THE Teaching Ecology Newsletter

British Ecological Society

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CaSE: Careers for young people

In November 2006 I attended an Opinion Forum hosted by the Campaign for Science and Engineering in the UK (CaSE). The opinion forum was titled ***"A new vision for careers guidance for students studying science or engineering"*** and looked at the issues surrounding careers advice to students at all levels within the education system. The summary of findings and recommendations for the opinion forum were published last month.

The report finds that young people in schools are in general served badly by the system of information and guidance about the career opportunities. This is especially true for those students of science.

Whilst many students are disenchanted with sciences and drop them as soon as they are able to do so, the message that science is not only for scientists and engineers is being lost. A background in science leaves up to 95% of the job market open to it's students compared to the opportunities of a non-science student and this is an important message to get across.

The report highlights the responsibility of schools and colleges but also of the government and wider science community in looking to the future of science recruitment.

Biology may not currently be suffering to the same degree as the physical sciences in terms of recruitment but there is some concern.

The information that is available is fragmented, disparate and variable in reliability whilst the word "career" itself is an obsolete term harking back to a time of one job, one employer for a working lifetime.

Careers advice in schools is not measured in any league table and as a result the delivery of top quality advice about careers is not high on the school or college agenda. Many of the careers advisors are very rarely from a scientific background and do not have the support, training or materials to provide advice on careers in the scientific arena.

Much of the careers advice that is available if often tightly focussed a specialist role within a given sector where as generic advice is limited.

Ultimately there are some big challenges ahead and issues such as climate change make it all the more important that we generate a supply of high quality scientists for the future.

For ecology there is a simple message, young people are enthused to take up ecological careers if there are exposed to high quality ecological teaching and good advice on the career prospects open to them. They make their choices based on their experiences and opportunities they are exposed to. Sitting back and letting the schools do all the work without our support isn't going to keep us supplied with ecologists in the future.

Karen Devine

Reference: Opinion Forum Number 6 March 2007.A full copy of the report is available online at www.sciencecampaign.org.uk

What's Inside ?

About the Teaching Ecology Newsletter (TEN)

The original purpose of TEN was to help ecologists teaching around the country to keep in touch with each other and with what the society was doing in education, and to provide a forum for debate. These remain its functions and we welcome the contributions of any TEN reader, whether they take the form of a very short note, a letter, a book review or a longer article.

Submitting a Contribution

We will accept material in any form but a text file attached to an email is preferable. Illustrations, pictures or clip art are also welcome. Please make sure there are no copyright problems with anything you submit for inclusion in TEN. Any secondary source material should be properly acknowledged and the author's permission obtained if necessary. The editor reserves the right to make modifications to material submitted in the interests of overall consistency, although we would normally get back to you in the case of major changes.

About the BES

The British Ecological Society is the oldest ecological society in the world and Sir Arthur Tansley was its first president. The BES has a worldwide membership of over 4000 ecologists, produces four internationally respected scientific journals and organizes meetings and symposia at both national and international levels.

The Education, Training and Careers Committee (ETCC) is a formal committee of the British Ecological Society, which administers an educational budget, has a growing number of educational initiatives, and advises the council on matters of educational policy.

You don't have to be a member of the BES to receive TEN, but we hope you might want to join and play a full part in the Society once you start to get involved

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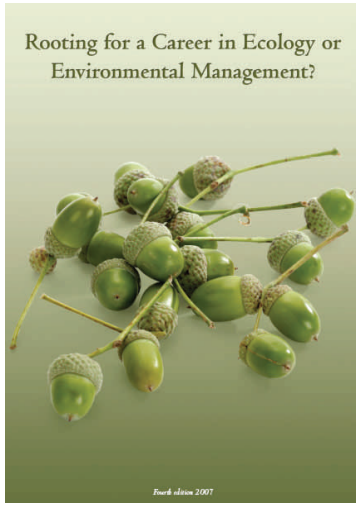
In this Issue.

Editorial

BES education continues to grow and we are seemingly involved in an increasing number of projects. As you read this issue you will come across our first education volunteer. Rachel Parsonson is currently working with Sussex wild life trust alongside a two day commitment to the BES before she heads off to a PGCE in September.

In September 2008 the AS/A2 biology courses in schools will change, the Qualifications and Curriculum Authority (QCA) sets out the criteria against which the examination boards develop their specifications and assessments. At first glance there will be an obvious advantage to ecology in that the previously A2 topic is split between AS and A2. Teachers should in theory have greater opportunity throughout a two year course to take their students out for fieldwork. Micro organisms are more explicitly mentioned than they have been and biodiversity has a higher prominence.

Coinciding with these changes has been the BES symposium on speciation and ecology which took place on March 29th-30th at the University of Sheffield. Having looked at the abstracts of the speakers I noticed how many papers were discussing concepts and issues which are mentioned in the QCA biology criteria and so in an attempt to bring ecologists and teachers together we ran a teachers workshop on Wednesday 28th March prior to the "main event". More details can be found on page 15.



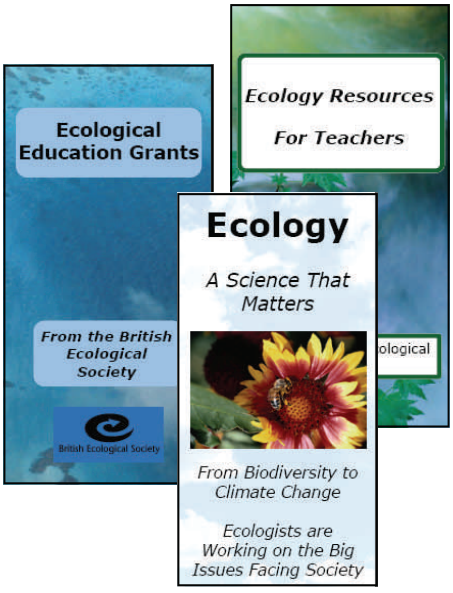
By the end of May there will be a new edition of the "Rooting for a career in ecology or environmental management" booklet. This careers booklet is a collaborative effort between the BES and

IEEM. It has proved popular and useful for students and professionals alike. The fourth edition has been updated and sections on environmental consultancy and career progression have been expanded. Copies will be available from the BES office and on-line as a pdf document.

We are currently collaborating with the Pond Conservation Trust and the Freshwater Biological Association on the development of a new poster for the creation and use of ponds in the science curriculum. The poster is intended to be available by the start of the new academic year and will link to a range of online resources and lesson plans, student worksheets and advice on the importance and construction of a school pond. If you have a great idea for lesson plan that you would like to share online then please get in touch.

Following the success of the thematic topic, *"Research and research priorities in ecological education"* at the annual meeting in Oxford 2006 there will be an education session at the upcoming 2007 meeting in Glasgow. The education session has been brought together around the premise of recruiting young people to science and ecology. We have been fortunate enough that Peter Cotgreave of CaSE has accepted an invitation to speak at the education session, more details of which can be found on page 19.

And finally a range of new leaflets relating to Education have been produced and are available online



Career in ecology?

It's a wonder I've made it to a career in ecology. I don't recall any out of classroom science lessons until a college field trip, and I recall that as a rather dry week of measuring the height and width of limpets on a rocky shore. It took much persuasion from my mum for me to undertake biology and chemistry A-levels, rather than the rather more exciting subjects of psychology and sociology. I was eventually swayed by the wider variety of options open to me after college if I did science and maths.

It was hard work; my biology teacher did anything but make my lessons enjoyable, and while I spent hours in the chemistry labs many of my friends appeared to have it much easier in the design rooms. But I made it to university to study biology, and with the help of a few engaging lecturers got hooked on ecology and thoroughly enjoyed myself. But as the end of my final year loomed, I realised that I still had no idea what I wanted to do with my degree.

I'd done a year in research as part of my course and decided that it wasn't for me, so crossed a PhD off the list. Next came considering an MSc or MRes, but I didn't have the required £10,000 to get me through it, especially when I wasn't sure how it would be of benefit to me. The obvious choices gone, I began trawling through the web in hope of finding something to aspire to.

My problem was that I really had no idea what careers existed in ecology. My lecturers, though helpful, had come through the research route and could advise on little else. The university careers centre couldn't suggest much that was more complex than

becoming a ranger or conservation officer, which I was over- and under-qualified for respectively. Thankfully I was saved by my enthusiasm for teaching science, and with some more internet trawling have carved out something approaching a career in ecology, but I still remain oblivious to the majority of possible routes available.

The paucity of relevant ecological careers advice is something that affects many others, from school leavers to graduates. Careers services abound, but I for one have never found them very helpful. At school they suggested I become a dog groomer or a doctor, and at university I simply got infuriated with filling out forms requesting me to decide what proportion of my time I wanted to spend negotiating/ communicating/ being creative etc. when what I really wanted was to be put in touch with people who could tell me in detail about the careers available in my subject of choice, or at least put me on to relevant websites.

For school leavers the picture seems to be getting better: many universities run outreach programs which help increase awareness of higher education in pupils, and development of the UCAS website means access to an enormous number of courses is readily available. Career fairs are a useful source of information for students, but can be dominated by larger, more affluent firms, with ecology-based jobs in smaller firms and the public sector being under represented, a problem mirrored in many careers websites. Incredibly, despite the multitude of available information it still remains difficult to get relevant information about careers in ecology.

Even for those who know what they want to do from an early stage, the required routes can be baffling, especially for postgraduate courses. Finding and being accepted onto a course can be difficult if you have not been privy to relevant information about existing courses, interview preparation and available funding. My experience of applying for teacher training had me throwing my notebook at the computer more than once, and applying for PhDs can be equally frustrating.

Another problem for many graduates is the gulf that lies between the tuition received at university, and what is actually required in the job sector. Many complain of insufficient training in practical techniques (e.g. ecological sampling) at university, which leave them unqualified for available jobs and research posts. There then follows the catch-22 of "needing experience to get experience" which can be problematic for those beginning a career. A good way of gaining this can be to undertake a "sandwich" degree course, which includes a year in research or industry in addition to the usual programme: an option offered by many institutions in the UK which allows valuable experience to be gained, and contacts made before graduation. Otherwise the choice has to be made between undertaking voluntary work or the demoralising path of signing-on and applying to every available job until accepted on a short contract.

The recent experiences of a friend of mine, who graduated last year with a first class biology degree from York, stand as a cautionary tale for anyone embarking on a career in ecology. He was advised that a good way into non-research based ecology jobs was through the civil service. He failed to locate a position, finding potential posts only in the statistical service. Exasperated by the lack of biology funding in this sector, and unable to find a suitable position for someone of his talents, he's now training as a chartered accountant.

Rachel Parsonson

Fieldwork, evidence and the 14-16 UK science curriculum

by Ros Roberts

Introduction

A recent focus in many curriculum developments has been that of scientific literacy.
This article summarises work at Durham University that suggests that fieldwork provides the opportunity to teach ideas that are central to scientific literacy. It describes a case study to illustrate the importance of understanding evidence in fieldwork contexts and shows how evidence is the scientific heart of the new KS4 How Science Works curriculum.

Scientific literacy

Scientific literacy has been defined in many different ways. One aspect we consider important is for pupils to question what is going on in the science that impacts on their lives – that they should be actively engaged with science rather than just passive consumers of others' science. We argue that this requires an understanding of the weight that can be placed on evidence that results from others' research. Importantly pupils should be able to identify what might be wrong or inconclusive about evidence they are examining.

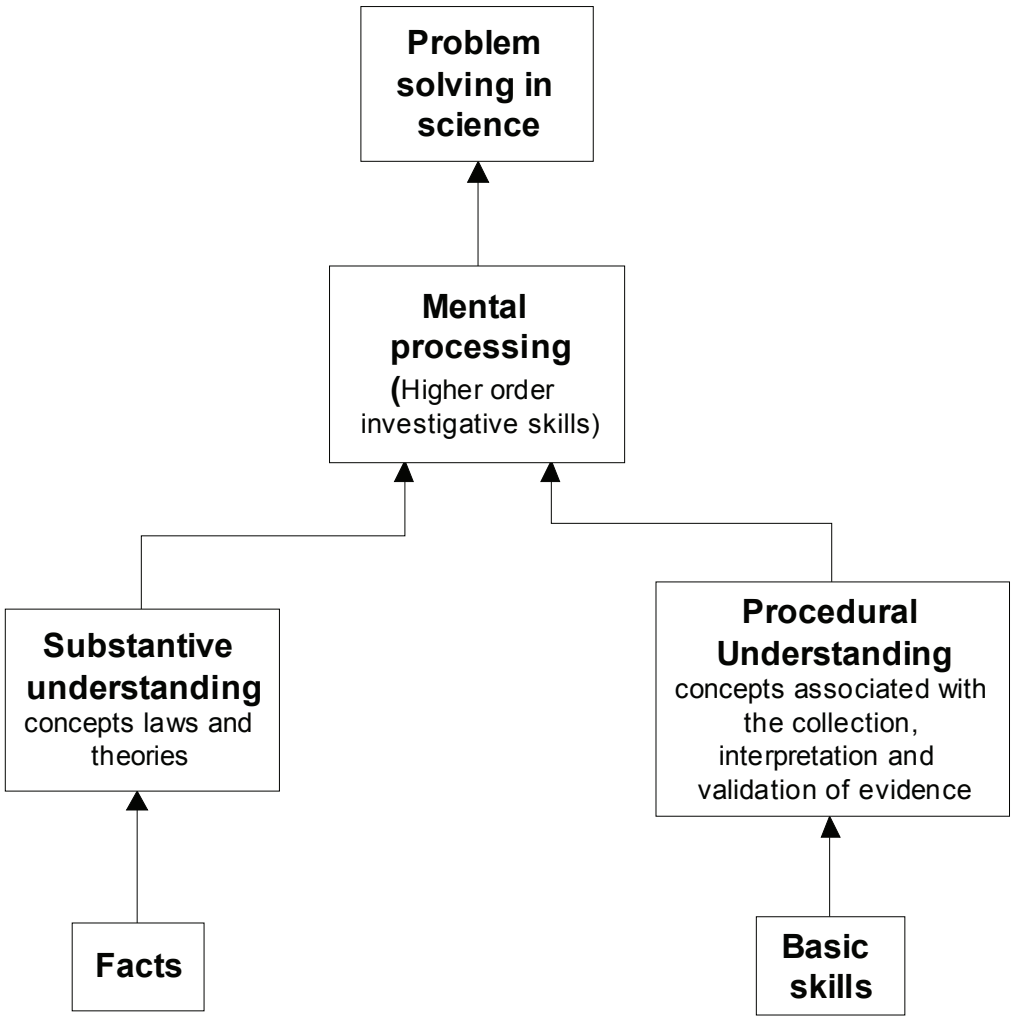
An illustrative case study

At Durham we researched how a local community responded to a local environmental issue.
A cement works, situated in an area of outstanding natural beauty, changed the fuel it burnt in its chimney. Residents were concerned that the new liquid recycled fuel might damage their health and the environment. The company agreed to call in experts to evaluate any potential pollution. After carrying out their research they reported that the chimney was safe.
Some of the residents decided to ask questions about what evidence there was to support the claim of 'safe'. They asked questions about the scientists' work. Where did they take their readings? When did they take the readings? What instrument did the experts measure pollution with? Was it sensitive enough to detect levels potentially harmful to health?
At a public enquiry they challenged the experts' conclusions: their questioning of the evidence, about what was measured and how, had revealed that the claims of 'safe' were made without strong evidence. Eventually the inconclusive scientific evidence was weighed up with other considerations, such as the possible risks to health and the environment, the economic costs of collecting more evidence and the potential affects on jobs and tourism and a decision was made to stop burning the new fuel.
Our case study research has shown that those who asked the questions had a good procedural understanding: an understanding of the ideas that underpin the design, collection and analysis of reliable and valid evidence. We have attempted to articulate these ideas and have called them the Concepts of Evidence – the 'thinking behind the doing' of science (see website). We have validated these ideas against the work of scientists in research and industry. The ideas used in science to carry out investigations are also important when evaluating others' evidence.
The concepts of evidence are the ideas used by scientists in their varied work. Lab-based investigations draw on many of the concepts of evidence. However, some of the ideas are particularly emphasised in research in fieldwork contexts where ideas behind sampling become particularly important, as do ideas associated with handling variation in data, ensuring validity in investigations with complex variable structures and post-hoc analysis. It is these ideas along with those associated with measurement that the residents were asking questions about: where and when were the samples taken to ensure a representative sample that was not confounded by other variables? Since many controversial issues that impact on people's lives are in non-lab-based contexts, we argue that they are ideas that pupils should be taught so that they can engage with evidence and that fieldwork contexts can be used to teach them.

The Concepts of evidence

Let us expand on the rational underpinning our work. Solving a practical problem in science requires that the solver works with two sets of ideas (Figure 1): the substantive ideas of science with which we are all familiar – ideas such as force, niche, photosynthesis, chemical change etc. – and ideas that are, to scientists, more often implicit than explicit, the concepts of evidence – ideas underpinning the reliability and validity of measuring a datum and a data set, design of investigations and analysis. We have explicitly taught students these ideas and not only can they understand what they are doing when they investigate, they can also questions others' evidence.

Figure 1.
A simplified problem solving model for science



The concepts of evidence can be summarised as the ideas required to determine the reliability and validity of each of the layers in Figure 2.

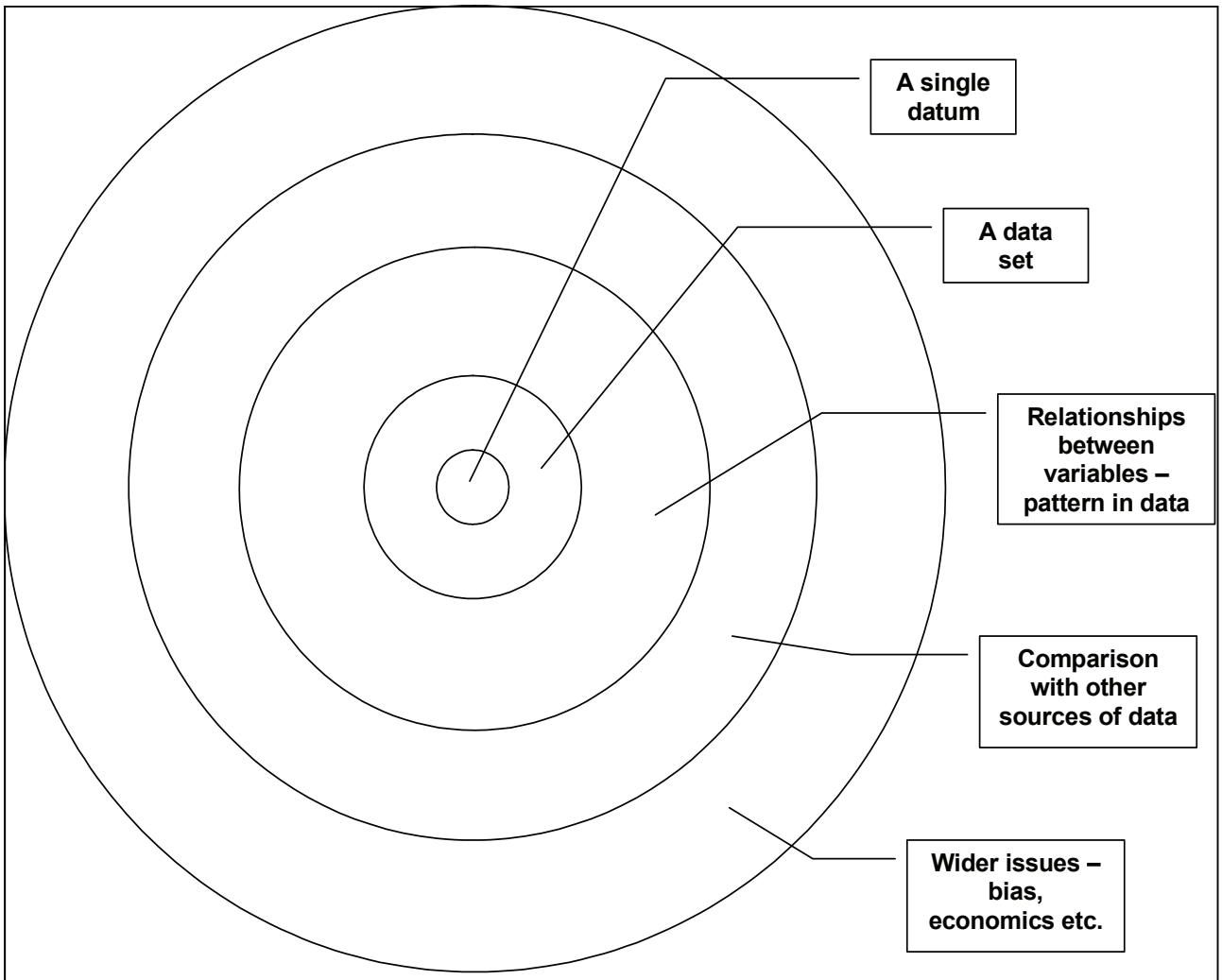


Figure 2
A summary of the concepts of evidence

How Science Works

The UK's 14-16 (Key Stage 4) National Curriculum, introduced in 2006, now includes a section entitled How Science Works (HSW). This is now incorporated within all the different exam boards' GCSE specifications albeit with differences in interpretation and implementation. Up to 50% of the assessment weighting in the GCSE exams can be awarded for HSW which means it will be assessed in coursework as well as exams. We have shown that the science knowledge-base at the heart of this curriculum initiative is evi-

dence and its underpinning ideas; science, in all its manifestations, works by seeking and evaluating evidence. Evidence is what distinguishes science from other ways of understanding the world. Evidence ideas run through HSW.
We have acted as consultants to the AQA exam board who have explicitly included the Concepts of Evidence in their specification to be taught and assessed in most of their syllabuses.
We have argued so far that a curriculum that addresses scientific literacy so that people can engage with science that impacts on their lives requires an understanding of the concepts of evidence, including those ideas emphasised during fieldwork. But we all know that curriculum aims do not always get translated into practice! However, in our assessment-driven culture, we ought to find that the high weighting given to HSW in the GCSE results in it being emphasised in teaching. Since Evidence is the scientific knowledge-base for the new HSW curriculum initiative teaching that focuses on evidence is clearly required.
So we are now in a position to consider how the concepts of evidence might be taught using fieldwork.

Teaching the concepts of evidence through fieldwork and environmental contexts

Figure 3 illustrates some examples of activities that target specific concepts of evidence. As can be seen, they provide opportunities for teachers to emphasise particular aspects. We have found this a useful way of illustrating the difference between teaching activities so that teachers can distinguish between them and select appropriately.

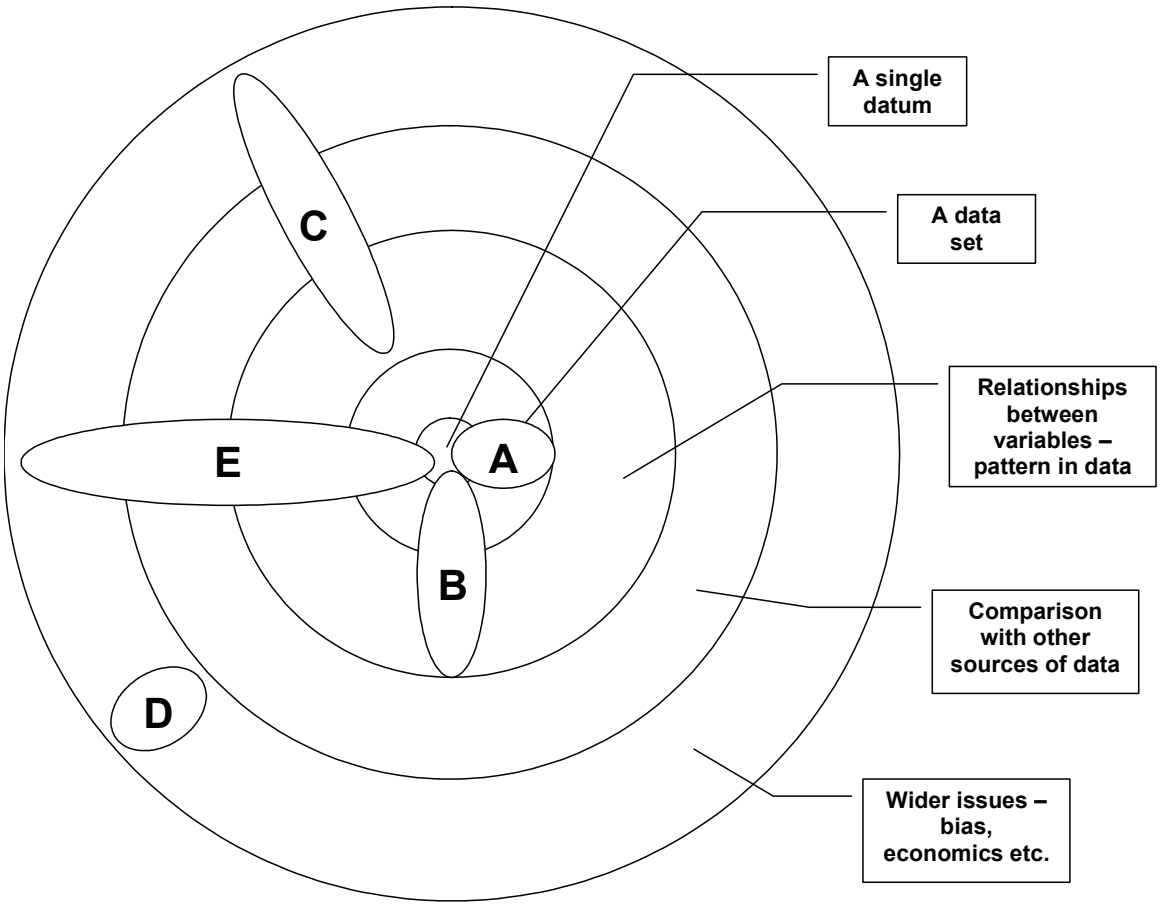


Figure 3Different types of teaching activities that can be used to target different concepts of evidence

A. How many dandelions in the field? What is the flow rate in the stream?
These short activities provide the opportunity for pupils to consider the reliability and validity of a set of repeated measures. They enable pupils to realise the 'messy' nature of real data and how this affects questions of validity and reliability of importance in all science. How much do they trust the data they have obtained? Have they measured the right thing? Where do they take their samples? How many readings 'capture' the variation? How much uncertainty is there on their measurements? How can this variation be summarised - using the mean? range? frequency histograms? standard deviation?

B. Is the density of dog's mercury affected by light intensity? What factors affect the distribution of *Gammarus*?
These investigations into the relationship between variables include all the ideas suggested in A (above) as well as important ideas about how valid data can be collected in contexts where the values of variables cannot be manipulated to control their effects. Surveys, involving several key variables, and post-hoc analysis are ideas that are important in any environmental issue. Often datasets are so complex that continuous variables, such as light intensity, are dichotomised into 'sunny' and 'shady'. Pupils can see how decisions about the cut off points affect the resultant patterns in the data.

C. Global warming using secondary data.
Data that is in the public domain enables pupils to consider the relationship between variables, although it is worth noting that determining the quality of the data presented using ideas in the inner two layers is often not possible with the information available. Pupils need to be aware of this limitation when they compare the relationship presented with others' work, as scientists do when work is published, as well as considering how wider issues, such as the status of the researchers and the funding of the work, may have impacted on its reliability and validity.

D. News report on proposals for positioning a wind farm.
Some teaching activities about environmental issues can be used to focus just on the wider issues that should be considered when evaluating the reliability and validity of any claim. It could be argued that pupils who have previously had the opportunity to collect data and design environmental investigations utilising the ideas in the inner layers will be in a better position to understand how these wider issues could impact on the evidence cited by different people.

E. Project into the biology and environmental impact of reed bed sewage systems.
Longer projects that involve pupils in their own investigation, collecting and analysing 'messy' data and then comparing it with others' work enables pupils to think about all the aspects of the concepts of evidence. As such they are lengthy and relatively complex activities but they provide the opportunity for pupils to engage with the whole research process.

In summary

We have argued that ideas about evidence are important for an empowered form of scientific literacy, where future citizens are able to engage with science that impacts on their lives. Some of the ideas of particular importance to real life issues are those emphasised in fieldwork contexts. The new HSW curriculum has ideas about evidence at its heart; these ideas should be taught. Fieldwork provides the opportunity to do just that.

For further information and details about our research and publications please visit our website http://www.dur.ac.uk/richard.gott/Evidence/cofev.htm or contact Ros Roberts on Rosalyn.Roberts@dur.ac.uk

Ecology hits the headlines

Loss of top predators affects fisheries

Over-fishing of the top predators is disrupting the marine ecosystem, and having a knock-on effect on fisheries. The loss of 11 species of shark such as hammerhead and tiger sharks resulted in population increases in 12 out of 13 species eaten almost exclusively by large sharks. The increased populations of species such as the cownose ray (a 20-fold increase since 1970) has meant that populations of shellfish such as scallops, oysters and clams have been reduced to levels where commercial shellfisheries have suffered, and the water filtering service of remnant populations have been compromised.
Science, 30 March 2007; 315: 1846-1850

Wasps have their own medicine supply

It has been discovered that beewolf wasps have special reservoirs in their antenna, filled with *Streptomyces* bacteria which are used to protect their young. Adults secrete these onto underground brood cells, and chemicals produced by the bacteria protect them from fungal infection, boosting larval survival. The relationship appears to be symbiotic, with bacteria gaining nutrition from the insect's blood.
New Scientist, 2 April 2007

Troglobites halt mining project

A £5bn mining project in Pannawonica, Western Australia, has been halted by the discovery of five new species of troglobite. The tiny, blind creatures are just a few millimetres long, and evolved to exist entirely in darkness, with many species not possessing eyes, but instead using their front legs as feelers. They are intolerant of UV light, and just a few seconds exposure is enough to kill them. An Environmental Protection authority report deemed that the mining site would prove fatal to these species, and rejected the plans. The company, Rio Tinto, have appealed, and the final decision rests with the state's environment minister, who must take into account social and economic factors, as well as environmental issues.
The Guardian, 30 March, 2007

Five years for the Orang-Utan

It has been predicted that one of man's closest cousins could be virtually extinct within five years due to rapid depletion of its rainforest habitat, according to a UN report. The primary causes of deforestation are no longer forest fires and illegal logging, but the expansion of oil palm plantations competing to meet Western demand for palm oil for foodstuffs and biofuels. The report says that 'At current rates of intrusions, it is likely that some parks may become severely degraded in as little as three to five years, that is by 2012.'
The Observer, 25 March, 2007

Motorway closes to let butterflies pass

In the first week of April, Taiwan closed a busy 600 metre section of elevated expressway to allow purple spotted *Euploeini* butterflies to complete their annual migration unharmed. Although no previous accidents had occurred, with up to 1 million insects passing the road each day, each year countless thousands were splattered on windscreens and crushed under wheels. In addition to the road closure, a net was erected to force the butterflies higher above the traffic. The measures, costing £20,000 to put in place, were suggested by Lin Tie-Shyong, associate professor at I-shou University's department of civil and ecological engineering. The National Freeway Bureau said the plan was worth doing even if it led to traffic jams.
BBC News

Trouble in paradise

Tourism is causing so much damage to the Galapagos that the islands are in danger of losing their status as a UNESCO world heritage site. June will see UNESCO make it's decision regarding the status of the islands. UNESCO cites uncontrolled expansion of the tourism industry as one of the main threats. The 8th President of Ecuador in 10 years, Rafael Correa is the first leader to declare the islands should be a national priority.
New scientist, 22 April, 2007

Conference for Primary School Teachers

Rachel Parsonson

On the 27th March 2007 an afternoon conference for primary school teachers was held at the University of Leeds, organised jointly by the Association for the Study of Animal Behaviour (ASAB) and the British Ecological Society (BES), and attended by local primary school teachers. The speakers were Stuart Naylor, Karen Devine and Michael Dockery, who spoke on effective ways of teaching science in the classroom and school grounds.

The conference was opened by Karen Devine, the BES education officer, who spoke on *Investigating Outdoors: A Practical Guide to Making Use of Opportunities in the School Grounds*. The incentive to get children directly involved with the topics they are studying was introduced by discussion of the Learning Outside the Classroom Manifesto, and followed up by some practical ideas. Simple experiments were described that can be done in the school grounds using inexpensive materials, such as measuring soil compaction in the school field using plastic cups, and observing the commonly found holly leaf miner as a project covering multiple curriculum objectives.

This was followed by *Adaptation in Animals*, some ideas for making the topic of adaptation more engaging in the classroom from Michael Dockery. Camouflage in moths, behaviour of European cuckoos, and the primate foot and hand were all used as interesting examples of adaptations in animals. The background to the topics was introduced before the audience participated in activities, finding "moths" camouflaged in a piece of wrapping paper, drawing primate hands and feet, and building a weaver bird nest using only a "beak" which were enjoyed by all. Ideas were given for extensions of the topic, and resources were provided for their implementation.

The final speaker was Stuart Naylor, who talked about *Active Assessment: Thinking, Learning and Assessment in Science*. To begin, the key idea of "starting from where the learners are" was introduced, and a simple example of its execution given in a "True or False" group activity which had everyone in disagreement, but instantly involved. This showed its use as an introduction to a lesson, as prior knowledge was assessed while interest in the subject was sparked. The development from this to a lesson was demonstrated, using resources such as annotated drawings, concept cartoons and graphic organisers which can also serve as assessment tools. The use of group working means that children's explorations tend to be deeper and broader than the perspectives afforded by the use of text books, and knowledge is retained more readily; teachers already using this system agreed on its effectiveness in the classroom.

This conference brought together many ideas on how to make teaching ecology simple, effective, and a more absorbing experience for children. Often seen as a challenging subject to teach, I for one left feeling optimistic and enthused about the possibilities for teaching science both in and out of the classroom.

Demonstrating finding camouflaged "moths"

Biological approach to wasp sting prevention

By Sue McBean

Arguably wasp stings are a significant public health hazard. Every year a few people in the UK die after overwhelming anaphylactic allergy. Stings in the oro-pharyngeal area can compromise the airway due to local swelling in people who don't have a systemic allergy. In 2006 concern was raised in the House of Commons because in 2004 at least 8 people died in England alone. In 2006 the national media reported 2 people dying in one month - August.

Sue McBean, University of Ulster nursing lecturer and biologist specialising in Public Health and out of school biology education has recently been researching the quality of English language internet advice on wasp sting treatment. Through this she began to realise the public health threat that ignoring the biology of wasps brings to people who are unknowingly systemically allergic. While the level of severe allergy may be as high as 1 in 500 people, the chances of dying from a wasp sting are mathematically less than 1 in several million.

Sue has created a treatment guidance list from high quality health websites and also a unique template of advice on wasp sting prevention. This focuses on two biological issues: avoiding disturbance of wasps and awareness of their feeding habits particularly from summer to autumn. She is now working on getting this information more widely known via an internet project using a small academic enterprise award. Anyone wanting the wasp sting prevention advice can contact Sue by e mail (SF.McBean@ulster.ac.uk) giving details of name, snail mail address and place of work. Meantime you might like to muse on this little known old comic verse:

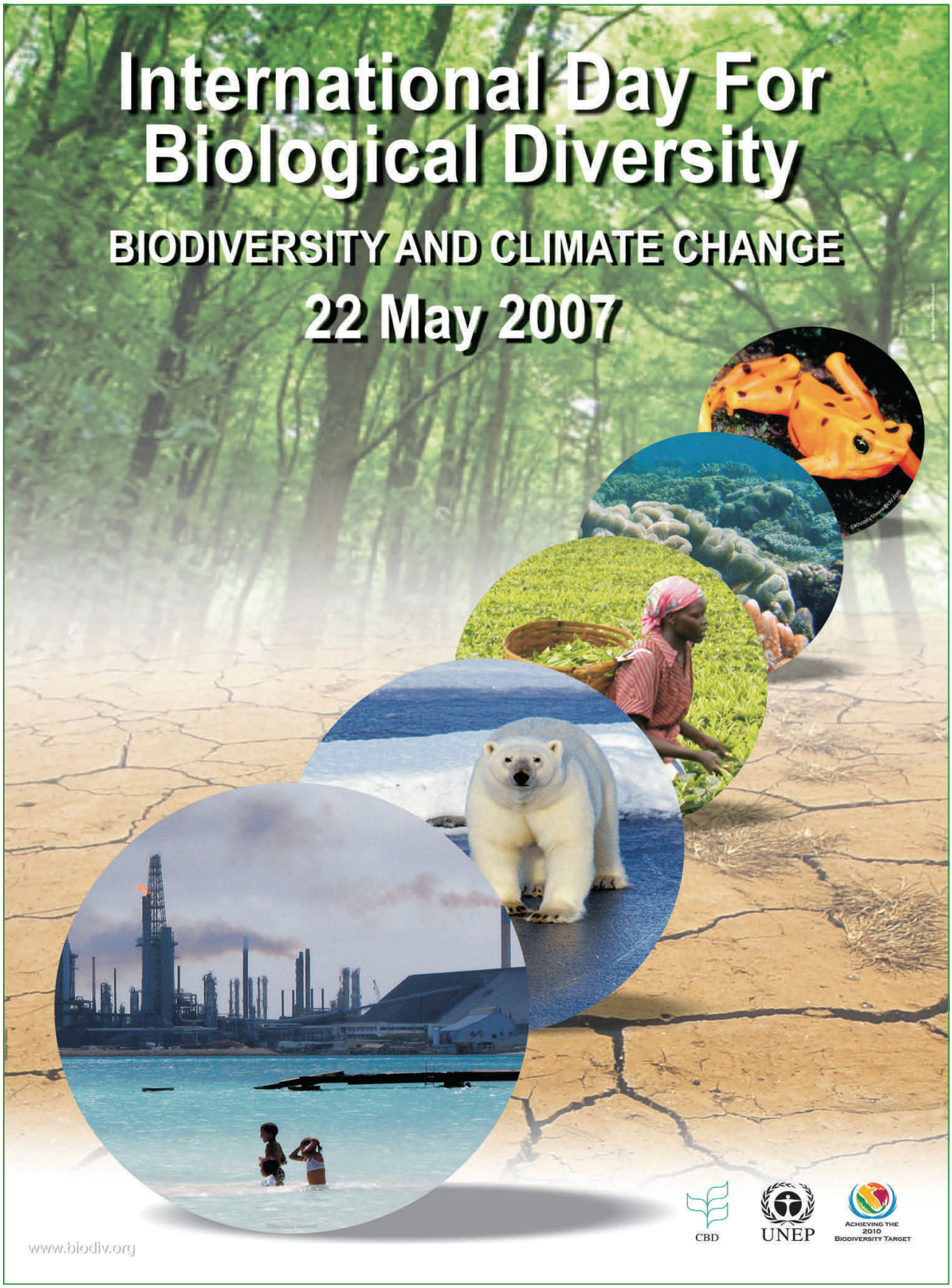
Plain Murder by A.G. Prys-Jones 1888 – 1987
(poem known to be pre 1957)

I saw a wasp upon a wall
And did not like his face at all:
And so the creature had no time
To wonder whether he liked mine

You can read more about her work in Biologist: April 2006 (journal of the Institute of Biology – online) where she berates journalists for limited understanding of biology. She has published some of her findings in the September 2007 copy of Primary Health Care (Prevention and treatment of wasp stings, Vol. 16, No. 7, September: 20 – 23) which is available on interlibrary loan or in some Universities where there is a School of Nursing. In this article the folklore use of topical vinegar immediately after a wasp sting is mentioned as being helpful to alleviate initial pain as long as a comprehensive evidence based sequence of actions is also instituted.

Prevention ideas for field work and educating people to develop protective skills for later life:

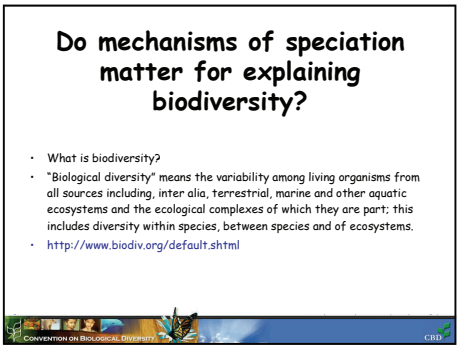
- Teach simple means to distinguishing between wasps, hoverflies and bees
- Teach biological approach to dealing with insects that might sting e.g. wasp will move to light (e.g. window), move away from attractive food/smell, crushed wasp will attract others
- Ask about allergy to insects (specifically stings) before field trips
- Request to be informed about stings, remember signs of overwhelming allergy and carry phone
- Be aware of wasp nests in previously undisturbed shrubbery and log piles
- Be alert wherever there is food waste in summer and autumn
- Mimicry of flowers (scent or colour) in clothes or skin products are a risk for attracting wasps
- Drinking from cans or bottles in hot weather is high risk for oro-pharyngeal wasp sting
- Advise wearing of shoes and also shaking of things before storage e.g. clothes placed on ground


International Day For Biological Diversity
BIODIVERSITY AND CLIMATE CHANGE
22 May 2007
www.biodiv.org
CBD
UNEP
ACHIEVING THE 2010 BIODIVERSITY TARGET

Speciation and the QCA AS/A2 Biology criteria

There is increasing anecdotal evidence that AS/A2 biology students are finding the ecology and evolution sections of their courses less interesting than molecular and cellular biology aspects and that this in turn is impacting on their undergraduate choices.

Ecologists in higher education and the field have access to a range of awe inspiring research and information, much of which is never shared with young people at school



On March 28th, in an attempt to bring teachers and ecologists together the BES hosted a teacher's workshop prior to the BES annual symposium on Speciation and Ecology held at the University of Sheffield.

This particular symposium was chosen because many of the abstracts submitted di

scussed issues and concepts which are raised with students in their AS/A2 Biology courses. The symposium was timely, as in September 2008, the content of the AS/A2 Biology specifications will change with Biodiversity introduced at AS and Ecosystems covered at A2 level. This provides greater opportunity for teachers to deliver effective fieldwork, and integrate ecological concepts more fully into the "synoptic" elements of their teaching.

Four speakers were invited to address teachers and introduce their work in light of the changing Biology specifications.

Roger Butlin of the University of Sheffield launched the workshop with a question "Do mechanisms of speciation matter for explaining Biodiversity?"
Course content laid down by QCA (Qualifications and Curriculum Authority) states that all AS/A2 biology specifications should demonstrate that ***Adaptation and selection are major components of evolution and make a significant contribution to the diversity of living organisms.*** However Roger surmised that this assumes that natural selection is the driving force of speciation and does not take into account such factors as chance mutation and drift or sexual selection, neither of which are explicitly mentioned in the ecological units of the biology criteria.

He was followed by Tim Barraclough of Imperial College London who presented a session titled "What do species do?" introducing the species as the fundamental unit of biodiversity. Using the example of Bdelloid Rotifers he demonstrated how the process of speciation in asexual species can occur and how genetic analysis can confirm diversity within the taxonomic group. The presentation provided a useful and practical example of the statement ***Biodiversity can be measured, for example within a habitat or at the genetic level***, with his evidence of speciation in this group having been collected at the genetic level.

Graham Bell from McGill University in Canada worked with teachers to discuss how microbes can be used in school to demonstrate

natural selection and adaptation, using *Pseudomonas fluorescens* as an example of species which shows a reasonably rapid response (6 weeks) to stress. Where QCA previously set out biological processes as applied to plants and animals the new criteria make more explicit that these processes apply to plants, animals and microbes. As such microbes could be a useful tool for schools in practical demonstration of natural selection. *P. fluorescens* is an approved organism for use by schools and any advice can be found through MISAC, www.microbiologyonline.org.uk, the microbiology schools advisory committee

The workshop was brought to a close by Jim Mallet of University College London with a general session on "Speciation and Species" and the complexity of a subject which in the school setting is often reduced to a series of simplistic facts. He successfully demonstrated that much of the complexity of speciation has been removed from the specification despite the wonder that such examples might provide. From butterfly mimicry as an example of "***Adaptations of organisms to their environments can be behavioural or physiological as well as anatomical"*** to hybridization in birds and mammals giving rise to fertile offspring (e.g Blue and Fin whale), reproductive isolation alone as a definition of a species leaves out a few interesting facts.

All four of our invited speakers successfully communicated the link between their own work and the QCA criteria that determines what AS/A2 biology students are learning in terms of Biodiversity. However at the same time, they highlighted the confusion and misinformation that could potentially arise from the relatively narrow specifications.

Using P. fluorescens to demonstrate adaptation and speciation

Introduction

Pseudomonas fluorescens grows quite well on nutrient agar. A simple method of demonstrating adaptation and speciation within a school setting can look at how the organism copes with stress.

Creating a serine tolerant population

In the case of *P. fluorescens* an initial culture is obtained ***and maintained*** throughout the investigation. However small samples are removed and grown in a serine based agar. Serine as a carbon source provides the stress to which the bacteria must adapt. Increasing the concentration of serine in the agar over successive populations will result in a serine tolerant population. This process takes 6-8 weeks.

Comparing populations

A final comparison can be made by growing a culture of the original and tolerant population on a serine based agar. The original population of *p.fluorescens* is not successful where as the tolerant population grows well. For students who have followed the successive populations this is a clear indication that there has been a change in the species and the role of adaptation and speciation can be demonstrated practically

Safety

P.fluorescens is an approved organism for use in in schools however other *Pseudomonas* species are **not** approved and can be opportunistic pathogens. The website www.microbiologyonline.org.uk provides advice on the health and safety of practical microbiology work in schools.

In the Journals

Are humans the neighbors from hell?

Birds choosing their new home take a number of factors into account about their new location, including environmental conditions and human disturbance. Shore bird numbers are decreasing worldwide, and it has been of concern that anthropogenic factors could be making birds move away from their usual sites.

Little is known about the consistency of roost use by different species and the factors affecting selection by certain species, so Kimberly Peters and David Otis studied high tide roost site selection in eight non-breeding bird species on their winter migration. They found that the most important factors at the yearly scale were in fact roost size, and local region, substrate and aspect. Only one species avoided roosts with high human activity nearby. Daily roost use was influenced most by wind speed, and the ability of the roost to provide shelter from the wind. Again, only one species avoided roosts with high human activity nearby.

Their research shows the need to consider differences in factors affecting species roost site choice, and that human activity does play a role for some. For these reasons they highlight the importance of monitoring roost site activity before making conservation decisions, so that the maximum benefit can be gained.

Peters KA, Otis DL (2007) *Shorebird roost-site selection at two temporal scales: is human disturbance a factor?* Journal of Applied Ecology 44: 196-209.

The morning after the nightingale before

Animals learn from experience, and models predict that territorial animals benefit by altering their behaviour according to prior challenges. In this experiment Schmidt *et al*. investigated the effects of singing contests in nightingales on their subsequent behaviour. Using interactive playback during nocturnal song, a rival was simulated to counter-sing either aggressively or moderately; the following morning the "rival" returned as a moderate intruder. It was found that males that had encountered aggressive competition the previous night approached closer to the speaker much more quickly than those who had only encountered moderate opposition. This shows that nightingales do indeed use prior information to make decisions about territory defence.

Schmidt R *et al*. (2007) *The day after: effects of vocal interactions on territory defence in nightingales.* Journal of Animal Ecology 76: 168–173.

Breeding like Rabbits

The European rabbit is a major pest in Australia, continuing to destroy valued native flora. To control populations, a new method is under development to stop them breeding like rabbits: immunocontraception. The genetically modified myxoma virus spreads contagiously through the population, reducing fertility – but does it reduce the overall population?

Williams *et al.* found that sterilized populations produced fewer young, but because sterilized adults were healthier, the adult population remained unchanged. For this reason immunocontraception seems unlikely to become a good method of controlling rabbit populations. It does however spread rapidly, and reduce breeding season peaks of abundance, so may be of some use in conjunction with other methods.

Williams CK *et al*. (2007) *Population responses to sterility imposed on female European rabbits*. Journal of Applied Ecology 44: 291–301.

Book Review: Invasion Ecology

Paul Ganderton

The idea that we could populate the Earth with any species and that this would re-create an 'Eden' somewhere goes back to the Acclimatisation Societies of the 19th century. Today, after much (often painful) association with non-native species we recognise invaders for what they are. Whereas this is often to the detriment of the existing ecosystem it does provide us with a way of studying population movements. Whether biomes are the best place to try out experiments is another question altogether but there is now a small but growing band of ecologists who are specialising in this area and invasion ecology is now a distinct topic in its own right.

Because this is new, there is the initial problem of getting the terminology right and demonstrating the parameters of the subject. This is the aim of the first chapter here. That there are at least 27 different terms to cover essentially the same thing shows how far we need to go to produce a synthesis that we can agree with. To assist further, this chapter outlines the main process of invasion and gives examples to illustrate this. To be an invader you need to travel so it is no surprise to find this as the topic of chapter two. A distinction is made early on between the route (pathway) and mode (vector) of transport. We get several examples to highlight this basic division. Vectors are further investigated and the key ones (notably sea-based) is described with cases ranging from the slave trade to 19th century commerce. Given this increasing ease of movement it is easy to see how, in chapter three, that the trend in invasion is sharply upward. Wherever you look, and examples here span the globe, the same trend is seen (suggesting, as others have put it, to a homogenisation of ecology!). This shouldn't be taken to be a blanket increase - temperate zones seem to have more than their fair share (due presumably to the greater amount of trade). Chapter four turns to the invader itself and shows the parameters needed to be successful. It's not just a question of being tough you also need the reception to

be agreeable. As chapter five notes, the best places are those where disturbance has taken place e.g. fire, agriculture and, these days, global warming. Once the non-native has reached a suitable abiotic environment it needs to establish against the resident biota. Although the title of chapter six suggests this is simple, the real picture, as we see, is far from obvious with no strong evidence for any particular model of success. One is left with the impression that multiple causes are needed for success or failure. Once the population becomes established there's a need to see where it spreads. For plants this might be simple but for animals it's far harder and so a key weapon is mathematical modelling. As outlined in chapter seven we do get some idea of rate and direction of spread. Non-native species are just native species elsewhere so it should be possible to study them using standard ecological concepts. This is the work of chapter 8 which describes the population models, dispersal patterns and biotic interactions we can see in non-native organisms. All this invading must have an effect on the resident ecology and chapter 9 highlights some of the key findings such as extinction and predation. Chapter 10 takes this one stage further to include human reactions to invaders and how impacts can be measured and therefore addressed. Chapter 11 complements this by looking at invasion for the invaders perspective and describing the possibilities of invaders evolving in their new habitat. Finally, we look at assessing the risks and seeing how we can deal with the invaders (if indeed it is cost-effective to do so).

This is an excellent guide to the topic. It covers a significant portion of the study and highlights all the key elements. The aim of this text was to provide a broad overview and in this it has succeeded. Although at this stage a little too complex for secondary students it provides a very good foundation for both theoretical and practical ecology. The focus on human impact and management gives the book a far broader appeal and more useful scope than the more usual ecological focus. Definitely a key text in its field.

Title: Invasion Ecology

Authors: Julie L Lockwood, Martha F Hoopes and Michael P Marchetti

Date of Publication: 2007

Publisher: Blackwell Publishing

Pages: vii + 304

ISBN: 978 1 4051 1418 9
Price:£ 32.99

Paul Ganderton regularly reviews Ecology and Environmental texts. A full list of his reviews can be found at http://users.bigpond.net.au/paul_ganderton/index.htm

Education at the Annual Meeting 2007

The Education, training and careers committee has proposed an education session at the BES annual meeting to be held at the university of Glasgow 10-12 September 2007.

Proposed papers include:

Action to reverse the decline in science education

Peter Cotgreave
Director, Campaign for Science & Engineering, 29 Tavistock Square, London WC1H 9QU
www.sciencecampaign.org.uk

Not enough youngsters are keen to study sciences, with potentially damaging consequences for their prospects and for the nation's economy and environment.
Contributing factors include a shortage of qualified teachers, poor careers advice and a dull curriculum. To address the problem, scientists, government and schools must take responsibility and act now.

Trends in recruitment to secondary biology teaching - Ecology in Decline?

Nicky Souter
University of Strathclyde, Department of Curricular Studies, 76 Southbrae Drive, Glasgow G13 1PP

Entry to biology teacher education programmes is highly competitive throughout UK. We profiled typical entrants, examining previous qualifications in particular. We reviewed the previous experience of graduates following a PGDE Secondary programme in Scotland. Discussion will focus on successful applicants and explore implications for future biology departments, classes and curricula.

Perceptions of ecology in education

Mark Langan
Manchester Metropolitan University, UK

There are many issues associated with being attracted to study ecology at university and ecology as a career route. This joint paper provides an opportunity for a current undergraduate to summarise their views, and those of their peers, to catalyse debate about perceptions of ecology in education.

The challenges of delivering field based ecology in a secondary school

Davinia Surdival,
Allerton High school, Leeds

This paper will look at the challenges facing secondary science teachers in delivering practical ecology within the curriculum.

Practitioner Research as a Means to Improve Students' Understanding of Evolution by Natural Selection in an Undergraduate Introductory Biology Course.

Bruce Grant
Ecological Society of America and Widener University, Chester, Pennsylvania USA

I will describe my use of scientific practitioner research to improve my undergraduate students' understanding of evolution by natural selection.
For six years, I have been using evidence of students' misconceptions, collected from standardized assessments, to redesign my course. Besides being more fun, data indicate that these efforts improved students' learning.

Fieldwork – real and virtual

Gary Skinner
Bedales School, Hampshire, UK.

This paper will briefly review the use of field work in school ecology, mainly in the UK, and discuss some associated problems. It will then concentrate on the use of virtual field trips to support, extend and consolidate this vital and stimulating area of secondary education.

The BES annual meeting will take place at the University of Glasgow 10-12 September 2007.
Booking deadline 2 August 2007

Please check the BES website for further details