

Irish National Review of Taxonomic information

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Introduction

The European Platform for Biodiversity Research Strategy (EPBRS) meeting being held under the Czech Presidency of the EU in May 2009 aims to identify the key research questions that would allow taxonomy to better address policy needs. In this context the meeting will explore areas that the users of taxonomic information see as the main issues taxonomists should focus on and what taxonomists can offer to these users.

The users will include managers and policy makers dealing with the Nature Directives, Water Framework Directive, Marine Strategy Directive, but also a much wider group that include Customs officials dealing with CITES, those responsible for environmental assessments, coping with biological invasions, assessing the impact of climate change, dealing with ecosystem processes and ecosystem services, bio-prospecting, access and benefit sharing and understanding disease and vectors.

As stated by the Global Taxonomic Initiative “there is too little taxonomic expertise, information and infrastructure available for the users of taxonomic information to enable them to work with their biota in the way they need. This deficiency is known as the ‘taxonomic impediment’ to implementing the Convention on Biological Diversity. The taxonomic impediment is therefore specifically about the taxonomic needs of non-taxonomists. It is distinct from the taxonomic capacity of a country, which refers to what taxonomy can be done, and the levels of expertise, information and infrastructure, without considering needs. It is distinct from the taxonomic capacity of a country, which refers to what taxonomy can be done, and the levels of expertise, information and infrastructure, without considering needs”.

The purpose of this review is to assess how taxonomic information is used by these groups, what hinders them in their jobs and what they would like taxonomists to put more research effort into.

1. Taxonomic Information: Strategy and Methods - Inventory and Identification

1.1. Does your country use taxonomy-based tools for biodiversity assessments and policy making? What are these tools?

The main use of taxonomic tools for biodiversity assessments includes the use of taxonomic keys, field guides, web-based species imagery databases and reference collections to ascertain and confirm species identifications by specialists. However such tools are not available for a wide range of taxonomic groups. While specialists use taxonomic tools to a limited extent in biodiversity assessment they would not be directly used in policy making and their relevance here would seem to be limited. The use of taxonomic databases has limited use for non-specialists who argue that most databases are too technical for their use and the need for more online databases with simple explanations and a variety of images at both species and sub-species level are required. This was found to be especially true for customs officials working on the implementation of CITES.

1.2. Does your country have a national species checklist and when was it last revised and updated?

National checklists for the following taxa are available:

- **Invertebrates**

Invertebrate Ireland has a programme of checklist development for invertebrates which are updated annually and available on-line. Checklists for invertebrate taxa are also regularly published in the Bulletin of the Irish Biogeographical Society.

- **Higher Plants**

The National Botanic Gardens, The National Parks and Wildlife Service of the Department of the Environment, Heritage and Local Government and the National Biodiversity Data Centre have worked together to produce a national vascular plant checklist in 2008. In this checklist all higher plant groups have been revised and are available online.

- **Algae**

Irish marine (and some freshwater algae) are catalogued in an online database (algbase.org). This database is regularly updated.

- **Birds**

A new national bird checklist is planned by BirdWatch Ireland.

1.3. Is there any national assessment of which taxonomic groups in particular lack taxonomic information? Did you submit a response to the GTI questionnaire on these issues?

There is no national coordination of checklist production; hence no national assessment. Ireland did not submit a response to the GTI questionnaire on these issues.

1.4. Flagship projects related to taxonomic information

Box 1.1: Bees of Ireland by Mark Brown, Trinity College Dublin.

<http://www.tcd.ie/Zoology/research/Bees>

This site is intended to stimulate interest in Irish bees by acting as an educational tool that makes bees more accessible to interested naturalists, biological recorders, students and the general public.

The database is presented as a simple, user-friendly web based interface.

The site provides a complete list of the bees of Ireland together with information on their key identification features, flight period, habitat preference, nesting biology, flowers visited and conservation status for each species. A distribution map for each species is also provided.

An interactive species prediction tool allows the user to enter key attributes such as location, time of year and habitat to aid identification.

Box 1.2: National Biodiversity Data Centre

<http://www.biodiversityireland.ie>

The National Biodiversity Data Centre has established a hub for biodiversity data and information in Ireland. The management and operational systems are now in place and a national data management system has been established.

Central to the Centre's data management system is a web portal to provide access to biodiversity data and associated information in a user-friendly format. This web portal enables users to query the database by species and dataset, and to generate distribution maps of the selected species at the national and local levels. Some basic interpretation of the data is possible by presentation of the data against background GIS layers on topography, soils, land cover and designations.

The National Biodiversity Data Centre is currently gathering information on the following: Invasive species (in collaboration with Invasive Species Ireland); Fish of freshwater lakes (in collaboration with Central Fisheries Board); Water beetles (in collaboration with Prof. Garth Foster and NPWS); Macro-moths (in collaboration with Ken Bond and MothIreland); Micro-Lepidoptera (in collaboration with Ken Bond and the National Museum - Natural History Division); Non-marine molluscs (in collaboration with CEDaR and Conchological Society of Britain and Ireland); Craneflies (in collaboration with Irish Biogeographical Bulletin); Vegetation (in collaboration with NPWS and key national experts); Joint Irish Cetacean Database (in collaboration with NPWS and cetacean data holders). Lichen Ireland (<http://www.habitas.org.uk/lichenireland/>).

Box 1.3: Species.ie

<http://species.ie>

Species.ie is a database of Irish living organisms developed at NUI Galway as part of the Biochange project funded by the Irish Environmental Protection Agency. It is currently (April 2009) in an early stage of development, although more than 12,000 species have now been added. Presently, the database includes a preliminary set of reasonably complete data on seaweeds, flowering plants, birds, and marine vertebrates and invertebrates together with some sources, references, distributional data and other information. Incomplete entries include freshwater algae and terrestrial fungi and lichens. The database will eventually will include conservation status, ecological preferences and taxonomy. It is hoped that these data will be of use to professional and amateur scientists and naturalists alike. It is intended eventually to provide information on a county-by-county basis for use by county environmental officers and by conservationists. Mapping will be added when funding becomes available.

Box 1.4: Interactive Flora of the Burren Ireland

The Interactive Flora of the Burren Ireland is currently a CD-ROM (but soon to be published online) database of the flora of the Burren, the Aran islands and to the east of Connemara region of Ireland. It provides photographs and detailed information on dicotyledon plants of the region. In total 550 species are included. The glossary provides explanations for the botanical terms used. The native status is recorded and conservation interest indicated. In total 2373 photographs and drawings aid recognition and show important characteristics for each species. There is a general multi access identification key, which covers all species of the flora.

The flora is presented as an attractive, user-friendly database suitable for specialists and non-specialists alike.

1.5 Outline of national taxonomy-based monitoring or surveys designed to establish the distribution, status and trends of any taxonomic group.

A number of national projects conducted through the National Parks and Wildlife Service are designed to establish the distribution, status and trends of key taxonomic groups. However to-date most of the information gathered is baseline data so that future conservation status can be monitored. This data is limited to a small number of species. These assessments are species based they are not specifically taxonomy based.

1.6 Is there any coordinated effort in your country regarding bar coding for identification or the assessment of biodiversity?

While molecular bar coding is used for a variety of taxonomic studies there is no coordinated national effort in this regard.

1.7 Are you aware of any major efforts (or projects) to integrate morphological and molecular taxonomy?

A number of projects are currently underway that integrate molecular and morphological information. Most of which are run by researchers within the university sector. The majority of work integrating morphological and molecular taxonomy is related to plant species. The molecular systematics group at the

University of Dublin, Trinity College, concentrates on assessing genetic variation in plants. Current research projects are divided into those that study the population genetic structure of target species (genetic resources and conservation genetics) and those that are involved with phylogenetic reconstruction for a large number of species. Population genetic studies include work on forest trees (oak, ash and yew), Pacific island species, *Brassica*, Cassava, *Miscanthus*, and a number of threatened native Irish plant species. Phylogenetic work is centred on monocotyledons such as the grasses (including bamboos), sedges, and rushes but has also included poppies and yew. This department is also involved in phylogenomic study of grasses (the biomass crop *Miscanthus* and the forage *Lolium*).

A DNA bank held at the University of Dublin, Trinity College is used for the long term storage of DNA and it is envisaged this resources will become central to many internal activities and will be made available to the wider botanical community.

The integration of molecular and morphological taxonomy is less advanced for other animal species and invertebrates but projects related to molecular phylogenetics and population genetics of marine invertebrates integrating both approaches are conducted at the National University of Ireland, Galway, while studies integrating molecular and morphological taxonomy in a limited number of mammal groups is conducted at University College Dublin.

2-Taxonomy as a Basis for Ecological Research and Sustainable Management of the Biodiversity

Ecological Functions and Services: “What does it do, and what does it interact with?”

How does taxonomic research contribute to better understanding of the functions and attributes of species, and to the management of biodiversity?

2.1 Do you know projects involving taxonomists in the understanding of ecological functioning, or the assessment of ecosystem services?

A number of university based research groups are currently studying ecological functioning and the assessment of ecosystem services. However the involvement of taxonomists in this research area is very limited.

2.2 What is the contribution of taxonomy in your country to the management of biological invasions?

The *Invasive Species Ireland* project is using museums and herbaria to verify records of invasive aliens. Some specialist taxonomic workshops on key taxonomic groups have addressed the issue of the taxonomic identification of alien invasive species for non-specialists and specialists alike.

The Environmental Protection Agency funded Biochange project (www.biochange.ie/aliernplants/index) has developed a database of alien plants in Ireland containing detailed information on 716 alien plant taxa currently occurring in (semi-) natural habitats in Ireland (both the Republic and Northern Ireland). Data on species identification together with, invasiveness and a series of biological and ecological species traits are included. This project will run a training workshop on the identification of alien species within terrestrial, freshwater and marine habitats in June 2009 aimed at researchers, practitioners and other parties interested in alien invasive species.

2.3 What is the contribution of taxonomy in your country to efforts to understand the status and trends of key functional groups such as pollinators?

The contribution of taxonomy to understand the status and trends of key functional groups in Ireland has been limited to-date. The “*Biodiversity Knowledge Programme for Ireland*” published in 2006 has highlighted the need for further research to improve basic understanding of how genetic, species and ecosystem ecology and processes together with the taxonomic needs to understand these processes influence the development and maintenance of biodiversity across a gradient of managed and natural ecosystems.

One of the main projects currently addressing this need is the Trinity College Dublin Insect Conservation and Pollination Research Group, which is examining insect biology and conservation (primarily focusing on pollinators such as bees) and on the interactions between these insects and the plants which they pollinate. In particular, the group focuses on the factors that affect insect and plant distributions, including intrinsic population traits and extrinsic factors such as habitat. This research fosters an integrated and interdisciplinary approach and spans scales from population genetics and single species interactions to community interactions with an associated

taxonomic input. For example one sub-project “Speciation processes and pollinator-mediated selection in nectarless *Dactylorhiza* species” aims to examine processes producing new species and/or leading to extinction of some species of *Dactylorhiza* via hybridization of co-occurring diploid *Dactylorhiza* species.

Further efforts to build and apply the skills of taxonomists to this area are required.

3. Taxonomy, biodiversity and its conservation:

“How to manage it in sustainable way?” Describe 1-2 flagship projects related to bullet points below and suggest some recommendations useful for the May meeting of the EPBRS as a result of these projects:

3.1 Are there non-professional organisations recording biodiversity data collections (e.g. ornithologists) involved in the decision process of land use planning etc.?

Yes, to a point. The majority of biodiversity data collection in Ireland is still done in a voluntary capacity, often by very qualified personnel. For example the Water Beetles of Ireland initiative has created a database of 34,000 records. Resulting from this, the National Biodiversity Data Centre has provided the National Parks and Wildlife Service with a list of the key sites where the threatened species from this taxonomic group occur. One of the roles of the National Biodiversity Data Centre is to bridge the gap between the volunteer collectors and policy makers. The Centre has only recently commenced this process and will continue and expand over the coming years.

Box 3.1: Water Beetles of Ireland

<http://waterbeetlesofireland.biodiversityireland.ie>

The aims of the Water Beetles of Ireland Initiative are to increase the understanding of water beetles in Ireland and increase Irish expertise in this field with the overall objective of providing a framework to aid the development of freshwater habitat quality monitoring tools.

As of the 6th of October 2008, there are over 36,000 records of more than 340 species of water beetle for Ireland. Fulfilling one of the major objectives of the Data Centre, this important dataset will be brought into the public domain through the internet and will be a readily accessible resource for local authorities, conservation managers, and interested public alike.

3.2. Are there some indicators (or red-list species) either for monitoring Natura 2000 sites or for delimitation and management of nature reserves used in your country?

The National Parks and Wildlife Service conducts surveys and is developing red-lists of fauna and flora. NPWS and the Environment Agency Northern Ireland are currently formulating All-Ireland red lists and books, which will include many more Irish species in need of conservation assessment. Red data lists and books are underway for the following groups: Molluscs, Mammals, Moths, Butterflies, Dragonflies Lichens, Bryophytes, and Seaweeds as well as an update of the Red Data Book on Vascular Plants.

Box 3.2: Birds of Conservation Concern In Ireland

BirdWatch Ireland and the RSPB NI have agreed a list of priority bird species for conservation action on the island of Ireland. These Birds of Conservation Concern in Ireland are published in a list known as the BoCCI List. In this BoCCI List, birds are classified into three separate lists (Red, Amber and Green), based on the conservation status of the bird and hence conservation priority.

The Red List birds are of high conservation concern, the Amber List birds are of medium conservation concern and the Green List birds are not considered threatened. Specific criteria are used to classify a bird into one of these three categories.

This information is also collated at a wider EU context, to help us evaluate the status of Birds in Europe, and also globally. Birds in Europe (2004) is the second review of the conservation status of all wild birds in Europe. It identifies priority species (Species of European Conservation Concern, or SPECs) in order that conservation action can be taken to improve their status

The National Biodiversity Data Centre is currently facilitating the production of a Non-Marine Molluscan Regional Red List. When this is produced (June 2009) a suite of key Red List species will be identified for priority conservation action, including the identification and monitoring of designation sites. A similar process has been completed in relation to Irish Bees.

The Environmental Protection Agency funded *Biochange project* is currently reviewing the range of likely pollutants of Irish aquatic habitats and exploring potential biomonitors, bioindicators and indicators of biodiversity or conservation status to select those most likely to be effective for selected habitats and taxonomic groups and establish a strategic agenda to assess their effectiveness for others.

In the marine environment a list of sensitive subtidal species suitable as indicators of environmental and anthropogenic change are currently used by the National Parks and Wildlife Service to establish baseline habitat maps within NATURA 2000 sites and to aid future monitoring.

3.3. Which taxonomy-related research (standardized taxonomic metadata, delivery of checklist building tools, building expertise network) in developing non-European biodiversity-rich countries is supported by policy-makers from your country based on your national expertise and experience?

Currently there is none.

3.4. Is there a National Needs Assessment of GTI in your country? If yes, what are your specific needs, e.g. for conservation, protected areas, CITES/customs, dealing with invasive species etc?

No, this has not been carried out.

4. Taxonomy, Potential Users and Capacity Building of Experts

Open Access to Information: “How to find out about it?”

How does taxonomic information get from where it resides to where it is needed elsewhere in the world?

4.1 To what extent is taxonomic research in your country contributing to international biodiversity initiatives and projects (e.g GTI, GBIF, PESI, EOL).

Ireland became a full member of GBIF in 2008, and the National Biodiversity Data Centre has been established as the national GBIF node. The Centre is currently working on the portal to enable data to feed into GBIF.

The Melon foundation project at the University of Dublin, Trinity College supplies Type specimens of vascular plants to the African Types Project. Algaebase at the National University of Ireland, Galway provides information on algae at a Global level (<http://www.algaebase.org/>).

4.2. What is the state of the art in biodiversity informatics in your country? e.g. etaxonomy and e-science tools).

Significant developments in this regard have taken place in the last year. The National Biodiversity Data Centre has developed a state of the art online national mapping and data management system for display of biodiversity data. This system will be launched in May 2009 and will be fully accessible to users.

A recently published interactive key to the flora of the Burren (see box 1.4) has been designed so that it can be expanded to cover the entire flora of Ireland in the future.

Specie.ie (see box 1.3) has also made significant contributions to e-taxonomy in Ireland.

4.3. Has there been a national assessment of best practices for taxonomic data quality and validation?

The National Biodiversity Data Centre is developing standards for data collection and presentation, and guideline documents have been produced setting our best practice. This programme of work will continue over the coming years.

4.4. Do you have any national guidelines on how to approach the proof of absence?

No. There are currently no national guidelines in this regard.

4.5. What are the taxonomic standards used in the databases (TDWG, Darwin core, COL, PESI, etc.)?

The Darwin core is the standard employed by the National Biodiversity Data Centre. Other databases of taxonomic information have applied a variety of criteria, most of which are related to standard texts of the Irish flora and fauna rather than established international systems.

4.6. Could you identify the major digitization efforts for biodiversity data (e.g. collections, observations, species checklists)?

Species checklists have been developed, notably for plants. GIS systems exist for many plant records, in particular of Invasive Alien Species.

The following checklists have been digitised:

- Craneflies of Ireland
- Irish pseudoscorpions
- Irish harvestmen
- Irish chalcids (Hymenoptera)
- Microlepidoptera
- Irish Topographical Botany (Praeger)
- Irish Vegetation Data

Additional digitised databases of the following taxa have also been compiled by various organisations:

- Bats
- Birds
- Vascular plants

The National Parks and Wildlife Service have created an online mapping system for species records from key datasets and reports held by NPWS. Species records are accurate to 1km² level, after that there may be errors due to different map scales being used to calculate the grid references. Many were calculated before the widespread use of GPS. All records within the database are specific to the date of recording and do not necessarily imply the continuance of the species at that site.

4.7. Is there any effort in your country to make taxonomic information especially identification services easily accessible and useful to practitioners?

The Biodiversity Data Centre has established a programme of taxonomic identification workshops in 2009, and the plan is for this to develop to enable identification tools available online.

5. Capacity Building in Biodiversity-rich Countries and Worldwide

What is the state of training and education in systematics and are there any gaps in capacity?

In common with many countries worldwide there are enormous gaps in taxonomic capacity in Ireland. The situation has been highlighted in a number of reports including the “*Biodiversity Knowledge Programme for Ireland*” published by the Irish National Platform for Biodiversity Research. While there are a number of specialists for particular taxa the taxonomic capacity across a wide range of taxa is very low.

Taxonomic training within the third level sector is extremely low and while a number of initiatives to train non-specialists in the identification of key taxa have commenced it is unlikely that the level of training currently envisaged will assist in filling the enormous gaps that exist without specific policy objectives and funding to address the problem.

5.1. Are there any policy initiatives in your country to orient capacity building in taxonomy?

No. All initiatives to build capacity in taxonomy have been driven by the research sector rather than through policy initiative. The “*Biodiversity Knowledge Programme for Ireland*” a report compiled by the Irish National Platform for Biodiversity Research has highlighted the need for policy to implement a programme for capacity building in taxonomy in Ireland. Unfortunately this has not been acted on by policy.

5.2. Are there any sources of finance or policy actions in your country dedicated to applied taxonomy (e.g. identification tools, training for parataxonomists, i.e. field-trained biodiversity collection and inventory specialists recruited from local areas)?

Only to a very limited extent. Training has been provided by the National Botanic Gardens in Ireland to staff of the Environmental Protection Agency in relation to collecting and identifying aquatic plants. The National museum also assists with the identification of specimens being investigated by customs officers and the police force. However there is no dedicated source of finance or specific policy actions in this regard.

6. Conclusions

While systems to facilitate access to taxonomic information have improved both in Ireland and internationally in recent years the lack of capacity in the area of taxonomic expertise cannot be under emphasized. While many national and international projects are designed to facilitate access to information there is still a lack of trained taxonomists available to assess biological diversity on the ground and assist the end users of taxonomy.

Taxonomic training within the third level sector in Ireland is inadequate and this has resulted in a lack of qualified taxonomists across a range of areas and will continue to do so in the future. Unless a co-coordinated and concerted framework, strongly support by policy and with the necessary funding, to increase taxonomic training and capacity is made it is difficult to envisage how the taxonomic impediment can be improved.