Taxonomy Research
& Information Network
building australian capacity

ENTER

ISSUE ONE

Accelerating discovery

the products, outcomes and protocols from the Taxonomy Research & Information Network to assist with identifying and preserving Australia's biodiversity

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Taxonomy is the discovery, description, identification and classification of organisms.

Taxonomy provides the basis for identifying and monitoring Australia's biodiversity which in turn provides the knowledge needed for effective environmental management.

The Taxonomy Research & Information Network (TRIN) has been addressing critical gaps in taxonomic knowledge of key Australian animal and plant groups.

Research within the projects of TRIN covered a range of taxonomic and systematic investigators using a diversity of approaches and methodologies.

'Accelerating discovery' is the first of two online publications produced by TRIN to highlight its products, research outcomes and protocols.

Further information and contact details can be found on the TRIN website at: www.taxonomy.org.au

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Small Terrestrial Vertebrates: clarifying taxonomic status

Challenges

The perception that vertebrates are taxonomically well known in Australia has been shattered over the last two decades by discovery of high levels of genetic diversity in many widespread vertebrate species. Vertebrate diversity in Australia clearly is much higher than we currently think, but what groups are most seriously affected? And what are the best strategies and methods for documenting this hidden diversity?

For many species, little is known about their original geographic distribution and habitat preferences, and even less about the original pattern of genetic variation. These gaps in knowledge hinder management of surviving populations and impede reintroduction programs that can rebuild ecological communities and assist individual species survival.

With the inevitability of further loss of small, isolated populations through difficult-to-predict biological and environmental variation, climate change impacts, and the evidence of more general ongoing declines in the mammal fauna of northern Australia, there is a real possibility that Australian mammals will experience a second wave of extinctions.

Seeking solutions

A combination of molecular and morphological approaches were used to unravel taxonomic diversity. The focus was on adequate and effective approaches that lead to taxonomic resolution, e.g. the analysis of 'ancient' DNA from historical specimens which was then compared with the morphological features displayed in a micro-CT scanned image of a skull.

Benefits

The combination and application of modern taxonomic approaches lead to rapid improvements in knowledge and effective decision making and management, through:

- new species discovery
- incorporating sub-fossil material together with morphological, molecular and biogeographic information
- assisting government reintroduction initiatives
- increasing power and efficiency with the use of 3D micro-CT scanning approaches and electronic field data capture.

Impact on decision making

Reintroduction

Through building such linkages between extinct and living populations, we have been able to reconstruct the original fauna's composition and ensure the best chance of successful re-colonisation (see vodcast).

Predictive tool

Improved understanding of the ecological and climatic profiles of species now locally extinct across south-eastern NSW helps underpin better prediction of the impact of climate change.

3D Micro-CT scan of hopping mouse skull from extinct *Pilliga* population (scale 3.2cm). Species identity is part of the ecological profiles research.

Ants: taxonomic and evolutionary studies of a hyperdiverse fauna

Challenges

While ants are exceptionally diverse and occur in high densities throughout Australia, they are biologically and taxonomically poorly understood. A better understanding is essential for conservation agencies and other organizations working in the areas of conservation priority setting, planning, monitoring and management.

Seeking solutions

Traditional morphological approaches as well as cutting-edge molecular methods have been combined to provide the tools necessary to increase our understanding of Australian ants. Special emphasis has been placed on the genera *Camponotus, Iridomyrmex* and *Monomorium*, which are some of the most species rich, ecologically important, abundant and taxonomically challenging groups of Australian ants.

Benefits

Identification tools and information on general and specific ant biology contributes to a wide range of studies from biodiversity surveys and ecological monitoring projects to studies of climate change and evolution. High quality and accurate biological data is available in the most efficient and rapidly accessible way possible.

Iridomyrmex

Camponotus

Monomorium rothsteini

Research highlights

- *Iridomyrmex*

  A species-level revision of the ant genus *Iridomyrmex* has resulted in the recognition of 79 species, 31 of which are newly described. An illustrated identification key to all species has been developed, along with full-colour illustrations and distribution maps for each species. This information will be made available in a range of electronic formats suitable for aggregation with similar data from other projects.

- *Camponotus*

  A molecular phylogenetic study of this world-wide genus has shown that not only are the majority of currently recognised subgenera within *Camponotus* composed of unrelated species, the genus itself is in fact not a natural group. It was found that two separate genera, *Calomyrmex* and *Polyrhachis*, fall within the current limits of *Camponotus*. As a result, *Camponotus* is being redefined with numerous species removed from the genus and a previously valid genus subsumed within *Camponotus*.

- *Monomorium*

  Species boundaries within the *M. rothsteini* species complex have revealed complex relationships within the group. There are strong indications that a number of distinct species are involved while at the same time one of the species is unexpectedly genetically variable. This variable species appears to be basal to the remaining species, with the more distinct species having arisen from the variable species. If confirmed, this will be one of the first documented cases of a polyphyletic species.

Aquatic Macroinvertebrates: scientifically informed water quality monitoring

Challenges

Aquatic macroinvertebrates are widely used for monitoring of freshwater quality in rivers, streams and wetlands. The taxonomic knowledge of adults and juvenile forms is incomplete and inconsistent, making it difficult to recognize different species from juvenile or adult forms. Misidentification impedes national river health programs.

The next generation of monitoring requires increased accuracy and species level identification to detect the more subtle environmental changes associated with human impact, consumptive use of water, environmental flows and climate change.

Seeking solutions

To provide baseline taxonomic data for effective environmental and ecological research in aquatic ecosystems, taxonomic revisions have been undertaken for key aquatic macroinvertebrates.

The study focused on Ephemeroptera (mayflies) to improve their capacity to be used to detect environmental changes due to impacts or restoration programs. Phenotypic and molecular datasets were combined with different life history stages using contemporary DNA barcoding approaches to provide web-based interactive keys to species.

DNA barcoding has improved the ability to identify and define species, discover cryptic species, and associate adult and larval stages.

Benefits

A greater knowledge of the aquatic macroinvertebrates and their identification keys will provide better scientifically informed water quality monitoring. Keys have been rolled out at various taxonomic workshops, to a range of users such as water quality experts and policy makers. The suite of keys includes:

1. Interactive keys

Keys have been developed to genus level for the adult mayflies of Australia and to the species level for the larvae of the Australian Baetidae.

2. Dichotomous keys

Keys include a large number of images and have been developed for:

- adult mayflies of Australia
- larvae of Australian Chironomidae
- mature nymphs of *Coloburiscoides*
- selected Australian aquatic Oligochaetes, and
- species of Australian Baetidae.

Correct identifications will improve detection of subtle changes in the inland aquatic systems and assist the management of biodiversity and the environmental condition of inland waters.

Research highlights

- First key to adult Australian Mayfly genera since the mid 1950s has been prepared in both dichotomous and electronic formats
- The number of species known from Australian Baetidae has tripled to 60
- Genetic methods were used to rapidly associate larvae and adults for almost all alpine species of the stonefly genus *Riekoperla*
- The larvae and adults of ~ 40 Lepidopteran (moth) Family Crambidae species were associated and larval characters were found to be more phylogentically informative than adult characters.

What Bug Is That?
on-demand insect identification keys

Challenges

Because of their diversity, insect identification is a major challenge. Traditional approaches to insect identification using dichotomous keys have proven difficult for non-experts to use.

Solution

'What Bug Is That?' is a one-stop shop for on-demand insect identification that is easily updateable, expandable, and can link to a galaxy of other web-based information related to those families inside and outside the resource.

The website provides well illustrated interactive identification guides to the 650 families of Australian insects, designed as a much-needed tool for a diverse range of end users and to complement existing hardcopy products incorporating:

- multiple guides to simplify the identification of major insect groups (Orders)
- identification keys for all families
- illustrations and notes on identification and biology for each family
- keys developed in other formats that have been translated into Lucid keys for deployment on the web
- the Lucid On-Line Player so that key software and data is supplied free through the user's browser
- family fact sheets in BioLink so they can be used elsewhere on the web, such as in the Atlas of Living Australia
- web-based information using currently acceptable biodiversity informatics best practice with consistent user interfaces and standardised information across all taxa.

A range of innovative techniques were used to integrate material from earlier research and to update and combine variously formatted keys (e.g. dichotomous, web-based, Delta, Lucid, etc.) into a uniform web-based environment. In particular, the family factsheets are assembled on demand from data and information held in Biolink, and exposed on the web. This facility allows the information to be repurposed for other web-based applications.

Benefits

On their own, user-friendly interactive identification keys have major benefits to tertiary students, and beginner and advanced workshops. Collectively, they provide an unrivalled resource to support education, training, and a variety of 'citizen science' environmental activities.

'What Bug Is That?' has been implemented in an undergraduate entomology course at the Australian National University. Students identified specimens they brought to class each week and provided TRIN with valuable feedback on how easy and satisfying the product is to use.

The on-going development of keys for the 'What Bug Is That?' relies on contributions by collaborators from Australia and around the world.

'What Bug Is That? is available at:
http://anic.ento.csiro.au/insectfamilies/

Environmental Weeds: developing better weed control strategies

Challenges

Understanding Australia's invasive species biodiversity is a critical and often overlooked component of understanding our overall biodiversity, and it is essential for developing better weed control strategies.

Environmental weeds place pressure on Australia's native species through direct competition for space and resources, and as a consequence of ecosystem modification. Current figures show 15% of plants in Australia are now weeds[1] and are costing the agricultural industry a staggering $4 billion a year[2]. The cost of environmental weeds to the community in terms of conservation and reduced amenity is estimated to be of a similar magnitude.

[1] http://www.anbg.gov.au/weeds/weeds.html
[2] Sinden, et al 2005, The economic impact of weeds in Australia, CRC for Australian Weed Management, Technical Series No. 8, Adelaide

Bitou bush infestation, Wollongong NSW.

Despite massive and expensive efforts to control or eliminate weeds, and to prevent new weeds arriving in the country, the problem continues to worsen.

Seeking solutions

Weeds have complex histories. They reach Australia from many locations around the world, and are often created by hybridisation or by horticultural breeding. Once here populations continue to evolve and adapt.

The history of a weed, or in what ways the weed is adapting as it invades the Australian landscape, cannot always be determined from its morphology. However, a record of that history is carried in the genes of the plant. Methods like gene sequencing revealed genetic patterns showing the species to which a weed is most closely related, and whether it is hybridising with other plants. Genetic relationships also revealed where in the species' original geographic range the weed came from or which populations within Australia are the major sources of infestation.

There are far too many weeds to permit in-depth studies of each one; instead the project used pre-existing prioritisation processes and consultation with weed managers and control scientists to target critical knowledge gaps, and emphasised rapid method transfer to maximise flexibility.

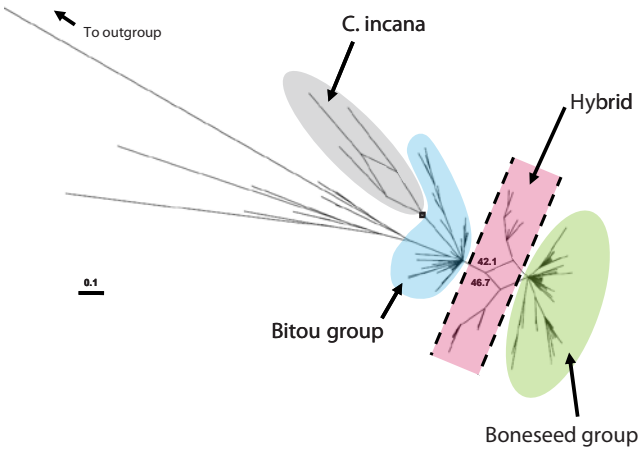
In this project we targeted four Weeds of National Significance (Willows, Lantana, bitou bush and boneseed, and mesquite) as these have been prioritised for national action due to their invasiveness and adverse impact.

Findings

Our results provide a scientific basis for decision making. Some examples of the way in which the findings have been used are:

1. Improving the efficiency and speed of agent discovery and release by telling scientists where in the world to conduct targeted searches for pathogens or insects that can be introduced to Australia as biological control agents

   - Genetic relationships in Lantana showed that Australian plants are more closely related to plants from the Caribbean and Venezuela than they are to plants from Central and North America, where biological control agent discovery efforts have typically focussed.



Phylogenetic network analysis of ITS gene for boneseed and bitou bush showing the presence of hybrid alleles in the Australian population, demonstrating that the two are hybridising where they come into contact.

2. Prioritising infestations for eradication by identifying major source populations for reinfesting seed

   - Genetic profiling of hundreds of willows is allowing the parents of individual plants to be identified. This means that infestations that are major seed sources can be controlled first, reducing the rate at which the plant reinvades previously controlled sites.

3. Assessing future risks like the formation of new weeds through hybridisation, or the consequences of climate change so as to enable strategic decisions by managers

   - Genetic analyses reveal that bitou bush and boneseed are hybridising in Australia. This increases the likelihood of these weeds invading new environments, and of the evolution of resistance to control agents

   - Ecological modelling combined with genetic and morphological profiling of the Australian Lantana population reveals a decline in genetic diversity in the Southern part of the range, and that morphological variation is structured by latitude, elevation and rainfall. Together these results suggest that the expansion of Lantana is constrained by environmental factors that will be relaxed as a result of climate change, and as a consequence presently effective containment lines will become far more expensive to maintain.

4. Providing information on the taxonomic identity of weeds in order to permit the formulation of appropriate policy and legislation.

5. Catalysing further taxonomic research in key species groups.

Australian Mangrove and Saltmarsh Species: a model ecological community information resource

A freely available online resource to improve access to biodiversity information.

Challenges

The Australian Mangrove and Saltmarsh Resource collates information on the plant and animal species found in Australian mangrove and saltmarsh ecosystems, including taxonomy, appearance, identification, biology, distribution and ecology.

The project is the start of a larger and self sustaining national project documenting the species of Australian mangrove and saltmarsh communities and is an example of an ecosystem based resource for biodiversity information collation and delivery.

Mangroves and saltmarshes are found in intertidal areas where deposition of sediment occurs.

Mangrove ecosystems are made up of trees and shrubs > 0.5 m tall, while saltmarshes are dominated by grasses and herbs < 0.5 m tall.

Saltmarsh plants dominate where mangrove plants are excluded by either high salinity, low rainfall or cool temperatures.

There is evidence that alternate climatic conditions could alter the equilibrium with one plant type replacing the other.

Saltmarsh graduating into mangrove, Cairns, Queensland. Photo: Frank Zich.

Seeking solutions

By linking with researchers, experts and collections, the project aims to provide access to easily accessible on-line resources using new and existing biodiversity management activities, and encourages further contribution from the mangrove community.

The Australian Mangrove and Saltmarsh Resource includes:

- species lists of animals and plants
- detailed profiles of plants and birds which include nomenclature and taxonomy, description, distribution, ecology, biology and images
- an online interactive key to Mangrove plant species, focusing on obligate trees, shrubs, palms and ground ferns
- a Resource Directory providing a compendium of government legislation, regulations, policies and programs, and international and national research and educational institutions and projects relating to Australian mangroves and saltmarshes.

Benefits

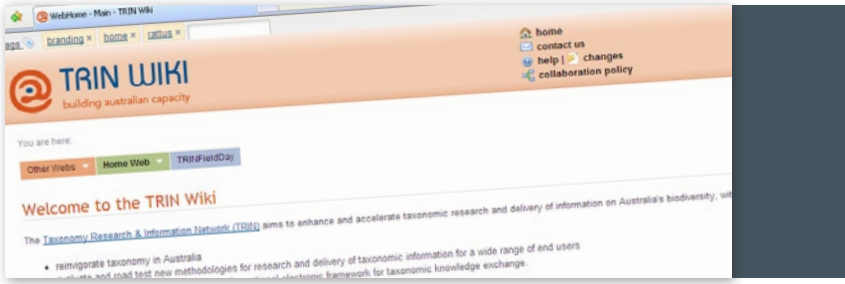
The Australian Mangrove and Saltmarsh Resource was chosen as an exemplar of an ecosystem-based resource that collates information from a wide range of sources, and is publicly accessible online. Benefits of the resource include:

- incorporation into the Atlas of Living Australia, which is delivering reliable and comprehensive information on Australia's biodiversity to support research, education and decision making
- information being collated and delivered at an ecosystem level, which can be applied to other ecosystems or groups
- the accessibility of the web-based wiki platform on which the Resource is hosted, encourages contributions from users and fosters collaboration between scientists and interested groups.

This Australian Mangrove and Saltmarsh Resource provides not just information on mangrove plants but any organism within the mangrove community.

Visit: http://wiki.trin.org.au/Mangroves/WebHome

Biodiversity Informatics: developing effective taxonomic information management tools



Challenges

The management and delivery of taxonomy information in Australia is done with limited tools to record, use and re-use taxonomic data, such as specimen records, nomenclature, descriptions, keys and publications.

The time taken for taxonomic information to become available to users is generally longer than most would like and there is a perception that new technology will offer the taxonomic community increased productivity. Accelerating threats to biodiversity, such as climate change and habitat destruction, add to the urgency of this task.

Seeking solutions

The taxonomic process has been analysed in collaboration with taxonomic researchers to identify bottlenecks in taxonomic throughput and to identify areas of activity amenable to information technology solutions.

The focus has been on secure and convenient systems to facilitate the movement of biodiversity data content from the taxonomist to the rest of the Australian biodiversity informatics framework, with an emphasis on the integration of existing systems and only building what is missing in the existing framework. Work has involved:

- developing, implementing and maintaining the TRIN Wiki, which provides a platform for collaborative taxonomy, with tools designed to facilitate the taxonomic workflow
- developing, implementing and maintaining other web-based services for taxonomists e.g. Virtual Microscopy, online keys for the identification of plants and animals, resolution of Life Science Identifiers (LSIDS)
- implementing and extending Personal Digital Assistant (PDA) technology to capture specimen data in the field, and seamlessly integrate captured data with museum databases
- developing new ways to compile and publish descriptive taxonomic information i.e. a *Taxon Profile Toolkit*, a streamlined system for creation of structured information associated with a group of organisms in a form that can be distributed online and re-used and rearranged by online resources such as the Atlas of Living Australia and the Encyclopaedia of Life
- applying the Taxon Profile Toolkit to the collation and up-to-date description of all of Australia's flora for the Atlas of Living Australia, and for other projects
- communicating with other biodiversity informatics groups and projects in Australia and abroad to ensure consistent and interoperable standards and approach to species descriptive data.

Benefits

Extensive user consultation and research has resulted in effective communication tools for widely dispersed groups of researchers working collaboratively on diverse taxonomic groups.

By breaking away from traditional approaches to the management and delivery of taxonomic information, we have provided modern, web-based and, where possible, open-source solutions to suit the taxonomist's immediate and longer term needs.

Taxonomists can now look forward to efficient and effective information management where taxonomic data are entered only once to be available always to a broad range of users.

The TRIN wiki is available at: https://wiki.trin.org.au/

Knowledge Exchange: understanding the user community and its needs and preferences for taxonomy information

How can we better facilitate the uptake of taxonomic research?

What can taxonomists do to improve the communication of their findings?

What broader issues impact on the communication of their science?

The Taxonomy Research & Information Network took these questions directly to the user community.

Challenge

Taxonomy is an essential component of the suite of information needed to make sound decisions in conservation, management and sustainable use of Australia's biota. Users of taxonomy include decision makers and other non-taxonomists as well as taxonomists. User needs for taxonomy information drive the application of taxonomy research outputs. However, a limitation to users in applying taxonomy research is the accessibility of taxonomy information.

Seeking solutions

A three year study was undertaken to gain a better understanding of the range of users of taxonomy information. The study focused on what information they use, how they use it, their needs and preferences as well as exploring the issues that effect adoption of taxonomy research results. A knowledge broker facilitated engagement between researchers and users to identify these issues and solutions for improvement.

Program of Activities

The study included:

1. A consultation phase using a questionnaire to identify and scope the diverse range of people who use taxonomy information. User needs and preferences, and barriers to adoption of taxonomy information, were elicited. Issues raised by respondents in the questionnaire were tested and explored in more depth through focus group discussions.
2. A product testing and development phase where researchers and users engaged in the collaborative development of taxonomy products from the 6 areas of TRIN taxonomic research.
3. A product release phase raising awareness of taxonomy products produced by TRIN and involving user communities in evaluation and feedback.

National Consultation - Who Participated

Participants of the study were drawn from federal and state government departments of agriculture and the environment, local government, community groups, NGOs, associations, private consultants, ecotourism, universities, CRCs, museums, botanic gardens, CMAs and more. 847 people responded to the questionnaire and 132 people participated in 19 focus groups, nationwide.

As part of its product testing and development phase, the Knowledge Exchange project facilitated a series of workshops around the country. The Aquatic Mayflies workshop bridged the gap between researchers and those using their technology.

A collection of Early Findings

User Community Needs and Preferences

- Less complex information, like plain language descriptions, is considered more important and used more frequently. More complex information, like identification keys, is considered less important and used less frequently.

Key Issues in Delivery of Taxonomy Information

- The most highly preferred ways of accessing taxonomy information are through books or the internet. Consultation with an expert is also a highly preferred way of accessing taxonomy information.
- While the internet is highly preferred as a mechanism of delivery of taxonomy information, not all web sites are considered to have the same level of credibility as reliable sources of information. Networks are important for sharing opinions on the credibility of web sites.

Key Issues in Finding Out About New Taxonomy Research

- The most highly preferred ways of finding out about new taxonomy research are through email and the internet. The opportunity to access an expert is also highly preferred.

Product Testing and Development

- Two major issues that impact on the use of taxonomy information when making identifications is time and working conditions. Users want to be able to identify organisms as quickly and easily as possible with a reasonable degree of confidence.
- Speed, accuracy and confidence were used as criteria for testing identification tools developed by TRIN researchers in user product-testing workshops.

What's next?

Explore how the experience of users, the organisation they represent and frequency of use may be associated with perceived importance of different types of taxonomy information and its delivery.

Product Awareness and Evaluation

- The publication 'Accelerating Discovery' is a two-part issue summarising TRIN's outcomes and achievements. It is available to users nationally by email or on the TRIN web site.
- Two 'field day' events have been scheduled to provide the opportunity for users to network, interact with developers and scientists, and gain hands-on experience with TRIN products and applications through a range of exhibits and small presentations.
- Evaluation of TRIN products is ongoing and is encouraged through the TRIN wiki.

Benefits

- Provide an exemplar to the taxonomy community by incorporating user needs into the development of taxonomy information.
- Inform the generation and publication of taxonomy information and provide a guide, based on empirical evidence, of what and how to deliver taxonomy. Taxonomists will be able to reference this evidence and show funders how their work is targeted in its impact.

The project has been documented on the TRIN Wiki at: https://wiki.trin.org.au/KnowledgeExchange

Products and Publications

Small Terrestrial Vertebrates

Publications

Donnellan, S.C., P.J. Couper, K. M. Saint & L. Wheaton, L. (2009) Systematics of the *Carlia 'fusca'* complex (Reptilia: Scincidae) from northern Australia. Zootaxa 2227: 1-31.

Mecke, S. Doughty, P. and Donnellan, S.C. (2009) A new species of *Eremiascincus* (Reptilia: Squamata: Scincidae) from the Great Sandy Desert and Pilbara Coast, Western Australia and reassignment of eight species from *Glaphyromorphus* to *Eremiascincus*. Zootaxa 2246: 1-20.

Richards, S.J., Hoskin, C.J., Cunningham, M.J., McDonald and K., Donnellan, S.C. (2010) Taxonomic re-assessment of the Australian and New Guinean green-eyed treefrogs *Litoria eucnemis, L. genimaculata* and *L. serrata* (Anura: Hylidae) ZooTaxa 2391: 33-46.

Vodcast

http://www.taxonomy.org.au/linkedfiles/WeeJasperVodcast.wmv

Ants

Peer-reviewed journal publications

Dominiak, B.C., Worsley, P., Gillespie, P.S., Löcker, H., Kerr, M., Shattuck, S. (2010) Search for Red Imported Fire Ant Solenopsis invicta Buren in New South Wales from 2004-2006. Plant Protection Quarterly 25:15-18.

Heterick,B. (2009) A guide to the ants of the South-west Botanical Province, Western Australia. Records of the Australian Museum Supplement. 76: 1-206

LaPolla, J.S., Brady, S.G., Shattuck, S. (2010) Phylogeny and taxonomy of the Prenolepis genus-group of ants (Hymenoptera: Formicidae). Systematic Entomology 35: 118-131.

Shattuck, S. (2010) Book review: Heterick, B.E. 2009: A guide to the ants of south-western Australia. Myrmecological News 13: 114.

Shattuck, S., Janda, M. (2009) A new species of the Camponotus aureopilus species group (Hymenoptera, Formicidae) from Papua New Guinea. Myrmecological News 12: 251-253.

Shattuck, S. (2009) Austromorium, a new myrmicine ant genus from Australia (Hymenoptera: Formicidae). ZooTaxa 2193: 62–68.

Shattuck, S. (2009) A revision the Australian species of the ant genus Myrmecina (Hymenoptera: Formicidae). ZooTaxa 2146: 1-21.

Smith, D.J., Shattuck, S. (2009) Six new, unusually small ants of the genus Leptomyrmex (Hymenoptera: Formicidae). ZooTaxa 2142:57-68.

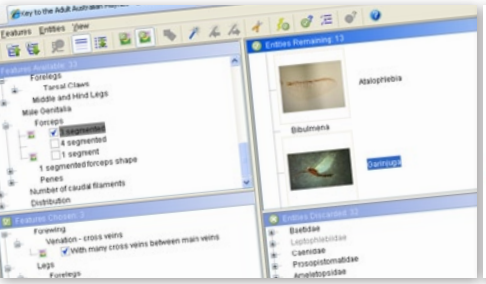
Shattuck, S. (2008) Review of the ant genus Aenictus (Hymenoptera: Formicidae) in Australia with notes on A. ceylonicus (Mayr). ZooTaxa 1926: 1-19.

Shattuck, S. (2008) Revision of the ant genus Prionopelta (Hymenoptera: Formicidae) in the Indo-Pacific region. ZooTaxa 1846: 21-34.

Shattuck, S. (2008) Australian ants of the genus Aphaenogaster (Hymenoptera: Formicidae). ZooTaxa 1677: 25-45.

Other data

Details of approximately 4000 type specimens have been recorded and are available at http://anic.ento.csiro.au/ants/. Details available include specimen locality details, status of type and museum housing specimen.



Aquatic Macroinvertebrates

Identification keys are available on the TRIN wiki (http://wiki.trin.org.au/Mayflies/TaxonomicWorkshops) and include:

Interactive keys

To genus level for the adult mayflies of Australia and for the larvae of the Australian Baetidae.

Dichotomous keys

- Adult mayflies of Australia
- Larvae of Australian Chironomidae genera
- Mature nymphs of *Coloburiscoides*
- Selected Australian aquatic Oligochaetes

Publication

Shackleton, M. (2010) Two new species of *Pliocaloca* Neboiss (Trichoptera: Calocidae) from eastern Australia, with descriptions of the immature stages of one species. Zootaxa 2476: 30-38.

Webb, JM. and Suter, P. (2010) Revalidation and redescription of *Bungona illiesi* (Lugo-Ortiz & McCafferty) (Ephemeroptera: Baetidae) from Australia, based on mitochondrial and morphological evidence. Zootaxa 2481: 37-51.

Suter, P., Webb, J.M., and Rowe, D. (2009) Key to the mature nymphs of *Coloburiscoides* (Lestage) (Ephemeroptera: Coloburiscidae). Museum Victoria Science Report No. 14.

Insect Identification Keys

What Bug Is That?

This site provides identification keys and information to the 600+ insect families of Australia.

http://anic.ento.csiro.au/insectfamilies/

Australian Mangrove and Saltmarsh Species

Australian Mangrove and Saltmarsh Resource

The building blocks of a comprehensive resource for Australian Mangrove and Saltmarsh species, built using current biodiversity information technologies.

http://wiki.trin.org.au/Mangroves/WebHome

Species lists of animals and plants

Comprehensive list developed for vascular plants in Mangroves. Bryophytes, Lichens, Fish, Amphibians, Reptiles, Birds, Insects, Crustaceans, Molluscs, Annelids, and Fungi in progress.

http://wiki.trin.org.au/Mangroves/MangroveAndSaltmarshSpecies

Key to Mangrove Plant Species of Australia

Interactive key to obligate trees, shrubs, palms and ground ferns in Australia mangrove ecosystems.

http://wiki.trin.org.au/Mangroves/KeyToMangrovePlantSpeciesOfAustralia

Mangrove plant species profiles

http://wiki.trin.org.au/Mangroves/Plants

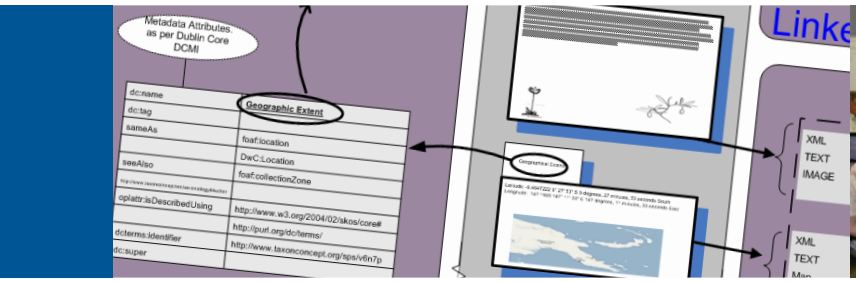
Mangrove bird species profiles

https://wiki.trin.org.au/Mangroves/Birds

Resource Directory

Compendium of government legislation, regulations, policies and programs, and international and national research and educational institutions and projects relating to Australian mangroves and saltmarshes.

https://wiki.trin.org.au/Mangroves/ResourceDirectory/WebHome



Biodiversity Informatics

Taxonomic Workflow

Analysis of taxonomy and documentation of the taxonomic workflow

https://wiki.trin.org.au/TaxonomicProcess/WebHome

Development of new ways to deliver taxonomic information

Taxon profiles

https://wiki.trin.org.au/HubRIS/TaxonProfiles

Tools for collaborative taxonomy on the web

TRIN wiki

https://wiki.trin.org.au/

Knowledge Exchange

Questionnaire

Biodiversity Information – We want to know what you think

https://wiki.trin.org.au/KnowledgeExchange/Questionnaire

Focus Groups

Biodiversity Information – We want to know what you think

https://wiki.trin.org.au/KnowledgeExchange/FocusGroups

TRIN Strategic Communication

http://taxonomy.org.au/linkedfiles/CommStratPlan_June08.pdf

Knowledge Exchange Preliminary Findings

https://wiki.trin.org.au/KnowledgeExchange/Internal/KE_Project_Update_-_Preliminary_Findings

Workshop Movie

http://www.taxonomy.org.au/linkedfiles/MAIWorkshop.wmv

Taxonomy Research & Information Network
building australian capacity

Interactive Field Day

Tuesday 31 August 2010, 10am till 4pm
Australian National Botanic Gardens, Canberra

Join us for a hands-on experience with the latest range of biodiversity technology and identification products

Product developers and scientists will be on hand to engage with users at a variety of interactive booths displaying:

- identification keys for mangroves, insects, mayflies, rodents and others
- management protocols for weeds and small vertebrates
- remote microscopy demonstrations online to other lab locations
- sub-fossil bones and CT scanner technology
- a Wiki corner
- other resources and applications that support biodiversity management, such as the Atlas of Living Australia, Australian Plant Name Index and Australian Plant Census.

For further information and to register your interest go to: www.taxonomy.org.au/fieldday.html

2010 International Year of Biodiversity

BACK

CSIRO

Centre for Plant Biodiversity Research

ABRS

Australian Government
Department of the Environment, Water, Heritage and the Arts

South Australian Museum

THE AUSTRALIAN NATIONAL UNIVERSITY

THE UNIVERSITY OF ADELAIDE AUSTRALIA

JAMES COOK UNIVERSITY

www.taxonomy.org.au

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