Bulletin of the Chartered Institute of Ecology and Environmental Management

CIEEM

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Monitoring and Measuring Mitigation Success

In this issue

Welcome

Successful Mitigation: Are We Striving for the Impossible? Was Ignorance Bliss?

CIEEM's 'Guidelines for Ecological Impact Assessment' states that 'evidence should be provided of the effectiveness of recommended mitigation... measures and to what extent their success can be guaranteed' (paragraph 5.5). Unfortunately, guaranteeing the success of mitigation is difficult, if not impossible, in many scenarios. However, those designing mitigation measures, and those giving consent to developments, have a duty to consider their likely effectiveness – whether they are 'appropriate', 'technically feasible' and 'likely to achieve desired outcomes' (paragraph 8.1e of the British Standard on Biodiversity BS42020). Despite this, there is a lack of evidence for the likely effectiveness of many of the mitigation measures recommended or implemented as part of development projects.

Mitigation can only succeed if it is based on a sound knowledge of the relevant ecological processes and how they will be affected by a development project. Yet, increasingly I'm finding myself having to assess the likely effects of a project and design mitigation without this information. The quality of the ecological surveys undertaken to inform an assessment is also vitally important, yet there are gaps in our knowledge of appropriate survey techniques in many cases. And some species groups are rarely surveyed at all, such as invertebrates, fungi, lower plants, and some of the less regularly encountered or unprotected mammal species – so how do we even know if there is an impact that requires mitigation?

As professional ecologists, we need to be pragmatic but aware of the limitations of our knowledge. It is vital that we improve the evidence base for the effectiveness of mitigation measures, in order to protect biodiversity from the impacts of development, and to improve the image of ecology as a profession. In some cases this can be achieved through post-construction monitoring schemes but these must be designed to answer the right questions – something that is frequently overlooked, as monitoring is often seen as a 'tick box' exercise. Robust data collection may be beyond the scope of post-construction monitoring where longer-term research projects are needed, or where the costs of the studies would be disproportionately expensive. Partnerships with research scientists might be the way forward in such cases.

One of the major frustrations we have as practising ecologists is the knowledge that someone else has almost certainly faced the same issue that we have to tackle, possibly coming up with a bespoke mitigation solution, and maybe even having done some monitoring to determine its effectiveness, but unless the outcomes are shared we end up having to reinvent the wheel. The Professional Standards Committee is discussing the options for a web-based platform where information and experiences about survey design, the effects of impacts, and the success of implementing mitigation can be shared by the membership. Its development is in its infancy, and needs help from CIEEM members to make sure it delivers what we need it to. There are key questions to answer, such as:

- Are there appropriate host websites we could build on?
- What file type would be best for upload? Should there be standard form or free form?
- How confident are our members in deciding for themselves the efficacy of information uploaded?
- To what extent should our uploads be subject to peer-review?
- How should a website be organised so that relevant information can be found easily?
- Should members be able to add comments on uploaded material?

We would welcome your feedback on these questions, and your input if you have expertise that could help us.

CIEEM also needs to improve our links with those in academia, to encourage research into the effectiveness of mitigation measures, and to collaborate with other nature conservation organisations over the production of survey and mitigation guidelines (such as a proposal to develop such guidance for invertebrates in partnership with Buglife).

As an industry we must set ambitious targets to aim for – improving the evidence for the effectiveness of mitigation measures is a challenge, but not an impossible one. And knowing that something doesn't work, or might not work, is surely better than recommending mitigation measures without any evidence to back them up.

Mike Dean CEcol CEnv MCIEEM
Joint Chair of CIEEM's Professional Standards Committee
mike@mdecology.co.uk

Information

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Editor
Dr Gillian Kerby (gillkerby@cieem.net)

Internal contributions coordinator
Mr Jason Reeves
(jasonreeves@cieem.net)

CIEEM Office
43 Southgate Street, Winchester,
Hampshire, SO23 9EH, UK

T: 01962 868626
E: enquiries@cieem.net
W: www.cieem.net

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Offshore windfarm risk to seabirds varies between years

New research by the British Trust for Ornithology shows how lesser black-backed gulls breeding at a protected site in Suffolk use areas of sea where offshore windfarms already exist, and where future developments are earmarked. BTO tracked 25 birds in three consecutive summers and found that gulls visited offshore windfarm areas significantly more in some years than in others.

http://www.bto.org/news-events/press-releases/offshore-wind-farm-risk-seabirds-varies-between-years

Wetland Birds Survey: 2013/14 report

The 33rd annual Wetland Bird Survey (WeBS) report which includes counts from 2013/14 is now available online. Overall the report shows that UK wintering waterbird populations have declined during a run of milder winters in the last decade.

http://jncc.defra.gov.uk/page-6999

Year of Fieldwork: September 2015 – August 2016

The Field Studies Council has joined together with Esri UK, the Geographical Association, Ordnance Survey and the Royal Geographical Society (with IBG) to create the 'Year of Fieldwork'.

http://www.field-studies-council.org/outdoorclassroom/yearoffieldwork.aspx

Scientists say non-native plants 'not a threat' to floral diversity

New research by scientists at the University of York has shown that non-native plants are not a threat to floral diversity in Britain. New research has shown that non-native plants are not a threat to floral diversity in Britain. The study found that native plants are unlikely to be out-competed by communities of non-native species, and that most non-native species remain too localised to have national-scale impacts.

https://www.york.ac.uk/news-and-events/news/2015/research/non-native-plants-not-a-threat/

Learning outdoors is more engaging

Teachers who take their pupils into the outdoors find it makes their learning more enjoyable, challenging, active and collaborative according to a report published by Scottish Natural Heritage (SNH). The study shows that outdoor learning in school and pre-schools has increased since Curriculum for Excellence was introduced but that further increases could be made. The survey of nursery, primary and secondary schools looked at over 1,000 outdoor lessons and compared results from surveys in 2006 and 2014.

http://www.lochlomond-trossachs.org/looking-after/learning-outdoors-more-engaging-says-report/menu-id-483.html

http://www.snh.org.uk/pdfs/publications/commissioned_reports/779.pdf

Ten-year experiment identifies optimum upland farming system

A study carried out over a 10-year period by ecologists at the Universities of Hull, Aberdeen and the James Hutton Institute, has shown that grazing a mixture of sheep and cattle at low intensity is the best approach for maintaining biodiversity in the British uplands. Grazing both cattle and sheep, rather than sheep alone, is particularly important, as the different feeding habits of these two animals mean that a whole range of different plants and plant parts are consumed. This prevents just a small number of plant species being grazed very hard, while others are allowed to grow freely.

http://www.esajournals.org/doi/full/10.1890/ES14-00316.1

Protected species and sites: how to review planning proposals

Natural England has published information for planners on reviewing development proposals that might affect protected species and sites, including the standing advice.

https://www.gov.uk/protected-species-and-sites-how-to-review-planning-proposals

National Water Vole Monitoring Programme

The People's Trust for Endangered Species (PTES) has launched the first ongoing National Water Vole Monitoring Programme across England, Scotland and Wales, working in collaboration with The Wildlife Trusts, Natural Resources Wales, Scottish Natural Heritage, Environment Agency, Natural England and RSPB.

http://www.wildlifetrusts.org/news/2015/04/14/race-save-ratty-uk-water-voles-face-uncertain-futurelaunch-first-national-water-vole

BVA calls for change to badger cull but wider roll-out

The British Veterinary Association has called for the four-year culls of badgers in West Somerset and West Gloucestershire to be completed using the 'tried and tested' method of cage trapping and shooting only. In light of the results from two years of culling in the two pilot areas, BVA has concluded that it can no longer support the continued use of controlled shooting as part of the badger control policy.

http://www.bva.co.uk/News-campaigns-and-policy/Newsroom/News-releases/badger-cull/

European report says pesticides could lead to shortage of crop pollinators

The European Academies' Science Advisory Council (EASAC), a network of EU science academies that seeks to inform EU policy-makers, has published a report concluding that there is an increasing body of evidence that the widespread use of neonicotinoids has severe negative effects on beneficial insects and other wildlife.

http://uk.reuters.com/article/2015/04/08/eu-food-neonicotinoids-idUKL6N0X43AL20150408

http://www.easac.eu/home/reports-and-statements/detail-view/article/ecosystem-se.html

SNH releases reports on Tayside beavers

More than 150 beavers living in the River Tay and Earn catchments have been found to be well adapted to living in Scotland. They are Eurasian beavers, which were once native to Britain, and are free of diseases of concern to humans, domestic animals and other wildlife.

http://snh.presscentre.com/News-Releases/SNH-releases-reports-on-Tayside-beavers-198.aspx

Scottish Marine Plan published

Scotland's first ever National Marine Plan has been published. The plan sets out a single statutory planning framework for all marine activity in Scottish waters. This will include policies for the sustainable management of a wide range of marine industries, including those which are long established such as fishing and ports and those more recently emerging such as offshore wind and marine renewable energy. It also includes sectoral plans for offshore wind, wave and tidal energy in Scottish waters and removes the options for offshore wind development in the Solway Firth. The framework covers all of Scotland's seas out to 200 nautical miles and applies to existing and emerging activities as well as devolved and reserved functions. The plan will be reported on within three years of adoption.

http://news.scotland.gov.uk/News/Marine-Plan-published-17ef.aspx

Environmental groups have however expressed reservations.

http://www.scotlink.org/public-documents/environmental-groups-urge-caution-on-new-marine-plan/

BES policy review of forthcoming legislation

The British Ecological Society (BES) has published the fifth assessment of the forthcoming legislation that is likely to have consequences for the environment and for ecologists.

http://www.britishecologicalsociety.org/publications/the-bulletin/policy-scans/

EUROBATS publish revised guidelines for bats and windfarms

The guidelines should also be of interest to local and national consenting authorities who are required to draw up strategic sustainable energy plans. These guidelines are applicable to larger windfarm developments in urban as well as rural areas, on the land as well as offshore. Small wind turbines (SWT) are briefly mentioned, including an overview of the types of issues that need to be considered.

http://www.eurobats.org/publications/eurobats_publication_series

Integrating Climate Change into Strategic Environmental Assessment in Ireland

This good practice guidance note shows how to practically incorporate climate change into Plans/Programmes/Policies/Strategies (PPPS), falling under the remit of the SEA Directive. It is aimed at plan-making authorities and SEA practitioners who, in implementing the requirements of the SEA Directive, need to consider that PPPS may be directly or indirectly affected by climate change, or may affect climate change directly or indirectly.

http://www.epa.ie/pubs/advice/ea/integratingclimatechangeintoseainireland.html#.VUuEyZOvwr8

Dick Balharry obituary

We are saddened to report the death of Dick Balharry. He was one of Scotland's foremost conservation advocates and CIEEM was pleased to have received some of his wisdom as recently as last November at our Autumn Conference in Edinburgh.

http://www.theguardian.com/environment/2015/may/04/dick-balharry

Dick Ballharry (right) with CIEEM President John Box

European environment state and outlook 2015

The European Environment Agency has published its annual, comprehensive assessment of the European environment's state, trends and prospects, in a global context.

http://europa.eu/rapid/press-release_IP-15-4534_en.htm?locale=en

http://www.eea.europa.eu/soer

https://www.iucn.org/news_homepage/news_by_date/?18985/European-Environment-Agency-rings-alarm-bells-over-state-of-EUs-environment

IUCN report says commercial agriculture and forestry could have a net positive impact on biodiversity

A new IUCN study examines how commercial agriculture and forestry production could reduce global biodiversity loss by applying innovative approaches already used by some companies in the extractive and infrastructure industries.

http://www.iucn.org/?20232/npipressrelease16april2015final1doc

Wales Environment Bill to include statutory climate change targets

The Minister for Natural Resources has announced that the forthcoming Environment Bill will include statutory climate change targets. The Minister is currently looking at how targets can help Wales best achieve progress in tackling climate change whilst also creating a workable and affordable model for the future.

http://gov.wales/newsroom/environmentandcountryside/2015/9918435/?lang=en

Members urged to respond to public consultation on Nature Directives

The second part of the European Commission's Fitness Check of the Birds and Habitats Directives, seeking public opinion, is now open until 24 July. We urge all members to complete the consultation. See next page for CIEEM engagement with the consultation.

http://ec.europa.eu/environment/consultations/nature_fitness_check_en.htm

CIEEM Awards 2015

This year's Awards finalists have been announced and the winners will be presented on 25 June 2015 at the Birmingham Botanical Gardens. The Awards Luncheon programme includes a drinks reception, a sumptuous three course meal, the presentation of the 2015 CIEEM Medals and the announcement of the winners and commended entries in the 11 award categories.

We are delighted that this year's Guest Speaker is CIEEM Patron and leading independent environmentalist, Tony Juniper.

Why not attend to support the finalists and celebrate the achievements of our profession? We would love to see you there.

Full details for the event, including the list of finalists and booking information, can be found at http://www.cieem.net/events/840/cieem-awards-luncheon-2015.

EU Fitness Check of the Nature Directives

CIEEM has recently responded to the European Commission's call for evidence consultation on the 'fitness' of the EU Birds and Habitats Directives. We submitted our response through our membership of the European Network of Environmental Professionals, which had opened a direct dialogue with the consultancy conducting the consultation on behalf of the Commission.

Our response concluded that there are issues with the Directives, but that they have an overarching purpose in protecting species and habitats across Europe that would be difficult to achieve without them. We also pointed out the importance of professional ecologists and environmental managers and the value of skills and training.

The second part of the consultation, seeking public opinion, is now open until 24 July. We urge all members to complete the consultation, which can be found at http://ec.europa.eu/environment/consultations/nature_fitness_check_en.htm.

People, Politics and the Planet Debate

On 9 March 2015, CIEEM, the British Ecological Society (BES) and the Sibthorp Trust held a pre-election debate on the environmental policies of the UK's major political parties. The debate – held at The Light in Euston, London and attended by over 300 guests – gave members of the BES and CIEEM, invited guests, and the general public a unique opportunity to question representatives of the UK's major political parties (Conservatives, Labour, Green Party, Scottish National Party, Liberal Democrats, and UK Independence Party) on their environmental commitments ahead of the election. The event was expertly chaired by leading broadcaster and author Jonathan Dimbleby.

The report from the event, along with a video recording, can be found at www.cieem.net/news/242/people-politics-and-the-planet-eo-any-questions.

Environmental Priorities for the Next UK Government

"A more holistic approach is needed; creating long-term strategies to tackle environmental challenges" is the key message from a new report from the Society for the Environment. The new publication – which offers a diverse menu of policy ideas from across 12 professional bodies and Policy Connect – was launched with a panel debate chaired by leading environmentalist Tony Juniper, President of the Society.

To read the report, which includes an article written by CIEEM President Elect Stephanie Wray, please visit www.socenv.org.uk/EasySiteWeb/GatewayLink.aspx?alId=1515016.

New Fellow

We are pleased to announce that a member has recently been admitted to fellowship of CIEEM.

Sue Bell has been a practising ecologist for almost 30 years, employed in the statutory agencies, voluntary sector, and latterly consultancy. These varied work experiences have led her to contribute to ecology across a number of areas, including ecological survey, research, policy development and education in both terrestrial and aquatic habitats.

Sue is primarily known for her freshwater ecological knowledge, research and practice, most especially of aquatic macrophytes of Scottish lochs and rivers. Over her career she has carried out surveys of lochs, many of which have not been surveyed before, contributing to a national classification of standing waters, developed an evaluation system to assist in the identification of standing water SSSIs, added to the distribution knowledge of scarce submerged aquatic species and, more recently, researched and tested methods of containing and managing aquatic plant species.

New CEO for the Society for the Environment

The Society for the Environment has recently appointed a new CEO. Dr Emma Wilcox has a background as a physicist and has most recently been working for Energy and Utilities Skills. She joins the Society at an exciting time as it looks to promote wider engagement with the CEnv community and welcomes the Royal Society of Chemistry as a new Licensed Body.

Dr Wilcox takes up her new role on the 1st July.

New Guidance on Work Experience and Internships

For many students and graduates seeking that first step on the career ladder, an unpaid or temporary work placement or internship is the only way to get the experience they need to gain a permanent post. There are some excellent examples of companies and organisations providing valuable opportunities for those seeking such experience. However there are also a number of pitfalls and legal requirements which must be followed and which can act as a barrier to providers offering such opportunities.

We would like to see more companies and organisations providing work experience, traineeships or internships but we would like to see this done in a way that is legally and ethically appropriate. Accordingly we have set up a new Working Group to produce some good practice guidance on this issue. Chaired by Peter Glaves MCIEEM (who is also Chair of the TECDC Committee), the Working Group hopes to publish the guidance early in 2016.

Work with Natural England and Defra

The initial phase of the roll out of the Low Impact Class Licence Scheme (Bats) is now complete and over 50 consultants are now working under the new licence arrangements. CIEEM has been supporting Natural England in this important initiative. The next step us to review the scheme, including the criteria, training and assessment, prior to hopefully launching the next phase. The Low Impact Class Licence Scheme (Bats) is part of an overall Earned Recognition approach to licensing that Natural England are exploring.

Thank you to all those who responded to the survey on how you currently use Natural England guidance, some of which is now in the Government archive website We are continuing to talk to Defra and Natural England about how we can help them make sure that important guidance is accessible in the future.

New Guidelines for Ecological Report Writing

CIEEM is pleased to announce the publication of new Guidelines on Ecological Report Writing. These new Guidelines replace the old Professional Guidance Series 9 on Ecological Report Writing and have been produced by a working group of expert members working under the auspices of CIEEM's Professional Standards Committee. We are very grateful to them for volunteering their time in this way. These new Guidelines are designed to help practitioners ensure that their reports are fit for purpose, whilst also clarifying expectations for those involved in assessing reports. Those working in local planning authorities or statutory nature conservation organisations (SNCOs) and those commenting on report contents as part of the planning process, should benefit from the publication of these guidelines. With this in mind, the new Guidelines are no longer only available in the members' area of the CIEEM website but are freely available to download for everyone. We will be actively promoting adoption of the new Guidelines to planning authorities, SNCOs and other competent authorities.

CIEEM will also be offering training courses in ecological report writing based on these new Guidelines to help those who would like to refresh their skills in this important area of practice.

The Guidelines can be found online at www.cieem.net/guidelines-for-ecological-report-writing.

Guidelines on Bat Survey and Mitigation

CIEEM has recently contributed to the latest round of the Bat Conservation Trust's review of the Guidelines on Bat Survey and Mitigation. The review had to be undertaken in a short timescale at a very busy time of year for those involved in bat surveys and we are very grateful to those members who made the time to contribute their views. These have now been collated and submitted to BCT and it is hoped that the next edition of these important Guidelines will be published later this year.

New Membership Application Video

We have recently added a short video to the membership section of our website, explaining the application process in more detail and introducing the competency framework as a means of determining the appropriate level of membership to apply for. If you know of anyone considering becoming a member please do take a few minutes to send them the link below and encourage them to submit an application. It might also be useful for you to watch the film if you're thinking of upgrading your own membership.

www.cieem.net/membership-grades-and-costs

Ecological Impact Assessment Guidelines for use in New Zealand

The New Zealand Chapter of the Environment Institute of Australia and New Zealand has just launched guidelines for use in terrestrial and freshwater ecosystems. These address the process of assessment, in particular as it is applied under the country's comprehensive Resource Management Act. A section on professional practice also examines some of the ethical dilemmas faced by professional ecologists carrying out EcIA. The Guidelines can be freely downloaded from www.eianz.org/news/id/175.

Staff Changes

We are pleased to welcome two new members to the team.

Katie Allen has replaced **Annie Hall** as Membership Administrative Assistant. Annie has taken up an exciting move to the Scottish Islands.

Emma Downey has joined us as the new Marketing Officer. Emma replaces **Emma Kiss**, who has moved on to a new role here in Winchester.

Mairead Stack has also left us as the Irish Support Officer. At the time of writing we are recruiting her replacement.

Conferences

On 24 March 2015 we held a successful Spring Conference at MShed in Bristol. The topic was 'Managing Change in Coastal Habitats' and the presentations are available online at www.cieem.net/previous-conferences-2015-spring-conference-585.

On the day after the conference there was also an optional site visit to Steart Peninsula to see the managed realignment scheme there. Our thanks go to the Wildfowl and Wetland Trust staff who made this such an interesting and insightful visit.

The Summer Conference will take place on 15 July in London. The topic will be 'Managing the Impact of Plant and Animal Disease on Biodiversity'. Please see page 47 for more information.

The Autumn Conference will be held in November on the theme of 'Reconnecting People and Nature'. The location will be Sheffield. The call for papers will be announced soon.

For more information on forthcoming conferences please see www.cieem.net/events/category/57/cieem-conferences.

Activities of the Professional Standards Committee (PSC)

The PSC met in February for one of our regular quarterly meetings. We discussed some 'hot topics' as well as new and ongoing work from Committee members and working groups:

Bat survey guidance for homeowners – We have pulled together a simple guide for homeowners on what to expect when advised to carry bat surveys for a planning application. The working group are consulting with others to get this finalised, and will then be consider what other publications may be useful to this audience.

Preliminary Ecological Assessment (PEA) guidelines – PSC agreed that there is a need to more clearly define the purpose of PEAs, and have formed a working group to review existing guidance.

Invertebrate survey guidance – The committee reviewed a proposal to develop new survey guidance for invertebrates. The intention is to fill any gaps, and consolidate existing guidance. PSC will support Buglife on this work to help secure CIEEM endorsement.

Water vole guidance – PSC discussed proposed revisions to guidance on water vole survey and mitigation, and the issue of licensing displacement. The guidance is still being drafted following recent consultation. CIEEM will consider endorsement once finalised.

Permitted development – PSC discussed changes to planning law that allows some development without submitting a planning application. We will be seeking evidence about where this has impacted on protected species and habitats so we can ascertain the scale of the risk, and make an informed decision about next steps.

Reporting wildlife crime – We have formed working group to pull together an article for *'In Practice'* on wildlife crime and our responsibilities as professionals. This will parallel conversations we are having with the National Wildlife Crime Unit about ways of working.

Habitat classification system – PSC reviewed proposals to look at a new habitat classification to compliment and trouble-shoot existing systems. There has already been a lot of work on this and PSC are keen talk more about our role as this develops.

Future Themes for *In Practice*

Edition	Theme	Deadline
December 2015	Reconnecting People and Nature	31 August 2015
March 2016	Valuing Ecosystem Services	30 November 2015

If you would like to contribute an article to one of these editions please contact the Editor. Contributions are welcomed from both members and non-members.

CIEEM and EU Referendum

Following on from the Conservative Party winning a majority in the UK general election we now know that there will be an in-out referendum on the UK's membership of the EU by the end of 2017. Changes to our relationship with Europe and to the legislation under which most of our profession works will have profound and potentially serious implications for our members.

This political issue is one that CIEEM must, and will, engage with. Over the coming months we will be calling on all UK-based members to have their say on how CIEEM should seek to influence the debate and we urge you to engage with us on this issue.

www.cieem.net/news/250/implications-of-the-uk-general-election-eo-a-perspective-from-cieem

Figure 3: Effective mitigation as a result of both monitoring and incorporating biodiversity into the business plan. Photo by Katherine Drayson.

Monitoring Mitigation in EIA Developments

Katherine Drayson MCIEEM
Policy Exchange

Stewart Thompson
Oxford Brookes University

Keywords: Ecological Impact Assessment, habitat mitigation measures, mitigation effectiveness, mitigation implementation

Monitoring and measuring mitigation success is the only way to 'close the loop' and ensure mitigation implementation is effective. After almost 30 years of monitoring being excluded from Environmental Impact Assessment (EIA) legislation, the EIA Directive has now been amended to include monitoring.

This article discusses the methods and findings of a PhD study exploring the treatment of ecology in EIA. The study included both a review of the information on ecological mitigation and monitoring provided in planning application documents, and an assessment of on-site ecological mitigation implementation and effectiveness. In both cases, considerable improvements can be made.

EIA and its recent amendments

EIA ensures that developers and Local Planning Authorities (LPAs) consider the likely environmental impacts of those built development projects that are most likely to result in significant environmental impacts. The Ecological Impact Assessment (EcIA) chapter of the Environmental Statement (ES) submitted with planning applications should include consideration of mitigation and, ideally (though not previously legally required), monitoring. As a result, ecological and other environmental impacts can potentially be avoided or reduced, and better informed decisions made (Armstrong *et al*. 2010).

The recently amended EIA Directive (European Parliament & Council of the European Union 2014) introduces new

monitoring obligations, which can apply to both the implementation and management of the project. Where planning permission is granted, consideration must be given to whether monitoring of significant adverse environmental (including ecological) effects of the project is required. Monitoring must be proportionate to the nature, location and size of the project. Fortunately, to avoid duplication, existing monitoring arrangements may be relied on, if appropriate.

The UK must transpose the amended EIA Directive into national legislation by May 2017. The implications could be considerable. Unfortunately, however, there is surprisingly little data available on either EcIA or ecological mitigation monitoring. For example, the last review of EcIA chapter content and quality was published 15 years ago (Byron *et al*. 2000). Since then, the context for EcIA has changed considerably, for example with the publication of CIEEM's EcIA Guidelines (IEEM 2006) and the tightening of nature conservation legislation. In addition, most consultants will know of projects where mitigation is agreed and planning permission granted, but with little or no monitoring ever being conducted. There is therefore no evidence base from which to learn or innovate.

Because of this, we studied ecological mitigation in developments requiring EIA (hereafter EIA developments) between 2010 and 2013. We reviewed the mitigation and monitoring information that EcIA chapters provide, and surveyed development sites to assess ecological mitigation implementation and success (Drayson and Thompson 2012, 2013).

EcIA chapter review

Six previous reviews of UK EcIA chapter content and quality have explored mitigation and/or monitoring information (Spellerberg and Minshull 1992, Treweek *et al*. 1993, RSPB 1995, Thompson *et al*. 1997, Treweek and Thompson 1997, Byron *et al*. 2000). This study examined the EcIA chapters of 112 EIA developments granted planning permission in England between 2000 and 2010. The mitigation and monitoring sections were reviewed and compared to the findings of the six earlier reviews.

Table 1: Summary of the changes in EcIA chapter content observed over time, in comparison with earlier reviews.

Review Criteria	Comparison studies that included the review criteria						Current review findings in comparison with earlier studies
	Spellerberg & Minshull 1992	Treweek *et al*. 1993	RSPB 1995	Thompson *et al*. 1997	Treweek & Thompson 1997	Byron *et al*. 2000	
Mitigation descriptions included?	✗	✓	✗	✓	✓	✓	+
Detailed mitigation descriptions provided?	✗	✓	✗	✓	✗	✓	+
Likely success of mitigation measures stated?	✗	✓	✗	✓	✓	✓	+
Time required for mitigation effectiveness stated?	✗	✗	✗	✗	✓	✗	+
Modifications for unsuccessful mitigation proposed?	✗	✓	✗	✓	✓	✗	N/A
Commitment to any mitigation indicated?	✗	✗	✓	✗	✗	✗	+
References to monitoring made?	✓	✓	✓	✓	✓	✓	+
Commitment to any monitoring made?	✗	✓	✓	✓	✓	✓	+
Monitoring programme provided?	✗	✓	✓	✗	✗	✗	N/A

✓ = comparison study included the review criterion, ✗ = comparison study did not include the review criterion

+ = Significant positive change over time, N/A = No significant change over time

Mitigation and monitoring information provision improved markedly over time (see Table 1), although largely because the baseline established from the previous reviews was so low that it was almost impossible not to see an improvement. For example, the 1993 study of 37 road developments found that almost half (49%) had "failed to describe" any mitigation measures and just 8% had given "detailed prescriptions for proposed mitigation measures". Our review found that whilst all but one EcIA chapter had described at least some form of ecological mitigation, less than a fifth (18.75%) included any detailed mitigation descriptions. The EcIA chapter often contains the only data on which to base a monitoring strategy; yet vague descriptions of proposed mitigation measures, like 'grassland' or 'meadow' creation, make it impossible to assess the effectiveness of implemented mitigation.

What can be done about this? A literature review identified the main factors potentially linked to EcIA chapter quality, such as the year of preparation (later documents tend to include more information). Statistical analysis established that the most important factor in determining EcIA chapter quality was the stated use of CIEEM's EcIA Guidelines. There is an argument, therefore, for strengthened mitigation and monitoring sections in future revisions of the EcIA Guidelines.

On-site mitigation and monitoring

Even with the best mitigation prescriptions and monitoring programme, what is proposed in an EcIA chapter will not necessarily be what is implemented on-site. To investigate both implementation and effectiveness, seven completed or partially completed EIA developments were visited in 2010 and 2011. They included transport, housing, education and industry developments, with applications submitted between 1998 and 2006 to seven different LPAs across England.

Implementation

Before each visit, all the relevant planning documentation for the site was gathered (see Box below), and every ecological mitigation measure was identified and collated into a checklist.

Additional planning documentation

Once planning permission is granted, further mitigation and/or monitoring information can be included in documents other than the EcIA chapter. For example, the decision notice and the Section 106 agreement may outline measures that the LPA requires and must be implemented by law. An Ecological Management Plan (EcMP) may provide extra detail, together with prescriptions for how mitigation should be implemented and maintained (aimed towards contractors). Landscape management plans and accompanying maps may also contain extra details.

During the site visit, the implementation of each mitigation measure was recorded, regardless of how well or poorly executed, to give an indication of on-site implementation rates. However, many measures would have been implemented during construction (e.g. working at particular times of year) and therefore could not be assessed. Of 202 proposed and/or required ecological mitigation measures across the seven sites, 65.3% were fully implemented, 18.8% partially implemented, and 15.8% not implemented at all. Full implementation rates for each site were relatively high, ranging from 52% to 85.7%; a reassuringly positive finding.

However, the site surveys revealed considerable variability in effectiveness. For example, Figure 1 shows a great crested newt 'reserve' with ditch and on-line ponds along the site boundary, created as a condition of a European Protected Species (EPS) development licence. Before the development was completed, the developer went into administration, and the neighbouring housing development used the reserve for fly-tipping. Despite the problem being reported to the LPA and Natural England, neither became involved.

Figure 1. Poor mitigation effectiveness as a result of unforeseen circumstances and lack of monitoring. Photo by Katherine Drayson.

Figure 2 is an example of (easily avoidable) poor mitigation management. A balancing pond to reduce flood risk was intended to also be a wildlife pond with reedbed and marshy grassland. However, frequent mowing (with cuttings left to blow into the pond) resulted in a eutrophic, wildlife-unfriendly and visually unattractive feature. Reedbed creation was attempted but, without netting, geese pulled up the reeds; no further action was taken.

The site in Figure 3 incorporated biodiversity into the development's business plan from the outset; this was a previously neglected hay meadow. The site was an example of general good practice, with the developer installing solitary bee houses, constructing bat lofts, and planting a harvest hedgerow.

Implementing ecological mitigation is therefore insufficient to ensure effectiveness. However, effective implementation is not always easy to measure objectively, particularly for habitat creation, recreation, translocation, and /or management measures (referred to collectively as 'habitat mitigation measures'). Yet if monitoring is to inform site management decisions or result in enforcement, objectivity is necessary. This is best achieved by providing both the criteria against which mitigation will be

Figure 2. Poor mitigation implementation and effectiveness that monitoring could have resolved. Photo by Katherine Drayson.

Table 2: The effectiveness of auditable habitat mitigation measures identified from EcIA chapters and EcMPs.

Habitat mitigation measure	EcIA chapter habitat description	EcMP habitat description	Actual British plant community name	MATCH Similarity score	Mitigation considered effective?
Creation	Marginal	Marshland	OV25 *Urtica dioica-Cirsium arvense*	37.1	No
Creation	N/A	Species-rich wet grassland	MG6 *Lolium perenne-Cynosurus cristatus*	62.8	No
Creation	Unknown	Marginal	MG9 *Holcus lanatus-Deschampsia cespitosa*	37.5	No
Creation	N/A	Wet grassland	MG6 *Lolium perenne-Cynosurus cristatus*	41.4	No
Creation	Acid grassland	Acid grassland	OV19 *Poa annua-Matricaria perforata*	19.4	No
Management	N/A	Unimproved neutral grassland	MG6 *Lolium perenne-Cynosurus cristatus*	63.8	No
Management	Grassland	Marshy grassland	OV19 *Poa annua-Matricaria perforata*	36.8	No
Management	Unimproved species-rich calcareous grassland	Calcareous grassland	MG5 *Cynosurus cristatus-Centaurea nigra*	36.2	Partially
Creation	Reedbed	Reedbed	S4 *Phragmites australis*	43.2	Yes
Creation	Grassland	Neutral grassland	MG6 *Lolium perenne-Cynosurus cristatus*	42.1	Yes

judged, and using a standard methodology to determine effectiveness.

Effectiveness

It was not possible to monitor effectiveness for every mitigation measure. Therefore, only grassland and marginal habitat mitigation measures were surveyed, since these were most likely to have become established by the time of survey (in contrast to newly planted woodland, for example). Fifteen mitigation measures across the seven sites were surveyed (Table 2 outlines the survey results for the ten measures that were auditable). All were identified from the EcIA chapter or the EcMP, rather than the decision documents, highlighting the importance of consultants in proposing and describing mitigation measures, rather than relying on LPAs.

During the site visits, National Vegetation Classification (NVC) surveys of grassland and marginal habitat mitigation areas were conducted and the results compared with the descriptions provided in the reviewed planning documentation using the relevant NVC volumes (Rodwell 1992, 1995, 2000) and MATCH software (Malloch 1992). Where the documentation used Phase 1 habitat survey or other descriptions, the National Biodiversity Network (NBN) Habitats Dictionary was used to find the equivalent NVC community (National Biodiversity Network 2005). MATCH provides a numerical measure, ranging from 1 to 100, of the similarity of a plant community to the closest matching NVC community. In general, similarity scores of greater than 60 are considered acceptable matches for NVC communities, according to the following scale: 0-49 = very poor; 50-59 = poor; 60-69 = fair; 70-79 = good; and 80-100 = very good (Morris and Therivel 2001, p. 504).

The NVC communities were originally described from habitats of high conservation value and so we did not expect a high degree of similarity between these and the habitats surveyed on the case study sites. In addition, given that many of the surveyed habitats were relatively immature, we expected to have to assess the potential for mitigation goals to be achieved in the future, based on the species present and the management regime.

Of the 15 habitat mitigation measures, five had habitat descriptions that were too vague (i.e. did not refer to recognised plant communities or habitats) for effectiveness to be determined. Of the remainder, only three at least partially achieved the description set out in the planning documentation. Of the seven habitat mitigation measures that were not effective, five involved habitats requiring at least temporary standing water (marshland, marshy grassland, wet grassland, and marginal habitat) but there was insufficient water on the site. This reflects well-established research findings that it is very difficult to create the hydrological conditions of damp or wet habitats (Chinn *et al.* 1999).

Critique

Assessing changes over time in the inclusion of information in EcIA chapters is fraught with methodological difficulties, not least the different interpretations that reviewers will give to the same information. However, we consider that attempting to benchmark EcIA chapter quality is an important first step in encouraging improvement over time.

We also recognise that the single surveyor, and the small number of study sites and habitat measures in this study are weaknesses. Assigning a 'pass' or 'fail' score to mitigation effectiveness is also simplistic. However, we hope that building on ecological mitigation monitoring research will inspire debate and encourage further work, for example using additional research methods such as interviews and questionnaires.

Recommendations

What can be done about the considerable variability in mitigation measure descriptions in EcIA chapters and EcMPs? We recommend that CIEEM strengthens the mitigation section of its EcIA Guidelines, and produces guidance on the information that EcMPs should contain. There could also be greater effort to keep the same ecologists throughout a project to reduce information loss and ensure that the spirit of proposed mitigation measures is kept.

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Is NVC optimal for objective assessment of habitat mitigation measure effectiveness? Given inter-surveyor variability in assigning NVC classifications, which worsens with each lower level of sub-classification (Hearn *et al*. 2011), it may be time to consider a new habitat classification system (Edmonds *et al*. 2015).

With monitoring barely mentioned in EcIA chapters, we consider that guidelines are needed outlining when, and for what, monitoring is required, and what survey effort is required over what time period.

Enforcement is difficult when a developer goes into administration and site management responsibilities are uncertain, particularly given local authority budget cuts and their general lack of ecological expertise. We consider that there is potential for greater use of performance bonds and/or endowments to fund long-term monitoring and mitigation management.

Would biodiversity offsetting help to overcome some of the problems we identified? There is an argument that creating an institutional framework, a body of expertise, and utilising long-term covenants, would help ensure habitat mitigation measures are more effective.

Conclusions

Our study found that there has been considerable progress in the way that mitigation and monitoring are considered in EcIA chapters, although the baseline was extremely low. On-site ecological mitigation implementation is relatively common, but its effectiveness is largely unknown. We found that the majority of the habitat mitigation measures we investigated failed to meet the goals set out in the EcIA or EcMP. Only two of the seven study sites carried out any monitoring. This makes it impossible to modify site management decisions when mitigation goes wrong. There are methodological issues with both components of this study, but we consider it a useful start, given the recent inclusion of monitoring in the EIA Directive.

About the Authors

Katherine Drayson completed her PhD at Oxford Brookes University's Faculty of Health and Life Sciences, supervised by Stewart Thompson. This article is based on that work. She previously worked as an ecological consultant and now works as an environmental policy researcher for Policy Exchange.

Contact Katherine at:
katherine.drayson@policyexchange.org.uk

Stewart Thompson is Professor in Biodiversity Conservation at Oxford Brookes University's Faculty of Health and Life Sciences. He has been researching the ecological component of EIA for over 20 years.

Contact Stewart at:
sthompson@brookes.ac.uk

Animal Welfare Implications of Mitigation Schemes

Merryl Gelling MCIEEM
Spires Ecology Ltd.

Adam Grogan MCIEEM
RSPCA

Keywords: conservation schemes, mitigation success, post-mitigation monitoring, stress, translocation

Badger cub emerging from a newly created sett. © Andrew Harrington.

Schemes designed to mitigate the effects of development on species or habitats rarely consider the welfare implications for individual animals. In the worst case, this may jeopardise the success of the entire mitigation scheme. This article considers the welfare implications of mitigation schemes and how CIEEM members involved in this work can improve animal survival and wellbeing in the long-term.

Introduction

Within the UK, any animal that is captured as part of a mitigation scheme becomes a protected animal under the Animal Welfare Act 2006 and the release of animals that are unable to fend for themselves may be considered abandonment (Hansard 2008). Furthermore the IUCN (2013) Guidelines for Reintroductions refer to mitigation translocations and explicitly state that *'rigorous analysis and great caution should be applied when assessing potential future conservation benefits and using them to mitigate or offset current development impacts, in view of the inherent uncertainty regarding translocation success. Further, any mitigation proposal should follow the process of design and feasibility, implementation, monitoring and adaptive management of these Guidelines.'*

Mitigation schemes are rooted in the need to protect specific habitats and species (e.g. Minteer and Collins 2005), identified *a priori* as hitherto viable populations liable to be detrimentally affected by proposed development. Unfortunately, the plight of the individual is often eclipsed by efforts to save a population. Historically, animal welfare has been focused on the needs of individual animals held in captivity (often laboratories, farms or zoos) (Sainsbury *et al*. 1995), specifically focusing upon the reduction or prevention of animal suffering, and with an implicit duty to improve the quality of animal

life (Singer 2003). Nonetheless, animal welfare can have a significant impact upon conservation success – the plight of an individual animal can make a strong case for conservation – and should be explicitly considered within conservation schemes.

A well-planned Environmental Impact Assessment (EIA) can include recommendations to avoid sensitive habitats and 'at risk' populations altogether. Alternatively, it can provide mitigation measures that will significantly reduce the impacts on individual animals affected by a development scheme, thereby promoting both conservation and welfare simultaneously. However, EIAs rarely address animal welfare, instead focusing on habitats and species protected by conservation legislation. Whilst beneficial for conservation in general, this approach ignores the fact that all animals, legally protected or not, have the potential to suffer. Unfortunately, some of the tools commonly used to mitigate the effects of development may result in stress and suffering to the individual animal, and may perhaps result in the failure of the mitigation as a whole. Conservation mitigation is ultimately, and often grudgingly, paid for by the developer who has a legal imperative to mitigate for protected species but is highly unlikely to agree to mitigation for those species that are not legally protected, and thus their welfare may be compromised.

A major issue is the lack of post-mitigation research: valuable data on the success or failure of individual projects is lost and cannot be used to improve the design of future schemes. If the continued survival of a population of animals is the criteria for success then a fundamental principle

An urban fox. As foxes are not protected, they are not considered in EIAs but they still have the capacity to suffer as a result of development. © Adam Grogan.

Mitigation involving the creation of a fauna passage and culvert. © Adam Grogan.

behind any mitigation scheme should be that the affected animals must be monitored for a significant period after completion of the project. That is the only way that any project can measure success, and if such follow-up monitoring shows that a project has failed then this information should be made available to guide future mitigation. Repeated failure of mitigation schemes means that animals have suffered and died for no good purpose and these mitigation methods should not be accepted as licensable procedures. Mitigation may fail if the animals are stressed either by the mitigation process itself or by environmental changes introduced by the development.

Mitigation

The scale of any mitigation scheme should be proportional to the development proposed with a guiding principle of minimising intervention in any given habitat. Careful and accurate pre-development survey is the first step to establishing what animals will be affected and in what way. A well-thought-out mitigation programme should take into account the complete range of impacts on the individuals and species liable to be affected. These should be specified in the ecological chapter of EIAs and translated into recommended mitigation actions in Ecological Management Plans (EcMPs), and welfare implications should be analysed and addressed through careful planning.

Mitigation can also be applied to situations where humans and wildlife are in conflict. For example, The Deer Collisions project is recording and mapping deer road-casualty hotspots so that the information can be used to target mitigation measures, including fencing and vegetation management, thereby not only protecting deer from drivers but also drivers from deer. At the other end of the scale, mitigation for cryptic species can be a positive outcome of pre-development survey work: these species may have gone unnoticed were it not for prerequisite survey work.

Maintaining habitat connectivity using well-designed bridges and underpasses to allow movement of species following road developments is good mitigation of which long-term benefits include reduced fragmentation of the target population (e.g. otters *Lutra lutra*) as well as other, often-overlooked species (e.g. foxes *Vulpes vulpes*). Species without legal protection such as foxes are customarily ignored in the planning process but often suffer as a direct result of development taking place, for example through increased animal/vehicle collisions.

In a comprehensive review of nearly 200 reintroduction projects that were systematically monitored, 67% reported problems such as high mortality rates (> 50% mortality in 23% of projects), dispersal of animals, lost animals, disease,

and human conflict (Harrington *et al*. 2014). It is unfortunate that the majority of mitigation projects for development purposes do not undertake significant post-mitigation monitoring. As well as high mortality rates, the welfare of survivors may be compromised by stressful encounters with extant territory holders, injuries from fighting, hunger due to unfamiliarity with the area and the location of food resources, and difficulties in adapting to a novel environment.

Monitoring mitigation

Most mammalian species are cryptic with presence only identifiable by the field signs they leave, thus without post-implementation monitoring it is difficult to judge the effects of development or the success of mitigation schemes. A common response to disturbance is to remain hidden, meaning that fewer field signs are apparent. There is a risk that surveyors will conclude that animals have moved away of their own accord when in reality they remain under stress in shelters. Bats may be disinclined to leave roosts if external conditions are unsuitable, either due to natural elements or man-made environmental alterations (Boldogh *et al*. 2007). Water voles *Arvicola amphibius* might stay in their burrows feeding on roots after the removal of vegetation surrounding their entrance holes during displacement interventions.

Many development projects can have negative consequences for animal welfare due to poor mitigation planning, poor implementation or lack of attention to detail. Animals frequently abandon places of shelter due to changes in their immediate environment, regardless of whether a licenced mitigation scheme has been completed. For example, bat roosts may be destroyed and bats are unable to locate, or don't take up residence in, the replacement roost provided. Changes to foraging grounds and commuting routes, or their destruction, can increase the distance individuals must travel to find food, exposing them to greater danger and imposing heavier energy requirements. Water voles or dormice *Muscardinus avellanarius* may be at risk from predation by domestic cats brought in to new housing estates. The numbers of individuals involved and the long-term fate of animals affected by development can only be established accurately through scientific research, rigorous monitoring and measuring mitigation success.

Translocation

Mitigation programmes must be carefully planned in order to be successful. This involves choosing the correct method(s) for the species concerned, their conservation status (both nationally and locally) and the type and scale of development.

The translocation of sentient animals represents a major issue, both for the conservation of a population and the welfare of individuals. It is frequently believed that translocation is preferable to killing animals (indeed killing of a protected species is prohibited by law); however, there is little data on how animals react to being caught, housed and subsequently re-released, although this situation is improving.

Much information currently available refers to small populations and individual translocation projects. For example, when problem grey squirrels *Sciurus carolinensis* were trapped and translocated from an urban area of Baltimore, USA, to a more rural woodland area between 1994 and 1997, 37 of the 38 squirrels moved were dead or had disappeared within 88 days of release (Adams *et al*. 2004). Similarly, of six badgers *Meles meles* moved from an urban area of Bexhill and translocated to rural Sussex in the UK, three promptly escaped from their release pen. The study concluded that released badgers may actively seek out familiar habitats within which to locate a new sett, in this instance near housing, with preferential foraging in gardens (Brown and Cheeseman 1996), which, if taken into account when siting replacement badger setts for mitigation purposes could help to increase the rate of successful uptake.

Molony *et al*. (2006) compared hedgehog *Erinaceus europaeus* survival when translocated from the Uists, Outer Hebrides, which were (a) released soon after capture; (b) kept in care for 30 days before release; and (c) released from rehabilitation centres with wild hedgehogs. Individuals held in captivity for longer, survived longer post-release than those released after a minimal time in captivity. Acclimatisation to human intervention in an environment protected from predators, which supplies the necessary food and water, may help to reduce the negative impacts of the stress response associated with being moved. Interestingly, no evidence of competition between released hedgehogs and the existing local population was found, suggesting no obvious impacts on the welfare of the extant population from the influx of new individuals.

So, why should translocation pose a problem for wild animals? All animals, humans included, have normal physiological responses that enable them to cope with potentially stressful events. However, certain events may lead to chronic over-stimulation of these responses, resulting in harm for the individual concerned. Removal of an individual from its familiar environment, a procedure that may potentially include live capture, housing (both short- and long-term), transportation and subsequent release in a novel environment, is likely to trigger a stress response. By teasing out which elements of a translocation are the most stressful, we have the potential to refine techniques and improve overall translocation success.

Research has been conducted into different aspects of the stress response. In this situation, 'stress' refers to the normal biological response to a stimulus.

A water vole being handled prior to release. © Andrew Harrington.

Slow worm located under a reptile mat. © Merryl Gelling.

In extreme conditions chronic stress can become immunosuppressive, potentially resulting in the development of pathology that is ultimately damaging. Montes *et al*. (2004) showed that badgers undergoing routine methodologies as part of a long-term, scientific study in Wytham Woods, Oxfordshire, UK, exhibit an increase in neutrophil activation when trapped overnight and transported to a central sampling station. Neutrophils are part of a body's immune system, activated when an individual has an infection or undergoes trauma, and neutrophil activation being measurable under conditions routine to the badger population suggests that the process is stressful, despite the frequency of occurrence.

However, there are a number of situations where translocation is judged to be the most appropriate methodology, e.g. for water voles due to their rapid population decline coupled with being relatively easy to trap, handle and maintain in captivity prior to re-release in a new location. Gelling *et al*. (2010) investigated the impact of different housing conditions for water voles in captivity prior to a reintroduction using changes in body weight and Leucocyte Coping Capacity, a measure of the stress response produced by chemically stimulating an immune challenge *in vitro*. They concluded that reducing group size within captive colonies or during transportation can lower the stress experienced by individuals, highlighting the need to account for life-history strategies when keeping animals in captivity.

A long-term study on the effects of habitat quality on reintroduction success in water voles suggested that, provided the habitat was of sufficient quality and quantity when the animals were released, the translocated population survived and thrived (Moorhouse *et al*. 2009). Animals were given Passive Integrated Transponder (PIT) tags and were monitored for a number of months post-release. Findings indicated that greater numbers of the initial release cohort survived in release sites with a higher vegetation abundance, with higher post-establishment survival rates and population densities. This demonstrates that there are several separate elements involved in a translocation – discussed further in the forthcoming revised Water Vole Mitigation Guidelines (Dean *et al*. 2014).

Every species has their own life-history strategy, which defines their response to potentially stressful events, details that should influence the individual practices occurring within a translocation. It is likely that newts may have a similar response to mammals: amphibians possess nociceptors (a neuron receptor that responds to potentially damaging stimuli causing the perception of pain), like fish and mammals (Stevens 2004); however, pain in amphibians is largely undefined and poorly understood. Nonetheless, it is likely that newts will be stressed when captured, placed into a novel and artificial (poor quality) environment and then stressed again when released, perhaps due to differing water chemistry, lack of shelter and competition with conspecifics. Such environmental stressors can be evaluated during the translocation, but the direct measure of the impacts on the animals concerned can be difficult as methodologies may also cause welfare concerns. Research has demonstrated that wild amphibians bought into captivity rapidly become stressed, as measured by haematological profiles, and might not display normal behaviours (Davis & Maerz 2008). Therefore should we apply a precautionary principle and assume that all vertebrate animals may be stressed

by translocation? Ways to potentially minimise this stress include taking into account the species behaviour and moving only those individuals found together as a single group, rather than placing all animals from a given trap session into one holding container. This would undoubtedly make the ecologists' job more difficult but might improve the post-release survival of affected populations. However, more research is needed to quantify translocation success and to investigate ways by which sources of potential stress can be minimized. This information is needed to inform future practices and to better understand the needs of reptiles and amphibians in these situations.

Conclusions

It is possible for a mitigation strategy to be conducted without negative welfare issues. However, if a mitigation scheme is poorly implemented, or not implemented at all, then there may be detrimental impacts upon both the target species and ancillary non-target species as a consequence of development schemes. In particular, research has demonstrated that individual elements of a translocation can be stressful for the animals involved. Therefore, translocation should only be considered as a last resort, with best practice protocols including comprehensive long-term monitoring in order to measure success or failure, which can then inform future mitigation designs. Such programmes are already understood for some species, especially mammals, but similar programmes need to be developed for reptiles and amphibians using techniques allowing us to identify individual animals so that survival post-release can be determined.

Finally, suffering affects individuals of all species, therefore it is imperative that the planning and implementation of mitigation schemes takes account of the welfare impacts on non-protected and protected species alike if there is to be a positive outcome.

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About the Authors

Dr Merryl Gelling has a specific interest in wild animal health and welfare, and on bridging the gap between scientific research and the practical application of findings to inform best practice in the field. Her D.Phil. at Oxford University focused on changes in health and welfare of animals undergoing reintroduction.

Contact Merryl at:
merryl@spiresecology.com

Adam Grogan currently works for the RSPCA where he advises on policy regarding sick and injured wildlife and wildlife management. His previous work includes research into mitigation used to prevent otter road casualties and studying a number of mammal species, including perturbation in badgers, and impact of American mink on water voles.

Contact Adam at:
adam.grogan@rspca.org.uk

European Nightjar – Best Practice Mitigation Measures during Windfarm Construction

Mike Shewring and Dan Carrington
Natural Power Consultants Ltd.

Keywords: construction impacts, disturbance buffer, ground nesting birds, radio-tracking

Windfarm development in the UK has the potential to impact wildlife, notably birds and bats. Whilst the risk of fatalities caused by collision with turbine blades or barotrauma is well documented, the potential effects of disturbance to ground-nesting birds during windfarm construction are less well known.

This article reports the mitigation work carried out to prevent disturbance to breeding nightjars or damage to nest sites at Pen y Cymoedd windfarm in Wales.

Introduction

The European nightjar *Caprimulgus europaeus* is a crepuscular and nocturnal bird that breeds across most of Europe and temperate Asia. Considered to be a bird of heathland, in Wales nightjars are almost exclusively associated with commercial forestry plantation (Conway *et al*. 2007). Renewable energy policy (i.e. Welsh Assembly Government (2005) Technical Advice Note (TAN) 8: renewable energy) has encouraged large wind-power developments at commercial forestry sites throughout Wales where it has the potential to impact on important nightjar populations. Appropriate mitigation is required during construction activities and, in this article, we describe the effectiveness of one such scheme.

Background

Nightjars are cryptic birds with low levels of daytime activity. They feed on a wide variety of flying insects with peaks of foraging activity at dusk and dawn. Their preferred habitat is generally dry, open country with some trees and small bushes, such as heaths, forest clearings or newly planted woodland and forestry.

Figure 1. Adult nightjar at Pen y Cymoedd. Photo by Dan Carrington.

Nightjars are migratory, arriving back in the UK in May and departing in September. They do not construct a nest but lay their eggs directly onto the ground. Nests are difficult to locate in brash and wood chip habitat and eggs are cryptically coloured (see Figure 2). The female typically lays two eggs, which both parents incubate: the female during the day and the male from

Figure 2. Nightjar nest site and egg at Pen y Cymoedd. Photo by Dan Carrington.

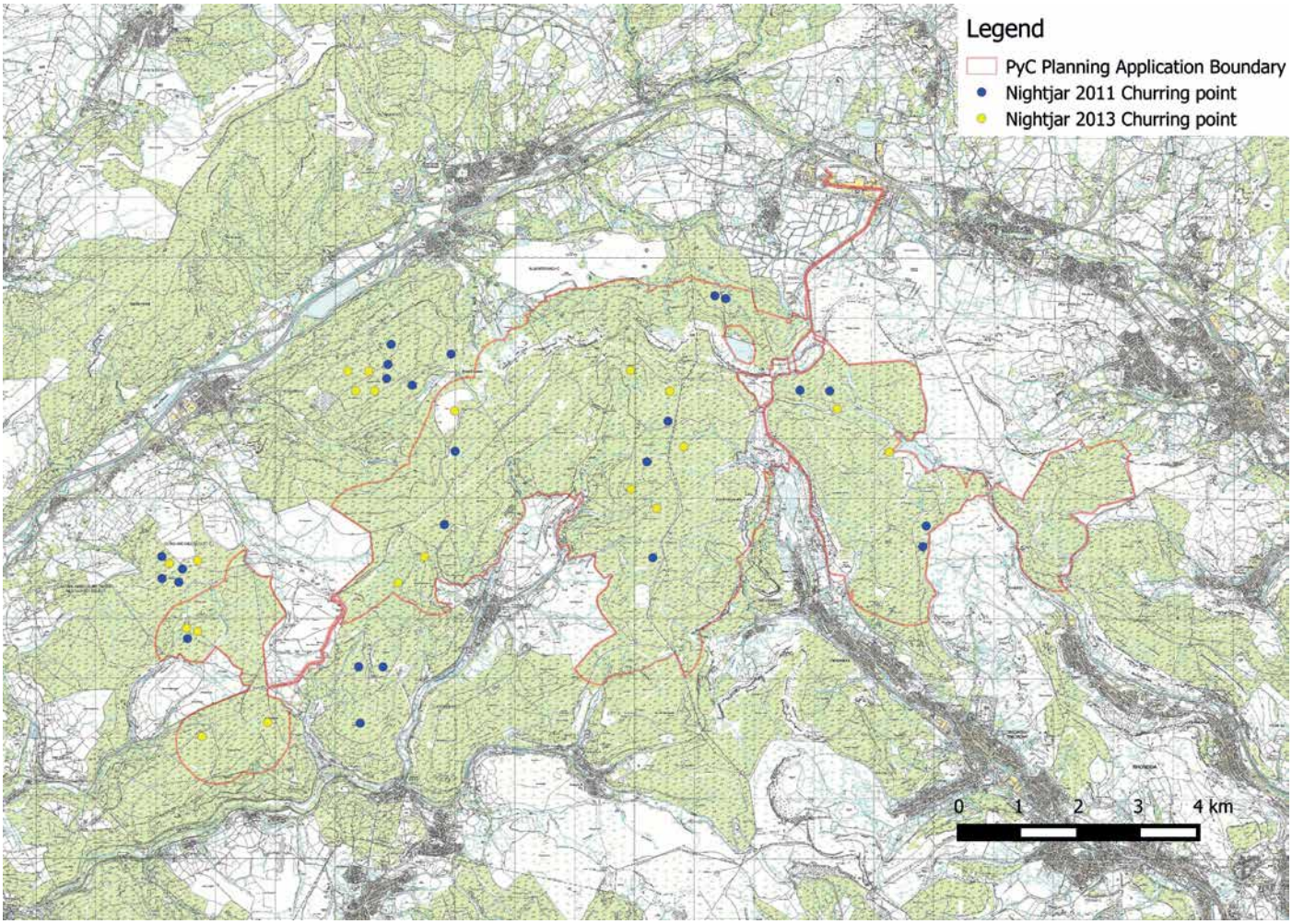

Figure 3. 2011 and 2013 post-consent surveys of nightjars at Pen y Cymoedd showing 2011 (blue) and 2013 (yellow) churring male locations. Licence No. AL 100020693.

dusk through the night in-between bouts of foraging. Despite recent increases in numbers and range, due to historic population declines nightjars are listed as Red status birds of conservation concern in the UK and on Annex 1 of the EC Birds Directive (Eaton *et al*. 2009).

Pen y Cymoedd in south Wales is the largest on-shore windfarm in England and Wales. It is situated within an area of commercially managed forestry between 50 m and 600 m above sea level, although the majority of the site is on a plateau 300 m to 500 m above sea level. The forestry is managed by Natural Resources Wales (formerly Forestry Commission Wales) and is planted on rotation with sitka spruce *Picea sitchensis* up to 60 years of age. In February 2014, the windfarm infrastructure construction phase commenced in preparation for a 76-turbine scheme.

An important breeding population of nightjars was identified at the site during the pre-consent Environmental Impact Assessment (EIA) and in update surveys undertaken during the consenting process (Figure 3). Construction activities were considered to have the potential to impact on nightjars through disturbance or damage / destruction of active nest sites. Consequently, during the planning process an appropriate mitigation strategy was agreed with consultees to minimise any risk of impact on breeding nightjars. Nest sites are protected through a combination of avoidance and the implementation of a 200 m (minimum) works exclusion zone, based on the recommendations of Currie and Elliott (1997) and Murison (2002).

Methods

Traditionally, presence/ absence assessments for this species rely on listening surveys, following methods described by Gilbert *et al*. (1998). Transects in areas of suitable habitat are walked twice during the breeding period to listen for 'churring' males. However, baseline and pre-construction surveys at Pen y Cymoedd and other Welsh nightjar sites (Figure 3) found little or no link between nest site location and churring locations (Jenks *et al*. 2014) so a three-stage approach to locating areas of activity and nest sites was implemented. This comprised (i) walked transect listening surveys (Gilbert *et al*. 1998); (ii) call-back / tape-luring surveys (utilising both churring male and contact 'kewick' calls); and (iii) subsequent capture (using mist nets) and radio-tracking of individuals.

Listening and call-back surveys focused on locations likely to be disturbed by construction activity (i.e. turbine or track works) within the nightjar breeding period (May/June – August) and the results were used to target subsequent capture and radio-tracking work. If no evidence of nightjars was found during two consecutive listening and call-back / tape-luring surveys, the areas were judged unlikely to support an active nest site and were cleared for construction works (within 24-48 hrs of survey), assuming that an additional pre-construction walk-over survey immediately before work began found no new evidence of nightjar nests.

Nightjars were caught in mist nets using tape-luring (under appropriate license issued by BTO). Captured birds were weighed, sexed, aged and fitted with a metal ring before being tagged with a radio transmitter (Biotrack PIP tag see - http://www.biotrack.co.uk/small-beeper-transmitters.php#s3) fixed to one of the two central tail feathers (Figure 4). Tagged individuals were subsequently radio-tracked during daylight hours to locate active nest sites. Exclusion zones were imposed encompassing a circular area (minimum radius 200 m) around active nests and a decision was made about whether turbine construction works could proceed in the vicinity without risk to nesting birds.

In cases where listening and call-back / tape-luring surveys had identified display activity but subsequent radio-tracking had found no evidence of nightjar nesting activity, then construction works were cleared to progress within 24-48 hrs, following an additional pre-construction walk-over survey.

Pre-construction walk-over surveys were undertaken by the Ecological Clerk of Works (ECoW) team to double-check that there were no nightjar nest sites in the immediate area and to minimise the potential for damage or destruction of any nest. All areas of suitable habitat (clearfell, young restock, conifer regeneration (<12 yrs), remnant heath, etc.) within the construction zone plus a 200 m buffer zone were walked before any construction work was allowed to proceed, taking care that the surveyor passed within 2-3 m of any location in the search area. Surveyors recorded any nightjar encountered, whether roosting or nesting, the grid reference of any nest along with the number of eggs.

Results

The survey work undertaken at Pen y Cymoedd as part of the nightjar mitigation strategy in 2014 identified the first churring male on the 5 June and a further 18 churring male locations during the 2014 season (Figure 5). This compared with a total of 20 in 2013, 24 in 2011 and 12 in both 2009 and 2010 (no surveys were undertaken in 2012). Survey effort in 2014 was greater than in previous years but covered a smaller area because it focused on those areas scheduled for construction work during the breeding period. Therefore, the yearly totals are not directly comparable but are likely to represent a higher number of birds per unit area. This is considered likely to be attributable to the greater availability of suitable nesting habitat on site due to recent felling works.

Thirteen nightjars (9 males, 4 females) were caught and radio-tagged in 2014 [in collaboration with Tony Cross, Ecology Matters Ltd]. Six nest sites were identified; four through radio-tracking and two through pre-construction walk-over surveys. All nest sites were monitored through to successful fledging or nest abandonment: two successful nests fledged a total of four chicks, two nests failed and two nests were probably successful (three recently fledged chicks seen in the area during dusk surveys).

The first nest was located during a morning pre-construction walk-over survey on 18 June. No evidence of an active nest site had been recorded at this location during previous listening or call-back surveys although churring and display activity had been recorded in an area of clearfell 380 m to the north. Due to the lack of display at the relevant location there was considered to be a low likelihood of nesting. Unfortunately the nest site was located during the disturbance-sensitive early laying stage (one egg only) and the nest subsequently failed, possibly as a result of the survey disturbance. This period prior to the laying of the second egg is thought to be the most sensitive to disturbance as the female has not committed all resources to the breeding attempt at that stage and is liable to abandon a disturbed nest.

Figure 4. Male nightjar with radio tag *in-situ*. Photo by Dan Carrington

Subsequently, as a consequence of this experience, we considered nightjar display behaviour to be a potential indicator of an active nest site within 400 m.

The second nest was identified incidentally during a non-nightjar, afternoon walk-over survey on 18 June. The nest was located outside of the construction zone but within 200 m of a track and layby. No construction works were scheduled in the vicinity during the breeding season although traffic was passing regularly within 300 m. This nest site was successful and fledged two young.

A single, second brood attempt was recorded at Pen y Cymoedd in 2014 when a radio-tagged female was identified at two separate nest sites. The first nest was discovered at an advanced stage on 9 July; the second nest contained one egg and was located on 15 July. Both nests were monitored: two chicks fledged from the first nest but the second nest was unsuccessful, probably due to predation.

The nest sites were located in a variety of habitats but mostly (5 out of 6 nests) within large areas of complete and recent clearfell (felled <2 yrs ago) rather than in young restocked plantations, as found in previous studies. One nest was located in acid grassland growing on older clearfell (felled >2 yrs ago).

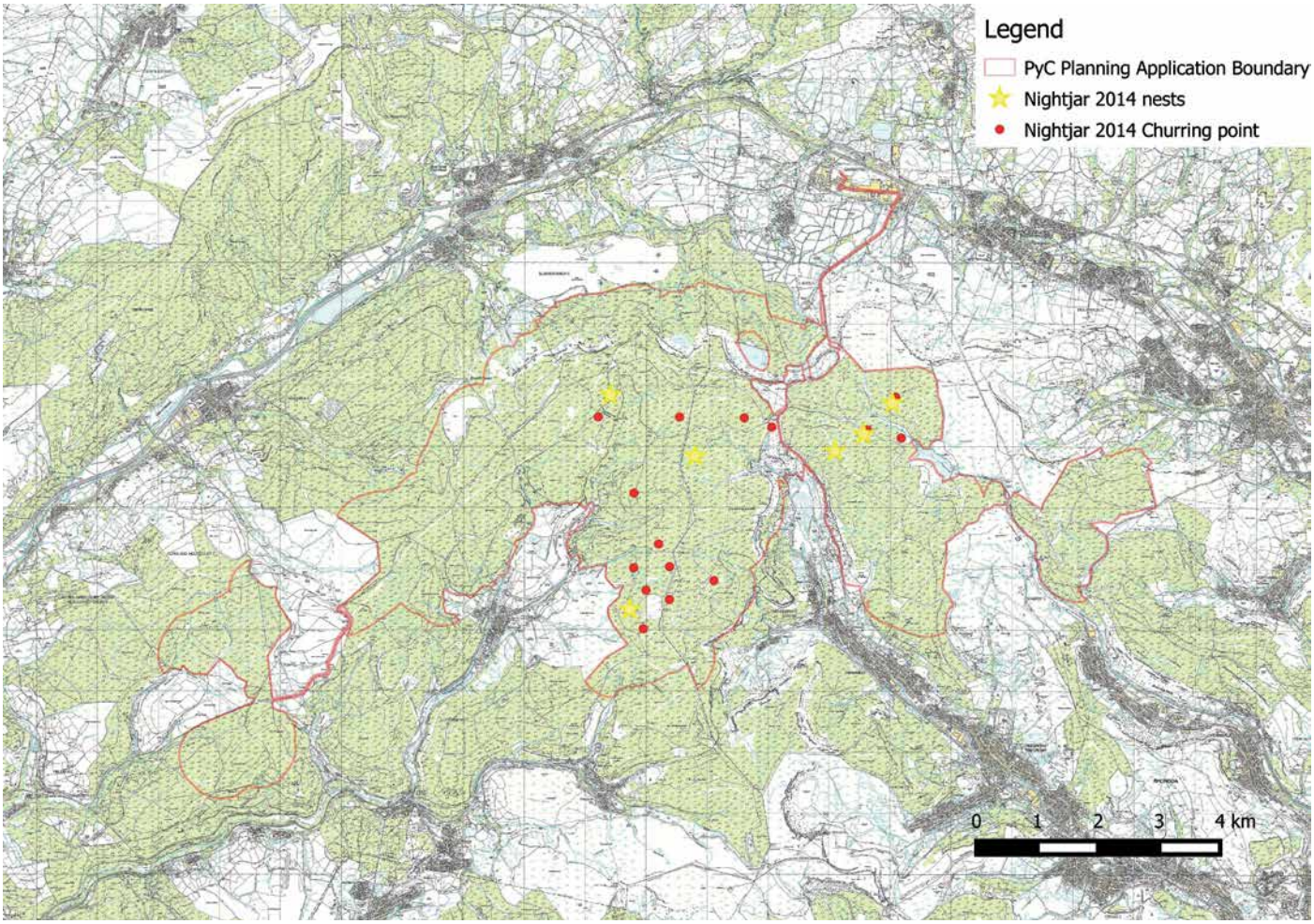

Figure 5. 2014 survey data – churring male nightjar (red), nest sites (yellow star). Licence No. AL 100020693.

Mitigation

Four of the six nest sites identified during the 2014 surveys were located within construction areas or in the adjacent 200 m buffer zone. They had the potential to be affected by construction works (damage, destruction and/or disturbance) in the absence of mitigation interventions.

Therefore, as soon as an active nest site was located the Pen y Cymoedd ECoW team informed both the client and contractor and applied the exclusion zone around the nest site to minimise the risk of any detrimental impact on nesting nightjar. Of three nests protected in this way, two were successful and one failed. The failure was most probably a consequence of initial disturbance during the walk-over survey during the sensitive egg laying stage

A fourth nest site was located approximately 170 m from the works area. In this instance, the construction work was partially obscured due to the topography and was confined to a short period of access track construction; therefore, it was decided to allow works to proceed with care. A visual screen on the edge of the works area was erected. The nest site was continuously monitored by the ECoW team through the two days of track works and then at a lower intensity over the next two weeks (monitored twice daily for 2-3 days; every second day for 4-10 days). The incubating female bird was radio-tagged so monitoring was undertaken from outside the 200 m buffer to minimise disturbance. The adult bird remained on the nest throughout the construction work and for the following 2-3 days. Regular radio signals were recorded from the nest site for 10 days after completion of the construction work but a visit a week later (prompted by a lack of radio signal) revealed that the nest had failed. This failure was considered to have most likely been due to predation given the absence of any eggshell around the nest site.

Conclusions

The intensive nightjar monitoring work undertaken on behalf of Vattenfall Ltd at Pen y Cymoedd windfarm during baseline studies (2011, 2013) and windfarm construction (2014) has provided a good understanding of how nightjars use the site and respond to construction activity in the area. We draw the following conclusions based on the data collected during the 2014 construction period:

- Nightjar display activity (i.e. churring) does not always correspond to the location of an active nest site;
- Numbers of churring males do not accurately translate to numbers of breeding pairs;
- The territorial response elicited by a tape-lure is a poor predictor of nest location although it may indicate an increased probability of an active nest site within 400 m;

- A lack of display activity during both listening and tape-luring surveys (two visits) at the work site and in an adjacent 400 m buffer provides reasonably robust evidence of nest site absence;
- Tape-luring for mist net capture attracts more male birds than females;
- A combination of radio-tracking and pre-construction walk-overs is an effective method of finding nests (although walk-over surveys must be carefully targeted to minimise the potential for nest disturbance);
- Implementation of a minimum 200 m disturbance exclusion zone was helpful in mitigating disturbance impacts at Pen y Cymoedd windfarm and may also be appropriate at other sites (although more data is needed to increase confidence in this conclusion);
- Temporary physical screens can be effective when used in conjunction with exclusion zones and if positioned at least 170 m from a nest.

Future recommendations

Any mitigation strategy for nightjars at windfarm sites should prioritise the risks of disturbance to sitting birds and damage to, or destruction of, nest sites. These impacts will be proportional to the scale of the operation, the size of the resident population of nightjars, the nesting resource and the timing of construction works. Therefore, mitigation strategies should be informed by baseline studies to gather robust demographic, habitat use and potential future habitat suitability data (i.e. felling plans).

All construction-phase mitigation strategies should, in the first instance, aim to avoid impact where possible either through appropriate sighting of infrastructure or timing of works. Where this is not possible, a suite of non-intrusive listening, call-back / tape-luring surveys and, in some cases, radio-telemetry should be used to identify nest sites. We would recommend that a minimum survey effort in suitable habitat should comprise a single listening survey visit (30 min at dusk in suitable weather) in late May to early July plus a single tape-luring survey. Where neither survey finds evidence of nightjar in a given area, it provides reasonably robust evidence of nest site absence.

In future, it may be possible to detect nightjars without risk of disturbance using automatic bioacoustic recorders, which have been found to perform better than human recorders (Zwart *et al*. 2014). Once deployed, bioacoustic recorders can be left in situ for extended periods of time, offering the potential to monitor and measure mitigation success.

These recommendations relate to construction phase mitigation strategies. Operational mitigation strategies are outside of the scope of this article although a suite of measures to reduce any potential impact has been committed to through the planning process at Pen y Cymoedd windfarm.

Acknowledgements

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About the Authors

Mike Shewring – Senior Ecologist at Natural Power Consultants Ltd. Mike is the ECoW team lead for the Pen y Cymoedd windfarm development. Mike specialises in bird and bat ecology and in particular the potential impacts of renewable energy schemes on these species groups.

Contact Mike at:
mikes@naturalpower.com

Dan Carrington – Ecological Clerk of Works at Natural Power Consultants Ltd. Dan is a highly experienced ECoW currently working full time on the Pen y Cymoedd windfarm development.

Contact Dan at:
danc@naturalpower.com

Buzzard found in short grass beneath single turbine, Co. Derry (decapitated). © John Clarke.

A Review of Bird Strike Mortality at Irish Onshore Windfarms

Robert Fennelly MCIEEM
Jacobs Engineering

Keywords: bird monitoring, carcass search, Ireland, statistical bias, turbines

This article reviews bird strikes at Irish onshore windfarms based largely upon unpublished accounts and expert opinion. The level of carcass searching is estimated and the effectiveness of carcass searching methodologies is assessed. A standardised method for carcass searching is recommended for Ireland and the UK.

Background

Since the construction of the first windfarm at Bellacorrick, Co. Mayo, in 1992, a wide range of bird surveys have been undertaken at proposed windfarm sites on the island of Ireland ('Ireland' hereafter includes Northern Ireland and the Republic of Ireland), primarily in support of planning applications. However, neither the amount of bird survey work at operating windfarms nor estimates of actual bird fatalities have been documented in Ireland (or the UK) to date, despite their obvious value in monitoring and measuring mitigation success.

Percival's seminal paper *Birds and Windfarms in Ireland* (Percival 2003) assessed potential rather than actual effects and did not comment on whether collisions and/or carcass searching were reported in the Irish peer-reviewed literature or 'grey' literature. No Irish bird monitoring reports were cited in the global reviews by Langston and Pullan (2004) and Hötker *et al*. (2006), although numerous British windfarms were cited in both reviews. Only two published studies have reported suspected or observed bird strikes at Irish windfarms. Scott and McHaffie (2008) were the first to publish carcass searching results. They reported several scavenged carcasses near turbines (cause of death unknown) at a windfarm in Co. Antrim, as well as a hen harrier *Circus cyaneus*, common buzzard *Buteo buteo*, several hooded crows *Corvus cornix*, and a raven *Corvus corax* carcass found near turbines with severed wings and other physical injuries consistent with force trauma. In 2010, Cullen and Williams reported the first observed fatality from a turbine strike, of a Eurasian sparrowhawk *Accipiter nisus* on an unnamed Co. Tipperary windfarm.

In neighbouring Great Britain, by way of contrast, with its broadly similar avifauna, there are many more published records of turbine strikes. For instance, Percival twice reviewed collisions on British windfarms from the peer-reviewed and grey literature (Percival 2000, 2005). A more recent study

by Duffy and Steward (2008) in Scotland, published on the website of the Natural Research Group (www.natural-research.org), recorded several probable passerine, raptor and game bird turbine fatalities during carcass searches over a 12-month period at the Braes of Doune windfarm. Newton and Little (2009) published a review of studies of shoreline bird carcass searches near the coastal Blyth Harbour windfarm and collated data spanning an unparalleled 11-year period which indicated mostly gull and some eider *Somateria mollissima* turbine fatalities.

The review reported in this article is the first to assess bird strikes at windfarms in Ireland. Due to the sparse published record, this study relied heavily on unpublished accounts and expert opinion from professional ornithologists. This study also estimates the amount of carcass searching that has or is being conducted on Irish windfarms, and assesses the methodology.

Objectives

1. Assess the relative value of different methods of gathering data on turbine strikes on birds.
2. Generate a species list of probable/confirmed turbine bird fatalities on Irish windfarms (excluding possible strikes) for the period up to November 2013.
3. Estimate the amount of carcass searching effort on the c. 193 windfarms operational in Ireland at the time of this review (Irish Wind Energy Association 2013).
4. Critically assess carcass search methods with reference to the use of dogs, survey effort, and correction for searcher efficiency and carcass removal by scavengers.

Methods

Four methods were trialled to collect carcass data and information on search methodology.

1. Publicly available, online sources were searched for peer-reviewed, government and other reports.
2. Online, local authority planning portals in the Republic of Ireland were used to search for planning reports from a random selection of operational windfarms listed on the Irish Wind Energy Association (IWEA) website.
3. A data request was sent to the British Trust for Ornithology's (BTO) Ringing Scheme for historical ringing recoveries of dead or injured birds in Ireland assigned the circumstance code *'Found Dead at Site of Wind Turbine'*.
4. An extensive consultation exercise included:
    - Distributing questionnaires at a Northern Irish BTO conference (November 2012) and an Irish Raptor Study Group (IRSG) conference in Dublin (February 2013);
    - Consulting ornithologists in the Irish wind energy sector using CIEEM's online Professional Directory using search terms relating to renewable energy and bird survey;
    - Consulting the Northern Ireland Environment Agency's (NIEA) Ornithology Officer, who receives carcass search reports on a nationwide basis for Northern Irish windfarms; and
    - Consulting a number of public authority Biodiversity Officers and Heritage Officers, and National Parks & Wildlife Service (NPWS) staff in the Republic of Ireland (RoI) to request carcass search reports (a small 'random' selection responded to requests for data).

Reliability of 'Strike' Records: Where carcasses were reported from windfarm sites, the likelihood of each bird fatality having been caused by a turbine strike was determined as either 'confirmed', 'probable', or 'possible' by questioning respondents in accordance with the following criteria:

- Confirmed – Turbine strike observed or post-mortem indicated turbine strike.
- Probable – Carcass found with evidence of trauma consistent with turbine strike.
- Possible – Injuries to carcass unknown or carcass scavenged.

'Possible' turbine fatalities were considered unreliable and excluded from subsequent analysis.

Carcass search methods: The following details were recorded:

- Were dogs used to find carcasses?
- What was the search effort (i.e. frequency of search visits)?
- Were scavenger trials conducted (i.e. use of 'dummy' corpses to measure removal rate)?
- Were searcher efficiency trials conducted of human and/or canine surveyors?

Carcass information: The following details were recorded:

- Species of bird carcass or lowest taxonomic rank where only partial remains were available.
- Evidence of trauma ('unknown', 'none evident', 'broken bones', 'severed body parts').
- Evidence of scavenging (Yes/No).
- Post-mortem examination (Yes/No).

Results & Discussion

1. Value of different data gathering methods

Most data came from consultation with ecologists, and the Ornithology Officer of the Northern Ireland Environment Agency. The remaining data were from the peer-reviewed literature, and Non-Governmental Organisations (Figure 1). The public authorities consulted in the Republic of Ireland, which included the Birds Unit of the National Parks & Wildlife Service (NPWS), had no data.

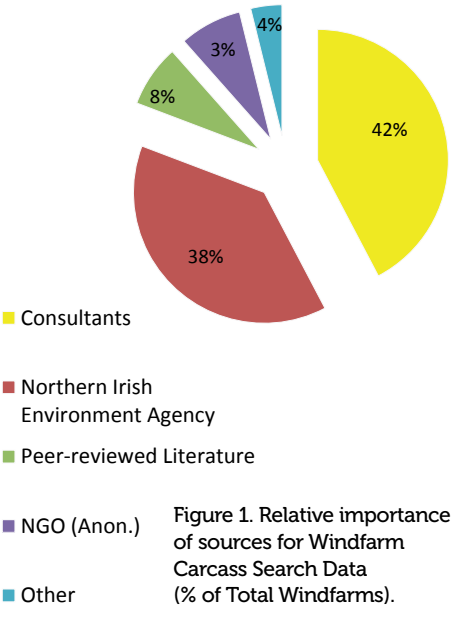

Figure 1. Relative importance of sources for Windfarm Carcass Search Data (% of Total Windfarms).

Searches of RoI planning portals yielded a sample of eight windfarms for which bird monitoring was a planning condition. Conditions required that monitoring reports be submitted to a variety of different recipients, namely: both the NPWS and planning authority (n=5); the planning authority alone (n=1); and Birdwatch Ireland (n=1). The planning condition for one windfarm specified no recipient for the monitoring reports. It was known that at least one year's monitoring had been completed at one windfarm (planning authority also known) and the report had documented bird strikes. No monitoring reports, including carcass-search reports, were available on the Local Authority planning portals either for this windfarm or the other seven windfarms.

No data were found in 'grey literature' available online. No BTO ringing recoveries in Ireland were *'Found Dead at Site of Wind Turbine'* from 1992 to 2012. Thereafter, the records and expert opinion of consultant ornithologists working in the wind energy sector was adjudged the best source of data.

2. List of turbine strikes

Including records from Scott and McHaffie (2008) and Cullen and Williams(2010), a total of three 'confirmed', 22 'probable', and 12 'possible' turbine fatalities were recorded (Table 1). The proportion of fatalities by taxonomic group (i.e. family or order) is shown in Figure 2. Carcasses in the 'possible' strike fatality category included some uncommon species in Ireland (e.g. ring ouzel *Turdus torquatus*) and some species of little or no known vulnerability to turbine strikes (e.g. Eurasian curlew *Numenius arquata*; EC 2010). However, these records were considered unreliable and were not considered further.

3. Amount of carcass searching in Ireland

Formal carcass searches were reported from 22 windfarms in 14 counties, equating to 11% of all windfarms in operation at the time of the study (n=193 windfarms; IWEA 2013). The actual number of Irish windfarms searched is unknown. However the broad reach of the consultation exercise is considered likely to have captured most carcass search data.

Table 1. Bird Fatalities from 25 windfarms (probable and confirmed combined). Colour-coded for Conservation Concern in Ireland (Red = High; Amber = Medium; Green = Low; Colhoun & Cummins 2013)

Species	Scientific name	No. carcasses	% Total
White-tailed sea eagle	*Haliaeetus albicilla*	2	8
Black-headed gull	*Chroicocephalus ridibundus*	1	4
Kestrel	*Falco tinnunculus*	5	20
Snipe	*Gallinago gallinago*	2	8
Hen harrier	*Circus cyaneus*	1	4
Merlin	*Falco columbarius*	1	4
Starling	*Sturnus vulgaris*	1	4
Buzzard	*Buteo buteo*	2	8
Chaffinch	*Fringilla coelebs*	1	4
Hooded crow	*Corvus cornix*	3	12
Raven	*Corvus corax*	1	4
Redwing	*Turdus iliacus*	1	4
Rook	*Corvus frugilegus*	1	4
Sparrowhawk	*Accipiter nisus*	2	8
Willow warbler	*Phylloscopus trochilus*	1	4
	Total	25	100%

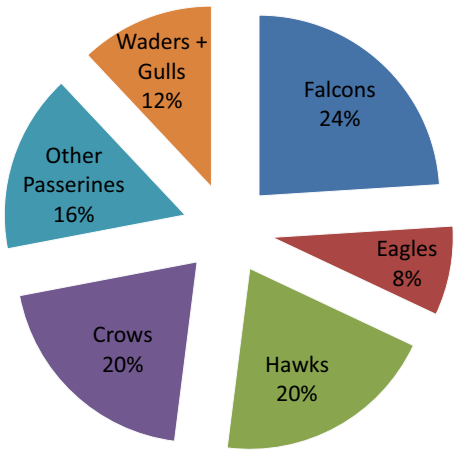

Figure 2. Turbine Fatalities by Taxonomic Group. Probable + Confirmed carcasses combined (n=25).

4. Critique of carcass search methodologies

Dogs were used to search for carcasses on three of the 22 windfarms (13%) assessed in this review.

Dogs are significantly more efficient than humans at finding carcasses (Paula *et al*. 2011) but are likely to result in additional expense and will impose some constraints on survey design (e.g. landowner concerns regarding risks to cattle, disturbance to nesting birds). Trials in Portuguese scrublands using a trained German shepherd dog detected 96% of bird and bat carcasses, compared to a detection rate of 9% by humans alone (Paula *et al*. 2011). Hunting primarily by scent, a dog's search efficiency is generally likely to be much less affected by vegetation density compared to humans (Homan *et al*. 2001), although dogs cannot safely search some habitats (see Stanhope, pp. 29-32 this issue). Many windfarms in Ireland, including at least half of those assessed in this review, are dominated by densely vegetated moorland or forest habitats.

Although the results of human and dog searches were not compared directly, it appears likely that carcass numbers reported in this review (Table 1) are underestimates because dogs were not used on 77% of windfarms. Furthermore, it is likely that additional bird species would have been reported if dogs had been used more widely, particularly smaller birds which are frequently overlooked by humans searching denser vegetation (Smallwood 2007).

Springer spaniel used in carcass search on windfarm in Republic of Ireland.
© INIS Environmental Consultants Ltd. Photo by Howard Williams.

The carcass search effort across the 22 windfarms varied widely (Figure 3), with the majority searched weekly or fortnightly (52%). Evidence from bat carcass searches in Europe and the United States (reviewed in Jones *et al*. 2009) indicated that weekly searches provide reasonable survey effort. Where searches are conducted less frequently than weekly, (i.e. 73% of Irish windfarms reviewed), there is a risk that scavengers will remove significant numbers of carcasses.

Searcher efficiency trials were conducted on nearly a third of windfarms reviewed (29%) and scavenger removal trials were conducted on 16% of windfarms. Respondents were not asked about other important aspects of the methodology, such as the size of the search plot and whether the order in which turbines were searched was randomised to minimise search-effort bias (see also Stanthorpe, pp. 29-32 this issue, in relation to dog 'enthusiasm').

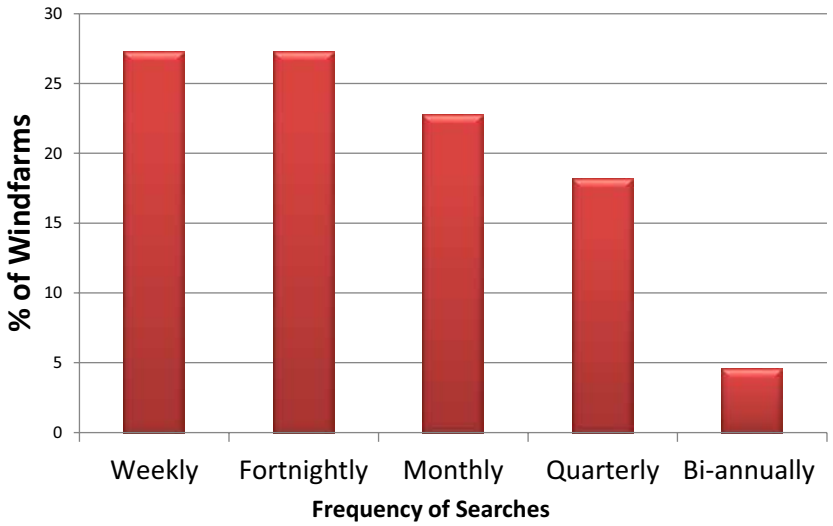

Figure 3. Carcass Search Effort (n=22 windfarms).

Conclusions and Recommendations

The analysis carried out in this review identified the following key points:

1. There is no centralised repository for bird monitoring reports In the Republic of Ireland, where searching of planning portals was inefficient and fruitless in the author's experience. In Northern Ireland, all monitoring reports are held in a central repository by the NIEA Ornithology Officer. This greatly facilitates assessments of carcass searching.
2. The evidence base could be increased if an anonymous bird strike recording system was adopted in Ireland or UK-wide, based on that used by Scottish Natural Heritage (SNH 2015).
3. Search methods should be standardized in Ireland and the UK. The excellent SNH guidance on carcass searching (SNH 2009) could be revised to prescribe more clearly, if possible:
    a. when carcass searching is needed;
    b. when to use dogs, and what dog breeds and/or training are needed;
    c. the minimum survey effort for searching, both temporally and spatially;
    d. minimum standards for scavenger- and searcher-efficiency trials

Dog searching windfarm.
Photo by Howard Williams.

4. If search methods in Ireland and the UK were standardized, statisticians would have access to a large sample size to robustly assess the effect of windfarm design on bird strikes. This would be invaluable in designing future mitigation strategies.
5. Based on published research in Europe, the USA, and the UK (this issue), the use of dogs is likely to be a critical factor in detecting bird carcasses, particularly in dense vegetation. Importantly, dogs are likely to greatly reduce the risk of obtaining 'false zeros' which underestimate windfarm impacts, but cannot be corrected using values for searcher efficiency or scavenger removal rates.

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About the Author

Robert Fennelly is a full CIEEM member and Senior Ecologist working in the Dublin office of Jacobs Engineering. Robert studied and worked as a plant taxonomist in Asia before entering consultancy, and has worked in the UK and Ireland. Robert is keen to disseminate practical research of value to the consultant community, and is grateful to CIEEM for the forum offered by *In Practice*.

Contact Robert at:
robert.fennelly@jacobs.com

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Stanhope, K. (2015). Ecological monitoring using wildlife detection dogs: bat carcass searches at the Wanlip Wind Turbine. *In Practice – Bulletin of the Chartered Institute of Ecology and Environmental Management*, **88**: 29-32.

Ecological Monitoring using Wildlife Detection Dogs: Bat Carcass Searches at the Wanlip Wind Turbine

Keywords: bat fatality, bat monitoring, carcass searches, predation trials, search efficiency trials

Katrena Stanhope CEnv MCIEEM
Atkins Ltd.

Planning permission is often conditional upon post-construction, ecological monitoring of wind turbine developments to assess impacts on wildlife. Ecological monitoring at wind turbines frequently focuses on bird and bat carcass searches, which in some cases can be carried out more effectively and efficiently using wildlife detection dogs. This article describes the use of wildlife detection dogs to identify bat carcasses at Wanlip wind turbine, demonstrating the value of this novel monitoring option as an effective method to be used alongside other ecological monitoring methods.

Introduction

There is a risk of bird and bat fatalities from collision with turbine blades when a windfarm is operational. Ecological monitoring, to try and quantify this impact, is a common requirement when planning permission for wind turbines is granted, which can be required for several years after the windfarm becomes operational. Ecological monitoring for bat carcasses carried out by humans is constrained by the limitations of our vision. The common pipistrelle *Pipistrellus pipistrellus* can weigh just 5 g and measure only 7 cm from head to tail; a dead pipistrelle against a backdrop of vegetation or even bare brown earth can be extremely difficult to spot. Wildlife detection dogs have the potential to be much more effective than humans, using scent to detect carcasses rather than visual cues. This is particularly advantageous in tall and/or thick vegetation.

There is little published information from the UK on the use of wildlife detection dogs to guide ecological monitoring surveys. This article describes the use of wildlife detection dogs to detect bat carcasses at Wanlip wind turbine in Leicestershire. To the best of the author's knowledge, the use of detection dogs for commercial bat monitoring at this site is the first carried out in the UK. Based on the Wanlip wind turbine case study, bat carcass searches by humans alone would be ineffective, particularly in areas of dense vegetation. In contrast, the use of the detection dogs is a valid and effective method to be used alongside other monitoring methods.

Wanlip wind turbine

Wanlip wind turbine was constructed at Wanlip Sewage Treatment Works between 2013 and 2014. The bat survey report and Environmental Statement prepared to support the planning application for the turbine concluded that the presence of a single turbine at Wanlip was unlikely to have significant impacts on populations of bats. However, planning conditions required monitoring of bat mortality for three years post-construction.

There is currently no agreed procedure for post-construction wind turbine monitoring in the UK, although methods have been developed in North America and Europe. Atkins Ltd devised the methodologies for monitoring the Wanlip wind turbine on behalf of Severn Trent Water Renewables (Atkins 2012), including searches for bat carcasses. The methodologies were agreed with Charnwood Borough Council in 2013. The first year of bat monitoring was carried out between April and September 2014 (poor weather prevented monitoring in March and October).

The field surrounding the wind turbine is disused arable land and now supports tall ruderals, including dense thistles growing to head height. The lack of vegetation control was required by a planning condition in order to deter wintering birds such as lapwing *Vanellus vanellus*, for which there was a potential risk of collision with the turbine blades. Due to the difficulty of visually detecting bat carcasses in a large search area with overgrown vegetation, the use of wildlife detection dogs was proposed as part of the monitoring methodology for bat carcass searches. The search area covered a 132 m radius surrounding the turbine base; equal to the height of the turbine mast plus blades. Research has found that most bats will be found within 50 m of the turbine base (Johnson *et al*. 2003, Arnett 2006). However, a larger search area following a review of some North American studies summarised by the Bat Conservation Trust and University of Bristol (2009) was used to account for bats being thrown or blown further from the turbine base.

Monitoring of bats at the wind turbine also involved activity transects and static detection, although these methods are not discussed further in this article.

Bat carcass searches

Wagtail UK Ltd was approached by Atkins in 2013 to conduct the bat carcass searches. The company was established to offer detection dogs for criminal investigations, for example in the search for drugs, firearms, explosives, illegal immigrants and human corpses. The detection dogs and their handlers are trained to British Military and Police standards. Since 2011, Wagtail has been developing some of their dogs for specialist wildlife detection, recognising this as an area of potential growth, starting with Twister, a springer spaniel who was trained in the detection of dead bats (see Figure 1). In this study, Twister and two younger dogs

Figure 1. Louise Wilson, former Director of Wagtail UK Ltd, with her springer spaniel Twister. Reproduced with the permission of Wagtail UK Ltd.

(Ned and Luna, one- and five-years-old respectively) were trained and used as bat carcass detection dogs.

Dog handlers from Wagtail were trained by Atkins ecologists in the bat carcass search methodologies so that the dog handlers could conduct the visual transect searches for bat carcasses on the same visit as they carried out dog searches, for cost efficiency.

The transect methodology involved walking at 5 m intervals throughout the search area, shortly after sunrise, visually searching the ground on either side of the transect for dead bats. Easy-to-recognise markers within the turbine field were used to indicate the edge of the search area, including distance markers extending to the north-west and north-east of the turbine location at 30 m intervals, which were erected to aid noise monitoring. Following the visual transect, the handler would then cover the search area with the detection dogs. It was concluded early on that human visual transects were worthless in some areas of overgrown ruderal vegetation, as the surveyor could not see the ground. These areas were searched solely using the detection dogs.

Searcher efficiency trials

Trials were carried out to test the effectiveness of the detection dogs in finding bat carcasses. Searcher efficiency trials were carried out in April, June and September to allow for variation in vegetation cover.

The trials involved an Atkins ecologist placing five to seven bat carcasses within the search area immediately prior to one of the scheduled carcass searches (carried out by staff from Wagtail UK who were unaware of the location of the carcasses). The carcass search would then be carried out as usual, recording any bat carcasses that were found. The Atkins ecologist would then review the bat carcass finds to determine how many of the known carcasses had been identified.

The Atkins ecologist tried to ensure that no obvious paths were left in vegetation leading directly to the distributed carcasses, and some areas were walked but no carcass left in order to leave a 'false trail'.

The bat carcasses used during the searcher efficiency trials were 'wet': they were defrosted for use during the trials before being refrozen for the next trial. These carcasses may have given off a stronger scent than any fresh bat carcasses. This was evident during the June and September searcher efficiency trials when a very old, desiccated bat carcass was used, which had lost any noticeable smell to humans, and the detection dogs were unable to locate it. However, the detection dogs were able to pick up the scent of fresher bat carcasses used during the searcher efficiency trial, with all 'fresh' bat carcasses being found by the detection dogs during the sessions in September when the two younger dogs, Ned and Luna, were used. Twister, the springer spaniel used during the earlier searcher efficiency trials, managed to find a maximum of three out of five bat carcasses without help, finding the other two carcasses only when directed to the approximate location of the carcasses.

There was no direct comparison of the time it took a human to find bat carcasses compared to the detection dogs as the dogs could cover a much larger area including areas of tall ruderal vegetation that could not be checked visually. The human surveyors found none of the bat carcasses set out during the searcher efficiency trials.

No bats that had died as a result of wind turbine collision were found during the bat carcass searches.

Practicalities

Recording the search area: Whereas the visual transects for humans were based on a repeatable methodology, it was more difficult to make the detection dogs follow a set transect. In order to record the search area covered by the dogs, the dog handler carried a smart phone with a GPS recording application. An example of a screen shot of the application collected during a carcass search in July 2014 is shown in Figure 2.

Dog 'enthusiasm': The 'pilot' dog used early in the monitoring period, Twister – a nine-year-old springer spaniel – became tired and less interested toward the end of the search, particularly when no carcasses were found and therefore there was no 'reward'. Also, due to the uneven terrain and vegetation cover (see below) the search area took between two and four hours to cover thoroughly (including both human transects and detection dog search). Detection dogs usually work 20

Figure 2. Screenshot of GPS recorder used during carcass search in July 2014.

minutes at a time with a rest in-between, hence the search area proved to be too large for a single dog to cover on one visit. Therefore, the search area was divided into sectors, so that one dog could rest whilst the other searched a sector (see Figure 3). The blank area on Figure 3 could not be searched for health and safety reasons as it is within the operational sewage works.

The younger dogs (Ned and Luna) who shared the search later in the monitoring period were found to conduct the searches more quickly and accurately and tended to keep their interest in the search for longer. There was a learning curve both for the dogs and handlers, and the training for Ned and Luna was refined using knowledge of the site.

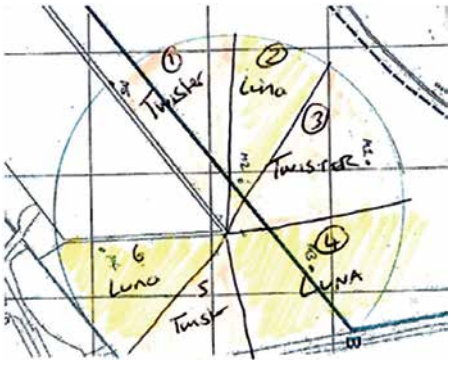

Figure 3. Examples from survey notes of the sectors used during the bat carcass search in May 2014.

Habitat in the search area: The swards of tall ruderal plants including thistles made some parts of the field impossible to visually search for bat carcasses. This author, during the searcher efficiency trails, struggled to spot a bat carcass on the ground that they had placed there only minutes before. The use of the detection dogs reduced this limitation. However, neither the dogs nor the handler could search within areas of dense, tall thistles due to health and safety considerations (the dogs developed blisters when trying to search these areas early in the monitoring period) and these areas were not searched from late June onwards. Before the 2015 monitoring period, Severn Trent Water aim to control the growth of thistles and areas of dense, tall ruderals using chemical or mechanical control.

Weather conditions: Scent molecules can be suppressed in damp conditions. Therefore, on humid mornings there were likely to have been limitations to the distance that scent carried from any bat carcasses. This would have lessened during the search as the sun rose, air temperature increased and the humidity in the air decreased. However, the searches had to begin early in the morning, at a time of high humidity and dew cover, to reduce the risk of predation of bat carcasses. Weather was monitored for five days preceding a scheduled bat carcass search to ensure favourable weather conditions.

Sample 'familiarity': There was initially concern that 1) the dogs would only be able to detect bat species used for their training (common pipistrelle, Natterer's *Myotis nattereri* and brown long-eared bats *Plecotus auritus*); and 2) the dogs would only be able to detect those specific carcasses that had been used during training. Bat carcasses used in the searcher efficiency trials used both 'training' bats and new bats introduced by Atkins ecologists and the dogs were able to detect both, alleviating the second concern. Due to the lack of availability of carcasses from a range of bat species during the searcher efficiency trials, we have so far been unable to test the first concern. An attempt to source the carcasses of other bat species will be made during the 2015 monitoring period.

Future use of wildlife detection dogs

Rodrigues *et al*. (2015) includes the use of detection dogs as a method for wind turbine monitoring. During trials in the US (Bats and Wind Energy Cooperative 2005), detection dogs have been shown to be more effective than humans at finding bat carcasses. Recent research carried out in the UK for Defra by the University of Exeter on the effectiveness of detection dogs compared to human observers recommends dogs as an effective means of monitoring bat fatalities, particularly when a high degree of search accuracy is important (Methews *et al*. 2013). It is anticipated that the University of Exeter's research project relating to bats and wind turbines, carried out over the last four years, will be published by Defra in 2015.

In the UK, wildlife detection dogs are already being used to detect great created newts *Triturus cristatus* in a pilot study for Amphibian and Reptile Conservation (ARC) UK; to detect dormice *Muscardinus avellanarius* nests for Cheshire Wildlife Trust; and to detect pine marten *Martes martes* scat for the Vincent Wildlife Trust. International work includes the detection of cheetah *Acinonyx jubatus* scat in South Africa. It is essential that this work is only carried out by trained handlers, for the scientific validity of the work and to protect the welfare of both the dogs and the wildlife.

Possible future uses could include locating live bats in roosts, and searching for dormice hibernation nests. This non-invasive method may be used to reduce the risk of injuring animals during hand searches carried out by ecologists, which may also damage habitat, where the presence of protected species is considered to be a low risk.

While there are many applications for ecologists to use detection dogs, there is also a need for standard methodologies to develop this new tool in wildlife detection and monitoring.

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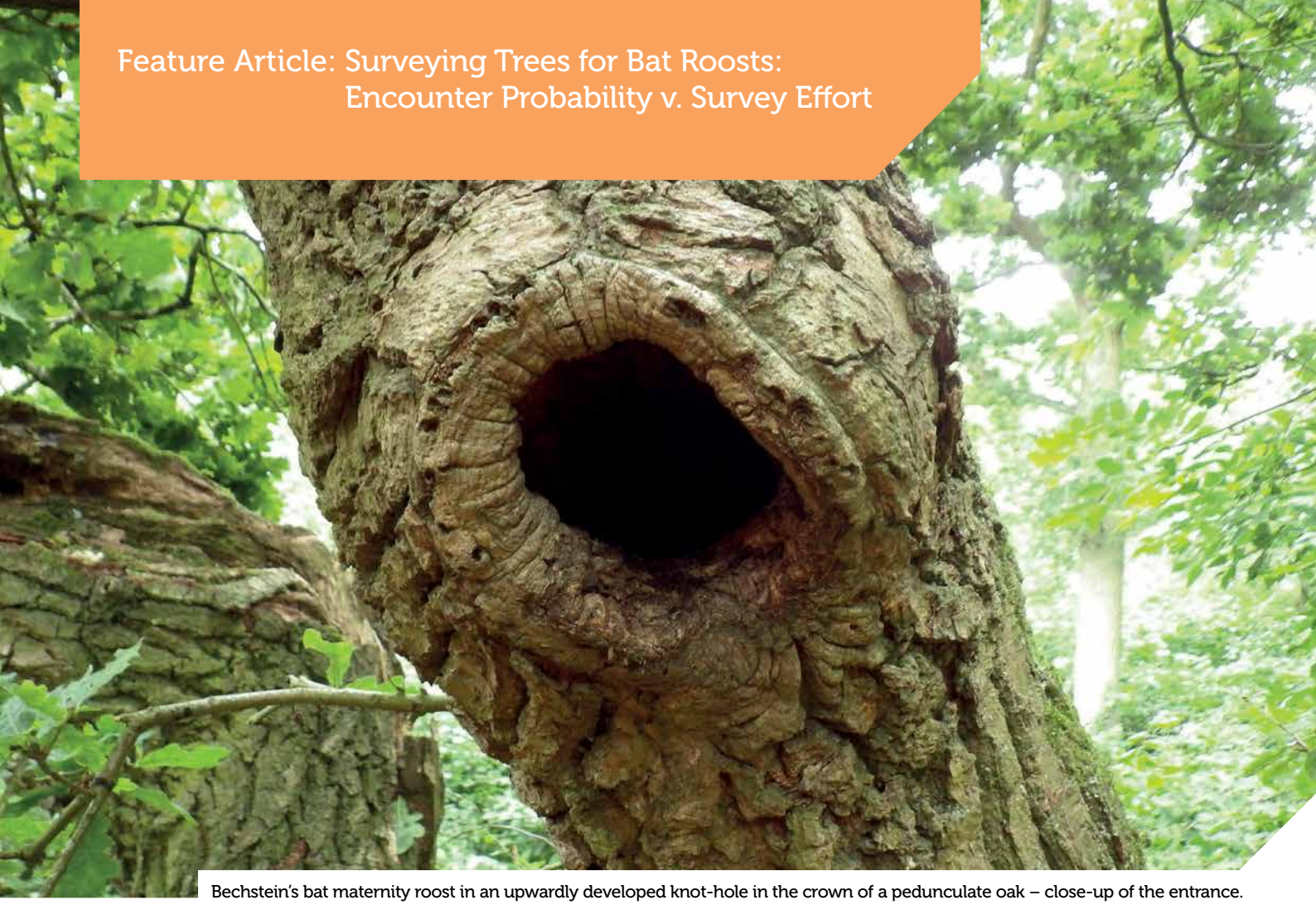
About the Author

Katrena Stanhope CEnv MCIEEM is an Associate Director of Ecology at Atkins Ltd and a Chartered Environmentalist. Kat has been a professional ecological consultant for over fifteen years, with experience relating to biodiversity issues in the context of environmental management and assessment, and the land use planning system including complex monitoring schemes.

Contact Kat at:
Katrena.Stanhope@atkinsglobal.com



Bechstein's bat maternity roost in an upwardly developed knot-hole in the crown of a pedunculate oak – close-up of the entrance.

Surveying Trees for Bat Roosts: Encounter Probability v. Survey Effort

Henry Andrews CEcol MCIEEM
Bat Tree Habitat Key (funded by AEcol)

Mark Gardener
DataAnalytics

Keywords: Bat Tree Habitat Key, computer modelling, evidence-supported, quantitative bat survey effort

Monitoring and measuring mitigation success frequently relies upon accurate survey, particularly of protected species such as bats. An evidence-base has been lacking in respect of recommendations regarding survey intervals and intensity in relation to bat roost surveys of trees.

This article presents a descriptive summary of evidence in support of survey intervals, and includes an encounter probability model for survey intensities during the maternity season. Although the method is primarily for assessing the status of Potential Roost Features in trees, it is likely that it would be effective for assessing the status of bat-boxes used as compensation for the loss of tree-roosts as a result of development. The key message is that monitoring bat roosts must be carefully planned and timed to maximise the probability of encountering bats and to return accurate survey results.

Background

This article was written as part of the *Bat Tree Habitat Key (BTHK)* project. *BTHK* is a dichotomous key to bat roosts in trees and includes an evidence-supported account of how Potential bat-Roost Features (PRFs) form in trees and which bat species use them, when and for what purpose. The document can be downloaded for free at www.aecol.co.uk (http://www.aecol.co.uk/Pages/48/Research--Development---Bat-Tree-Habitat-Key.html).

The project has now been widened to provide an evidence-base in support of recommendations for 'climb-and-inspect'

Bechstein's bat roost in sessile oak.

Close-up of the entrance.

bat roost surveys of trees. As a part of this aspect of the project a computer model was created to help predict encounter probabilities. This article provides a summary of the results.

Whilst not originally intended as a monitoring method, it is likely that the model would be applicable to encounters of bats within bat-boxes used in an effort to compensate for the loss of natural roosts. The model might therefore be effective for use in monitoring schemes where a count of bats using the boxes was desirable. The model parameters may need slight alteration; the authors welcome empirical data that may help refine the model.

Introduction

All bat species native to the British Isles and their roosts are legally protected under UK and EU law. Accordingly, it is necessary to identify the species and numbers present within a roost when surveys are carried out in support of planning, in advance of works that might destroy or disturb a roost, and for surveillance as part of a wider monitoring scheme.

Published guidance for bat surveys (e.g. Mitchell-Jones 2004, Mitchell-Jones & McLeish 2004, Hundt 2012) provides only very general advice for surveys of PRFs in trees, particularly in terms of the recommendations for survey effort that (in some cases due to a historic paucity of data) are not demonstrably supported by evidence. Experience has shown that surveys using these methods typically fail to encounter barbastelle *Barbastella barbastellus*, Bechstein's bat *Myotis bechsteinii*, Alcathoe's bat *Myotis alcathoe*, Natterer's bat *Myotis nattereri* and brown long-eared bats *Plecotus auritus*, even where dropping samples have been collected and identification confirmed by DNA analysis. As a result, no count of bats has been possible. In order to maximise the chances of encountering the bats within their roosts a protocol is needed that will define a probability of encounter with which surveyors can have a reasonable level of confidence. Specifically, it is necessary to understand:

1. What the optimum search periods are; and
2. How many visit would be necessary within those periods in order to achieve a measurable likelihood that, if a PRF is a roost, bats will be encountered.

Optimum search period

Published literature, bat-box surveillance and reference to the *Bat Tree Habitat Key* database (which holds detailed records of tree-roosts occupied by nine bat species) suggest that the peak periods for roost occupancy differ between species, and that different species may use the same roost at different points in the year. Therefore, a positive record of bat presence does not mean this is the only species that uses the roost; other species may be present in different numbers in other months. Mitchell-Jones (2004) breaks the seasons down into *winter, maternity, mating* and *flux*, as follows:

Winter – Peaking from November through March. Records of aggregations of bats occupying trees in winter relate to soprano pipistrelles *Pipistrellus pygmaeus* in Douglas fir *Pseudotsuga menziesii* and Scots pine *Pinus sylvestris* (R. Koczy pers. comm.). All other records relate to individual barbastelle, noctules *Nyctalus noctula*, common pipistrelles *Pipistrellus pipistrellus* and brown long-eared bats in December to March.

Maternity – The maternity season extends broadly from May to August, during which period the females aggregate in groups.

Mating – During the mating season, peaking in September, many PRFs can be occupied by mating pipistrelles (even though maternity aggregations of pipistrelles are rarely found in trees) as well as other species that were present in the maternity period. In *British Bat Calls*, Russ (2012) notes that although the

pipistrelles may give advertisement calls at any point over the active year, there is a sudden peak in early September, which drops dramatically in early October. Many accounts of mating ecology (e.g. Dietz and Pir 2011) suggest territorial behaviour, with males defending roosts. It is likely, therefore, that these roosts are occupied more or less continuously by the same male from early September to early October.

Flux – April is a grey area for bat occupancy; the *BTHK* database holds no records of bats occupying trees during April. Winter roosts are usually vacated in March (H. Andrews pers. obs.), but the *Myotis* bats do not return in any numbers until mid-May.

It is clear that there is no single optimum search period and therefore PRF searches are needed in the winter, maternity, mating and flux (April) periods in order to get the full picture. This may appear obvious, but we believe it is vital to provide an evidence-base in order to demonstrate this robustly.

Survey intensity

There are insufficient data to calculate encounter probability models for the mating, winter and April 'flux' periods. However, a single visit to a PRF in the latter half of September *may be* sufficient to find proof of a mating-roost. It is, however, important to be aware that a single visit that doesn't encounter clear evidence of a roost is insufficient to conclude *absence*. During the winter period, two visits, firstly in late-November to mid-January and secondly from mid-January to early-March, should detect overwintering bats. Survey visits in April have so far not yielded positive results.

Dietz and Pir (2011) provide a comprehensive monograph of Bechstein's bat that includes a detailed account of summer roost-switching behaviour. Other, less detailed accounts indicate that barbastelle, Natterer's bat and brown long-eared bats also exhibit similar roost-switching behaviour. It is therefore possible that a method based on the roost-switching behaviour of Bechstein's bat would work when applied to other tree-roosting species in Britain.

Dietz and Pir (2011) suggested that under natural conditions a maternity colony of Bechstein's bats switched roosts on average every 1.5 days in May and June, every 3.3 days in July and every 4.8 days in August. They also reported that the maternity colony used a complex of 35 to 40 PRFs each year, from an overall resource of more than 50 PRFs. Finally, during May, June and July the colony typically was split into two subgroups, each occupying its own individual tree, but from August onwards the colony divided into three or more subgroups as weaning proceeded (Dietz and Pir 2011). Using this account, it is possible to define a reliable interval for survey visits that might be applied to establish the status of all tree-roosting bat species in a PRF in the summer season.

Recording bat roosts

Barbastelle in a frost-crack. Photo Henry Andrews

Modelling the encounter rates

The model had to incorporate several parameters in order to determine the probability of finding a potential roost feature (PRF) that is occupied, with initial values taken from Dietz and Pir (2011):

- number of PRFs in a habitat/territory;
- frequency of roost switching;
- number of sub-groups in the colony;
- number of days of (sequential) observation;
- number of PRFs under observation.

Two different forms of model were constructed using the popular statistical programming language, R (R Core Team 2013):

1. Random roost switching: under this assumption bats choose a new roost randomly and each PRF in the territory has an equal chance of being selected.
2. Sequential roost switching: under this assumption previously occupied roosts are not used and the pool of PRFs reduces over time.

The reasons for roost selection are poorly understood but there are many reasons why bats may not select a new roost entirely at random, for example shifting food resource or reduction of parasite load. The two models give different results, with the random-switching version being most conservative. The model assumes that there are three distinct periods (pregnancy, lactation and weaning), which correspond to the changes in roost-switching timing. This allows the encounter rates to be assessed for surveys that begin in one period and extend through another.

Surveys during the pregnancy period

The model demonstrates that in May and June a single visit has a 5% chance of encountering bats if the PRF is a roost. Or, to put it another way, you have a 95% chance of being there on the wrong day. Furthermore, because tree-roosting species are nomadic, two *separate* visits each have a 5% chance of encountering bats (or 95% probability of failing to detect tree-roosting bats). However, two *successive* visits have a 9.8% chance of encountering bats because, if the tree was empty on the first day, the bats may have moved into it on the second day (the probability isn't 10% because the model depends on probability theory rather than simple cumulative addition).

The key message is that bat roost surveys cannot rely on *randomly-spaced* visits to PRFs; in order to maximise the encounter probability you have to conduct surveys during *regularly spaced, sequential* visits. The next step is to determine how many visits are needed to achieve an encounter probability of 50%, 80% and 95%.

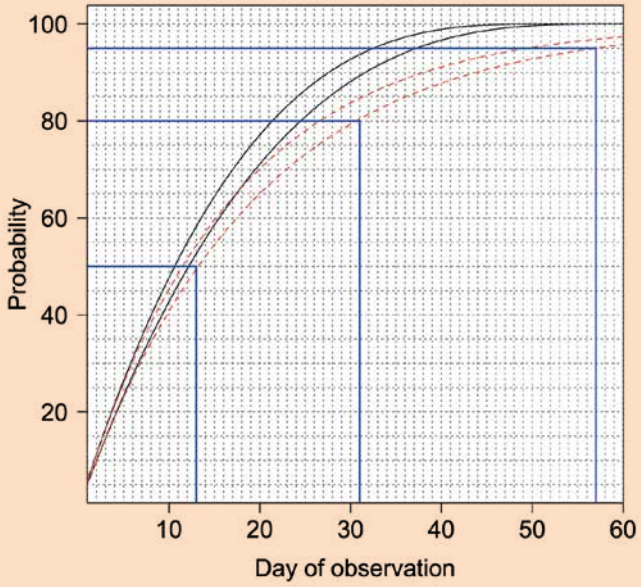


Figure 1. The encounter probability model for May and June. Horizontal and vertical lines indicate 50%, 80% and 95% probabilities and the corresponding number of sequential, required days of observation for the most conservative model.

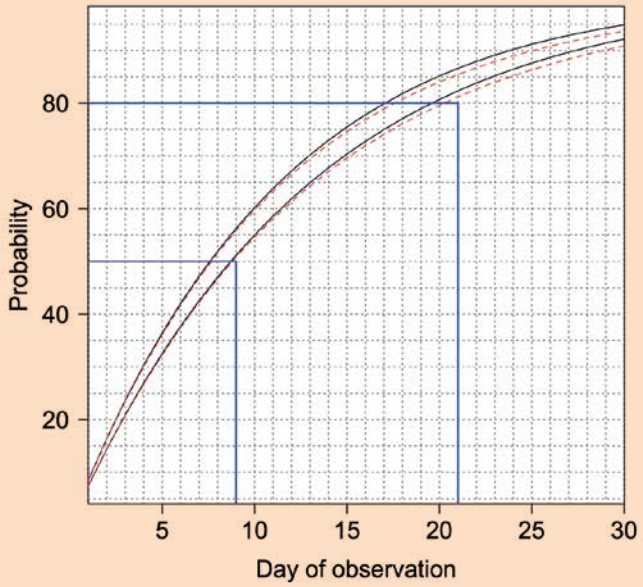


Figure 2. The encounter probability model for August. Horizontal and vertical lines indicate 50% and 80% probabilities and the corresponding number of sequential, required days of observation for the most conservative model.

Dashed red lines show probability of encounter for a random switching model (model 1, see text). Solid brown lines show probability of encounter for numbers of days of sequential observation for a sequential switching model (model 2, see text). Each model has two lines, representing different numbers of PRFs (35 and 40).

Surveys during May and June

Figure 1 shows the encounter probability model for May and June expressed as two sets of lines: the brown lines indicate what the probability of encountering bats would be if the colony moved sequentially (i.e. the bats visited each of the 40 PRFs in turn and did not re-use any sites until all 40 had been used once). The red lines show random movements (i.e. the colony may re-use certain PRFs before all 40 have been visited); the probability of encounter is lower than the 'move sequentially' scenario.

Taking the more conservative, random-switching scenario, the model demonstrates that a surveyor would need to visit the PRFs 14 days in a row in order to achieve a 50% probability of encounter; 31 days in a row in order to achieve an 80% probability of encounter; and 57 days in a row in order to achieve a 95% probability of encounter.

Surveys during July

The model for July showed similar results to that of May and June; a surveyor would need to visit the PRFs 14 days in a row in order to achieve a 50% probability of encounter and 31 days in a row in order to achieve an 80% probability of encounter. However, a 95% probability of encountering bats at a given PRF could only be achieved by visiting the PRFs every day in July plus an additional 7 days at the end of June, or alternatively continuing 11 days into August.

Surveys during August.

Figure 2 shows that during the weaning period, there is a 50% probability of having encountered bats by day 9, and an 80% probability of having encountered bats by day 21. A 95% probability of encountering bats by the end of August could only be achieved by starting to survey PRFs 5 days before the end of July.

Streamlining the survey process

We looked into two options for streamlining the process: missing days in the lactation and weaning periods when the colony is moving on average every 3.3 or 4.8 days, and increasing the number of PRFs that were surveyed.

Missing days

Although colonies do occasionally move during the day, it is more common for roost switches to be made at night. So, we can assume that in general terms the 1.5-day average will typically comprise 1- and 2-day residences. Therefore, in practical terms, visits must be made sequentially or there is a risk of sabotaging the survey. However, an alternate-day sampling strategy during July would be acceptable as there is only a low possibility that bats would come and go on the days between because they move every 3 days on average. In August the colony is roost-switching every 4.8 days, so a relatively safe option might be to lengthen the survey interval to every 3 days. The most efficient use of time is to survey throughout August as well as 5 days in July. This gives a 95% probability of encountering all bats for 13 actual visits, as shown in Table 1.

Increasing the number of PRFs surveyed

Survey efficiency can also be improved by increasing the number of PRFs inspected on each day. Table 2 shows a summary of

Table 1. Time-efficient options. If surveys are conducted on 13 days spread out as shown (yellow highlights) in July and August, there will be a 95% probability of encounter.

July						
S	**S**	**M**	**T**	**W**	**T**	**F**
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

August						
S	**S**	**M**	**T**	**W**	**T**	**F**
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

the necessary survey effort required within each of the three survey periods. The results demonstrate that the number of sequential visits required to achieve a 50%, 80% and 95% probability of encountering bats diminishes markedly the greater the number of PRFs inspected daily. Obviously, the PRF would have to be part of the same pool of resources for the group of bats under observation.

Conclusions

Bats and their roosts are legally protected, therefore the issue of encounter probability and the number of separate visits that are needed to be confident that Potential Roost Features have been robustly surveyed is clearly important in the context of development, and where surveillance is part of a wider monitoring scheme. Furthermore, it is important that professional ecologists are able to demonstrate that an evidence-base has been used to define the survey intensity recommended in specific circumstances, and if this can be quantified so much the better. By providing a demonstrable need for the levels of survey we recommend, we remove subjectivity from our methods and improve our individual reputations, and the reputation of the CIEEM and its members as a whole.

Our analysis, for the first time, provides a framework for deciding how many bat roost survey visits are necessary to achieve a defined outcome. In the long-term, after appropriate field-validation, it should be useful not only to field surveyors in quality checking their data but also to clients in understanding how much survey effort is required to properly assess potential development impacts. The model might also potentially be effective for assessing the efficacy of compensatory bat-box schemes used to offset the loss of natural roosts used by maternity colonies of woodland bats such as barbastelle, Bechstein's bat, Natterer's bat and brown long-eared bat, where the only real measure of success would be an uptake of the boxes by similar numbers of females to those encountered prior to development.

Table 2. The number of sequential visits required to reach the key percentage probabilities of encountering bats when observing 1, 2, 5, 10, 20, 30 and 40 PRFs. The number of PRFs checked each day is shown in the left column and the number of sequential visits to yield 50%, 80% and 95% probability of encounter is given for each survey period.

No. of PRFs	May/June			July			August		
	50%	80%	95%	50%	80%	95%	50%	80%	95%
1	14	31	57	14	31	----	9	21	----
2	9	21	38	9	21	----	7	16	28
5	5	10	18	5	10	19	4	9	16
10	3	5	10	3	5	10	2	5	9
20	1	3	4	1	3	4	1	3	4
30	1	2	3	1	2	3	1	1	2
40	1	1	1	1	1	1	1	1	1

Note

The model discussed here can be re-programmed for various scenarios and has the potential to be widely applied. However, we would emphasise that the model uses parameters derived from observation, and these parameters may need to be adjusted in the light of empirical evidence.

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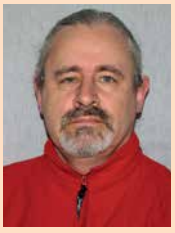
About the Authors

Henry Andrews is a full member of CIEEM and a Chartered Ecologist. He is the author of the *Bat Tree Habitat Key*.

Contact Henry at: henry.andrews@aecol.co.uk



Dr Mark Gardener is an ecologist and lecturer. He is author of several books on ecology and data science (including statistical programming) and is responsible for the computer programs described in this article. He currently teaches for the Open University as well as running freelance courses in ecology and data science. See www.dataanalytics.org.uk.

Contact Mark at: mark.gardener@me.com

Hedgehogs in Tunnels: Footprint Tracking Tunnels as a Method for Detecting Hedgehog Populations

Richard Yarnell MCIEEM
Nottingham Trent University

Emily Thomas
People's Trust for Endangered Species

Ben Williams
University of Reading

Philip Baker
University of Reading

Keywords: mammals, occupancy, presence absence, survey effort

Despite being listed on Section 41 of the NERC Act 2006, and being a species of principal importance in England, hedgehogs are often overlooked in environmental site assessments conducted for development purposes. One reason is the lack of a suitable method for determining whether hedgehogs are present or not. Here we present details of a simple method to detect hedgehog presence using footprint tunnels with a view to encouraging ecological consultants to use this approach in their biodiversity assessments of development sites, and to consider implementing mitigation plans to help reduce further declines in hedgehog numbers.

The hedgehog *Erinaceus europaeus* is currently a species of conservation concern in the UK (JNCC 2010), having declined by up to 25% in the last decade (Wembridge 2011). Agricultural intensification and land use changes (Krebs *et al.* 1999) and limited connectivity within rural (Becher & Griffiths 1998, Moorhouse *et al.* 2014) and urban (Hof & Bright 2009) landscapes are all factors that have contributed to this decline.

Despite being a species of principal importance in England, hedgehogs are often overlooked in Environmental

Impact Assessments. Consequently, the habitat requirements of hedgehogs and the impacts of development on their populations are poorly understood. One reason for this is the absence of an effective technique for determining the presence and/or abundance of hedgehogs in an area. Current methods for estimating hedgehog abundance such as spotlighting and capture-mark-recapture are expensive, time-consuming and often only suitable within certain habitats; even identifying presence/absence at a local scale is problematic due to their nocturnal behaviour and is typically reliant on sightings reported by local residents or observations of dead animals on roads. Therefore, there is the need for a suitable method that can reliably determine hedgehog presence across a range of habitats and which can be applied easily by ecological consultants.

Footprint tunnels are a straightforward method for detecting hedgehogs (Huijser & Bergers 2000). The tunnels are constructed from opaque corrugated plastic and contain an ink pad and paper to record their footprints (Figure 1). They are cheap, easily deployed and do not require special licences. Furthermore, footprint tunnels can be left *in situ* and checked easily whilst surveys for other protected species are being conducted.

Footprint tunnels are currently being used in a national hedgehog survey of England and Wales (http://ptes.org/get-involved/surveys/countryside-2/national-hedgehog-survey/) following a trial study designed to assess their accuracy as a method for determining presence/absence (Yarnell *et al.* 2014). The trial methodology involved placing 10 footprint tunnels at each of 115 sites, approximately 1 km^2 in size, across England and Wales between April and September 2011-2013 inclusive. Volunteer surveyors were recruited from local Mammal Groups and students at Nottingham Trent University and Reading University. Survey sites (e.g. farms, golf courses) were selected at random by volunteers based on accessibility (landowner permission, ease of access, travel distance to site); surveyors were specifically asked not to select sites based upon previous knowledge of the presence of hedgehogs, but rather to select sites that were potentially suitable habitat for hedgehogs.

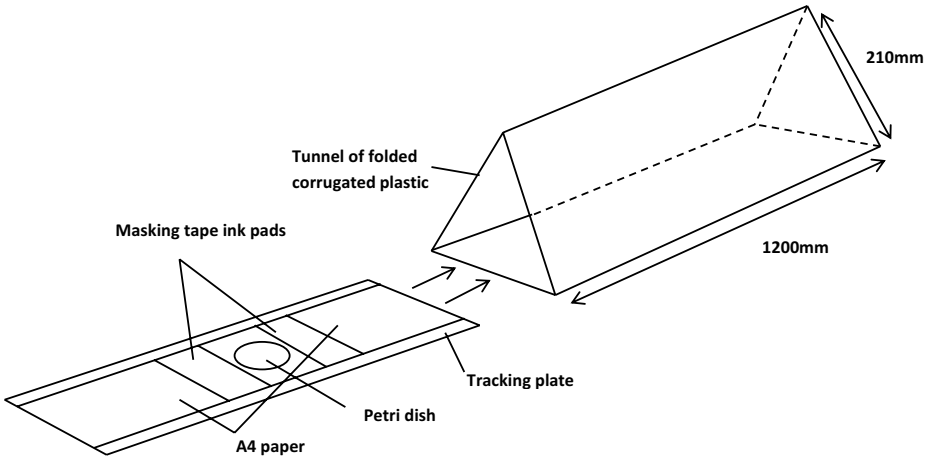


Figure 1. Schematic diagram of a footprint tunnel made from opaque corrugated plastic.

Footprint tunnels consisted of a triangular piece of commercially available plastic (Correx®: 1200 mm long with sides of 210 mm; approximate height at apex = 180 mm; Figure 1) containing a removable plate fixed to the base with Velcro®. Tunnels are available commercially from http://www.wildcareshop.com/tracking-tunnel-1.html. Food bait (tinned 'hotdog' sausages or commercial dry 'hedgehog food') was placed in the middle of the tunnel to encourage hedgehogs to enter the device. A piece of plain paper and a strip of masking tape were attached to each end of the base plate and non-toxic ink (carbon powder mixed with vegetable oil to prevent it drying out) was painted onto the strips of tape. The ink remained wet for approximately three days. As a hedgehog moved through the tunnel to reach the food bait, its paws were coated with ink and its footprints were recorded on the paper as it left (Figure 2).

Figure 2. Hedgehog footprints. Scale: the paper shown is A4.

Figure 3a. Footprint tunnel deployed in the field.

Tunnels were placed as close as possible to linear features such as hedgerows, fences and woodland edges (Figure 3). Hedgehogs are known to follow linear features when moving through the landscape (Hof & Bright 2010) and positioning tunnels adjacent to these features was a straightforward protocol for surveyors to follow. Tunnels were placed flush with the ground, held in place with tent pegs and placed at least 100 m apart, with no more than two tunnels in the same field in order

Figure 3b. Footprint tunnel deployed in the field.

to cover as much of the survey area as possible. Tunnel density was approximately 10 tunnels per km^2.

Tunnels were set for five consecutive days and checked daily to quantify hedgehog detection. After each daily check, the food bait was replenished if it had been eaten and papers were replaced if they had become wet, damaged or were marked in any way, i.e. with footprints of hedgehogs or non-target animals. All footprint papers were returned to the investigators for verification together with the tunnel location, date of survey, surveyor ID, and a map showing tunnel placement location.

To model the detection process, each daily check was treated as a repeat survey. A site was classified as being occupied if at least one of the ten tunnels at that site recorded hedgehog footprints on any of the five survey days. Individual tunnels were not treated as independent as hedgehogs could conceivably have moved between tunnels during the survey period. Therefore, each 1 km^2 site was treated as the sampling unit and all the tunnels at each site taken together were treated as the survey unit.

The daily detection rate at sites where hedgehogs were present was used to calculate the confidence that hedgehogs were truly absent from a site if they were not detected across all five days. The minimum number of days of surveying required to determine the absence of hedgehogs at a site (K) was estimated at two different confidence levels (p^*=0.8 and 0.95) as follows:

$K = \text{Log}_{10}(1-p^*)/\text{Log}_{10}(1-p)$, where p^* is the probability of detecting the species on at least one visit to an occupied site and p is the probability of detection on any given visit to an occupied site (McArdle 1990, Kéry 2002, Reed 1996).

Hedgehogs were present at 39% of sites surveyed, indicating that hedgehogs are not ubiquitous across rural England and Wales. Daily detection rates were 60% at sites where hedgehogs were known to be present. Therefore, three days of surveying are needed to establish that hedgehogs are absent from a site with 80% confidence, and four days are needed to be 95% confident. Therefore, the five days used in the trial study were sufficient to be confident that the absence of footprints at a site reflected a true absence rather than a failure of the survey protocol to detect hedgehogs (Yarnell *et al.* 2014).

This pilot study demonstrates that footprint tunnels provide a simple and reliable method for detecting hedgehogs that would be straightforward to use on development sites. Most importantly, the high levels of daily detection combined with five days of repeated surveys indicate a very small false-absence rate and confirm that the footprint tunnels reliably detected hedgehogs at sites where they were present. In addition, footprint tunnels can be used in a wide range of habitats and at different spatial scales to reflect different management practices within the wider landscape (i.e. individual farms, development sites, residential gardens; authors' unpublished data). Tunnels are also suitable for use by people with little field experience – it is a simple matter of positioning tunnels adjacent to linear features within a survey site – and their use eliminates the need to search for potentially sparse field signs. Furthermore, the tunnels can be checked during the day and the footprints can be kept for verification by a mammal expert at a later date, if necessary. Consequently, footprint tunnels can be easily deployed by consultants when carrying out fieldwork for other species.

Recommendations for survey protocols

We recommend a minimum survey effort of 10 footprint tunnels per km^2 deployed for four consecutive nights to determine hedgehog absence with 95% confidence. The four repeat surveys do not need to be made on consecutive days, but should be completed within one month to reduce the chances of hedgehog occupancy changing over time. For example, if repeat newt bottle trap surveys are taking place at a development site, hedgehog tunnels can be deployed at the same time. The surveys can be conducted at any time between April and October when hedgehogs are active in the UK, as season did not affect occupancy estimates (Yarnell *et al.* 2014).

For development sites that are smaller than 1 km^2, we also recommend the deployment of 10 tunnels to increase detection probabilities. For very small sites, tunnels can also be deployed in the surrounding habitat at similar tunnel densities to provide information of hedgehog presence in the wider area, and to inform mitigation strategies that include protecting hedgehog populations and habitats in and around the development footprint. Deployment of tunnels post-development can yield information on hedgehog presence, which can indicate whether mitigation has been successful in attempts to retain hedgehog populations on site.

Where hedgehogs are found to be present on sites proposed for development, we recommend that suitable mitigation schemes are implemented to help reduce further hedgehog declines across the country. There is a lack of suitable hedgehog-specific mitigation schemes in the literature due to the species being overlooked in biodiversity assessments. However, mitigation could include capture,

removal and exclusion of hedgehogs from sites prior to development, which would involve obtaining a licence from the Statutory Nature Conservation Organisations (SNCOs) to catch hedgehogs. Appropriate compensation should focus on providing suitable shelter and foraging areas for hedgehogs and ensuring habitats remain connected to allow hedgehog movement between habitats. For example, a simple technique that can be employed on new housing developments to improve connectivity between gardens is the creation of small holes in the base of fences to allow hedgehogs access to a range of gardens. Key to devising suitable mitigation and compensation for hedgehogs is a good knowledge of the species' ecology and habitat requirements and we encourage practitioners to attend suitable training to help inform hedgehog-related environmental assessments and also to make use of relevant guidance (see Further Resources).

In conclusion, hedgehog tunnels provide a simple, cheap and effective method to detect hedgehog presence and it is hoped that – through their use – ecological practitioners will consider the impacts of developments on hedgehog populations in the UK more frequently.

Acknowledgements

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Further resources

PTES hedgehog guide: www.ptes.org/hedgehogfootprintguide

PTES hedgehog ecology and habitat management training courses: http://ptes.org/hedgehogtraining

CIEEM Competencies for Species Survey: European Hedgehog http://www.cieem.net/data/files/Resource_Library/Technical_Guidance_Series/CSS/CSS_-_HEDGEHOG_April_2013.pdf

A free copy of a guide to UK mammal footprints can be found at the Mammal Society http://www.mammal.org.uk/sites/default/files/TRACK%20PRINTS%20for%20Hedgehog%20Tubes%20b.jpg

About the Authors

Dr Richard Yarnell MCIEEM is a Principal lecturer at the School of Animal, Rural and Environmental Sciences, Nottingham Trent University. He has a PhD in Ecology and has research interests in quantitative vertebrate conservation. He is also a member of the IUCN Hyaena specialist group, and CIEEM's Academia Special Interest Group.

Contact Richard at:
richard.yarnell@ntu.ac.uk

Ben Williams is a PhD candidate at the University of Reading. He has a BSc in Environmental Science and eight years of survey experience. His main research interests are human-wildlife conflicts, wildlife monitoring / surveying and citizen science. He is currently Chairman of Wiltshire Mammal Group.

Contact Ben at:
B.Williams@pgr.reading.ac.uk

Emily Thomas is Key Species Monitoring Officer at People's Trust of Endangered Species. She has a BSc in Zoology and an MSc in Wildlife Management and Conservation. She is currently coordinating the volunteers for a National Hedgehog Survey and a National Water Vole Monitoring Programme.

Contact Emily at:
Emily.Thomas@ptes.org

Dr Philip Baker is a lecturer at the University of Reading. He has a PhD in Zoology, and over 20 years' experience of studying mammals, including hedgehogs. He has published over 40 scientific papers on topics relating to the ecology, monitoring and management of mammals in both urban and rural habitats.

Contact Philip at:
p.j.baker@reading.ac.uk

Meet the Author – Henry Andrews

What do you do?

I am the director of AEcol, an ecological consultancy founded by my father, John Andrews, author of *Gravel Pit Restoration for Wildlife* amongst other books.

I'm privileged to lead a highly qualified team and work with several internationally respected sub-contractors providing a problem solving service to the minerals industry. In my spare time I co-ordinate the *Bat Tree Habitat Key* project, which is a finalist in this year's CIEEM Awards.

What or who first inspired you to get into ecology?

After leaving the Fleet Air Arm (Royal Navy) I blundered into ecology and might not have stayed if it wasn't for Roger Ransome's *Natural History of Hibernating Bats*. That book was a eureka point for me and inspired a bat project of my own which has kept my interest.

How did you get to where you are today?

In the Fleet I was trained never to walk past a job. Now the criterion is never to walk past a question. The questions that remain to be answered are what keep AEcol in demand, and make our work rewarding. The opportunities our clients have given us to develop our survey methods and analysis frameworks have been invaluable in our progression from survey outfit to consultancy practice.

What have been the most important steps along the way?

Encouragement from Dr Sarah Whild and Alex Lockton during the Biological Recording MSc was vital. In addition, assisting experts has been an integral part of my development. Dr Paul Chanin's ordered and analytical approach was an important influence early on. George Bemment taught me to keep an open mind and to recognise that many questions have yet to be answered. Assisting Diana Ward in a public enquiry as her advisor on bat survey gave me confidence, and also identified that I had room for improvement myself.

Are there any 'must-have' qualifications or experience?

I believe the experience of watching and trying to understand the thought processes used by intuitive surveyors with talents you will never possess is essential if you are yourself to develop. It's important to know your own limitations, so you know when you're out of your depth.

Do you have any advice for someone setting out on a career in ecology and environmental management?

Read the *Handbook for Phase 1 habitat survey*. Go to your local reserves and map them. When you get an interview you'll have a saleable skill and be ahead of the competition. Habitats are the foundation to every survey; it's essential to get them down early on.

What's the best thing about your job?

Collaborating with bat ecologists across Europe. Working in an enthusiastic team to find better methods of survey and analysis. Seeing the results lead to ecologically responsible operations and positive restoration.

What's the downside?

Being so busy that we haven't had time to share the developments we've made, particularly our *Predictive Ecological Analysis System* that would be a huge benefit to our profession.

What's next for you?

Finish the 3rd Edition of *Bat Tree Habitat Key* (yes, it will still be free) and use it to engage with more European bat ecologists to share data and experiences.

What's your top tip for success?

Read and read carefully. Read the preface and the references. In the preface the author gives you an insight into what motivates them; this is where the pearls of wisdom lie. In the references you find the leads to take you to the next level; take the red pill, and see how deep the rabbit hole goes...

One day you will answer a question that all of us have overlooked, and there will be no stopping you!

For further information

Contact Henry at:
henry.andrews@aecol.co.uk

Proposed New Guidance for Commissioning Terrestrial Invertebrate Surveys – A Call for Feedback

Richard Wilson CEnv MCIEEM
Senior Ecologist,
Richard Wilson Ecology

Sarah Henshall
Lead Ecologist, Buglife – the Invertebrate Conservation Trust

Streaked bombardier © Craig Slawson.

Introduction

Estimates vary considerably but based on Stork (1993) and Mora *et al*. (2011), at least 72% of all described species are invertebrates. There are more than 30,000 terrestrial and freshwater species in the UK alone (Key, Drake and Shepherd 2000); of which 4,942 (c.15%) have a nature conservation status (JNCC 2014)[1]. Invertebrates play a vital role in ecosystems, providing key services such as pollination (Potts *et al*. 2010), recycling of waste materials (dung and vegetation) (Nichols *et al*. 2008), soil quality (Santofuro *et al*. 2012), biocontrol of pest species (Shaw, Bryner and Tanner 2009) as well as significant biodiversity (Kirby 1992) and cultural values (Marren and Mabey 2010). Yet, within the ecological research (Leather 2009) and commercial sectors (Drayson 2011), invertebrates are given a reduced or negligible consideration compared with other fauna or flora (except perhaps lower plants).

This omission has been the experience of both authors in their respective fields; one predominantly working within the commercial consultancy sector and the other with a national NGO. The reasons why invertebrates are overlooked is likely to be complex, arising from a mosaic of ignorance, lack of awareness, misconceptions, taxonomic inexperience or prejudice. Invertebrates are also 'competing' with more favourable or 'charismatic' groups such as mammals

Standing and fallen decaying beech © Sarah Henhsall.

and birds with greater legislative and policy protection. At the time of writing, the current Government recognised the importance of invertebrates, pollinating insects in particular, as a consequence of its National Pollinator Strategy (Defra 2014)[2] and there are a number of landscape scale initiatives being funded to address these issues such as Buglife's B-Lines (Evans 2012)[3]. Invertebrates are also protected via various mechanisms, including Priority Species[4] and via Priority Habitats such as Open Mosaic Habitats on Previously Developed Land (OMH) on brownfield sites and old/ancient woodland, hedgerow and grassland communities on greenfield sites. All these habitats can and do come into potential conflict with development.

The current National Planning Policy Framework (DCLG 2012)[5] clearly prioritises development on brownfield land, providing it is not of high environmental value (Paragraph 17). Provisional results of the OMH habitat inventory (http://habitatsurveys.esdm.co.uk/home.aspx) undertaken by Natural England indicate between 6% and 8% of brownfield sites in England support this priority habitat. The Thames Gateway is one of the largest development zones in Europe and at least 15 Priority Species are associated with this region; in addition to over 100 Red Data Book and over 400 Nationally Scarce species (Buglife 2008) as well as a remarkable number of rare and scarce bees and wasps, including c.74% of the national fauna (Harvey 2000). Nevertheless, over half of the high value brownfield land was lost in this region in a five-year period between 2008 and 2012 (Buglife 2013). These facts emphasise the importance of conducting robust invertebrate surveys as well as more familiar faunal surveys (e.g. for great crested newts *Triturus cristatus*).

There is clearly a strong case to address the significant need for coherent guidance aimed at non-specialist ecologists. An objective is to enable ecologists with limited or non-existent invertebrate knowledge to determine if surveys are required, have the confidence to advise their clients accordingly, to enable informed decisions that can underpin robust Ecological Impact Assessment (EcIA) or Environmental Statements (ES).

The guidance would take the practitioner/decision-maker through a journey from the initial site visit and desk study that has informed a Preliminary Ecological Appraisal (CIEEM 2013)[6] to a robust decision as to whether more detailed invertebrate surveys are required.

Objectives

Ecologists are expected to be familiar with the drivers (legislation, policy and best practice) to recommend protected species surveys for a wide range of fauna and flora, in particular great crested newts (English Nature 2001), reptiles (Gent and Gibson 2003), bats (Hundt 2012), birds (Gilbert, Gibbons and Evans 2008) and flora (e.g. Rodwell 2006). However, there is a limited amount of guidance available to inform the non-specialist of the drivers or whether invertebrate surveys should be commissioned; and if they are, what to expect in terms of taxonomic coverage, extent (in geographic terms), duration (number of visits and season), methods and analysis. English Nature published a leaflet[7] which aimed to assist practitioners in determining if an invertebrate survey would be required, though it was not, in the authors' and other entomologists' view, particularly helpful. For example, it states, *"There are no hard and fast rules about when an invertebrate survey should be requested from a developer, but any site that may have 'good' invertebrate interest should be examined in some way."* (English Nature 2005, p. 4). The use of the word 'good' is unqualified and leaves the non-specialist none the wiser as to how to proceed.

There is a recognised skills gap within the profession relating to invertebrate ecology (IEEM 2011)[8] which can inevitably lead to inconsistency, in terms of whether surveys are commissioned or not; or if they are, the detail and quality of the work which is undertaken. There is therefore a pressing need for ecologists, land and

Slag banks Scunthorpe © Sarah Henshall.

Sandy mound and jetty © Sarah Henshall.

environmental managers to have guidance available to them, which would enable them to make informed decisions which can be defended if challenged by the client, decision-makers, consultees, or at Public Inquiry. Importantly the guidance can also be used by decision-makers and planners to conclude whether invertebrate surveys *should* have been commissioned; or if they were, did they meet minimum expected standards.

The guidance will *not* cover in detail *how to undertake an invertebrate survey*, or *analyse the results* as there is technical guidance available (e.g. Drake *et al*. 2007, Chandler 2010). However, it will signpost to relevant literature and provide case study examples of best practice. Likewise, it will not cover or introduce the identification of invertebrates. Whilst there is a range of literature aimed at the general naturalist (e.g. Chinery 2007, Brock 2014), these only include a limited number of representative taxa and should not be relied upon for professional surveys.

Content

The proposed content will aim to reduce inconsistency and provide a structured approach to decision making. It is envisaged that the guidance will include an:

- overview of legislation, policy and existing best practice;
- general overview of habitats/ features of relevance to invertebrates;
- habitat features of particular relevance to invertebrates in relation to familiar habitat terminology;
- what sites should be surveyed; and
- case studies.

Where possible, decision-making flow charts will be incorporated into the guidance.

It is also intended that the guidance will sign-post or highlight subject areas to inform expectations as to what the client, consultant and decision-maker should expect from an invertebrate survey, including:

- timings (e.g. seasons and need/ appreciation to consider restrictive phenology);
- frequency;
- types (e.g. scoping; detailed general survey; targeted survey);
- methods (e.g. active and passive techniques);
- taxonomic coverage (what species groups should be covered and in which habitat(s));
- interpretation and analysis;
- mitigation and enhancement; and
- assistance for ecological clerk of works.

Feedback

As part of the guidance development, feedback will be requested from experienced entomologists as well as non-specialists as to how the guidance could best serve their needs and where they feel they could most benefit from it. In the first instance, generic feedback to allow us to understand how consultants currently consider invertebrates and what triggers their use to determine if surveys are needed. Are there constraints (e.g. perceived legislative weaknesses) or resistance (e.g. financial and work programme burdens) that they feel exist or have experienced? How could guidance overcome these perceived weaknesses and resistance? Are there any other generic points not covered in this article that you feel should be included?

In order to provide this feedback, in the first instance, please contact Richard Wilson via e-mail (see end of article) or by post to CIEEM's address.

Notes

1 Data available via the JNCC website (http://jncc.defra.gov.uk/page-3408; last accessed 14 March 2015).

2 Available online: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/370199/pb14221-national-pollinator-strategy.pdf; last accessed 4 March 2015.

3 Information (including report) available online: https://www.buglife.org.uk/campaigns-and-our-work/habitat-projects/b-lines; last accessed 4 March 2015.

Available online: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf last accessed 12 March 2015.

Available online: http://habitatsurveys.esdm.co.uk/ last accessed 12 March 2015.

4 Priority species and habitats are identified as a requirement under section 41 and section 42 of the Natural Environment and Rural Communities Act 2006 (England and Wales respectively); section 2 of the Nature Conservation (Scotland) Act 2004 and section 3 of the Wildlife and Natural Environment (Northern Ireland) Act 2011.

In Ireland, 'priority' is used only in the context of EU Annexed habitats. Habitats and species protected at national level are listed under the Wildlife Acts, 1976 to 2012 which include the Flora Protection Order (SI 94 of 1999); European habitats and species are protected under the European Communities (Birds and Natural Habitats) Regulations 2011 (SI 477 of 2011).

5 Available to download via the Government website (https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf; last accessed 14 March 2015).

6 Available online: http://www.cieem.net/data/files/Resource_Library/Technical_Guidance_Series/GPEA/GPEA_April_2013.pdf; last accessed 4 March 2015.

7 Available to download here: http://publications.naturalengland.org.uk/file/116024; last accessed 14 March 2015.

8 Available online: http://www.cieem.net/data/files/Resource_Library/Education/Education-Ecological_Skills_Project_Final_Report.pdf; last accessed 7 January 2015.

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About the Authors

Dr Sarah Henshall is Buglife's Lead Ecologist, specialising in beetles of riparian, brownfield and saproxylic habitats. Sarah joined Buglife in 2009 and is currently working on various Priority species projects including violet click-beetle *(Limoniscus violaceus)*, Wart-biter cricket *(Decticus verrucivorus)* and exposed riverine sediment beetles. Sarah also leads Buglife's national brownfield work including species research, habitat creation and management, provision of guidance and training, planning and policy input and campaign work.

Richard Wilson CEnv MCIEEM is an independent senior-level ecologist with a specialist interest in invertebrate (particularly spiders) and avian ecology. Richard has a keen interest in EU and UK policy and legislation related to nature conservation and views robust guidance as a means to ensuring an overlooked group receives the protection it deserves. When not identifying various invertebrate taxa or completing bird surveys, he writes on various subjects related to nature conservation via his blog (http://richardwilsonecology.wordpress.com) or Twitter (@ecology_digest).

Contact Richard at:
Richard.Wilson_ecology@yahoo.co.uk

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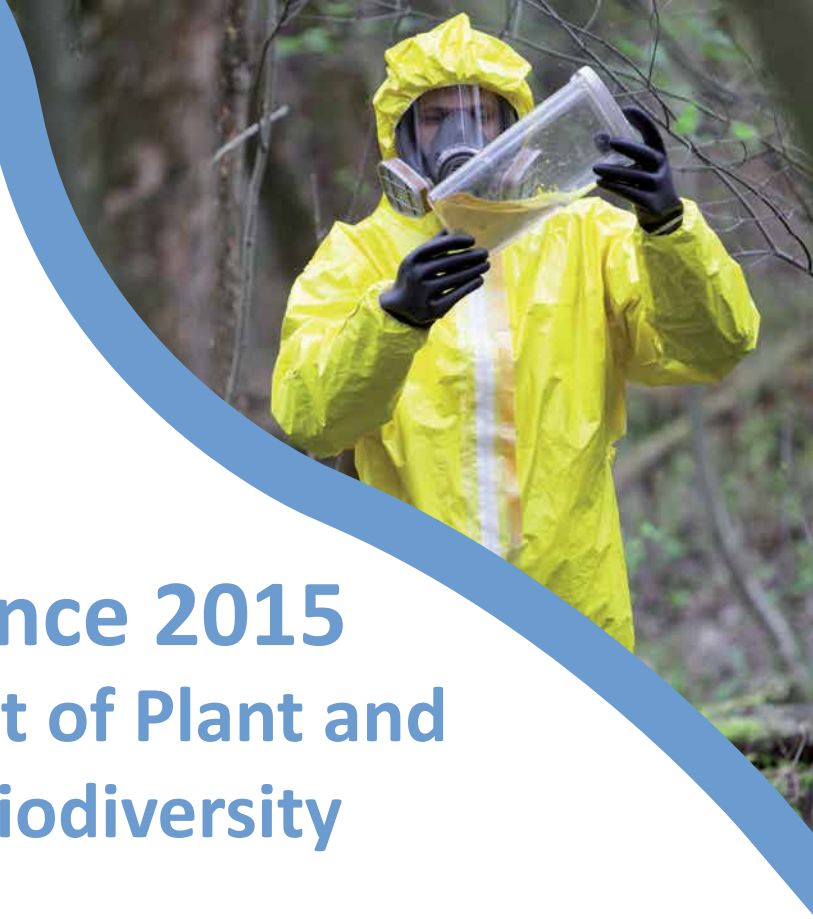

Summer Conference 2015

Managing the Impact of Plant and Animal Disease on Biodiversity

Resource for London, Holloway, 15 July 2015

The conference programme will address:

- the cumulative impact of plant and animal diseases on biodiversity and how this is being managed at a policy level in the UK
- the impact of specific animal and plant diseases on biodiversity and the latest techniques for surveillance, control and eradication
- the role of the ecological and environmental management professional in managing risks to biodiversity from plant and animal disease

Talks to include:

- UK strategy for managing the impact of plant and animal diseases on biodiversity
- Bats and the public – a UK approach to disease-risk management
- Building resilience to plant pests and diseases in woodlands

Contributing speakers from:

- Animal and Plant Health Authority (APHA)
- Bat Conservation Trust (BCT)
- Joint Nature Conservation Committee (JNCC)
- The James Hutton Institute
- British Trust for Ornithology (BTO)

Booking is now available online.

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www.cieem.net/summer-conference-2015

Meet the Professional Development Team

Lexie Munro and Helen Boulden

The Chartered Institute's Professional Development Team deliver over 100 training events and three CIEEM conferences every year in the Spring, Summer and Autumn. They work with an ever growing number of trainers and are responsible for ensuring that the training provided is relevant and meets high professional standards. The Team also provide careers guidance, facilitate members' CPD recording, support the Institute's Degree Accreditation Scheme and engage with other professional bodies and organisations to promote careers and professional development across the sector.

The Professional Development Team consists of two members of staff based at the Secretariat in Winchester, Helen Boulden (Professional Development Officer), and Lexie Munro (Professional Development Coordinator). The Team currently report directly to the CEO Sally Hayns and are part of the wider Professional Practice Team with Professional Practice Administrator, Deborah Alexander. Helen and Lexie are supported in their work by the Training, Education and Career Development Committee (TECDC) who meet four times a year providing their expertise to guide and advise on the delivery of the programme.

Helen has been in post as Professional Development Officer since 2011, and was joined by Lexie last year when the supporting role of Professional Development Coordinator was created. Helen and Lexie both combine their roles with bringing up young families.

Before joining CIEEM, Helen had worked for several environmental organisations including WWF-UK (providing communications support), and IUCN where she supported the 2008 World Conservation Congress and also administered the Sir Peter Scott Fund for Conservation Action. She has also worked for two local authorities, as part of a countryside services team and coordinating a local biodiversity partnership. She has an MSc in Ecology and Environmental Management from Lancaster University and has experience leading teams of volunteers on research projects in Poland, Ukraine and Peru for an ecotourism organisation. A keen ornithologist, she has acted as a volunteer for the charity Marinelife surveying seabirds and cetaceans on ferry routes from Portsmouth to the Bay of Biscay.

Lexie started her career as a marine biologist working on diving surveys and developing a volunteer-based project to monitor the ecology of protected reef habitats in Lyme Bay. She spent 10 years working as a secondary and sixth form biology/environmental science teacher, and has been involved in GCSE and A Level programme development and course standardisation. Lexie joined The Mammal Society in 2012 as Training and Events Co-ordinator, before moving to CIEEM in September 2014.

The Professional Development Team are supported in their work by other members of the Secretariat, most notably the Finance and Administration Team and the Administrative Officer Richard Watts, who deals with training event bookings and responds to queries as well as many other supporting tasks in the day-to-day running of the Professional Development Programme.

Lexie and Helen are always keen to hear from members on their training needs, about getting involved in delivering training, or to answer queries relating to careers advice and CPD guidance. Look out for the Team at future CIEEM events and please come and have a chat.

For further information

Contact Helen at:
helenboulden@cieem.net

Contact Lexie at:
LexieMunro@cieem.net

Featured CIEEM training events

BALI/ROLO Health and Safety Awareness

Skelmersdale, Yorkshire 7 July

This one day course in health and safety legislation and working practices aims to support those trying to obtain a CSCS (Construction Skills Certification Scheme) Card. The course includes a short multiple choice test; participants successfully completing the course and test will receive a ROLO (Register of Landscape Operatives) health and safety certificate (a pre-requisite to obtaining a CSCS Card).

Phase 1 Habitat Survey

Sudbury, Suffolk 10 September

Phase 1 techniques are essential for describing and mapping vegetation in a standard way that is recognised by ecologists throughout the country. Participants will visit a range of habitats including woodland and grassland, some of which is nature reserve and SSSI, and gain the confidence to carry out their own phase 1 habitat surveys.

The Water Framework Directive – An Applied Approach

London 10 September

This course aims to help ecologists to understand the requirements for ecological Water Framework Directive (WFD) Assessments and the procedures currently in use for the classifying the characteristics and quality of freshwater, transitional and coastal waters. The training covers the types of fish and invertebrates surveys used as part of WFD assessments, methods of data collection, the calculation of standard metrics and the utility of scoring mechanisms as proxies for the measurement of conservation value.

EIA Using Fish and Shellfish Data in Marine, Coastal and Estuarine Systems

London 24 September

Designed for graduate and early career ecologists interested in broadening their understanding of marine fish and shellfish EIA, this course will focus on the assessment of impacts of offshore and inshore developments (including windfarms, oil and gas infrastructure, dredging operations, harbours and marinas) relevant to fish and shellfish in UK waters.

Ecological Report Writing

London / Cardiff / Leeds
6 October / 24 November / 1 December

A well-written report is succinct, fit for purpose, tailored to the requirements of the reader and answers the brief agreed with the client. Good report writing is an essential skill for professional ecologists and environmental managers. This course has been developed in conjunction with the launch of CIEEM's new 'Guidelines for Ecological Report Writing'.

Protected Mammals (Republic of Ireland) – Survey, Impact Assessment and Mitigation

Dundrum, Co. Dublin 8 October

A one day introductory course focusing on nationally-protected terrestrial mammals in the Republic of Ireland. The training is suitable for those who are responsible for coordinating surveys of various mammal species in Ireland as well as those actually undertaking field surveys.

Making the Most of BREEAM and the Code for Sustainable Homes

Birmingham / London
21 July / 13 October

This training will help ecologists to be able to achieve maximum ecological benefit from BREEAM and the Code for Sustainable Homes. The course discusses each of the ecology credits individually, including the use of BRE's ecology calculator.

Effective Communication Skills for Women

Birmingham 13 October

A one day course which aims to develop the skills needed for authoritative communication, persuading and influencing others and resolving long term conflicts. The course will help women achieve confidence, credibility and composure in any workplace situation.

British Standard BS42020 Biodiversity – Code of Practice for Planning and Development

Manchester / Edinburgh / London
14 October / 15 October / 19 November

This training aims to provide professionals with the confidence to ensure ecology work is compliant with all aspects of this new British Standard by familiarising them with the content and structure of BS42020 and its application within the planning process. Led by Mike Oxford, Chair of BSI Technical Committee on Biodiversity and principal author for BS42020.

Details of all CIEEM's courses and on-line booking can be accessed at:

www.cieem.net/training-events

Chartered Members

Fellows and Full Members of CIEEM can develop their skills and gain professional recognition from employers, colleagues and clients by achieving Chartered status.

CIEEM offers two Chartership awards:

- **Chartered Ecologist (CEcol):** The Register of Chartered Ecologists recognises the effective application of knowledge and understanding of the science of ecology by professionals committed to the highest standards of practice.
- **Chartered Environmentalist (CEnv):** CIEEM is one of 23 professional bodies licensed by the Society for the Environment (SocEnv) to award Chartered Environmentalist status. CEnv is an increasingly recognised standard of good environmental practice.

The adjacent profiles highlight the work of Chartered professionals and provide an insight into the kind of roles that these senior ecologists and environmental managers are required for.

If you are interested in submitting your own profile please contact the Registration Officer (KarenSanderson@cieem.net). Karen is particularly keen to hear from Chartered members working in academia and the statutory agencies.

"In closing, can I offer my congratulations to you for your Royal Charter in April last year. This is a special recognition of your professionalism and standing. In Scotland, we are very keen to work with you. Scottish members are already active in your committees, and we would particularly like to see a roll-out of the excellent guidance you develop, not least in guiding standards for developers. I know that staff in SNH work well within the CIEEM, and we must ensure we get the most from this to ensure that we get the best deal for the environment."

Paul Wheelhouse MSP, Minister for Environment and Climate Change

Addressing the CIEEM Autumn 2014 Conference in Edinburgh

Paul Goriup CEcol CEnv FCIEEM

NatureBureau Ltd

I hold a joint honours degree (BSc) in Botany and Zoology (Reading University) – because in the 1970s ecology was not yet taught as a whole undergraduate degree – and an MSc in Conservation Science (University College London).

After graduating, I spent about four years working for the Nature Conservancy Council on river surveys, and on Great Bustard reintroduction and travelling in southern Europe, North Africa, Middle East and Asia for the International Council for Bird Preservation (ICBP, now BirdLife International), WWF and IUCN to study the impact of Arab falconry on desert wildlife. In 1992, I was recruited by ICBP as their first Project Officer in the newly established secretariat in Cambridge. By 1986, I had become Director of the Conservation Programme, coordinating over 300 projects around the world – from small survey expeditions to large multilateral aid-funded projects. This included starting the series of Important Bird Area inventories, which now form the basis for Special Protection Area designation in the EU Natura 2000 network.

In 1986, I moved from Cambridge to Newbury, where I established, with four colleagues, a biodiversity consultancy and design company, now known as NatureBureau. While working here, I realised how under-valued ecologists were as trained professionals and joined the group that would eventually establish the Institute in March 1991 and launch it in September 1991. Indeed, I was invited by the Council to serve as Executive Director of IEEM in a part-time capacity from 1991 to 1996. By 1995 I was investigating whether or not IEEM could set up a pension scheme for individual members not covered by their employers, and became interested in the ethical investment movement. After leaving IEEM in 1996, I subsequently founded one of Britain's first positively ecological public shareholding companies, Fieldfare International Ecological Development plc. This company raises private-sector capital for small-scale ecologically sustainable investments in Eastern Europe such as biomass production and ecotourism. I remain employed as Chairman of NatureBureau and Managing Director of Fieldfare, working on various projects in Bulgaria, Romania, Croatia, Ukraine, Russia, Georgia and Turkey.

Meanwhile, I was still keen to support a higher awareness of professional ecologists among other professionals. I felt an important way of doing this was to ensure I personally achieved as high a level of practice as I could. Accordingly, I was delighted to be elected a Fellow of IEEM in 1999 and became a Chartered Environmentalist in 2005. The launch of Chartered Ecologist in April 2014 for me marked the point when our professional train left the station – and in a remarkably short period of just 23 years. Naturally, enrolling as a Chartered Ecologist was a must and as a Fellow I was given an early opportunity to do so. Well, the application procedure was certainly challenging – all those competencies to prove – but also satisfyingly rigorous. I am certain that our profession is now one of the most highly regarded and I am proud to be part of it.

Nick Heasman CEnv MCIEEM

Area Manager, South Downs National Park Authority

Why did you join CIEEM?

For the contacts, training and keeping up to date.

Why did you apply for Chartered status?

It is affirmation of my professional achievement.

How did you find the process?

It was quite simple and useful to undertake and helped me take stock of my career.

How has achieving Chartered Status impacted on the types of work you undertake?

I now have a more strategic approach to work as a result.

Would you recommend applying for CEnv to your peers and colleagues?

Yes, and I do.

What is you education and experience?

I have a BSc Hons Countryside Management and am a Chartered Forester. Volunteer work is essential to starting a career; I volunteered with the Forestry Commission and set up a conservation group at the age of 16 to work in the local woods through my sixth form and then travelled around the UK looking for volunteering experience. I now sit as a trustee for a charity and volunteer for a number of industry related organisations in my spare time.

What is your advice for training?

My advice is to undertake as much training that is relevant to your work as possible, particularly in the formative years of your career, however consolidation and practice of what you have learned is very important so keep things simple.

What is the best thing about your job?

The people, the place and the job satisfaction.

New Chartered Members

CIEEM is pleased to announce the following new Chartered members:

Chartered Ecologists
Mr Dominic Coath CEcol MCIEEM
Miss Charlie Dwight CEcol MCIEEM
Mr Michael Gibbs CEcol MCIEEM
Miss Rebecca Harris CEcol MCIEEM
Mr Jeremy James CEcol CEnv MCIEEM
Mr Christopher Mitchell CEcol CEnv MCIEEM
Mr Mark Osborne CEcol MCIEEM

Chartered Environmentalists
Mr Jason Brown CEnv MCIEEM
Mr William Brown CEnv MCIEEM
Mr James Daplyn CEnv MCIEEM
Ms Tanya Ferry CEnv MCIEEM
Dr Rhys Jones CEnv MCIEEM
Mr Neil Parker CEnv MCIEEM
Miss Sarah Simons CEnv MCIEEM

Chartered Ecologist application deadlines

CEcol Application due date	CEcol Interviews	Ratification
21 Sept 2015	8 December 2015	Mid January 2016

Please note, these dates are subject to the availability of assessors and may change.

Chartered Environmentalist application deadlines

CEnv application due date	CEnv report submission deadline	CEnv Interviews
31 August 2015	30 November 2015	1-12 February 2016

Please note, these dates are subject to the availability of assessors and may change.

If you would like to submit your own profile please contact the Registration Officer, Karen Sanderson, at karensanderson@cieem.net.

Diversity in Ecology and Environmental Management – Practitioner's Survey

Elaine Richmond CEnv MCIEEM and Stephanie Wray CEcol CEnv FCIEEM
Peter Brett Associates and members of CIEEM's Diversity Working Group

> "CIEEM is a very inclusive organisation and should be an inspiration to other professional institutions."
>
> *(A member's response to the Diversity questionnaire.)*

CIEEM believes that diversity within the profession is important and should be encouraged. In spring 2014, CIEEM therefore established a Diversity Working Group to consider the impact of barriers to diversity within the profession, and the opportunities for CIEEM to effect change.

To inform its work, the Diversity Working Group gathered members' views on the extent to which our professional practices are a barrier to diversity within the profession, and how these could be overcome, by requesting completion of a questionnaire. There were over 400 respondents in total, from across the full spectrum of CIEEM's membership grades. A summary of the findings, along with a selection of members' views and personal experiences, is presented below:

Age

The vast majority of respondents were aged between 26 and 55 (82%). Only 6% felt they have been discriminated against because of age in their job, and very few (0.7%) felt they had experienced discrimination by CIEEM. Several members' views revealed that younger members can find it difficult to gain respect from employers and clients, particularly when working on construction sites. One comment also suggested that CIEEM is *"run by an older generation"*. Involving younger professionals in CIEEM could help to generate a diversity of thinking and better promote CIEEM to the next generation of ecologists and environmental managers. The benefit of a diverse age structure means that the older generation can pass on many years of experience and can train the younger generation with their valuable expertise which would otherwise be lost. Employers should adopt flexible working practices to enable this to happen through opening up more developmental workshops.

Gender

There is an approximate 50:50 split of male to female both in CIEEM's overall membership, and the respondents to the questionnaire. Whilst the vast majority of respondents (79%) answered that gender does not have an impact upon their career development, members' views would suggest that there are issues that CIEEM and the wider industry should be aware of. Several consistent themes were revealed, including a perception that men get paid more than women for undertaking an equivalent role; women of child-bearing age are often overlooked for promotion or not employed; women are taken less seriously than male colleagues in meetings; and unsociable hours and/or travel and overnight stays for field work can be difficult for women with families (though this could equally apply to single parents of either gender). Several women also expressed that they are conscious of the negative impact a career break to have children could have on their career development.

Ethnicity

The vast majority of respondents were White British (88%). The remaining 12% of respondents were split fairly equally across the following categories: mixed race, Asian, Caribbean, Polish, French, Australian. Some 7% answered that ethnicity is having (or has had) an impact on their career development, but 89% consider that CIEEM is sufficiently accessible to all regardless of ethnic background. Many of the views provided referred to ecology being perceived to be a white, middle-class interest/pastime with fewer people from black or minority ethnic backgrounds working in the environmental sector. The question as to whether this is a cultural issue was raised, with parents from some cultures potentially discouraging children from entering our profession (especially when compared to better-known, respected or lucrative professions, such as accountancy or medical careers).

Another respondent commented that as an employer, they see very few job applications from ethnic minorities. There was the recognition that there is a significant under-representation of ethnic minorities in ecology generally. A suggestion was that the cause is rooted in lack of take up of Science, Technology, Engineering and Maths (STEM) subjects which influences future career paths or that this may be cultural. Whatever the cause, if the profession is to ensure a supply of skilled professionals into the future, it needs to appeal to the broadest possible pool of talent. So raising awareness of career paths and making the profession appealing to a wide audience at an early age is important.

Caring Responsibilities

Approximately 40% of respondents confirmed that they have caring responsibilities. The majority of this relates to children and child care (34% have children younger than school age; 64%

have a child or children at school). Some 25% of respondents have elderly or disabled dependents. Over 75% of respondents confirmed that they receive sufficient support from their employer (if they have one) to help combine carer responsibilities with work commitments. However, approximately 40% of respondents consider that carer responsibilities have had an impact on their career progression. There were several common themes revealed by members' views: part-time working can be seen as a disadvantage by employers (21% of respondents work part-time); evening meetings, field work and/or long hours do not fit well with having family responsibilities; and women can fall behind in career development when taking maternity leave.

Disability

About 9% of respondents confirmed that they have a disability. This is compared to the UK national statistic of 16% of working age adults who have a disability[1]. Of these respondents, 33% confirmed a mental impairment, 33% confirmed a physical or mobility impairment, 18% have a hearing impairment and 18% have a visual impairment; 23% preferred not to say. Of the respondents, 20% feel unable to be open at work in relation to their disability. Members' views suggest there is fear of being discriminated against, and 60% of respondents think their disability has had a negative impact on their career, although little evidence of actual discrimination was provided. Discrimination can be direct or indirect. Indirect discrimination often occurs through adopting recruitment and developmental practices that can put people with disabilities at a disadvantage when compared to their mainstream colleagues through a lack of access to enable them to effectively compete on an equal par and level playing field in a highly competitive job market. Members' views suggest that having a disability has not necessarily impacted their ability at work, but reduced confidence to achieve their full potential. Comments also revealed that those with a physical disability tend to get side-lined to administration and/or office tasks given that some ecological work can be physical in nature, either associated with field work and/or long hours. It is also recognised that irregular working hours

and working away from home can also be a challenge for people with mental health disabilities. Another respondent commented that consultancy, in particular, does not deal well with people with mental health issues, such as depression or stress.

Although there are limitations on what could be done to make fieldwork more accessible and although 60% of respondents think CIEEM is already accessible to members with a disability, there are clearly some ways to make CIEEM even more accessible. This could include more careful choice of training venues (e.g. ensuring wheelchair access), making the CIEEM website more user-friendly (e.g. for those with impaired sight or dyslexia), the development of accessible online learning resources with subtitled videos or transcripts, or for employers to raise awareness of support they can offer employees with disabilities.

Religion

Around 82% of respondents said that they do not have strong religious beliefs. Of those who do however, 22% feel it can be difficult to express their religious beliefs, although this was not considered to be a significant issue in terms of membership or practice of CIEEM. In survey comments, it was suggested that employers need to make sure that they take religious festivals and cultural practice into account, however. For example, ensuring the health and safety of employees who may be fasting for Ramadan and carrying out fieldwork at the same time.

Sexuality

The vast majority of respondents are heterosexual (88%); 7% are lesbian, gay, bisexual or transgender (LGBT); and 6% chose not to say. Six percent of respondents feel unable to be open about their sexual orientation at work, with 2.5% stating their sexual orientation has had, or is having, a negative impact on their career. Members' views on discrimination within the profession suggested that sexual orientation is irrelevant in terms of job performance, although it was recognised that it could be difficult for some gay men to deal with site managers on construction sites. One member commented: *"I think ecologists are generally more 'enlightened' and open-minded about things like sexuality, and wouldn't therefore be phased by working with someone of a different sexuality."* Another member commented on the importance of truly inclusive working environments where people can genuinely be themselves, free from worry about what colleagues will think of them. Being able to be your true self at work means you can better focus on the job, safety and your development, so is good for the employee, employer and clients. It means LGBT-inclusive workplaces make sense all round.

Other

Although the questionnaire did not specifically request information on the socio-economic status of members, this was raised as a potential barrier to entry into the ecology/environmental sector

by several respondents in the comments section of the survey. Comments suggested that our profession is deemed to be largely middle class, partly because of the amount of voluntary work/unpaid internships and similar placements that seem to be required to enter our profession. Several respondents felt that this excludes those who cannot afford to do voluntary or low-paid work as a 'foot in the door'.

Priority for Action

Overall, responses indicated that CIEEM should give a 'medium to high' priority to promoting diversity within the profession; on a scale of 1 to 10 (where 1 is very low priority and 10 is very high priority), the greatest number of respondents answered between 5 and 8 on this scale. A similar response was also given in relation to CIEEM promoting diversity within its membership and committees. In contrast, 5% of respondents thought that very low priority should be given by CIEEM to promoting diversity.

When asked what the two most important diversity issues that CIEEM should seek to influence and address were, the greatest number of respondents (57%) stated ethnicity, closely followed by age and disability (50% and 49%, respectively) with 38% of respondents answering gender.

The final section of the questionnaire asked for suggestions for actions that CIEEM could take to address these issues, along with identifying examples of good practice for promoting diversity. Responses included identifying why ecology is failing to attract people from more diverse ethnic backgrounds; promoting paid work experience opportunities for young people starting out in the profession; working with employers to identify and promote desk-based ecology careers that would be suitable for those with disabilities; encouraging and empowering women to achieve more senior roles; encouraging mentoring schemes for women (and men); promoting the importance of flexible working; and improving access at CIEEM events for those with a disability.

What Action Will CIEEM Take?

The views provided by members have been reviewed, and a series of key issues and action points have been identified for further consideration by CIEEM's Diversity Working Group. The intention is to devise and implement a series of short-, medium-, and longer-term objectives, which will seek to remove barriers and effect change within our institute and profession. Ideas include:

- Establish a Diversity Network within CIEEM with clear objectives identified in a Diversity Action Plan.
- Celebrate success and showcase role models from diverse backgrounds (to include career pathways) via articles within *In Practice* and on CIEEM's website and to promote those articles to other under-represented groups to encourage a more diverse range of people to consider a career in ecological consultancy.
- Create a CIEEM Diversity LinkedIn discussion group.
- Ensure a greater consideration is given to diversity issues when planning CIEEM events, meetings and training courses.
- Investigate further how to make training accessible for all, such as online learning opportunities.
- Encourage diversity within CIEEM's committees and Governing Board.
- Identify opportunities for promoting ecology and environmental management professionals in connection with media coverage to raise the profile of our industry.
- Explore opportunities for working in collaboration with existing organisations which already have initiatives to address diversity issues or can provide advice to CIEEM and others within our profession, such as the Black Environment Network (BEN), Stonewall (the lesbian, gay and bisexual charity), Women in Science and Engineering (WISE), Women in Construction, Equality Challenge Unit, Royal Association for Deaf People, Deaf Unity, Disability on Action and Work, Royal Society, and British Ecological Society.
- Explore CIEEM's role in working with employers to provide Access to Work support for those who require communication support.
- Promote a series of training events in relation to diversity issues, for CIEEM members and their employers, through working with appropriate training providers.
- Promote a series of training events aimed at CIEEM members and their employees to raise awareness and encourage discussion of mental health and well-being.
- Produce a series of guidelines for CIEEM members and their employers in relation to diversity developed in partnership with relevant disability groups.
- Widen participation in education to support the promotion of ecological careers, by seeking access to a greater diversity of children/students through working with a range of education providers.
- Sign-posting to good practice guidelines found throughout the internet and forums for engaging with people from under-represented groups.
- Identify and encourage consultancies to develop or adopt schemes that would take on people from under-represented groups to enable them to develop valuable experience to improve their employment prospects.

Next Steps

The CIEEM Diversity Working Group will meet again soon to progress this and will report back on developments in future issues of *In Practice*.

Acknowledgements

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Note

1 https://www.gov.uk/government/publications/disability-facts-and-figures/disability-facts-and-figures#fnref:2

Source: Family Resources Survey 2010/11.

To find out more or contribute further

Contact Stephanie at:
swray@peterbrett.com

(Chair of CIEEM's Diversity Group)

Being Transgender and Work

Katrina Ash runs a company called Ash Ecology and Habitats, which deals with the creation and restoration of habitats – particularly wetlands. She also specialises in bird, reptile and wetland ecology surveys, amongst other things.

There were many things I wanted from life. A successful business, a career in Ecology, a nice house, a loving wife. A normal life. But I didn't feel normal, there was something I was ignoring, the most important thing… and that was me! Something ingrained in my very self constantly reminded me that I wanted to look different. And yet how could I follow this instinct as I wanted to look like the opposite gender. It sounded so wrong. I poured all my energy into my work and kept extremely busy. How could I possibly be transgender, my pre-conception was that it was a dirty word. I was a decent respectable person, I always paid my taxes, worked hard, held a degree. I battled with my inner self for years until I admitted to myself I had a real problem. This holding it in had led to anxiety problems. I decided that I needed to find a support group and find out more. Deep down I already knew, but I had to be sure as everything was at stake.

I was terrified of losing my career, my wife, my friends, my life. I edged forward grudgingly, yet ever forward.

That was over three years ago now and once I was certain I was transgender there was no chance of ever denying myself. There was a stage, when I was divorcing, selling my marital home, and having to face coming out to friends and losing them, that I felt a sense of complete despair, however, this feeling was also balanced out with joy and excitement about being who I really wanted to be. Things are easier now, I have more of an understanding of who I am. On the whole I am more confident than ever, I really like the way I look, have the fantastic social life I always dreamt of, have work coming out of my ears and have turned from a social recluse, who just felt awkward, into a happy, positive individual. I now can feel emotions and it feels like all my throat, heart and solar plexus chakras have been unblocked. I now feel more like a normal human than I did before and although I have difficult moments, I wouldn't swap it for the world.

All this has been hard won and despite all the positivity it is still a hard path to tread and there is lots to deal with, which can really grind you down. I know a lot of transgender people who struggle with life, and behind the crux of the struggle is the work/money situation. Work is very important to me and the thing with work is that I constantly have to meet new people. It's like I am in a perpetual state of coming out. This can be quite stressful and to be honest I could do without it. Most transgender people just want to be treated as normal human beings, addressed as their chosen gender and respected. One should always address a person in relation to the way they present. If they have made an effort to present as female, they should obviously be addressed as such, even if their voice is not too feminine and their birth gender is obviously male. If you are not sure of the gender expression, do not use pronouns, or, simply call them by their name. Never assume someone will want to explain to you if they are transgender, many transgender people believe they are their chosen gender and do not like the transgender label. Transitioning from one gender to another takes many years and the early stages can be quite awkward as you don't always look how you want to; so, if you see someone looking a bit difficult, have a heart and just be nice to us. It takes real guts to walk out on a building site, especially if you are still adjusting.

I recently approached a group of builders who were complete strangers and the first thing they asked me about were my genitals. Then they asked me if I was gay or straight – all this without even asking my name. I guess they assumed I was a bit weak or something, but I have this thing in me now which commands respect and after I had 'put them straight' they came and apologised. Now we are all good mates.

Transgender or 'trans' for short is a term describing people who partly or wholly relate to the opposite gender. What I didn't originally know is that it's on a sliding scale. There are many degrees of being trans and there are now so many boxes you can put yourself in, that it's hard to keep up.

In common with many trans people, boxes don't always seem to fit and so I identify best as non-binary. The binary concept is that we are all either all male or all female. Personally I don't identify completely 100% with either. My Identity is not at a fixed point on the scale, it's within a zone; this can be anywhere between androgynous and the mid ranges of femininity. I don't associate with a girly girl. According to the recent electoral register 0.4% of the population refused to tick either the male or female box, so there could be quite a lot of people out there who are non-binary. There are Alpha males, feminine males, masculine females and delta females, then there are those who are androgynous in the middle zone. Gender Identity is determined by your brain gender and it is perfectly possible to have a female or androgynous brain in a male body and vice versa. Just imagine how a feminine girl would feel if you gave her shots of testosterone and you might get a grasp of how a transgender/ transsexual women might feel prior to hormone replacement therapy.

I am just glad we live in an age when people are starting to be themselves and not feeling so constrained by this word 'normal' which seems to be some sort of ideal. One thing is for sure and that is the numbers of transgender people seeking help are doubling every four years. We just might be heading towards an age of androgyny.

Implications of the UK General Election – A CIEEM Perspective

Jason Reeves MCIEEM
Policy and Communications Manager, CIEEM

On 7 May the UK electorate voted for a majority Conservative government for the next five years. What does this mean for the ecology and environmental management sector?

In the run up to the 2010 election the Conservatives said that they would be the "*greenest government ever*". They stopped using this phrase soon after the last election and it has been used against them during the last parliament, particularly with reference to the climate-change sceptic former Environment Minister, Owen Paterson. So it came as some surprise that the Conservatives referred to themselves again as the "*greenest government ever*" in their 2015 manifesto[1]. No doubt the environmental sector will be feeling a little bit sceptical that this ambition will be realised over the next five years.

The Positives

There are potential positives in the Conservative manifesto. In coalition the government published the ambitious Natural Environment White Paper, and the Conservatives now add that they will further work to protect our natural landscapes, heritage and countryside. What this will look like in practice remains to be seen.

Further to this are commitments to tackle illegal wildlife trade, tackle plastic bags and other littering, ban wild animals in circuses, further support the EU ban on testing cosmetics on animals, launch a programme of pocket parks (small green spaces in cities), tackle air pollution, improve water quality in our rivers and waterways, reform fishing quotas so that at-risk species are caught at sustainable numbers by the end of this Parliament, create more Marine Protected Areas in the

Overseas Territories, complete the network of Marine Conservation Zones around the UK, and spend £3 billion from the Common Agricultural Policy on enhancing England's countryside.

We must applaud the new government for committing to extend the life of the Natural Capital Committee for the next five years, and to implement its recommendation of developing a 25-year plan to restore the UK's biodiversity. Alongside this however is also a 25-year plan to increase yields from British agriculture which could mean further intensification and loss of wildlife.

Courting Controversy

Some manifesto pledges will undoubtedly be controversial. There are commitments to protecting countryside pursuits such as hunting, shooting and fishing, and there will be a vote in the House of Commons on repealing the Hunting Act. We will also see the badger cull continued in an effort to control the spread of bovine TB in cattle. The Conservatives say that they will protect the public forest estate, but there is no mention of retaining other public land.

With the emphasis on a long-term economic plan and reducing the deficit, this Parliament will see more spending cuts. This new government has pledged to cut a further £10 billion annually in 2017-2018, and £15-20 billion in 2019-2020. Welfare is likely to be hit hardest, however with military and foreign aid spending protected, healthcare spending to increase, and large commitments to infrastructure projects (including investing £13 billion in roads, continuing with HS2 and Crossrail, and starting work on HS3 and Crossrail 2) nature conservation is likely to be cut again. From within the Defra budget there is also already a promise of 1,400 new flood defence schemes. Regarding heritage, there is a pledge to support essential repairs to cathedral and church roofs, which we hope will take account of relevant wildlife such as bats.

The new government is committed to further cutting regulation, to the value of another £10 billion, through the Red Tape Challenge. The Smarter Guidance project[2] continues with the move of information to www.gov.uk, which will only cover sufficient information for users to comply with the law and will not cover best practice guidance. We will have to see what further impacts the cuts have on planning, although it was interesting to note that house builder shares rose sharply[3] after the election result was announced.

It was disappointing to see no mention of 'no net loss' – or even 'net gain' or enhancement – of biodiversity in the Conservative manifesto. The significant cost of invasive species to the UK every year is also not covered. Biodiversity offsetting was not cited and we will have to see if it reappears in this Parliament following its enthusiastic promotion during the coalition government. Unsurprisingly there is no mention of controversial rewilding or species reintroductions. This

issue is gathering momentum, however, and we will see in due course where this government stands on, for example, the proposed lynx reintroduction.

Wider Issues

The government has pledged to protect the Climate Change Act. Counter to this however is the promise to support the exploitation of shale gas (fracking), to continue to promote investment in North Sea oil and gas extraction, and a "*significant expansion in new nuclear and gas*". There will be no new subsidies for onshore windfarms, and support only for renewable technologies that represent "*clear value for money*". A huge road building commitment (as mentioned above) is also at odds with reducing carbon emissions.

Prior to the election, David Cameron said, with reference to science, that a Conservative government would focus on investing in infrastructure and research, encouraging innovation and nurturing engineering talent. There will be further emphasis on apprenticeships and we are likely to see the cap on university tuition fees removed. Research funding will likely be protected, however it will probably be skewed towards areas with economic growth potential.

Further devolution will be implemented, including more financial independence for Scotland and further economic powers for the Welsh Assembly. The Westminster government has also committed to making both countries responsible for raising more of their own public spending budgets. Overwhelming Scottish National Party influence in Scotland may also have further implications for devolved environmental matters in Scotland. The Stormont House Agreement will be fully implemented in Northern Ireland to maintain stability.

Westminster ministerial posts have now also been announced. Liz Truss remains as Environment Minister, along with George Eustice. Rory Stewart has been appointed as Parliamentary Under Secretary of State for the Environment. Lord Gardiner has controversially been named as Defra's spokesperson in the House of Lords.

Amber Rudd becomes the new Energy and Climate Change Secretary. It is thought that Ms Rudd understands the significant risks of man-made climate change and promotes a precautionary approach. Greg Clark has been promoted to Secretary of State for Communities and Local Government. Eric Pickles is understood not to be taking up a new Ministerial role. Jo Johnson (Boris's brother) is the new Minister for Universities and Science. Justine Greening stays at international development. Theresa Villiers remains as Northern Ireland Secretary, and Stephen Crabb likewise as Welsh Secretary.

The Big Debate

Undoubtedly the most significant potential impact of the manifesto on the ecology and environmental management sector is the promise to hold an in-out referendum on the UK's membership of the EU by the end of 2017. The Conservatives are in favour of remaining within the EU, albeit with a renegotiated relationship.

Should the UK leave the EU there are many implications. Most of our wildlife and environmental legislation is based on EU Directives – for example, the Wild Birds, Habitats, Environmental Impact Assessment, and Strategic Environmental Assessment Directives – and we are unsure how these would be replaced. At our People, Politics and the Planet debate[4], Lord de Mauley agreed that we need to be in Europe and that, should the UK leave the EU, we would need to put in place our own equivalent legislation.

The Conservative manifesto commits to maintaining protected areas under UK designations (AONBs, National Parks and SSSIs), however European designations (designated under the Wild Birds and Habitats Directives) are noticeably absent from this list.

There would also be the loss of funding for wildlife from Pillar 2 of the Common Agricultural Policy, and leaving the EU would be damaging to UK science as EU structural funds indirectly support significant amounts of research.

A renegotiated relationship with the EU is even more uncertain. Would the UK seek to weaken the implementation of some of the above Directives? And would the government do away with the EU ban on neonicotinoids, which was opposed by the Conservatives in the last government?

Call to Action

Changes to our relationship with Europe and to the legislation under which most of our profession works will have profound and potentially serious implications for our members. This political issue is one that CIEEM must, and will, engage with. Over the next few weeks we will be calling on all UK-based members to have their say on how CIEEM should seek to influence the debate and we urge you to engage with us on this issue.

If you would like to comment or continue the discussion on the election please visit our LinkedIn discussion thread[5].

Notes

1. https://www.conservatives.com/Manifesto
2. http://guidanceanddata.defra.gov.uk/
3. http://www.bbc.co.uk/news/business/market_data/shares/3/87300/one_month.stm
4. http://www.cieem.net/news/242/people-politics-and-the-planet-eo-any-questions
5. https://www.linkedin.com/grp/post/4306428-6005997500220129284

About the Author

Jason Reeves is CIEEM's Policy and Communications Manager. His role embraces policy issues that include responding to consultations, engaging with governments and other stakeholders, and compiling the monthly Policy eBriefing newsletter.

Contact Jason at:
jasonreeves@cieem.net

CIEEM's Member Networks: What's been going on?

Vicky Bowskill
Geographic Sections Coordinator, CIEEM

It's been a busy year so far for our Geographic Sections and Special Interest Groups across the UK and Ireland.

The committees have been involved in running 53 events and 5 conferences for members in their own area and beyond.

Committee members have also attended a variety of careers events to support students seeking to enter the profession and other external events to help raise the profile of CIEEM.

Two new Special Interest Groups were launched in the autumn of 2014: Academia, and Marine and Coastal. You will be hearing more about the activities of these new groups as they become established.

There will be lots more happening across the UK and Ireland during the rest of the year, but here is a roundup of the highlights from each Section and Special Interest Group.

Scotland

It's been another busy year up in Scotland, with a continuing programme of events. As in previous years, the Committee continued its strong emphasis on student events, attending five different careers events at universities across Scotland. In addition to this, the Section organised events covering Golf and the Environment, at Castle Stuart; a joint event with the John Muir Trust and the Amphibian and Reptile Conservation Trust, and a botany workshop. Thanks go to Committee members for their help organising these events.

September 2014 saw a joint conference between the Scottish Section and the British Ecological Society at the Royal Botanic Gardens in Edinburgh, entitled 'Protecting Scotland's Biodiversity; monitoring in Action'. It was well attended and was an excellent conference including a range of short talks and workshops. The Scottish Section AGM was held in February 2015 in conjunction with two lectures, one on 'The use of Camera Traps in Ecology', and one on 'Making Mobile Mapping work for Ecologists'.

In an exciting recent development, the Scottish Section has now been asked to chair the Scottish Biodiversity Information Forum Commercial Interests Sub-Group. This provides a brilliant opportunity for members to find out more about the work of SBIF, and if they so wish, to get involved. Look out for more information on this new initiative.

Ireland

The Irish section has been busy, thanks in large part to Mairead Stack, our Irish Section Support Officer. The main event was the Irish Section Conference and AGM on 'Wetlands – Managing Biodiversity and Ecosystem Function', held in Belfast last November. Another highlight was their April workshop on the more challenging aspects of Appropriate Assessment.

The Section has focused on raising the profile of CIEEM by meeting Ministers Deenihan and Humphreys, and beginning a closer engagement with NPWS on best practice. Their policy group has made a number of submissions on issues like the National Peatlands Strategy and the consolidated NI Habitats and Species Regulations. They have continued to support more Ireland-based training courses based on last year's training needs analysis.

This year and next they want to host more informal member field trips, lectures and networking events. They also plan to build more links with universities so that they can encourage and support young ecologists to enter our profession.

Wales

Last autumn the Welsh Section held an exhibition stand at the Welsh Biodiversity Partnership conference in Cardiff. This was an excellent opportunity to promote the work of CIEEM in Wales and meet both members and potential members who attended.

Following on from the excellent 2014 conference, the Welsh Section held a very successful Winter Seminar in February 2015 at Bangor University, at which Jane Davidson of University of Wales Trinity St David's and former Assembly Minister, gave a presentation on the opportunities arising from the Future Generations Bill. John Box, CIEEM President, also provided a fascinating talk on the challenges associated with successful habitat creation.

There will be a series of events, workshops and seminars during 2015 to provide members and non-members alike with additional ID skills, other field skills and other topics of particular interest to Welsh members. The Section will, on behalf of members, provide a discussion forum for Welsh Government and Natural Resources Wales consultations and to provide official responses to those organisations.

As ever, keep an eye on the CIEEM website for details of upcoming events and activities.

South East England

Three events were held in the South East England region over the last year, including field visits in the New Forest and a Great Crested Newt Workshop in Oxford.

A committee of five members early in 2014 (Ben Benatt, Debbie Bartlett, Lynn Whitfield, Peter Lawrence and Liz Fagg) increased by co-opting three new members during the year, including a student member (Kate Harrington, James Hildreth and Kate Denton).

The South East England Section Committee approached the new year with new members on board and lots of ideas for more and different events for the year ahead. As well as a repeat of the over-subscribed visit to Richmond Park to hear about deer and veteran tree management in a well-used public open space, there will be opportunities to share experience of surveying, and to get to know other members working in the South East. Do go along and join them at one of their events.

South West England

The South West England Section Committee has sought to continue to run events that are pertinent to the regional membership. In the last year they have held well attended events including: a visit to an RSPB wetland reserve in old peat cuttings on the Somerset Levels; a visit to Braunton Burrows, a SSSI dune system in north Devon; and in December they heard of the ecological impacts of the flooding in the Somerset Levels in 2014, and the complex political, social and ecological issues associated with flood mitigation.

2015 has been a busy year so far for the South West Committee, with new members to the Committee and a programme of events for all levels of membership and a broader geographical spread than has been previously achieved. These include involvement with a conference in Cornwall focussing on best practice in ecology and planning in the county, events for students, and a proposed conference in December.

East of England

The East of England Section Committee hosted a series of well-attended talks and walks in 2014-2015, including their AGM in March 2015 which included a talk on restoring 'ghost' ponds in the arable Norfolk landscape.

The Section started off the season in 2014 with an indoor talk on the Environment Agency's Regional Habitat Creation Programme which we followed up with a site visit in September to Hilgay and Methwold wetland creation site in Norfolk in September. In July members got the chance to visit different habitats managed for wildlife and discuss successes and challenges with the site wardens at Oulton Marshes managed by the Suffolk Wildlife Trust and the Lodge in Sandy, Bedfordshire managed by the RSPB.

In December 2014, Poppy McDonald (Secretary for the East of England Committee) gave an interesting talk on badger mitigation that was very well attended at Writtle College, who have recently achieved CIEEM accreditation. The Committee is now looking forward to more great events over the year ahead.

CIEEM's Member Networks: What's been going on? *(continued)*

East Midlands

After a successful resurrection in January 2014, the East Midlands Section is flourishing and ran several workshops in 2014, culminating in the Section's first conference held in January 2015. The conference, on 'Technological Advances in Ecology', was well attended and covered a range of topics, from GIS and remote sensing, the use of lures and static monitors for birds and bats, to the use of drones for conservation/ecological applications. They were even treated to a demonstration of a drone in flight during a gap in the snowfall.

Following the Conference they held an AGM during which two new Committee members were elected and two Committee members who had been instrumental in restarting the Section stepped down. The Section thanks Matt and Diana for all their help.

Since the conference, the Committee has been busy organising events for 2015. If members have any ideas for events or have a suitable venue in which to hold an event please do get in touch.

West Midlands

The West Midlands Section Committee has been busy over the last year. June saw a fantastic event on 'Farmland Birds and Habitat Management in Environmental Stewardship' run by Land Management Advisors at Natural England, Matt Willmott, Katey Stephen and Rob Havard, in conjunction with Rob Allan, the Estate Manager of Upton Estate, Warwickshire. This was followed by a site visit around Upton Estate to see some of the positive measures included for farmland birds, such as skylark plots and field margin planting schemes.

Evening events over the year have included water vole mitigation, eDNA testing and mitigation for great crested newts, glow worms at Hatton locks and biodiversity offsetting to name a few.

The Committee has continued to strengthen links with universities, attending careers events at Harper Adams and the University of Birmingham. Student attendance was also high for the October 2014 talks on white-clawed crayfish and advanced bat survey techniques at the fifth West Midlands Section AGM.

Finally, the Section is currently running a photo competition. The deadline for entries is 1 July 2015 – check out the West Midlands website for details. The Section Committee is looking forward to seeing even more fantastic entries as the fieldwork season really gets going!

Yorkshire and Humber

Committee meetings and events have been well attended with both field workshops and indoor talks providing a focus for ecologists and environmental managers to meet, exchange ideas and learn about current developments in ecological practice. Of particular note was a woodland workshop in the spring focussing on ancient woodland indicators, which had to be run on two occasions due to overwhelming demand!

The Green Infrastructure event in Dearne Valley was also a success with participants cycling between sites using green infrastructure routes through the valley, which has benefitted from investment following decline of the coal mining industry. The route culminated at RSPB Old Moor where a meal and evening presentation rounded off a very informative and enjoyable half day.

A sub-group of the Committee has been working hard to develop an event around steady state economics which is championed by Dan O'Neill of Leeds University and we hope to bring this to fruition this autumn. They also have John Altringham of Leeds University pencilled in for a talk regarding his Defra-funded research on monitoring bats in woodland. The Section is looking forward to the year ahead with a strong Committee.

All Committee members are volunteers and the great range of activities outlined above are only possible because of the time they give for the benefit of CIEEM members in their country or region.

The support of the wider membership is vital to add value to this work and if you are interested in finding out how you might be able to help please visit www.cieem.net/get-involved.

North East England

In the last 12 months the North East England Section Committee has organised a range of events for members in the region, details of which have been made available on the North East England webpage and in *In Practice*.

At their AGM in October 2014, they co-opted three new Committee members and currently have an almost full house with 15 Committee members.

At the time of writing in 2015, the Section has already held events on introducing the changes to Environmental Stewardship schemes in England and a workshop on Chartered Ecologist applications to try to encourage more applications in the region.

However, the main focus during early 2015 has been the organisation of the Section Conference, held in April at Northumbria University, entitled 'Advances in ecological surveys: methodologies and findings'.

North West England

The North West England Section had a quiet year in 2014 for a variety of reasons. The Section held a stand at the Regen 2015 conference in Liverpool in July and the ninth AGM of the North West England Section was held at Liverpool Hope University on 25 March 2015. This included a talk by Philip James FCIEEM – Professor of Ecology and Ecosystems, and Environment Research Centre Leader at the University of Salford – entitled 'Managing today's ecosystems for decades to come: thoughts about riverine, estuarine and terrestrial systems'.

The Section Committee was re-convened in December 2014 with a series of meetings and several new members joined the committee. Planning for a programme of events for members in North West England throughout 2015 is ongoing and the future looks bright!

Overseas Territories Special Interest Group

The Overseas Territories Specialist Interest Group was busy throughout 2014 in preparation for the December conference entitled 'Lessons to be Learnt from Invasive Species Mitigation and Management in the UKOTs'. The conference included a diverse array of speakers who had been working throughout the Territories. Speakers discussed their perspectives and experiences on topics ranging from rat eradication (South Georgia) and finding the balance between native and introduced vegetation (Ascension Island), to grant applications received under the Darwin and Darwin Plus initiatives.

The group continue to raise awareness of the UKOTs, promote CIEEM and forge links with the UKOTs in 2015. This includes continued engagement in reciprocal relationships with organisations working within the Territories; both promoting ongoing work in the UKOTs to CIEEM members and promoting the skill set of CIEEM members to the UKOTs.

Academia Special Interest Group

The newly formed Academic Special Interest Group held its inaugural Committee meeting in April. It is anticipated that this will function as a network for those carrying out research in ecology and environmental management to share ideas as well as provide a pool of specialists. They are planning a careers conference, aimed at year 12 pupils planning UCAS applications and final year undergrads/new entrants who may be considering an MSc in summer 2016 to promote both the profession and the CIEEM accredited university offer.

The Group would be interested to hear from any CIEEM members working in academia.

You can find out more about members of the Committee online at www.cieem.net/academia.

Marine and Coastal Special Interest Group

The Marine and Coastal Special Interest Group was established on 2 December 2014 to represent the marine (including offshore), coastal and estuarine environments.

The aim of the Marine and Coastal group is to provide support to CIEEM members with an interest in the marine environment and provide a platform for discussion on marine topics or issues of relevance by forming networks, providing a focus for sharing good practice, and collating feedback on relevant issues to be disseminated via CIEEM. Early 2015 saw the group drafting responses to three important consultations on: Marine Conservation Zones, The Marine Strategy Framework Directive and the marine aspects of the River Basin Management.

If you are interested in finding out more about your local Geographic Section, or one of the Special Interest Groups, please visit www.cieem.net/geographic-sections.

North East England Section News

Section Conference 2015: Advances in Survey Techniques 16 April 2015, Newcastle-upon-Tyne

Nicola Faulks CEcol MCIEEM

Vice Convenor, North East England Section Committee

This conference was organised by the North East England Section Committee, sponsored by Northumbria Water and hosted by Northumbria University. The welcome address was given by John Box (CIEEM President) where he gave a powerful speech about ecology and the future of the discipline. The fact that we need to employ smart ecology and to work closely with engineers, so that despite ongoing development, we can aim for no net loss of biodiversity. He also stated that CIEEM is looking to increase its membership, so we need more Fellows, Members and Chartered Ecologists.

The next talk was given by Andy Cherrill (former Convenor for the North East England Section committee) who is now based at Harper Adams University. Andy talked about his work on inter-observer variation and suggested ways (such as training) that these variations can be reduced, e.g. when undertaking NVC surveys. Following on from Andy's talk, we changed tack completely and learned all about the trapping and the use of telemetry for tracking European lobsters from Dan Skerritt (Newcastle University). It seems lobsters are quite territorial!

After a tea and biscuit break, John Altringham (Leeds University) talked about setting up a public participatory survey protocol – a standardised method for survey and monitoring of woodland bats. After which Tina Wiffen (Northumberland Bat Group) talked about the Northumberland Nathusius Project and how, with a very limited (almost non-existent) budget, they managed to set up the project, involving 60 members of the public in the surveys and keeping the hunt for the elusive Nathusius bat going for three years from 2011.

Lunch was a social affair, with a buffet and seating in the airy open dining area. During the lunch session, a careers seminar was held. Four experienced practitioners were invited to form a panel to represent education, consultancy, utilities and government, so that people could ask questions of them about how to gain work in their sectors. A good discussion was had, ranging from questions about working abroad to how to seek employment in a consultancy when fresh out of university!

A lovely talk about search dogs (Conservation Dogs UK) given by Corry Brummer (Natural England) welcomed us back after lunch. She described how sniffer dogs have been trained not only to find drugs, but also bats and great crested newts (GCN). It would appear that they are more successful than humans at finding GCN, especially at night. The next talk also alluded to bats and GCN, but focussed on the emerging survey technique of employing eDNA analysis. Lisa Kerslake (Swift Ecology) talked about the uses of eDNA, e.g. its use for separating out mixed species samples where many bat species are sharing the same roost. At the current time the technology is not able to distinguish between domestic and wildlife interbreeding e.g. wild and domestic cats.

Mieke Zwart (Newcastle University) gave a talk on the use of Anabats for recording nightjars. The results of her PhD show that digital recorders may be more sensitive than humans. From the Anabat detectors to all types of detector, the next talk after a short tea break, was given by Paul Howden-Leach (Skyline Ecology) and was all about bat detectors. Feedback from this talk suggests that even the non-batty people in the audience learned about detectors and how they work.

The penultimate talk was by Barry Wright (Baker Consultants) on his practical development of the Phase 1 survey method and the use of a biro pen with four colours. His very informative and detailed maps produced through this survey method may not be for everyone, but he certainly provided an insight in to the need for updating the Phase 1 habitat survey as we know it. The final talk was about the use of Unmanned Aerial Vehicles (UAV) given by Simon Gibson-Pool (University of Edinburgh). Simon had even brought in some UAVs so we could see them, sadly not flying around the lecture theatre!

Robin Cox, North East England Section Convenor, summed up the conference by thanking all of the event organisers, speakers, sponsors, exhibitors and delegates for making the day such a success. A long and informative day, since which a lot of positive feedback has been received.

For more information in the talks please visit www.cieem.net/previous-conferences. Further details on the activities of the North East England Section can be found at www.cieem.net/north-east.

1. John Box and Peter Glaves chair the morning session
2. Peter Glaves chairs questions for Mieke Zwart
3. Delegates enjoy the conference exhibitor stands
4. Delegates visit the CIEEM stand
5. Andy Cherrill discuss inter-observer variation

East Midlands Section News

Section Conference 2015: Technological Advances in Ecology and Environmental Management

"Flying cameras, techno-pond dipping and Yorkshire fastenings..."

Diana Clark MCIEEM

Former East Midlands Section Committee member and current Welsh Section Committee member

After months of planning and hard work, fortified by encouraging words and gentle motivational nudges from CIEEM's Section Coordinator Vicky Bowskill, members of the East Midlands Section Committee finally arrived at the Derbyshire conference venue at the end of January amid threats of snow and plunging temperatures. Waking at the crack of dawn, we were pleased to pull back the curtains and find that the six inches of snow predicted had not materialised, and the conference could go ahead as planned.

Our morning session got off to a flying start with Neil Parker at Environment Systems Ltd taking a look at how GIS and remote sensing are helping advance our profession, and Mieke Zwart from Newcastle University talking us through the use of bio-acoustic recorders in detecting nightjars – a species notoriously tricky to survey. We also enjoyed an entertaining talk from Barry Wright at Baker Consultants, who demonstrated the practical use of combining infrared cameras, ultrasonic detectors and recording kit to aid emergence and re-entry bat surveys. All for a sensible price and topped off with a large helping of 'Yorkshire fastenings' – or elastic bands as the rest of us might call them.

After a lively tea break we heard from Dan Whitby (AEWC Ltd) about different types of acoustic lure systems used to increase the capture rates of bats – and all the pitfalls this can entail – as well as a glimpse of more exotic climes from Serge Wich with his presentation on the use of drones to detect primate nests in Sumatra and Borneo (Conservation Drones).

Our afternoon sessions saw Edward 'Zak' Zakrajsek (DeTect Global) present on avian radar systems for monitoring and mitigating wind turbine collisions, including some fascinating background and history to this technique. We also heard from Mark Webb (WSP Group) about this year's hottest topic: the use of environmental DNA to detect great crested newts in waterbodies, as well as from Emily Howard-Williams (Moulton College/ University of Northampton) about the use of Radio Frequency Identification (RFID) to study harvest mice dispersal.

The highlight of our day was an impromptu drone demonstration by Serge Wich, which was niftily dropped into a sunny interval between persistent snow flurries. We suspect that this drone is now the most photographed drone in, well, Derbyshire I guess.

Our final slot was a question and answer session hosted by Bob Edmonds of SLR, with Barry Wright, Veronica Lawrie (Atkins Ltd) and Tim Shreeve (Oxford Brookes University) on the panel, debating recent developments in habitat mapping methodologies.

All in all an excellent conference with a great range of topics covered. The East Midlands Section Committee would like to extend a big thanks to all the speakers, to conference sponsors Wildcare and to all our other exhibitors, whose contributions combined to make the conference such a success. Also to Vicky for her encouragement and support whilst we conference-organising-novices fumbled our way towards what ended up being a fantastic day. Finally, thanks to all 80+ delegates who braved the looming poor weather conditions and helped shape the conference with probing questions and sparky conversation in all the breaks. It was a pleasure to catch up with old friends and colleagues – and meet some new ones too. Looking forward to the next one already.

1. Neil Parker (Environment Systems) answers questions from the audience
2. Bob Edmonds Chairs a panel discussion with Tim Shreeve (Oxford Brookes), Veronica Lawrie (Atkins Ltd) and Barry Wright (Baker Consultants)

3a/b. Serge Wich sets up drone demo during a brief break in the snow

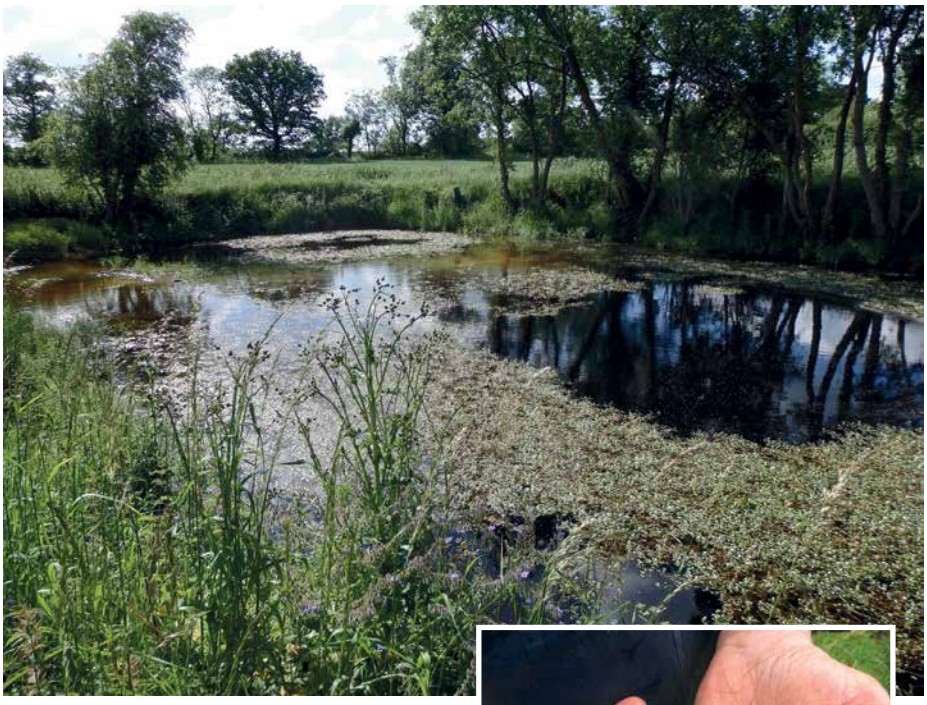
East of England Section News

Poppy McDonald CEnv MCIEEM
Secretary, East of England
Section committee

The East of England Geographic Section held their 2nd AGM on 9 March, which was attended by over 35 local members. The event was kindly hosted by the Department of Life Sciences at Anglia Ruskin University in Cambridge. After the formalities of the AGM in which new Committee member Martin Brammah was elected, the audience were treated to an excellent talk from Dr Carl Sayer. Carl is an aquatic ecologist in the Environmental Change Research Centre at UCL, and his talk focused on a PhD project to restore 'Ghost Ponds' in the Norfolk agricultural landscape.

Example of a ghost pond before restoration and one year after re-digging.

There are over 23,000 ponds in Norfolk, the highest of all the counties, and the majority of these comprise former marl pits dug in the 17th-19th centuries. Ghost ponds are ponds which have either been deliberately filled for land reclamation, or which have been allowed to disappear gradually through terrestrialisation, and can be seen with aerial mapping or as depressions or damp areas in arable land. The Ghost Ponds Project is investigating how these ponds can be restored, with a particular interest in the role of the old seed and egg bank buried within ponds, and how it can contribute to their re-colonisation and return to the world of the living.



Restored ghost pond

As an example, one ghost pond known to have been filled in the 1850s was restored and plant and snail remains were found as the pond was re-dug back to the original marl. At the end of the first year the seed bank had produced a variety of aquatic vegetation in the pond, after being several metres under agricultural land for over 150 years.

The ghost ponds team are also working with Norfolk Wildlife Trust, FWAG and others on the Norfolk Ponds Project, which aims to reverse the decline of Norfolk's ponds so that agricultural landscapes contain a mosaic of clean water ponds.

New Members

The decision on admission is usually taken by the Membership Admissions Committee under delegated authority from the Governing Board but may be taken by the Governing Board itself.

The names of applicants for Full and Associate membership are published at the first opportunity in the bi-monthly CIEEM E-Newsletter. Admission is subject to no objection from any member as to the candidate's suitability for admission being received in writing at the CIEEM office within 30 days of publication.

CIEEM is pleased to welcome the following individuals as new members:

ADMISSIONS

Full Members

Mr Michael Austin, Miss Rosetta Blackman, Dr Natalie Crawley, Miss Jennifer Diack, Mrs Gabrielle Graham, Dr Tim Rich, Dr Kathryn Turner, Mr Daniel Whitby, Mrs Janet Wilkinson.

Upgrades to Full Membership

Dr Katherine Drayson, Mr Tony Marshall, Miss Natasha Murray, Miss Octavia Neeves, Mrs Caroline Wright.

Associate Members

Miss Jenifer Andreu, Mrs Jenni Blakeman, Mr Charlie Fayers, Miss Rachel Godden, Mrs Frances Graham, Ms Sarah Ingham, Mr Brendan Kirwan, Miss Maeve Maher-McWilliams, Mr Anthony Mellor, Mr Toby Palmer, Mr Tommy Root, Mr Peter Watson, Mr Simon Wellock.

Upgrades to Associate Membership

Miss Rebecca Blamey, Mr Colin Davies, Miss Rachel Folkes, Miss Casey-Ruth Griffin, Miss Caroline Langdon, Ms Hayley Oates.

Graduate Members

Mr Nebson Dube, Miss Zoe Adlington, Miss Victoria Armstrong, Mr Thomas Aspin, Miss Hannah Bates, Mr Samuel Bentley-Toon, Miss Rachel Bover, Mr Samuel Buckland, Mr Owen Crawshaw, Mr Adam Cross, Ms Molly Dailide, Miss Laura Dartnell, Miss Laura Dennis, Miss Angelena Efstathiou, Miss Eleanor Frew, Miss Charlotte Goodayle, Mr Michael Janicki, Mr Thomas Johnston, Mr Richard Laws, Mr Barnaby Leigh, Mr Kevin McGee, Mr Mark Nelson, Miss Amy Nichol, Miss Anna Owen, Miss Helen Pearce, Mr Philip Ramsden, Mr Lloyd Richards, Mr George Simpson, Ms Taryn Stack, Mr Edward Walker, Dr Daniel Weaver, Mr Richard Webber-Salmon, Mr Daniel Winter, Miss Bethan Withey, Mr Kevin Wood.

Upgrades to Graduate Membership

Mrs Julie Player, Miss Kate Isger, Miss Courtenay Holden, Miss Hannah Gardner, Mr Daniel Wales, Miss Anna Simpson, Mr David Kent.

Student Members

Mr Stuart Abernethy, Mr James Barker, Miss Grainne Barron, Mr Misho Baxendale, Miss Alexandra Brown, Mr Richard Cooper, Mr Andrew Cutts, Miss Donya Davidson, Ms Louise Duignan, Miss Paige Gallagher, Mr Joe Gosling, Mr Warren Gregory, Miss Sarah Hall, Mr Cayce Harburg, Miss Kirsty Hardy, Miss Emma Higgins, Mr Robert Hillier, Mrs Sarah Holman, Miss Sarah Housley, Mr Aron Howells, Ms Victoria Howes, Mr Hristov Hristiyan, Mr Nathan Jenkinson, Miss Jaqueline Jobes, Mr Shane Kemp, Mr Douglas Kerr, Mr Matthew Kirby, Ms Karolina Krystyna, Miss Hemali Lalji, Miss Catriona Mackison, Miss Sofia Magarinos, Miss Maya Master, Mr Liam McFarlane, Mrs Annette Middleton-Burke, Miss Eloise Murray, Miss Victoria Norman, Miss Laura O'Keefe, Mr Erik Paterson, Miss Sara-Jane Ponting, Miss Jennifer Pullen, Mr David Roberts, Miss Kelly Rosier, Miss Charis Russell-Smith, Mr Thomas Shannon, Miss Emily Simpson, Miss Kirstene Stevenson, Mr Thomas Travers, Miss Jennifer Wardle, Mr Sam Williams.

Qualifying Members

Mr Bryce Blandford-Corp, Mr Alan Crane, Mrs Rosslyn Howell, Ms Julie Merrett, Mr Michael Richardson.

Supporter Members

Mr Jonathan Barrett, Miss Emily Bartlett, Ms Penny Simpson, Mrs Rosemary Teixeira.

Recent Publications

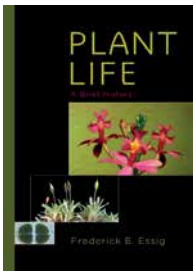
White-Clawed Crayfish

Authors: Nick Mott (Staffordshire Wildlife Trust)

Price: free download

Available from: www.staffs-wildlife.org.uk/sites/default/files/files/crayfish.pdf

Just one crayfish species is native to the British Isles and Ireland: the white-clawed crayfish. The name 'crayfish' is thought to derive from the Old French word for 'crevice'. This is apt as these fascinating creatures hide in various nooks and crannies during the day and then come out to forage at night. Its menu is unfussy: it will eat pretty much whatever it can get its claws into including dead fish, insects, plants, detritus and one another. It therefore has an important role to play in cleaning up our freshwater environments. Its presence is generally a good indication of a healthy and balanced wetland habitat. Prior to the 1970s the white-clawed crayfish was common and widely distributed across much of England, Wales, Ireland and Europe. Since then the population has suffered a catastrophic decline. There is now genuine concern over its future.



Plant Life: A Brief History

Author: Frederick B. Essig

ISBN: 9780199362646

Price: £42.99

Available from: www.nhbs.com

Botanist Frederick Essig traces how familiar features of plants evolved sequentially over hundreds of millions of years as various environmental challenges and opportunities were met. This chronological narrative begins with the origin of photosynthesis and the rise of cyanobacteria, continues with the evolution and diversification of photosynthetic eukaryotes and their invasion of dry land, explores the varied adaptations for sexual reproduction and dispersal in the terrestrial environment, and concludes with the diverse growth forms of the flowering plants.

Bird Ringing Station Manual

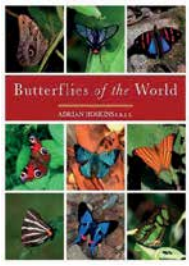
Authors: Przemysław Busse and Włodzimierz Meissner

ISBN: 9788376560526

Price: £79.99

Available from: www.nhbs.com

In an attempt to standardise elements of the station routine, this publication describes the procedures used in passerine and wader ringing stations. It offers a comparative analysis of versatile evaluation techniques such as measurements, orientation experiments and monitoring. The authors meticulously analyse different methods used to track birds, including catching passerines with mist-nets in land and wetland habitat, as well as the use of the Heligoland trap. This publication, as a successful bid to establish a bird station routine that is favourable to both birds and ringers, will benefit all professional and amateur ringers.



Butterflies of the World

Author: Adrian Hoskins

ISBN: 9781921517334

Price: £16.99

Available from: www.nhbs.com

A lavishly illustrated book covering the butterflies of the world with informative text written by an expert author who has spent many years watching and studying Lepidoptera around the world. Opening chapters cover the evolution, anatomy, lifecycle, ecology and taxonomy of the world's butterflies. The bulk of the publication comprises chapters offering comprehensive coverage of each of the world's butterfly families, from the spectacular swallowtails, apollos, morphos and birdwings through to the cryptic browns, whites, skippers and hairstreaks. The pages are illustrated with hundreds of stunning colour photographs.

Implementing the Nagoya Protocol: Comparing Access and Benefit-sharing Regimes in Europe

Editors: Brendan Coolsaet, Fulya Batur, Arianna Broggiato, John Pitseys, Tom Dedeurwaerdere

ISBN: 9789004293205

Available from: http://booksandjournals.brillonline.com/

The adoption of the Nagoya Protocol on Access and Benefit-sharing to the Convention on Biological Diversity in 2010 is a major landmark for the global governance of genetic resources and traditional knowledge. The way in which it will be translated into practice will however depend on the concrete implementation in national country legislation across the world. This publication compares existing ABS regimes in 10 European countries, including one non-EU member and one EU candidate country, and critically explores several cross-cutting issues related to the implementation of the Nagoya Protocol in the EU. Gathering some of the most professional and widely acclaimed experts in ABS issues, this book takes a major step towards filling a gap in the vast body of literature on national and regional implementation of global commitments regarding ABS and traditional knowledge.

Scientists' responsibilities towards evidence-based conservation in a Small Island Developing State

Kaiser-Bunbury, C.N., Fleischer-Dogley, F., Dogley, D. and Bunbury, N.

Journal of Applied Ecology 2015, 52: 7–11 (doi: 10.1111/1365-2664.12346)

Much has been written about bridging the implementation gap, also known as the 'great divide' or the 'knowledge–action boundary'. Most of these authors make valid and needed points concerning the application of science to conservation management, including the proposal of conceptual frameworks or changes to the structure of the research system. Whilst recommendations for higher-level structural changes are desirable, they are rarely in sync with the constraints of conservation scientists, which call for rapidly achievable outcomes with limited resources. As a consequence, the recommendations of many well-intentioned researchers end with publication, despite the fact that publication alone is usually ineffective in triggering management changes. Here the authors show, using a successful case study from the Seychelles, how researchers and practitioners have worked together to change strategy and policy for conservation of an endangered species based on scientific evidence. Further, the example expands on the responsibility of researchers by demonstrating immediate actions that can be taken by scientists to improve uptake of their research results. Such steps can be highly effective, and practical guidelines can be drawn from this example by other researchers hoping to more effectively bridge the gap between their research and management.

Correspondence: ckaiser-bunbury@bio.tu-darmstadt.de

How much is new information worth? Evaluating the financial benefit of resolving management uncertainty

Maxwell, S.L., Rhodes, J.R., Runge, M.C., Possingham, H.P., Ng, C.F. and McDonald-Madden, E.

Journal of Applied Ecology 2015, 52: 12–20 (doi: 10.1111/1365-2664.12373)

Conservation decision-makers face a trade-off between spending limited funds on direct management action, or gaining new information in an attempt to improve management performance in the future. Value-of-information analysis can help to resolve this trade-off by evaluating how much management performance could improve if new information was gained.

The authors address this gap by applying value-of-information analysis to the management of a declining koala *Phascolarctos cinereus* population. Gaining new information about survival and fecundity rates and the effect of habitat cover on mortality threats will do little to improve koala management. The value of information was low because optimal management decisions were not sensitive to the uncertainties considered. Decisions were instead driven by a substantial difference in the cost efficiency of management actions. The value of information was up to 40 times higher when the cost efficiencies of different koala management actions were similar.

The authors also theoretically demonstrate that the value of reducing uncertainty is highest when it is not clear which management action is the most cost efficient. This study will help expand the use of value-of-information analyses in conservation by providing a cost efficiency metric by which to evaluate research or monitoring.

Correspondence: smaxwell@uq.edu.au

Is Great Britain heading for a Ponto–Caspian invasional meltdown?

Gallardo, B. and Aldridge, D.C.

Journal of Applied Ecology 2015, 52: 41–49 (doi: 10.1111/1365-2664.12348)

The outcome of multiple invasions from a common origin may lead to facilitative interactions because the invaders have co-evolved under similar environmental conditions. This outcome is often referred to as invasional meltdown, with a resultant increase in invasive species and a decline in native species richness and abundance. This study seeks to assess the full scope of the threat posed by a high-risk group of 23 freshwater invaders originating from the Ponto–Caspian region (south-east Europe) across Britain. Ponto–Caspian invaders constitute a group of special concern because they have recently caused a large-scale invasion into Western Europe. At least 14 out of the 23 Ponto–Caspian organisms investigated are well-established in the Rhine estuary and Dutch ports. Four of them *(Hemimysis anomala, Dikerogammarus villosus, D. haemobaphes* and *Hypania invalida*) have recently established in Britain. Regression models suggest the rest are under a critical risk of being transported, with four species predicted to have arrived in Britain already: *Echinogammarus ischnus, Jaera istri, Limnomysis benedeni* and *D. bispinosus*. According to species distribution models, the cumulative risk of invasion of multiple Ponto–Caspian species, thus invasional meltdown, is highest in the south-east of England and decreases to the north and west. Britain might be on the brink of invasional meltdown, and as a consequence, confronting the problem of Ponto–Caspian invasive species is a vital element for national biosecurity.

Correspondence: galla82@hotmail.com/belinda@ebd.csic.es

Managing breaches of containment and eradication of invasive plant populations

Fletcher, C.S., Westcott, D.A., Murphy, H.T., Grice, A.C. and Clarkson, J.R.

Journal of Applied Ecology 2015, 52: 59–68 (doi: 10.1111/1365-2664.12361)

Containment can be a viable strategy for managing invasive plants, but it is not always cheaper than eradication. In many cases, converting a failed eradication programme to a containment programme is not economically justified. Despite this, many contemporary invasive plant management strategies invoke containment as a fallback for failed eradication, often without detailing how containment would be implemented. The authors demonstrate a generalized analysis of the costs of eradication and containment, applicable to any plant invasion for which infestation size, dispersal distance, seed bank lifetime and the economic discount rate are specified. We estimate the costs of adapting eradication and containment in response to six types of breach and calculate under what conditions containment may provide a valid fallback to a breached eradication programme.

Correspondence: cameron.fletcher@csiro.au

Neonicotinoid insecticide travels through a soil food chain, disrupting biological control of non-target pests and decreasing soya bean yield

Douglas, M.R., Rohr, J.R. and Tooker, J.F.

Journal of Applied Ecology 2015, 52: 250–260 (doi: 10.1111/1365-2664.12372)

The authors investigated in laboratory and field studies the influence of the neonicotinoid thiamethoxam, applied as a coating to soya bean seeds, on interactions among soya beans, non-target molluscan herbivores and their insect predators. In the laboratory, the pest slug *Deroceras reticulatum* was unaffected by thiamethoxam, but transmitted the toxin to predaceous beetles *(Chlaenius tricolor)*, impairing or killing >60%. In the field, thiamethoxam-based seed treatments depressed activity–density of arthropod predators, thereby relaxing predation of slugs and reducing soya bean densities by 19% and yield by 5%. Neonicotinoid residue analyses revealed that insecticide concentrations declined through the food chain, but levels in field-collected slugs (up to 500ng.g^{-1}) were still high enough to harm insect predators. The findings reveal a previously unconsidered ecological pathway through which neonicotinoid use can unintentionally reduce biological control and crop yield. Trophic transfer of neonicotinoids challenges the notion that seed-applied toxins precisely target herbivorous pests and highlights the need to consider predatory arthropods and soil communities in neonicotinoid risk assessment and stewardship.

Correspondence: mrd276@psu.edu

Perverse incentives risk undermining biodiversity offset policies

Gordon, A., Bull, J.W., Wilcox, C. and Maron, M.

Journal of Applied Ecology 2015, 52: 532–537 (doi: 10.1111/1365-2664.12398)

Offsetting is emerging as an important but controversial approach for managing environment–development conflicts. Biodiversity offsets are designed to compensate for damage to biodiversity from development by providing biodiversity gains elsewhere. The authors suggest how biodiversity offset policies can generate behaviours that exacerbate biodiversity decline, and identify four perverse incentives that could arise even from soundly designed policies. These include incentives for (i) entrenching or exacerbating baseline biodiversity declines, (ii) reducing non-offset conservation actions, (iii) crowding out of conservation volunteerism, and (iv) false public confidence in environmental outcomes due to marketing offset actions as gains. Despite its goal of improving biodiversity outcomes, there is potential for best practice offsetting to achieve the opposite result. Reducing this risk requires coupling offset crediting baselines to measured trajectories of biodiversity change and understanding the potential interaction between offsetting and other environmental policies.

Correspondence: ascelin.gordon@rmit.edu.au

Stacking the odds: light pollution may shift the balance in an ancient predator–prey arms race

Minnaar, C., Boyles, J.G., Minnaar, I.A., Sole, C.L. and McKechnie, A.E.

Journal of Applied Ecology 2015, 52: 522–531 (doi: 10.1111/1365-2664.12381)

Lights may interfere with anti-bat defensive behaviours in moths, and disrupt a complex and globally ubiquitous interaction between bats and insects, ultimately leading to detrimental consequences for ecosystems on a global scale. The authors combined experimental and mathematical approaches to determine effects of light pollution on a free-living bat–insect community. They compared prey selection by Cape serotine bats *Neoromicia capensis* in naturally unlit and artificially lit conditions. Moth consumption was low under unlit conditions, but increased six-fold under lit conditions despite a decrease in relative moth abundance. The models suggest the increase in moth consumption was a result of light-induced, decreased eared-moth defensive behaviour. In the current context of unyielding growth in global light pollution, the authors predict that specialist moth-eating bats and eared moths will face ever-increasing challenges to survival through increased resource competition and predation risk, respectively. Lights should be developed to be less attractive to moths, with the goal of reducing effects on moth behaviour. Unfortunately, market preference for broad-spectrum lighting and possible effects on other taxa make development of moth-friendly lighting improbable. Mitigation should therefore focus on the reduction of temporal, spatial and luminance redundancy in outdoor lighting. Restriction of light inside nature reserves and urban greenbelts can help maintain dark refugia for moth-eating bats and moths, and may become important for their persistence.

Correspondence: cminnaar@zoology.up.ac.za

Street lighting adds to urban light pollution.

Forthcoming Events 2015

For information on these events please see *www.cieem.net*.

Conferences and Other Events		
Date	Title	Location
25 June	CIEEM Awards Luncheon	Birmingham
15 July	CIEEM Summer Conference – Managing the Impact of Plant and Animal Disease on Biodiversity	London
16 July	Joint CIEEM/IAQM Discussion Meeting – Habitats Directive: Air Quality and Ecological Impact Assessment	London
November TBC	CIEEM Autumn Conference – Reconnecting People and Nature	Sheffield

Training Courses		
15 June	Camera Trapping for Ecologists	Preston Montford, nr Shrewsbury
17 June	Introduction to the National Vegetation Classification	Broxton, Cheshire
18 June	Barn Owl: Surveying and Reporting	Tamworth
23 June	Otter Ecology and Surveys	Rugeley, Staffs
24 June	Otter Mitigation	Rugeley, Staffs
29 June	Introduction to Grasses	Donabate, Co Dublin
30 June	Introduction to Sedges and Rushes	Donabate, Co Dublin
30 June	Water Vole Ecology and Surveys	Ilkeston
1 July	Water Vole Mitigation	Ilkeston
6 July	Wildflower Identification – Neutral and Calcareous Grasslands	Old Sarum, nr Salisbury
6 July	Japanese Knotweed – control and legislation	Swansea
7 July	BALI/ROLO Health and Safety Awareness	Skelmersdale
11 July	Hazel Dormouse: Handling and Survey Methods	Herne Bay, Kent
16 July	Habitats Directive: Air Quality and Ecological Impact Assessment Joint CIEEM/IAQM Discussion Meeting	London
16 July	Introduction to White Clawed Crayfish: Field Techniques and Licensing	Windermere
21 July	Making the Most of BREEAM and the Code for Sustainable Homes	Birmingham
22-24 July	Working with Crayfish – Survey, Ecology, Mitigation and Licensing	Malham Tarn, Settle
23 July	Identification of Invasive Alien Plants	Dorking
31 July	Developing Wildflower Identification Skills	Middleton-by-Wirksworth, Derbyshire
5 August	Hazel Dormouse: Handling and Survey Methods	Herne Bay, Kent
2-4 September	Working with Crayfish – Survey, Ecology, Mitigation and Licensing	Malham Tarn, Settle
4 September	Preliminary Ecological Appraisal – An Applied Approach	Lewes
7 September	Invasive and Non-Native Flora	Swansea
9 September	Using the Vegetative Key to the British Flora	Southampton
10 September	Phase 1 Habitat Survey	Sudbury
10 September	The Water Framework Directive – An Applied Approach	London
16 September	Management of Invasive Plant Species	London
16 September	Water Vole Ecology and Surveys	Nr Cirencester
17 September	Water Vole Mitigation	Nr Cirencester
24 September	Assessing and Describing Architectural Features in Bat Surveys and Report Writing	Warwickshire
24 September	Environmental Impact Assessment (EIA) Using Fish and Shellfish Data in Marine, Coastal and Estuarine Systems	London
29 September	Japanese Knotweed – Identification, Assessment and Management	London

Geographic Section Events		
10 July	North West England Section – Biodiversity within the seabed: species and the services they provide	Caldy
26 July	North West England Section – Bird ringing at Oxmoor Nature Reserve	Runcorn
10 October	Irish Section – Glendalough bryophyte outing	Glendalough
3 November	South East England Section – University of Kent annual Careers Fair (CIEEM stand)	Canterbury

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