NATIONAL FEDERATION FOR BIOLOGICAL RECORDING
Sharing Information about Wildlife

Natural partners:

biodiversity observations and collections

Report of a conference
held at the National Museum & Gallery of Wales, Cardiff
2nd – 3rd July 2004

Content

Background to the Conference

The National Federation for Biological Recording's Annual Conference in 2004 was held jointly with the National Biodiversity Network Trust, and was expanded to a two-day event in order to examine an increasingly important topic in more detail.

The objectives of the Conference were:

- To examine the apparent divergence between field observations, collections and natural science archives, especially the role of museums in biodiversity documentation.
- To consider issues of data quality, validation, networking, inter-operability, and access to biodiversity resources (such as information, records, specimens and natural science archives).
- To examine progress in integrating the collation, management and provision of access to these biodiversity resources.
- To consider what future action might be needed in these areas and to make recommendations.

The NFBR has long had an interest in this subject, as it was established as an organisation largely by professional museum biologists in the mid-1980's, who were involved in the fledgling business of biological recording as part of their work. In turn, the National Biodiversity Network Trust was born from initiatives largely originally promoted by the NFBR. Both these organisations, therefore, recognise the seamless relationship which ought to exist between biological collections, natural science archives biodiversity data and engaging the public in the subject. The fact that these areas appear to have drifted apart is or should therefore be of fundamental concern to all those involved.

Cardiff Museum very kindly supported the Conference by making their facilities available at a substantially reduced rate, which is gratefully acknowledged by the Conference organisers. Their staff also took an active part in the Conference, and have a great interest in its outcome.

This report was compiled by Trevor James, NFBR Council member / NBN Development Officer for National Societies & Recording Schemes, October 2004.

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Day 1: Presentations

Morning Session.

Chairman: Bill Butcher, Chairman of NFBR, Trustee of the NBN Trust and Director of Somerset Environmental Records Centre

Participants in the Conference were welcomed by the Chairman for the morning, Bill Butcher, who outlined the historic link between biological recording and the collection of natural science specimens. He also highlighted the premise of the Conference: that there is an increasing divide between the two. The aim of the Conference was therefore to seek ways to bring these two sides of the same coin together again, and to formulate recommendations to that end. The National Biodiversity Network, as a focus for the use of biodiversity data, is an appropriate mechanism to help with this.

Keynote address: Ray Woods, Science Advisor to the Countryside Council for Wales.

Ray opened the Conference with a thought-provoking consideration of how "records", "specimens" and conservation are indivisibly linked, by firstly demonstrating how up-to-date and accurate data underpin sensible conservation policy. He reflected on some early problems with sites in Wales and elsewhere which were identified on the basis of old data, but which were subsequently found to have been destroyed. In these sorts of cases, the old records formed the only proof that such species had existed, and gave an insight into the drastic effects of landscape change. These kinds of problems, and the data which gave the evidence, were the spurs to making effective conservation policy in the UK.

Historic records are also especially important as a support for conservation action, because they give a basis against which modern information can be judged, and can sometimes lead to new insights. In their turn, specimens form a vital back-up of these historic records. Ray gave an example provided by the local lichen *Usnea articulata* which has a current distribution in the south-west, with mostly very old records from further north, such as at Burnley, where its occurrence might be doubted but for the existence of good specimens. Another example from Wales comes with the survival of specialist species of ancient woodland, such as species of *Lobaria*, in sites which were once historic wood-pasture parklands, and where the species has subsequently been found in modern landscapes, like the grounds of Hafod in central Wales. Such finds allow us to understand the nature of ecological continuity, and have led to increased protection for ancient trees and the landscapes they inhabit. Without the survival of historic specimens this kind of protection might never have been possible.

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The functions of museums and records centres and how they have changed:

Chris Palmer, Senior Keeper of Natural Sciences,
Hampshire Museums & Archives Service

There is no telling what value collections of biological material might have in the future. A classic example might be the re-evaluation of the Dodo's appearance and biology which historic specimens have provided.

The Museums, Libraries & Archives Council have stated that

> "*Museums…stimulate, fascinate and educate. They satisfy our curiosity about the world and enlarge our understanding of the past and present*"

Another example of the unforeseen use of collections is that of the use of historic collections of multiple specimens of butterflies for DNA analysis of populations. However, much historic material in local museums has limited data attached to it, and this can make it of limited use. Nevertheless some specimens also provide the only real confirmation of the existence of species in the past, such as the specimen of the robber fly *Choerades gilvus* in the collections of Hampshire Museums – confirming the last record from Britain.

Historic collections also play an important role in linking with the expert local natural history community, who frequently take an active role in working with the collections. The collections then also become an important training and teaching resource in their own right, encouraging the next generation's interest in the environment. However, the recent rise in interest in the natural environment presents museums with a challenge. While some places, like the Wakes at Selborne, home of Gilbert White, attract much attention, getting support for the core work of museums in maintaining important reference and research collections becomes increasingly difficult. Many new developments are carried out purely in order to maintain profile. In the meantime, mainstream natural science activities in museums tend to be side-lined, and are prone to cuts. Natural science collections, therefore, tend to be the least well supported area of museum collections. This problem is exacerbated by museums not being a statutory function. There is always a pressure on staff to justify their existence. The cost of maintaining voucher specimens, with specialised storage facilities, climate controls and visitor provision, is often quite high, while interest by governing bodies in the subject, as compared with the arts, is often low.

Museums have in the past used their collections as "props" to explain the subject of ecology, but with an increasing concern about the collection of specimens, there has been recently a tendency to move away from their use at all. This is a great mistake, because the use of specimens in teaching and awareness-raising is ultimately the only way to interact with the real thing.

The saviour of many collections over the last 30 years has been their link with biological recording. However, there is always a danger that the collections then get seen merely as subservient to data. An important role of museum collections is to support the activities of amateur naturalists, and the reward for the museum in the longer term is the acquisition of more and better, up-to-date collections. Many museums also have become

involved with the development of local records centres, although more often than not these were developed on shoe-string budgets. The idea of the "local records centre" has also developed since 1991, and has culminated recently in the issue of the NBN position statement on local records centres.

However, this has also led concurrently to some problems:

- A reduced role in local records centres for partnership with museums. The NBN position statement is, actually, to some extent a lost opportunity to re-emphasise the role of museum collections.
- A lack of recognition of the role of voucher specimens in recording. Again, the NBN position statement makes no mention of the need for vouchers.
- The advent of "mass recording" is resulting in related problems, particularly the tendency to overlook the need to support data on difficult groups with specimen collections.
- The lack of a nationally-focused system for maintaining voucher specimens.

A museum now seems to need to be part of a local records centre partnership merely to survive. The NBN itself could be seen as a threat if it were to undermine this local partnership.

The conclusion is that museums need to be much more proactive in engaging with the voluntary sector. However, museums cannot do this alone – they need to work in partnership with others, and notably with local records centres and the users of their information.

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Questions and answers:

Q. Is there any guidance available on what vouchers are needed?

A. It depends on what the source of the data might be. This can only be judged according to individual taxonomic groups. Individual recording schemes or groups need to define what is needed.

Q. Is there a need for museum biological collections to go down a similar route to archaeology in terms of funding support?

A. Yes. There needs to be formal support for biological collections which are made in the process of carrying out surveys for development proposals, and for their deposit in museums.

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The form and function of archival collections

Neil Thomson, Head of Data & Digital Systems,
The Natural History Museum

Libraries and archives tend to be two sides of a coin:

Libraries	**Archives**
Published documents	Unpublished material
Multiple copies	Unique copies
May be borrowed	For reference only
Maintained to the MARC* standard	Maintained to ISAD(G)* standard
"Ego"	"Id"

*MARC: MAchine-Readable Cataloguing

*ISAD(G): (General) International Standard for Archival Description

Only some 15% of official records held by a body are really useful as archives. However, this does not apply to informal (i.e. not official) "archives".

There are a number of discrete functions in operating an archival system. Firstly, there will be a formal process of acquisition and selection. Archives are defined by their structure, and by their provenance. There is a standard approach to their description and their conservation and preservation for the future needs to be considered. Finally, provision of facilities to access the archives is needed.

In acquiring archives, an initial decision needs to be made as to what is kept, and who is to keep it. There is a legal framework for this kind of decision. This needs to take into account the provisions of the Freedom of Information Act 2000 – which requires a public authority to produce an "information access scheme". We also need to take into account the Data Protection Act, 1998; and the Environmental Information Regulations, 2003. Under the "Modernising Government" White Paper, issued in 1999, all public authorities have a target date of 2005 to make information and records available to the public. This presents those maintaining natural science archives with something of a challenge.

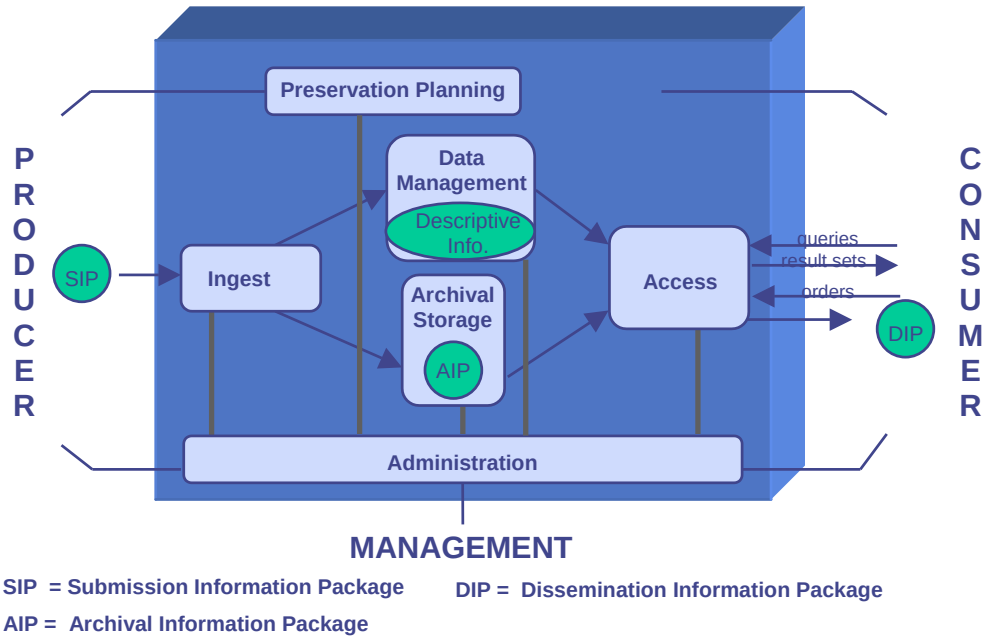
Digital records present us with more of a challenge. They include both the original records and "preserved" copies. Documentation of digital data is more difficult. An extra layer of technology on top of the records is needed. This takes the form of "metadata". For this, standard formats need to be defined. Metadata also needs to allow us to have fore-warning of potential access problems, such as the incremental loss of accuracy through the transfer of data. So, "digital sustainability" might include the following considerations:

- The nature of the electronic documents and records
- Understanding the difference between "preservation digitisation" and "digital preservation"
- The physical formats and electronic data formats that the records are in

- What is involved with data migration, emulation and refreshment
- The combination of the unique content of particular data and generic problems, which jointly give us the respective possibilities for collaboration with any one set of records

The central point is that digital data curation is not being effectively recognised as a need. "Benign neglect" is no longer an option. Effective digital curation and sustainability for the future need to be emphasised. We are, in fact, in danger of entering a "digital Dark Age".

No one organisation can tackle the issue on its own. A standard approach has therefore been developed: the Open Archival Information System:



More details can be found in "British archives: a guide to archive resources in the United Kingdom" by Janet Foster and Julia Sheppard, Palgrave, 2002 (4th ed.). There is also a Linnaean Society guide to the deposit of natural science archives. Most local records centres are not in a position to store either natural science archives or specimen collections. A collaborative approach is therefore needed to avoid a loss of the links between data and vouchers etc. Use of "interoperable" data systems, such as the National Biodiversity Network, can help with this.

The use of standard approaches to the description of collections can help re-unite dispersed collections. Work on this has been progressing slowly for many years. The

BioCASE Project[1] is the most recent and continuing development, looking at a distributed search service and collections description processes.

Some relevant Web resources are:

The National Archives (TNA) http://www.nationalarchives.gov.uk/

National Digital Archive of Datasets (NDAD) http://ndad.ulcc.ac.uk/

Digital Preservation Coalition (DPC) http://www.dpconline.org/

Biological Records Centre (BRC) http://www.brc.ac.uk/

OAIS (The Open Archival Information System Reference Model)
http://www.dpconline.org/docs/lavoie_OAIS.pdf

The danger is that we are entering a time when data not on the Web do not "exist" from the public's point of view.

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The use of technology in providing access to information about biodiversity

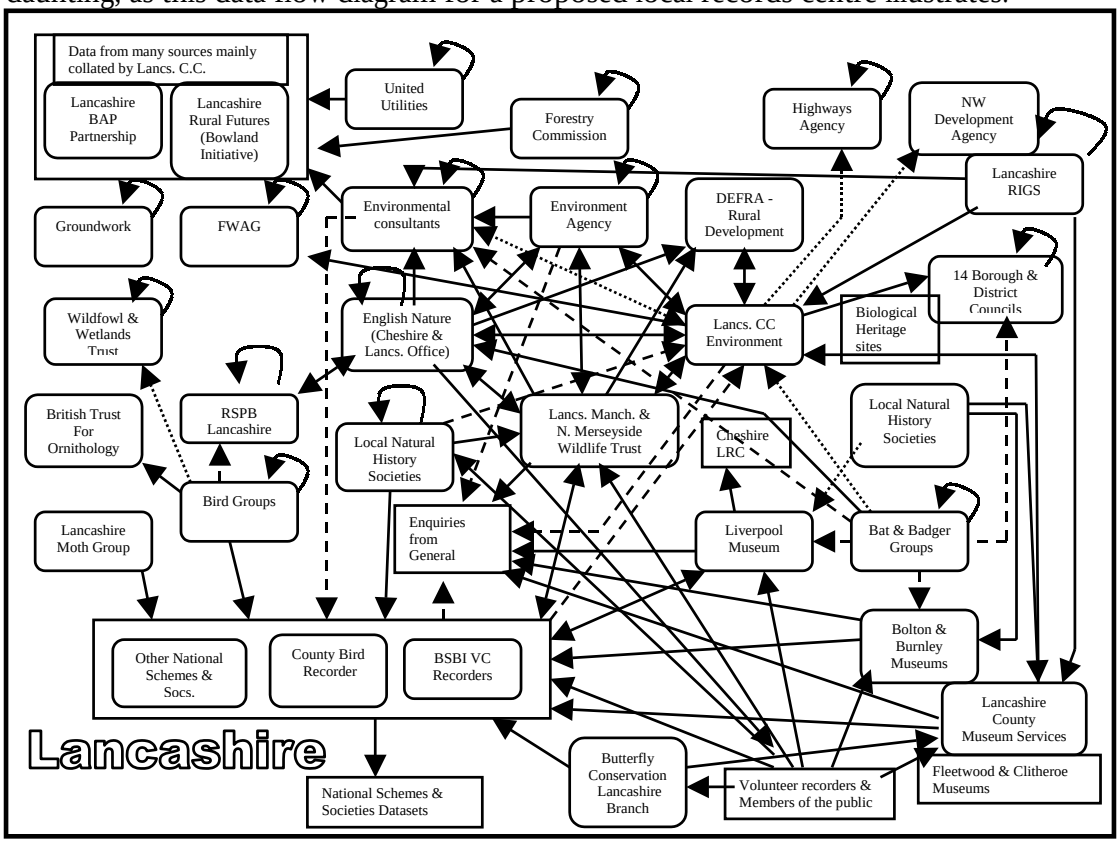
Charles Copp
Environmental Information Management/
The Natural History Museum

There are some Big Questions underlying this topic, such as:

- ***Who has the information - how do we find out?***
- ***Who needs the information - are we really addressing the needs of all users?***
- ***How is the information structured - is it important?***
- ***How is it stored - can we get at it?***
- ***How do we know where to look for the information we want?***
- ***How do you get the information back, once it's been found?***
- ***How can data be used - what tools are available to make sense of it?***
- ***How do we know who is getting their hands on the data?***
- ***How can you mix free and charged-for data or services?***
- ***How stable are the networks we are creating - could they collapse?***
- ***Where will it all end?***
- ***Why are we doing it anyway?***

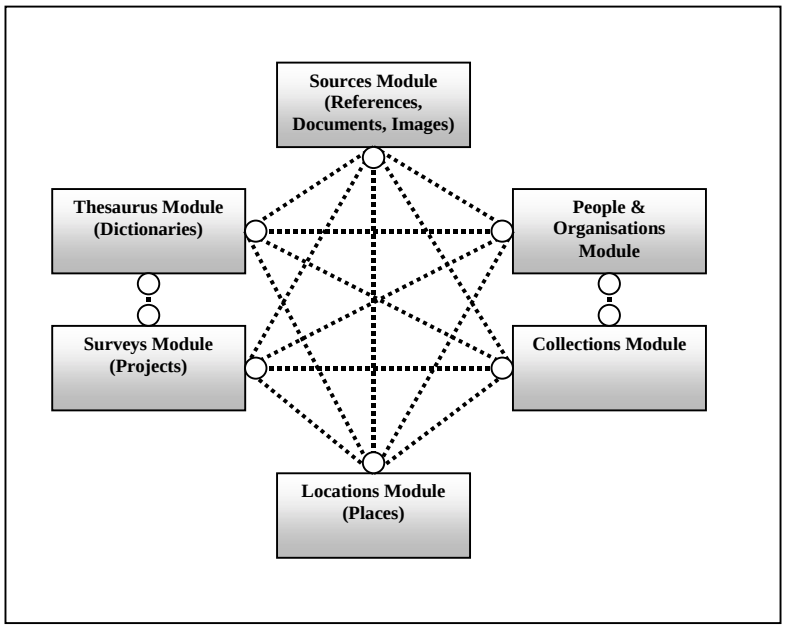
[1] Biological Collection Access Service for Europe (www.biocase.org/)

There is in fact rather a flood of information on wildlife. How do we find what we want? How do we make use of it? Who pays? Technology does not replace people and specimens in this web, but the complexity of information flows can be quite daunting, as this data flow diagram for a proposed local records centre illustrates:



Initiatives like the NBN and the BioCASE Project are helping to simplify the system, but ultimately do not replace the need at the local level for agreements between people about the use of information. The problem is actually defining what the "market" is for biodiversity information. What is "the public"? In the event, those interested in wildlife information comprise a web of overlapping communities of interest.

Standards concerning biodiversity data management are developing fast. The NBN Data Model is an example, which is complex, but modular, as this diagram illustrates:

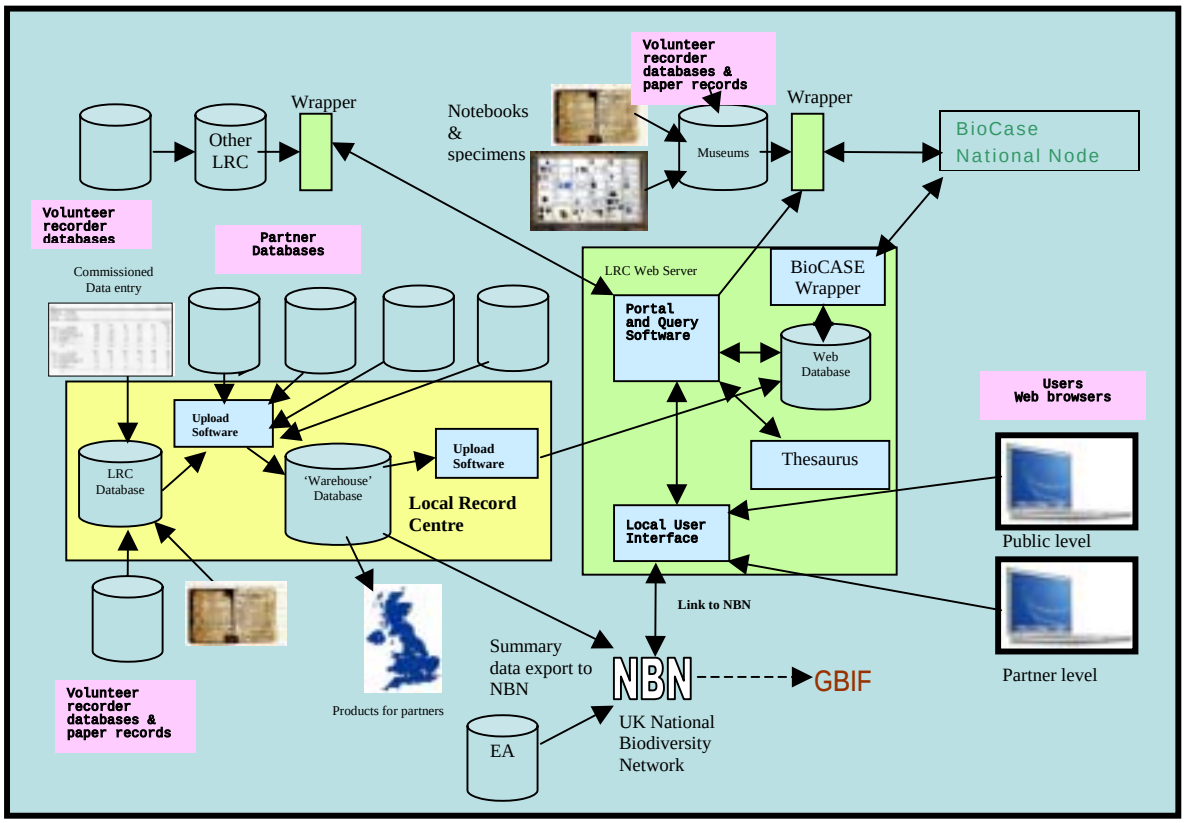


The new Recorder 6 database is being developed to accommodate collections information, based on this model, which will enable integrated specimen, collection and field records management.

But how do we find information? We could use our Web browsers, but the results can be problematic. The NBN Gateway in its new version is good, but is designed for a specialist audience, and needs more work for it to enable people to find information effectively. At the other end of the scale, there is the GBIF[2] portal to worldwide data on biodiversity – but maybe more of a portcullis?

We need to really consider the accessibility of information. The way forward is not with monolithic portals, but the development of an interlinked system. This will involve the development of distributed networks and diversification of sources and outputs for specific user needs, such as links between local records centres and their partners, or interfaces with Web links between outside databases and museum collection databases etc., as in this diagram:

[2] Global Biodiversity Information Facility



New developments to enable this to happen are coming on stream now, including things like semantic webs, logical systems, ontological relationships, thesaurus building and intelligent response systems, while digital signatures will allow tracking of requests. However, we must not forget that the goal is to defend our knowledge of the natural world.

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Local and regional biodiversity networks and local records centres: recent developments

Adam Rowe, South-east Wales Biodiversity Records Centre

This is an opportunity to look at recent developments in the ways that local records centres are and have been working together at the regional level, and to relate these to the overall themes of the conference. In particular, we can look at the outcome of the NBN South-west Pilot Project, and also the establishment of the Welsh local records centre network. The principal questions might be:

- How can we assure the quality of data held by local records centres, building on existing systems and partnerships?
- What is the role of collections and archives in supporting the work of local records centres and local recording networks?
- How can the existing system be improved?

The NBN South-west Pilot Project

The aims of the Project were to demonstrate the benefits of a fully-functioning network at the regional scale by:

- Promoting and supporting the sustainable, long-term collection of wildlife data.
- Developing and trialling policies on data access and accreditation standards.
- Increasing the quantity and value of wildlife data accessible through the NBN Gateway, especially GIS-based inventories of UK BAP[3] habitats.
- Trialling the NBN Gateway as a means of delivering information to users.
- Demonstrating the benefits of the NBN by providing data on wildlife to decision-makers in government and elsewhere.

The role of regional government in the UK is likely to increase, with more decisions made at the regional level, which will need data to be aggregated and made use of at that level. In the past, local records centres have, rightly, concentrated on serving the needs of their local data suppliers and users. However, if they are to survive, increased co-operation may be required at the regional level. But this is not a green light to merge local records centres into regional bodies, because the "L" in "local records centre" cannot be over-stressed – reflecting the essential trust that is needed in working relationships with local recorders and local users of information.

The findings of the South-west Pilot were:

- A successful demonstration of how independent records centres can work together to common standards and produce valued regional products.
- Showing that such a network of records centres is needed in all regions, although regional levels of funding present problems.
- Demonstrating that the whole system is dependent on establishing and maintaining trust between records centres and voluntary recorders.
- Showing that the NBN is not just a technical solution, but also a partnership between different organisations with different expectations.

The final report will be published as an English Nature Research report, available through the NBN website.

The Welsh Local Records Centre Network

As the Conference was in Wales, this was an excellent opportunity to update delegates on the exciting recent developments relating to local records centres in Wales. The Welsh Assembly is one of the first governments in the world to refer to "sustainability" in its constitution. In addition, there has been strong political support for these developments, which could be a model for other devolved regions in the UK. The result is that Wales is midway to establishing an entire network of records centres for the country. In 2001, there were no records centres in Wales, but by 2007 the network should be complete.

[3] UK Biodiversity Action Plan

Recommendation no. 7 of the Review of Local Biodiversity Action (February 2003) was:

> "The Welsh Assembly Government [should] take steps to establish the development of a national Local Records Centre network, building on the Powys pilot project."

The reason for this is that such a network was seen as a cost-effective way to manage data and to combine it with other partners' data, "the whole being much greater than the sum of the parts", to quote the Chairman of the Countryside Council for Wales. As a result of this recommendation, the level of support from Countryside Council for Wales for local records centres is far greater than that provided by either Scottish Natural Heritage or English Nature.

Two other quotations from Carwyn Jones (Welsh Assembly Minister for Environment, Planning and the Countryside) focus on the two related aspects of this Conference:

> "Many of the records that local records centres need in order to work effectively will come from the unsung heroes of biodiversity – the voluntary recorders… but more needs to be done in Welsh local records centres to support this network [of recorders] and ensure that they feel valued for the important contribution they make to biodiversity conservation".

> "The [National] Museum [of Wales] will be a key contributor of records – it houses a vast quantity of specimens in its collections, as well as paper records".

In fact, when the South-east Wales Biodiversity Records Centre was launched, the National Museum of Wales was identified as a key partner, source of data and a repository for voucher specimens.

Although much effort is being expended to make information available to decision-makers, the key questions posed at the beginning need to be openly discussed:

How can we assure the quality of data held by local records centres?

Data quality is the key to the "natural partnership" we are talking about. The key issues here include:

- The level of knowledge of local recorders.
- Access to reference collections.
- The availability of training in identification and recording skills.

The whole biodiversity community has a role to play in these areas, although museums perhaps have the most important role, which then begs the questions:

- Are museums sufficiently resourced to play a key role in this area?
- Are museum collections accessible enough?

Interestingly, the availability of training is being taken seriously in Wales, where another recommendation of the Environment, Planning and Transportation Committee report

related to the need to increase opportunity for training, which is being taken up by the Wales Biodiversity Partnership, which is planning an audit of biodiversity training needs in Wales. Regarding museum collections, however, access to the National Museum of Wales is difficult for those working in the north or west of the country.

So, what is the role of local records centres in this? Local records centres are at the front line of incoming data. They have a specific role to work in partnership with recorders to link in to existing systems of record validation, and also to support the establishment of these procedures where they do not already exist. But there are some questions for further discussion:

- Should local records centres be doing more to improve the quality of the data they hold?
- Many records centres cover themselves by issuing caveats on the quality of the data they provide, but in doing so, are they to some extent hiding behind these caveats?

So, we need to consider how we can more effectively work together. Is the "apparent divergence between field observations, collections and archives" real or imagined? Is a new initiative required to improve the situation (e.g. providing better access to collections), or do other projects already cover this area? Finally, can action points be identified to improve the way we work together?

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Your data going global: what is in store now that we can connect biodiversity data locally, nationally and internationally

Lawrence Way, Joint Nature Conservation Committee

We have probably heard the response when we talk about making biodiversity data available globally:

- "GBIF? Surely not a priority!"
- "We don't need a network – we have all the data we need"

But, at Oaxaca in Mexico in 1993, another position was taken, with a declaration, signed by all the biodiversity-related institutions in the country:

- "We need a global network to understand our biodiversity"

The result was the launch of the REMIB[4] Project in Mexico, which has already got 32 nodes and access to 6 million records, with:

- A distributed computer network
- Access to remote data, with Spain, the USA and the United Kingdom contributing
- Extensive use of computer modelling
- Use of specimen data to identify environmental niches
- Use of Sweden and the UK as models to start volunteer recording and get public engagement with biodiversity.

In fact, there is a whole raft of reasons why we need to link data globally, such as:

- To help provide the data needed to understand, manage and protect the oceans
- To help Europe set better priorities for biodiversity
- To help manage diseases and disease vectors
- To identify which biodiversity we have a particular responsibility for, e.g. great diving beetles or badgers
- To supply data to help with global measures of biodiversity decline
- To track invasive species
- To help other countries understand, conserve and use their biodiversity
- To enjoy nature

The problem is that we tend to be very focused on our locality, species group or conservation priority, and forget the bigger picture. So we can look at examples, from mosses through to marine fish data. Using linked data on bog mosses, for example, we can begin to see the UK picture through the NBN, while GBIF indexes data sets worldwide, and begins to allow the compilation of world-wide maps of species occurrence. This gives a better understanding of BAP priorities and needs, for example. Another example might be marine fish data, where distribution data from one source might be analysed against environmental parameters (such as salinity) to identify factors affecting the species distribution. Then again, international maps of mosquito occurrence can be compared with plots of environmental factors which might identify its potential to spread.

Data plumbing

How do we make this all happen? It involves technical systems to be put in place, but the most important bit is for people to be aware of potential future uses of information. The other key point is that it is vital to have fine-scale data used, even at the global level, in order to get the most out of recording effort.

The mechanisms for setting up these systems have varied from the GBIF approach – starting with a distributed network, but developing a centralised data-caching portal; through to the NBN model, which has started with a centralised data-warehouse, but aiming to develop a distributed system. Alongside both approaches, there need to be

[4] "World Information Network on Biodiversity" (www.conabio.gob.mx/remib_ingles/doctos/remib)

the same controls: on data access, for data verification, application of names, indexing and caching for performance enhancement, use of metadata, data transfer standards and automated updating procedures.

Specimen and observational data are all part of the same network, although gaining recognition of this fact was a major battle within GBIF, which is now won.

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Questions and Answers

Q. Is it possible to ensure that specimen determination information can be linked to observational data?

A. This is not technically difficult, but needs setting up, and needs to operate using "master copies" of a dataset.

Q. Comment: that the sources of records need to be remembered, as not all records are of the same quality.

A. Agreed.

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Developing networks of data suppliers

Adrian Spalding, Spalding Associates (Environmental) Ltd.

This topic is perhaps best illustrated by a case study: the development of the Moth Recording Project in the UK.

The proposals for a National Macro-Moth Recording Scheme are being developed following a large-scale consultation process funded by the Heritage Lottery Fund and involving a wide range of partners, including academic bodies, government conservation agencies, as well as amateur societies and Butterfly Conservation, the body which has taken the initiative in setting up the process.

The brief has been to:

- Engage the moth recording community
- Assess current recording capacity and existing data sets
- Identify potential sources of records
- Consider survey methodologies, data verification and access issues
- Assess computer options
- Develop recorder training
- Prepare an "audience development plan"
- Formulate a scheme for all macro-moths

The consultation exercise involved the sending out of questionnaires to interested parties, as well as regional conferences and workshops. The general consultation questionnaire produced 1032 replies. Key issues included:

- Use of data (including data exchange, ownership of data and access to data)
- Validation of records
- Confidential records
- Computer software (what database packages to use etc.)
- Habitats to focus on
- The way the scheme might be organised

Two things in particular emerged from this: the importance of ensuring a "bottom-up" approach to developing the scheme would be crucial in its future success; and the fact that there is a strong anti-collection feeling among the moth-recording world, which may have implications for the way the scheme runs, and could impinge on the validity of records.

There are a plethora of places where moth recorders can currently send records, ranging from the volunteer County Recorder (who often acts as a data validator, fields queries and may aim to publish County lists, but with patchy coverage across the country) to local wildlife trusts, records centres, societies or some existing national initiatives. Despite this, a key fact is that **21% of existing recorders do not currently send their records anywhere**. There were biases derived from focuses of interest, and of coverage in terms of geographical areas: rural as against urban, as well as a sex bias (80% of

recorders are male). There is also strong evidence for a long-lasting interest in recording, and for an increase in recording recently. Most importantly, there was a 97% response in favour of setting up a recording scheme. The most important driver appears to be that moth recording is fun, although conservation and the use of records to identify environmental trends were also important.

The issue of killing specimens for identification evoked strong feelings, for ethical and conservation reasons. However, this poses problems for record validity in some cases, although digital photography has gone a long way to solving the problem for many specimens. The consultation showed that 58% of field recorders verified records by the use of voucher specimens where necessary, while 55% also used photographs. Of more concern was that over 14% carried out no verification at all. With County Recorders, the picture was slightly different. Of the 61 questionnaires sent to County Recorders, 48 replied, and 100% of these were in favour of the idea of a scheme. Interestingly, 97% of these used computers to store records, but the number of field recorders sending in records ranged from 1 to 100! 87% used either specimens or vouchers for verification, while 18% had an independent verification panel. There were also some other issues, such as the need to train "experts", and the need to alleviate the tensions between "beginners" and "experts".

Finally, bearing in mind the focus of the Conference, the consultation examined what the role of museums might be. Museums were seen as potentially offering access to reference collections, help with identification, and access to expertise and information. The main problems, though, were also revealing:

- Inaccessibility of collections
- Variable quality
- Not necessarily local material
- The perception that museums were "full of dead things"
- Faded colours on specimens
- The daunting quantity of specimens
- The perception that museums are "geared to the expert"

The outcome of the consultation will be the production of proposals for a new recording scheme that will meet the needs of the recorders, as well as the users of records, and will aim to inform the wider public.

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Engaging the public: outreach training and education

Steve Tilling, Director of Communications, Field Studies Council

There is currently a seed-bed of interest in the environment, and possibly more opportunities now than ever before. In general, there is an increase in training courses in biodiversity-related subjects, from the National Vegetation Classification and habitat management through invertebrate identification to mammal studies and biological recording. Despite this, there is a decline in the number of biologists passing through the Field Studies Council's centres relative to other subjects (1 in 2 in 1970, compared with 1 in 3 in 2001). Parallel to this, there is a loss of the ethos of fieldwork among teachers and a loss of empathy with the environment, and this is having repercussions for the number of students that are in a position to take up biology as a subject, coupled with pressures from a range of other factors:

- Curriculum pressures (the advent of standardised subjects)
- Funding needs (residential courses are expensive)
- Quality of educational provision (pressures from government)
- The difficulty of demonstrating the impact of reduction in the subject
- Pressures from course assessment
- The problem of teachers themselves not being trained in whole organism biology or fieldwork
- The needs for course accreditation
- The lack of potential progression for field biologists as a career
- Lack of resources to support the subject
- The impact, real and perceived, of health and safety concerns

The results are a general turning away from whole organism biology and ecology, both at school and university levels. The result is that there is a diminishing number of people available to fill key positions. A survey of 44 environmental consultancies revealed that 80% had experienced difficulties in recruiting staff in the last 5 years, with lack of field skills a particular problem. However, a worrying number said that candidates lack a "love of or a feel for ecology and the environment". In fact standards are so bad that there is a progressive loss of ability to use scientific keys at all for identification, resulting in a loss of quality in fieldwork.

So, what are the real barriers to recruitment and engagement? There is no doubt that new recruits can be "turned off" by the "experts". But the evidence strongly suggests that students' interests closely mirror those of teachers. If teachers have limited enthusiasm for a subject, then students are not likely to have either. For example, a survey of A-level biology students found that 41% of them could not put a name to more than 1 out of 10 common British plants, and that no less than 38% of trainee biology teachers were similarly incapable.

We may, therefore, need new tools. We also need to recognise basic starting points, and understand the progression of engagement with a subject, and the way that access to a subject has to change with the times. For example, an introductory key to woodlice

published in 1964 was at a far "higher" level than the Aidgap key published in 1984 in terms of scientific expectations, and in turn the most recent (2004) picture-based identification chart produced by the FSC is another order of magnitude different again, reflecting the ability of the average member of the public to engage with a subject, as well as the way that people respond to such material. Only through clearly recognising levels of capability and potential will we begin to redress the problem:

- General population
- Unskilled supporters of "the environment"
- Unattached novices in a particular subject
- Early recruits to a subject
- Developing adherents
- Experts

We can then begin to develop different materials for different levels, ranging from mass media presentations, to introductory walks for the unconvinced, focused courses and guides for those needing to be recruited, and access to collections or more specialised courses and training for those needing to be directed in developing their interest. Finally, even the "experts" have needs – for further training and refresher courses, and in other areas of expertise, such as media management or in training expertise to train further trainers. Only in this way will we be able to feed back capability up the chain from expert to general public.

In order to achieve this, it is important to understand both the tools which need to be developed (group management, health and safety in lab and field, risk assessment, teaching and learning approaches); as well as the partnerships and infrastructure which can underpin the process, ranging from local wildlife trusts and special interest groups through to professional and educational institutions to learned societies and funders.

References

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Day 2: Workshops and plenary discussion

Workshops

Workshop discussions were held concurrently during the morning on three principal topics:

- **Data validation and verification**
- **The management and role of collections**
- **The management and role of archives**

Detailed notes from these discussions were not kept, but feedback from the sessions was taken to the afternoon's plenary session.

Key points:

The Conference concurred that the original premise that biodiversity data recording and collections had diverged was true, and that this divergence was increasingly of concern.

1. **The impact of this divide on biodiversity information and its use is especially important in the following ways:**

    1. It had resulted to some extent in a lack of awareness of the need for precision and a scientifically reliable basis for biological records.
    2. It had especially allowed the rise of a general sentiment that collecting is in some way a "bad thing", owing in part to a lack of understanding of the relationship between specimens, data quality and conservation action.
    3. It had begun to militate against the engagement of new recruits to the business of biological recording, and was inhibiting their training.
    4. It is in danger of exacerbating future problems which might arise from taxonomic changes and refinements.
    5. It is in danger of undermining the long-term capacity of recording organisations to maintain their recording effort.
    6. It could exacerbate potential distrust by others, especially funding authorities, in the value of biodiversity data in the future.

2. **Each workshop had looked at the overall issues in relation to different aspects of the problem, but a number of key themes came out of these:**

    1. The increasing separation of biological collections in museums from the activity of biological recording is seriously jeopardising the long-term perceived usefulness of biological collections, and exacerbating funding difficulties.
    2. While many (most?) recording schemes and recording organisations might say they value the use of specimens for verification of records, and as vouchers for records, there has been little coherent thought given to working with collections managers to identify what actually needs collecting, and who should look after it,

adding to the problems of poor policies and a lack of focused support for collections on the one hand and for recording (at the local level especially) on the other.

3. While all parties have identified public engagement and training as important issues, the capacity to use collections effectively in training and outreach is undermined because responsibilities are divided between different sectors and organisations.
4. If natural science collections are in danger of serious neglect and loss, then the situation for informal natural science paper archives is even worse, owing to the extremely low profile these have had in many institutions, and especially exacerbated by the separation of biological recording from collections, and the advent of electronic data management.
5. There has also been almost no awareness until now of the growing problems of electronic data archiving, and the long-term impact this might have on biodiversity recording.
6. Specific improvements could be made by encouraging those involved with biodiversity data management to formally recognise the role of collections as underpinning data quality and to work with collections managers to establish data quality standards.
7. There is a need for co-ordinated partnerships in order to improve the situation, because no one sector has enough influence or capacity to achieve changes on its own.
8. Government in particular has a key role in remedying the situation, because it especially has the power to influence the way that responsible funding authorities respond to the problems.

The Conference resolutions

From this discussion, the Conference agreed that the following resolutions and recommendations should be put on record and disseminated to interested parties:

1. **The Conference affirmed that a key link between biodiversity data and biodiversity collections is the role of collections in underpinning long-term data quality.**

2. **It also confirmed that there has been a serious decline in resources to manage biodiversity collections across the UK, and that this is largely a direct result of the increasing divorce between these collections and the process of collecting and using biodiversity data.**

3. **The Conference recommended that biodiversity data collectors and managers should aim to ensure the long-term viability of data, and should adopt mechanisms to ensure that these data are supported by reference to relevant collections where necessary.**

4. **It also recommended that collectors of data should describe their responsibilities to ensure that, where appropriate, records are underpinned**

by the collection of specimens, and that these are maintained for the future.

5. **Biological recording schemes and societies should actively formalise their relationship with relevant local and national taxonomic expertise, and promote more formal agreements with appropriate museums and other holders of collections over the use and deposit of specimens.**

6. **Museums which hold biological collections should actively seek to engage with local volunteer networks and expertise to support and reinforce the maintenance and use of these collections as an archive of voucher or related material and as a resource to underpin the local collection of records.**

7. **The Conference recommended that the National Biodiversity Network Trust should actively pursue the issue of a statutory need to be recognised for quality biodiversity data to be made available in the Environmental Assessment process, parallel to the situation for archaeological information.**

8. **It also recommended that the National Biodiversity Network Trust should actively support the need for biological collections to be used by local biodiversity partnerships to underpin their data.**

9. **All biodiversity organisations should seek to promote the links between biodiversity collections and the collection of data, and to encourage collaborative approaches to the funding of collections through formal partnerships with users of biodiversity information.**

10. **The National Biodiversity Network Trust should develop best practice guidance, with partners, concerning the long-term management of natural science archives, including electronic data and "grey literature".**

11. **Relevant organisations should seek to encourage professional training and accreditation for staff involved in biological recording, particularly in local records centres.**

12. **The Museums Association and The Museums, Libraries and Archives Council should promote the development of regional/local "hubs" under the "Renaissance in the Regions" programme, especially in relation to biological collections and their use with respect to biological recording.**

Final List of Delegates

Name	Organisation
Ross Andrew	Herefordshire Nature Trust
Andrew Barker	Hampshire Biodiversity Information Centre
Ray Barnett	Bristol Museums & Art Gallery Service
Dr L S Bellamy	National Organiser Freshwater Tricladida
Jenny Bruce	Carlisle Museum
Phillipa Burrell	Thames Valley Environmental Records Centre
Bill Butcher	NFBR Chairman Somerset Environmental Records Centre
Alan Cameron	Biological Recording in Scotland
Julian Carter	National Museum of Wales, Cardiff
Sara Carvalho	Ecorecord, Staffordshire
Charles Copp	NFBR Council / Environmental Information Management
Nicky Court	NFBR Council / Hampshire Biodiversity Information Centre
Lesley Cropper	North-East Scotland Biological Records Centre
Nichola Davies	Butterfly Conservation
Steve Docker	Derbyshire Wildlife Trust Volunteer
John Edmondson	National Museums & Galleries on Merseyside
Rebecca Ellis	IEPPP, Lancaster University
Jon Follows	Manchester City Council
Jeffrey Gillian	The Natural History Museum
David Gurney	Norfolk Museums & Archaeology Service
Paul Harding	NFBR Secretary / British Myriapod & Isopod Group
Dr Peta Hayes	Department of Botany, Natural History Museum
Stephen Hewitt	Carlisle Museum
Morgan Hughes	Ecorecord
Charles Hussey	The Natural History Museum
M. E. J. Jaggar	Natural History Museum Volunteer
Trevor James	National Biodiversity Network Trust / NFBR Council
Alison Jones	Caerphilly County Borough Council
Anna Lawrence	University of Oxford (Environmental Change Institute)
Caroline Lidgett	Warwickshire Museum
James Mortimer	North & East Yorkshire Ecological Data Centre
Jim Munford	National Biodiversity Network Trust
John Newbould	NFBR Membership Secretary / Yorkshire Naturalists' Union
Chris Palmer	Hampshire County Council Museums Service
Mike Palmer	Buckinghamshire County Museum
Abigail Pedlow	Bristol Regional Environmental Records Centre
Mark Pollitt	Dumfries & Galloway Environmental Resources Centre
Jennifer Preston	Hampshire Biodiversity Information Centre
Geoff Radford	North Wales Wildlife Trusts
Sally Rankin	Recorder 2002 Authorised Reseller
Mandi Robins	The Wildlife Trusts (North Wales)
Adam Rowe	NFBR Council / South-East Wales Biological Record
Mandy Rudd	NFBR Council / Greenspace Information for Greater London
David Slade	South-East Wales Biological Record
Stephen Smith	Kent & Medway Biological Records Centre
Adrian Spalding	Spalding Associates
Deb Spillards	National Museum of Wales, Cardiff
Darwyn Summer	NFBR Council / Leicestershire Environmental Resource Centre
Alistair Taylor	The Natural History Museum
Christine Taylor	Hampshire County Council Museums Service

Kelly Thomas	Butterfly Conservation
Neil Thomson	The Natural History Museum
Steve Tilling	Field Studies Council
Ian Tittley	The Natural History Museum
Samantha Trebilcock	Bristol Museums & Art Gallery Service
Dr John Tweddle	The Natural History Museum
Julia Verity	Hampshire Biodiversity Information Centre
Ian Wallace	Caddis Recording Scheme
Graham Walley	Natural Science Collections Association & Nottingham Local Records Centre
Amanda Waterfield	London Natural History Society
Lawrence Way	Joint Nature Conservation Committee
Michael Weideli	NFBR Treasurer / Littlefield Consultancy
Steven Whitbread	
Mike Wilson	National Museum & Galleries of Wales
Rupert Wilson	Royal Horticultural Society
Simon Wood	Worcestershire Biological records Centre
Ray Woods	Countryside Council for Wales