, clearing the southern and western sides of the marsh and all outbreaks now concentrated in the northern and eastern sides adjacent to the Exeter Ship Canal

Total biomass removed has also reduced significantly from approx thirty – forty bags per visit to around three. With fewer sites to locate and revisit the use of GPS has been a great help in both accuracy and perfect knowledge of the sites.

THE CURRENT STATUS OF *CRASSULA HELMSII* IN DERWENTWATER

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Australian swamp stonecrop or *Crassula helmsii* is an invasive species which was first discovered as a naturalised plant in Britain in 1956 (Dawson and Warman, 1987). The success of this species invasion relates mainly to its successful vegetative reproduction, vigorous growth rate and ability to colonise a variety of different aquatic habitats. Its' presence in aquatic ecosystems causes major environmental problems as control and management are extremely difficult. Derwentwater is a large lake situated in the North West of the Lake District National Park and it is a Site of Special Scientific Interest (SSSI). It supports a number of native plant species, including the nationally scarce Floating Water-plantain *Luronium natans*. *Crassula helmsii* was first recorded in Derwentwater in 1992 (Halliday, 1992).

Competition between *C. helmsii* and other native species often results in an almost total suppression of native plants, or other invasive species, within a few years (Leach and Dawson, 1999). To determine the impact of *C. helmsii* on native plant populations within Derwentwater, a large scale macrophyte survey was performed in 2000 by Darwell (2000). During this initial survey, three 100 m transects were established in the South West corner of the lake. The transects were positioned within areas which best represented the submerged flora by demonstrating diverse floral communities as well as the absence of extensive, homogenous stands of *C. helmsii* at this time. Along each 100 m transect, species presence and estimated percentage cover were recorded within three 2 m^2 quadrats positioned at 20, 50 and 80 metres from the shore. In 2005, two out of the three transects were re-visited and surveyed once again. The aim of this study was to determine if the abundance of *C. helmsii* had changed since 2000, and to identify the extent to which native plant species were being out-competed. Also in 2005, an additional lake-bed survey was carried out within various lake locations to provide additional information on the current distribution and status of *C. helmsii*.

Transect results suggested that the diversity of native plant species was reduced despite *C. helmsii* not significantly increasing in abundance within the monitored areas since 2000. However, results of the lake-bed survey indicated that *C. helmsii* was the most dominant species in many other areas of the lake. Species which decreased in abundance and / or had been completely lost from quadrats included *Myriophyllum alterniflorum, Potamogeton berchtoldii, Ranunculus aquatilis agg., Juncus bulbosus* var. *fluitans, Isoetes echinospora,* and *Lobelia dortmanna*. Surprisingly, *L. natans* had increased in abundance in 2005 in two quadrats and was found to be abundant within one quadrat in which it had not been recorded in 2000. Despite this, *L. natans* was generally low in abundance within the monitored area. The complete eradication of *C. helmsii* from Derwent water is unlikely. However, it is still important that efforts

should be made to minimise further impact of *C. helmsii* on populations of native plants, as further colonization and spread could threaten the SSSI status and conservation value of the lake. Efforts should also be made to prevent the spread of *Crassula* into other lakes in the Lake District which have not yet been colonised by the species.

TRIALS WITH ULTRASOUND AND ESTABLISHMENT OF *EGERIA DENSA*

Sarah Clarke

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The results of trials with ultrasonic devices for the control of algae will be presented. The implications of these trials will be assessed and various observations made. A fuller abstract will appear in the web based version of this document.

ULTRASOUND FOR THE CONTROL OF ALGAE – PROS AND CONS

Jonathan R. Newman

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Low power ultrasound offers an environmentally friendly method of controlling algae in the absence of herbicides. There are a lot of benefits – targeted weed control with no non-target effects (except on dolphins, which are rare in UK inland watercourses); the ability to switch control on and off at critical times (fish spawning etc.); and the obvious non-chemical approach so beloved of the EU.

This talk will provide an assessment of various models of equipment currently available, with recommendations for various types of waterbody; explain how it works; and try to figure out any adverse effects of using ultrasound for algal control.

BIOLOGICAL CONTROL OF *HYDROCOTYLE RANUNCULOIDES* – A REALISTIC POSSIBILITY?

Richard Shaw

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Floating pennywort, *Hydrocotyle ranunculoides*, is a growing problem on UK waterways with 50km stretches present in some slow flowing rivers. Due to the difficulty of traditional control and its likely rate of spread, the plant is the subject of an EPPO alert and has been banned in the Netherlands and could soon be added to the Wildlife and Countryside Act banned list. As a non-native invasive plant it should be susceptible to control by co-evolved natural enemies from its area of origin.

Aquatic weed biocontrol has a long history of success, often with the use of weevils which seem to be their Achilles heel. Reports from Argentina of an apparently specific weevil *Listronotus elongatus*, collected from *H. ranunculoides* led to the development of the first phase of a biocontrol programme for this weed. A rapid collection trip was made in collaboration with the USDA ARS field station in Buenos Aires, to obtain the weevil for preliminary host range testing in UK quarantine against the native *H. vulgaris*, amongst others. The survey in November 2006 covered over 3,500km by car and took in 17 sites in 3 provinces, during which time the target plant was observed suffering severe damage from the weevil as well as other arthropod and fungal natural enemies. The presence of at least 4 other *Hydrocotyle* spp. (one possibly new) enabled good field data to be gained on the weevil's host specificity.

Preliminary host range studies in the laboratory support field observations that this weevil is highly restricted in its oviposition and feeding habit. A high level of mortality due to entomopathogens is encouraging since their removal could allow increased populations but this has hindered the work. A stem mining fly was also observed inflicting significant damage to the weed and identification is on-going. This highly reduced biocontrol project approach is novel but in this case has yielded adequate information to support the continuation to a full programme with full host range testing and dossier preparation. The biological control of *Hydrocotyle ranunculoides* is fast becoming a realistic possibility rather than a pipe-dream.

HERBICIDE SELECTION FOR JAPANESE KNOTWEED

Jonathan R. Newman

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Trials were conducted at several sites using three herbicides or mixtures for the control of fully grown *Fallopia japonica.* The three herbicides were picloram (Tordon 22K), glyphosate (Roundup Pro Biactive) and 2,4-D amine (Dormone). The latter are approved for use in or near water, while the former has a buffer zone restriction and should not be used near trees that you want to retain. Results will be presented that show regrowth of rhizomes in all treatments at a depth of 1 m, while regrowth of rhizomes at a depth of 10 cm was variable between treatments. The implications for soil treatments, depth of excavation and retreatment of excavated material are presented.

