GLOBAL BIODIVERSITY INFORMATION FACILITY

GBits Science Supplement

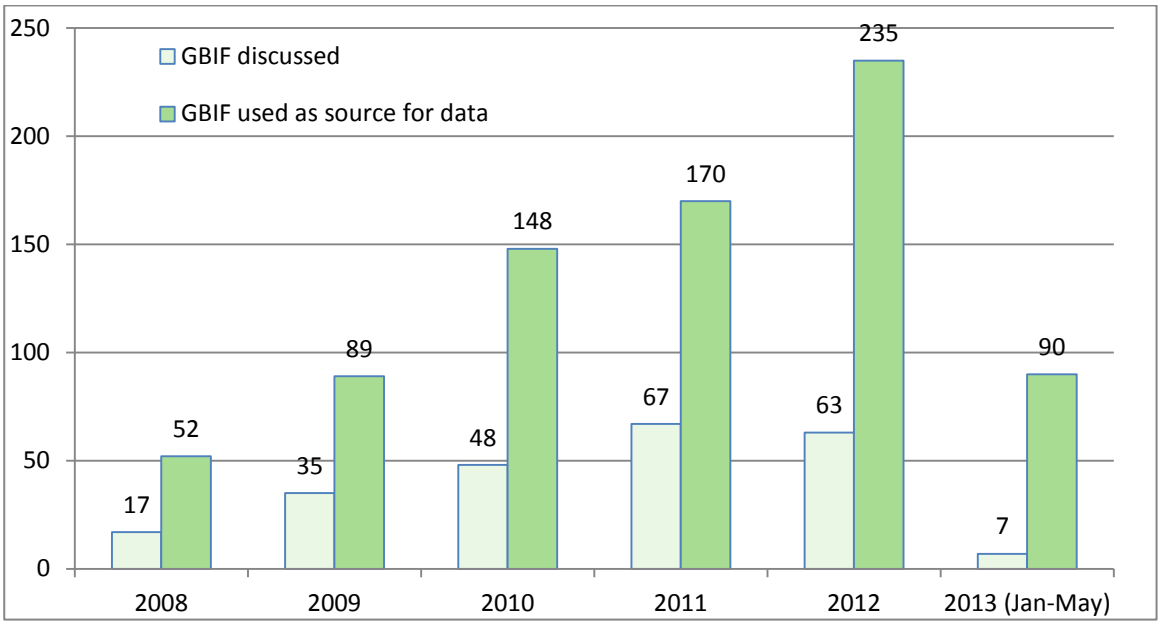
No. 8, April-May 2013

Welcome to this eighth edition of the GBits Science Supplement. It provides a summary of research published during April and May 2013 for which the Global Biodiversity Information Facility (GBIF) has been cited as a source of data.

For this issue, we have slightly changed the format. The research is grouped into a number of key thematic areas (shown by the green headings). Each section begins with a summary of one or more papers for illustration, followed by a list of citations for other research in the same category. The supplement ends with a selection of publications discussing GBIF, and the latest data papers describing datasets published through the GBIF network.

This format mirrors the new 2012 GBIF Science Review, which documents more than 270 GBIF-related use cases published last year. The review accompanies the GBIF Annual Report, and we hope it will be useful to all those interested in the research outcomes of biodiversity data publication.

This supplement is published alongside the bimonthly GBits newsletter, which provides a range of news from around the GBIF community. If you are not already a subscriber, you can access GBits here and follow the instructions if you would like to sign up. Users of the Mendeley academic archiving platform can also consult the GBIF Public Library.



Use and discussion of GBIF in scientific literature, 2008-13 (number of peer-reviewed, published research papers)

Invasive alien species

USING SOCIO-ECONOMIC FACTORS TO HELP TARGET SPECIES INVASIONS

Gallardo, B. & Aldridge, D.C., 2013. The "dirty dozen": socio-economic factors amplify the invasion potential of 12 high-risk aquatic invasive species in Great Britain and Ireland C. Frid, ed. *Journal of Applied Ecology*. Available at: http://doi.wiley.com/10.1111/1365-2664.12079.

Summary: This study from the Aquatic Zoology Group of Cambridge University set out to identify invasive species that posed the highest risk to aquatic biodiversity in Great Britain and Ireland. Starting with a list of 12 invertebrates, fish and plants known to be 'potential aquatic invaders' the researchers used both environmental and socio-economic factors to establish which areas were at greatest risk of invasion from which species.

To generate models for the study, the researchers obtained data on the global occurrence of all 12 species through GBIF, Fishbase, the United States Geological Survey and the Atlas Flora Europaea. Environmental factors such as climate, altitude and geology were used to determine which areas of Great Britain and Ireland would be most suitable for the invaders to thrive.

An innovation of the study was to integrate socio-economic factors to improve the prediction of invasion risk. For example, population density, a 'human influence index' and the closeness to major ports can predict where aquatic invaders are most likely to be introduced from activities such as shipping, sport fishing, canal building and the pet trade.

The study concluded that the threat from aquatic invasive species was especially high in southeast England, with five species of special concern: the killer shrimp (*Dikerogammarus villosus*), bloody red mysid (*Hemimysis anomala*), both from the Black Sea/Caspian region; the water primrose (*Ludwigia grandiflora*); and two crayfish species from Central America (*Procambarus clarkii* and *P. fallax*). The authors note that including socio-economic factors can improve prediction of areas at risk of multiple invasions and help target limited resources for prevention and control.

Author country: United Kingdom

Other research relating to invasive species citing use of GBIF-mediated data

Capinha, C. et al., 2013. Effects of climate change, invasive species, and disease on the distribution of native European crayfishes. *Conservation Biology*. Available at: http://doi.wiley.com/10.1111/cobi.12043.
Author countries: Portugal, United States, Italy

Geerts, S. et al., 2013. Montpellier broom (*Genista monspessulana*) and Spanish broom (*Spartium junceum*) in South Africa: An assessment of invasiveness and options for management. *South African Journal of Botany*, 87, pp.134–145. Available at: http://linkinghub.elsevier.com/retrieve/pii/S025462991300241X.
Author country: South Africa

Geerts, S. et al., 2013. The absence of fire can cause a lag phase: The invasion dynamics of *Banksia ericifolia* (Proteaceae). *Austral Ecology*. Available at: http://doi.wiley.com/10.1111/aec.12035.
Author countries: South Africa, Australia

Guareschi, S. et al., 2013. How far could the Alien Boatman *Trichocorixa verticalis verticalis* spread? Worldwide estimation of its current and future potential distribution M. Convertino, ed. *PLoS ONE*, 8(3), p.e59757. Available at: http://dx.plos.org/10.1371/journal.pone.0059757.
Author countries: Spain, Australia

Jones, M.C. et al., 2013. Applying distribution model projections for an uncertain future: the case of the Pacific oyster in UK waters. *Aquatic Conservation: Marine and Freshwater Ecosystems*. Available at: http://doi.wiley.com/10.1002/aqc.2364.
Author countries: United Kingdom, Canada

Palaoro, A. V. et al., 2013. Niche conservatism and the potential for the crayfish *Procambarus clarkii* to invade South America. *Freshwater Biology*. Available at: http://doi.wiley.com/10.1111/fwb.12134.
Author country: Brazil

Sacca, A. & Giuffre, G., 2013. Biogeography and ecology of *Rhizodomus tagatzi*, a presumptive invasive tintinnid ciliate. *Journal of Plankton Research*, 0, pp.1–13. Available at: http://www.plankt.oxfordjournals.org/cgi/doi/10.1093/plankt/fbt036.
Author country: Italy

Svobodová, E. et al., 2013. Pest occurrence model in current climate – validation study for European domain. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, 61(1), pp.205–214. Available at: http://acta.mendelu.cz/61/1/0205/.
Author country: Czech Republic

Wetterer, J.K., 2013. Exotic spread of *Solenopsis invicta* Buren (Hymenoptera: Formicidae) beyond North America. *Sociobiology*, 60(1), pp.50–55. Available at: http://periodicos.uefs.br/ojs/index.php/sociobiology.
Author country: United States

Impacts of climate change

MODELLING CLIMATE IMPACTS ON COMMON SPECIES

Warren, R. et al., 2013. Quantifying the benefit of early climate change mitigation in avoiding biodiversity loss. *Nature Climate Change*, 3(5), pp.1–5. Available at: http://www.nature.com/doifinder/10.1038/nclimate1887.

Summary: This paper looked at nearly 50,000 globally widespread and common species and found that more than half of the plants and over a third of animal species could lose more than half of their climatic range by 2080 if nothing is done to limit greenhouse gas emissions. However, it concluded that acting quickly to mitigate climate change could reduce losses by 60 per cent and buy an additional 40 years for species to adapt.

The study defined the climate 'niche' occupied by each species, based on temperature and rainfall where they live now, and mapped the areas that would remain suitable for them according to various scenarios of future climate change. The researchers obtained data on the occurrence of plants, mammals, birds, reptiles and amphibians from around 170 million records published through GBIF by some 200 different institutions around the world.

According to the research, plants, reptiles and especially amphibians are expected to be at highest risk from climate change. The climate will become especially unsuitable for both plant and animal species in Sub-Saharan Africa, Central America, Amazonia and Australia. A major loss of plant species is also projected for North Africa, Central Asia and southeastern Europe.

One of the co-authors of the study, Jeff Price of the University of East Anglia's School of Environmental Sciences, United Kingdom, commented: "This research would not be possible without GBIF and its global community of researchers and volunteers who make their data freely available."

Author countries: United Kingdom, Colombia, Australia

PREDICTING CLIMATE RESPONSES OF PARASITES AND HOSTS

Pickles, R.S.A. et al., 2013. Predicting shifts in parasite distribution with climate change: A multi-trophic level approach. *Global change biology*. Available at: http://www.ncbi.nlm.nih.gov/pubmed/23666800.

Summary: This study emphasized the need to develop combined models for climate responses from multiple species, to understand the likely future impacts of harmful parasites. The research looked at a parasitic worm which causes severe neurological damage to moose, elk, caribou, domestic sheep and goats. The worm is spread through white-tailed deer, which it does not harm, but also depends on a number of snail and slug species during other parts of its life-cycle. To predict future occurrence of the worm under different climate scenarios, the researchers took an 'ensemble approach', modelling areas of suitability for both types of host as well as for the parasite itself. Data for white-tailed deer and the mollusc hosts were accessed through GBIF. The study concluded that the parasite was likely to decline in the Great Plains and southeastern United States, but increase in northern forest areas especially in Alberta, Canada.
Author country: Canada

Other research relating to climate change citing use of GBIF-mediated data

Record, S. et al., 2013. Projecting global mangrove species and community distributions under climate change. *Ecosphere*, 4(3), p.art34. Available at: http://www.esajournals.org/doi/pdf/10.1890/ES12-00296.1.
Author countries: United States, Malaysia

Foote, A.D. et al., 2013. Ancient DNA reveals that bowhead whale lineages survived Late Pleistocene climate change and habitat shifts. *Nature Communications*, 4, p.1677. Available at: http://www.nature.com/doifinder/10.1038/ncomms2714.
Author countries: Denmark, Germany, Australia, Netherlands, United Kingdom, Sweden

Jueterbock, A. et al., 2013. Climate change impact on seaweed meadow distribution in the North Atlantic rocky intertidal. *Ecology and Evolution*. Available at: http://doi.wiley.com/10.1002/ece3.541.
Author countries: Norway, Belgium, Australia, United States, Netherlands

Seth, H. et al., 2013. Metabolic scope and interspecific competition in sculpins of Greenland are influenced by increased temperatures due to climate change. *PloS one*, 8(5), p.e62859. Available at: http://www.ncbi.nlm.nih.gov/pubmed/23690960.
Author country: Sweden

Smith, S.E. et al., 2013. Predicting the distribution of a novel bark beetle and its pine hosts under future climate conditions. *Agricultural and Forest Entomology*. Available at: http://doi.wiley.com/10.1111/afe.12007.
Author countries: United States, Mexico

Species conservation and protected areas

BRAZILIAN FOREST RESERVES IN A CHANGING CLIMATE

Collevatti, R.G. et al., 2013. Stability of Brazilian seasonally dry forests under climate change: Inferences for long-term conservation. *American Journal of Plant Sciences*, 04(04), pp.792–805. Available at: http://www.scirp.org/journal/PaperDownload.aspx?DOI=10.4236/ajps.2013.44098.

Summary: A research team from the Universidade Federal de Goías in central Brazil investigated whether the current network of reserves for the region's seasonally-dry forests was effective in conserving these threatened ecosystems over the long term. The study used data on 16 forest plant species, obtained through GBIF and two Brazilian databases, to model which areas would be suitable for their survival under past, present and future climate conditions. The study concluded that many protected areas would lose importance in conserving these species in the future, due to climate change, and that current Brazilian reserves covered only a small proportion of the areas presenting stable climate conditions for the forests over time. Nevertheless, the research found that long-term conservation of the forests may be partially achieved through the current network, and recommended that the reserves should be connected to enable species to move in response to changing conditions.

Author country: Brazil

HOW IMPORTANT ARE RARE SPECIES FOR ECOSYSTEM FUNCTIONING?

Mouillot, D. et al., 2013. Rare species support vulnerable functions in high-diversity ecosystems. *PLOS biology*, 11(5). Available at http://dx.doi.org/10.1371/journal.pbio.1001569.

Summary: This research tackled the controversial question of whether the loss of rare species will damage the functioning of ecosystems, and to what extent more common species can buffer the impacts of extinctions. The study examined three highly diverse ecosystems: coral reef fish, alpine plant communities and tropical forest trees. It investigated whether rare species in each of these

ecosystems carried out distinctive functions, or whether so-called 'functional redundancy' in other species would insure against loss of rarer plants and animals.

In the case of tropical forests, the study used records of 662 species available through GBIF in French Guiana, Surinam and Guyana, combined with field data collected by the research team from forest plots. It found that rare species were disproportionately responsible for vulnerable functions in the ecosystem: for example, the recently-described forest tree *Pouteria maxima*, which grows to more than 40 metres in height in French Guiana, has very thick bark and leaves that make it exceptionally resilient to fire and drought, and thus a potentially important buffer to maintain forest structures and functions during climate change.

The research came to similar conclusions in the coral reef and alpine plant ecosystems, where rare species were also associated with vulnerable functions. The authors say their findings highlight the need to change thinking about biodiversity in general, and conservation strategies in particular, by moving beyond focussing on iconic and charismatic species, and concentrating instead on protecting species that support irreplaceable ecosystem functions and associated services.

Author countries: France, Australia, United States, Switzerland

ANIMAL BURROWS NEED PROTECTION AS CLIMATE REFUGES

Pike, D.A. & Mitchell, J.C., 2013. Burrow-dwelling ecosystem engineers provide thermal refugia throughout the landscape. *Animal Conservation*. Available at: http://doi.wiley.com/10.1111/acv.12049.

Summary: The burrows created by animals such as tortoises, seabirds and various mammals are in urgent need of conservation as refuges from temperature extremes in a changing climate, according to this study. The researchers focussed on the gopher tortoise (*Gopherus polyphemus*) in the southeastern United States, which uses varied conditions within its burrows to maintain moderate and stable body temperatures on hot days, while keeping relatively warm overnight. Data on the occurrence of the tortoise were obtained from museum records accessed through GBIF, as well as a wildlife database in Florida. Climate change is predicted to increase maximum air temperatures throughout the geographic range of the species, with impacts most severe in Florida. This highlights the importance of burrows as refuges from extreme conditions, not just for the 'ecosystem engineers' themselves but for many other species that use the burrows for shelter. The researchers note that large burrowing animals are widely distributed around the world (for example aardvarks, pocket gophers, rabbits, seabirds, other tortoises and wombats) and may provide similar climate refuges for countless other species.

Author countries: Australia, United States

Other research related to species conservation and protected areas, citing use of GBIF-mediated data

Ballesteros, M. et al., 2013. Conservation status of the narrow endemic *gypsophile Ononis tridentata* subsp. crassifolia in southern Spain: effects of habitat disturbance. *Oryx*, 47(02), pp.199–202. Available at: http://www.journals.cambridge.org/abstract_S0030605312001688.
Author country: Spain

Vinceti, B. et al., 2013. Conservation Priorities for Prunus africana Defined with the Aid of Spatial Analysis of Genetic Data and Climatic Variables G. G. Vendramin, ed. *PLoS ONE*, 8(3), p.e59987. Available at: http://dx.plos.org/10.1371/journal.pone.0059987.
Author countries: Italy, Colombia, Austria, Kenya, Belgium

Food, farming and biofuels

MANAGING INVASION RISK FROM BIOFUEL CROPS

Kriticos, D.J. et al., 2013. Balancing bioenergy and biosecurity policies: estimating current and future climate suitability patterns for a bioenergy crop. *GCB Bioenergy*. Available at: http://doi.wiley.com/10.1111/gcbb.12068.

Summary: This study used GBIF-mediated data to help decision-makers assess the risk of crops used for bio-energy becoming harmful invasive species if they escaped into the environment. The researchers looked at the Indian beech or Pongam oiltree (*Millettia pinnata*, also referred to as *Pongamia pinnata*), native to the Indian subcontinent and southeast Asia. The oil produced from its seeds has many traditional uses as fuel, medicine and fodder, and the plant is now of great interest for biofuel production in Australia and elsewhere. To assess the risk of the tree becoming an invasive weed in the Australian environment, the study used records of its worldwide geographical distribution sourced from GBIF and the Australia Virtual Herbarium. Based on the range of conditions where the plant is found, the researchers produced a model for where it is likely to become naturalized under current and future conditions. It found that while under current conditions the plant would only thrive in wetter tropical regions of Australia, with irrigation it had the potential to naturalize across most of the country. The authors argue that this kind of model can support development of policies designed to manage invasion risks and balance the advantages of bioenergy with biosecurity concerns.

Author country: Australia

Other research related to food, farming and biofuels, citing use of GBIF-mediated data

Shehadeh, A., Amri, A. & Maxted, N., 2013. Ecogeographic survey and gap analysis of *Lathyrus L.* species. *Genetic Resources and Crop Evolution*, 2050(Un 2011). Available at: http://link.springer.com/10.1007/s10722-013-9977-0.
Author countries: Syria, United Kingdom

Stobbe, U. et al., 2013. Potential and limitations of Burgundy truffle cultivation. *Applied microbiology and biotechnology*. Available at: http://www.ncbi.nlm.nih.gov/pubmed/23666478.
Author countries: Germany, Switzerland

Advancing biodiversity science

FINDING PATTERNS IN BEE-PLANT RELATIONSHIPS

Giannini, T.C. et al., 2013. Interactions at large spatial scale: The case of *Centris* bees and floral oil producing plants in South America. *Ecological Modelling*, 258, pp.74–81. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0304380013001506.

Summary: This study from a team of Brazilian researchers looked at how climatic conditions affect the complex networks of relationships between bees and the plants they pollinate. It analysed interactions across South America between the widespread *Centris* genus of bee with plant species that produce oil in their flowers. Data on the occurrence of both the bees and the plants were obtained from 32 data publishers through GBIF, and from 60 datasets published from Brazil through speciesLink (http://splink.cria.org.br). The study found patterns in these interactions mainly associated with rainfall. Wetter areas tended to have higher numbers of species in the networks with each bee species having more plant 'partners'. Drier areas such as the Andes and northeast Brazil had fewer species and more specialized relationships between bees and plants. The authors conclude that the interactions observed among pollinators and plants are probably influenced by a combination of current ecological processes and past evolutionary history.

Author country: Brazil

Other research related to advancing biodiversity science, citing use of GBIF-mediated data

Ahmadzadeh, F. et al., 2013. Rapid lizard radiation lacking niche conservatism: ecological diversification within a complex landscape. *Journal of Biogeography*. Available at: http://dx.doi.org/10.1111/jbi.12121.
Author countries: Iran, Germany, Portugal, Turkey

Alfonso, G. & Belmonte, G., 2013. *Neolovenula alluaudi* (Guerne and Richard, 1890) (Calanoida: Diaptomidae: Paradiaptominae): first record in Italy and review of geographical distribution. *Journal of Limnology*, 72(2), pp.251–261. Available at: http://www.jlimnol.it/index.php/jlimnol/article/view/641.
Author country: Italy

Bienentreu, J., Hertz, A. & Lotzkat, S., 2013. Distribution extension for *Anolis salvini* Boulenger, 1885 (Reptilia: Squamata: Dactyloidae), in western Panama. *Checklist*, 9(1), pp.169–174. Available at: http://www.checklist.org.br/.
Author country: Germany

Brundu, G. & Camarda, I., 2013. The Flora of Chad: a checklist and brief analysis. *PhytoKeys*, 23, pp.1–18. Available at: http://www.pensoft.net/journals/phytokeys/article/4752/abstract/the-flora-of-chad-a-checklist-and-brief-analysis.
Author country: Italy

Caners, R.T., 2013. Disjunct occurrence of *Harpanthus drummondii* (Taylor) Grolle (Geocalycaceae, Jungermanniopsida) in the boreal forest of west-central Canada. *Evansia*, 30(1), pp.24–30. Available at: http://www.bioone.org/doi/abs/10.1639/079.030.0104.
Author country: Canada

Deng, X., Wagner, H.-J. & Popper, A.N., 2013. Interspecific variations of inner ear structure in the deep-sea fish family Melamphaidae. *The Anatomical Record*, pp.1–19. Available at: http://www.ncbi.nlm.nih.gov/pubmed/23625740.
Author countries: United States, Germany

Gassert, F. et al., 2013. From southern refugia to the northern range margin: genetic population structure of the common wall lizard, *Podarcis muralis* A. Parmakelis, ed. *Journal of Biogeography*. Available at: http://doi.wiley.com/10.1111/jbi.12109.
Author countries: Luxembourg, Germany, Poland

Humphreys, A.M. & Linder, H.P., 2013. Evidence for recent evolution of cold tolerance in grasses suggests current distribution is not limited by (low) temperature. *The New Phytologist*. Available at: http://www.ncbi.nlm.nih.gov/pubmed/23528107.
Author countries: Switzerland, Sweden, United Kingdom

Kouamé, F.P.B.K. et al., 2013. Phytochemical investigation of the leaves of *Leptoderris fasciculata*. *Phytochemistry Letters*, 6(2), pp.253–256. Available at: http://linkinghub.elsevier.com/retrieve/pii/S1874390013000360.
Author countries: France, Cote d'Ivoire

Leavitt, S.D. et al., 2013. Local representation of global diversity in a cosmopolitan lichen-forming fungal species complex (Rhizoplaca , Ascomycota) H.-P. Comes, ed. *Journal of Biogeography*. Available at: http://doi.wiley.com/10.1111/jbi.12118.
Author countries: United States, Germany, Spain, Iran, Czech Republic

Romanov, E. V et al., 2013. First pelagic record of the velvet dogfish *Zameus squamulosus* (Günther, 1877) (Squaliformes) from the southwestern Indian Ocean and some notes on its regional distribution. *Zoosystema*, 35(1), pp.11–23. Available at: http://www.bioone.org/doi/abs/10.5252/z2013n1a2.
Author countries: Île de la Réunion (France), Ukraine, France

Salamone, I. et al., 2013. Bioclimatic, ecological, and phenotypic intermediacy and high genetic admixture in a natural hybrid of octoploid strawberries. *American Journal of Botany*, 100(5), pp.1–12. Available at: http://www.ncbi.nlm.nih.gov/pubmed/23579477.
Author country: United States

Singh, C.P., Panigrahy, S. & Parihar, J.A.I.S., 2013. Modeling environmental niche of Himalayan birch and remote sensing based vicarious validation. *Tropical Ecology*, 54(3), pp.319–327. Available at: http://www.tropecol.com/online/default.htm.
Author country: India

Vences, M. et al., 2013. Radically different phylogeographies and patterns of genetic variation in two European brown frogs, genus Rana. *Molecular phylogenetics and evolution*, (May). Available at: http://www.ncbi.nlm.nih.gov/pubmed/23632031.

Author countries: Germany, United Kingdom, Spain, Poland, Russia, France, Portugal, Italy, Croatia, Greece, Ukraine

Vieira, R.P. et al., 2013. The deep-sea fish *Kali macrodon*: a new record for the tropical eastern Atlantic off Cape Verde. *Marine Biodiversity Records*, 6, p.e4. Available at: http://www.journals.cambridge.org/abstract_S1755267212001248.
Author countries: Portugal, Germany

Villalobos, F., 2013. Tree squirrels: A key to understand the historic biogeography of Mesoamerica? *Mammalian Biology*. Available at: http://linkinghub.elsevier.com/retrieve/pii/S1616504713000086.
Author country: Costa Rica

Discussion of GBIF in scientific literature

Mesibov, R., 2013. A specialist's audit of aggregated occurrence records. *ZooKeys*, 293, pp.1–18. Available at: http://www.pensoft.net/journals/zookeys/article/5111/abstract/a-specialist.

Belbin, L. et al., 2013. A specialist's audit of aggregated occurrence records: An "aggregator"s' perspective. *ZooKeys*, 305, pp.67–76. Available at: http://www.pensoft.net/journals/zookeys/article/5438/abstract/a-specialist

Summary: The first of these articles took a critical look at the quality of data relating to native Australian millipedes published through GBIF and the Atlas of Living Australia, the national GBIF node, comparing them with an independent database. The author highlighted errors in the data accessed through the 'aggregator' web portals and argued that the institutions should do more to correct them. The second article published in reply, by authors in ALA and GBIF, accepted that published records could include errors for a variety of reasons, but emphasized that improving quality was a high priority for GBIF and its nodes. The paper argued that while automated checks could detect and flag many errors, improving data quality in open-access biodiversity databases was ultimately a collaborative effort involving both 'aggregators' and the wider specialist community.

Other research related to discussion of GBIF in scientific literature

Beck, J. et al., 2013. Online solutions and the "Wallacean shortfall": what does GBIF contribute to our knowledge of species' ranges? S. Ferrier, ed. *Diversity and Distributions*. Available at: http://doi.wiley.com/10.1111/ddi.12083.

Blagoderov, V. et al., 2012. No specimen left behind: industrial scale digitization of natural history collections. *ZooKeys*, 146(209), pp.133–46. Available at: http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3406472&tool=pmcentrez&rendertype=abstract.

Caujapé-Castells, J. et al., 2013. Transformer-4 version 2.0.1, a free multi-platform software to quickly reformat genotype matrices of any marker type, and archive them in the Demiurge

information system. *Molecular Ecology Resources*. Available at: http://www.ncbi.nlm.nih.gov/pubmed/23437862.

Eisen, L. et al., 2013. What is the risk for exposure to vector-borne pathogens in United States national parks? *Journal of Medical Entomology*, 50(2), pp.221–230. Available at: http://openurl.ingenta.com/content/xref?genre=article&issn=0022-2585&volume=50&issue=2&spage=221.

Gatto, F. et al., 2013. Evaluation of online information sources on alien species in Europe: The need of harmonization and Integration. *Environmental Management*. Available at: http://www.ncbi.nlm.nih.gov/pubmed/23609303.

Hardisty, A. & Roberts, D., 2013. A decadal view of biodiversity informatics: challenges and priorities. *BMC Ecology*, 13(1), p.16. Available at: http://www.biomedcentral.com/1472-6785/13/16.

Narwade, S., Varier, D. & Nakashe, T., 2012. Data discovery and information dissemination service of the Environmental Information System (ENVIS) Centre on Avian Ecology at BNHS, India. *Buceros*, 17(2). Available at: http://bnhsenvis.nic.in/writereaddata/BUCEROS 17-2(1).pdf.

Oksanen, M. & Kumpula, A., 2013. Transparency in conservation: rare species, secret files, and democracy. *Environmental Politics*, pp.1–17. Available at: http://www.tandfonline.com/doi/abs/10.1080/09644016.2013.775726.

Data papers

Brosens, D. et al., 2013. FORMIDABEL: The Belgian Ants Database. *ZooKeys*, 306(August 2012), pp.59–70. Available at: http://www.pensoft.net/journals/zookeys/article/4898/abstract/formidabel-the-belgian-ants-database.

Torralba-Burrial, A. & Ocharan, F.J., 2013. Iberian Odonata distribution: data of the BOS Arthropod Collection (University of Oviedo, Spain). *ZooKeys*, 306: 37-58. Available at: http://www.pensoft.net/journals/zookeys/article/5289/abstract/iberian-odonata-distribution-data-of-the-bos-arthropod-collection-university-of-oviedo-spain-

For further information, please contact:

(For general inquiries) Tim Hirsch, Senior Programme Officer for Engagement, thirsch@gbif.org

(For queries regarding scientific content and methodologies used) Samy Gaiji, Senior Programme Officer for Science and Scientific Liaison, sgaiji@gbif.org

(For queries relating to data papers) Vishwas Chavan, Senior Programme Officer for Data Mobilization, vchavan@gbif.org