# Report 2013-2014
# Naturalis
## Research and Education

Naturalis
Biodiversity
Center

# Contents



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**Report 2013-2014 Naturalis Research and Education**

# Introduction

The impact of research by our scientists received a strong impulse from the grant of the Dutch government in the framework of the *Economic Structure Enhancement Fund* (FES). Not less than 15.3 million euro became available in 2009 to improve the research infrastructure of our institute formed after the merging of the National Museum of Natural History, the Zoological Museum of the University of Amsterdam, and the National Herbarium of the Netherlands with branches in Leiden, Utrecht and Wageningen.
New or improved laboratories were built for morphological, geological, and molecular studies, while huge investments were made in our IT and bioinformatics infrastructure. We have also appointed research fellows and PhD candidates to enter new fields of biodiversity research.
NWO, the national research organisation, accepted Naturalis as an institute eligible for funding.
This  was another essential step to further the success of the sector Research and Education.
Our staff may now directly apply for funding and there are opportunities for international exchange programmes. Two researchers successfully submitted personal grant applications to the so-called *NWO vernieuwingsimpuls*. Other grants and contracts were received from the Dutch government, the European Union, and private organisations.
Our scientific output and impact is steadily and significantly improving, which was also duly acknowledged by an international committee of experts that visited and evaluated the sector's achievements in 2014. However, our research sector is still in transition. We have started to re-organise our researchers in hypothesis-driven research groups, rather than in discipline-oriented departments as they exist up to now. This transition will be finished by the end of 2015. At the same time, we are still seeking a balance between taxon-oriented systematic studies, considered a core activity of Naturalis, and hypothesis-driven research.
The dynamics of biodiversity research asks for staff that can comfortably adapt to new opportunities, both in fundamental and applied research.
The present report shows the wide expertise we have and the great progress we have made during the two years described in this report.

Koos Biesmeijer, scientific director
Erik Smets, scientific director
Jan van Tol, managing director

# Departments, Focus projects and Programmes

**Fig. 1.** Pollinator-driven speciation in action: the moth *Helicoverpa armigera* pollinates the scented flowers of one of the three pollination ecotypes of the heath species *Erica plukenetii* in the Cape Floral Kingdom of South Africa. The other two ecotypes are pollinated by sunbirds and have unscented flowers with much longer nectar tubes. Photo: T. van der Niet.

# Botany

Research in the Department of Botany focuses on a wide range of subjects related to:

- Taxonomy and phylogeny of selected clades of flowering plants, ferns, bryophytes and macrofungi;
- Speciation and character evolution, species interdependencies, palaeobotany and ethnobotany;
- Biogeography of selected taxa, including historical biogeography, spatial analysis of biodiversity patterns, and species distribution modelling;
- Diagnostics and species identification tools, including DNA barcoding, biodiversity assessments and species monitoring.

Within the Department specialist expertise is available on the taxonomy of a variety of taxa, on comparative morphological and anatomical approaches, and state-of-the-art molecular techniques and bio-informatics, including GIS-applications and species distribution modelling.

The Department of Botany (co-)coordinates the production of five Floras. Two of them – *Heukels' Flora van Nederland* and *Flora Agaricina Neerlandica* – support the taxonomical knowledge of the Dutch biodiversity, while the other three – *Flore du Gabon, Flora of the Guianas* and *Flora Malesiana* – have their focus in the tropics. These products reflect the focus present in the herbarium collections and represent a very important component of the visibility of Naturalis as a center of expertise, not only for scientists, but for a much larger user group including educational institutions and non-governmental organizations.

Our research saw increased efforts to integrate more process-related or applied research into our core activities. The research cooperation with profit and non-profit partners has proven to be a welcome addition to the more fundamental research projects. Examples have been the successful cooperation with plant breeding company Rijk Zwaan into the functional anatomical study of tomato plants (Frederic Lens) and a climate change proofing project for WWF Netherlands (Niels Raes).

## Highlights

**Projects and partners**
In continuation of the previous years the Department of Botany has been successful in obtaining external funding for its research projects. In the period 2013-2014 researchers were efficacious in becoming partner within the EU FP7 projects NetBiome-CSA (Soraya Sierra, Michael Stech & Niels Raes) and DECATHLON (Barbara Gravendeel), starting a digitization project of the botanical collections made on Halmahera Indonesia, financed by Missouri Botanical Garden (USA) (Marco Roos & Peter van Welzen), and obtained a Postdoc position through the Stichting Rijksherbariumfonds Kits van Waveren (Jorinde Nuytinck). Additionally, among others, the NWO ALW open project 'Back to Future? Biodiversity gradients revisited' (Niels Raes), the WOTRO TASENE project 'Identifying and monitoring trade in Tanzanian wild-harvested medicinal plants by means of innovative genomics-based DNA barcoding' (Hugo de Boer, Barbara Gravendeel & Tinde van Andel) and the EU funded FP7-CSA pro-iBiosphere project coordinated by Naturalis (Soraya Sierra) were completed successfully.

**PhD candidates**
Three new PhD candidates started within the Department. In 2013 and 2014 seven PhD candidates successfully defended their thesis: Pulcherie Bissiengou, Bhanumas Chantarasuwan, Tanawat Chaowasku, Annick Lang, Yotsawate Sirichamorn, Alexandra Towns, and Robin van Velzen.

**Publications**
The department published 172 SCI publications, including two in Science, and 15 books. Among the books are 'Mycoheterotrophy: the Biology of Plants living on Fungi' (edited by Vincent Merckx), and 'Medicinale en rituele planten van Suriname' (Tinde van Andel). Two volumes were published in the Flora of the Guianas, one in Flore du Gabon, and one in Flora Malesiana.

**Fig. 1.** Transmitted light microscopy image of a tulip-shaped corundum inclusion in spinel in a sapphire-bearing rock from eastern Sri Lanka. Width of view ~2 mm. Obliquely crossed (85°) polarized light.

# Geology

The Department of Geology of Naturalis has 6 full-time palaeontologists, 2 full-time mineralogists and 1 part-time palaebotanist who is emeritus professor at Leiden University. Palaeontological research has a focus on the Netherlands and adjacent regions, Southeast Asia, the Caribbean and Mediterranean and, more recently, the Pontocaspian realm. Thematic research builds on the taxonomic expertise of staff members, that includes (fossil) foraminifers, molluscs, echinoids, vertebrates, and plants, and covers most of the Phanerozoic. Mineralogical research focuses on the Mediterranean and Precambrian basement areas of former Gondwana. The department houses the Netherlands Gemmological Laboratory, the only major gemmological facility in the Netherlands.

## Highlights

In 2013 and 2014, highlights of the Department of Geology were manifold.

- Frank Wesselingh led an international consortium that attracted the EU funded ITN 'PRIDE' on the Pontocaspian lake systems and their biota in the last 2 million years, starting in 2015.
- We celebrated 3 PhD defences; Alexandra van der Geer, Vibor Novak and Sonja Reich, the latter 2 successfully closing the EU funded ITN 'Throughflow' involving Willem Renema and Frank Wesselingh.
- Anne Schulp joined the department in 2013 and played a key role in one of the highlights for Naturalis in the last few years, namely the excavation and acquisition of a female *T. rex*.
- Martin Rücklin was employed as a post-doc early 2014 to do research on jaw evolution in early fish, and with a special task to submit a VIDI proposal to NWO (granted May 2015).
- Frank Wesselingh, John de Vos and Anne Schulp co-authored a Nature paper in 2014 on 500,000 year old hominid carvings by *Homo erectus* on a bivalve shell from Trinil, Java.
- In March 2013 we hosted the symposium 'Green Planet' to celebrate the retirement and scientific career of Prof. Han van Konijnenburg-van Cittert. The symposium attracted palaeobotanists from all over the world.
- National infrastructure funding (NCB/FES) was used to obtain, with Utrecht University and VU Amsterdam, a FEG-EMP, hosted in Utrecht, that is being operated jointly via a national consortium.
- In December 2013 we obtained a rare carbonaceous chondrite from a private collection. The meteorite fell near the Dutch village of Diepenveen in 1873 and is now being investigated by an international consortium led by Naturalis (Leo Kriegsman).
- In 2014 we acquired the renowned mineralogical collections of the Technical University of Delft. Besides collections managers (Kees de Jong, Arike Gill), Hanco Zwaan and Leo Kriegsman were strongly involved.
- Managing editor Steve Donovan managed to attract a commercial publishing house to renew our in-house journal, Scripta Geologica, and hopefully lead it into the Web of Science.

As always, the Department of Geology was very productive in terms of publication output, attracting external funding, teaching courses and supervising students. In addition, we hosted many foreign based scientists for one or more months, leading to joint publications.

2015 will probably see the end of the department, with staff dispersed among various research groups. That means the end of a tradition since 1820 to have a separate Geology department, in some periods even a separate Geology and Mineralogy Museum.

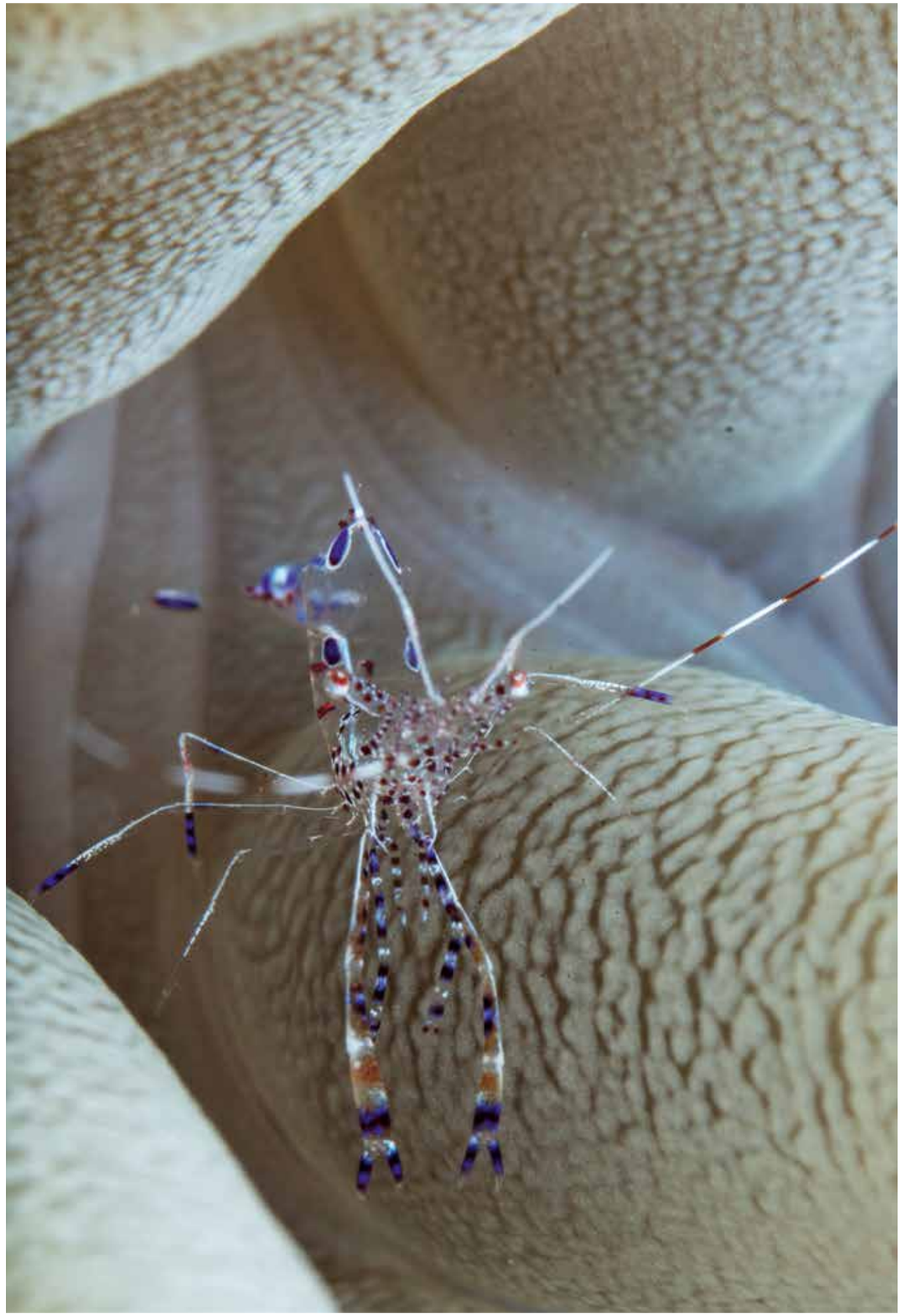


Fig. 1. Fish cleaner shrimp *Periclimenes yucatanicus* (Ives, 1891) on sea anemone *Condylactis gigantea* Weinland, 1860. Curaçao 2013. Photo: C.H.J.M. Fransen.

# Marine Zoology

Research in the Department of Marine Zoology is predominantly collection-based. It is integrative by combining field surveys with the application of morphological and molecular methods. Most field-work takes place in Atlantic and Indo-Pacific coral reef areas. Major research topics of the department concerning coral reefs and other ecosystems in 2013-2014 included:

- Comparison of Atlantic and Indo-Pacific reef faunas;
- Patterns of marine biodiversity in and around the Coral Triangle;
- Evolution of species interdependencies;
- Biodiversity along onshore-offshore gradients;
- Historical collections and changing marine biota;
- Reef invertebrates as producers of bioactive compounds;
- Exotic and invasive species;
- Fish fauna of Lake Victoria;
- Marine interstitial fauna;
- Biogeography and evolution of marine zooplankton.

## Tropical Marine Biodiversity

Most researchers in the department study the species richness of coral reefs, which is largely dependent on species interdependencies.
The study of the evolutionary history of species associations may help to clarify the origin of species-rich ecosystems, for which a knowledge of both the host and associated groups is required. Close collaboration between taxonomists dealing with the host group (e.g. corals, sponges) and the associated group (e.g. commensal shrimps, coral gall crabs, parasitic snails) is essential. The results are important for understanding patterns of marine biodiversity: a high number of hosts species is a condition for a rich associated fauna, especially if symbiotic species are host-specific.

## Highlights

**Deep reef studies in the Dutch Caribbean**
Thanks to the hospitality of Adriaan 'Dutch' Schrier, Director of Curaçao Sea Aquarium and Substation Curaçao, various researchers and students of the department were able to join trips with the Curasub submersible to the seafloor underneath the coral reef at approximately 300 m depth. Several new and rarely known species were observed during trips in 2013 and in 2014. This has been a great start of a research collaboration with Substation Curaçao and other research institutes. A more detailed story can also be found in this report.

**Fieldwork in the Maldives**
Three researchers of the department joined under-water surveys in the Republic of Maldives (Indian Ocean) in 2014 on the occasion of a course given to Italian MSc students. The scientists were hosted by the MaRHE Centre (Marine Research and High Education Centre) on Magoodhoo Island, Faafu Atoll, which is managed by the department of Bio-technologies and Biosciences of the University of Milan - Bicocca in Milan, Italy. They found new species, new species associations and species range extensions.

**Fieldwork in the Red Sea**
Six researchers of the department received an invitation to visit the Red Sea Research Center of King Abdullah University of Science and Technology (KAUST) in Thuwal, Kingdom of Saudi Arabia in 2014. They were able to study reefs varying in distance from the coast, in murky water close to the shore-line and in crystal-clear water around offshore islands.

**Trans-Atlantic oceanographic cruises**
Naturalis PhD candidate Alice Burridge joined cruise AMT24 (Atlantic Meridional Transect Programme) on board the British Antarctic Survey vessel James Clark Ross for a 13,500 km long trip from Immingham (UK) to the Falkland Islands (22-Sept.-1 Nov. 2014). She sampled marine plankton for her study on the evolution of pteropods under super-vision of Katja Peijnenburg. Katja joined a similar cruise at the end of 2012 (AMT22) on board British Royal Research Ship James Cook of Plymouth Marine Laboratories. More information on these trips can be found elsewhere in this report.

**Fig. 1.** Dead Head Fly (*Myathropa florea*), female. Photo: J. van Tol.

# Terrestrial Zoology

Composition, evolution and distribution of the diversity of terrestrial vertebrates and invertebrates: researchers of the Department of Terrestrial Zoology have a broad knowledge and interest. Research of our department includes systematic studies as well as studies to understand evolutionary processes or the effects of global change on species distribution. During 2013-2014, our studies were published in scientific papers and books, and sometimes also attracted the attention of newspapers. Apart from fundamental research we were also involved in application-oriented studies, such as changes in the distribution of pollinators in Northwestern Europe.

Two senior entomologists of the department retired, Kees van Achterberg in 2013, and Sandrine Ulenberg in 2014. Van Achterberg is generally considered one of the few global experts of the family Braconidae (Hymenoptera). Sandrine Ulenberg joined Naturalis when the Zoological Museum of the University of Amsterdam (ZMA) merged with the Leiden museum. She was the last director of the ZMA, and continued her research on the chalcidid fauna (Hymenoptera) of the Netherlands after moving to Leiden.

## Highlights

**Leafmining Lepidoptera**
Studies on host plant relationships of leafmining Lepidoptera by Erik van Nieukerken, Camiel Doorenweerd and Kees van den Berg continued with intensive collecting efforts in Japan, South Korea, China and South Africa. A thorough morphological and genetic studies on phylogenetics and speciation patterns is now undertaken. Van Nieukerken was awarded the Uyttenboogaart-Eliasen Prize for his close cooperation with Dutch amateur lepidopterists in the study of the fauna of the Netherlands.

**Pollinators**
A most notably paper by Koos Biesmeijer and collaborators in *Ecology Letters* showed that the decline of species richness and homogenization of pollinators and wild plants have slowed down. Biesmeijer obtained EU funding for a COST action plan, and was invited to lead the *Honeybee Surveillance Programme* for the Dutch ministry of Economic Affairs.

**Laboratory facilities**
Our molecular laboratory facilities were central in many of our high profile studies. Research by herpetologist Pim Arntzen, in collaboration with Ben Wielstra, laboratory staff members and students, on hybrid zones of *Triturus* newts extensively used genetic data, and resulted in several high-impact publications.

**And much more...**
- Menno Schilthuizen's new book *Nature's nether regions* about the evolution of genitalia and sexual selection drew much attention of media both in the Netherlands as well as abroad.
- Thor-Seng Liew, defended his thesis *The evolution of shell form in tropical terrestrial microsnails*.
- Arachnologist Jeremy Miller combined morphological, molecular and distributional data in a cybertaxonomy platform. Results of his inventories and analysis of tropical arthropod communities were published in *Plos One*.
- Tom Hakbijl contributed with his expertise in entomoarcheology and palaeo-ecology to an archeological research project on Fectio, a Roman castellum.
- The Odonata research group reports on their successful projects elsewhere in this report.
- The research group on free-living, planarian, flatworms of Ronald Sluys published two large studies on the diversity and evolution of a Mediterranean group of freshwater planarians.
- Freek Vonk was awarded a VENI grant from the Netherlands Organization for Scientific Research for his study *Assembling an arsenal: molecular basis of the venom-system in snakes.* Results of Freek Vonk's research projects on the king cobra were published in the *Proceedings of National Academy of Sciences* in 2013.

## DNA barcoding

The DNA barcoding project, supported by the Economic Structure Enhancement Fund, is nearing its final stages. The current total of successfully sequenced samples has already exceeded 40,000. With several additional projects processed in the high-throughput facility, the Naturalis DNA bank now has more than 60,000 extracts.

Within the DNA barcoding project there was a special focus on Dutch flora and fauna. Two large projects involving the bryophytes and vascular plants managed to cover most of the flora of the Netherlands, with a combined total of over 6,000 specimens. The Dutch fauna project mostly involved arthropod groups such as the Coleoptera, Diptera, Hemiptera and Hymenoptera, which were collected by both employees and amateur specialists, and covered over 10,000 specimens. The Lepidoptera were represented by over 10,000 specimens as well, spread over several projects both Dutch and international. The Odonata collections of Naturalis provided the barcoding project with over 8,000 specimens from all over the world.

While there are currently no plans for a continuation of the large-scale DNA barcoding, there will be an additional focus on the barcoding of freshwater organisms for the Water Framework Directive in the coming years with grants received from the Gieskes Strijbis Fonds. In addition to that, various projects have already been started using the DNA barcoding pipeline to solve different scientific questions.



# Laboratories

The Naturalis laboratories offer a wide range of opportunities to perform biological or geological scientific analyses. The highlights of 2013 and 2014 are as follows.

## Management

In 2013 and 2014 we had 14 FTE technical personnel to support research projects, education activities, collection activities and requests from the expert center and NEL (Dutch Gemology laboratory).
We established job profiles for (senior) research technicians adapted to their current duties and responsibilities. Furthermore we began setting up a quality system in which we describe procedures, methods, work instructions and templates in nearly 75 documents. We also generated overviews of rooms, equipment, projects etc. We generated 15 overview documents for laboratory management purposes. We implemented a project approach for DNA based requests and 59 projects were completed regarding ancient DNA, barcoding and meta barcoding; of these 16 were student projects guided by technicians.

The peer review committee visited the labs on the 18th of September 2014 and our presentation was well received. Tenders for TEM and CT scan equipment have been prepared. The expertise of the lab contributed to the acquisition of the grant for the DNA Waterscan project.

## Performance indicators

The laboratory was directly involved in 15 days of fieldwork and the collection of 267 specimens. Technicians and lab management were involved in 30 scientific publications as (co-) author, 1 newspaper article and 1 successful grant application. Four scientific meetings were attended with 4 presentations. Four consultancy reports were produced and, for outreach, 11 lectures were given at different institutes and schools.

## Facility

In 2013 the services of the laboratory facilities acquired a prominent position at Naturalis. In 2014 we started using temporary facilities at the Bio-parter building, mostly for botanical research.
The fully operational TEM, FEG-SEM and light microscopy facilities were used in multiple research projects. The light microscopy facilities at the Darwinweg and Darwinhouse were restructured, including redefinition of high risk facilities. These facilities have been made available through a booking system for efficient use. The website for laboratory facilities has been completed. The plans for the new building have been completed, including mapping of all furniture and (future) lab equipment.

## An ancient DNA story

Remains of an Ivory ring were found in an excavation of a Merovingian cemetery. The Cultural Heritage Agency of the Netherlands requested an ancient DNA analysis of the ivory to determine the elephant species in order to give an important clue about trade connections in the early middle ages.
Extraction and PCR methods were tested on a piece of confiscated ivory to determine it concerned an African bush elephant (*Loxodonta africana*). Unfortunately the origin of the archaeological sample remains unknown due to the heavy degradation of the archaeological material.

## Some morphology highlights

The morphology labs in the Biopartner building were visited by researchers and students from Naturalis and their colleagues to prepare specimens ranging from histological sections of planarian flatworms to bamboo specimens for transmission electron microscopy. For the ‘Rijksmuseum van Oudheden’ (RMO) in Leiden, we were able to make wood anatomy sections from several ancient mummy coffins. Prof. dr. Pieter Baas, our renowned wood anatomy specialist at Naturalis, was easily able to determine that all of the wood was from *Ficus sycomorus*, a tree species that grows abundantly in the Nile valley.

# Character Evolution

The overwhelming biodiversity on Earth is most clearly expressed in the variety of physical forms that species take. The evolution of diversification in these physical manifestations is the phenomenon that drives the research conducted within the Focus Group Character Evolution.

## Aims of the Focus Group

Naturalis Biodiversity Center aims to archive, exhibit, catalogue, and understand the diversity of life. The most eye-catching aspect of this biodiversity is the endless variety of size and shape in living organisms. A fascination with this richness of form is, of course, the primary drive for most researchers at Naturalis, and this leads to the obvious and inescapable research focus on the evolution of form. From the sheer endless diversity of morphologic traits we select a limited array of characters to study – in particular so-called 'key innovations': supposed crucial changes in shape and structure that have opened the way to new evolutionary pathways.

## Research highlights

One key innovation is the origin of jaws and teeth in vertebrates. One Focus Group member who studies this set of characters is Martin Rücklin, who has made a name for himself by detailed investigations of teeth in palaeozoic fishes. To do so, he makes use of Synchrotron radiation X-ray tomography. This allows non-invasive research (no need to damage the fossils in any way), and also enables him to find growth-lines in the teeth and reconstruct the growth through life of a set of dental elements in fossil fishes.

One of Rücklin's favorite fossils is *Compagopiscis croucheri*. This is a so-called placoderm, a group of ancient, extinct, armored fish that lived ca. 370 million years before today thought to be descendants of the same ancestor that also gave rise to the modern bony fishes, rays, and sharks. However, whereas modern fishes clearly have teeth, a key innovation that has been credited with the amazing

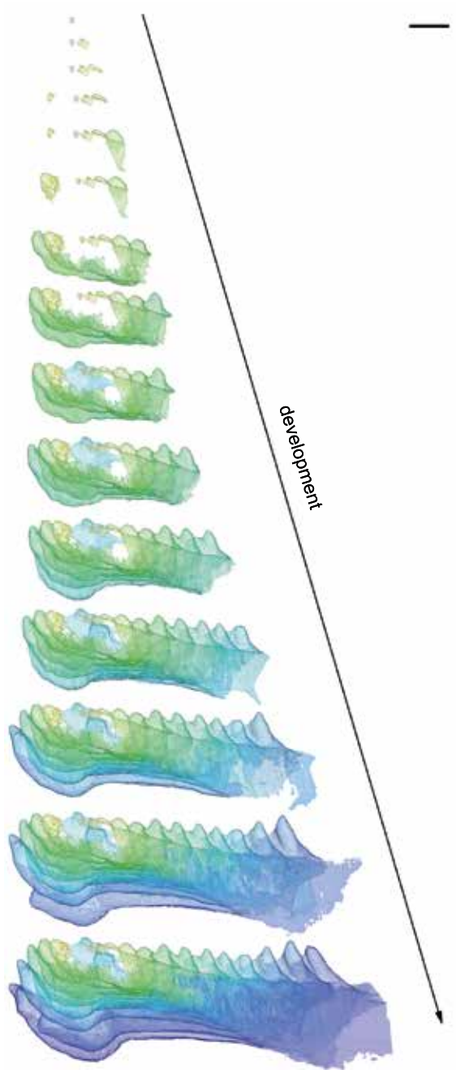



Fig. 1. A virtual dissection of the jaw with teeth of *Compagopiscis croucheri*, taken by using Synchrotron X-ray tomography, without damaging the specimen. Image courtesy: M. Rücklin.

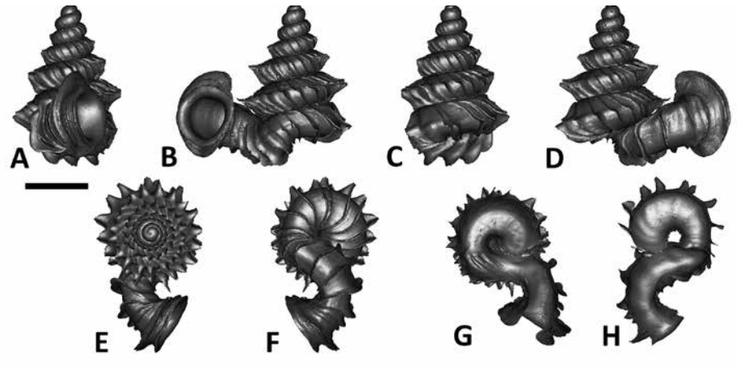



**Fig. 2.** *Plectostoma tohchinyawi*. A newly-described species from Malaysia, named after the local politician and conservationist Dato' Toh Chin Yaw (images made by micro-CT-scanning).

evolutionary fanning-out that fishes and their descendants (including ourselves) have enjoyed, it has for a long time been unclear whether placoderms also possess true teeth. Many researchers thought that they only had tubercles that grew out of the skin.

A few years ago, Rücklin solved this question by showing that *Compagopiscis* indeed had true teeth, meaning that teeth evolved almost as soon as jaws did. In 2014, in the *Journal of Paleontology*, Rücklin and colleagues asked what led to the controversy on the evolution of teeth in placoderms and examined which methods had been used, and what errors they might have introduced. They gave them a full set of dental records with a level of detail that would make any dentist's mouth water. They found that the fish's teeth had grown in a long series of growth spurts, which proved that placoderm teeth grew and developed just like modern teeth do, giving further grist to the mill of those who think (like Rücklin) that teeth and jaws evolved hand-in-hand.

Another key innovation in a different group of (invertebrate) animals is the mollusk shell. Naturalis has always had a large and active team of malacologists, for whom snail shells are their bread and butter. Evolutionary innovations in shell design can precipitate species diversification, and many examples of species-rich groups of snails exist where this seems to have happened. One such group is the genus *Plectostoma*. This is a genus of tiny (but beautiful) land snails that occur in Southeast Asia. They are all characterized by a curious inversion in coiling: when the snail is almost mature, it turns itself upside down in its shell and continues to grow, thereby giving a counter-clockwise twist to the final whorl of the shell. The result is a remarkably irregularly coiled shell. Endless variations on this theme exist, with some species reversing just before the aperture, others reversing much earlier, or even multiple times. In addition, the shell may be adorned with spines and flanges, providing the tropical malacologist with an amazing set of forms.

In May 2014, Thor-Seng Liew defended his PhD on a thesis entirely devoted to these snails, and the evolution of their shells. Liew described several new species (some of which almost or entirely extinct due to habitat destruction in Malaysia), invented a new way of modeling and quantifying shell shape (using the micro-CT-scanner), and reconstructed the evolutionary tree of the species (using DNA-sequences). In the end, he came up with a description of how the settings of the growth model of these snails has evolved throughout their history and given rise to the many forms we see today.

Over the next few years, the Focus Group will continue delving into these and other key innovations to understand how the amazing diversity of life has evolved.

# Dynamic Biodiversity

Biodiversity has great societal value. Biodiversity supports life, is a fascinating scientific topic but is also under increasing threat caused by loss and fragmentation of natural habitats, over-exploitation, and global climate change.

## Aims of the Focus Group

The main mission of Dynamic Biodiversity is to unravel the processes that generate and maintain biodiversity. We are committed to understanding the natural variability of biodiversity and the governing processes and settings. This should enable us to assess the human role in the global biodiversity crisis we are experiencing today. Our extensive collections and databases create a solid foundation for the Focus Group 'Dynamic Biodiversity'.
They allow for detailed comparison of temporal and spatial diversity patterns in marine and terrestrial environments. We study all levels of biodiversity, from single species to whole ecosystems. We have a unique range of experts, ranging from deep time geologists to zoologists and from species modelers to ecosystem service experts.

## Research highlights

The effect of glacial cycles on the Southeast Asian (SEA) rainforest during the Quaternary is unresolved. Using an extensive georeferenced database of collection records for 317 Dipterocarpaceae species, we modelled their climatic niches, based on current climatic conditions. These distribution models were then hindcast onto historical climatic conditions of the last glacial maximum. The results indicate that central Sundaland, exposed because of lower sea levels at glacial maxima, harbored suitable environmental conditions for Dipterocarpaceae and was probably covered by rainforest.

Understanding the processes underpinning and supporting marine biodiversity is necessary to protect severely threatened marine ecosystems. In 2013 we finished ITN THROUGHFLOW aiming at unraveling the origins of extreme biodiversity in Southeast Asian reefs. At shorter time-scales we aim at generating time-series of reef ecosystem change in Indonesia, in this project, funded by the Portuguese Science Foundation, we demonstrated that the potential to recover from major perturbation events differs along an onshore-offshore gradient. Furthermore, Frank Wesselingh was awarded ITN PRIDE studying the rise and demise of the endemic Caspian Sea fauna.

The kingdom Fungi is one of the most diverse groups of organisms on Earth. They are integral ecosystem agents that govern soil carbon cycling, plant nutrition, and pathology. Fungi are widely distributed in all terrestrial ecosystems, but the distribution of species, phyla, and functional groups has been poorly documented. On the basis of 365 global soil samples from natural ecosystems, we contributed to determine the main drivers and biogeographic patterns of fungal diversity and community composition. The data reveal that climate and soil properties have the largest influence on fungal diversity and distribution and that many fungi are restricted to certain types of habitats.

Ecological interactions are the glue of all ecosystems. We study how one of the best known mutualisms, pollination, is affected by global change. We assembled 32 million occurrence records of plants, bees, butterflies and hoverflies from the Netherlands, the UK and Belgium and spanning more than 80 years. We compared four 20-year periods, comparing periods of rapid land-use intensification and natural habitat loss (1930-1990) with a period of increased conservation investment (post-1990). We found extensive species richness loss and biotic homogenisation before 1990, whereas these negative trends became substantially less accentuated during recent decades, being partially reversed for certain taxa. These results highlight the potential to maintain or even restore current species assemblages (which despite past extinctions are still of great conservation value), in regions where large-scale land-use intensification and natural habitat loss has ceased.
The use and factors underlying people's decision to use traditional medicines (TM) among urban populations in developing countries are poorly documented. Interviews among 270 randomly selected citizens of Paramaribo yielded 144 medicinal plant species, of which *Gossypium barbadense, Phyllanthus amarus* and *Quassia amara* were most salient. 66% had used TM the previous year, especially people who suffered from cold, fever, hypertension and headache. The strongest explanatory variables were health status and (transfer of) plant knowledge. Age, gender, education, income, government or doctors opinion had no influence. People's main motivation to use TM was their familiarity with herbs. Given the frequent use of self-collected, home-prepared herbal medicine and the fact that illness and traditional knowledge predict plant use rather than poverty or a limited access to modern health care, the potential risks and benefits of TM should be put prominently on the national public health agenda.


**Fig. 1.** Amazonia showing the location of the Amazon Tree Diversity Network (ATDN) plots that contributed data to the analysis of hyperdominance and hyperdiversity in the Amazon. Source: ter Steege *et al.*, 2013. *Science* 342: 1243092.

The vast extent and record diversity of the Amazon have hampered an understanding of basin-wide patterns. A team of 120 Scientist, coordinated from Naturalis, compiled and standardized species-level data on more than half a million trees in 1170 plots sampling all major lowland forest types to explore patterns of commonness, rarity, and richness. Analyses suggest that lowland Amazonia harbors $3.9 \times 10^{11}$ trees and ~16,000 tree species. Just 227 'hyperdominant' species were so common that together they account for half of all trees in Amazonia, whereas the rarest 11,000 species account for just 0.12% of trees.

# Evolution of Species Interdependencies

Interactions between species are ubiquitous in all ecosystems and they contributed significantly towards the increasing complexity in the evolution of life. Some interactions can involve a wide range of organisms that form complex networks of interdependencies. Networks of interdependent species are often heterogeneous and have architectures that are well-defined by the phylogenetic relationships between the interacting species. However, little is known about the evolutionary processes that generate these interdependencies.

## Aims of the Focus Group

To increase our understanding of species interdependencies and their importance for biodiversity maintenance, on-going research at Naturalis aims to address whether (1) phylogenetic relationships are a determining factor in shaping the architecture of species interdependencies; (2) both co-speciation and host shift events are important mechanisms for speciation of interacting species; and (3) the signature of species interdependencies (e.g. mutualism, parasitism, commensalism) shapes the architecture of the phylogenies of the associated taxa.

## Research highlights

Exploratory marine biodiversity research in the Caribbean and Curaçao in particular has been extensive in early and mid-20th century. The important Dutch Caribbean collections are now housed in Naturalis Biodiversity Center. The combination of taxonomic expertise and historical collections present in Naturalis provides a solid basis for the study of biodiversity changes caused by human-mediated processes. Selected taxonomic groups are used as a proxy to detect biodiversity changes in the area.

In 2013, 3 members of the Naturalis Marine Biodiversity Team performed fieldwork on the reefs of Curaçao investigating crabs, shrimps and molluscs living in association with various invertebrate groups. Many new records for the Curaçao marine fauna were established with regards to the targeted groups, including new associations and species new to science.

**Fig. 1.** Members of the Naturalis Marine Biodiversity Team in the Curasub. Left to right: Charles Fransen, Bastian Reijnen and Sancia van der Meij. Photo credit: Barry Brown, Substation Curaçao.

Charles Fransen studied a group of symbiotic shrimp forming associations with various reef organisms like sponges, coelenterates, echinoderms, ascidians and molluscs. From Curaçao only 7 species were previously recorded in the scientific literature. Our recent inventory yielded 25 species constituting many new records for Curaçao. Among our findings is a new species which lives in association with a stony coral. Such an association has not been recorded for the Atlantic Ocean before. Another interesting observation was made during our dive with the Curasub. At about 220 m depth we observed echinoids hosting shrimps. These echinoids belong to the species *Paleopneustes tholoformis*. The shrimp species turned out to be a species (*Diapontonia maranulus*) only know from a dive to 244-309 m with the Johnson Sea Link submersible off Grand Bahama Island.

Sancia van der Meij studied coral-gall crabs (Cryptochiridae), a family of small crabs that live in obligate symbiosis with stony corals. Most species have been described from the Indo-West-Pacific, only 4 species are known from the Caribbean. During our inventory at least 3 gall crab species were recorded from

**Fig. 2.** A common sight on the reefs of Curaçao, *Cyphoma gibbosum* (Linnaeus, 1758) (vernacular name: Flamingo Tongue) on a *Pseudoplexaura* sp. Photo: B.T. Reijnen.

**Fig. 3.** Vincent Merckx investigating a flower of *Thismia hillii* in New Zealand. Photo: V.S.F.T. Merckx.

21 different coral hosts, 7 of which are new associations. One of the newly recorded gall crab species constitutes a range extension of a species described from Brazil. During a dive with the CuraSub a tunnel of the gall crab *Opecarcinus hypostegus* was observed in a colony of *Agaricia lamarcki* at approximately 60 meter depths. This is the first mesophotic record of a gall crab.

The third member of the team, Bastian Reijnen studied Octocorallia (gorgonians and soft corals) as well as members of the gastropod family Ovulidae. Most ovulid snails live in obligate symbiosis with octocorals and are therefore highly dependent on their coral hosts. We have possibly found 3 new species of gorgonians in the shallow waters around Curaçao. Close examination of our octocoral samples also revealed new host species for a number of Atlantic Ovulidae, for example *Cyphoma signatum* was found on a sea fan (*Gorgonia ventalina*) whilst it was only known from the octocoral *Plexaurella dichotoma*. In addition, deep diving with the Curasub revealed many rarely encountered species of Octocorallia. One of the questions that arises from this deep dive with a submersible is if these gorgonians and soft corals will reveal new shrimp and/or ovulid species in the future.

Besides species interdependencies in marine ecosystems the Focus Group also investigated a highly specific interaction in terrestrial ecosystems. In 2013 and 2014 Vincent Merckx and Constantijn Mennes travelled to Australia and New Zealand to collect species of the mycoheterotrophic plant *Thismia.* These plants are parasitic on arbuscular mycorrhizal fungi. To track the evolutionary history of this interaction DNA extractions of *Thismia* roots were investigated with high-throughput sequencing by Sofia Gomes. Plant DNA data revealed that *Thismia* reached its current distribution by relatively recent dispersal and speciation events, and rapid range extensions. DNA sequences of the root colonizing fungus shows that *Thismia* exclusively associates with a narrow range of *Rhizophagus* fungi. Closely related *Thismia* species growing at the same site were found to grow on similar fungi. These results demonstrate that AM specialist plants are capable of rapid range expansion and speciation without host jumping.

# Bioinformatics

Biology is becoming a computationally intensive science: data sets that are analyzed to answer biologically meaningful questions are growing in volume and complexity; analytical methods are becoming increasingly sophisticated. The Bioinformatics Programme at Naturalis Biodiversity Center, started in 2012, seeks to respond to this trend by developing informatics-oriented research projects and by supporting Naturalis researchers in developing computational research methodologies.

## Aims of the Programme

Researchers in the Bioinformatics Programme develop computational methods to sift through and analyze the wealth of digital observations coming out of labs, the field, and even old books. Our focus is on developing innovative, reusable, open source analysis methods that can be broadly applied to biological research questions.

## Research highlights

The programme currently includes the activities of Hannes Hettling (phyloinformatics), Youri Lammers (bioinformatics), Serrano Pereira (image analysis), Hester Stekelenburg (text mining) and Rutger Vos (computational biology, leadership). We collaborate intensively with researchers and IT technologists within Naturalis, at the local level with Generade, at the national level with bioinformaticians and computer scientists through platforms such as DTL, VLPB, NBIC and SURFsara, and internationally in European and bilateral research projects. These collaborations form an important source of funding for our activities.

Recently, our bioinformatics contributions have played key roles in bringing several high-profile Naturalis projects in next-generation sequencing to completion. These projects include analysis of the king cobra genome, assembly and analysis of ancient genomes from old herbarium specimens of tomatoes, assembly of the genomes of two phytophagous insects, and the identification of the gut contents of a Holocene horse and a Holocene bison. Our current interests focus on the following research questions.

Can we place all organisms on the tree of life? – Where organisms fit on the tree of life is interesting in and of itself, but it also can tell us a great deal about what these organisms are like – at any level of organisation, from molecules to communities – and how they evolved to their current form. Reconstructing the tree of life using sophisticated algorithms operating on comparative data is the central project of the field of phylogenetics. Lots of data to work with, from DNA sequences to fossils, are publicly available.

In collaboration with the University of Gothenburg, Sweden, and the European project BioVeL we have developed a knowledge system that automatically collects these data from public resources and integrates them into large-scale phylogenetic analyses. The system uses clever informatics to bring order to the large number of different genes sequenced in different organisms and to subdivide the number-crunching into manageable subtasks. The system fits fossils to the results of the calculations so that the final estimate not only describes in what order lineages split up to give rise to current species, but also when this happened.

Can computers identify protected species automatically? – Taxonomic identification by experts, for example to inform conservation, is one of the core competencies of Naturalis. However, taxonomic expertise is rare and costly, while large amounts of reference data (DNA barcodes, images) are available that could form the basis of automated identification systems that could give 'good enough' results for certain cases. To demonstrate this for image data we have developed a system of artificial neural networks with which photographs can be classified to genus, section and species level. In our proof of concept, the system classifies slipper orchids and cross-references the results with more information about these charismatic, colourful, but endangered species.

Likewise, for DNA barcoding reference data we have developed a system that performs taxonomic identification of the constituents of biological mixtures – for example, blends of traditional Chinese medicine, or incense – and cross-references the results with the CITES appendices to detect whether the mixture contains materials from species in which international trade is prohibited. Our experience in constructing these identification systems and integrating their findings with additional data helps us in developing a new platform for freshwater quality assessment based on metabarcoding coupled with knowledge about ecological traits of detected species: the upcoming DNA Waterscan project.

How can we open up old books to new research? – High-quality databases of ecological traits of plants have many applications in research in ecology, functional diversity and evolutionary biology. Much knowledge on ecological traits is contained within published volumes of floristic treatments. Recent investments by Naturalis in digitization and optical character recognition of floras have made a wealth of 'raw' text data available, for which XML markup pipelines have been developed. Our experiences gained at the 2014 Hackathon have indicated that this XML might form the basis of further text mining to obtain standardized, comparative data sets. To this end we are developing pipelines that extract character-state matrices from marked-up floristic treatments.

In addition to our research, we seek to make a positive contribution to strengthen Naturalis's research community, for example by organizing the colloquium series, some of the infrastructure for open source software development, and hackathons.

# Nature of the Netherlands

Although we are living in a man-made, urbanized country with a considerable loss of biodiversity, the number of professional amateurs and hence biodiversity data is unparalleled. This makes the Netherlands a valuable experimental garden for the development of knowledge and innovative tools in bio assessments, for the benefit of a variety of stakeholders.

## Aims of the Programme

The primary objective of the Nature of the Netherlands Programme is to utilize the knowledge of Naturalis and partners to address societal issues within our country. Therefore we collaborate with a network of specialists and institutes for stakeholders within different areas such as water management, nature management and conservation, public health and education. Our activities are based on taxonomic knowledge. Themes within the Programme are aquatic biodiversity, invasive species, urban ecology, pollinators and the Dutch Caribbean.

## Highlights

One of the promises for future bio assessments is the use of molecular data. Naturalis invested heavily in the development of a reference library with DNA barcodes for the Dutch flora and fauna. Over 200 specialists from different NGO's have been recruited to collect and identify specimens, which have been photographed and processed in our DNA labs and stored in our collection as verifiable voucher specimens. We collected over 22,000 specimens resulting in over 23,000 barcodes. The barcodes have been used for biological control, invasive species, bird strikes and environmental research. In 2014 we started the project DNA Waterscan, funded by the Gieskes-Strijbis Fund, to develop an alternative assessment for water quality, based on DNA barcodes. We set up a collaboration with KWR Watercycle Research Institute for joint projects within the realm of hydrogenomics.

In 2010 the islands of Bonaire, St. Eustatius and Saba became special municipalities within the Netherlands. Naturalis is involved in the Caribbean Netherlands Science Institute based on Statia and started a project to develop research and outreach activities on the Dutch Caribbean Islands. This has led to preparations for a tropical field course and terrestrial and marine expeditions in 2015, digitization of Caribbean specimens within the collection of Naturalis and digitization of Caribbean literature, a photo exhibit about local biodiversity and a plan for outreach and education. To achieve all this there are several collaborations with NGO's, local nature managers and local governments.

We moved the web platform Dutch Species Catalogue to our own ICT department by rebuilding and improving it, including an user friendly editorial module for the taxonomic thesaurus. We updated the information of most organisms with revisions of major groups such as beetles (4,000 species), flies (5,000 species) and vascular plants (3,700 species). Together with NGO's and funded by the Netherlands Food and Consumer Product Safety Authority we collected data of established invasive animal species and published the information in the species catalogue. Together with Natuurmuseum Nijmegen we started a project to collect all names of historical records of vascular plant species to add them to the catalogue. Preparations were made to synchronize the taxonomy of the catalogue with the National Database Flora and Fauna, a joint project with NGO's and provinces (BIJ12). The catalogue has been used in a variety of projects from Rijksmuseum and VU University Amsterdam to the radio program Vroege Vogels.

Several projects focused on the development of identification tools. We developed datasets, images and texts for digital multi entry keys for several groups of organisms including garden bees, beetles, dragonflies, grasshoppers, cockroaches, spiders, flies, ants and several marine groups. They are or will be published as part of the Dutch Species Catalogue. In the wake of this project we published reference cards and posters of groups including garden beetles, garden spiders, water bugs and ladybugs. These are used in several monitoring projects. We also produced 80 new drawings and texts for the Dierenzoeker (animal searcher) app for primary school children (Fig. 3).

**Fig. 1.** Researchers collecting moth specimens on Statia in the Dutch Caribbean. Photo: B. van der Hoorn.


**Fig. 3.** Dierenzoeker app on Samsung telephone.

Some new publications came to light in 2013/2014 or were in preparation. Naturalis was involved in the publication of 2 new books with bees as a subject: Bijenplanten and Gasten van Bijenhotels. The in 2012 published book De Bijen van Nederland made it to the last 5 of the Jan Wolkers Prijs 2013 for the most excellent nature books. We published the issues 39-43 of Nederlandse Faunistische Mededelingen, Entomologische Tabel 7 on leaf beetles and an distribution atlas of true bugs. In 2013 we published a first volume of the Jaarboek Natuur, an initiative later merged in a joint project with WWF, Statistics Netherlands and NGO's to publish a Living Planet Report for the Netherlands in the autumn of 2015. Also in preparation are 2 new volumes in the book series Nature of the Netherlands focused on mammals and water beetles. An affiliated initiative of Naturalis is the digitization of over 60 nature magazines of Naturalis and partner organizations to make the articles readily accessible to research communities, published and to be published on a newly developed web platform Natuurtijdschriften.

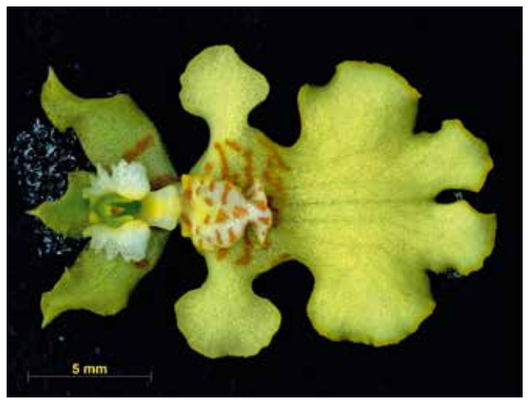
**Fig. 2.** Reference cards are a useful tool to involve general public in citizen science.

# Economic Structure Enhancement Fund, Education, and External evaluation

# Economic Structure Enhancement Fund (FES)

## New research infrastructure and research projects

Based on a grant from the Fonds Economische Structuurversterking (Economic Structure Enhancement Fund) plus additional funding from the Netherlands Ministry of Education, Culture and Science, Naturalis continued to build on new research infrastructures, discussed below. Most elements of the infrastructure were finished by the end of 2014, but final decisions on the purchase of a new Transmission Electron Microscope and an additional micro-CT-scanner were postponed until early 2015.




## Laboratories

The morphological laboratory became fully equipped in period 2013-2014, but it was decided that an additional upgrade of certain aspects of this facility was needed. This was started in 2014 and continued in 2015. We further invested in high-end light microscopy, and a few culture facilities for dedicated support of successful research lines.

The geological laboratory now consists of two parts: most of the common equipment is housed in our own premises, but the electron microprobe was placed in Utrecht as part of the National Geological Facility to be used by all geologists in the Netherlands. Our own laboratory replaced the outdated spectrophotometry equipment as well as invested in dark field and specialised compound microscopes for large objects.

The DNA barcoding laboratory needed only minor replacements and additions. The ancient-DNA laboratory had some minor upgrades and additional equipment was purchased for challenging DNA extractions. A project to select a professional Laboratory Information Management System, integrated with our own collection registration system, started with a project definition in 2014.

It was decided not to invest in an additional Next-Generation Sequencer, since we already have access to equipment of various institutions at the Bioscience park. The contract with BaseClear for Sanger sequencing was renewed. The staff of the laboratories, partly on short-term contracts, proved itself to be absolutely necessary for professional support of the research staff and teaching of students.

Installation of the GIS laboratory (Geographic Information Systems) was completed. Dedicated high-end personal workstations, with software such as ArcGis and detailed maps of relevant areas, supported research projects for Ecological Niche Modelling or Species Distribution Modelling by several of our permanent staff, postdoctoral researchers and PhD candidates.

On the other hand, we concluded that our 3D laboratory needed substantial upgrading, both in quality and quantity of computer power. Our present Micro-CT scanner, and a new one planned for 2015, produce many and large sized files that need to be analysed. Most 3D-modelling projects ask for high-end computer facilities; because of limitations of the software our High Performance Cloud-computing facility cannot be used. A project to redesign this laboratory was started late 2014 and budget has been allocated for this upgraded facility.

Even more challenging was the development of a Naturalis data centre. Many of our new research projects (molecular lab, 3D and GIS lab) produce enormous amounts of data; this is also true for the digitisation of the collections. Our own infrastructure for data storage was considered neither reliable nor sufficient, and for various reasons it was decided that this infrastructure had to be moved outside our own premises. Under supervision of our IT sector, Naturalis started this project in 2014, which will continue into 2015.

Finally, we continued to work on other infrastructure. The DNA barcoding database grew substantially due to collaboration of our staff with many professional amateurs in the Netherlands, herewith adding to the database of DNA barcodes of all Dutch species. Several other projects also contributed to the Naturalis database of currently more than 30,000 barcodes, such as the inventory of Mount Kinabalu on Sabah carried out in September 2012, and the All-Odonate project, on which we have reported elsewhere in this report. The results of DNA barcoding by Naturalis and CBS Fungal Biodiversity Centre will be made visible on a dedicated website EUBOLD, in collaboration with other barcoding centres in Europe.

## New developments

DNA barcoding is a very promising method for applications in fields where reliable identification to species level is essential. A 1.2 million euro proposal to the Gieskes-Strijbis Fonds to develop an information system for water quality assessment in the Netherlands based on aquatic invertebrates, was awarded in 2014. The data, including those uploaded in the Barcode of Life Database at Guelph, Canada, proved to be of crucial importance for advice, e.g. on identification of just traces of corpses of birds after strikes with aircraft. It is a welcome continuation of the FES funding, and clearly shows the potential of the FES investments for society.

The research infrastructure of Naturalis has proved to be successful in many ways. We have welcomed users from other research institutes, both from the Netherlands and from abroad, and various projects using our facilities have resulted in high-impact publications. A more detailed report on the activities and results of the FES Programme will become available by the end of 2015.

# Education

Staff of Naturalis is involved in the BSc and MSc-curriculums of our partner universities, but also of several other institutions, such as the University of Applied Sciences in Leiden. Per institution, the volume of the present activities in academic education amounts per year to:

## University of Leiden

- 2 Chairs: Systematic Botany and Character Evolution and Biodiversity.
- 2 Extraordinary chairs: Economic Botany and Tropical Plant Biogeography.
- A substantial input of staff with responsibility for and/or significant contribution to 61 EC cursory BSc/MSceducation and ca. 700750 EC BSc internships plus 650-700EC MSc internships each year (Tree of Life; taxonomical, palaeontological and morphological expertise; methodological skills for (molecular) character analyses and phylogeny reconstruction; historical biogeography, spatial pattern analyses and ecological modelling; evodevo; evolution and speciation).

## University of Amsterdam

- 1 Extraordinary chair in Functional Biodiversity and substantial involvement in 6 EC cursory BSc-education and structural contributions to 7 other courses plus 200-250 EC internships (zoological, ecological and evolutionary courses, various excursions, ethnobotany).

## University of Wageningen

- 1 Chair in Biosystematics (until September 2013).
- A substantial involvement in 12 EC BScand MSc courses and ca. 75 EC internships each year (Dutch and SW European flora and fauna and biosystematics, ethnobotany).

## University of Utrecht

- 0.6 fte Appointment as Assistant Professor with responsibility for 24 EC cursory BSceducation plus 200-250 EC internships (biodiversity, ecology and evolution, field course).

## University of Applied Sciences, Leiden

- 0.4 fte Lectureship dedicated to provide courses and internships in the TopLab (diverse molecular techniques and bioinformatics for analysis and processing of results).

Additionally, the Netherlands Gemmological Laboratory organises 3 successful gemmological courses, 1 on HBO-level on contract basis, 1 at HBO-Zadkine and at the UvA (total 16 EC). Furthermore, individual staff members contribute more or less incidentally to ca. 5 EC education, e.g. at University of Groningen, University of Cologne, Museum für Naturkunde in Berlin and the Free University of Brussels.

## Academic courses by Naturalis Biodiversity Center

| Institution | Level | Title |
|---|---|---|
| Leiden University | BSc 1 | Project Popularisering van de Wetenschap |
| | | Tree of Life: Biodiversiteit Planten, Protisten en Fungi & Fylogenie |
| | | Excursies Flora en Fauna |
| | | Projecten Ecologie, Biodiversiteit en Natuurbehoud |
| | BSc2 | Moleculaire Technieken |
| | | Zoölogie en ontwikkelingsbiologie |
| | | Evolutionaire analyse |
| | | Biodiversiteit I & II |
| | | Excursiecursus Flora |
| | BSc3 | Minor Biodiversity and the Natural Environment |
| | | • Module 1: Introduction to Dutch Landscapes |
| | | • Module 3: Large scale patterns of biodiversity |
| | | • Module 4: Evolutionary developments |
| | | • Term paper |
| | | • BSc projects & General research skills |
| | MSc | Orientation track Evolution, biodiversity and conservation |
| | | Orientation track Plant sciences and natural products |
| | | Development and evolution |
| | | Methods in biodiversity analysis |
| | | Plant families of the tropics |
| | | Economic botany |
| | | Seminar Biodiversity and conservation |
| | University college | Crisis in biology |
| University of Applied Sciences, Leiden | | Genomics and sequencing |
| | | Strategies for analyses |
| | | Sequence technics and data analysis |
| | | Infectious diseases |
| University of Amsterdam | BSc1 | Keerpunten in de natuurwetenschappen |
| | | Regulering van vorm en functie van dieren |
| | | Organisme in het milieu |
| | BSc2 | Evolutiobiologie theorie & practicum |
| | BSc3 | Paleoecology |
| | | Biodiversity and global change |
| | | BSc projects |
| University of Applied Sciences, Amsterdam | | Forensische biologie |
| Wageningen UR | BSc | Biodiversiteit van Nederland |
| | | Webben van terrestrische biodiversiteit |
| | MSc | Advanced biosystematics |
| Utrecht University | BSc | Biodiversiteit en Landschap |
| | | Evolutie |
| | | Evolutie en biodiversiteit |
| | | Natuurbehoud, duurzaamheid en plantendiversiteit |
| Uppsala University, Sweden | BSc | Fysiologi |
| | | Functional genomics |
| The Gemmological Association of Great Britain (Gem-A, London) | | Foundation in gemmology |
| Federation of European Education in Gemmology (FEEG) | MSc | Diploma in gemmology |
| Vrije Universiteit Brussel | Population and conservation genetics | |

## BSc- and MSc research projects by Naturalis Biodiversity Center

| Title | BSc students | Naturalis supervisor |
|---|---|---|
| Development of a pipeline for automatic phenotyping and morphometric analyses of plants | Mirna Baak, Hogeschool Leiden | B. Gravendeel |
| Groundwater amphipods Madagaskar | Jesper Brugman, University of Amsterdam | R. Vonk |
| Assembly of PacBio and Illumina HiSeq reads / Bioinformatics analyses of the genome of *Erycina pusilla* | Josje Buren, Hogeschool Leiden | B. Gravendeel |
| Functional anatomy of insular woody species and their herbaceous relatives | Thibaud Chauvin, Leiden University | F.R. Lens |
| Identification of the natural pollinators of the orchid species *Neottia cordata* in The Netherlands | Emma de Haas, Leiden University | B. Gravendeel |
| *In situ* hybridization of orchid floral buds | Sadhana Doebar, Hogeschool Leiden | B. Gravendeel |
| Identificatie van Stigmella op eiken met morfometrie | Hessel Hoekstra, Leiden University | T.M. de Meulemeester |
| Generating DNA barcodes of leaf mining Lepidoptera from degraded DNA in old collection material as tool for agricultural pest identification | Julian van der Hoogen, Hogeschool van Amsterdam | B. Gravendeel |
| Identification and quantification of Hippocampus (Seahorses) in Traditional Chinese Medicine (TCM) | Jeanine Joling, Hogeschool Leiden | B. Gravendeel |
| DNA barcoding of Traditional Chinese Medicines (TCMs) containing CITES protected tree ferns | Maaike Karsten, Hogeschool Leiden | B. Gravendeel |
| Molecular dating of insular woody Canary Island groups | Vé Koninck, Leiden University | F.R. Lens |
| Variation in shells of the planktonic pteropod (*Heliconoides inflata*) along a naturally occurring gradient of ocean acidification | Sanne Kruijt, University of Amsterdam | K.T.C.A. Peijnenburg |
| Salep orchid trade in Turkey | Selay Kucukaladag, Hogeschool van Amsterdam | B. Gravendeel |
| Assembly of PacBio and Illumina HiSeq read/ Bioinformatics analyses of the genome of *Erycina pusilla* | Dennis Middendorp, Hogeschool Leiden | B. Gravendeel |
| Earthworms in European temperate agricultural systems | R.J. Michielsen, Utrecht University | E.T. Pos |
| DNA-sequencing of Ptomaphagus | Wesley van Oostenbrugge, Hogeschool van Amsterdam | M. Schilthuizen |
| Revision Dimorphocalyx (Euphorbiaceae) | Anne van Oostrum, Leiden University | P.C. van Welzen |
| Molecular phylogeny and description of a new species of Dendrochilum (Orchidaceae) | Bobby Prabowo Sulistyo, Hogeschool Leiden | B. Gravendeel |
| Screening antimicrobial effects of medicinal plant extracts with Helicobacter bioassays | Melanie Richel, Hogeschool Leiden | B. Gravendeel |
| Expression of orchid floral developmental genes | Peter van Schaik, Hogeschool Leiden | B. Gravendeel |
| Evolution of Eucomis | Debbie Schoor, Leiden University | T. van der Niet |
| Evolution of floral spur length | Michelle Taal, Leiden University | T. van der Niet |
| Salep orchid trade in Turkey | Sedef Terzioglu, Hogeschool van Amsterdam | B. Gravendeel |
| Wat weet het publiek over bestuiving | Sahayra Tjon, VHL | J.C. Biesmeijer |
| Evolution of Tulip Breaking Virus (TBV) by sequencing RNA from historical and extant tulip collections | Katja Tkacova, Hogeschool Leiden | B. Gravendeel |
| Groundwater amphipods Madagaskar | Justin Velinga, University of Amsterdam | R. Vonk |
| Molecular diet analysis of Barnacle goose (*Branta leucopsis*) populations across the Greenland Sea | Tessa Verstraate, Avans Hogeschool, Breda | M. Stech |

| Title | BSc students | Naturalis supervisor |
|---|---|---|
| DNA-sequencing of Ptomaphagus | Stefan Visser, Hogeschool van Amsterdam | M. Schilthuizen |
| Assembly of PacBio and Illumina HiSeq reads/ Bioinformatics analyses of the genome of *Erycina pusilla* | Jan Willem Wijnands, Hogeschool Leiden | B. Gravendeel |
| The Future of Amazonian Forests | M.A.J. van der Velden, Utrecht University | E.T. Pos |
| **Title** | **Msc students** | **Naturalis supervisor** |
| Documentation and identification of medicinal plants threatened by trade in Tanzania by means of DNA barcoding | Siri Abihudi, Muhimbili University of Health and Allied Sciences, Dar-es-Salaam, Tanzania | S. Veldman |
| Medicinal plants from Historia Naturalis Brasiliae (1648) | Mireia Alcantara Rodriguez, Utrecht University | T.R. van Andel |
| Tiny molluscs and big cooling: mollusc response across the Eocene-Oligocene Transition | Jonathan Arciszewski, Leiden University | W. Renema |
| Mosasauruspathologie | Dylan Bastiaans, Utrecht University | A.S. Schulp |
| Triceratops | Dylan Bastiaans, Utrecht University | A.S. Schulp |
| Biodiversity indices under the loop: Recent shifts in Dutch butterflies | Sharina van Boheemen, Leiden University | E.J. van Nieukerken |
| Coexistence in Erica in the Cape floral kingdom | Roderick Bouman, Leiden University | T. van der Niet |
| Solving the species complex of the Oriental arboreal Onthophagus species group | Thijmen Breeschoten, Leiden University | M. Schilthuizen |
| Temporal and spatial differences of fish populations in the Thousand Islands and the Bay of Jakarta, Indonesia | Aline Duine, Utrecht University | N.J. de Voogd |
| Laag 14 Winterswijk | Melanie During, Utrecht University | A.S. Schulp |
| Explaining amphipacific distributions | Conrad van den Ende, Leiden University | P.C. van Welzen |
| Cryptic speciation of an Indonesian coral killing sponge | Esther van der Ent, Utrecht University | N.J. de Voogd |
| African medicinal plants traded in Matonge-Ixelles, Brussels | Marie-C. C. Fundiko, Leiden University | T.R. van Andel |
| Carrion mimicry | Frank Geers, Leiden University | T. van der Niet |
| Erinaceid phylogeny | Flora van Glabbeek, Leiden University | L.W. van den Hoek Ostende |
| Inventory and comparison of the faunal diversity from the Beekbergerwoud before and after its clearing in 1871 | Marvin Groen, Leiden University | B. Gravendeel |
| Evolution and development of the dermal skeleton in early jawed vertebrates | Yae-Rim Hannah Park, Leiden University, Instituut voor Biologie Leiden | M. Rücklin |
| Sponge microbial communities | Glenn Hauquier, Leiden University | N.J. de Voogd |
| Dental variations in the island ruminant Hoplitomeryx | Jesse Hennekam, Utrecht University | L.W. van den Hoek Ostende |
| How nutrients and floral diversity in field margins determine flower visitor communities | Ya-Hsien Huang, Leiden University | L.G. Carvalheiro |
| Species boundaries in globally distributed *Diacavolinia* pteropods | Rémy van der Hulst, Leiden University | K.T.C.A. Peijnenburg |
| Science-policy interface in pollination communication | Nieke Knoben, Radboud Universiteit Nijmegen | J.C. Biesmeijer |

| Title | Msc students | Naturalis supervisor |
|---|---|---|
| Impact on tundra vegetation of foraging behaviour and seasonal changes in diet of the Barnacle goose (*Branta leucopsis*) in the Arctic | Elspeth Kolvoort, Leiden University | M. Stech |
| Quantification of MADS-box gene expression in *Erycina pusilla* | Kelly van Kooperen, Leiden University | B. Gravendeel |
| Phylogenetic diversity and taxonomic richness of the basidiomycete genus Entoloma in tropical lowland and mountain forest types on Mount Kinabalu, Borneo | Ruud Kuin, University of Amsterdam | J. Geml |
| Threeway meeting point Triturus Austria | Patricia Lagler, Vienna | J.W. Arntzen |
| Phylogeography of *Brachidontes* sp. in Indonesia, Palau, Papua New Guinae, and New Caledonia: insights into the evolution of marine lake populations | Christiaan de Leeuw, University of Amsterdam | K.T.C.A. Peijnenburg |
| Phylogeography of the Indo-pacific giant barrel sponge | Christiaan de Leeuw, University of Amsterdam | K.T.C.A. Peijnenburg |
| Population structure of *Brachidontes sp.* Mussels of marine lakes in Indonesia | Diede Maas, Wageningen UR | K.T.C.A. Peijnenburg |
| P-T conditions of the Dryos Unit and the underlying Cycladic Blueschist Unit on Paros, Greece | Christina Malandri, Utrecht University | L.M. Kriegsman |
| Screening the potential of anti-diabetic Cucumis and Dendrobium extracts using qPCRs of Pck1 in zebrafish | Helen Mendel, Leiden University | B. Gravendeel |
| Plesiosauriër Maastricht | Feiko Miedema, Utrecht University | A.S. Schulp |
| The phylogeny of the mycoheterotrophic genus Epirixanthes (Polygalaceae) and its specificity to clades of arbuscular mycorrhizal fungi | Angelo Moerland, Leiden University | V.S.F.T. Merckx |
| Deploying a novel method for identification of inbreeding in bumblebees based on wing shape | Collin Molenaar, Leiden University | T.M. de Meulemeester |
| Pheromones to optimize crop pollination | Collin Molenaar, Leiden University | T. van der Niet |
| Wing morphometics in bumble bees | Collin Molenaar, Leiden University | T. van der Niet |
| Co-evolution from the pollinator's perspective (Testing whether tongues evolve according to a trend from short to long in *Prosoeca ganglbaueri*?) | Harro de Moor, Utrecht University | T. van der Niet |
| Predicting crop pollination in NL | Jolien Morren, Leiden University | J.C. Biesmeijer |
| Revision Blumeodendron (Euphorbiaceae) | Marije Ottens-Treurniet, Leiden University | P.C. van Welzen |
| Diversity and connectivity of Atlantic Arrow Worms (Phylum: Chaetognatha) | Emma Otto, University of Amsterdam | K.T.C.A. Peijnenburg |
| Vallesian mammal biogeography of the Iberian Peninsula in the Late Miocene | Jeanne van de Put, Leiden University | L.W. van den Hoek Ostende |
| Next Gen Phylogeography *Pterosagitta draco* | Cas Retel, Leiden University | K.T.C.A. Peijnenburg |
| Evolution of asymmetric genitalia in *Drosophila pachea* | Flor Rhebergen, Leiden University | M. Schilthuizen |
| Morphological traits associated with epiphyllous canopy specialists in leafy liverworts (Lejeuneaecea) | Marit van Santen, Leiden University | S. Mota de Oliviera |
| Traits associated with canopy microhabitat conditions in Amazonian Lejeuneaceae | Marit van Santen, Leiden University | M. Stech |
| *Amanita muscaria*: an interdisciplinary approach | Gennaro Scognamiglio. Leiden University | J. Geml |
| Right-handed snails and left-handed crabs (or vice versa) | Iris Sipman, Leiden University | M. Schilthuizen |
| Protoceratops | Stephan Spiekman, Leiden University | A.S. Schulp |
| Screening Vanilla extracts with fungal assays | Frederike Stock, Hogeschool Leiden | B. Gravendeel |



| Title | Msc students | Naturalis supervisor |
|---|---|---|
| Life history influences on range expansion and population connectivity in a widely distributed marine sponge | Thomas Swierts, University of Amsterdam | N.J. de Voogd |
| Infestation patterns and population genetic structure of galls crabs (Cryptochiridae) inhabiting corals (Scleractinia) along the Curacao coast | Kaj van Tienderen, Utrecht University | S.E.T. van der Meij |
| Reconstructing the transition from crust to milkcap (Russulales) | Ann Vanderheyden, Ghent University | J. Nuytinck |
| Molecular identification of arctic Bryum specimens, and effects of grazing on a Svalbard (Norway) bryophyte community | Julien Vollering, Leiden University | H. Kruijer |
| Morphology of female genitalia in Cholevidae | Ruben Vijverberg, Leiden University | M. Schilthuizen |
| Insights on phylogenetic relationships within Caribbean octocorals, with a focus on Plexauridae | Yee Wah Lau, Leiden University | L.P. van Ofwegen |
| Identification of the bluetongue disease vector Culicoides by wing shape | Eelco Ufkes, Leiden University | T.M. de Meulemeester |
| Plants used for cultural bound diseases in children in Surinam | Tessa Vossen, Leiden University | T.R. van Andel |
| *In situ* sapphire growth in SE Sri Lanka | Jorien van der Wal, Utrecht University | L.M. Kriegsman |
| Identification of Dutch Andrena species by wing shape | Dexter Wessel, Leiden University | T.M. de Meulemeester |
| Development of self learning software to identify illegally traded orchids | Patrick Wijntjes, Leiden University | B. Gravendeel |
| Putting Species Distribution modelling to the test | Stephanie IJff, Utrecht University | H. ter Steege |
| Molecular and morphological diversity of Bryum across the Greenland Sea | Tintin Zhou, Leiden University | M. Stech |

# External evaluation

In September 2014, the Naturalis Sector Research and Education was peer-reviewed by a committee of international experts, covering the assessment period 2009-2013. This independent evaluation was commissioned by the Ministry of Education, Culture and Science (OCW) following the Dutch Standard Evaluation Protocol (SEP) 2009-2015. In addition to the evaluation criteria as indicated in the SEP, OCW added some supplementary questions to be addressed during the review. These additional questions primary focussed on the Naturalis development in light of its recent formation through the merger of four research institutes, its position towards the partner universities and its unique position in being both a leading research institute and leading museum with a word-class collection.

The evaluation was performed by an international external Evaluation Committee, which was asked to provide an impartial assessment and appraisal of the Sector Research and Education.

## Composition of the Evaluation Committee:

Prof. dr. Leo Beukeboom (chair)
Professor of Evolutionary Genetics, University of Groningen
Prof. dr. Stephen Blackmore
Former Regius Keeper of the Royal Botanic Garden Edinburgh
Prof. dr. Peter K.L. Ng
Professor of Systematics and Ecology, National University of Singapore, and Director of the Raffles Museum of Biodiversity Research, and the Tropical Marine Science Institute
Prof. dr. Katherine Willis
Professor of Biodiversity, University of Oxford and Director of Science at the Royal Botanic Gardens, Kew
Prof. dr. Geerat Vermeij
Distinguished Professor of Earth and Planetary Sciences, University of California
Prof. dr. Nico van Straalen
Professor of Animal Ecology, Vrije Universiteit Amsterdam

## Assessment procedure

The Standard Evaluation Protocol 2009-2015 requires the Evaluation Committee to assess four main aspects of the institute and its research. These are:

- *Quality* (sub-criteria: quality and scientific relevance of the research, leadership, academic reputation, organization, resources, and PhD training);
- *Productivity* (productivity strategy and the actual productivity);
- *Societal relevance* (such as societal quality, societal impact, valorisation);
- *Vitality and feasibility* (strategy such as strategic planning, SWOT-analysis, robustness and stability).

These four main assessment criteria were rated according to a five-point scale, as specified in the SEP (5 Excellent, 4 Very good, 3 Good, 2 Satisfactory, and 1 Unsatisfactory).

## Assessment

As part of the evaluation, Naturalis constructed a Self-evaluation report[1], and provided this to the Committee together with the progress report 2009-2012[2] and two bibliometric analyses by the Centre for Science and Technology Studies (CWTS)[3,4]. The Self-evaluation report dealt with Naturalis' objectives, composition, quality and scientific relevance, scientific output, earning capacity, academic reputation, links with academia and its role in other networks and organizations ('combining forces'), societal relevance, viability, and future strategy. It included statistics on the progress of PhD students (gender, year of enrolment, success rates

1. Smets, E. (ed.). 2014. Self-evaluation report – Research & Education 2009-2013. Naturalis Biodiversity Center, Leiden. 96 pp.
2. Duistermaat, L. & van Tol, J. 2014. Report 2009-2012 Naturalis Research and Education. Naturalis Biodiversity Center, Leiden. 224 pp.
3. Costas-Coesaña, R. 2014. Bibliometric research potential study of scholars affiliated with Naturalis Biodiversity Center, the Netherlands (2009-2011/12). CWTS, Leiden. 40 pp.
4. van Wijk, E. 2014. Bibliometric research evaluation study of the past performance of Naturalis Biodiversity Center, the Netherlands (2009-2011/12). CWTS, Leiden. 44 pp.

**Fig. 1.** From left to right: Prof. dr. Smets, Prof. dr. van Straalen, Prof. Ng., Dr. Dekker, Prof. dr. Vermeij, Mrs. Crul, Mrs. Vermeij, Prof. dr. Beukeboom, Prof. dr. Blackmore, Mrs. Romijn.

per year) and a Strengths Weaknesses Opportunities and Threats (SWOT) analysis. The Appendix contained a list of Science Citation index (SCI) publications in 2013.

Another important element of the evaluation was the site visit in Leiden which took place from September 17 (evening) until and including September 19. The site visit included interviews with members of the Management Team, the Supervisory Board, the Scientific Advisory Board, the senior research staff, the PhD candidates, the postdocs and the support staff, and visits to various research facilities (incl. laboratories and collection depots). All these elements were used by the Committee for their assessment.

At the end of the site visit, the committee presented their main preliminary findings to the Naturalis Director, Management team and staff. Early 2015 a finalized assessment was presented in the formal Evaluation report[5]. The overall assessment was as follows.

"The committee was very much impressed by the fast and successful merger of the different institutes and collections into a world-class institute, including implementation of very complex processes such as digitization of collections and change in management. Many institutes and museums around the world have tried to merge scientific research, education and collections, but very few have succeeded to any significant degree. Naturalis is therefore a role model in this respect and this makes it all the more important as a platform for future work." [– quote Evaluation Report].

5. Romijn, M. & Evaluation Committee. 2014. Evaluation report 2009-2013 of the Sector Research & Education. Naturalis Biodiversity Center, Leiden. 27 pp.

**Fig. 2.** Evaluation report presented to State Secretary Dekker (middle) by Director van Huis (left) and Chair of Naturalis Supervisory Board Brinkman (right).

Considered all the criteria and sub-criteria listed above, the Evaluation Committee graded the institute as indicated below (scale 5-1):

## Institute level

| | |
|---|---|
| **Quality** | **4,5** |
| A2 Leadership | 4,5 |
| A3 Academic Reputation | 4 |
| A4 Organization | 4 |
| A5 Resources | 5 |
| A6 PhD training | 4,5 |
| **Productivity** | **4** |
| B1 Productivity strategy | 3,5 |
| B2 Productivity | 4 |
| **Relevance** | **4,5** |
| C1 Societal relevance | 4,5 |
| **Vitality and Feasibility** | **3,5** |
| D1 Strategy | 3,5 |
| D2 SWOT analysis | 3,5 |
| D3 Robustness and stability | 4 |

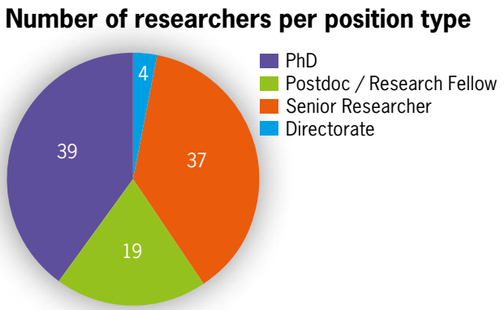



**Fig. 3.** Division of the staff between different types of position.

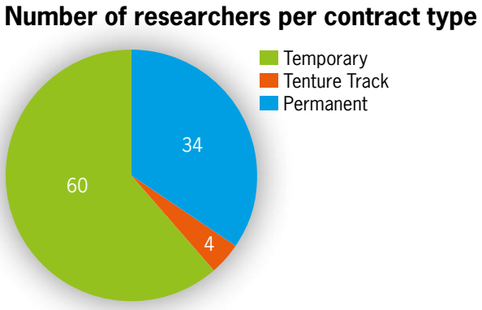



**Fig. 4.** Division of the staff between different contract types.

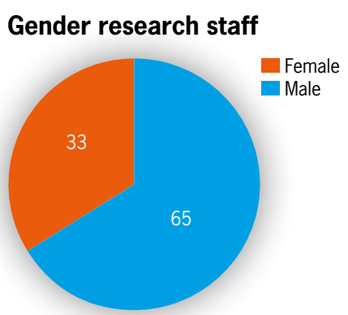



**Fig. 5.** Division of research staff based on gender.

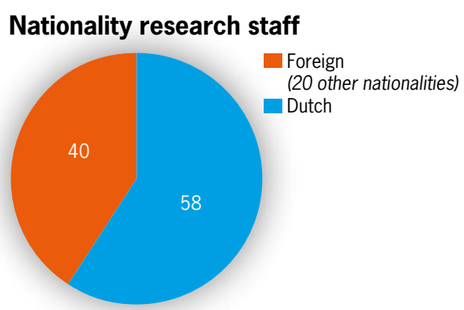



**Fig. 6.** Division of research staff based on nationality.

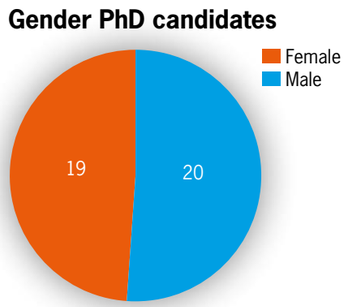



**Fig. 7.** Division of PhD candidates (39 persons) based on gender.

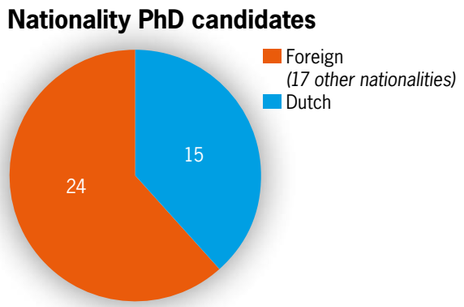



**Fig. 8.** Division of PhD candidates (39 persons) based on nationality.

In the Evaluation Report the committee also presented ten conclusions and six recommendations. The Management of Naturalis and the Sector Research and Education in particular addressed the issues raised and the recommendations proposed by the Evaluation Committee in an formal reply[6]. The very positive Evaluation Report and our reply were presented to the State Secretary for Education, Culture and Science, Sander Dekker, on 23 April 2015, completing the peer-review.
For the external evaluation Naturalis performed several analyses on different aspects of the Sector Research and Education, namely the publication output, the externally funded projects and the demography of the staff. Some of these analyses are presented graphically and described in the following paragraphs.

## Personnel in numbers

For the external evaluation, per 31 December 2013, the demography of the Naturalis research staff (98 when excluding the support staff) was analyzed (Figs 3-8). For PhD candidates there is a more balanced gender division (Fig. 7) and larger percentage of foreign nationalities (Fig. 8) than for research staff (resp. Figs 5 and 6).

6. Smets, E. (ed.). 2014. Reply to the evaluation report 2009-2013 of the Sector Research & Education. Naturalis Biodiversity Center, Leiden. 6 pp.



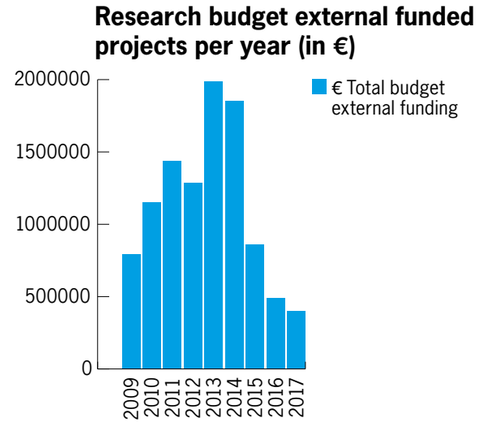



**Fig. 9.** Number of externally funded projects active in the particular year (e.g. a project that runs for two years is indicated to be active in each year).

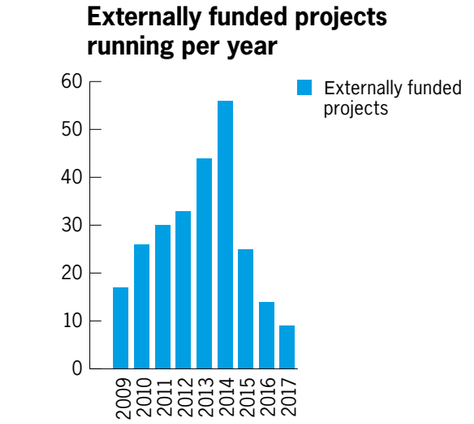



**Fig. 10.** Research budget per year available through external funding (e.g. a project that runs for two years the budget was equally divided over each project year).

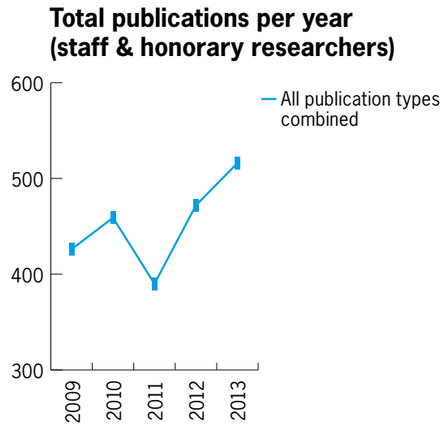



**Fig. 11.** Total numbers of publications of the research staff and honorary researchers combined. This concerns all types of publications (in SCI and non-SCI journals, chapters in books, books, etc.).

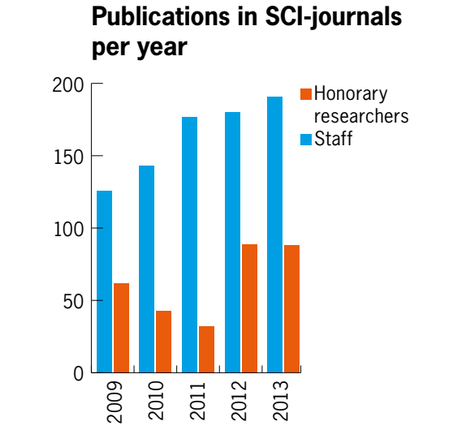



**Fig. 12.** Number of publications in SCI-journals separately for the research staff and honorary researchers.

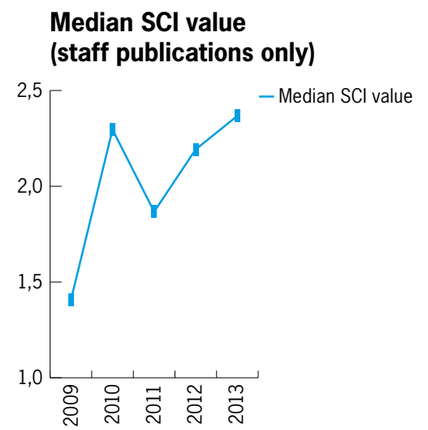



**Fig. 13.** Median SCI value for the SCI publications published by the research staff only.

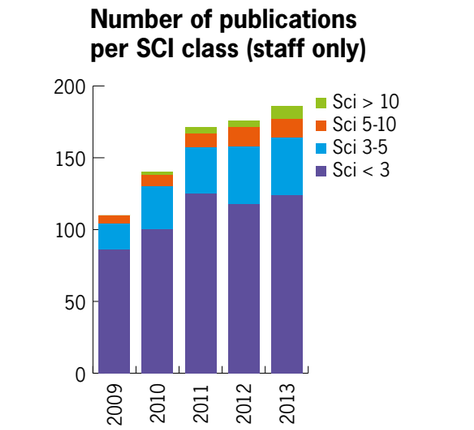



**Fig. 14.** SCI-publications of the research staff based on their SCI value.

# Research contributions

## Publications in numbers

For the external evaluation, per 31 December 2013, the Naturalis publications output was compared to the achievements in the previous years. Below some of the resulting graphs are presented. There is a steady increase over the last years with publishing 516 publications in total, an increase of 90 publications since 2009 (Fig. 11). Also, there is a yearly increase in the number of SCI-publications (Fig. 12). In 2013 there were 191 SCI publications by the staff and 88 by the honorary researchers. The large increase in the number SCI publications by the honorary researchers has largely been caused by a change in policy and positive encouragement towards publishing in SCI journals. For the median SCI value, outside a peak in 2010, again a steady yearly increase is seen (Fig. 13). In comparison to 2009, the median value has increased from 1,406 to 2,368 in 2013, well above the median values (2013) for biology (1,432), plant sciences (1,337), zoology (0,987), mycology (1,805) and geology (1,139). Finally, the number of publications in the journals with an SCI lower than 3 has remained rather constant over the last years, but that there has been an increase in the number of publications in higher impact journals (Fig. 14). So has the number of publications in journals with a SCI above ten has doubled from 2012 to 2013, while in 2009 the number of publications in this group was zero.

# Recognizing plants in a New World

**Tinde R. van Andel[1], Charlotte van 't Klooster[2], Diana Quiroz[3], Alexandra M. Towns[1], Sofie Ruysschaert[4] & Margot van den Berg[5]**

[1] *Naturalis Biodiversity Center, Leiden*
[2] *Medical Anthropology, University of Amsterdam*
[3] *Biosystematics, Wageningen University*
[4] *WWF Suriname, Paramaribo*
[5] *Institute for Linguistics, Utrecht University*

**Vernacular plant names provide insight into the process of useful plant species recognition, acquisition of new knowledge, and replacement of familiar useful species with new ones. This study tries to unravel the way in which the forced migration of nearly 11 million enslaved Africans to the Americas influenced their knowledge of plants. The combination of African, Amerindian and European words in one plant name illustrates the process of creolization and exchange of ethnobotanical information.**

Nearly 300,000 West and Central Africans were enslaved and brought to Suriname between 1658 and 1825, carrying with them little personal belongings but a rich cultural and botanical knowledge. Slave ships, however, also transported African food crops, medicinal plants, fodder and weeds to the Americas. In order to survive in the Neotropical jungle that was largely alien to them, enslaved Africans had to familiarize themselves with the American flora. The process of trying out unknown plants, recognizing familiar species, genera or families from Africa, learning new plants from Europeans or Amerindians and replacing African useful plants with American ones has hardly been documented.

## Local names hold the clue

We constructed a database of 2,350 vernacular names from Naturalis herbarium labels, literature (van 't Klooster *et al.*, 2003; Burkhill, 1985-2010), and recent ethnobotanical fieldwork in Suriname, Ghana, Benin, and Gabon. We traced the origin of Afro-Surinamese (Sranantongo and Maroon) plant names to those plant names used by local Amerindians, Europeans, and related groups in West and Central Africa. A strong correspondence in sound, structure, and meaning among Afro-Surinamese vernaculars and their equivalents in other languages for botanically related taxa was considered as evidence for a shared origin. For example, when the Gabonese Bapunu people use the name 'musobisobi' for the small tree *Trema guineensis*, and Aucan Maroons in Suriname call the related (and quite similar-looking) species *Trema micantha* 'misobisobi', we can conclude that they 'remembered' this (strictly Neotropical) species from Africa. In this way, we could determine which plants Africans recognized from their motherland on their arrival in the New World, and what plant names they learned from Europeans and Amerindians.

## Surinamese trees with African names

Many plants that came with the slave ships, such as okra, sesame, yam, and weeds like *Eclipta prostrata*, kept their African names in Suriname. Typical Amerindians domesticates (*Bixa orellana*) and wild plants frequently used by indigenous groups (e.g. *Siparuna guianensis*) that do not occur in Africa, were called by their Amerindian name. About 65% of the Afro-Surinamese plant names contained European lexical items, like 'weti baka' (white back) for the fern *Pityrogramma calomelanos* of which the leaves are white below. African slaves recognized a substantial part of the Neotropical flora. We found that 20% of Sranantongo plant names and 43% of plant names among Maroons, descendants of escaped slaves that live in the forested interior, contain elements strongly resembling West African plant names for related genera and families. The greatest correspondence was found among plant names from Gabon and Angola, the main areas where the Dutch purchased their slaves.

## Better chance for best botanists

Corresponding plant names across the Atlantic show that African-born slaves in Suriname immediately started to classify and name the Neotropical flora. Only they remembered what the African congenerics looked like. Our results suggest that Africans in Suriname, particularly escaped slaves living in inland forests, transferred their cultural botanical heritage to the New World. The combination of African, Amerindian and European words in one plant name illustrates the process of creolization and exchange of ethnobotanical information that has taken place. Quickly adapting oneself to a new environment was essential for the Maroon's successful flight to freedom. Our research (van Andel *et al.*, 2014) shows that by looking at herbarium labels, you can prove, even centuries later, that it were the best botanists (and those who stayed close to them) that stood a better chance to survive in the Surinamese jungle.



**Fig. 1.** No surprise that this Surinamese tree's got an African name: you can hardly notice the difference. (a) *Staudtia kamerunensis* var. *gabonensis*, mbona (Fang language, Gabon). Photo: http://congotrees.rbge.org.uk/, (b) *Virola surinamensis*, moonba (Saramaccan Maroon language, Suriname). Photo: Smithsonian Institute.

**Fig. 2.** *Commelina*, known in Ghana as 'onyame bewu na mawu' (Twi), meaning 'only if God dies, then I will die too'. The Sranantongo name 'Gado dede dan mi dede' signifies exactly the same. Photo: Wikipedia.

## References

van 't Klooster, C.I.E.A., Lindeman, J.C. & Jansen-Jacobs, M.J. 2003. Index of vernacular plant names of Suriname. *Blumea Supplement* 15: 1-322.

Burkill, H.M. 1985-2010. Useful plants of West Tropical Africa, Vol. 1-6. Kew: Royal Botanic Gardens.

van Andel, T.R., van 't Klooster, C.I.E.A., Quiroz, D., Towns, A.M., Ruysschaert, S. & van den Berg, M.C. 2014. Local plant names reveal that enslaved Africans recognized substantial parts of the New World flora. *PNAS* 111(50): E5346-E5353.

# Identification by genome weight

## *Cardamine hamiltonii* G. Don

**Gerard M. Dirkse[1], Ben J.M. Zonneveld[2] & Leni (H.) Duistermaat[2]**

[1] *Natuurmuseum Nijmegen*
[2] *Naturalis Biodiversity Center, Leiden*

**The flora of the Netherlands, although relatively very well known, continues to show new introductions. The identification of these exotic species is often severely hampered by the lack of monographic works, as is the case in Bitter-cresses (*Cardamine*, Brassicaceae). Here we report the identification by means of genomic weight of an Asian species naturalising in the Netherlands.**

Since a few years, a winter-flowering, almost glabrous and small-flowered *Cardamine* (Brassicaceae) is encountered in Nijmegen (the Netherlands) that cannot be identified with regional floras. This form lacks a leaf rosette, has leaves without auricles, 3-lobed leaflets, and flowers with 6 anthers (Fig. 1). Identification with standard floras always leads to *C. flexuosa* With., but plants do not fit there because of the absence of rosette leaves and other characters. Plants are similar to *C. hirsuta* L. in the lack of hairs. From literature it is known that *C. hirsuta* is strictly diploid, while *C. flexuosa* is strictly tetraploid (Lihová *et al*., 2006). Ploidy can be inferred from genome weight. Flow cytometry is a relatively simple method to measure this.
To determine the nature of these remarkable plants – if it is one of the two species, or perhaps the hybrid between the two – we collected material of all three forms (*C. flexuosa*, *C. hirsuta*, and the deviating form). We harvested of each of the 35 specimens fresh leaflets to establish the genome weight by flowcytometric analysis. Plants were pressed and dried to herbarium specimens for morphological analysis.

## Not a hybrid

Flowcytometric analysis reveals that the deviating form is not one of the species or hybrids known from our country (Fig. 2). The diploid *C. hirsuta* has an average genome weight of 0,48 pg/2C, and *C. flexuosa* of 1,15 pg/2C. The measured values of the two species are well separated. However, the unknown *Cardamine* (called *C. hamiltonii* in Fig. 2) shows an even higher genome weight of 1,70 pg/2C. We can conclude that the unknown *Cardamine* is neither *C. hirsuta*, nor *C. flexuosa*, but also not the hybrid between the two species. The measurements clearly indicate that we are dealing with another species, with a much higher genome weight corresponding with an octoploid genome. In the Netherlands, only *C. pratensis* has a similar genome weight (Table 1). Widening our scope from European to global we could match our form morphologically to an Asian species described as 'Asian flexuosa', a name already mentioned by Rutger Barendse on an internetforum for a record in Eindhoven (the Netherlands) in 2009. It is an octoploid species from Southeast Asia (Lihová *et al*., 2006). Similar plants have been reported from Germany, North America, Tenerife, Belgium and Spain. Differences with *C. flexuosa* and *C. hirsuta* include the absence of a rosette of leaves, glabrous leaf uppersides and short fruiting pedicels (2-6 mm long).

## Nomenclature

Recently, the Flora of North America recognized this taxon as *Cardamine flexuosa* subsp. *debilis* O.E.Schulz. However, treatment at species level is preferable. In his monography Schulz (1903) included several species as synonym under his newly described subspecies. The oldest name he mentioned, *C. debilis* D.Don is not available because it had been used for another species. For the second oldest, *C. hamiltonii* G.Don, we could not find any objections and therefore propose to use this name for plants that can be assigned to 'Asian flexuosa'. The taxonomy of Asian *Cardamine* is the subject of study of the group of Marhold. It is possible that from their research older synonyms emerge. One of the names for which they will check the type specimen is *C. obscura* Hornem. For the time being, however, *C. hamiltonii* is the best name available for this addition to the flora of the Netherlands.

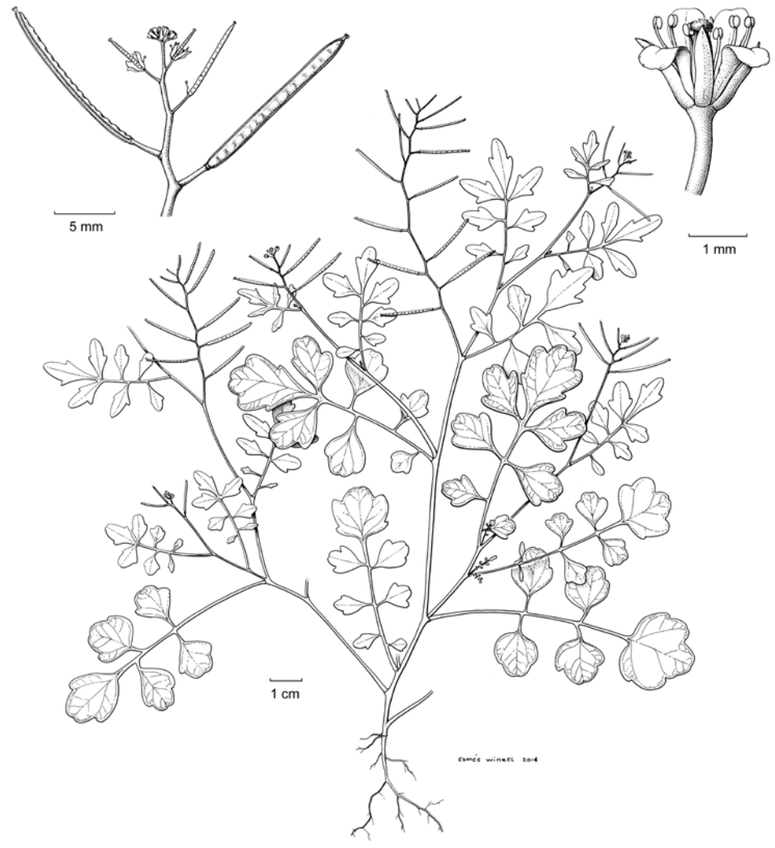



**Fig. 1.** Habit and details of inflorescence and flower of the deviating form of *Cardamine* (Brassicaceae). Illustration: Esmée Winkel.

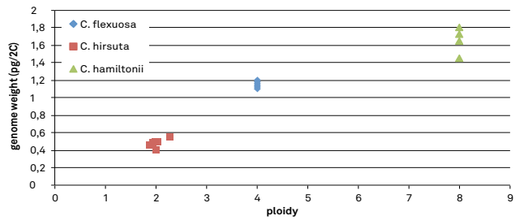



**Fig. 2.** Genome weight (pg/2C) to ploidy of three species of *Cardamine* in the Netherlands.

**Table 1.** Summary of genome weight of the species of *Cardamine* from the Netherlands, ranked according to their weight. The meassurements are performed by the second author (BZ).

| Species | DNA per nucleus (pg) |
|---|---|
| *Cardamine impatiens* | 0,43 |
| *Cardamine amara* | 0,48 |
| *Cardamine hirsuta* | 0,50 |
| *Cardamine flexuosa* | 1,15 |
| *Cardamine corymbosa* | 1,49 |
| *Cardamine hamiltonii* | 1,70 |
| *Cardamine pratensis* | 1,82 |
| *Cardamine bulbifera* | 4,33 |

## A recent introduction

From 2009 onwards, *Cardamine hamiltonii* has been reported from the Netherlands from many different locations, varying from between pavement, as a weed in pots and plant containers in garden centres, on cemeteries, in flowerbeds and green areas.
The species seems to be a recent introduction. The national collection of Naturalis harbours under *C. flexuosa*, the species it is most likely to be confused with, no specimens that could be assigned to *C. hamiltonii*. The pathway of introduction seems to be the import of (bonsai) plants from Southeast Asia. As part of the long-year project Q-bank - Invasive plant species information system, the import of bonsai plants is screened on weeds by the NVWA. The third author (LD), being one of the curators of this information system, was able to identify four of these weeds as *C. hamiltonii*.

## References

Dirkse, G.M., Zonneveld, B.J.M. & Duistermaat, H. 2015. *Cardamine hamiltonii* G.Don – Aziatische veldkers (Brassicaceae) in Nederland. *Gorteria* 37: 64-69.

Lihová, J., Marhold, K., Kudoh, H. & Koch, M.A. 2006. Worldwide phylogeny and biogeography of *Cardamine flexuosa* (Brassicaceae) and its relatives. *American Journal of Botany* 93: 1206-1221.

Schulz, O.E. 1903. Monographie der Gattung *Cardamine*. *Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie* 32: 280-623.

# A new *Sacoglottis* fruit
## Sea-beaners find living fossil

**Raymond W.J.M. van der Ham & Tinde R. van Andel**

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**Sea-beaners collect sea-beans, which are 'seeds and fruits that are carried to the ocean, often by freshwater streams and rivers, then drift with the ocean currents and (hopefully!) wash ashore' (www.seabean.com). In 2012 an unknown, conspicuously furrowed sea-bean found among debris from the Dutch North Sea coast was brought to our attention. The story below reminds of the discovery of the coelacanth *Latimeria chalumnae*, which belongs to an order (lobed-finned fish) that was thought to be extinct, but which was recognized on a fish market in South Africa in 1938 and eventually (1952) found near the Comoros in the Indian Ocean. In our case, the 'living fossil' appeared to represent a new *Sacoglottis* fruit, most similar to a fossil type.**

## Unidentified sea-bean

The sea-bean closely matched a drawing in Gunn & Dennis' World Guide to Tropical Drift Seeds and Fruits (1976). This picture was included in a plate illustrating mahogany (*Swietenia mahagoni*, Meliaceae) from Florida. However, after checking mahogany fruits it became clear that neither the unknown sea-bean nor the drawing could possibly represent a Meliaceae fruit. After some research, the sea-bean was identified as an endocarp (inner hard part) from a fruit of a Humiriaceae species. A well-known sea-bean from this almost completely Neotropical family is the blister pod (*Sacoglottis amazonica*). This endocarp, with large globular cavities (blisters), is one of the commonest tropical drift seeds in Florida. It is found on beaches around the North Atlantic Ocean and has occasionally also been collected in northwestern Europe. However, the unknown distinctly furrowed endocarp did not resemble the endocarp of *S. amazonica*, which is smaller and has a shallowly and irregularly furrowed surface. Consulting sea-beaner Ed Perry prompted the reply 'This is *Sacoglottis gabonensis*! ... related to blister pod ..., but much rarer in drift.' Following the included link to *S. gabonensis* on the sea-bean-website provided photographs of two furrowed endocarps from Florida, undoubtedly of the same species as our specimen. An image of an additional specimen from Bermuda accompanied Ed's reply. The African *S. gabonensis* is the only non-American species of the family Humiriaceae. Endocarps of this species are often found floating in rivers and on sea shores in the western part of tropical Africa. They are similar to those of *S. amazonica*, and consequently do not resemble the unknown furrowed endocarp either. A request on Facebook ('Sea Beans' group) generated reports of several more specimens of the furrowed endocarp, including one from the Gulf of Mexico, which raised the number of available specimens to nine.

## New fruit resembling fossil species

The furrowed endocarps are woody and 54 to 72 mm long. The 5 valves are filled with globular cavities and each bears 2 prominent ridges along a median furrow. Some endocarps are covered with marine epibionts, such as barnacles and bryozoans. The observed characters indicate that the endocarps should be attributed to the genus *Sacoglottis*. However, the conspicuous ridges and furrows were not found on any described endocarp of an extant *Sacoglottis* species. The furrowed endocarps do resemble the fossil endocarp species *Sacoglottis costata*, which is based on a single specimen of unspecified Tertiary age from Colombia. It is difficult to define an essential difference between the extant furrowed endocarps and the fossil *S. costata*. Therefore, we did not erect a new species, but preferred to indicate the furrowed endocarps as *Sacoglottis* cf. *costata*. As common name, we proposed 'furrowed blister pod' (van der Ham *et al.*, in press).

## From South America?

We can only speculate about the origin of the furrowed endocarps. Five specimens stranded in Florida indicate that the Caribbean Current might have been the way of transport. This would imply that the parent tree(s) of the furrowed endocarp, as *S. amazonica*, grow(s) somewhere in northeastern South America, within the reach of river systems like the Amazon, Orinoco, Magdalena, and Atrato Rivers. Transport from the Caribbean Current into the Gulf of Mexico, to Bermuda and via the Gulf Stream and the North Atlantic Drift to Europe is possible. Wherever occurring, the producer of the furrowed endocarps might be rare and threatened. In earlier times, its fruits might have been dispersed by a presently extinct megafauna, as known for several other large-fruited Neotropical species, including the humiriaceous *Duckesia verrucosa* and *Endopleura uchi*. In Africa, large mammals (e.g. elephants) are still known to forage for the fruits of *S. gabonensis*.

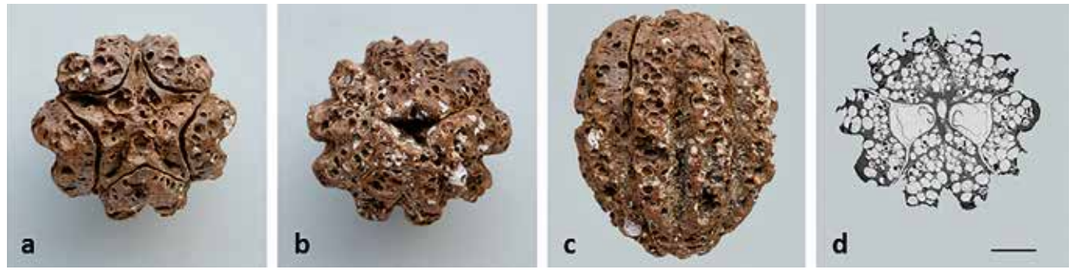


**Fig. 1.** *Sacoglottis* cf. *costata* endocarp from South Padre Island, Gulf of Mexico, Texas. a. Apical view. b. Basal view. c. Lateral view. d. Micro-CT cross-section showing two fertile locules with remnants of seeds, and many small globular cavities. Scale bar = 1 cm.

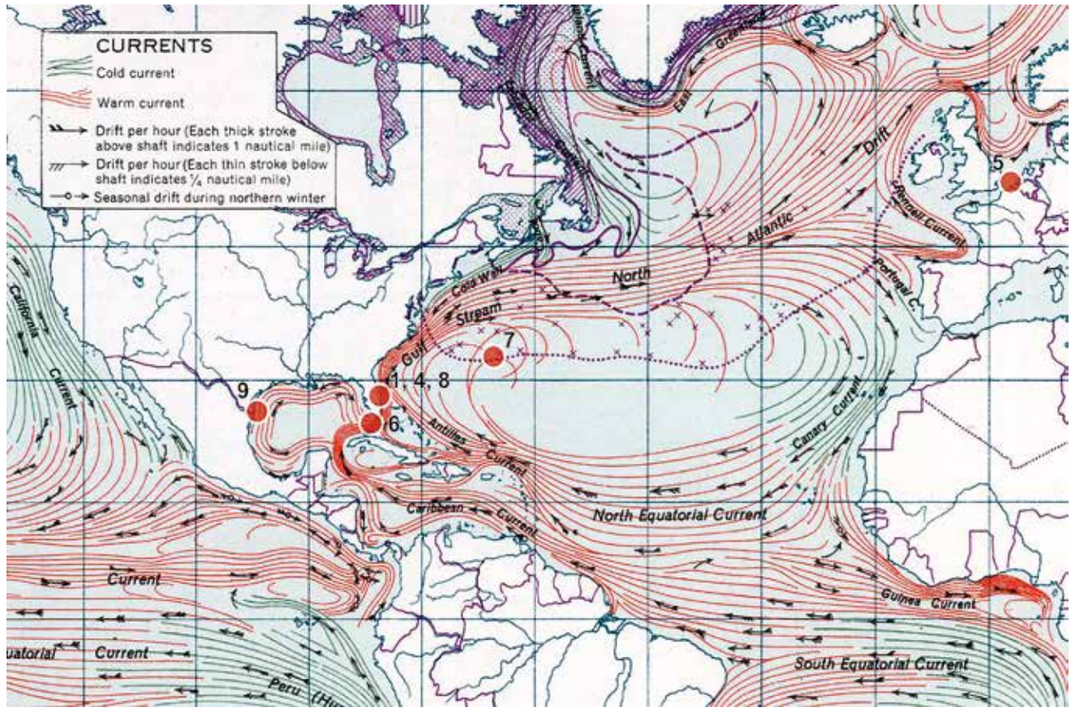


**Fig. 2.** Map showing localities of stranded *Sacoglottis* cf. *costata* endocarps. 1, 4, 8: SE coast of Florida; 5: Middeldiep, Zeeland, Netherlands; 6: Lignumvitae Key, Florida; 7: Bermuda; 9: South Padre Island, Texas. Localities of two specimens (2, 3) unknown.

## Reference

van der Ham, R., van Andel, T.R., Butcher, L., Hanno, I., Lambrechts, T., Lincicome, K., Mikkelsen, P., Mina, J., Patterson, B., Perry, E. & Romance, M. In press. Furrowed blister pods stranded on northern Atlantic Ocean coasts represent an undescribed *Sacoglottis* (Humiriaceae) endocarp most similar to the fossil *Sacoglottis costata*. *J. Bot. Res. Inst. Texas* 9.

# Plant drought stress
## The role of secondary woodiness

**Frederic P. Lens**

*Naturalis Biodiversity Center, Leiden*

**Current increases in global mean temperature and rainfall shifts are expected to leave large areas of the planet with less rain and extreme drought events. Forests and crops thus become highly vulnerable as extreme droughts hamper plant growth and survival. This study wants to investigate whether there is a correlation between secondary woodiness and drought stress resistance. Therefore, water transport measures in stems are carried out to estimate differences in drought resistance between herbaceous species and their closely related woody descendants.**

## Disruption of water transport

Understanding patterns of drought-induced tree mortality and crop productivity decline requires substantial knowledge of physiological mechanisms of plant drought resistance. This is especially critical with respect to hydraulic failure, which corresponds to the disruption of water transport in air-filled (= embolized) vessels when plants are exposed to water stress (Lens *et al*., 2013*b*). Species that are resistant to embolism are less prone to hydraulic failure because their xylem sustains more negative pressures without lethal levels of air bubble formation. Interestingly, most trees operate very close to their embolism threshold and thus appear highly vulnerable to drought-induced mortality under drier global change conditions. Embolism resistance is controlled by a complex interaction of wood anatomical features. One of the hydraulically most important wood features are fine-scale modifications of intervessel pits that can only be studied with a transmission electron microscope (Lens *et al*., 2013*b*). Another crucial adaptation leading to greater embolism resistance is increased wood formation in the stem.

## Vulnerability curves

Woody phenotypes that are derived from herbaceous relatives have been experimentally proven to be linked with increased embolism resistance in *Arabidopsis*, as shown in so-called vulnerability curves in which the percentage loss of hydraulic conductivity is plotted against the pressure needed to induce embolisms (Fig. 1). The pressure inducing 50% loss of conductivity, or P50, is often used as a reliable proxy for drought stress resistance and is species specific. The more negative the P50, the more embolism resistant the species is.

## Drought stress and wood formation

The majority of shifts from herbs towards woody shrubs in angiosperms has taken place in dry regions (Lens, unpublished data), which emphasizes the potential role of drought stress in relation to increased woodiness. These distribution data confirm our hydraulic experiments in *Arabidopsis* (Fig. 1) and in the daisy lineage (Lens, unpublished data). To provide more evidence for this novel correlation between drought stress and wood formation, Lens wants to focus on the Canary Island flora, which is known as the only secondary woodiness hot spot within Europe (Lens *et al*., 2013*a*), and the herbaceous relatives from the European mainland. We found that 220 secondarily woody species from 38 independent angiosperm lineages are native to this archipelago, and most of them grow in the dry coastal regions (Fig. 2). The Canary Island flora therefore represents a unique case study, which will be further investigated by a new PhD student who will start in May 2015.

## Other potential factors

We are also eager to explore other potential factors that play a role in wood formation. For example, the secondarily woody *Begonia* species on Mount Kinabalu grow on very wet tropical mountain peaks with poisonous ultramaphic soils (Kidner *et al*., in press; Fig. 3). Furthermore, many of the native woody oceanic island endemics are released from seasonal growth conditions (especially frost), showing the potential effect of temperature as well in relation to wood formation. To dig deeper into the abiotic variables that could cause wood formation in otherwise herbaceous angiosperms, we are performing niche modeling analyses on various groups to assess which specific environmental variables can be linked to the secondarily woody habit niche.

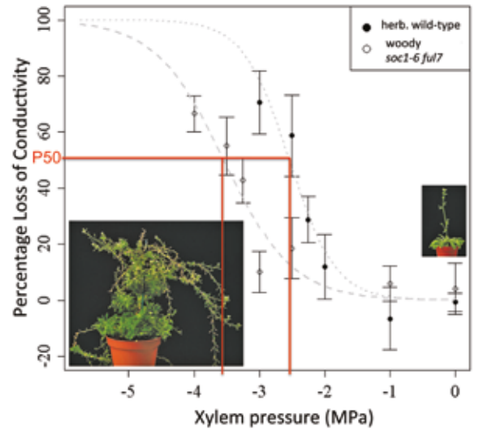


**Fig. 1.** Vulnerability curves (VC) showing more embolism resistance in woody *Arabidopsis* mutant compared to herbaceous wild-type (picture adapted from Lens *et al*., 2013*b*).


**Fig. 2.** The native Canary Island flora comprises in total 38 shifts to insular woodiness, positioned in the red branches of the angiosperm phylogeny.

**Fig. 3.** Two new *Begonia* species found during Mount Kinabalu expedition: a lowland herbaceous species (above: < 1000 m. asl) and a secondarily woody highland species (below: > 2000 m. asl).

## References

Kidner, C., Groover, A., Thomas, D., Emelianova, K., Soliz-Gamboa, C. & Lens, F. In press. First steps in studying the origins of secondary woodiness in *Begonia* (Begoniaceae): combining anatomy, phylogenetics, and stem transcriptomics. *Biological Journal of the Linnean Society*.

Lens, F., Davin, N., Smets, E. & Del Arco, M. 2013*a*. Insular woodiness on the Canary Islands: remarkable case of convergent evolution. *International Journal of Plant Sciences* 174: 992-1013.

Lens, F., Tixier, A., Cochard, H., Sperry, J.S., Jansen, S. & Herbette, S. 2013*b*. Embolism resistance as a key mechanism to understand plant adaptive strategies. *Current Opinion in Plant Biology* 16: 287-292.

# Amazonian bryophytes
## up in the canopy

**Sylvia Mota de Oliveira & Hans ter Steege**

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**In tropical rain forests, most of the bryophyte diversity is found on the bark of trees. As epiphytes, these small plants can inhabit all forest strata, from the understory to the canopy. In this research we investigated the distribution patterns of epiphytic bryophyte communities at local and geographical scales, with a standard sampling procedure carried out in 9 sites across 2,800 km of Amazonian lowlands. This was the first large scale inventory of the Amazonian bryoflora, including the canopy. The most exciting question of our work was to which extent the processes of environmental filtering and dispersal limitation shape bryophyte species composition on different spatial scales.**

The vertical microenvironmental gradient established from the bottom to the top of the canopy trees was the main driver of the local turn-over in community composition. More than one-third of the species showed a significant preference for a given height zone on the tree. Despite of the high species turn-over related to environmental conditions at local scale, the great majority of the species can be found everywhere across 2,800 km from east to west of the Amazon forest. Different than observed for tree species, bryophytes do not show any geographical pattern across the basin and no relationship with gradients of rainfall or dry season length. Apparently, the full range of the environmental gradient that matter for epiphytic bryophytes – light intensity and moisture – can be observed on a single tree. Once this gradient is repeated in every canopy tree across the basin, no large scale geographical pattern emerge. Specific site conditions, however, do influence species composition. A small increase in altitude clearly shaped the bryoflora of two of the sampling sites – Tiputini, in Ecuador, and Saul, in French Guiana. These localities, far distant from each other, have the highest species richness and a closely related species composition, with the occurrence of some sub-montane and/or Andean elements, such as the genera *Porotrichum* and *Neckeropsis* and an increased frequency of the genus *Plagiochilla*.

The framework of the Neutral Theory of Biogeography and Biodiversity was used to estimate recruitment rates. Using sub-sets of our dataset and the concepts of metacommunity, local community and habitat species pool, we showed that establishment limitation had a clear variation along the height zones – being strongest at the two extremes of the gradient, i.e. the base of the tree and the outer canopy. On the other hand, dispersal limitation – expected to be reduced in the canopy, showed similar strength along the height zones.

## The dispersal puzzle

Dispersal patterns of epiphytic bryophytes in the Amazon are thought-provoking. The current hypothesis is that species inhabiting the canopy have higher chances of engaging in long-distance dispersal events, due to the greater exposure to wind currents. Because communities from the same height zone on a tree are subjected to the same environmental filtering, higher dispersal would lead to higher similarity values between communities. At a local scale, similarity values obtained among outer canopy communities were indeed the highest recorded, lending support to the hypothesis of facilitated dispersal in the canopy. At a larger scale, contrary to the expectation, recruitment rates estimated to represent the immigration from the metacommunity to the local communities in each site – a process that takes place through long distance dispersal – indicated that the intensity of dispersal events in canopy communities is not higher than in other height zones on the host tree. Population studies on dispersal frequency and dispersal modes of canopy and understory species will help us understand why height zone has a stronger effect on dispersal at local scale. Do species from different habitats also show different dispersal strategies? Is the frequency of production of sexual and/or asexual propagules related to the frequency of long-distance dispersal events in the different taxa? These are the questions that will guide our future work.

**Fig. 1.** Canopy opening in Cuieiras Biological Station, Central Amazon, Brazil.

**Fig. 2.** A liverwort species of the genus *Plagiochila*, growing on a tree branch.

## References

Acebey, A., Gradstein, S.R. & Krömer, T. 2003. Species richness and habitat diversification of bryophytes in submontane rain forest and fallows of Bolivia. *Journal of Tropical Ecology* 19(01): 9-18.

Gradstein, S.R. & Costa, D.P. 2003. Hepaticae and Anthocerotae of Brazil. New York, The New York Botanical Garden Press.

Mota de Oliveira, S. & ter Steege, H. 2014. Bryophyte communities in the Amazon forest are regulated by height on the host tree and site elevation. *Journal of Ecology*. Early view doi: 10.1111/1365-2745.12359.

# Dipterocarp rainforests covered Sundaland at Quaternary glacial maxima

**Niels Raes[1], Charles H. Cannon[2, 3], Robert J. Hijmans[4], Thomas Piessens[5], Leng Guan Saw[6], Peter C. van Welzen[1, 5] & J.W. Ferry Slik[7]**

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[2] *Xishuangbanna Tropical Botanical Garden, Yunnan, China*
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**The effect of glacial cycles on South-East Asian (SEA) rainforest during the Quaternary is unresolved. Some historical evidence suggests that rainforests were confined to small refugia during glacial maxima, but dynamic vegetation models suggest that evergreen rainforests were widespread. Because Dipterocarpaceae dominate current SEA rainforests, their distributions closely reflect general rainforest extent. Here, we use an extensive georeferenced database of collection records for 317 Dipterocarpaceae species to model their climatic niches, based on current climatic conditions. These distribution models were then hind-cast onto historical climatic conditions of the last glacial maximum. The results indicate that central Sundaland, exposed because of lower sea levels at glacial maxima, harbored suitable environmental conditions for Dipterocarpaceae and was probably covered by rainforest.**

Until recently there was little conclusive evidence concerning the nature of vegetation that covered Sundaland at Quaternary glacial maxima, despite the fundamental importance of environmental history for diversity and conservation. At the glacial maxima of the Quaternary sea-levels were 120 m lower than today which exposed the landmass between the islands of Borneo, Sumatra, Java and the Malay Peninsula, a region known as Sundaland. It is since the discovery of 1 pollen core from the Malay Peninsula and 6 cores from southern Borneo that were all indicative for drier vegetation types and date back to the Pleistocene that the existence of a transequatorial savannah corridor on Sundaland at glacial maxima was proposed. The proposed savannah corridor ran from Thailand over the exposed Sunda shelf to the current island of Java and was supposedly used as dispersal route for the large megafauna, but also for humans. However, a recent analysis using a vegetation model in combination with paleoclimatic data proposed that the forests of South East Asia are currently in a refugial state, and that the distribution of lowland evergreen rainforest was much wider distributed on Sundaland at Quaternary glacial maxima.

## Estimating niche dimensions

The rainforest of South East Asia are characterized by tree species that belong to the plant family of the Dipterocarpaceae that dominate these forests in number of stems but also in biomass. With recent efforts to digitize the botanical collections of Naturalis Biodiversity Center, the Forest Research Institute of Malaysia (FRIM), and Singapore Botanical Gardens it is now possible to plot the current distribution of these species on the map of South East Asia. With the development of species distribution modelling techniques that relate the presence of species from the collection records to abiotic bioclimatic conditions it is now possible to estimate a species bioclimatic niche. Once the niche dimensions are estimated, i.e. a species occurs at sites with mean annual temperature between 20-25°C and precipitation in the driest month exceeding 200 mm, it is possible to identify all localities that fulfil the niche requirements. That is not only possible for current bioclimatic conditions, but also for bioclimatic conditions at the last glacial maximum using paleoclimatic model predictions.

## Unlikely savannah corridor

We used the digitized collection records from 362 Dipterocarp species and bioclimatic data describing the present conditions and the bioclimatic conditions predicted by 2 paleoclimatic models (CCSM4 and MIROC-ESM) that describe conditions at the last glacial maximum (LGM). The distributions

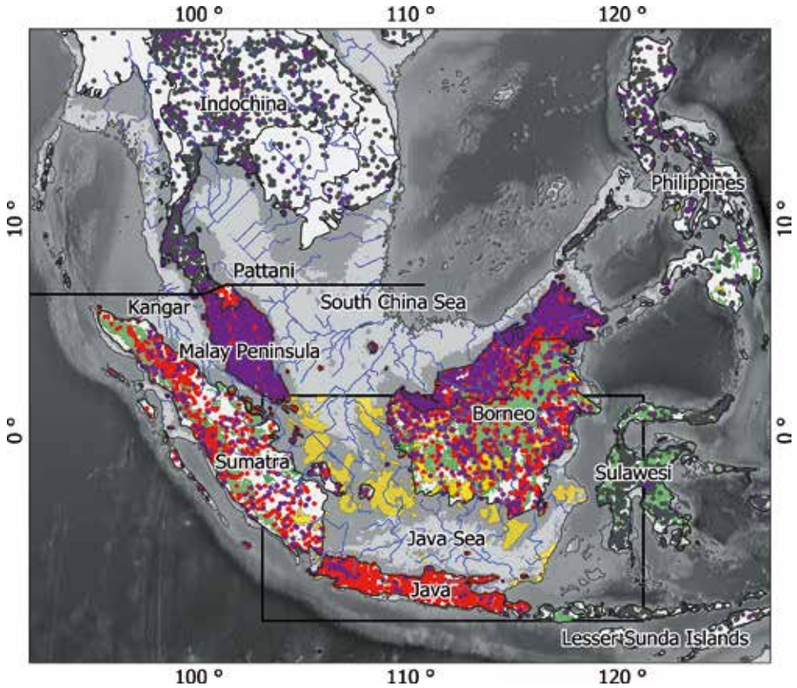


**Fig. 1.** Collections of all Dipterocarpaceae (purple), other botanical collections on Sundaland (red), and remaining botanical collections outside Sundaland (dark grey).

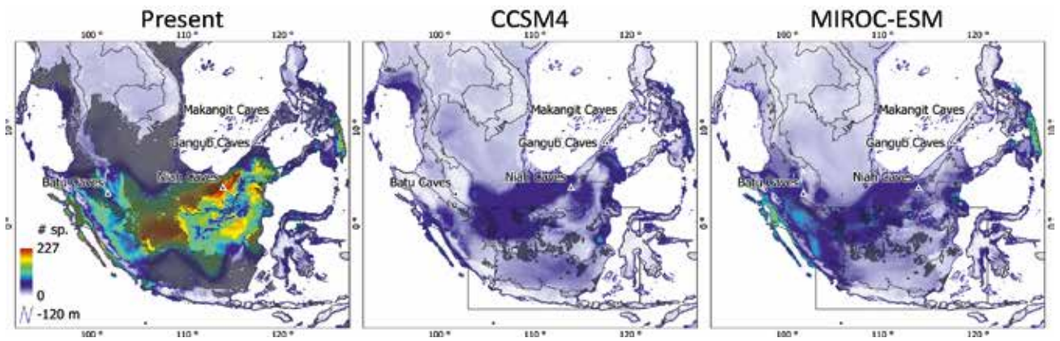


**Fig. 2.** Current and past Dipterocarp richness at the last glacial maximum according to hindcast results to paleoclimatic models CCSM4 and MIROC-ESM.

models of the 362 species were calibrated using the current bioclimatic conditions and subsequently hindcast on the LGM conditions predicted by 2 paleoclimatic models. This allowed assessing whether the bioclimatic conditions on Sundaland were suitable to sustain Dipterocarp rainforest at the LGM. The results indicate that central Sundaland was likely covered with Dipterocarp rainforest, and that the presence of a transequatorial savannah corridor at the LGM is unlikely. At the same time the results show that the extent of Dipterocarp rainforest was reduced compared to the present extent, despite the fact that large parts of Sundaland are presently flooded as a result of higher sea-levels.

## Reference

Raes, N., Cannon, C.H., Hijmans, R.J., Piessens, T., Saw, L.G., van Welzen, P.C. & Slik, J.W.F. 2014. Historical distribution of Sundaland's Dipterocarp rainforests at Quaternary glacial maxima. *Proceedings of the National Academy of Sciences* 111: 16790-16795.

# Plotting the rainforest
## The Amazon Tree Diversity Network

**Hans ter Steege**

*Naturalis Biodiversity Center, Leiden*

**Much remains unknown about the Amazonian flora, the richest assemblage of plant species on Earth. Tree inventories carried out over the past two decades have helped improve our understanding of regional scale patterns of distribution and abundance in Amazonian tree communities, but similar advances at the basin-wide scale remain scarce. Until recently we did not know how many tree species occur in the Amazon, how many tree species were recorded to date, how those species are distributed across the basin, and in what regions or forest types they are rare or common. So uncertain were patterns at the largest scales that even the simplest question of all - what is the most common tree species in the Amazon? - was never addressed in the scientific literature, much less answered.**

The Amazon Tree Diversity Network is a loose network of ca 170 botanists and ecologists, maintaining a growing plot database now close to 1,600 plots in the 9 countries that have Amazonian rainforest, coordinated from Naturalis Biodiversity Center. Our first publication in 2000 (ter Steege *et al.*, 2000) marked the start of the network. Since then the number of plots has been growing steadily and updates of our maps have been published regularly on the web (http://web.science.uu.nl/Amazon/ATDN/), in various papers and now appear in text books. The database and/or its plots have been helpful in joint publications with other research groups and have been used in species estimation, carbon dynamics, remote sensing, leaf morphology, leaf physiology. Recently, we reported on the interplay between the geological history of the Amazon and it's diversity (Hoorn *et al.*, 2010).

## 1.4% Hyperdominant species

Our first analysis of Amazon wide structure of composition was published in 2013 (ter Steege *et al.*, 2013). Our analyses suggest that lowland Amazonia harbors 3.9 × 1,011 trees and ~16,000 tree species. We found 227 'hyperdominant' species (1.4% of the total) to be so common that together they account for half of all trees in Amazonia, whereas the rarest 11,000 species account for just 0.12% of trees. Most hyperdominants are habitat specialists that have large geographic ranges but are only dominant in one or two regions of the basin, and a median of 41% of trees in individual plots belong to hyperdominants. A disproportionate number of hyperdominants are palms, Myristicaceae, and Lecythidaceae.

## Need for testing underlying causes

Finding that Amazonia is dominated by just 227 tree species implies that most biogeochemical cycling in the world's largest tropical forest is performed by a tiny sliver of its diversity. The causes underlying hyperdominance in these species remain unknown. Both competitive superiority and widespread pre-1492 cultivation by humans are compelling hypotheses that deserve testing. Although the data suggest that spatial models can effectively forecast tree community composition and structure of unstudied sites in Amazonia, incorporating environmental data may yield substantial improvements. An appreciation of how thoroughly common species dominate the basin has the potential to simplify research in Amazonian biogeochemistry, ecology, and vegetation mapping. Such advances are urgently needed in light of the >10,000 rare, poorly known, and potentially threatened tree species in the Amazon.

## References

Hoorn, C., Wesselingh, F.P., ter Steege, H., Bermudez, M.A., Mora, A., Sevink, J., Sanmartin, I., Sanchez-Meseguer, A., Anderson, C.L., Figueiredo, J.P., Jaramillo, C., Riff, D., Negri, F.R., Hooghiemstra, H., Lundberg, J., Stadler, T., Sarkinen, T. & Antonelli, A. 2010. Amazonia Through Time: Andean Uplift, Climate Change, Landscape Evolution, and Biodiversity. *Science* 330: 927-931.

ter Steege, H., Pitman, N.C.A., Sabatier, D., Baraloto, C., Salomão, R.P., Guevara, J.E., Phillips, O.L., Castilho, C.V., Magnusson, W.E., Molino, J.-F., Monteagudo, A., Núñez Vargas, P., Montero, J.C., Feldpausch, T.R., Coronado, E.N.H., Killeen, T.J., Mostacedo, B., Vasquez, R., Assis, R.L., Terborgh, J., Wittmann, F., Andrade, A., Laurance, W.F., Laurance, S.G.W., Marimon, B.S., Marimon, B.-H., Guimarães Vieira, I.C., Amaral, I.L., Brienen, R., Castellanos, H., Cárdenas López, D., Duivenvoorden, J.F., Mogollón, H.F., Matos, F.D.d.A., Dávila, N., García-Villacorta, R., Stevenson Diaz, P.R., Costa, F., Emilio, T., Levis, C., Schietti, J., Souza, P., Alonso, A., Dallmeier, F., Montoya, A.J.D., Fernandez Piedade, M.T., Araujo-Murakami, A., Arroyo, L., Gribel, R., Fine, P.V.A., Peres, C.A., Toledo, M., Aymard, G.A., Baker, T.A., Cerón, C., Engel, J., Henkel, T.W., Maas, P., Petronelli, P., Stropp, J., Zartman, C.E., Daly, D., Neill, D., Silveira, M., Paredes, M.R., Chave, J., Lima Filho, D.d.A., Jørgensen, P.M., Fuentes, A., Schöngart, J., Cornejo Valverde, F., Di Fiore, A., Jimenez, E.M., Peñuela Mora, M.C., Phillips, J.F., Rivas, G., van Andel, T.R., von Hildebrand, P., Hoffman, B., Zent, E.L., Malhi, Y., Prieto, A., Rudas, A., Ruschell, A.R., Silva, N., Vos, V., Zent, S., Oliveira, A.A., Schutz, A.C., Gonzales, T., Trindade Nascimento, M., Ramirez-Angulo, H., Sierra, R., Tirado, M., Umaña Medina, M.N., van der Heijden, G., Vela, C.I.A., Vilanova Torre, E., Vriesendorp, C., Wang, O., Young, K.R., Baider, C., Balslev, H., Ferreira, C., Mesones, I., Torres-Lezama, A., Urrego Giraldo, L.E., Zagt, R., Alexiades, M.N., Hernandez, L., Huamantupa-Chuquimaco, I., Milliken, W., Palacios Cuenca, W., Pauletto, D., Valderrama Sandoval, E., Valenzuela Gamarra, L., Dexter, K.G., Feeley, K., Lopez-Gonzalez, G. & Silman, M.R. 2013. Hyperdominance in the Amazonian Tree Flora. *Science* 342: 1243092.

ter Steege, H., Sabatier, D., Castellanos, H., van Andel, T.R., Duivenvoorden, J.F., De Oliveira, A.A., Ek, R., Lilwah, R., Maas, P. & Mori, S. 2000. A regional perspective: Analysis of Amazonian floristic composition and diversity that includes the Guiana Shield. *Tropenbos Series* 18: 19-34.


**Fig. 1.** Amazonia showing the location of the Amazon Tree Diversity Network (ATDN) plots that contributed data to the analysis of hyperdominance and hyperdiversity in the Amazon. Source: ter Steege *et al.*, 2013. *Science* 342: 1243092.

**Fig. 2.** *Cecropia latilobia* dominates large stretches of forest along the fertile and highly dynamic, riverbanks of the Amazon river (Ilha Marchantaria, Brazil 2013).

**Fig. 3.** Sunset over the forest of Caxiuana National Forest (Brazil, 2014).

# Historical biogeography
## Congruence in sister genera

**Peter C. van Welzen[1], Joeri S. Strijk[2], Johanna H.A. van Konijnenburg-van Cittert[1], Monica Nucete[1] & Vincent S.F.T. Merckx[1]**

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**The sister genera *Macaranga* and *Mallotus* (Euphorbiaceae) share much genetic information, which results in similar evolutionary developments in both genera. They show the same radiation in ecological niches and in a 'synchronised' dispersal via similar pathways. The major difference is that *Mallotus* speciated less often than *Macaranga*, resulting in more widespread species in *Mallotus* and more endemic species in *Macaranga*.**

How congruent are sister taxa? The sister genera *Macaranga* and *Mallotus* contain mainly Asian species, but both distributions range from Africa and Madagascar via SE Asia to Australia and the W Pacific. *Macaranga* is far more species rich than *Mallotus* (280 versus 135 species), but *Mallotus* has more widespread taxa and a slightly wider distribution than *Macaranga* (Japan included). Both genera have a remarkable correlation between ecology and leaf shape. Species with narrow, small leaves are found in primary tropical rain forests, while species with large, broad leaves are pioneer species, which quickly invade open spaces, shade out the soil and facilitate seeds of primary forest trees to germinate. This group of taxa is of extreme importance in forest turnover. The majority of species facilitates ants to protect the leaves and flowers by offering them nectar via extrafloral nectaries and glandular scale hairs to even allowing them to nest in the pith of branches.

## Dispersal through stepping stones

The phylogeny of both genera (e.g., Kulju *et al.*, 2007) was dated via the program BEAST, whereby carefully selected fossils, those which could be identified correctly and related to the cladogram, acted as calibration points (Nucete *et al.*, 2012) together with a maximum age derived from literature.

The dated phylogeny formed the input for a historical biogeographic analysis with the program RASP (S-DIVA option). The resulting areacladograms (see Fig. 1 for that of *Macaranga*; van Welzen *et al.*, 2014) show highly similar patterns that correspond with the plate tectonic configurations of areas at various geological times. The ancestor of both genera existed ca 60 Ma on Borneo, where ca 25 Ma later both genera originated. The first speciation events were on Borneo followed by dispersal to SE Asia mainland. As soon as stepping stones were available dispersal to New Guinea and Australia occurred (between 33 and 22 Ma), whereby the two genera were one of the early arrivals in Australia from W Malesia. They confirm the picture that the direction of dispersal was mainly towards Australia and not from Australia. Dispersal towards E Malesia and Australia occurred several times, sometimes on clade level, sometimes on the individual species level like many of the widespread taxa in *Mallotus*.

## Disjunct distribution

Both genera show a Palaeotropical intercontinental disjunctions (PIDs), a disjunct distribution between Africa and Asia (see article in this report: 'Understanding disjunct distributions between Africa and Asia'). The cladograms of both genera show that dispersal occurred from Asia to Africa around 22 Ma in the early Miocene. Two species (or their ancestors) of *Mallotus* individually dispersed to Africa and *Macaranga* developed even a complete clade in Africa, Magadascar and the Mascarenes. Within the African *Macaranga* clade one species re-dispersed to S Asia.

## Dispersal routes

In the early Miocene the climate was warmer and wetter in S Asia and the Arabian Peninsula, consisting of parallel islands, provided stepping stones between Asia and Africa. It is likely that both genera dispersed from India via SW Asia to Africa over land. The sister species of the re-dispersed *Macaranga* species occurs in Madagascar and the Mascarenes, therefore it is likely that this dispersal route was along the island chains in the Indian Ocean, perhaps

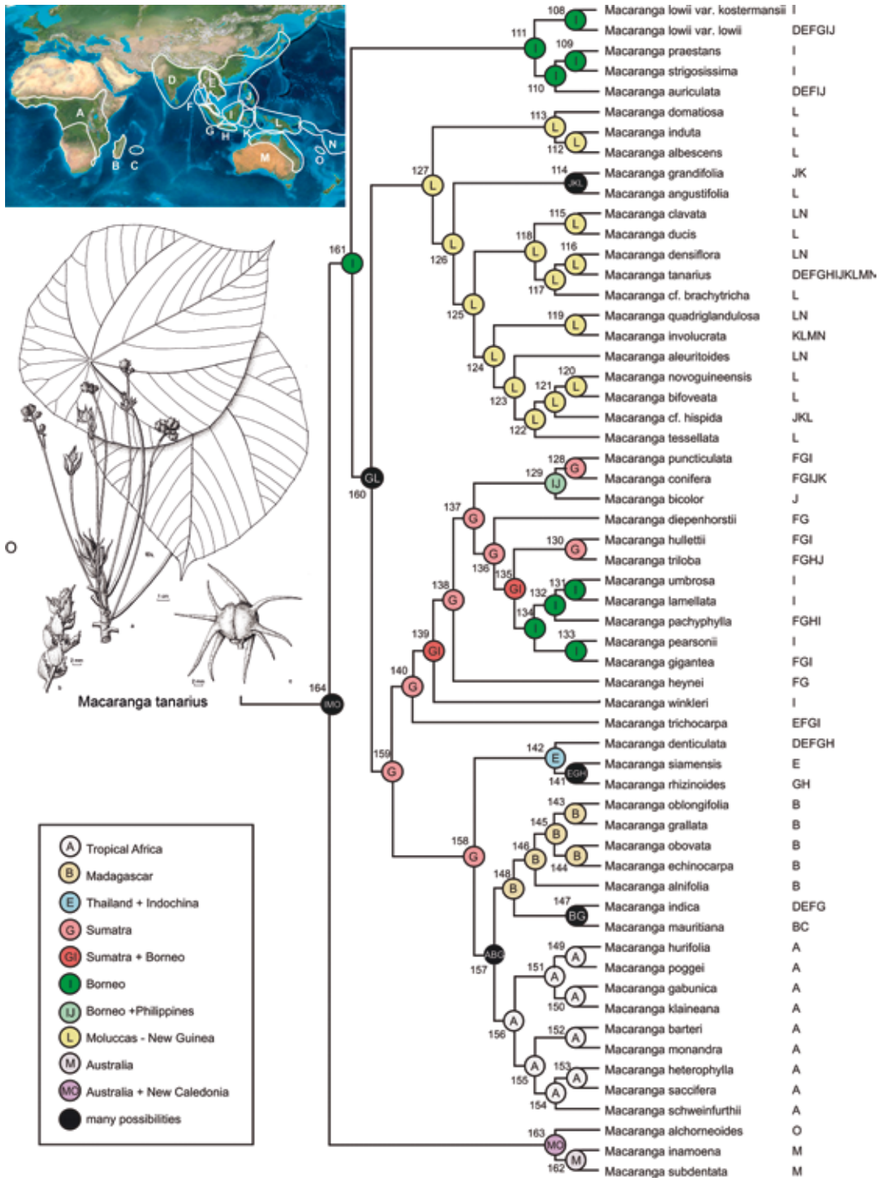


**Fig. 1.** Areacladogram of *Macaranga*. Abbreviations in circles indicate distributions of ancestral species. The areas are explained in the map.

even as late as during glacial periods. The fruits of *Macaranga* and *Mallotus* can 'explode' and shed the seeds around, but the fruits are also often eaten by birds and perhaps also bats, whereby the glandular scale hairs or extrafloral nectaries on the fruits may provide the reward for the disperser.

## References

Kulju, K.K.M., Sierra, S.E.C., Draisma, S.G.A., Samuel, R. & van Welzen, P.C. 2007. Molecular phylogeny of *Macaranga*, *Mallotus*, and related genera (Euphorbiaceae s.s.): insights from plastid and nuclear DNA sequence data. *American Journal of Botany* 94: 1726-1743.

Nucete, M., van Konijnenburg-van Cittert, J.H.A. & van Welzen, P.C. 2012. Fossils and palaeontological distributions of *Macaranga* and *Mallotus* (Euphorbiaceae). *Palaeogeography, Palaeoclimatology, Palaeoecology* 353-355: 104-115.

van Welzen, P.C., Strijk, J.S., van Konijnenburg-van Cittert, J.H.A., Nucete, M. & Merckx, V.S.F.T. 2014. Dated phylogenies of the sister genera Macaranga and Mallotus (Euphorbiaceae): Congruence in historical biogeographic patterns? *PLoS ONE* 9: e85713.

# Understanding disjunct distributions between Africa and Asia

**Yotsawate Sirichamorn[1], Bhanumas Chantarasuwan[1], Daniel C. Thomas[1], Frits A.C.B. Adema[1], Nina Rønsted[2], Finn Kjellberg[3] & Peter C. van Welzen[1]**

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**Palaeotropical Intercontinental Disjunctions (PIDs) are disjunct distributions between Africa and Asia. Taxa are generally present in central Africa and Madagascar, absent in SW Asia and S Asia and present again from India throughout the rest of SE Asia, Malesia up to Australia and the W Pacific. Various plant groups show different pathways to pass the disjunction between Africa and Asia. The legume genus *Aganope* indicates vicariance between Africa and Asia. The legumes *Brachypterum scandens* and *Derris trifoliata* display long distance dispersal along the coastal mangrove vegetations, while *Ficus* subsection *Urostigma* rafted with India to Asia and redispersed to Africa via the coastal regions.**

PIDs are a distribution pattern, which is difficult to explain. They appear to be relict Gondwanan distributions, but generally dated phylogenies show that the taxa originated far after the split up of Gondwana. Sirichamorn *et al.* (2014) reviewed 4 alternative theories explaining the PIDs: (1) Gondwanan taxa rifted from Africa (and Madagascar) on India to Southeast Asia, known as the 'Indian raft' hypothesis; (2) dispersal occurred via boreotropical forests during the Palaeocene and Eocene when these were warm and humid (the 'Boreotropical migration' hypothesis); (3) long-distance dispersal (LDD hypothesis); (4) overland dispersal between Asia and Africa via Arabia and south Asia during the first warm half of the Eocene (the 'Miocene geodispersal' hypothesis).

## Explaining dispersal

Phylogeny reconstruction (Parsimony and Bayesian), dating with BEAST, and a historical biogeographic analysis (Lagrange, S-DIVA) were performed in Naturalis Biodiversity Center as part of the theses of the two first authors (Sirichamorn *et al.*, 2014; Chantarasuwan, 2014). A comparable study was performed on *Macaranga* and *Mallotus* (Euphorbiaceae; van Welzen *et al.*, 2014; see article in this report: 'Historical biography, Congruence in sister genera'). In all studies PIDs were present. *Aganope* has indigenous species in Africa and SE Asia, *Brachypterum scandens* and *Derris trifoliata* are widespread species ranging from Africa to Asia, both (regularly) found along or in mangroves. The basal clade of *Ficus* subsection *Urostigma* originated on Madagascar (with dispersal to the Mascarenes) followed by dispersal to Africa and to SE Asia, a later lineage (*F. ingens*) dispersed from India back to Africa. *Macaranga* showed dispersal once and *Mallotus* twice from India to Africa, probably all in the same period. One species of *Macaranga* later dispersed back to India from Madagascar and/or the Mascarenes.

## 'Out of India'

In all but one study the taxa are too young for the 'Out of India' and 'Boreotropical migration' hypotheses. India separated ca 90 Ma from Madagascar and collided with Asia at ca 50 Ma. The Boreotropical forests in Europe and Asia had optimal conditions till a drastic drop in temperature at the end of the Eocene, beginning of the Oligocene (ca 34 Ma). The crown node of *Aganope* is dated at 18.8 Ma. This genus was probably widespread from Africa via Arabia and S Asia to SE Asia, whereby the drier colder climate after the Middle Miocene Climatic Optimum (17-15 Ma) caused desiccation of the Arabian and SW Asian coast resulting in local extinction of *Aganope* and a vicariance between Africa and Asia. *Brachypterum scandens* and *Derris trifoliata* both have (like *Aganope*) light weight pods that are buoyant, indehiscent and water impermeable. These species may be hydrochore and their correlation with mangrove indicates that LDD is the best fitting hypothesis to explain their distribution. *Ficus* subsection *Urostigma* probably originated on Madagascar and may have migrated via a rafting India to Asia ('Out of India' hypothesis).

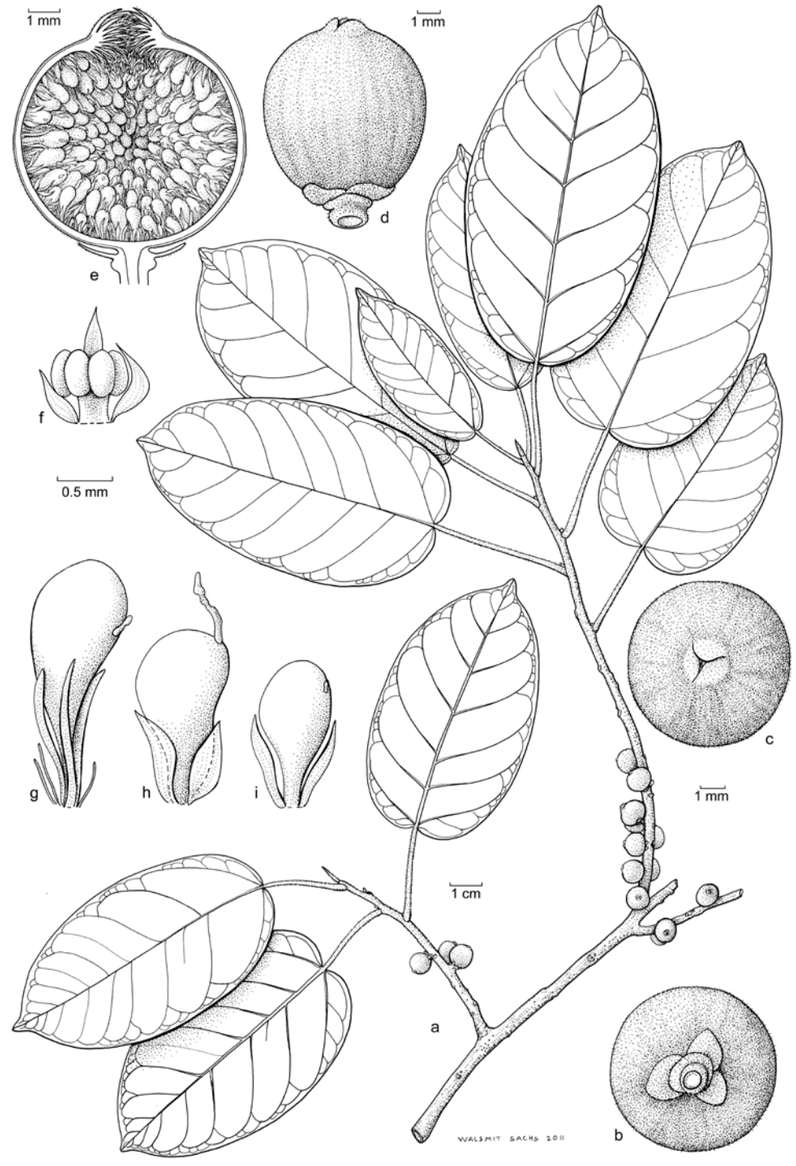


**Fig. 1.** *Ficus middletonii* – a. Twig with leaves and figs; b. basal bracts; c. ostiole; d. fig; e. fig in longitudinal section; f. staminate flower; g, h, i. pistillate flowers. Drawing: Anita Walsmit Sachs, 2011.

The re-dispersal from India to Africa (*F. ingens* or ancestral species) can best be explained by dispersal along the coastal regions of S Asia and the Arab Peninsula, similar to that of *Macaranga* and *Mallotus* (see article in this report: 'Historical biogeography, Congruence in sister genera'). Finally, one species of *Macaranga* probably re-dispersed from the Mascarenes back to India via Indian Oceanic island arcs, another type of LDD.

## References

Chantarasuwan, B. 2014. Taxonomy, systematics, and biogeography of *Ficus* subsection *Urostigma* (Moraceae). Thesis University of Leiden, ISBN978-90-6519-012-3.

Sirichamorn, Y., Thomas, D.C., Adema, F.A.C.B. & van Welzen, P.C. 2014. Historical biogeography of Aganope, Brachypterum and Derris (Fabaceae, tribe Millettieae): insights into the origins of Palaeotropical intercontinental disjunctions and general biogeographical patterns in Southeast Asia. *Journal of Biogeography* 41: 882-893.

van Welzen, P.C., Strijk, J.S., van Konijnenburg-van Cittert, J.H.A., Nucete, M. & Merckx, V.S.F.T. 2014. Dated phylogenies of the sister genera Macaranga and Mallotus (Euphorbiaceae): Congruence in historical biogeographic patterns? *PLoS ONE* 9: e85713.

# Conservation metagenomics
## Mapping rare fungi using soil DNA

**József Geml, Barbara Gravendeel & Machiel E. Noordeloos**

*Naturalis Biodiversity Center, Leiden*

**Our work highlights that fungal communities found in the rhizosphere of *Salix repens* can have very different species composition due to edaphic factors and that the protection of areas that harbour such varied *S. repens* beds is vital for the conservation of co-habiting fungi, including many Red-Listed species.**

Fungal communities are notoriously difficult to fully characterize for ecological and biodiversity studies and for conservation purposes. Even for macrofungi (e.g., such as mushrooms, true and false truffles etc.), that have the longest history of diversity studies among fungi, basic questions about the number of species at a given location or differences in species richness among vegetation types have generally remained unanswered due to taxonomic problems and the scarcity of long-term sporocarp-monitoring projects.

## Tradition of mushroom mapping

Despite the above challenges, significant advances have been made in our knowledge on taxonomy, distribution and conservation status of European macrofungi in the last two decades, based on sporocarp collections and on obtaining spatial and temporal information about fruiting. Collecting such data has been particularly successful in the Netherlands with a nation-wide network of paraprofessionals that have gathered huge amounts of data on the distribution and fruiting patterns of macrofungi. For example, the Working Group Mushroom Mapping Netherlands (Werkgroep Paddenstoelenkartering Nederland, WPN) has been mapping mushrooms since 1980, with an added monitoring program since 1998. As a result, an official national Red List of fungi was published in 1996, followed by a revision in 2008 (Arnolds & Veerkamp, 2008).

## New tools, frontiers and insights

Traditionally, our knowledge of fungal diversity has been based almost entirely on collections and the taxonomic study of sporocarps. In recent years, however, DNA-based studies of soil fungal communities have provided valuable insights into the biodiversity and ecology of fungi and provided evidence that there is an incredible amount of fungal diversity in soils that is still mostly unknown. Our large-scale soil DNA sequencing projects aim to supplement long-term sporocarp records with DNA-based species identification from soil samples for mapping purposes and to extend the taxonomic scope to all groups of fungi to be found in the soil. The first of the fungal diversity assessments has focused on *Salix repens* sand dune communities along the North Sea coast, because these areas are highly important for nature conservation, water resource management, and recreational purposes (Figs 1 & 2). Based on more than 600,000 DNA sequences generated, we detected 1,211 distinct fungi in the sampled *Salix repens* beds with varying soil pH and moisture levels. Sites with lower pH generally harboured more diverse fungal communities. With regard to ecological groups, dark-septate endophytic fungi were more diverse in acidic soils, ectomycorrhizal fungi were more species rich in calcareous sites, while various arbuscular mycorrhizal genera fungi showed opposing trends regarding pH (Fig. 3).

## Red-Listed fungi in new locations

Besides providing the first kingdom-wide diversity assessment for this coastal ecosystem, we also detected numerous Red-Listed species in the samples, often from previously unknown locations. The majority of them, such as *Clavicorona taxophila, Pseudobaeospora pyrifera, Russula pascua,* and several *Tomentella* species, to name a few, were found in multiple locations, indicating that they may be more widespread in the Netherlands than previously thought. In addition, we found several species that had never been reported from the Netherlands.

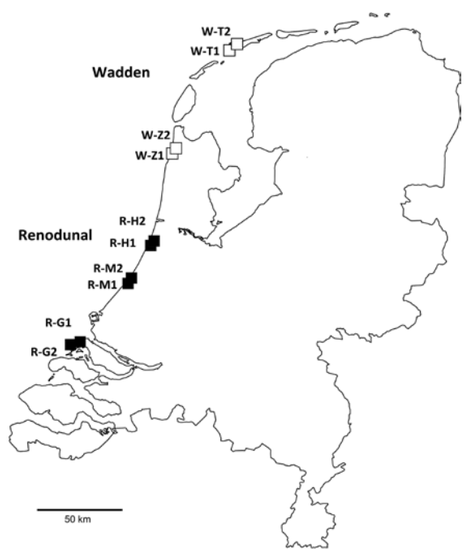


**Fig. 1.** Sampling sites along the coast of the Netherlands.

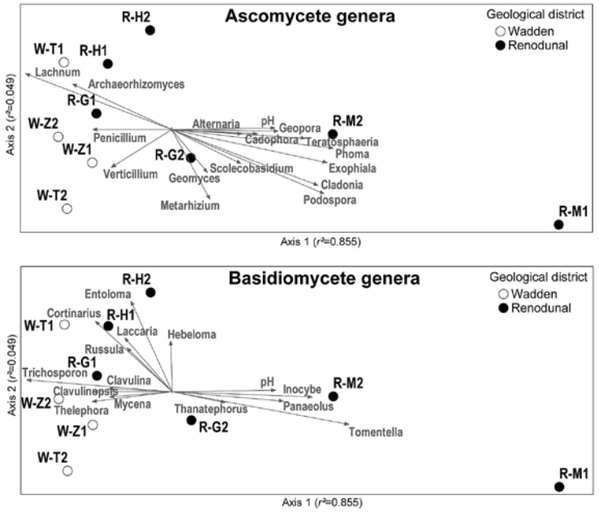


**Fig. 3.** NMDS ordination plot of fungal communities in *Salix repens* beds with vectors ($r^2 > 0.25$) for soil pH and richness in the most diverse genera that correlated with the ordination axes.

**Fig. 2.** Dune slack vegetation with *Salix repens* with *Cortinarius favrei* (inset), a predominantly arctic-alpine ectomycorrhizal fungi never before reported from the Netherlands. Photo: J. Geml.

Among these, species that usually occur in arctic-alpine regions, such as *Cortinarius favrei* (Fig. 2) and *Russula nana*, are particularly interesting. In the Arctic, these species are symbionts of various dwarf willow species (e.g. *Salix polaris, S. reticulata*), while in the Netherlands, they were detected in the soil under *Salix repens* (Geml *et al.*, 2014).

## References

Arnolds E. & Veerkamp, M. 2008. *Rode Lijst Paddenstoelen*. Basisrapport. Nederlandse Mycologische Vereniging.

Geml, J., Gravendeel, B., Neilen, M., Lammers, Y., Raes, N., Semenova, T.A. & Noordeloos, M.E. 2014. DNA metabarcoding reveals high fungal diversity and pH-correlated habitat partitioning in protected coastal *Salix repens* communities in the Netherlands. *PLOS ONE* 9(6): e99852. doi: 10.1371/journal.pone.0099852

# Fungi in the Andes
## Hyperdiversity and altitudinal turnover

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[2] *Universidad Nacional de Córdoba, Argentina*

**We provide an unprecedented insight into the enormous diversity of fungi in the Yungas, many of which are unknown. In addition, our work indicates that most of these fungi are specific to a certain habitat. Our work offers examples for the potential contribution of high-throughput soil sequencing studies to biodiversity assessments and landscape ecology that can provide crucial field data for conservation efforts.**

The Andean cloud forests (i.e. the Yungas) are a system of tropical and subtropical montane forests developed on the eastern slopes of the Andes and represent one of the most diverse biogeographic regions globally (Fig. 1). Generally, the majority of biodiversity studies and conservation efforts are focused on vascular plants and vertebrates, while soils remain a relatively unexplored, yet presumably significant source of biodiversity. Despite their central roles in the functioning of terrestrial ecosystems as plant symbionts and decomposers, an estimated 90% of all fungi are still unknown. Similarly, diverse fungal communities in the Yungas still remain virtually unexplored.

## Hyperdiverse soil fungal communities

Large-scale DNA sequencing projects have immense potential to augment our current knowledge of fungal diversity and to better understand environmental factors that influence fungal community structure. Such undertakings are particularly important in poorly sampled and presumably highly diverse tropical and subtropical areas. We carried out a massive next-generation sequencing project of soil samples from 24 sites along the entire latitudinal extent of the Yungas in Argentina to provide the first kingdom-wide fungal biodiversity assessment for the Yungas (Geml *et al.*, 2014). The selected sites represented three major altitudinal forest types: the piedmont forest (400-700 m above sea level), the montane forest (700-1500 m asl), and the montane cloud forest (1500-3000 m asl).
We observed 14,039 fungal Operational Taxonomic Units (OTUs, a proxy for species) in our soil samples. Despite the presence of more than 400,000 fungal ITS sequences in public databases, more than half of the OTUs in our samples could not be identified to species or species complexes. Because of the rigorous quality checks applied while processing the sequence data, our conservative estimates clearly indicate the need for further mycological research in the Yungas in particular and in the Neotropics in general.

## Strong habitat preference

Contrary to what has been observed for plants, where the piedmont and montane forests harbour many more species than the montane cloud forests, we did not find substantial differences in soil fungal diversity among the three altitudinal zones. On the other hand, the data suggest that fungal communities are strongly structured according to forest types (Fig. 2). Different fungal groups appear to prefer certain habitats and such turnover of taxa along an elevation gradient apparently does not affect substantially the richness in each zone. Our study documents a strong correlation between vegetation and fungal community composition in the Yungas, likely influenced by the presence of hosts for symbiotic fungi and substrate for decomposers, and by environmental (microclimatic, edaphic etc.) differences. There are many fungi that exhibit certain host or substrate specificity and are restricted to suitable sites. For example, ectomycorrhizal and root endophytic fungi were most diverse in the montane cloud forests, particularly at sites dominated by *Alnus acuminata* (Nouhra *et al.*, 2014), while saprophytic, leaf endophytic and animal pathogenic fungi are most diverse at lower elevations (Figs 2 & 3).

## Crucial role of scientific collections

Many fungi at the sampling sites likely are still undescribed, while others may remain unidentified because of the unavailability of reference sequence data from known species. Building a near-exhaustive reference sequence library for already described species with available voucher specimens, e.g. via large-scale DNA barcoding efforts at herbaria and culture collections, is urgently needed to close the gap in our knowledge and to make better use of high-throughput soil sequencing projects.

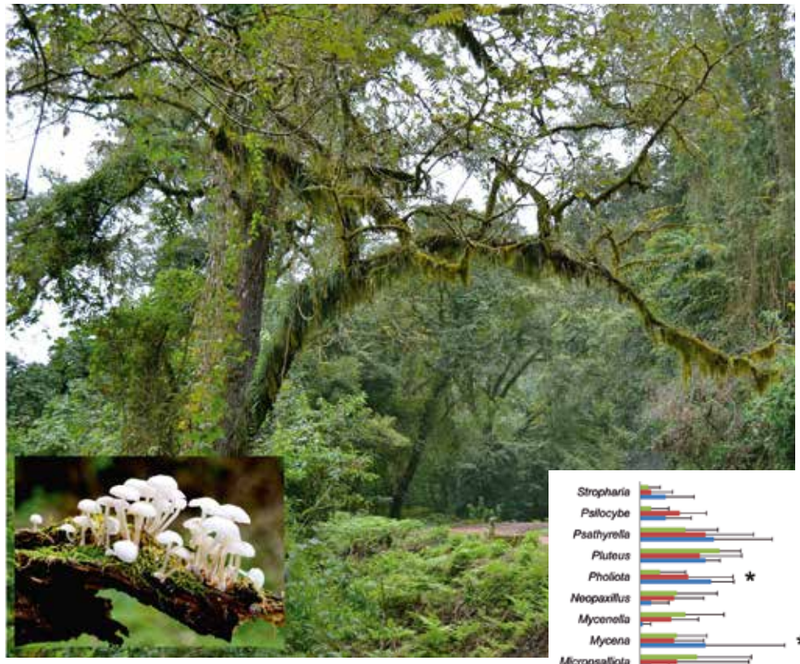

**Fig. 1.** The mid-elevation montane forest zone of the subtropical Yungas forests in the Calilegua National Park, Argentina.
Photo: J. Geml.

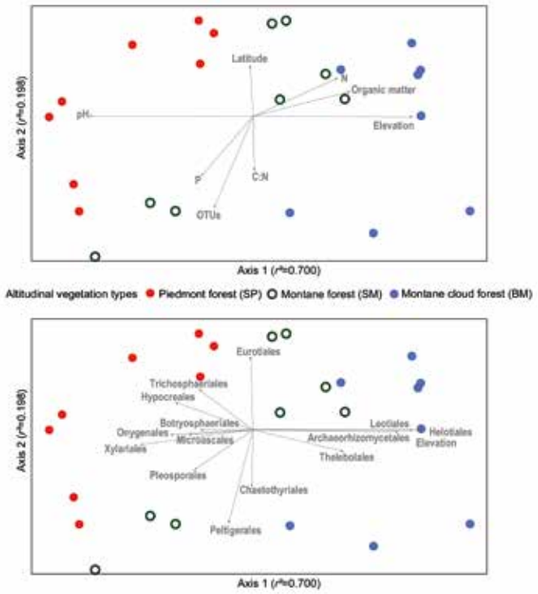


**Fig. 2.** NMDS ordination of fungal communities in the three altitudinal forest types with vectors ($r^2 > 0.25$) of environmental variables and richness in orders of ascomycetes.

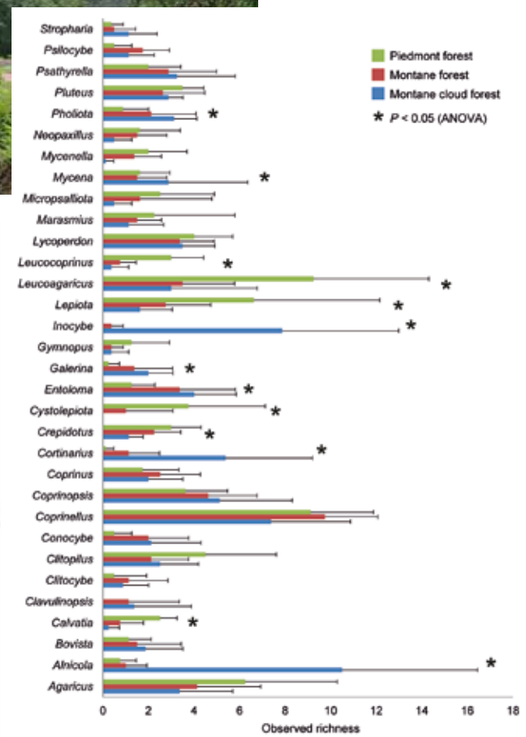


**Fig. 3.** Observed richness of macrofungal genera in the order Agaricales in the altitudinal forest types.

## References

Geml, J., Pastor, N., Fernandez, L., Pacheco, S., Semenova, T.A., Becerra, A.G., Wicaksono, C.Y. & Nouhra, E.R. 2014. Large-scale fungal diversity assessment in the Andean Yungas forests reveals strong community turnover among forest types along an altitudinal gradient. *Molecular Ecology* 23: 2452-2472.

Nouhra, E.R., Pastor, N., Becerra, A.G., Sarrionandia Areitio, E. & Geml, J. 2014. Greenhouse seedlings of *Alnus* showed low host intrageneric specificity and a strong preference for some *Tomentella* ectomycorrhizal associates. *Microbial Ecology* doi: 10.1007/s00248-014-0522-2.

# Solving a taxonomic puzzle
## *Entoloma* phylogeography

**Luis N. Morgado[1], Machiel E. Noordeloos[1], Yves Lamoureux[2] & József Geml[1]**

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[2] *Cercle des mycologues de Montréal, Montréal (Québec), Canada*

***Entoloma*** **is among the most diverse genera of mushroom-forming fungi and has a cosmopolitan distribution. However, species boundaries are mostly based on morphology, which often blurs evolutionary and distribution patterns. We used molecular phylogenetic analyses to study species limits with presumed distribution in North America, Europe and Australasia. Our results contradict previous assumptions and suggest that most species are not widely distributed. Moreover, several look-a-like and closely related species can be morphologically circumscribed.**

Worldwide, more than 1,500 species of *Entoloma* s.l. (Agaricales, Fungi) have already been described, and likely many more await discovery and formal description, especially in the tropical regions. This group is also diverse with respect to ecological functions. For example, some species establish ectomycorrhizal (ECM) symbiosis with woody plants in order to obtain photosynthesized products in exchange of mineralized soil nutrients. Others are saprotrophic obtaining their carbon through decomposition of dead organic matter. There are even some species that are parasitic on plant species of the family Rosaceae. However, despite their diverse and interesting ecology, much knowledge at the species level is still lacking, such as, species distribution patterns and phylogenetic relationships.

## Studying species boundaries

In the last decade, *Entoloma* systematics has been the focus of a few molecular phylogenetic studies but none of these focused on their biogeography, and the actual distribution patterns of *Entoloma* spp. are still hindered by uncertainties in morphological species recognition criterions and lack of taxon sampling. In our study, we focused on 4 morphological species complexes to study their phylogeography and key morphological traits that might be useful for the recognition of species boundaries. The species complexes we studied were: 1) *Entoloma sinuatum*, a notoriously poisonous ECM species, described initially from Europe and commonly recorded also in North America; 2) *Entoloma bloxamii*, a taxon included in the red list of European fungi initially described from Europe and also recorded in North America, with similar species recently collected in Australasia; 3) *Entoloma prunuloides*, the type species of the genus, initially described from Europe and also reported from North America; 4) *Entoloma nitidum*, initially described from Europe and recorded from North America and Australasia.

## A versatile toolbox

In our study we included 61 collections from 3 geographic regions: North America, Europe and Australasia. We used 4 molecular markers (3 nuclear, including ITS – the official DNA barcode for fungi, and 1 mitochondrial), to reconstruct a maximum-likelihood phylogeny and to perform statistical comparisons of the phylogenetic composition of these 3 main regions with Fast UniFrac analysis. Moreover, we also performed detailed morphological studies on relevant herbarium and recently collected specimens, targeting a wide-range of morphological characters beyond the traditional diagnostic and commonly recorded, in order to study formerly overlooked but potentially informative combination of characters for species delimitation and recognition.

## Phylogenetic patterns uncovered

Our analysis indicated that the phylogenetic composition of *Entoloma* species is significantly different according to geographical regions, with the Australasian group showing the strongest divergence. In fact, none of the collections studied from Australasia was found to be conspecific with European and North American collections. However, the phylogenetic pattern uncovered suggests that Australasia might be an ancestral area for the group of species closely related with *E. nitidum*. Interestingly, the

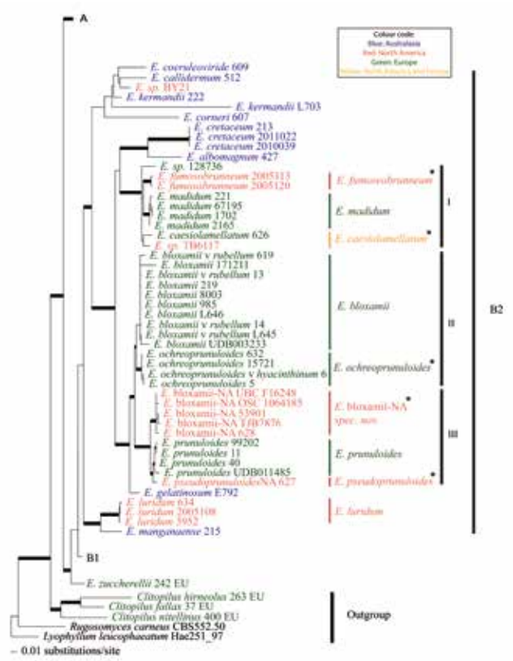


**Fig. 1.** Phylogenetic tree showing *E. bloxamii* and *E. prunuloides* clade (B2). With * are the new species we discovered or reclassified.

**Fig. 2.** Morphological diversity in clade B2. From Morgado *et al.* (2013) *Persoonia* 31: 159-178.

true species seems to be restricted to the Holarctic region, with collections from North America and Europe being conspecific. Our study also revealed that *E. sinuatum* and *E. prunuloides* belong to distinct evolutionary groups (clades), but nevertheless, showed a similar distribution pattern. The collections from North America and Europe are closely related but do not seem to be conspecific with the European lineages, showing discrete morphological differences, especially in the coloration of the cap and spore size. Similarly, the true *Entoloma bloxamii* is also restricted to Europe. However, in this taxon, we uncovered several closely related but distinct taxa within Europe whose recognition was hindered by the formerly used broad morphological species concept of *E. bloxamii*. The main morphological differences are spore size, fruit-body proportions (stipe and cap), and the pigmentation patterns during fruit-body ontogenesis. Altogether we described 4 new taxa, out of the 5 discovered, and reclassified 2 other. Moreover, we were able to 'recover' previously recognized taxa that had formerly been treated as synonyms based on morphological traits.

**Fig. 3.** From left to right, Machiel E. Noordeloos, József Geml and Luis N. Morgado in 2011 during a field trip in Limburg.

## References

Noordeloos, M.E. & Morgado, L.N. 2015. New insights into *Entoloma bloxamii*. *Coolia* 58(1): 41-47.

Morgado, L.N., Noordeloos, M.E., Lamoureux, Y. & Geml, J. 2013. Multi-gene phylogenetic analyses reveal species limits, phylogeographic patterns, and evolutionary histories of key morphological traits in *Entoloma* (Agaricales, Basidiomycota). *Persoonia* 31: 159-178.

Noordeloos, M.E. 2004. *Entoloma* s.l. in *Fungi Europaei* vol. 5a. Ed. Candusso, Alassio.

# Fungi in the arctic tundra
## Effects of long-term summer warming

**Luis N. Morgado[1], Tatiana A. Semenova[1], Jeffrey M. Welker[2], Marilyn D. Walker[3], Erik F. Smets[1] & József Geml[1]**

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[3] *HOMER Energy, USA*

**Understanding the effects of global warming in the ecosystems is currently one of the major concerns of our society. Even though many studies have already shown altered biodiversity patterns and ecosystem functions due to the recent global temperature increases, almost nothing is known about these effects on soil fungi. In our study, we show that the arctic fungal community also respond to increased temperatures with altered patterns of diversity and functions.**

The arctic tundra extends throughout 8 million km$^2$ and is the coldest biome on earth. The enormous fluctuations in environmental conditions, such as, light and temperature, are a main driver in the life cycle of polar species. Therefore, it is expected that the recent warming, that is greatest in the Arctic, is causing major changes in this biome. In addition, a great portion of the Earth's reactive carbon (C) is stored in the arctic permafrost and there are serious concerns about the effects of increased temperatures on C mobilization by soil microbes that could release major quantities of greenhouse gases into the atmosphere.

## The Arctic black box

Fungi play crucial roles in the functioning of terrestrial arctic ecosystems as symbionts (e.g. mycorrhizae, endophytes, lichens) and decomposers. It is estimated that arctic tundra plants obtain up to 86% of their nitrogen (N) through mycorrhizal fungi. Also, several other fungal groups appear to be abundant in the soil and in plant tissues, but little is known about their diversity, identity and ecological roles in the Arctic. Given their intimate relationships with plants in a wide range of symbioses and their importance in nutrient cycling, fungi are expected to play an important role in how tundra communities respond to current and future changes in the Arctic.

## From the tundra to the lab

As part of a large-scale ongoing effort, this project aimed to understand the effects of chronic increases in temperatures during the summer period on the composition of fungal communities in dry and moist arctic tundra in northern Alaska. In each tundra type, we sampled soil from plots that were subjected to increased summer air temperature by open top chambers during 18 consecutive summers, and adjacent areas with unaltered conditions (control). Then, we extracted DNA from the soil samples and sequenced all fungal species present in the soil through next-generation sequencing and compared the communities with statistical tools.

## Bird's-eye view

We generated 2,068,216 quality-filtered sequences that could be assembled into 6,887 OTUs (operational taxonomic units, which are often used as a surrogate for species). Our analyses indicate that fungal community composition in the moist tundra changes significantly with warming, while in the dry tundra did not. The warming-induced changes become even more obvious when we take into account that previous studies on warming-induced vegetation changes have generally reported changes in abundance of certain plant species, but not their presence or absence. In fungi, most of the differences in community composition among the control and warmed plots were caused by the presence of many OTUs in a particular treatment type and absence in the other. While the currently prevailing view is that altered vegetation, particularly altered composition of plants, drives fungal community to change in the Arctic, we argue that it is reasonable to conclude that species composition of fungal communities likely is more dynamic than that of plant communities.

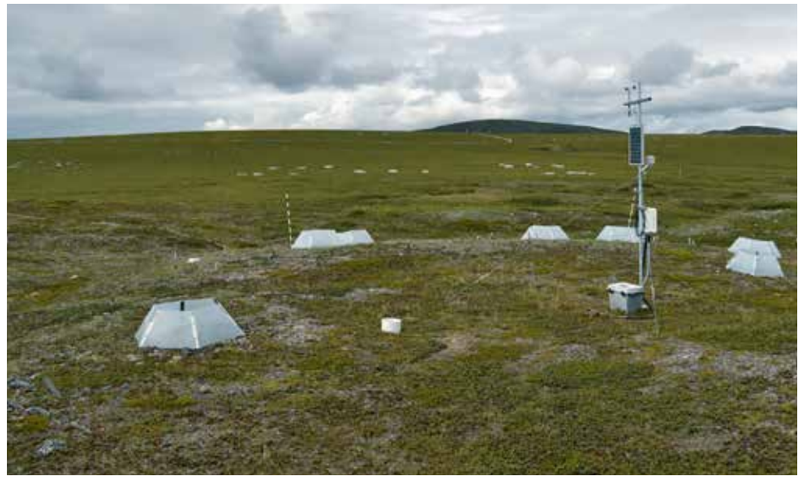

**Fig. 1.** Open top chambers, which increase air temperature by 1.5 °C, in the dry tundra at Toolik Lake, Alaska.

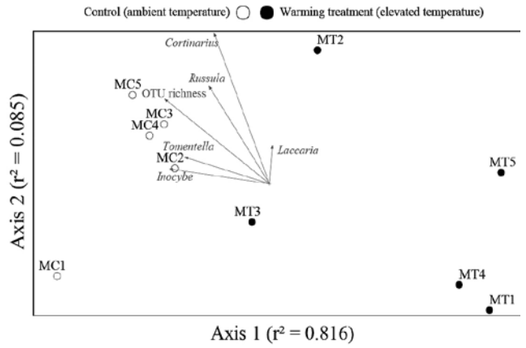


**Fig. 3.** NMDS analysis showing the effect of temperature (axis 1) in ectomycorrhizal fungal community composition in the moist.

**Fig. 2.** (From left to right) Luis Morgado, Tatiana Semenova and József Geml during fieldwork in Alaska.

## Zooming in

Another key finding is that various groups respond differently to warming, even within groups with broadly similar ecological functions. For example, OTU richness of ectomycorrhizal (ECM) ascomycetes was positively correlated with warming in both the moist and dry tundra types. On the other hand, OTU richness of ericoid mycorrhizal and ECM basidiomycetes decreased with warming in the moist tundra. Zooming in further, our in-depth analysis of the ECM basidiomycetes further suggests that besides community composition and OTU richness, patterns of functional groups that scavenge the soil for different types of N sources were also significantly altered by warming, with one group showing a major decrease in richness while the other maintained. The saprotrophic fungi also responded to warming in distinct manners. On one hand, most saprotrophic and animal pathogenic ascomycetes had increased OTU richness in warmer conditions in both tundra types, possibly due to increased litter accumulation and increased decomposition rates. On the other hand, there was a significant decrease in OTU richness of several saprotrophic basidiomycetes genera, which might be a consequence of the warming-induced decrease in plant species diversity and therefore a less diverse array of plant substrates available for decomposers.

## References

Morgado, L.N., Semenova, T.A., Welker, J.M., Walker, M.D., Smets, E. & Geml, J. 2014. Summer temperature increase has distinct effects on the ectomycorrhizal fungal communities of moist tussock and dry tundra in Arctic Alaska. *Global Change Biology* doi: 10.111/gcb. 12716 (early view).

Semenova, T.A., Morgado, L.N., Welker, J.M., Walker, M.D., Smets, E. & Geml, J. 2014. Long-term experimental warming alters community composition of ascomycetes in Alaskan moist and dry arctic tundra. *IMC10 eBook of abstracts* O 4.4.2.

# Tales of the unexpected
## Hypogeous milkcaps

**Jorinde Nuytinck**

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**Independently and on many different occasions, fungi that produce typical mushroom-like fruiting bodies have evolved into truffle-like and hypogeous (underground) species. It is generally believed that drought is the key selective pressure that causes this major morphological transition. The discovery of a large diversity of truffle-like milkcaps in tropical forests was unexpected and we hypothesize that evolutionary forces that drive this transition are more diverse than generally assumed.**

The Russulaceae constitute a fascinating fungal radiation. The family has a global distribution and its members are ecologically important as ectomycorrhizal partner in many habitats, the 3 major genera (*Lactarius, Russula* and *Lactifluus*) are very species rich and some amazing morphological transitions occurred. On multiple independent occasions fruiting bodies evolved from agaricoid (mushroom-like) to gasteroid (truffle-like and hypogeous) or pleurotoid forms (similar to the oyster mushroom, without a real stipe but laterally attached). Possibly the ancestor of the Russulaceae was even a saprotrophic, corticioid (crust-shaped) species that underwent a drastic morphological transition to an agaricoid form, independent of all other typical macrofungi.

## Drought as selective pressure

Truffle-like and hypogeous fruiting bodies have developed in several groups of fungi. Various plausible selective pressures have been proposed to explain this transformation from agaricoid to gasteroid. It is often assumed that changing environmental conditions led to enclosed fruiting body morphology, offering protection against moisture loss or frost from the hymenium and thus preventing desiccation. Arid or seasonally dry climates thus exert a selection pressure towards a gasteroid fruiting body, especially in ectomycorrhizal fungi which provide the plants with extra water through their mycelium and help them to survive the xeric conditions. Gasteroid Russulaceae are indeed particularly well-represented and well-studied in Australia and dryer parts of North America. Records from the humid tropics so far seem rare and occasional.

## Unexpected diversity

Nevertheless, a striking diversity of sequestrate Russulaceae was encountered during expeditions in tropical South East Asian forests. The studies of Verbeken *et al*. (2014*a*; 2014*b*) report on collections of gasteroid representatives, encountered in tropical forests in the area around Shinharaja Forest Reserve, Sri Lanka, and around Chiang Mai, Northern Thailand. None of the collected specimens fits with previously described taxa, therefore 7 new species in the genus *Lactarius* are described. Molecular data were used to ascertain their phylogenetic position and full descriptions and illustrations are given (Figs 1-3). It is striking that all tropical species have a very high spore ornamentation, either consisting of wings, or of isolated high spines, while all known Australian species have a much lower ornamentation that is usually subreticulate or formed of irregular warts, to sometimes even extremely low resulting in almost smooth spores, as in *Lactarius glabrellus*.

## Overlooked mushrooms

Wilson *et al*. (2011) show that the gasteromycete lineages within the Agaricomycetes might now be diversifying at rates comparable to, or exceeding, those of their nongasteroid relatives. Their analyses suggest that the net diversification rate of gasteroid forms exceeds that of nongasteroid forms, and that gasteroid forms will eventually come to predominate over nongasteroid forms in the clades in which they have arisen. The low number of gasteroid forms in the Agaricomycetes as a whole may reflect the relatively recent origin of many gasteroid lineages. The even more recent origin of gasteromycetization in the Russulaceae is suggested by several observations. Firstly, the anatomy of the basidiomes is relatively simple and in no way comparable to the complex and specialized tissues found in highly evolved gasteroid groups such as Sclerodermatineae

**Fig. 1.** *L. bisporus*. Photo: F. Hampe.

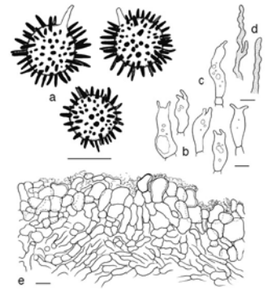
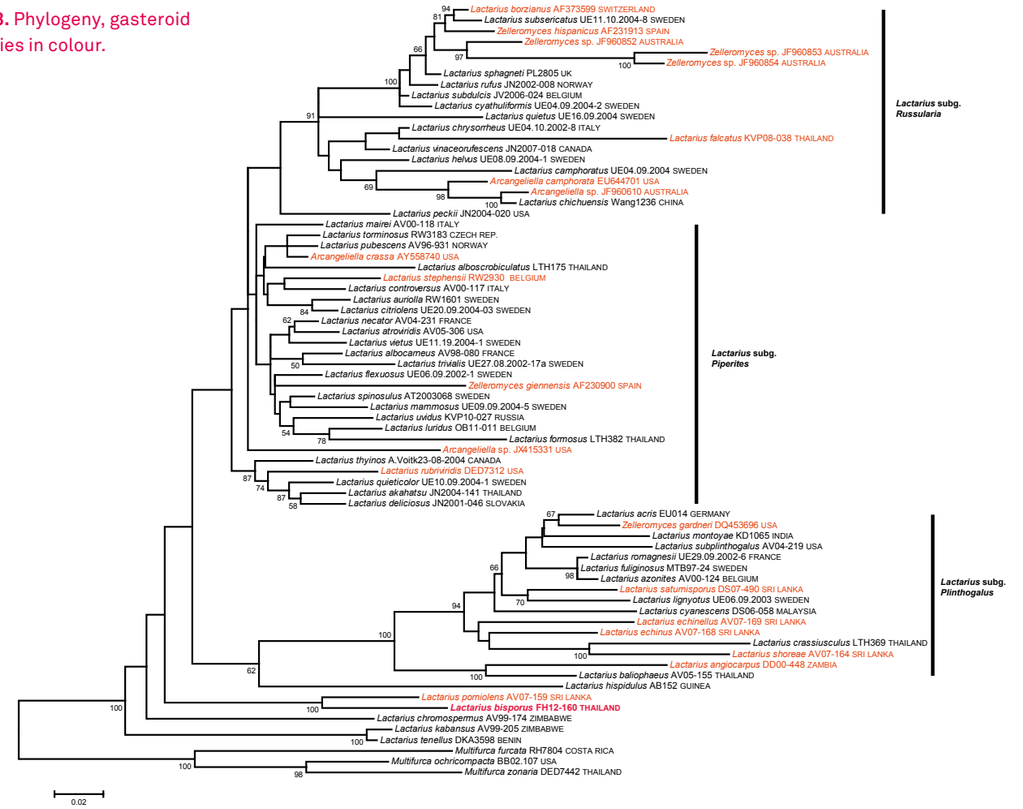



**Fig. 2.** *L. echinus*, microscopical features.

**Fig. 3.** Phylogeny, gasteroid species in colour.




or Phallomycetidae. Secondly, none of the gasteroid lineages in *Lactarius* has evolved into a clade containing a diversity of species. On the contrary, the gasteroid species appear as independent and isolated incidents within the phylogeny (Fig. 3). It is generally assumed that dry climatic conditions are one of the driving forces that enhance the development of gasteroid fruiting bodies. However, the current findings demonstrate a strong presence in tropical rainforests as well. In Sri Lanka for instance, the number of known gasteroid *Lactarius* species now exceeds the number of known agaricoid species.

## References

Verbeken, A., Hampe, F., Wissitrassameewong, K., Hyde, K.D., Eberhardt U. & Nuytinck, J. 2014*a*. A new angiocarpous *Lactarius* species from Thailand. *Phytotaxa* 181: 163-170.

Verbeken, A., Stubbe, D., van de Putte, K., Eberhardt, U. & Nuytinck, J. 2014*b*. Tales of the unexpected: angiocarpous representatives of the Russulaceae in tropical South East Asia. *Persoonia* 32: 13-24.

Wilson, A.W., Binder, M. & Hibbett, D. 2011. Effects of gasteroid fruiting body morphology on diversification rates in three different clades of fungi estimated using binary state speciation and extinction analysis. *Evolution* 65: 1305-1322.

# Deep snow, shrubs and fungi
## Implications for climate change

**Tatiana A. Semenova[1], Luis N. Morgado[1], Jeffrey M. Welker[2], Marilyn D. Walker[3], Erik F.Smets[1] & József Geml[1]**

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[2] *University of Alaska Anchorage, USA*
[3] *HOMER Energy, Colorado, USA*

**Global warming has been increasing winter precipitation in arctic tundra, visible as deeper snow cover during the prolonged winter season. Deeper snow keeps the soils warmer and alters communities of soil fungi. New fungal assemblages, in turn, are altering nutrient cycling in tundra soils in such a way that carbon stored as frozen organic matter is being released to the atmosphere as inorganic $CO_2$, facilitating further warming of the climate. Our data suggest that under deeper snow slow-growing fungi forming lichens or living as endophytes of mosses decline and are being substituted by species able to rapidly break down complex organic substances. These changes will likely contribute to higher rates of decomposition in the arctic with greater release of carbon dioxide and implications for the Earth's climate.**

Arctic regions are characterised by a prolonged cold winter season and very short summer that result in a distinctive dwarf vegetation: tundra. Because low temperatures limit the activities of decomposer soil microbes, tundra soils store a large amount of carbon: carbon content in the active tundra soil layer only is equivalent to ca 70% of the carbon in the Earth's atmosphere. Over the last decades, climate warming has been increasing the winter precipitation in the Arctic, leading to deeper snow cover and higher soil temperatures in winter. Warmer soils facilitated growth and expansion of shrubs with substantial losses of shade-intolerant lichens and mosses. Taller vegetation, in turn, appeared to trap more snow resulting in even deeper snow cover and even higher soil temperatures. In our research project, we studied the effect of increased snow depth on the communities of soil fungi that are known to form tight associations with arctic plants, and are among the most potent decomposers of organic substances on the Planet.

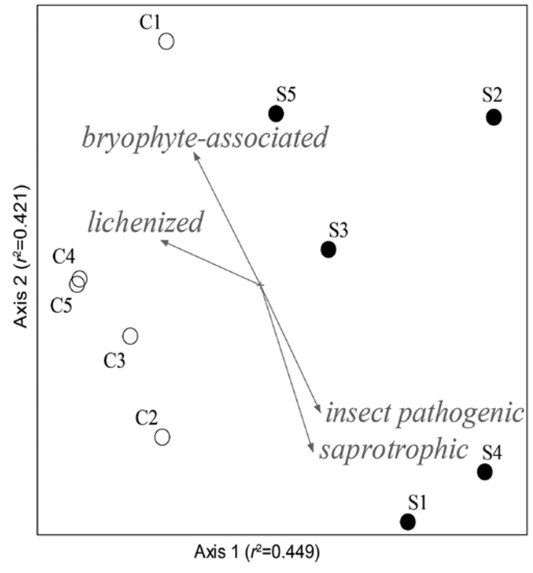
## Experimenting with deep snow

In 1994 an experimental facility (Fig. 1) that simulates increased winter precipitation was established in the arctic tundra. On the hillside, a wooden fence was constructed in such a way that it trapped the snow by creating a leeward drift. The results of these experiments confirmed a rapid increase in growth and coverage of arctic shrubs, and decline in mosses and lichens. Also, growing shrubs produced more leaves that created a thicker litter layer on the soil surface. After ca 18 seasons of the experiment, we collected the soil samples from the areas with natural and experimentally increased snow depth and compared fungal community compositions across the experimental and control plots. We hypothesised that under deeper snow fungal species associated with lichens and mosses would reduce, and species associated with shrubs and their leaf litter - increase. To assess the fungal communities, we used next generation sequencing that allows for the identification of thousands of fungal species based on their DNA (Geml *et al*. 2014; Morgado *et al*., 2014).

## Changing fungal communities

We found that fungal communities in the Arctic are diverse (several thousand species) and changed significantly under deeper snow. As it was expected, we observed a reduction in number of species associated with lichens and mosses and an increase in saprotrophic and insect pathogenic fungi (Fig. 2). We suggest that increased layer of leaf litter that formed across the shrub areas under deep snow could provide favourable conditions for insects, and in turn, led to a higher diversity of insect-pathogenic fungi. Specific fungal characteristics also shifted under the deep snow. We observed an increase in proportion of mycorrhizal fungi that form so-called rhizomorphs – hyphae that are better adapted to growth under the higher moisture levels (generally expected during the spring snowmelt), and may scavenge nitrogen not only from easily assessable inorganic compounds but also from complex organic molecules, facilitating the nutrient turnover in soil.

▲ **Fig. 1.** Experimental facilities simulating climate change in the Arctic. Photo: T.A. Semenova.




◀ **Fig. 2.** Responses of fungal ecological groups to warming: saprotrophic and insect pathogenic species increased, and lichen- and moss-associated declined under the deeper snow. C-control plots, S-deep snow plots.

## References

Geml, J., Pastor, N., Fernandez, L., Pacheco, S., Semenova T., Becerra A., Wicaksono, C. & Nouhra, E. 2014. Large-scale fungal diversity assessment in the Andean Yungas forests reveal strong community turnover among forest types along an altitudinal gradient. *Molecular Ecology* 23: 2452-2472.

Morgado, L.N., Semenova, T.A., Welker, J.M., Walker, M.D., Smets, E. & Geml, J. 2014. Summer temperature increase has distinct effect on the ectomycorrhizal fungal communities of moist tussock and dry tundra in Arctic Alaska. *Global Change Biology*.doi:10.111/gcb. 12716 (early view).

# Two cryptic toad species that meet in France

**Pim J.W. Arntzen**

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**The European amphibians and reptiles are well catalogued in morphologically recognizable species. There are, however, more species than meet the eye and increasingly molecular data assist with their recognition. The search is on. Discoveries are not just made in southern European peninsulas where diversity is high and species ranges are small, but also in the north where ranges are large and species are few.**

European toads of the genus *Bufo* (Fig. 1) show a remarkable degree of morphological variation across their range. Most variation is along the north to south axis, with adult toads being small and smooth-skinned in Scandinavia and large and spiny around the Mediterranean. While molecular genetic data support a deep genetic differentiation in two groups, the genetic divide is not latitudinal, as would be predicted from general morphology, but longitudinal (Arntzen *et al*., 2013*a, b*). Accordingly, the Spined toad, *B. spinosus* Daudin, 1803 can be defined as an Ibero-Maghrebian endemic, with populations in North Africa, the Iberian Peninsula, the southern fringe of the British Isles (i.e., Jersey, Arntzen *et al.*, 2014) and north of the Pyrenees, across the southern part of France. The Common toad, *Bufo bufo* (Linnaeus, 1758), occupies the remainder of Europe (including the Apennine and Balkan peninsulas) and extends as far east as northern Kazakhstan and eastern Siberia.

## How to tell species apart

*Bufo bufo* and *B. spinosus* classify as cryptic species: they appear similar in the field but are genetically distinct. However, once put on the right track by molecular-genetic species identifications, it turns out fairly straightforward to identify the two species on the basis of morphology as well. Whereas French *B. bufo* toads have the poison glands on the back of their heads (the so-called parotoids) positioned in parallel, the parotoids of *B. spinosus* are diverging (Fig. 2). Another diagnostic character is the shape and size of the 'inner metatarsus tubercle' that helps the toads with digging (not shown). New data suggest that the diagnostic value of the morphological characters breaks down inside a narrow section of the species' contact zone, presumably due to interspecific hybridization. From the combined morphological and molecular data a first, sketchy map of the distribution of the two species in France can be drawn (Fig. 3). The species' contact zone bisects the country along a line from Caen in the Northwest to Lyon in the Southeast.

## Mapping the contact zone

The two toad species in France are widely distributed, locally common and easily observed. Along with colleagues from Spain and Italy, Arntzen is mapping the contact zone in detail, from coast to coast. Molecular markers employed are diagnostic single-nucleotide polymorphisms (SNPs) for one mitochondrial and four nuclear loci. We are especially interested in the extent of hybridization along different sections of the contact zone and whether this is influenced by environmental parameters such as altitude and soil type. An intriguing aspect is that the two toad species meet in the same region where two *Triturus* newts have obtained secondary contact.

## References

Arntzen, J.W., McAtear, J., Recuero, E., Ziermann, J.M., Ohler, A., van Alphen, J. & Martínez- Solano, I. 2013*a*. Morphological and genetic differentiation of *Bufo* toads: two cryptic species in Western Europe (Anura, Bufonidae). *Contributions to Zoology* 82: 147-169.

Arntzen, J.W., Recuero, E., Canestrelli, D. & Martínez-Solano, I. 2013*b*. How complex is the *Bufo bufo* species group? *Molecular Phylogenetics and Evolution* 69: 1203-1208.

Arntzen, J.W., Wilkinson, J.W., Butot, R. & Martínez-Solano, I. 2014. A new vertebrate species native to the British Isles: *Bufo spinosus* Daudin, 1803 in Jersey. *Herpetological Journal* 24: 209-216.

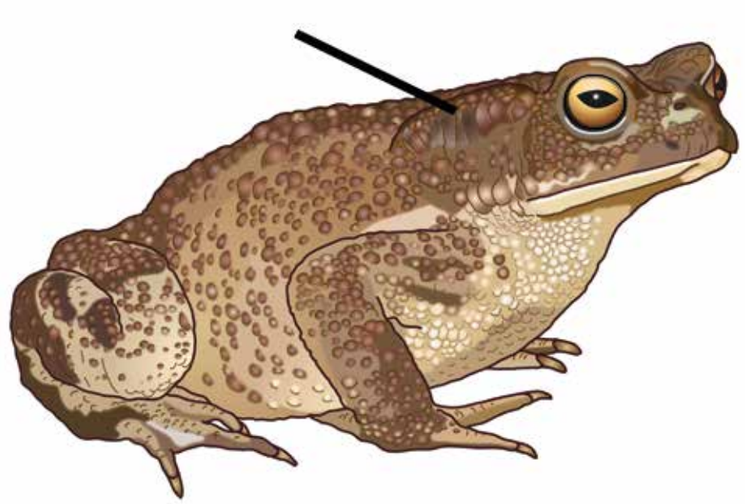

**Fig. 1.** The Common toad, *Bufo bufo.* The one visible parotoid is marked by a bar. Drawing: B. Blankevoort.

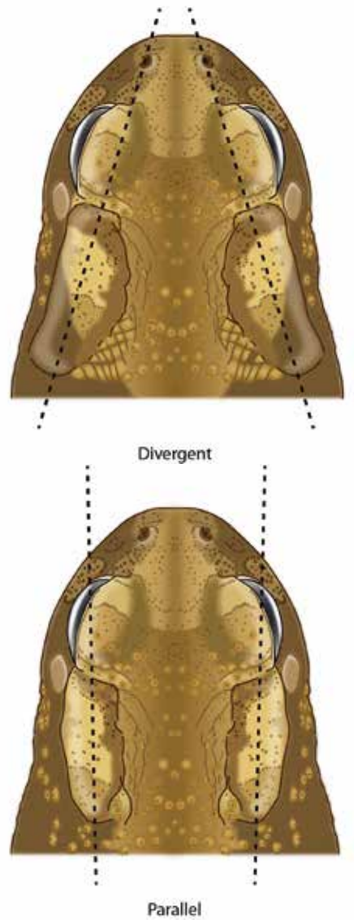


**Fig. 2.** Poison glands at the back of the head ('parotoids') are placed in parallel in the Common toad, *Bufo bufo* (below) whereas in the Spined toad, *Bufo spinosus*, they are diverging (above). Drawing: B. Blankevoort.

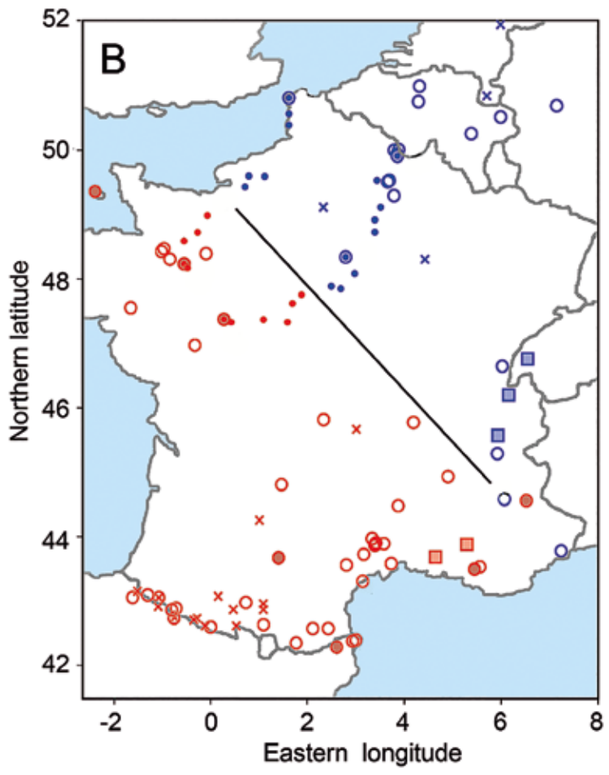


**Fig. 3.**The known distribution of toads in France. Blue symbols are for *Bufo bufo* and red symbols are for *B. spinosus*. After Arntzen *et al.* (2013*a*).

# Bees and wild flowers
## Slow down in biodiversity loss

**Luisa G. Carvalheiro[1], Bill Kunin[2] & Koos (J.C.) Biesmeijer[1]**

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[2] *Earth and Biosphere Institute, Leeds, UK*

**The disappearance of bees and other pollinators has been a regular headline in the media over the last decade. The media seem to have a better idea of this process than scientists, as many of these reports are merely anecdotal or address a single species, such as the managed honeybee. To fill this knowledge gap, we set out to obtain insight in the changes in species richness of pollinators and plants in NW Europe.**

Studying change in biodiversity is often hampered by the lack of historic data. Systematic species recording only started fairly recently with the rise of ecology as a science in the middle of the 20th century. Looking back further is only possible if non-standard data sources are being used. These include museum collections and records from amateur inventories. In NW Europe we have a long tradition of biodiversity recording not only for iconic groups like birds, plants and butterflies, but also for bees and hoverflies, e.g. now organized by EIS Kenniscentrum Insecten. This allowed us to answer the important question: are pollinators and the plants the depend on declining? Pollinators are key ecosystem function providers with more than 80% of flowering plants dependent on animal (mostly insect) pollinators as well as more than two-thirds of our crop species. Consequently, a better understanding of the state of pollinators is essential. This work was part of the EU FP7 STEP project (for summary of results see Potts *et al*., 2015), which also addressed the main drivers of change and ecological and economic impacts of pollinator loss (see also Gonzalez-Varo *et al*., 2013).

## Past declines have slowed

We found evidence of dramatic reductions in the diversity of species of bees, hoverflies, butterflies and wild flowers in Britain, Belgium and the Netherlands in the post war period (Carvalheiro *et al*., 2013). But the picture brightened markedly after 1990, with a slowdown in local and national biodiversity losses among bees, hoverflies and wild plants. For example, the study found a 30% fall in local bumblebee diversity in all 3 countries between the 1950s and the 1980s. However, by 2010 that decline slowed to an estimated 10% in Britain, whilst in Belgium and the Netherlands bumblebee diversity had stabilized. The picture was better for other wild bees, with an 8% reduction in diversity in the Netherlands and a stable picture in Great Britain turning into significant increases (7% in the Netherlands and 10% in Britain) over the past 20 years. While these solitary bees continued to decline in Belgium, hoverfly diversity improved there, shifting from stable diversity in the 1980s to significant (20%) increases in recent decades. British wildflower diversity had declined about 20% from the 1950s to the 1980s, but again the declines have ceased in the past 20 years. Not all groups fared so well. Butterfly diversity continued to fall in all 3 countries at roughly the same rates as in the past.

## Drivers of richness change

This work is based on a very large dataset of species records, more than 30 million in total, and improved analytic methods. However, while we can use biodiversity records to measure changes in the diversity of pollinators, we can't tell what's happening to their overall abundance or to the quality of the pollination services they provide to wildflowers or agricultural crops. To study these issues would require a proper long term monitoring programme to be set up. Moreover, it is still unclear what drove the patterns of richness change here reported. It is possible that by 1990 the most sensitive species had already gone and were, partially, replaced by generalist species. But that's probably not the whole story, as there are still plenty of rare and vulnerable species present in recent records. There is a much more encouraging possibility: reducing environmental pollution, conservation work and agri-environment programs paying farmers to encourage biodiversity may be having an effect. We may also be seeing a slowdown of the drivers of decline. The postwar emphasis on getting land into production and on more intensive farming has given way to a more stable situation in which the rate of landscape change has slowed and in which agrichemical excesses are regulated.

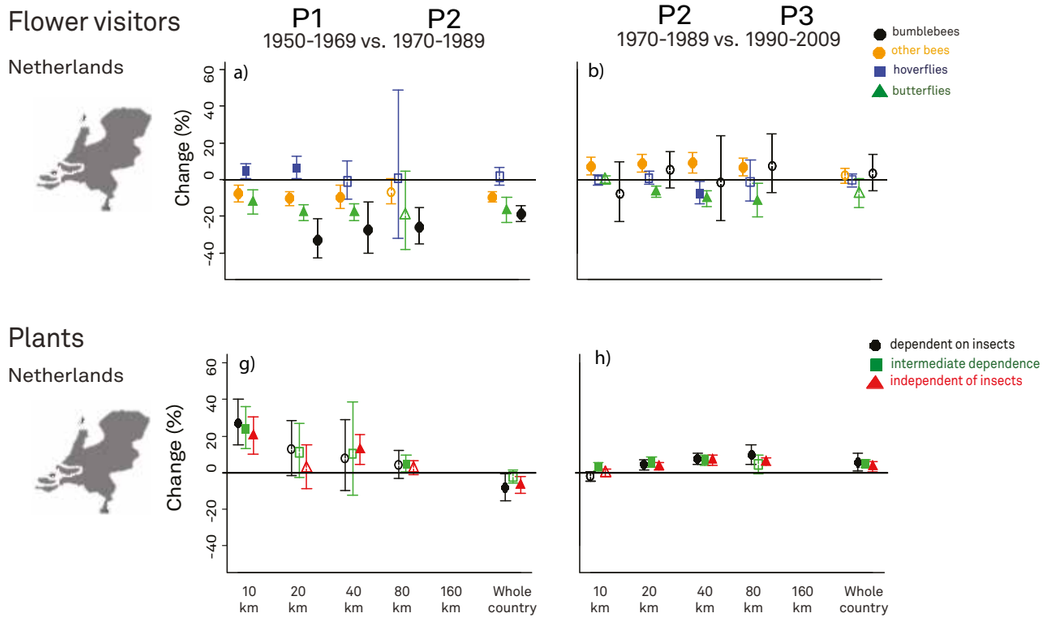


**Fig. 1.** Change of species richness of flower visitors and plants through time at different spatial scales. Filled symbols indicate that change was significantly different from zero, otherwise symbols are open.

**Fig. 2.** The pollen specialist bee *Andrena hattorfiana* (Fabricius) (Hymenoptera: Andrenidae) is rare in the study region foraging on Dipsacaceae. Photo: Nicolas J. Vereecken.

## Wider study relevance

Most observers have been saying that the 1992 Rio Earth Summit targets to slow biodiversity loss by 2010 failed, but what we are seeing is a significant slowing or reversal of the declines for wild plants and their insect pollinators. If what we take from the Rio targets is that the investment in conservation gave us no results, then that is a counsel of despair. This study brings a positive message for conservation. But some important groups are undoubtedly still declining, so continued and increased investment in conservation practices is essential for guaranteeing the persistence of a diverse assemblage of species.

## References

Carvalheiro, L.G., Kunin, W.E., Keil, P., Aguirre Gutierrez, J., Ellis, W.N., Fox, R., Groom, Q., Hennekens, S., van Landuyt, W., Maes, D., van de Meutter, F., Michez, D., Rasmont, P., Ode, B., Potts, S.G., Reemer, M., Roberts, S.P.M., Schaminee, J., Wallis-DeVries, M.F. & Biesmeijer, J.C. 2013. Species richness declines and biotic homogenisation have slowed down for NW-European pollinators and plants. *Ecology Letters* 16: 870-878.

Gonzalez-Varo, J.P., Biesmeijer, J.C., Bommarco, R., Potts, S.G., Schweiger, O., Smith, H.G., Steffan-Dewenter, I., Szentgyoergyi, H., Woyciechowski, M. & Vila, M. 2013. Combined effects of global change pressures on animal-mediated pollination. *Trends in Ecology & Evolution* 28: 524-530.

Potts, S., Biesmeijer, K., Bommarco, R., Breeze, T., Carvalheiro, L., Franzén, M., González-Varo, J.P., Holzschuh, A., Kleijn, D., Klein, A.-M., Kunin, B., Lecocq, T., Lundin, O., Michez, D., Neumann, P., Nieto, A., Penev, L., Rasmont, P., Ratamäki, O., Riedinger, V., Roberts, S.P.M., Rundlöf, M., Scheper, J., Sørensen, P., Steffan-Dewenter, I., Stoev, P., Vilà, M. & Schweiger, O. 2015. Status and trends of European pollinators. Key findings of the STEP project. Pensoft Publishers, Sofia, 72 pp.

# Awareness for freshwater
## Dragonfly field guides

**K.-D.B. Dijkstra, Rory A. Dow & Vincent J. Kalkman**

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**Freshwater is one of Earth's most vital resources. Covering less than 1% of the planet, it is also home to one tenth of all animal species. By comparison, saltwater covers 70% but only a quarter of diversity. Few groups represent both Earth's most threatened biodiversity and its greatest animal radiation - the insects - as well as the 6,000 species of Odonata, the dragonflies and damselflies. Building on a century of experience, researchers at Naturalis use the visual beauty and ecological sensitivity of these colourful aquatic insects to increase awareness of nature's diversity and vulnerability. Aiding species identification with field guides and handbooks is the primary step to popularisation, and documenting their threat status in red lists is the first step to conservation.**

Fifteen years in development, *The Dragonflies and Damselflies of Eastern Africa* by Dijkstra & Clausnitzer (2014) is the first handbook of its extent and detail to appear on tropical Odonata (Fig. 1). Extending from Sudan and Somalia to Zambia and Mozambique, including the entire eastern half of the Congo Basin, the book covers a third of Africa, about 10 million square kilometres, an area comparable to China or the United States, and treats almost two thirds of the continent's species. More than 500 species are illustrated with 1,120 original drawings and over 360 colour photographs portraying 320 species. Identification keys to adult males of all species set a new standard for recognising 'the birdwatcher's insects' in Africa, detailed genus descriptions provide the most comprehensive account of their ecology and taxonomy so far, and all species have been furnished with a vernacular English name for the first time.

## From Europe to New Guinea

Our philosophy is that new frontiers in research, protection and appreciation of nature can only be opened if expertise on emerging flagship groups is expanded and disclosed. The *Field Guide to the Dragonflies of Britain and Europe* by Dijkstra & Lewington (2006) is probably the most successful publication on Odonata ever with 35,000 copies printed in five languages in the past decade. In 2014 the first German and Spanish editions and the second Dutch edition appeared (Fig. 2). Kalkman & Orr's (2013) *Field Guide to the Damselflies of New Guinea* allows easy identification in the region for the first time (Fig. 3). In the long run only local workers can obtain sufficient data on Papuan odonates. Therefore over 500 copies were distributed for free among students and enthusiasts in the region. Both the book's content and mission were acknowledged with the 2013 Whitley Award for the best Australasian natural history publication. The vision will be expanded in the next years: 100 free copies of the handbook are available for African researchers, a complementary guide for New Guinea's dragonflies is in production, and an introduction to the highly threatened but poorly known Odonata of Madagascar has been commissioned.

## Guardians of the watershed

Knowing a species' threat status is the initial step towards its application in environmental assessments and conservation. Odonata are one of the few freshwater groups, and possibly the only insect order, where a global estimate of extinction risks is possible (Clausnitzer *et al.*, 2009). As members of the IUCN Dragonfly Specialist Group we coordinated most regional Red List projects in the past decade, resulting in complete assessments of the fauna of Africa, Europe and large parts of Asia. With a Red List for the Near East over half the world's species have now been assessed (Boudot & Kalkman, 2014). Further projects are being initiated, for example in the American tropics and Indonesia.

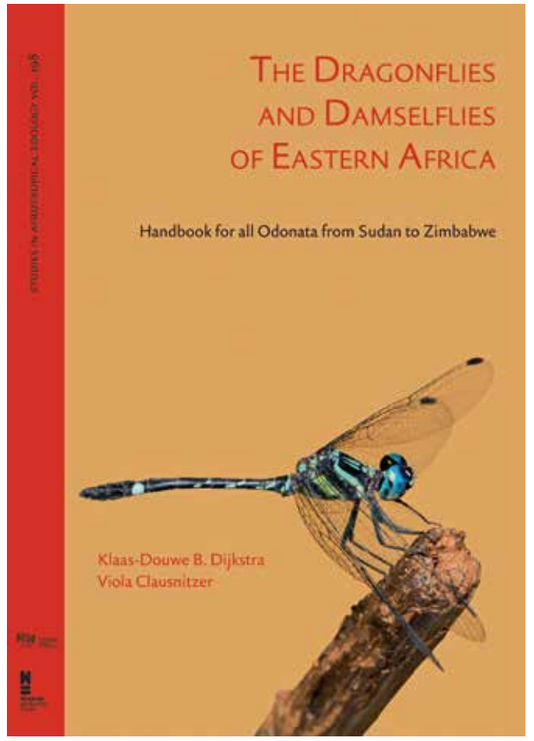



**Fig. 1.** Cover of Dijkstra & Clausnitzer (2014).

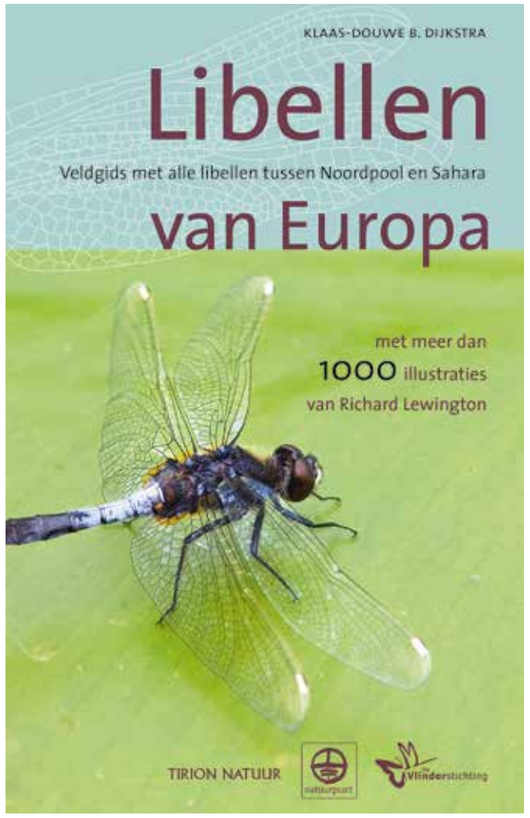



**Fig. 2.** Cover of Dijkstra & Lewington (2014), second Dutch edition.

## References

Boudot, J.-P. & Kalkman, V.J. 2014 Chapter 5. Odonata (dragonflies and damselflies). In: Smith *et al*. The status and distribution of freshwater biodiversity in the Eastern Mediterranean. IUCN, Cambridge.

Clausnitzer, V., Kalkman, V,J., Ram, M., Collen, B., Baillie, J.E.M., Bedjanič, M., Darwall, W.R.T., Dijkstra, K.-D.B., Dow, R.A., Hawking, J., Karube, H., Malikova, E., Paulson, D., Schütte , K., Suhling, F., Villanueva, R.J., von Ellenrieder, N. & Wilson, K. 2009. Odonata enter the biodiversity crisis debate: the first global assessment of an insect group. *Biological Conservation* 142: 1864-1869.

Dijkstra, K.-D.B. & Lewington, R. 2006. Field guide to the dragonflies of Britain and Europe. British Wildlife Publishing. 1-320.

Dijkstra, K.-D.B. & Clausnitzer, V. 2014. The Dragonflies and Damselflies of Eastern Africa: handbook for all Odonata from Sudan to Zimbabwe. Studies in Afrotropical Zoology. Royal Museum of Central Africa, Belgium. 1-260.

Kalkman, V.J. & Orr, A.G. 2013. Field Guide to the Damselflies of New Guinea. *Brachytron* 16: 1-118.


**Fig. 3.** Cover of Kalkman & Orr (2013).

# Diversity of dragonflies
## Getting to know popular insects

**K.-D.B. Dijkstra, Rory A. Dow, Vincent J. Kalkman, Frank R. Stokvis & Jan van Tol**

*Naturalis Biodiversity Center, Leiden*

**Naturalis holds the world's foremost collection of Odonata, the dragonflies and damselflies, with almost 4,000 of the 6,000 named species. Our material allowed the first description of the fauna from Malaysia to New Guinea, one of the greatest and most endangered biodiversity hotspots, but also includes new samples of 4 in 5 African species, which may still await most change at the hand of man. This resource and our expertise are critical in supporting the growing popularity of Odonata. Scientists, conservationists and the public require robust knowledge of the species' names and relationships to apply and appreciate them. We published the first globally agreed classification in 2013 and the most complete molecular family tree for damselflies in 2014. These results are part of ongoing efforts to collate and analyse molecular data of all world's species. 10,000 DNA-barcodes generated for 2,000 species will also expedite a stable taxonomy at the species level.**

Naturalis holds one of the most vast and valuable collections of Odonata, including about 10% of all name-bearing types. The foundation was laid by Maurits A. Lieftinck, who worked in Leiden until 1969, after being curator and director of the Museum Zoologicum Bogoriense in the Dutch East Indies (now Indonesia) from 1929 to 1954. His treatment of New Guinea, Java, Borneo and other island faunas remains the base of Oriental odonatology.
Dirk C. Geijskes succeeded Lieftinck, focusing on Suriname, and Jan van Tol followed him in 1985, making important acquisitions from South America (Jean Belle), the Philippines (Roland A. Müller) and Southeast Asia (Matti Hämäläinen). The present research group and our network added significantly in the last 15 years, sampling especially in the Old World tropics, describing many new species to science, and providing fresh insights into evolutionary relationships and historical biogeography.

## Dawn of the damselflies

Naturalis's molecular facilities opened new opportunities for the collection's analysis. Nicknaming ourselves the Damselfly Workers at Naturalis (DAWN) we focussed on elucidating the relationships within the 3,000 species of the suborder Zygoptera. Phylogenetic reconstruction was based on mitochondrial and nuclear data of 59% of the 310 genera and all (suspected) families except for one with only a single species (Dijkstra *et al.*, 2014). While the result was largely congruent with the traditional classification, we recognised 11 families on top of the 16 known, with another 7 likely to be separated in the future. This seems radical, but most changes were in smaller groups and the family affiliation of only 1 in 5 damselfly species changed. All 11 extra families and the 7 potential ones came from just 2 former families, the Amphipterygidae and Megapodagrionidae composed mostly of geographically isolated groups. These were 'waste baskets' for equally unusual taxa, which persisted in stable but isolated areas, with no or only very distant relatives surviving elsewhere (Kalkman, 2013). That we had fresh samples of over 9 in 10 of those relict genera for study is indicative of our collaborative network's extent. While these groups were taxonomically fragmented, the largest damselfly family became even greater: several tropical groups were found to fall within the Coenagrionidae, including the famous helicopter damselflies of tropical America, which can be up to 15 cm long. In fact, the Common Red Damsel (*Pyrrhosoma nymphula*) that is seen in many Dutch gardens in spring is more closely related to these rainforests giants, than to the Azure Bluet (*Coenagrion puella*) or Common Bluetail (*Ischnura elegans*) found nearby.

## Wings won't work

Odonata are famed for their mastery of flight and the lacelike intricacy of their wing veins. The shape and number of these veins vary greatly and are easy to quantify, forming the basis of odonate classification for over a century. However, these characters show little congruence with molecular results,

**Fig. 1.** Named after the 'Good Hope' motto of its native Western Cape, the relationships of the endangered new genus *Spesbona* were only revealed by our research. Photo: Jens Kipping.

suggesting they evolve rapidly, often in convergence. The most poignant example is Protoneuridae, which in its broadest historic definition encompassed almost 1 in 5 damselfly species. Defined by the reduction of the most peripheral vein in narrowed wings, the family dissolved completely into 6 clades from 5 families. Such findings challenge the current taxonomy for fossil Odonata, based almost entirely on wing veins. Our study forms the basis for more detailed analyses at the family level, and further results are expected in the next years. Meanwhile the proposed classification must be introduced to the community of dragonfly researchers and enthusiasts. We consistently attempt an active role in finding consensus among the many experts, explaining the taxonomic reasons for changes in classifications, and updating the textbooks (Dijkstra *et al.*, 2013).

## References

Dijkstra, K.-D.B., Bechly, G., Bybee, S.M., Dow, R.A., Dumont, H.J., Fleck, G., Garrison, R.W., Hämäläinen, M., Kalkman, V.J., Karube, H., May, M.L., Orr, A.G., Paulson, D., Rehn, A.C., Theischinger, G., Trueman, J.W.H., van Tol, J., von Ellenrieder, N. & Ware, J. 2013. The classification and diversity of dragonflies and damselflies (Odonata). In: Zhang, Z.-Q. (Editor). Animal biodiversity: An outline of higher-level classification and survey of taxonomic richness. *Zootaxa* 3703: 36-45.

Dijkstra, K.-D.B., Kalkman, V.J., Dow, R.A., Stokvis F.R. & van Tol, J. 2014. Redefining the damselfly families: a comprehensive molecular phylogeny of Zygoptera (Odonata). *Systematic Entomology* 39: 68-96.

Kalkman, V.J. 2013. Studies on the phylogeny and biogeography of damselflies (Odonata) with emphasis on the Argiolestidae. PhD thesis, Leiden University.

# Unlocking biodiversity data
## from legacy taxonomic literature

**Jeremy A. Miller[1,2], Donat Agosti[1], Guido Sautter[1], Serrano Pereira[2], David King[3], Terry Catapano[1], Rutger A. Vos[2] & Soraya E.C. Sierra[2]**

[1] *Plazi, Bern, Switzerland*
[2] *Naturalis Biodiversity Center, Leiden*
[3] *The Open University, Milton Keynes, UK*

**Specimen data in taxonomic literature are among the highest quality primary biodiversity data. Treatments from legacy taxonomic literature, including specimen data, were extracted using XML markup. In this structured form, data from literature can be combined with specimen data from other sources including collections databases. A series of charts is used to visualize legacy literature data and reveal key information at a glance.**

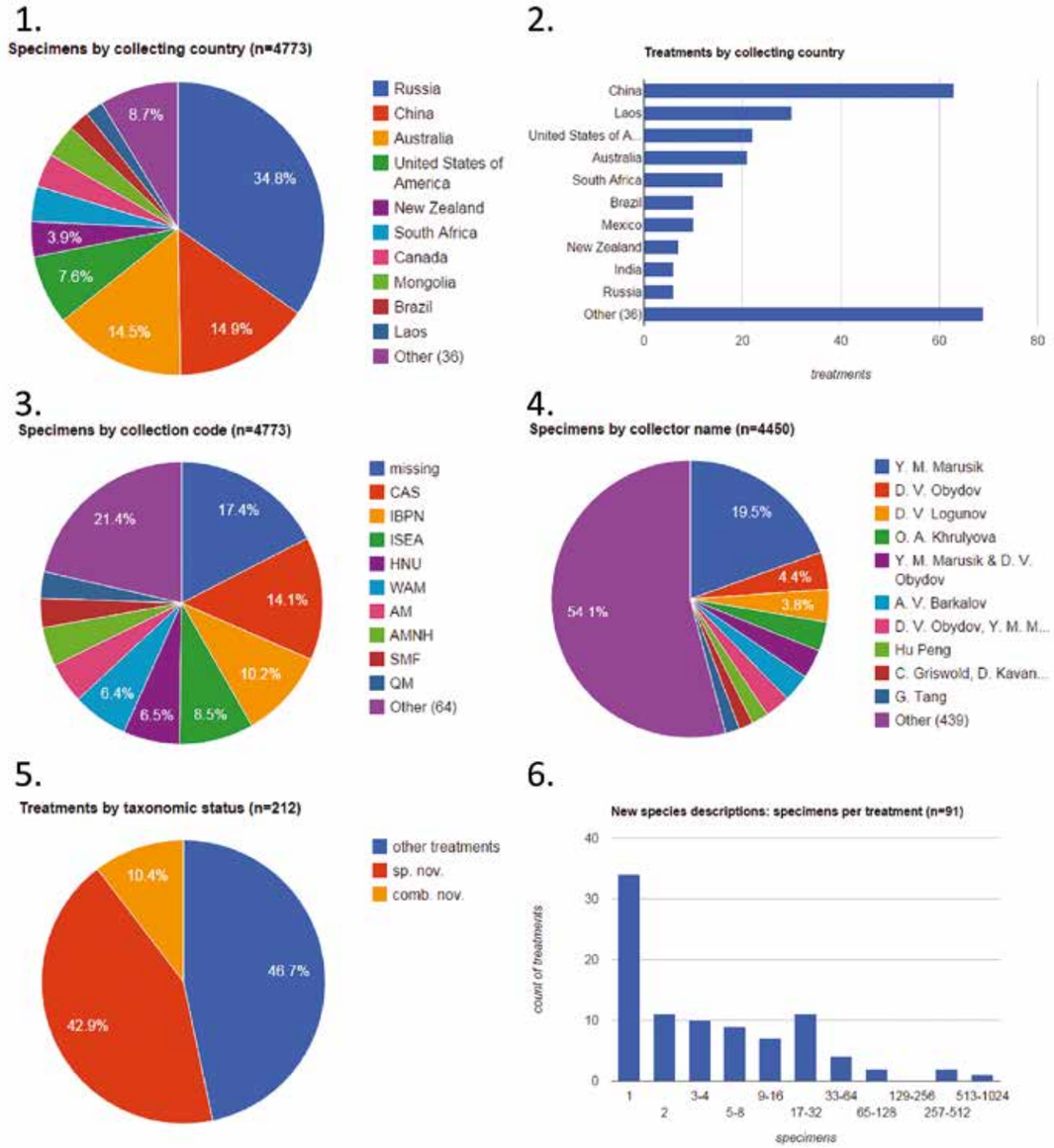
Our accumulated biodiversity knowledge includes an estimated 3 billion specimens in natural history collections and 500 million pages of printed text. We need this legacy data to address today's challenging environmental questions, like setting conservation priorities and anticipating the effects of climate change on biodiversity and ecosystem functions that affect the lives of people. Computer models of the biosphere are becoming increasingly sophisticated and powerful. These models integrate data about biodiversity with physical geography and climate. To fully realize the benefits of these nascent technological advances, we have to bridge the gap between 250 years of knowledge accumulated in libraries and contemporary structured digital data so all can be used by computers.

## New set of tools

To mobilize the vast legacy of knowledge about the world's biodiversity, we need to return to the biodiversity library of half a billion pages with a new set of tools to unlock structured data from legacy literature. Mark-up is a mechanism to make data in legacy biodiversity literature more accessible, especially for computer analysis. A computer program called GoldenGATE (available from http://www.plazi.org/wiki/GoldenGATE_Editor) uses natural language processing to help recover the structured data from documents. Once 'marked-up' using GoldenGATE, the descriptions and data become available for the full range of applications. Our mark-up approach has been optimized to extract primary specimen data from legacy publications. A series of charts has been developed to visualize the content of specimen data in XML-tagged taxonomic treatments, either singly or in aggregate. These same data are also shared with the world's largest aggregator of biodiversity records, the Global Biodiversity Information Facility (www.gbif.org), where they can be combined with data from other sources.

## Querying taxonomic literature

We recently undertook a pilot project to extract data from a selection of articles on spiders published in the zoological mega-journal Zootaxa. The analysis of structured data provides a unique way to look at a wide range of activities associated with biodiversity data. The 37 articles in this study contain 212 species treatments and records of 4,773 specimens. We learned that although the largest number of specimens came from Russia (Fig. 1), the largest number of treatments included specimens from China (Fig. 2). We also learned that the institution archiving the most specimens in this body of taxonomic research is the California Academy of Sciences (Fig. 3). The most active collector, credited with nearly one fifth of all specimens, is Yuri Marusik (Fig. 4). Ninety-one of the treatments are newly described species (Fig. 5), and one third of those were described based on a single specimen (Fig. 6). In this digital, interactive form, data from legacy taxonomic literature becomes available in a way that allows it to be recombined with other information and served in a variety of ways. This helps spread what we already know about biodiversity to a variety of users, ranging from scientists to the public. When we all have better access to the information that already exists in the global biodiversity library, this helps us do a better job of exploring what we don't know and wisely applying what we do.




Figs 1-6. Selected materials citations data extracted from 212 treatments on spiders published in 37 open access articles in Zootaxa. 1. Proportion of specimens collected by country. 2. Count of treatments with specimens collected by country. 3. Proportion of specimens by institutional collection code. 4. Proportion of specimens by collector. 5. Proportion of treatments by taxonomic status, including descriptions of new species (sp. nov.) and transfers of species from one genus to another (comb. nov.). 6. Number of specimens cited by treatments describing new species.

# Flatworm phylogeography
## Fluvial basin history underlies diversity

**Eduard Solà[1], Ronald Sluys[2], Konstantinos Gritzalis[3] & Marta Riutort[1]**

[1] *Universitat de Barcelona, Spain*
[2] *Naturalis Biodiversity Center, Leiden & Institute for Biodiversity and Ecosystem Dynamics, University of Amsterdam*
[3] *Hellenic Centre for Marine Research, Institute of Inland Waters, Anavyssos, Greece*

**We analyzed the phylogeographic relationships of the eastern Mediterranean freshwater planarians of the genus *Dugesia*, estimated divergence times for various clades, and correlated their phylogeographic patterns with geological and paleoclimatic events, in order to discover which evolutionary processes have shaped the present-day distribution of these animals.**

The *Dugesia* specimens were collected from freshwater courses and lakes in continental and insular Greece. Genetic divergences and phylogenetic relationships were inferred by using the mitochondrial gene subunit I of cytochrome oxidase (COI), and the nuclear ribosomal internal transcribed spacer-1 (ITS-1) from 74 newly collected individuals from Greece. Divergence time estimates were obtained under a Bayesian framework, using COI sequences. Two alternative geological dates for the isolation of Crete from the mainland were tested as calibration points.

## Isolated flatworms on Crete

A clear phylogeographic pattern was present for *Dugesia* lineages in the Eastern Mediterranean. Morphological studies, combined with information on genetic divergences, revealed that 8 out of the 9 known species were represented in the samples, while additional new and still undescribed species were detected. Divergence time analyses suggested that *Dugesia* species became isolated in Crete after the first isolation of the island, and that their present distribution in the Eastern Mediterranean has been shaped mainly by vicariant events but also by dispersal events. During the Messinian salinity crisis these freshwater planarians apparently were not able to cross the sea barrier between Crete and the mainland, while they probably did disperse between islands in the Aegean Sea. Their dependence on freshwater to survive suggests the presence of contiguous freshwater bodies in those regions.

## A major extinction

Our results also suggest that a major extinction of freshwater planarians on the Peloponnese may have occurred at the end of the Pliocene, while about 2 My ago, when the current Mediterranean climate was established, the Peloponnese populations probably began to disperse again. At the end of the Pliocene, mainland populations of *Dugesia* colonized the western coast, including the Ionian islands, which were then part of the continent.

## Reference

Solà, E., Sluys, R., Gritzalis, K. & Riutort, M. 2013. Fluvial basin history in the northeastern Mediterranean region underlies dispersal and speciation patterns in the genus *Dugesia* (Platyhelminthes, Tricladida, Dugesiidae). *Mol. Phyl. Evol.* 66: 877-888.

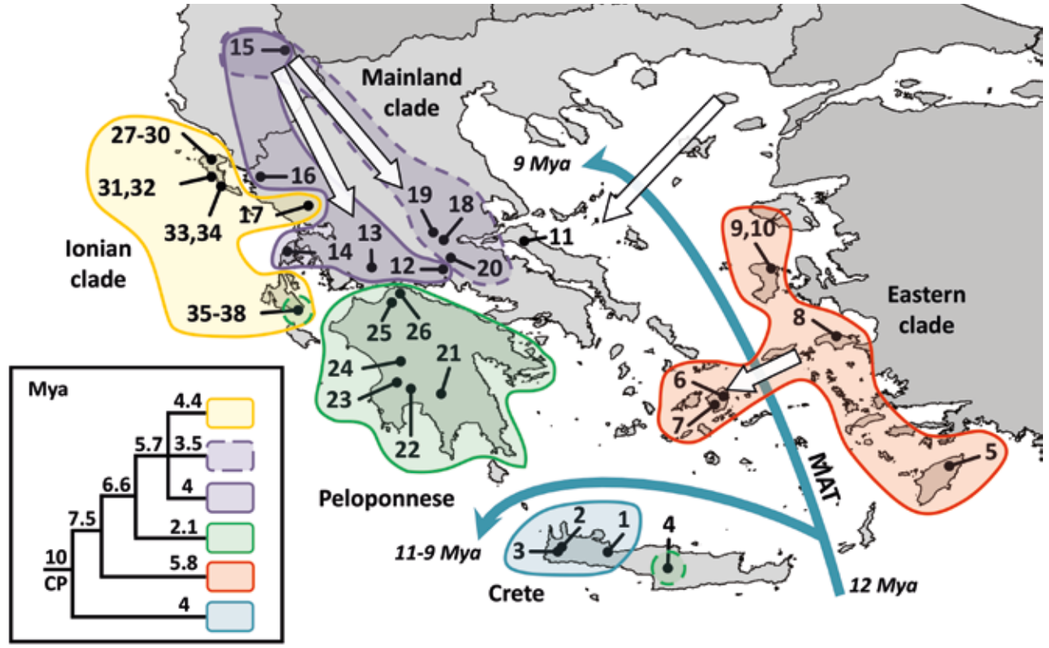



**Fig. 1.** Divergence times between Greek lineages of *Dugesia*. Vertical colour bars indicate opening of the mid-Aegean trench (MAT; blue) and Messinian salinity crisis (MSC; orange).

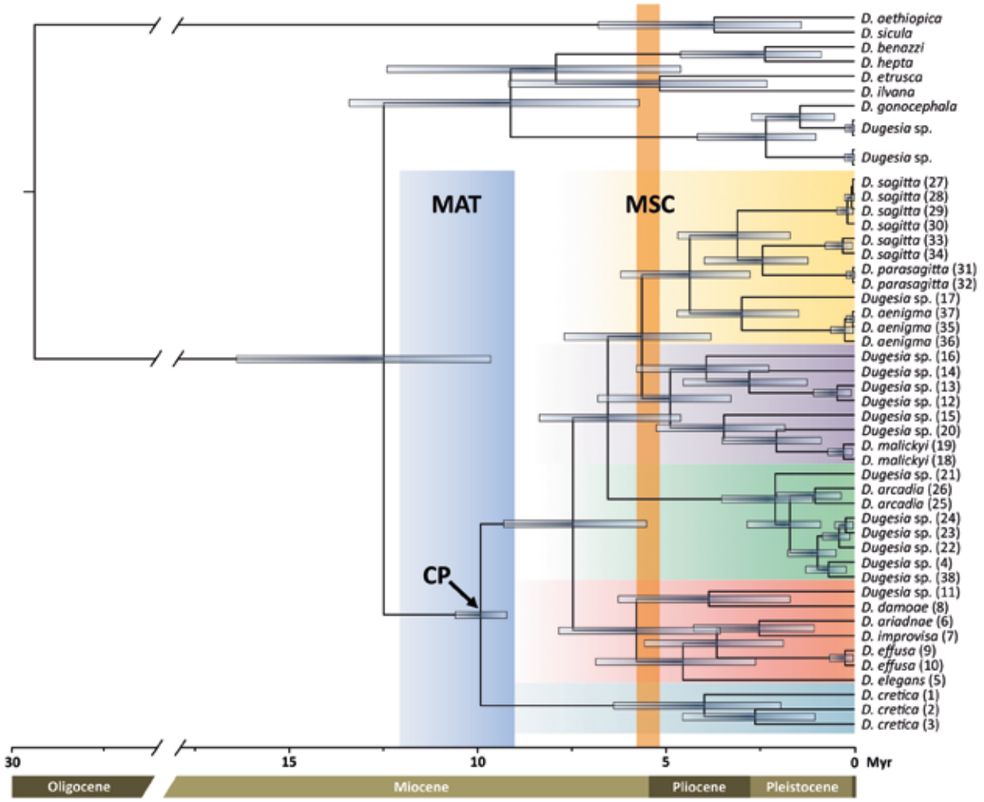



**Fig. 2.** Historical biogeographic scenario. Two main geological events, isolation of Crete and opening of the mid-Aegean trench (MAT), are shown as blue arrows. White arrows indicate our main dispersal hypotheses. Inset: condensed tree with divergence times.

# Pinball machine methodology
## The analytical nature of taxonomy

**Ronald Sluys**

*Naturalis Biodiversity Center, Leiden*

**The analytical, hypothesis-testing nature of taxonomic research is underappreciated and forms a major constraint on the rate of taxonomic descriptions. This point of view contrasts with suggestions that species discovery may be speeded up by, for example, DNA barcoding or online identification tools. It is only the training of a new generation of professional taxonomists that will increase the pace of the taxic inventory of the world's biodiversity.**

Taxonomy is the subdiscipline of systematic biology involved in species discovery and documentation, and in the construction of classifications. Unfortunately, the status of the discipline of taxonomy among the natural sciences is generally poor. This has resulted in a discrepancy that is called the taxonomic impediment: on the one hand the poor reception of taxonomy, resulting in a decreased funding and dwindling number of professionals, and on the other hand the desire of society to make an inventory of the world's biodiversity. Several ways have been suggested to improve this poor status of taxonomy as well as to overcome the taxonomic impediment and thus to speed up species discovery and documentation, such as: DNA barcoding, creation of databases of taxa and identification tools, online quantum contributions, standardization of morphological features, training of a new generation of taxonomists. This study comments on desirability and effectiveness of these presumed remedies. It is argued that the analytical, hypothesis-testing nature of taxonomic research is not well understood or appreciated and forms a major constraint on the rate of taxonomic descriptions.

## Complex and erratic interaction

The various components of the taxonomic method, such as exploration, data, analysis, and results, interact in a complex manner that resembles the erratic, bouncing behaviour of a pinball machine. When we encounter a specimen that we want to identify, the following process takes place. Starting with Exploration and Discovery and the formulation of a preliminary hypothesis on species identity, during each step the process bounces more or less erratically between Gathering Data, Interpreting Data, Community Analysis and Feedback until a stable species hypothesis can be formulated that can be incorporated into the existing knowledge and be used in scientific and societal contexts (Benefits and Outcomes) and also reflects on future rounds of Exploration and Discovery.

## Endangered discipline

Species hypotheses probably are the most tested hypotheses in the natural sciences. The introduction of cybertaxonomy instrumentation and infrastructure will not alleviate the time-consuming, intrinsically analytical and hypothesis-testing process underlying the description and/or identification of each taxon. Long-term survival of the discipline of taxonomy, thus guaranteeing the future cumulative taxonomic output of amateurs and professionals, is endangered by a diminishing workforce of adequately trained professional systematists. The only way to increase the pace of a well-documented and scientifically useful taxic inventory of the world's biodiversity is to increase the number of professional taxonomists.

## Reference

Sluys, R. 2013. The unappreciated, fundamentally analytical nature of taxonomy and the implications for the inventory of biodiversity. *Biodiv. Cons.* 22: 1095-1105.

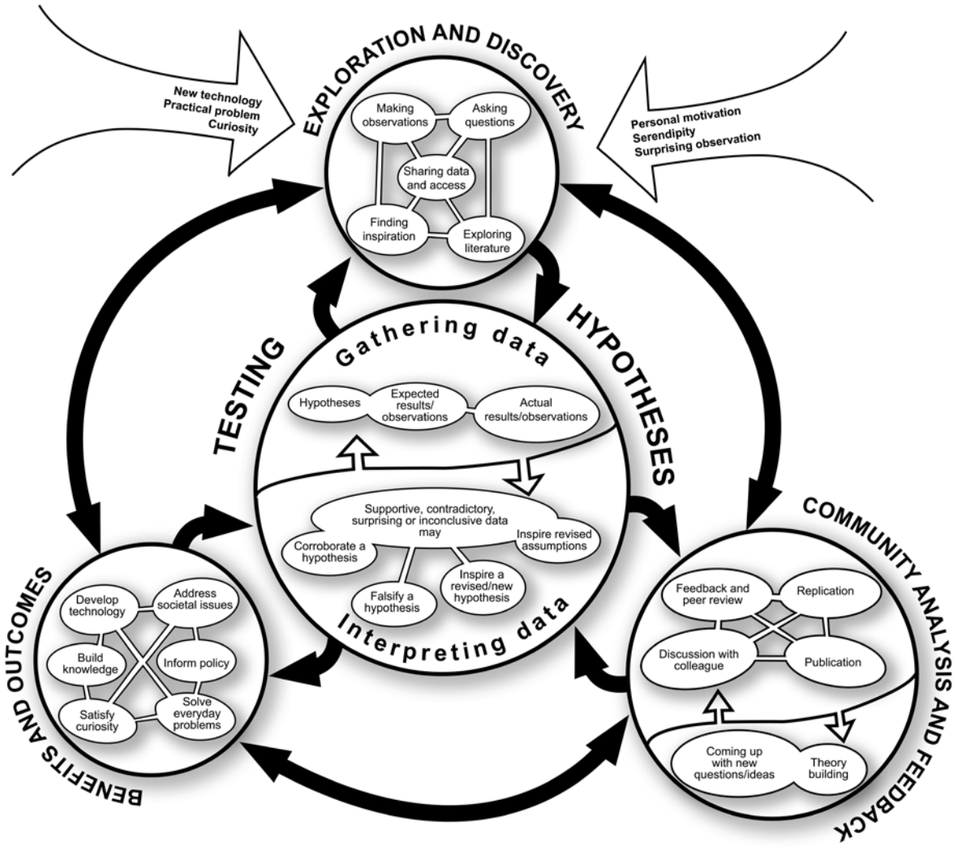



**Fig. 1.** Pinball machine methodology in taxonomy.

# When morphology meets DNA
## Identification of flatworms

**Ronald Sluys[1,2], Eduard Solà[3], Konstantinos Gritzalis[4], Miquel Vila-Farré[3,5], Eduardo Mateos[3] & Marta Riutort[3]**

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[2] *Institute for Biodiversity and Ecosystem Dynamics, University of Amsterdam*
[3] *Universitat de Barcelona, Barcelona, Catalonia, Spain*
[4] *Hellenic Centre for Marine Research, Institute of Inland Waters, Anavyssos, Greece*
[5] *Max Planck Institute of Molecular Cell Biology and Genetics, Dresden, Germany*

**Through an integrative study, using information on morphology and DNA, we assessed the species diversity of dugesiid freshwater planarians in the northeastern Mediterranean. The study revealed that the morphological features used by taxonomists in comparative studies of dugesiid flatworms generally result in reliable identifications and delineations of species.**

Integrative taxonomy is rapidly becoming the new conceptual framework for the formulation of stable species hypotheses. In an integrative approach several, independent data sources are used to formulate and test species boundary hypotheses. In this study we used the morphology and DNA of dugesiid freshwater flatworms from the north-eastern Mediterranean region to identify the animals that were collected during fieldwork. The morphological information obtained for the specimens was used in a traditional way by comparing the organismal traits of the various populations and candidate species with those of known species, as documented in the taxonomic literature and as revealed by examination of histological sections of museum specimens. In the molecular species delimitation the General Mixed Yule-Coalescent method (GMYC) was used.

## High *Dugesia* species diversity

The combined, integrated results of our study supported the presence of 13 *Dugesia* species in the Hellenic area (including *D. sicula* Lepori, 1948, a pan-Mediterranean species). It culminated in the description of 4 new *Dugesia* species and we suggested the presence of 2 Confirmed Candidate Species. The results pointed to 12 GMYC-delimited units in Greece and 2 in Slovakia as Unconfirmed Candidate Species, and revealed the presence of an entirely new genus, represented by 2 newly described species and a third Unconfirmed Candidate Species. Our results revealed a high diversity of dugesiid species in this relatively small region.

## Unexpected findings

Very interesting and unexpected were the finding of a completely new genus, *Recurva*, and the situation that on the island of Corfu populations of a particular species actually grouped into 3 different evolutionary branches in the molecular tree. Also, a different species of the new genus *Recurva* was found on each of the widely separated islands of Rhodes, Cephalonia, and Paros. The species from Paros could only be identified molecularly and therefore remains at present undescribed and unnamed. The 3 different molecular branches that we found on Corfu coincide, at least partly, with morphological results and therefore 1 branch was described as the new species *Dugesia parasagitta*. Another branch concerns the already known species *Dugesia sagitta*, while the third branch at present remains unnamed.

## Reference

Sluys, R., Solà, E., Gritzalis, K., Vila-Farré, M., Mateos, E. & Riutort, M. 2013. Integrative delineation of species of Mediterranean freshwater planarians (Platyhelminthes: Tricladida: Dugesiidae). *Zool. J. Linn. Soc.* 169: 523-547.

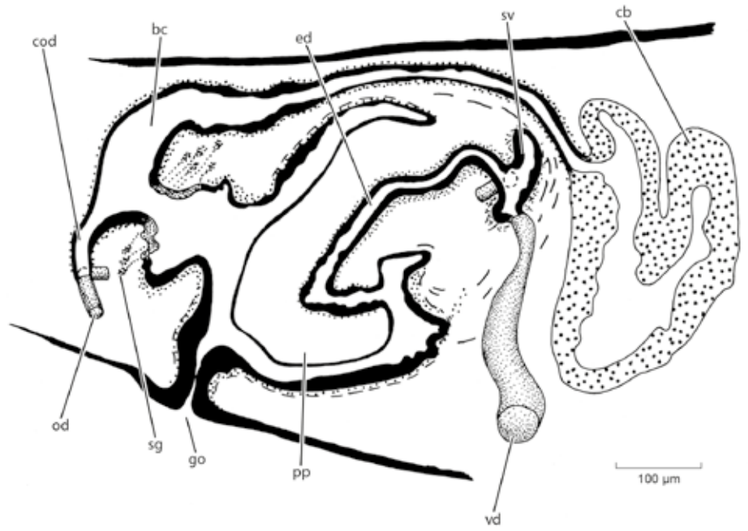


**Fig. 2.** *Recurva postrema* Sluys & Solà (2014). Sagittal reconstruction of the copulatory apparatus. Abbreviations: bc, bursal canal; cb, copulatory bursa; cod, common oviduct; ed, ejaculatory duct; go, gonopore; od, oviduct; pp, penis papilla; sg, shell glands; sv, seminal vesicle; vd, vas deferens.

◀ **Fig. 1.** External features of the new species *Recurva postrema* Sluys & Solà (2014) from Rhodes.

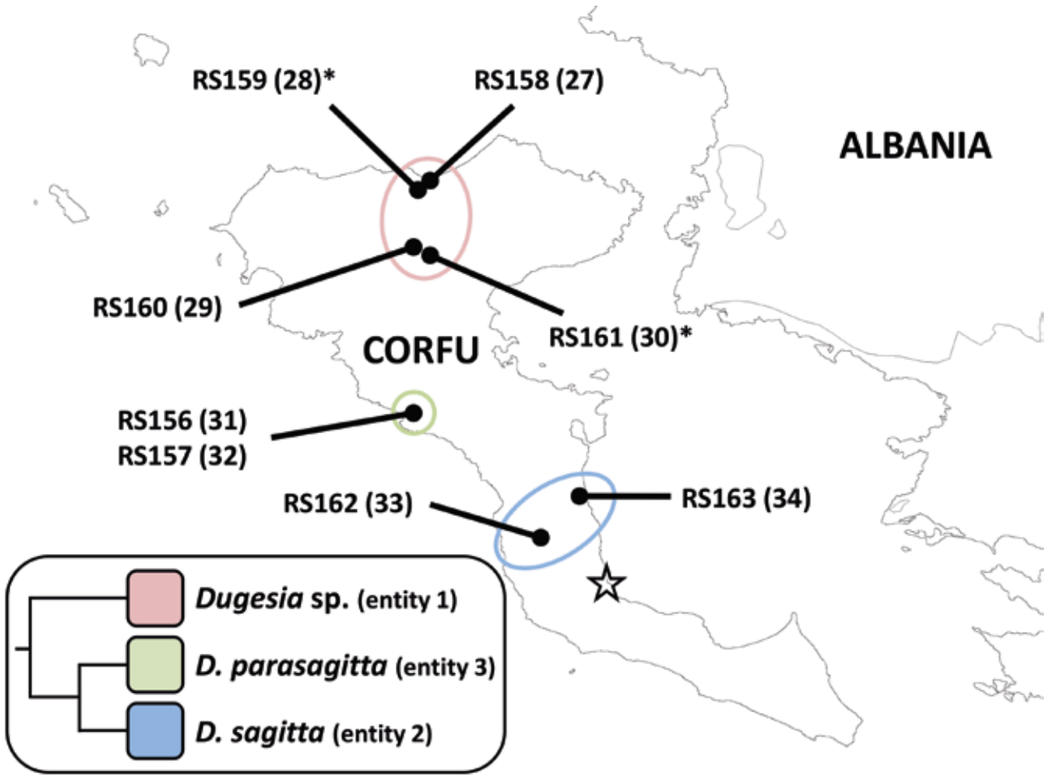


**Fig. 3.** *Dugesia* sampling sites on Corfu. Populations labelled with field codes (e.g. RS161) and locality codes (e.g. 34). Locations with asterisk have not been used in molecular analysis. Populations belonging to different clades encircled by different colours. Inset: molecular phylogenetic relationships resulting from GMYC analysis.

# FAQ FishFinder Programme
## Non-expert identification guides

**Charles H.J.M. Fransen**

*Naturalis Biodiversity Center, Leiden*

**Correct identification is of utmost importance in marine resource management. The quality of fisheries statistics depends on the ability to correctly assign landing and catch data to taxon-specific categories. The species name is the link to all relevant biological and ecological information in the literature. This information is fundamental in any attempt to manage a fishery. Correct identification is also important for those scientists gathering biological data relevant to marine resource management. Therefore, non-expert identification guides in the FAO FishFinder Programme will benefit fisheries workers gathering catch statistics and resource assessment information, and marine biologists researching information pertinent to resource management. This is particularly important for the Eastern Central Atlantic area because it encompasses the highest diversity of marine organisms exploited by fisheries in the Atlantic Ocean.**

Since 1971 the FAO FishFinder Programme has produced identification tools for more than 8,000 aquatic species. FAO FishFinder prioritizes the development of species identification guides for non-experts in developing countries. The programme supports sustainable fisheries management by providing scientists and fishery officers with the tools to accurately assess, monitor and report fishery catches at the species level.

## Global catalogues

At the basis of the FAO FishFinder products are the global catalogues for selected species groups, e.g. for invertebrates like shrimps, lobsters, cephalopods and sea cucumbers and for vertebrates like sharks and rays, many commercially important bony fish groups, mammals and sea turtles. Naturalis has a long lasting cooperation with the FAO in preparing catalogues dealing with Crustacea. Catalogues on shrimps and lobsters were prepared by the late Prof. L.B. Holthuis (1980, 1991), former curator of Crustacea at Naturalis. These catalogues have also been digitally made available through our Naturalis ETI BioInformatics group through web based identification tools and on CD-ROM.

## Field Guides

The FAO FishFinder Field Guides are being used by biologists, well-trained fishery officers and resource users. They are comprehensive with regard to the number of species included and are essential for scientific studies of aquatic ecosystems, either for fisheries or ecological research. These Field Guides play an important role in increasing a country's scientific capabilities and knowledge regarding its aquatic resources.

## Guide for Fishery Purposes

In the series 'FAO Species Identification Guide for Fishery Purposes', the first volume of 'The living Marine Resources of the Eastern Central Atlantic', dealing with crustaceans and molluscs was published in 2014 (Carpenter & De Angelis, 2014). The chapters on 'Stomatopods', 'Shrimps and Prawns', 'Anomurans', and 'True Crabs' were prepared by Charles Fransen. The chapters comprise an illustrated explanation of technical terms, illustrated keys to families, genera and species occurring in the area with the emphasis on those of interest to fisheries. Species are illustrated presenting their diagnostic features. Information of distribution as well as habitat, biology and fisheries is provided. With this volume the collaboration between the FAO and Naturalis is being continued.

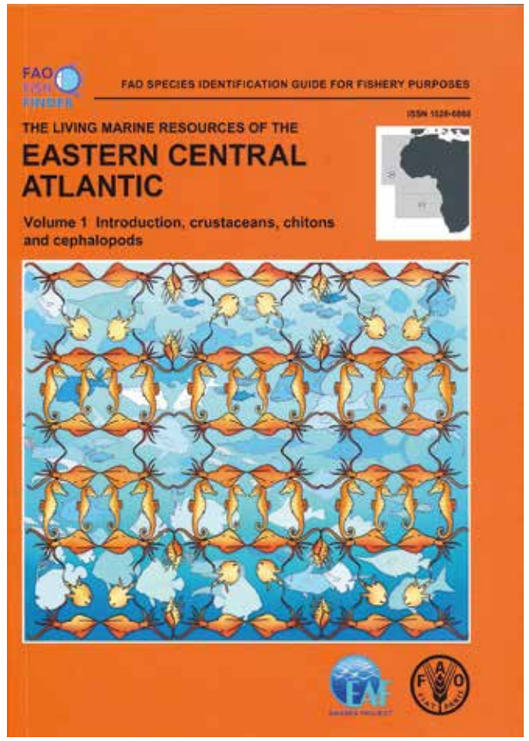


**Fig. 1.** Book cover.

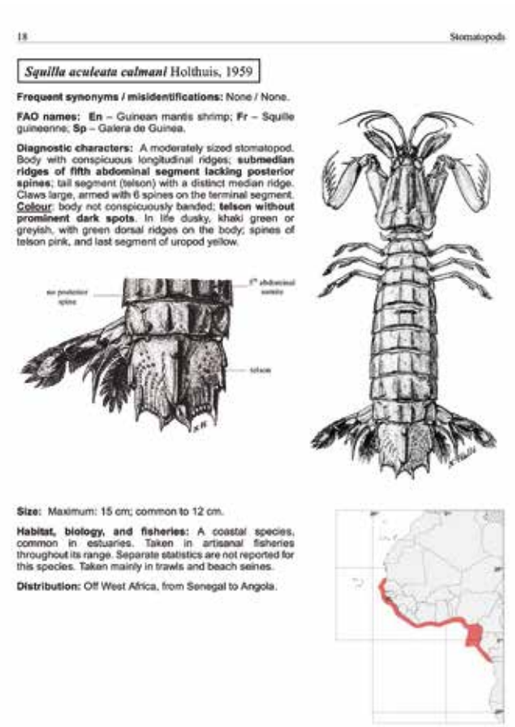


**Fig. 2.** Example page of stomatopods.

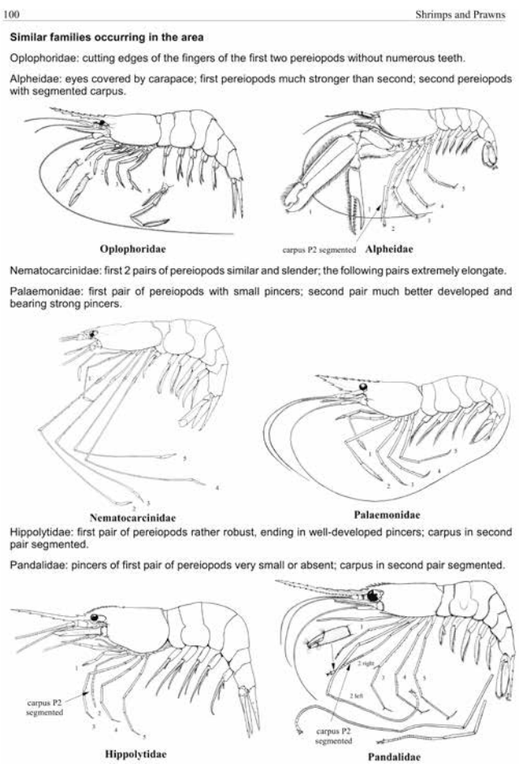


**Fig. 3.** Example page of Shrimps & Prawns.

## References

Carpenter, K.E. & De Angelis, N. (eds). 2014. *The living marine resources of the Eastern Central Atlantic. Vol. 1: Introduction, crustaceans, chitons and cephalopods* FAO Species Identification Guide for Fishery Purposes. Rome, FAO, pp. i-xvi, 1-663.

Holthuis, L.B. 1980. FAO Species Catalogue. Vol. 1. Shrimps and prawns of the world. An annotated and illustrated catalogue of species of interest to fisheries known to data. *FAO Fisheries Synopsis*, 125(1): i-xvii, 1-271.

Holthuis, L.B. 1991. FAO Species Catalogue. Vol. 13. Marine lobsters of the world. An annotated and illustrated catalogue of species of interest to fisheries known to data. *FAO Fisheries Synopsis*, 125(13): i-viii, 1-292.

# Discoveries with the Curasub
## in the Dutch Caribbean deep

**Bert W. Hoeksema, Charles H.J.M. Fransen, Sancia E.T. van der Meij, Bastian T. Reijnen, Cessa Rauch, Kaj M. van Tienderen, Yee W. Lau, Leontine E. Becking & Rob W.M. van Soest**

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**During the last decades scientists of Naturalis Biodiversity Center have been involved in the discoveries of many new marine species around the islands Curaçao and Bonaire in the former Netherlands Antilles. Most of these species were invertebrates from shallow coral reefs, such as sponges, serpulid worms, and bryozoans. Marine biota at deeper parts of the seafloor were not investigated because they were not accessible for divers with SCUBA (self-contained underwater breathing apparatus). Availability of new techniques may offer opportunities to explore the biodiversity at these greater depths. Naturalis wants to take advantage of this possibility.**

In November 2013 and March 2014, some staff members, PhD candidates and students of the Naturalis Marine Biodiversity Team were invited by the owner of the submersible *Curasub*, Adriaan 'Dutch' Schrier, to join underwater surveys along the coastline of Curaçao. Curaçao is a Caribbean island, which used to be one of the former leeward Netherlands Antilles, but at present it is part of the Dutch Caribbean. The submarine dives were made down to 300 m depth from Substation Curaçao, based at the Sea Aquarium, and at Porto Mari, more northward. Both sites are located at the sheltered western coast of Curaçao. In order to dive at Porto Mari, the submarine was transported on board *RV Chapman,* from where it was lifted by a crane and launched by means of a floating dock.

## Corals in the twilight zone

During the trips photographs, samples, and video shots were taken. These can be used as evidence to support new records of marine life at mesophotic (30-200 m) and aphotic (> 200 m) depths. It was discovered that reef corals and their associated fauna can be studied in the twilight zone down to ca 80 m depth. Photographs were used to report that an association of a reef coral and a coral gall crab usually found at shallow depths, also can be observed at 60 m depth (van der Meij *et al*., 2015). During two surveys various small shrimps were photographed and collected at 210-220 m depth. These shrimps belonged to a commensal species that usually occurs in between the spines of a sea urchin. This shrimp species was only recorded once before, from the Bahamas, also with the help of a submersible (Fransen, 2014).

## 13 New deep-sea sponge species

Guest researchers Dr. R.W.M. van Soest and Dr. L.E. Becking studied sponges from Klein Curaçao and Bonaire, which were collected from 100-142 m depth in May 2013. A total of 13 new species was described by them (van Soest *et al*., 2014). Deep-sea sponges were also observed in high diversity and high densities at Curaçao itself during the two dives at Sea Aquarium and Porto Mari, along with various kinds of cnidarians, such as sea anemones, zoantharians, gorgonians, antipatharians, stylasterids, and scleractinians.

## Innovative research

More material was collected from Curaçao and it is likely that thanks to these specimens and those obtained during additional submersible surveys in the future, additional new and rarely known species will be discovered in the Dutch Caribbean. These samples have to be studied and described in collaboration with colleagues. It is a great opportunity and a challenge for Naturalis to endeavour in this kind of innovative research.


**Fig. 1.** The Curasub offloaded from the *RV Chapman* off Porto Mari, Curaçao. Photo: B.W. Hoeksema.

**Fig. 2.** Sea urchin as host for commensal shrimps (arrows) at Curaçao. Photo: Curasub.

**Fig. 3.** An assemblage of sponges and cnidarians encountered down the slope at Substation Curaçao. Photo: Curasub.

## References

Fransen, C.H.J.M. 2014. A second discovery of *Diapontonia maranulus* Bruce, 1986 (Crustacea: Decapoda: Palaemonidae) in the Caribbean. *Zootaxa* 3881: 591-596.

van der Meij, S.E.T., van Tienderen, K.M. & Hoeksema, B.W. 2015. A mesophotic record of the gall crab *Opecarcinus hypostegus* from a Curaçaoan reef. *Bulletin of Marine Science 91* doi: 10.5343/bms.2014.1072.

van Soest, R.W.M., Meesters, E.H.W.G. & Becking, L.E. 2014. Deep-water sponges (Porifera) from Bonaire and Klein Curaçao, Southern Caribbean. *Zootaxa* 3878: 401-443.

# New biodiversity research at Curaçao

**Charles H.J.M. Fransen, Harry A. ten Hove, Yee W. Lau, Sancia E.T. van der Meij, Leen P. van Ofwegen, Cessa Rauch, Bastian T. Reijnen, Kaj M. van Tienderen & Bert W. Hoeksema**

*Naturalis Biodiversity Center, Leiden*

**In October-November 2013 and in March-May 2014 staff members, PhD candidates and MSc students of the Naturalis Marine Biodiversity Team performed fieldwork on the reefs of Curaçao investigating crabs, shrimps, mollusks and polychaetes living in association with various invertebrate groups. Additionally, octocorals and stony corals were studied as potential host species. SCUBA dives were made at various localities along the leeward coast and one at the northeast coast. Many new records for the Curaçao marine fauna were made, including new host-symbiont associations, species new to science and new insights in phylogenetic relationships.**

Marine biodiversity research at Curaçao (Dutch Caribbean) has been carried out extensively in the 20th century. Historical collections from there are now housed in Naturalis Biodiversity Center.
In recent years there has been a renewed interest in the marine fauna and flora of the area because of anthropogenic threats to marine biodiversity, such as climate change, coastal development, tourism and the introduction of invasive species. The Naturalis Marine Biodiversity Team is developing research projects in the area, including those executed by MSc students. Selected taxonomic groups are used as a proxy to detect biodiversity changes.

## Symbiotic shrimps

Charles Fransen studied a group of symbiotic shrimp forming associations with various reef organisms like sponges, coelenterates, echinoderms, ascidians and mollusks. Worldwide about 600 species of such shrimps have been recognized, 10% of which have been recorded in the Caribbean, which is a topic of ongoing research (Snijders & Fransen, 2010). Previously, from Curaçao only 7 species were reported in the scientific literature. Our recent inventory resulted in a total of 25 species, constituting 18 new records for Curaçao, including new species. One species has been found in between the tentacles of a stony coral, which has not been recorded in the Atlantic Ocean before. From present experience it is expected that further extensive research on the reefs of Curaçao will yield many new records for its marine fauna, as well as new species of shrimps.

## Coral gall crabs

Sancia van der Meij and Kaj van Tienderen studied coral gall crabs of the family Cryptochiridae, which live in obligate symbiosis with stony corals. Worldwide around 50 gall crab species are recognized from shallow and deep reefs. Most species have been described from the Indo-West-Pacific, whereas only 5 are known from the Atlantic. From Curaçao 3 gall crab species were recorded from 21 different host corals, 8 of which represent newly discovered associations. One of these crabs constitutes a range extension of a species described from Brazil, which therefore is also a new record for the Caribbean (van der Meij, 2014).

## Snails and octocorals

Bastian Reijnen and Yee Lau studied Octocorallia (gorgonians and soft corals) as well as species of the gastropod family Ovulidae. Most ovulid snails live in obligate symbiosis with octocorals and are therefore highly dependent on their coral hosts (Reijnen *et al.*, 2010). Possibly new species of gorgonians have been discovered in the shallow waters around Curaçao. Close examination of the octocoral samples also revealed new host species for a number of Atlantic Ovulidae. Additionally, phylogenetic and morphological studies have resulted in new insights in the systematics of the family Plexauridae (Octocorallia).

**Fig. 1.** Two gall crabs inside an *Agaricia agaricites* coral at Curaçao, 2014. Photo: B.W. Hoeksema.

## Christmas tree worms

Bert Hoeksema and Harry ten Hove have started a study on the host specificity of Christmas tree worms (*Spirobranchus* spp.) of the family Serpulidae. These tube-building worms are most commonly associated with scleractinian corals. They are famous for their pairs of spiral-shaped, feathery tentacles, which show much colour variation. Off Curaçao, various new coral host species have been discovered and also worms that are not associated with corals but with other kinds of hosts, including Christmas tree worms themselves.

The collected material is currently analysed at Naturalis Biodiversity Center using e.g. molecular techniques to reveal phylogenetic relationships and discover possible cryptic species. More scientific publications on new associations and other interesting observations are expected in the coming years.

**Fig.2.** Two *Cyphoma gibbosum* snails dwelling on a *Gorgonia* coral at Curaçao, 2015. Photo: B.W. Hoeksema.

**Fig.3.** A *Porites astreoides* coral at Curaçao, 2014, inhabited by Christmas tree worms, *Spirobranchus giganteus*. Photo: B.W. Hoeksema.

## References

van der Meij, S.E.T. 2014. Host species, range extensions, and an observation of the mating system of Atlantic shallow-water gall crabs (Decapoda: Cryptochiridae). *Bulletin of Marine Science* 90: 1001-1010.

Reijnen, B.T., Hoeksema, B.W. & Gittenberger, E. 2010. Host specificity and phylogenetic relationships among Atlantic Ovulidae (Mollusca: Gastropoda). *Contributions to Zoology* 79: 69-78.

Snijders, N. & Fransen, C.H.J.M. 2010. *Pseudopontonides plumosus* sp nov., a new cnidarian-associated pontoniine shrimp (Crustacea, Decapoda, Palaemonidae) from Curacao. *Zootaxa* 2372: 7-14.

# Mushroom coral surveys
## outside the Coral Triangle

**Bert W. Hoeksema & Zarinah Waheed**

*Naturalis Biodiversity Center, Leiden*

**The Southeast Asian - West Pacific Centre of maximum marine diversity is known as the Coral Triangle. It contains the highest number of reef coral species, especially stony corals (Scleractinia). Most of these are known to host associated fauna, predominantly consisting of invertebrates and fishes that may act as parasites or commensals. The boundary of the Coral Triangle is not well defined due to lack of precise information on coral species richness around it. In order to get a clearer image of its delineation, areas outside the Coral Triangle were surveyed for their coral fauna, in which mushroom corals (Fungiidae) served as a model group.**

The scleractinian family Fungiidae consists of 52 species, which are popularly known as mushroom corals. These iconic animals occur on coral reefs in the tropical Indo-Pacific, from the coastlines of eastern Africa to those of Central America. Most species (80%) are free-living when full-grown. They can move and colonize all kinds of substrates, ranging from solid, rocky substrates of shallow reef flats to sandy sediments of the deeper reef bases.

## Naturalis studies

Mushroom coral research in Naturalis started with the sampling of reef corals during the Siboga Expedition to eastern Indonesia (1899-1900). In November 1982, Hoeksema started to use the coral reference collection of Naturalis as introduction and preparation for his first revision of the taxonomy, phylogeny and biogeography of mushroom corals, which was published in 1989. His field surveys started in 1983, in the Thousand Islands off Jakarta. In 1984-1986 and 1993-1998 he lived in Makassar, which was used as base to visit other areas in Indonesia. The mushroom coral diversity of the islands off Makassar, in eastern Indonesia and part of the Coral Triangle, is higher than that of Jakarta, in western Indonesia and outside the Coral Triangle.

## Uncertain boundary

It appeared that the coral fauna in various areas outside the Coral Triangle was not investigated previously and that the position of its boundary was therefore uncertain. Hence, various areas in and outside its boundaries were studied for the presence or absence of mushroom coral species. Hoeksema found an ally in PhD candidate Zarinah Waheed, based at the Borneo Marine Research Institute, Universiti Malaysia Sabah, in Kota Kinabalu. They found the highest concentration of fungiid species (44) in Semporna, northeastern Borneo (Waheed & Hoeksema, 2013).

## Research in 2013 and 2014

In 2013 and 2014, various localities outside the Coral Triangle were surveyed for their mushroom coral fauna, with emphasis on species richness, endemism, and the composition of associated fauna. Earlier, studies in Vanuatu (2006), Brunei (2012), and Kota Kinabalu (2012) showed that these areas outside the Coral Triangle were much richer in fungiid species than previously assumed and actually should be considered part of the Coral Triangle (Waheed & Hoeksema, 2013; Hoeksema & Lane, 2014). In 2013, Waheed and Hoeksema visited Layang-Layang atoll (northern part of the South China Sea), Langkawi islands (Andaman Sea), Tioman Island and Redang Island (southern part of the South China Sea, adjacent to the Gulf of Thailand). In 2014, Hoeksema collaborated with local researchers to study the mushroom coral fauna of the Loyalty Islands and the southeastern part of New Caledonia, the Maldives, southern Japan, and the Saudi Arabian coast of the Red Sea. The mushroom coral faunas of New Caledonia and southern Japan were as rich as those known of several areas in the Coral Triangle. Some of these localities had species with very limited distribution ranges, exclusively outside the Coral Triangle: *Cantharellus doederleini* in the Red Sea, *Podabacia lankaensis* in the Maldives and *Cantharellus noumeae* in New Caledonia. In the coming years new taxonomic and biogeographic revisions of mushroom corals will be published based on the new results.

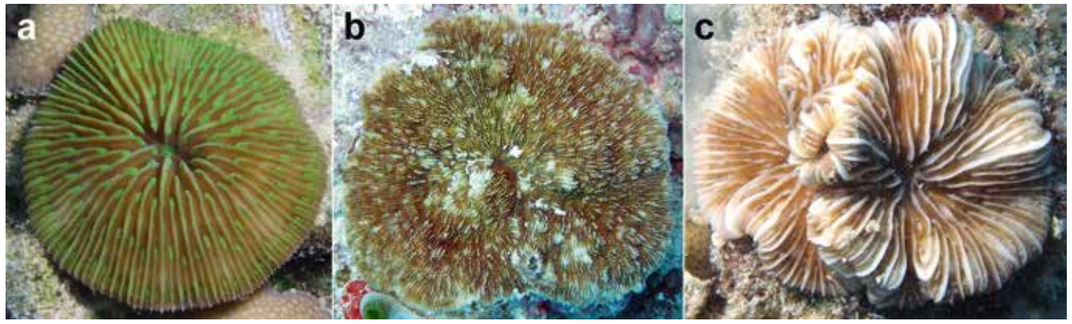


**Fig. 1.** Unique and rare mushroom corals outside the Coral Triangle: a. *Cantharellus doederleini* (Saudi Arabia, Red Sea), b. *Podabacia lankaensis* (Maldives), c. *Cantharellus noumeae* (New Caledonia).

**Fig. 2.** The Research Vessel *Alis* of the *Institut de Recherche pour le Développement* at Nouméa, New Caledonia, functioned as base to explore the reefs of the Loyalty Islands and New Caledonia.

## References

Hoeksema, B.W. & Lane, D.J.W. 2014. The mushroom coral fauna (Scleractinia: Fungiidae) of Brunei Darussalam (South China Sea) and its relation to the Coral Triangle. *Raffles Bulletin of Zoology* 62: 566-580.

Waheed, Z. & Hoeksema, B.W. 2013. A tale of two winds: species richness patterns of reef corals around the Semporna peninsula, Malaysia. *Marine Biodiversity* 43: 37-51.

Waheed, Z. & Hoeksema, B.W. 2014. Diversity patterns of scleractinian corals at Kota Kinabalu, Malaysia, in relation to depth and exposure. *Raffles Bulletin of Zoology* 62: 66-82.

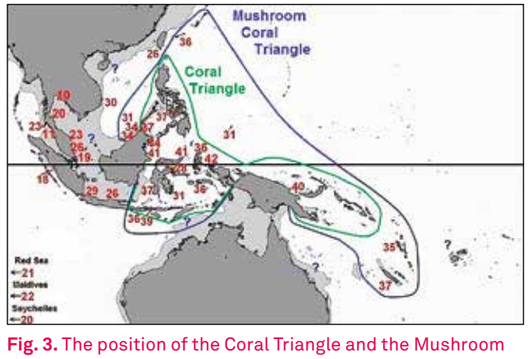


**Fig. 3.** The position of the Coral Triangle and the Mushroom Coral Triangle. The latter is preliminary and based on presence/absence data of Fungiidae. Numbers indicate species richness of Fungiidae.

# Ocean drifters
## Evolution of marine zooplankton

**Katja T.C.A. Peijnenburg[1, 2], Alice K. Burridge[1, 2] & Erica Goetze[3]**

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**Open ocean zooplankton are often viewed as slowly evolving species that have limited capacity to respond adaptively to changing ocean conditions. Hence, attention has focused on *ecological* responses. However, we ask: do plankton have significant capacity for *evolutionary* responses to a changing ocean? Given emerging evidence for regional-scale genetic isolation and expected strong responses to selection, we argue that zooplankton are well-poised for rapid adaptive responses to climate change.**

The oceans are changing on a global scale and, in some cases, at rates greatly exceeding those observed in the historical and recent geological record. Plankton, the organisms that drift with the ocean currents, show the most dramatic range shifts of any organisms reported in either terrestrial or marine environments (e.g. Beaugrand *et al.*, 2009). Marine zooplankton serve as key links in the food web between microscopic plants and higher trophic levels (such as fish and whales) and are important mediators of biogeochemical fluxes in the ocean. Marine zooplankton are a phylogenetically diverse group (Fig. 1) with representatives from 12 animal phyla.

## Evolution in the open sea

Although we know very little about the evolutionary potential of open ocean zooplankton, most authors have explicitly or implicitly assumed that zooplankton have limited capacity to evolve on time scales relevant to adaptation to 21st century global change. This assumption is based, in part, on the idea that plankton are expected to be 'high dispersal' species, and gene flow is known to inhibit local adaptation. However, our review (Peijnenburg & Goetze, 2013) of 45 primary studies on population genetics and phylogeography of marine zooplankton found that these species often do show significant spatial genetic structure, implying limits to dispersal in the open sea. A second reason to think that zooplankton have high capacity for evolutionary responses to global change is based on theoretical insights. Natural selection is expected to be a dominant force driving evolutionary change in species with large population size. Marine zooplankton have some of the largest populations on Earth (e.g. $>10^{15}$ census size), and it can easily be shown that these populations should respond to even very mild selective pressures (Peijnenburg & Goetze, 2013). The wide occurrence of deviations from neutrality reported in plankton genetic studies (15 out of 20 studies) provides indirect support for the hypothesis that selection is a dominant force in the plankton.

## Priorities for future research

Currently, little is known about adaptation of zooplankton to local oceanographic conditions. Testing our hypothesis of high evolutionary potential in open ocean plankton will require research in at least two primary areas. First, the question of how pervasive selection is in driving population divergence in zooplankton needs to be addressed. Second, the spatial and temporal scales over which differentiation occurs in the open ocean need to be rigorously quantified. Next Generation Sequencing technologies have made it possible to rapidly generate large-scale sequence data from non-model organisms at reasonable costs. We expect that these technologies will enable the field to move away from single marker studies and to allow comparisons of adaptive and neutral variation across genomes.

## Basin-scale transects

We also need rigorous sampling in terms of numbers of individuals sampled per population, and across space and time to increase the scientific rigor of plankton population genetic studies. For these reasons, our team has participated in two oceanographic expeditions sampling ~13,500 km transects

**Fig. 1.** Examples of the diverse zooplankton assemblage of the Atlantic Ocean (members of the phyla Arhropoda, Mollusca, Annelida, Cnidaria and Chaetognatha are shown).

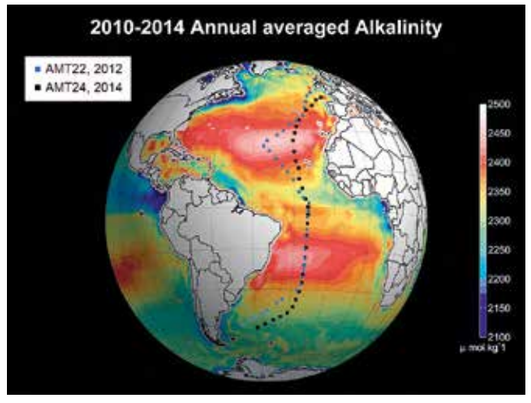


**Fig. 2.** Two meridional transects in the Atlantic ocean (AMT22 and AMT24) plotted onto a map showing total alkalinity as measured from space (Land *et al.*, 2015). Each square represents a plankton tow.

in the Atlantic ocean in 2012 and 2014 (Figs 2 & 3) within the Atlantic Meridional Transect Programme (http://www.amt-uk.org). During these expeditions, we have collected a total of 97 plankton samples (from ~300m depth to the surface). Tows were conducted with 0.71 m diameter bongo nets (200 and 333 µm mesh sizes) and an RMT1 midwater trawl (333 µm mesh size) that has a nominal mouth area of 1 $m^2$. Most tows were conducted at night to efficiently sample the migratory plankton community.


**Fig. 3.** The zooplankton team preparing for the AMT24 cruise with the research vessel 'James Clark Ross' in October 2014. From left to right: Erica Goetze, Katja Peijnenburg, Alice Burridge, and Michelle Jungbluth.

## References

Beaugrand, G., Luczak, C. & Edwards, M. 2009. Rapid biogeographical plankton shifts in the North Atlantic Ocean. *Global Change Biology* 15: 1790-1803.

Peijnenburg, K.T.C.A. & Goetze, E. 2013. High evolutionary potential of marine zooplankton. *Ecology & Evolution* 3(8): 2765-2781.

Land, P.E., Shutler, J.D., Findlay, H.S., Girard-Ardhuin, F., Sabia, R., Reul, N., Piolle, J-F., Chapron, B., Quilfen, Y., Salisbury, J., Vandemark, D., Bellerby, R. & Bhadury P. 2015. Salinity from space unlocks satellite-based assessment of ocean acidification. *Environ. Sci. Technol.* 49: 1987-1994.

# Marine groundwater crustaceans and reef fossils

**Ronald Vonk[1], Bert W. Hoeksema[1], Damiá Jaume[2], Michael F. Gable[3], Leonardo Latella[4], Roberto Zorzin[4] & Samar Ishak[5]**

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**Amphipods (9,500 species, example Fig. 1) are small crustaceans living mostly in marine coastal waters. This group also colonized ocean waters, and in the freshwater and terrestrial realm they conquered habitats such as rivers, lakes, moist forest floors, caves and groundwater. Although their fossil record is young compared to related crustacean orders and does not exceed Paleogene age, it is an important part of our research to infer a much older origin. This research is part of the international effort to detail the evolution of Pancrustacea and present their history of descent in public museums.**

Especially the biogeography of members of the very rare amphipod suborder Ingolfiellidea (Fig. 2) suggests that the appearance of this group predates the opening of the Atlantic Ocean (Fig. 3). The Naturalis marine expedition team directs part of its specific searches to the habitat of shallow marine interstitial spaces within the coral reef debris. Recently, sampling in the Maldives and the Red Sea was successful in finding some specimens of ingolfiellids. New species are being described and their morphological characters coded and fitted into existing databases, with DNA vouchers stored for future research.

## Studying the transition route

Naturalis is important for groundwater crustaceans as it has one of the few large European specialized collections on them, dating back 50 years. The Dutch Caribbean makes up a considerable part of the sampling efforts since that time. Given a specific array of animal groups in the underground what kind of research can be done on them? Crustaceans have colonized many different habitats and in doing so they must have gone through phases of a rather radical change of form in attempts to adapt to a new physical environment. The marine interstitial 'landscape' lends itself quite good to study this transition route. Those populations that have the potential to colonize freshwater or vice versa, and those that move toward a secondary invasion of the marine environment are present in this habitat. One truly fascinating aspect of sampling in the narrow band of intertidal coast sediments is the encounter with certain rare but circumtropical genera that contain few species but nonetheless have occupied this habitat all over the tropical zone. It is possible that thousands of species show up after thorough sampling of this environment but it is also possible that it remains a species poor environment where only a few pre-adapted forms take their hold.

## Convergent development

Repeated visits to the same island groups or to mainland karst areas have often revealed additional species each time a specific search was made. In other cases populations of the same species are distributed over different islands. This was encountered in the Canary islands for the widely separated islands Hierro and Tenerife. On the Philippines *Ingolfiella alba* appears in littoral sands of more than one island and remains the only species known from that large archipelago. But in the small Indonesian Gura Ici island group in the Molucca Sea 2 species appear in syntopy in the same beach groundwater spot. After many years of sampling on the Caribbean islands of Aruba, Curaçao, and Bonaire 5 species in diverse aquatic habitats such as marine sublittoral carbonate sands, brackish caves and terrestrial groundwater were recognized. These examples lead to the expectation that an ocean spanning, circumtropical continuum exists of populations gradually changing in minor morphological adaptations and converging in functional form toward their environment. Such convergence could explain why a sublittoral reef sand inhabiting form from the Caribbean



**Fig. 1.** Exceptionally large amphipods from the deep sea off New Zealand. The normal range is between 3 cm and 0.5 cm.
**Fig. 2.** Unidentified ingolfiellid from Namibian cave waters.

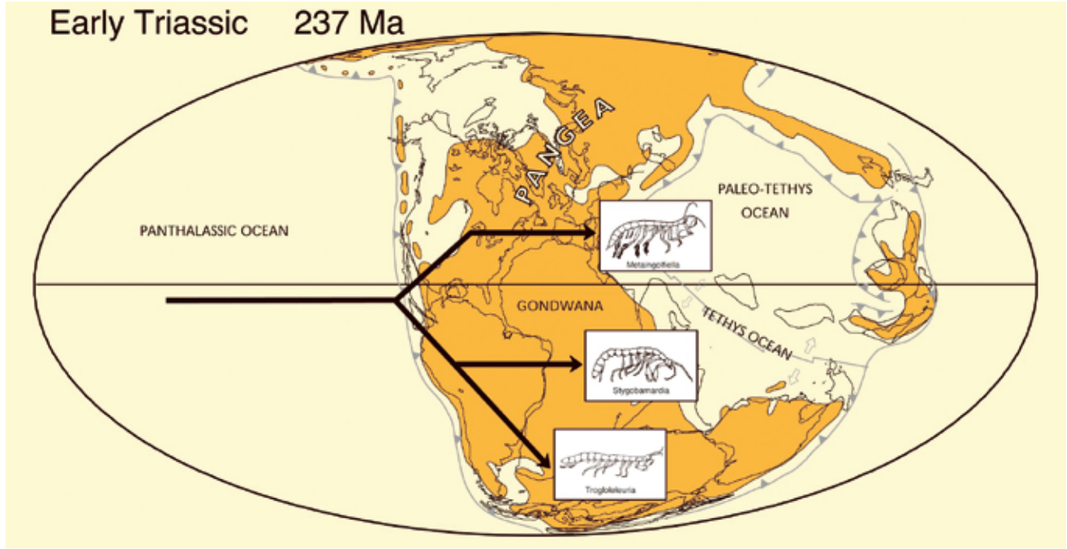


**Fig. 3.** Supposed continental configuration at the times of existence of deep inland freshwater Ingolfiellidea. Part of early branches in a phylogeny projected on Triassic geography.

is more similar to a form that lives in comparable micro-habitats in the Indian Ocean, than it is to a congener found a few kilometers away in a brackish cave bottom with other functional requirements to outward morphology. This convergent development can be observed in the close morphological resemblance of a species from the Caribbean island of Curacao and the species, recently discovered by us and described as *Ingolfiella maldivensis*. They both come from sublittoral reef sands. The Maldives have undergone dramatic sea level changes and these have changed the islands from karstic, well emerged platforms with ample subterranean habitat types to the flat atolls of today. Future discoveries of relicts of this subterranean diversification may reflect this geological past.

## Fossil isopods in Eocene reefs

In search of the groundwater composition of early reefs museum collections in Northern Italy were visited. Several museums have extensive collections of regional excavations in Eocene tropical reef deposits. We redescribed isopod species present in the Verona museum of Natural History and will continue to search for other peracarid representatives in the numerous records. This is important and directly related to the question about when the abundant and diverse Amphipoda entered the crustacean stage.

## References

Vonk, R. & Gable, M. 2014. Infaunal zoogeography and intergeneric character blending: The case of *Metaniphargus shiroi* sp. nov.(Crustacea: Amphipoda: Hadziidae), from interstitial beach water on Akajima Island, the Kerama Islands, Southwestern Japan. *Zoological Science* 31: 491-499.

Vonk, R. & Jaume, D. 2014. *Ingolfiella maldivensis* sp. n. (Crustacea, Amphipoda, Ingolfiellidae) from coral reef sand off Magoodhoo island, Maldives. *ZooKeys* 449: 69-79.

Vonk, R. 2014. Ypresian isopod crustaceans from Monte Bolca and Monte Postale (Italy). Rendiconti della società geologica Italiana (online) 31: 223-224.

# Out of the blue
## The Diepenveen meteorite

**Leo M. Kriegsman[1], Marco Langbroek[1, 2],**

with Peter Jenniskens[3] , Henk Nieuwenhuijs[4], Niek de Kort[5] , Wim van Westrenen[6], Karen Ziegler[7], Adrian Brearley[7], Rhian Jones[7] , Michael Zolensky[8], Qing-zhu Yin[9], Philippe Schmitt-Kopplin[10], Norbert Hertkorn[10], Aaron S. Burton[11], Daniel P. Glavin[11], Qinghao Wu[12], Richard Zare[12], Matthias M.M. Meier[13], Kees Welten[14] and Sebastiaan de Vet[15] (the Diepenveen Meteorite Consortium)

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[13] ETH Zürich, Switzerland;
[14] University of California Berkeley, USA;
[15] University of Amsterdam, the Netherlands

**A meteorite that fell in a field near Diepenveen (Overijssel province, the Netherlands) in October 1873 was rediscovered in a private collection late 2012 (Fig. 1). Its historical pathway from the observed fall, the immediate recovery by a local farmer and the various public and private collections holding it until it resurfaced in 2012, has been traced in detail. Its composition is unique. Scientific research on this special meteorite is now being carried out by an international consortium, including scientists of Naturalis Biodiversity Center.**

It was quickly realized by Henk Nieuwenhuis, former director of the Royal Eise Eisinga Planetarium in Franeker, that the meteorite is of a relatively rare type, namely a carbonaceous chondrite, the first ever in the Netherlands. On 12 December 2013, the then owner, Mrs. Kiers, kindly donated the meteorite to Naturalis Biodiversity Center to curate it as national heritage, and to allow scientific research. The occasion led to a flood of media attention and to a meteorite weekend for the general public in January 2014.

### Fifth Dutch meteorite ever

The Diepenveen is the fifth meteorite ever found in the Netherlands (after Uden 1840, Utrecht 1843, Ellemeet 1925 and Glanerbrug 1990), excluding a possible iron meteorite (Dordrecht, 1650) that was lost during the gunpowder disaster in Leiden in 1807. Chronologically Diepenveen is the third preserved Dutch fall.

### Which type?

Classifying the Diepenveen meteorite on subtype has proven to be less than straightforward. On the basis of mineralogy and petrology Diepenveen is a carbonaceous chondrite with similarities to the relatively rare subtype CM2. It contains a number of amino acids that are rare or absent on Earth. Minerals observed include olivine, clinoenstatite, various Fe-Ni phases - both metallic and sulphidic -, and hydrous phases. Some calcium-aluminium inclusions are present, characterized by diopside enclosing perovskite. The texture shows chondrules and fragments that have been aqueously altered to variable degrees and show no sign of significant thermal metamorphism, consistent with the history of other CM carbonaceous chondrites. Within the CM group, however, this meteorite features some unusual and unique aspects that raise the question whether it should be classified as CM or as C2-ungrouped instead. This classification issue is currently being discussed with the Nomenclature Committee of the international Meteoritical Society, where we are now registering the Diepenveen. Research results are preliminary and still under embargo, which means we cannot provide much detail at this moment, but Diepenveen is unusual in its age, and in its isotopic and organic composition.

**Fig. 1.** The Diepenveen meteorite in the original box in which it was kept in a school collection in the late 19th and early 20th century.

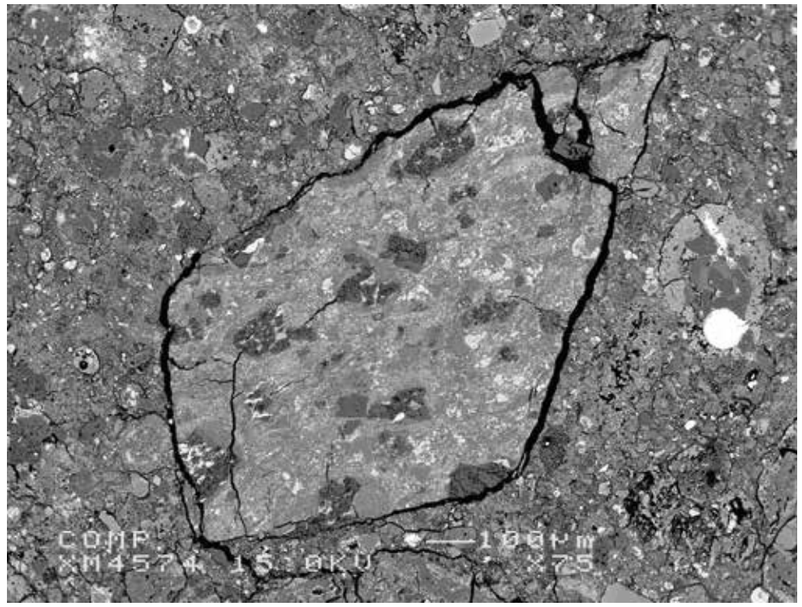



**Fig. 2.** A microscopic view of the Diepenveen meteorite, showing a fragment in a brecciated matrix.

The meteorite is a heterogeneous breccia and has all the characteristics of a regolith, i.e. the brecciated surface of an asteroid. Some of the meteorite's unusual characteristics and its reflectance spectrum lead us to think it could be a sample of a specific, rare sub-group among the Near Earth Asteroid population. If correct, then Diepenveen provides us valuable insights into the character and history of the surface of these asteroids.

### High-impact research

Current investigations of the Diepenveen meteorite by an international team from institutions in Europe and the USA, including NASA, use a large variety of sophisticated laboratory techniques that include microprobe mineral analyses, noble gas and isotope analyses, reflectance spectra and mass spectrometry on soluble organics. We anticipate to submit a high-impact paper by late 2015 which will also highlight potential links with asteroidal targets of upcoming space missions.

# Vertebrate evolution
## in deep-time

**Martin Rücklin**

*Naturalis Biodiversity Center, Leiden*

**How did recent vertebrates including us evolve? What are the main key-innovations in the evolution of jawed vertebrates? A deep-time analysis using developmental data is applied to answer these challenging questions. This study focusses on the organ systems of jaws and teeth as a model in evolutionary biology.**

The evolution of jaws and teeth is considered to be an important novelty underpinning the evolutionary success of jawed vertebrates. Basal stages and the evolution and development of teeth and the origin of tooth replacement are controversial. A major problem is the nature of the available data, the development is inferred on the basis of the outside morphology of fossils. Due to the rarity of fossils and the two dimensionality of the sections, using destructive methods to investigate the inside for identifying lines of growth is restricted. To overcome these problems, non-destructive high resolution X-ray scans from a synchrotron source are used. Lines of arrested growth are identified and three dimensional computer models of growth stages are generated (Rücklin *et al.*, 2014).

## Dental evolution

Arthrodiran placoderms, a group of extinct armoured fishes, are identified to possess jaw bones with teeth. Teeth are consisting of dentine with a pulp cavity and are added in rows along the margin of the jaw. Teeth are not replaced in the first jawed vertebrates. Reanalysis of supposed early dental structures in extinct jawless vertebrates, the conodonts, recovered that these elements are convergent to teeth in jawed vertebrates on the basis of phylogenetic congruence. Tooth-like patterning of pharyngeal denticles in the jawless thelodonts was also reanalyzed using the synchrotron tomographic approach. A less strict patterning as suggested is recovered and together with a test of the phylogenetic congruence this patterning is identified as convergence to tooth replacement patterns in jawed vertebrates (Donoghue & Rücklin, early online).

## Teeth and jaws

On the basis of this research an evolution of teeth after or in concert with jaws is plausible. No principal difference of dermal external denticles and oral ones is evident and an evolution of teeth through expansion of dermal competence in the oral cavity is supported. No evidence for an evolution of teeth before jaws and separate evolution of teeth and dermal scales is found.

## Non-destructive visualization

Applying micro-CT and synchrotron radiation X-ray tomography (SRXTM) enables non-destructive visualization of the morphology of organisms (fossil and recent) in very high resolution and makes it possible to study their development and histology. Along with these methodological advances possibilities in visualising the digital data for science, outreach and education are enabled (Lautenschlager & Rücklin, 2014). 3D scans can be used to create 3D models and published as 3D PDFs. Rapid prototypes or 3D prints can be made on the bases of computer models changing the magnification and showing minute details or virtually preparing and reassembling fossils. Anaglyphe stereo imaging and the use of 3D glasses can be used in presentations or museum exhibits. Using QR codes digital data can be linked and easily accessible using smart phones or tablet computers.

## References

Donoghue, P.C.J. & Rücklin, M. *early online*. The ins and outs of the evolutionary origin of teeth. *Evolution & Development* 1-12.

Lautenschlager, S. & Rücklin, M. 2014. Beyond the print – virtual paleontology in science publishing, outreach, and education. *Journal of Paleontology* 88: 727-734.

Rücklin, M., Donoghue, P.C.J, Cunningham, J.A., Marone, F. & Stampanoni, M. 2014. Developmental paleobiology of the vertebrate skeleton. *Journal of Paleontology* 88: 676-683.

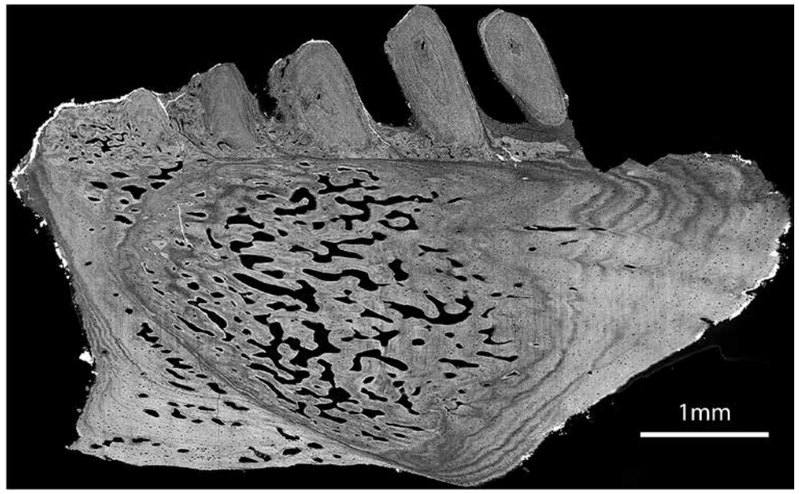



**Fig. 1.** Virtual section through the jawbone and teeth of the placoderm *Compagopiscis croucheri*.

**Fig. 2.** Virtual section and developmental model of pharyngeal denticles of the jawless fish *Loganellia scotica*.

# *Tyrannosaurus rex* on display at Naturalis in 2016

**Anne S. Schulp**

*Naturalis Biodiversity Center, Leiden*

**Right now, one dinosaur is conspicuously absent in the Oerparade exhibit at Naturalis: a large carnivore. With the new dinosaur gallery for the new museum currently in development, the herbivorous denizens of the Oerparade will at last find themselves accompanied by a genuine skeleton of a large carnivore: an adult *Tyrannosaurus rex* – arguably the most fascinating of all dinosaurs. With the new dinosaur gallery coming up, Naturalis set out to acquire a *T. rex*. Not a cast, but a real skeleton. Not exactly an easy task, but we succeeded!**

Decent specimens of *T. rex* are exceedingly rare. Moreover, Naturalis was keen on actually excavating the specimen and performing all the research possible, instead of acquiring a skeleton on the market. In Fall 2013, an unusually complete skeleton emerged from the badlands of Montana, and in a matter of weeks, the specimen was excavated and moved to the laboratory of Black Hills Institute for preparation and mounting. The fundraising campaign to cover the expenses of acquiring and preparing the fossil successfully completed in late 2014, and at the time of writing, preparation has started in earnest. In the next 18 months leading to the mounting of the specimen, Naturalis will be able to study the material in detail, as the bones emerge from the sandstone. The aim is to present the full story on the life and death of this 13-metre, adult female in the upcoming *T. rex* exhibition, scheduled to open in the Pesthuis in the second half of 2016.

## Perfectly preserved

The specimen is very well-preserved. Sedimentological analysis suggests that soon after her death, the bones were rapidly covered under some 3,25 metres of sand – resulting in a perfect, undistorted 3D preservation of the skeleton. With the exception of a leg and the tiny bones of the feet, arms and the tip of the tail, most of the rest of the skeleton is preserved, making it one of the most complete skeletons of *T. rex* ever discovered.

## Addressing many questions

In addition to a detailed morphological description and comparison with other specimens, a wide range of other research questions will be addressed. The geological setting of the specimen has been studied in detail already (together with Amsterdam VU University), and most of the sedimentological analyses (grain size distribution, TGA, magnetostratigraphy, pollen, geochemistry) are completed or ongoing.
The first CT scan of the many pathologies has been performed now (together with LUMC), and a diagnosis on the bony outgrowths adorning a tail vertebra should be in soon. With the isotope laboratory of Amsterdam VU University, the first samples of tooth enamel for stable isotope analysis ($^{13}C$, $^{18}O$, as well as Sr) have been taken, which will provide information on aspects of trophic level, diet, paleotemperature and migration patterns.

## Reconstructing dinosaur life

During her long life, the Naturalis *T. rex* suffered various injuries. Already at this stage, it is obvious she had an infection in her right upper jaw; her left lower jaw has been bitten by another *T. rex*, one of her ribs shows an intriguing, thick section suggesting a healed fracture, and her right lower leg suffered some serious trauma – also probably a healed fracture, or maybe a bone infection. These preliminary field observations will soon be further investigated together with the LUMC.
Similar to using tree rings to learn about the age of a tree, the Lines of Arrested Growth (LAGs) in dinosaur bone are known to give some clues as to the age of the dinosaur. Together with VU Brussels, Naturalis will extract a few samples from the bones to count growth lines, to – hopefully – find out about the minimum age of the specimen. Given her size and a few other skeletal features, she is expected to be well beyond her late twenties. In collaboration with the Henry Mosley X-Ray Imaging Facility at the University of Manchester, additional histological information using (non-destructive) X-ray microtomography should be recovered.
Prior to preparing the skull from the matrix, Naturalis will arrange for a detailed, high-resolution CT scan. Given the required X-ray energy and the size of the block this will by necessity be an industrial CT scanner. The CT scan will provide a road map for the preparation of the skull, but also help spatially resolve all kinds of delicate internal features, such as respiratory turbinates, the inner ear, etc.
The bones of the left leg of the *T. rex* will have to be reconstructed by mirroring from the right leg. Using a 3D scan and 3D printing will considerably speed up this process, and will allow for a much better accuracy. Additionally, having a 3D digital model of the skeleton available, would allow for detailed biomechanical (computer) modeling, as well as much easier comparisons to be made with other specimens.

**Fig. 1.** Excavation site of *T. rex* in Montana, USA. Photo: Servaas Neijens.

**Fig. 2.** *T. rex* skull.
Photo: Servaas Neijens.

**Fig. 3.** Tooth of *T. rex*. Photo: Servaas Neijens.

# Natural pearls
## from the Netherlands

**Hanco J.C. Zwaan**

*Naturalis Biodiversity Center, Leiden*

**In the framework of the *Netherlands Gemmological Laboratory,* the identification of gemstones and pearls for the private sector is part of the daily work, with systematic characterization of pearls and gems from different occurrences and new localities. We especially are alert with regard to new culturing techniques that produce cultured pearls with internal structures that closely resemble those of natural pearls, threatening the natural pearl market. Natural pearls are rare and fetch increasing high prices. Cultured pearls are over-produced and go down in price. Therefore great interest exists, not only in correct identification of natural pearls, but also in 'the unusual'. In 2013-2014, we had the opportunity to look at unusual pearls, found in the Netherlands, and an exceptionally large pearl, with strong historic ties to the Netherlands.**

Natural pearls are normally formed by bivalve mollusks, of the Genus *Pinctada.* Historically, *Pinctada radiata,* occurring in the Persian Gulf and Red Sea, was an important producer of natural pearls, but *Pinctada maxima* and *Pinctada margaritifera* in the Pacific region, also produced significant numbers. 'Nacreous' pearls formed by those species are a product of biomineralization, and usually consist of concentric layers of aragonite (calcium-carbonate) platelets ('nacre'), embedded within an organic matrix, producing a smooth surface with a high luster and subtle play-of-color.

## Dutch curiosities

Recently, some natural pearls were found in Zeeland, the Netherlands, reportedly from the Grevelingenmeer and Westerschelde areas. These non-nacreous pearls were white, and displayed a dull lustre and showed an uneven, bumpy surface in the microscope. X-radiography and micro-CT scanning of the pearls revealed concentric structures consistent with their natural origin. Raman spectroscopy typically identified not aragonite, but calcite as the sole component for these pearls. Calcitic pearls are very rare. A relatively low Mn and high Sr content (with SrO/MnO >>12) confirmed their saltwater origin. The host oyster for these pearls was identified as *Crassostrea gigas* (Thunberg, 1793), a common 'true oyster' species in Zeeland, also known as the 'Japanese oyster', which is harvested for its meat but not used for pearl cultivation. There is no human intervention in the growth of these oysters, which supports the conclusion that these pearls are truly natural. These pearls can be seen as curiosities from the Netherlands that are very rarely found. Although they have all the characteristics of natural pearls, due to their low lustre and imperfect surface, they are of limited commercial interest. However, larger pearls, such as the ~7.7 mm round sample (Fig. 1) may have considerable value – especially in light of the recent popularity of natural pearls from all types of mollusks. Concerning the relatively large size of this pearl, the growth must have started when the oyster was young and continued until the shell was of harvestable size (i.e. perhaps exceeding 5 years).

## Sleeping Lion

Opportunities to thoroughly study exceptionally rare objects (with often great monetary value) are scarce. The Sleeping Lion (Fig. 3) is one of the largest-known nacreous pearls and has an interesting history. Early references indicate that the pearl was left to be auctioned in Amsterdam in 1778. A print of an 'Oosterse Paarel' (oriental pearl) was found in the city archive of Amsterdam. It was accompanied by a note stating: 'a large pearl, of 578 carats, visualizing a sleeping lion', left by H.C. Sander, has been sold in the Munt, on 26th August 1778. Soon after it was sold for 2,100 Dutch guilders, it was offered for sale in St. Petersburg in 1779. After that, the pearl's history was unknown until 1865, when the second-known owner from Poland appeared, shortly before the return of the pearl to Amsterdam around 1868. Since then, it has been part of a Dutch private collection. The pearl was recently removed from its setting, allowing its weight to finally be determined at 2,373 grains (593 carats or 118.65 grams).

**Fig. 1.** Pearl (~ 7.7 mm in diameter), found in this 'Japanese oyster', reportedly from Grevelingen, Zeeland, the Netherlands. Photo: D. van der Marel.

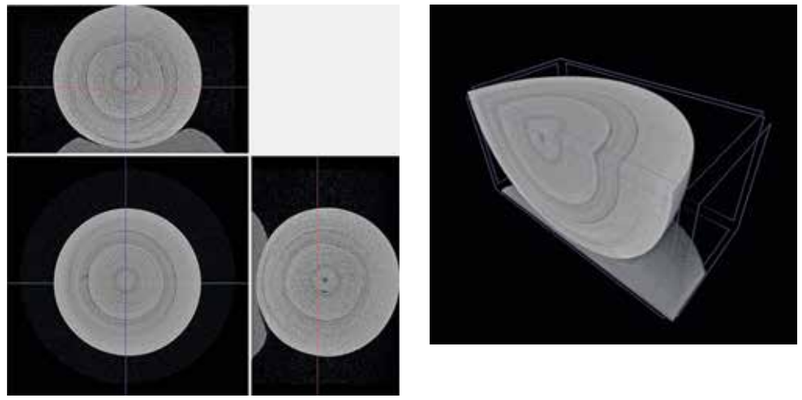


**Fig. 2.** Micro-CT images in the XYZ direction of the pearl depicted in Fig. 1, show concentric structures that confirm its natural origin.


**Fig. 3.** The Sleeping Lion pearl, which measures approximately 70 x 43 x 39 mm, displayed as drawn in 1778. Photo: J.C. Zwaan.

Comparing this weight with the mentioned 578 carats, the carat weight used at the time (before the standardization of the metric carat in the early 20th century) must have been around 0.2053 grams, which is exactly the value of the known London carat.

## Largest freshwater pearl

High resolution X-ray micro-CT scanning revealed the inner structure of the pearl, and together with Raman spectroscopy confirmed that the Sleeping Lion is a naturally formed blister pearl, without any substantial hollow cavities. Strong fluorescence under X-rays, combined with relatively high concentrations of Manganese and low concentrations of Strontium, indicate that this pearl has a freshwater origin. It is therefore confirmed to be the largest natural freshwater blister pearl documented to date, slightly less in weight than the Pearl of Asia (2,420 grains), but larger than the Arco Valley Pearl (2,300 grains), both reportedly of saltwater origin. Taking into account its size and colour, it appears to be likely that the pearl was formed in a large freshwater mussel of the family Unionidae, somewhere in East Asia (China or Japan). The 18th century print with the subscript 'Oosterse Paarel' appears to support a Far East origin. Historical references also confirm that from early times, large baroque pearls were known to come from China and Japan.

## References

Zwaan, J.C. & Groenenboom, P. 2014. Natural pearls from Edible 'True Oysters' in Zeeland, the Netherlands. *Journal of Gemmology* 34: 150-155.

Zwaan, J.C., van der Marel, D.M. & Dommisse, H.A. 2014. The 'Sleeping Lion' Baroque Pearl: An Update. *Journal of Gemmology* 34: 248-253.

# Ecology and Evolution
## in the Era of Big Data

**Alexandre Antonelli[1, 2], Fabien L. Condamine[1], Hannes Hettling[3], Karin Nilsson[1], R. Henrik Nilsson[1], Bengt Oxelman[1], Michael J. Sanderson[4], Hervé Sauquet[5], Ruud Scharn[1], Daniele Silvestro[1, 6], Mats Töpel[1, 7] & Rutger A. Vos[3]**

*[1] University of Gothenburg, Sweden*
*[2] Gothenburg Botanical Garden, Sweden*
*[3] Naturalis Biodiversity Center, Leiden*
*[4] University of Arizona, USA*
*[5] Université Paris-Sud, France*
*[6] University of Lausanne, Switzerland*
*[7] Swedish Bioinformatics Infrastructure for Life Sciences, Sweden*

**Rapidly growing biological data volumes hold an unprecedented, yet incompletely explored potential to reveal how ecological and evolutionary processes generate and maintain biodiversity. Most biodiversity studies integrating ecological data and evolutionary history use idiosyncratic approaches for the reconstruction of time-calibrated phylogenies. To address this, the bio-informatics programme at Naturalis is developing an analytical framework, termed SUPERSMART: the Self-Updating Platform for Estimating Rates of Speciation and Migration, Ages, and Relationships of Taxa. The framework reconstructs dated phylogenies based on the assembly of molecular datasets and collects pertinent data on fossils of the species group of interest. The data handled for each step are continuously updated as databases accumulate new records. We exemplify the practice of our method by presenting comprehensive phylogenetic and dating analyses for the orders Primates and the Gentianales. We believe that this emerging framework will provide an invaluable tool for a wide range of hypothesis-driven research questions in ecology and evolution.**

The SUPERSMART framework mines public DNA sequence data to assemble so-called 'supermatrices', that is, concatenated sets of the same gene in multiple species (Fig. 1). The framework automatically selects the optimal set of these genes such that all species have sufficient data coverage while keeping the total size of the supermatrix within reasonable limits. From this data set a backbone tree is reconstructed, for which a variety of different methods are available. The resulting tree is scaled to evolutionary time using carefully selected fossil calibration points. Subsequently, the backbone tree is expanded to include all species of interest. Because in this step more closely related species are compared with one another, more sophisticated – but more computationally intensive – methods are used that consider scenarios where the history of a gene does not track the history of the species that carry that gene, as is frequently the case in closely related species. Because of the divide-and-conquer approach that the framework takes, this method can be applied to larger sets of species than is normally possible. As we discuss below, the application of this method to the data sets that the framework selects gives results that conform well with previously published results, but allows such results to be generated more easily and at larger taxonomic scales.

## Large orders well resolved

Fig. 2 shows the time-calibrated species level tree comprising 701 species in all 5 families of the plant order Gentianales: Apocynaceae, Gentianaceae, Rubiaceae, Loganiaceae and Gelsemiaceae. The analysis included as many as 54 different genetic markers, thus providing the hitherto most comprehensive species-level analysis of the order. The group is estimated to have originated ca 103 million of years ago (Ma). All families form distinct monophyletic groups, and their relationship corroborates previous phylogenetic estimates, e.g. showing Rubiaceae as sister to the rest of the order. Higher-level relationships within the Rubiaceae, the largest family with 13,514 species, are also in large agreement with recent family-level phylogenetic analyses: subfamilies Cinchonoideae, Ixoroideae, and Rubioideae are found to be monophyletic, with Rubioideae as sister to the others. Furthermore, inter-tribal relationships within Rubioideae are largely consistent with their findings.

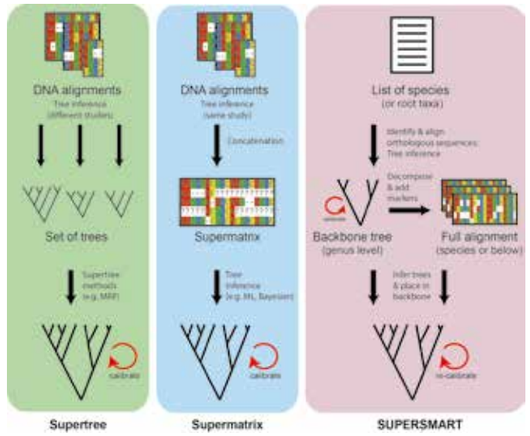



**Fig 1.** Comparison of three methods for constructing large phylogenies: 'supertrees', 'supermatrices', and the SUPERSMART pipeline discussed here.

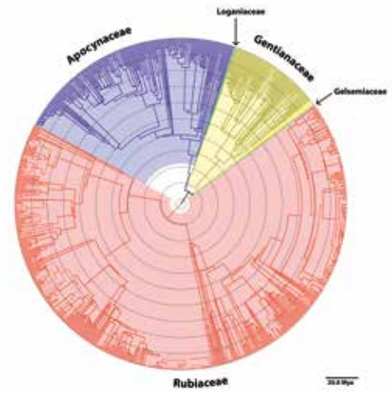



**Fig 2.** The SUPERSMART result for Gentianales comprises the Apocynaceae (blue), Gentinaceae (yellow), Rubiaceae (red), Loganiaceae (green), and Gelsemiaceae (turquoise).

## Splitting the monkey tree

Fig. 3 shows the results from the analysis of the order Primates using another way of visualising large trees. The topology of the extant lineages Strepsirrhini (78 Ma), Tarsiers (69 Ma), New World monkeys (50 Ma), Old World monkeys, and apes (33 Ma) is correctly reconstructed. The phylogeny is based on more than 20 markers, of which 3 had to be available for a species to be included in the backbone step of the analysis. The relationships among the families within the New World monkeys (Platyrrhini) are still unclear, but all genera are supported here as monophyletic. Our results suggest an initial split of the family Pitheciidae and a close relationship between the families Atelidae and Cebidae. The Old World monkeys (Cercopithecidae) comprise the 2 monophyletic subfamilies Colobinae and Cercopithecinae, which is in agreement with previously published primate trees. The Hominoidea are well resolved, including the resolution of the hominoid trichotomy. Relatively less data were available for the inference of the Tarsiformes and the Strepsirrhini. The Strepsirrhini split into Malagasy and non-Malagasy species. The lemurs are represented by 4 families that are well resolved in our tree. However, due to low sequencing data coverage within this group, many Strepsirrhine genera are represented by only their 2 backbone exemplar species.

## Open source software

The SUPERSMART framework is being developed as open source software in collaboration with the University of Gothenburg and the Gothenburg Botanical Garden. In addition funding has been provided by the BioVeL project (http://biovel.eu), the European Research Council (http://erc.europa.eu) and the Swedish Research Council (http://www.vr.se). Infrastructural support in the form of High Performance

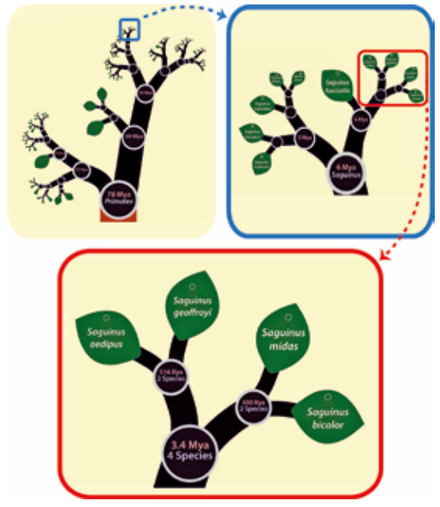



**Fig 3.** Result for the Primates, shown using OneZoom (http://www.onezoom.org). Top left: Full tree; top right: zoom to the genus Saguinus; bottom: zoom to a branch comprising four species.

Compute resources has been provided by SurfSARA (http://surfsara.nl), the Uppsala Multidisciplinary Center for Advanced Computational Science (http://www.uppmax.uu.se) and locally through the intensive collaboration between the bio-informatics programme and Naturalis's ICT department, which provides HPC cloud computing infrastructure.

## Reference

Antonelli, A., Condamine, F.L., Hettling, H., Nilsson, K., Nilsson, R.H., Oxelman, B., Sanderson, M.J., Sauquet, H., Scharn, R., Silvestro, D., Töpel, M. & Vos, R.A. 2014. SUPERSMART: ecology and evolution in the era of big data. No. e501v1. PeerJ *PrePrints*.

# Research projects

In 2013 and 2014 the Sector Research and Education submitted nearly 99 research proposals for external financing, either as coordinator, PI or partner. Of these proposals nearly 40% was successful in obtaining funding. When differentiating between funding provided by the government through a funding allocation agency (e.g., NWO, STW, KNAW) or by the European Commission (EC) the success rate over this two year period was respectively 23% and 22%.

In this overview the projects are presented that were terminated, started or ongoing in 2013 and 2014, with a Naturalis budget above €50.000. Projects that were granted financing in 2014, but have commenced in 2015, such as the EU H2020-MSCA-ITN-2014 project 'Drivers of Pontocaspian biodiversity Rise and Demise' [PRIDE] coordinated by Naturalis, are not included.

## Indirect government funding

Time Capsule – T.R. van Andel (partner) – NWO / TNO Creative Industry Call 2012,
1 October 2013-30 September 2017.

Plant use from the Motherland: linking Afro-Caribbean and West-African Ethnobotany – T.R. van Andel – NWO VIDI, 1 February 2010-31 January 2015.

Impact of Man and Climate on a Unique Tropical Ecosystem – P. Baas & T.J.J. Vernimmen (MSc) – ALW Open programme NWO PhD,
1 October 2009-31 September 2015.

DNA barcoding of Tanzanian world-harvested medicinal plants to identify and monitor trade and commercialization – H.J. de Boer – WOTRO – TASENE programme, 1 September 2012-31 December 2014.

Functional genomics of orchids – A. Dirks & B. Gravendeel – NWO Doctoral Grants for Teachers,
1 January 2014-31 December 2017.

Back to the future? Biodiversity gradients revisited – Dr. P.J.A. Kessler & N. Raes – NWO ALW Open programme Postdoc, 1 May 2010-31 December 2013.

Does specialization lead to rarity? The distribution of mycoheterotrophic plants in relation to their mycorrhizal fungi – V.S.F.T. Merckx – NWO Veni,
1 April 2012-31 July 2015.

Biodiversity, habitat partitioning and ecological functions of arctic fungi and their role in vegetation change due to climatic changes – E.F. Smets & J. Geml – ALW Open Programme PhD,
22 August 2012-21 August 2016.

Green eScience & Virtual Lab for Plant Breeding (VLPB)-II – J. van Tol & E.F. Erik Smets – TTI Green Genetics & Partners,
1 December 2012-15 June 2015.

DNA Waterscan (including 'Ontwikkeling van eDNA methodiek voor inventarisatie van aquatische biodiversiteit' project by B. Gravendeel (partner),
1 April 2014-31 March 2015) – J. van Tol – Gieskes-Strijbis Fonds & TKI Watertechnologie,
1 January 2014-30 June 2019.

The role of floral volatiles in host specificity and host shifts in the fig-fig wasp mutualism – A. Oldebeuving & J.C. Biesmeijer – NWO Doctoral Grants for Teachers, 1 July 2014-31 June 2018.

Biotic and abiotic drivers of shifting marine tropical biodiversity hotspots during the Eocene-Oligocene – W. Renema – ALW Open programme Postdoc,
18 March 2013-17 March 2016.

Determinants of species diversity at 14 spatial scales in tropical microsnails from endangered limestone habitats – M. Schilthuizen – ALW Open programme Postdoc,
1 June 2011-30 September 2014.

Morphospace in tropical microgastropods driven by Red Queen evolution – M. Schilthuizen – ALW Open programme PhD, 1 January 2010-31 July 2014.

On the origin of species assemblages – M. Schilthuizen (partner) – NWO Vici (applicant Prof. R. Etienne), 16 July 2014-15 July 2019.



Assembling an arsenal: molecular basis of the venom-system in snakes – F.J. Vonk – NWO Veni,
1 October 2014-30 September 2018.

## European Commission

SUPER-B: SUstainable Pollination in Europe: joint Research on Bees and other pollinators – J.C. Biesmeijer (coordinator) – EU COST,
4 April 2014-3 April 2018.

The Origin of Jawed Vertebrates and the Evolution of Morphology in Deep Time [JAWEVOL] – M. Brazeau – ERC Starting Grant,
1 January 2013-31 December 2017.
In 2013 M. Brazeau left Naturalis and took the grant to Imperial College London. His postdoc position in the project remained at Naturalis, with a budget of € 162.000.

Development of Cost efficient Advanced DNA-based methods for specific Traceability issues and High Level On-site applicatioNs [DECATHLON] – B. Gravendeel (subcontractor) – EU KBBE CALL 2013.3.5-01, 1 February 2014-31 January 2016.

Biodiversity Virtual e-Laboratory [BioVel] – R.A. Vos & J. van Tol (Partner) – EU FP7 Infrastructure,
1 September 2011-31 December 2014.

NetBiome – CSA : Strengthening European research cooperation for smart and sustainable management of tropical and subtropical biodiversity in outermost regions and overseas countries and territories – S.E.C. Sierra & M. Stech (partner) – EU FP7-ENV-2013-one-stage, 1 May 2013-30 April 2016.

Coordination and policy development in preparation for a European Open Biodiversity Knowledge Management System, addressing Acquisition, Curation, Synthesis, Interoperability and Dissemination (Pro-iBiosphere) – S.E.C. Sierra (coordinator) – EU FP7-INFRASTRUCTURES-2012-1; INFRA-2012-3.3, 1 September 2012-31 August 21014.

Cenozoic evolution of the Indonesian Throughflow (ITF) and the origins of Indo-Pacific marine biodiversity: Mapping the biotic response to environmental change [Throughflow] – W. Renema & F.P. Wesselingh – FP7-PEOPLE-ITN-2008,
1 January 2010-31 December 2013.

## Other (e.g., contract research, foreign governmental subsidies, foundations)

Honey Bee Surveillance – J.C. Biesmeijer (coordinator) – Ministry of Economic Affairs,
9 September 2014-31 May 2018.

Q-Bank – H. Duistermaat & E. Boer – Ministry EL&I / NVWA,
1 November 2011-31 December 2014.

Uitbreiding soortenregister met data exoten (dieren) – B. van der Hoorn – Ministry EL&I / NVWA,
1 December 2013-15 June 2014.

Uitbreiding soortenregister met data exoten (planten) – B. van der Hoorn – Ministry EL&I / NVWA,
1 November 2014-1 May 2015.

Flora of the Guianas – S. Mota de Oliveira – Alberta Mennega Stichting & Stichting Van Eeden fonds,
14 March 2011-31 December 2017.

Systematics, biogeography, and evolution of Impatiens, with a focus on southeast Asian taxa – T. van der Niet & E.F. Smets [PhD position S. Ruchisansakun] – Thai Ministry of Science and Technology, the Ministry of Education and the Institute for the Promotion of Teaching Science and Technology (IPST), 1 November 2013-31 October 2017.

Botanical Inventory on Halmahera – M.C. Roos & P.C. van Welzen – Missouri Botanical Gardens & Weda Bay Nickel, 1 November 2013 – 29 February 2016.

Phylogeographical patterns between the rain forest and the Amazon forest: An approach with the family Dicranaceae s.l. (Bryophyta) and other haplolepideous mosses – M. Stech [PhD R. Gama Dias Neto] – CAPES (Brazil),
10 September 2011-9 September 2015.

Filogenia molecular e evolução morfológica de Leucobryaceae Schimp. (Bryophyta, Dicranidae) – M. Stech [PhD Ms. M. Bonfim Santos] – CAPES (Brazil), 1 November 2013-31 October 2017.

Reducing the impact of Non-native species in Europe – J. van Tol – NVWA / INTERREG IVA 2 – RINSE, 1 January 2013-30 June 2014.

Kits van Waveren fellow 'teneinde onderzoek te verrichten aan de taxonomie, fylogenie en biogeografie van Russulales' – J.B. Mols & E.F. Smets – Stichting Rijksherbariumfonds Dr. E. Kits van Waveren,
1 April 2013-31 March 2017.

Supersmart project – R.A. Vos – Gotenborg Botanical Garden, 1 August 2014-31 July 2015.

Heruitgave en bewerking Bomenboek voor Suriname – T.R. van Andel – Alberta Mennaga Stichting,
1 June 2014-31 May 2015.

Digitization of Asian, Australian, European and North American plant type specimens at the National Herbarium of the Netherlands Phase 3 – M.S.M. Sosef & J.B. Mols – Andrew W. Mellon Foundation,
1 November 2012-31 December 2015.

Climate Change Proofing of WWF Netherlands priority conservation areas – N. Raes – WWF Netherlands, 1 October 2014-30 June 2015.

De inventarisatie, registratie en analyse van Nederlandse algen – J. van Tol & H. Stegenga – GiMaris, 24 February 2010-31 December 2014.

Living apart Together – on niche evolution in African Lianas – M.S.M. Sosef & E.F. Smets [PhD P.H. Hoekstra] – Alberta Mennega Stichting & Wageningen University, 1 November 2012-31 October 2016.

Biogeography and Evolution of the rattan Calamus javensis Bl. (Arecaceae, Calamoideae) Complex – P.C. van Welzen [PhD M. Atria] – Indonesian Directorate General for Higher Education (DIKTI), 1 December 2012-30 November 2016.

Taxonomy, systematics, and biogeography of Ficus subsection Urostigma (Moraceae) – P.C. van Welzen [PhD B. Chantarasuwan] – Royal Thai Government (Thailand), 1 September 2009-3 November 2014.

Systematics and biogeography of Aganope, Brachypterum and Derris (Fabaceae) in Asia – P.C. van Welzen [PhD Dr. Yotsawate Sirichamorn] – Royal Thai Government (Thailand), 8 September 2008-28 November 2013.

The Position of Malaysia in the world's centre of maximum marine biodiversity: Exploring the boundaries of the Coral Triangle – B.W. Hoeksema [PhD Z. Waheed] – Ministry of Higher Education, Malaysia, 1 July 2010-31 December 2015.

## Naturalis Expert Center

The Naturalis Expert Center is the front office for research requests from external parties, such as government and business. Besides the handling of identifications and smaller applied research questions, also business support is available for services and products which arise from the core competencies of Naturalis. Consultancy can be divided into three main components: knowledge, expertise and contract research. The Expert Center plays an intermediary role in contacts with third parties and organizes the administrative and organizational implementation of the resulting research project, all in close collaboration with the specialists (researchers, technicians and curators). The office is responsible for the technical completion, contracts and reports of the project. The Netherlands Gemmological Laboratory (NEL) is also thus supported; the Expert Center organizes courses, workshops and presentations. Subsequently, the researchers are also supported with questions concerning nature legislation (CITES).

In 2013 and 2014 the Expert Center, including the revenues of the NEL, brought in c. 95 k€ and c. 125 k€ respectively. Here we present 4 examples of our projects.

**Bestiaire Disparu (2013)**
For this project the Expert Center made the arrangements, drafted the agreement, and organised the selection of objects and photo's to be used in the book. The project resulted in a book, an advance royalty settlement, and the free use for non-commercial purposes of the high quality images – in total equivalent to a revenue of c. 40 k€. The photographs of Naturalis material were also used to create wallpapers with the Naturalis logo. They will probably be used (2015) for renewal of the website on extinct birds and possibly the Naturalis exhibitions.

**Surinam Wellness Center**
Commercial consultancy assignment of T.R. van Andel, selecting plants and instructions on the use of medicinal plants of Surinam for a local Welness Center.

**Birdstrikes Identification Netherlands Royal Airforce and Schiphol Airport**
The identification of birds involved in collisions with aircrafts (Fig. 1) via feather-recognition and DNA-research. Sometimes identification of bird remains provide us with insight into specific types of damage, cause, location, season and the height at which bird species are a hazard to aircraft. This information is helpful to the Bird control and for the planning around airports.

**Gallery Brief New Exhibitions in Kuwait**
Review on a final Gallery Brief, including content messages, content background and exhibit descriptions. This assignment is a follow-up of the visit to Naturalis and the discussions and talks with A.S. Schulp, researcher and expert on the dinosaurs of the Arabian Peninsula.

Fig. 1. Example of a bird strike. Photo: Ton Mens (Schiphol).

# New taxa

The research carried out by our staff and honorary researchers over the years 2013 and 2014, as presented in this report, has resulted in the description of more than 650 taxa.

For 2013 and 2014 a representative selection of new taxa is photographically presented below, followed by the total list of all new taxa.

## 2013

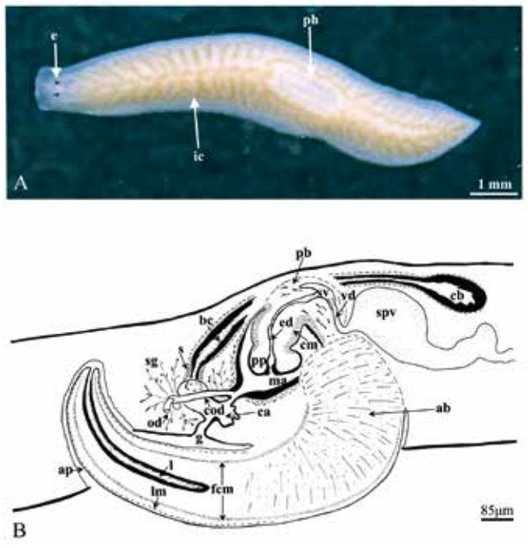
***Crassignatha danaugirangensis*** Miller *et al.*, 2013

Miller, J.A., Schilthuizen, M., Lilliendahl Burmester, J., van der Graaf, L., Merckx, V., Jocqué, M., Kessler, P.J.A., Fayle, T.M., Breeschoten, T., Broeren, R., Bouman, R., Chua, W.-J., Feijen, F., Fermont, T., Groen, K., Groen, M., Kil, N.J.C., de Laat, H.A., Moerland, M.S., Moncoquet, C., Panjang, E., Philip, A.J., Roca-Eriksen, R., Rooduijn, B., van Santen, M., Swakman, V., Evans, M.N., Evans, L.J., Love, K., Joscelyne, S.H., Tober, A.V., Wilson, H.F., Ambu, L.N. & Goossens, B. 2014. Dispatch from the field: ecology of ground-web-building spiders with description of a new species (Araneae, Symphytognathidae). *Biodiversity Data Journal* 2: 1-13.

Students participating in a two-week tropical ecology field course offered by Naturalis Biodiversity Center and hosted by Danau Girang Field Centre (DGFC) in Sabah, Malaysia, encountered this tiny spider in the course of their studies. Students and lecturers participating in the course, along with members of the field station scientific staff, resolved to describe this species and investigate its ecology using only the resources available at the field station. The results were submitted in the form on a manuscript before the end of the course.

***Dendrocoelum mariae*** Stocchino & Sluys, 2013

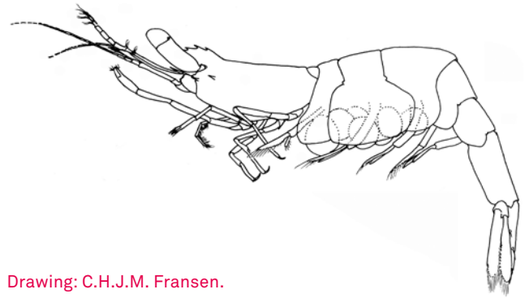
Stocchino, G.A., Sluys, R., Marcia, P. & Manconi, R. 2013. Subterranean aquatic planarians of Sardinia, with a discussion on the penial flagellum in the genus *Dendrocoelum* (Platyhelminthes, Tricladida, Dendrocoelidae). *J. Cave Karst Stud.* 75: 93-112.




(A) Habitus of living specimen. (B) Sagittal reconstruction of the copulatory apparatus.

***Hamodactylus macrophthalmus*** Fransen & Rauch, 2013

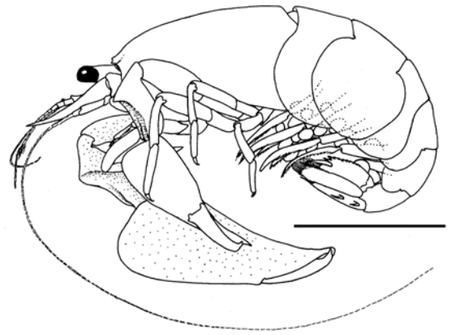
Fransen, C.H.J.M. & Rauch, C. 2013. Hamodactylus macrophthalmus spec. nov., a new coral-associated pontoniine shrimp (Decapoda, Caridea, Palaemonidae) from Indonesia. *Zootaxa* 3635: 286-296.



Drawing: C.H.J.M. Fransen.

***Nippontonia christellae*** Fransen, 2013

Fransen, C.H.J.M. 2013. A new species of the sponge-associated pontoniine shrimp genus *Nippontonia* Bruce & Bauer, 1997 (Decapoda, Caridea, Palaemonidae) from Sabah, Malaysia. *Zootaxa* 3694: 343-357.



Drawing and photo: C.H.J.M. Fransen.

***Specklinia absurda*** Bogarín, Karremans & R. Rincón, 2013

Bogarín, D., Karremans, A.P., Rincón, R. & Gravendeel, B. 2013. A new Specklinia (Orchidaceae: Pleurothallidinae) from Costa Rica and Panama. *Phytotaxa* 115(2): 31-41.

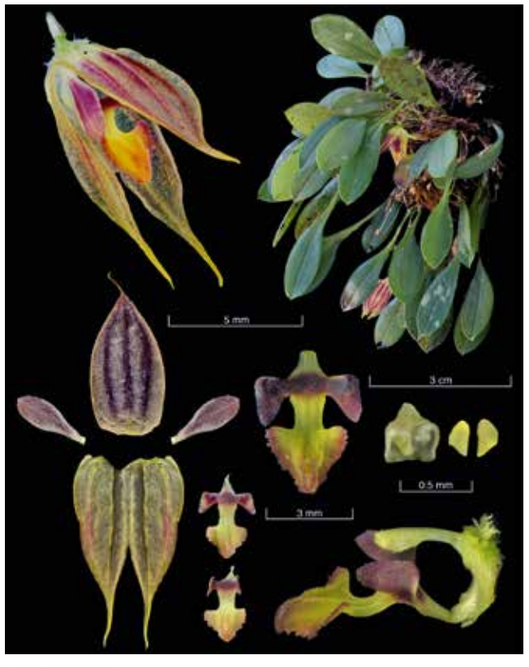



Photo: Diego Bogarín.

## Plantae (fossil plants)

***Azolla astroborealis*** van der Burgh, Collinson, van Konijnenburg-van Cittert, Barke & Brinkhuis, 2013 (Azollaceae): *Review Palaeobotany Palynology* 194: 50-68.
***Azolla nova*** van der Burgh, Collinson, van Konijnenburg-van Cittert, Barke & Brinkhuis, 2013 (Azollaceae): *Review Palaeobotany Palynology* 194: 50-68.
***Azolla nuda*** van der Burgh, Collinson, van Konijnenburg-van Cittert, Barke & Brinkhuis, 2013 (Azollaceae): *Review Palaeobotany Palynology* 194: 50-68.

## Plantae

***Annea*** Mackinder & Wieringa, 2013 (Legumiosae, Caesalpinioideae): *Phytotaxa* 142: 1-14.
***Annea afzelii*** (Oliv.) Mackinder & Wieringa, 2013 (Legumiosae, Caesalpinioideae): *Phytotaxa* 142: 1-14.
***Annea laxiflora*** (Benth.) Mackinder & Wieringa, 2013 (Legumiosae, Caesalpinioideae): *Phytotaxa* 142: 1-14.
***Campylospermum andongensis*** (Hiern) Biss., 2013 (Ochnaceae): *Blumea* 58: 1-7.
***Campylospermum auriculatum*** Biss., 2013 (Ochnaceae): *Blumea* 58: 1-7.
***Campylospermum costatum*** (Tiegh.) Biss., 2013 (Ochnaceae): *Blumea* 58: 1-7.
***Campylospermum gabonensis subsp. australis*** Biss., 2013 (Ochnaceae): *Blumea* 58: 1-7.
***Campylospermum gabonensis subsp. gabonensis*** Biss., 2013 (Ochnaceae): *Blumea* 58: 1-7.
***Campylospermum glaucifolium*** Biss., 2013 (Ochnaceae): *Blumea* 58: 1-7.
***Campylospermum glomeratum*** (Tiegh.) Biss., 2013 (Ochnaceae): *Blumea* 58: 1-7.
***Campylospermum longestipulatum*** (De Wild.) Biss., 2013 (Ochnaceae): *Blumea* 58: 1-7.
***Campylospermum lunzuensis*** (N.Robson) Biss., 2013 (Ochnaceae): *Blumea* 58: 1-7.
***Campylospermum lutambensis*** (Sleumer) Biss., 2013 (Ochnaceae): *Blumea* 58: 1-7.
***Campylospermum nutans*** (Hiern) Biss., 2013 (Ochnaceae): *Blumea* 58: 1-7.
***Campylospermum occidentalis*** Biss., 2013 (Ochnaceae): *Blumea* 58: 1-7.
***Campylospermum plicatum*** (Tiegh.) Biss., 2013 (Ochnaceae): *Blumea* 58: 1-7.
***Campylospermum warneckei*** (Gilg ex Engl.) Biss., 2013 (Ochnaceae): *Blumea* 58: 1-7.
***Chelonistele maximae-reginae*** de Vogel, Vugt, M. Perry, E. Winkel & Hoogend., 2013 (Orchidaceae): *Malesian Orchid Journal* Vol. 12: 5-12.
***Crotalaria tchibangensis*** Maesen, 2013 (Leguminosae, Papilionoideae): *Webbia* 68: 97-101.
***Dracontia montis-mortense*** Karremans & Bogarín, 2013 (Orchidaceae): *Systematic Botany* 38(2): 307-315.
***Dracontia pileata*** Karremans & Bogarín, 2013 (Orchidaceae): *Systematic Botany* 38(2): 307-315.
***Dracontia viridi-flava*** Karremans & Bogarín, 2013 (Orchidaceae): *Systematic Botany* 38(2): 307-315.
***Epidendrum bogarinii*** Karremans & C.M.Sm., 2013 (Orchidaceae): *Icones Orchidacearum* (Mexico) 14(10): t. 1412.
***Epidendrum inhibitiosum*** Karremans & Mel.Fernández, 2013 (Orchidaceae): *Icones Orchidacearum* (Mexico) 14(10): t. 1443.
***Epidendrum microanoglossum*** Hágsater & Karremans, 2013 (Orchidaceae): *Icones Orchidacearum* (Mexico) 14(10): t. 1457.
***Erythrina wieringae*** Maesen, 2013 (Leguminosae, Papilionoideae): *Webbia* 68: 97-101.
***Ficus chiangraiensis*** Chantaras., 2013 (Moraceae): *Systematic Botany* 38: 653-686.
***Ficus middletonii*** Chantaras., 2013 (Moraceae): *Systematic Botany* 38: 653-686.
***Ficus pseudoconcinna*** Chantaras., 2013 (Moraceae): *Systematic Botany* 38: 653-686.
***Ficus virens var. dispersa*** Chantaras., 2013 (Moraceae): *Sytematic Botany* 38: 653-686.
***Ficus virens var. middletonii*** Chantaras., 2013 (Moraceae): *Systematic Botany* 38: 653-686.
***Gabonius*** Wieringa & Mackinder, 2013 (Legumiosae, Caesalpinioideae): *Phytotaxa* 142: 15-24.
***Gabonius ngouniensis*** (Pellegr.) Wieringa & Mackinder, 2013 (Legumiosae, Caesalpinioideae): *Phytotaxa* 142: 15-24.
***Heteroblemma*** (Blume) Cámara-Leret, Ridd.-Num. & Veldk., 2013 (Melastomataceae): *Blumea* 58: 229-240.
***Heteroblemma alternifolium*** (Blume) Cámara-Leret, Ridd.-Num. & Veldk., 2013 (Melastomataceae): *Blumea* 58: 229-240.
***Heteroblemma barbatum*** (Bakh. f.) Cámara-Leret, Ridd.-Num. & Veldk., 2013 (Melastomataceae): *Blumea* 58: 229-240.
***Heteroblemma bisetosum*** (Bakh. f.) Cámara-Leret, Ridd.-Num. & Veldk., 2013 (Melastomataceae): *Blumea* 58: 229-240.
***Heteroblemma capillipes*** (Regalado) Cámara-Leret, Ridd.-Num. & Veldk., 2013 (Melastomataceae): *Blumea* 58: 229-240.
***Heteroblemma decurrens*** (Cogn.) Cámara-Leret, Ridd.-Num. & Veldk., 2013 (Melastomataceae): *Blumea* 58: 229-240.
***Heteroblemma flagellatum*** (Stapf) Cámara-Leret, Ridd.-Num. & Veldk., 2013 (Melastomataceae): *Blumea* 58: 229-240.
***Heteroblemma formanii*** (Regalado) Cámara-Leret, Ridd.-Num. & Veldk., 2013 (Melastomataceae): *Blumea* 58: 229-240.
***Heteroblemma kemulense*** (Regalado) Cámara-Leret, Ridd.-Num. & Veldk., 2013 (Melastomataceae): *Blumea* 58: 229-240.
***Heteroblemma loratum*** (Stapf) Cámara-Leret, Ridd.-Num. & Veldk., 2013 (Melastomataceae): *Blumea* 58: 229-240.
***Heteroblemma sandakanense*** (Regalado) Cámara-Leret, Ridd.-Num. & Veldk., 2013 (Melastomataceae): *Blumea* 58: 229-240.
***Heteroblemma serpens*** (Stapf) Cámara-Leret, Ridd.-Num. & Veldk., 2013 (Melastomataceae): *Blumea* 58: 229-240.
***Hymenostegia viridiflora*** Mackinder & Wieringa, 2013 (Legumiosae, Caesalpinioideae): *Blumea* 58: 13-17.
***Lagerstroemia huamotensis*** W.J. de Wilde & Duyfjes, 2013 (Lythraceae): *Thai Forest Bulletin (Botany)* 41: 93-96.
***Lagerstroemia kratiensis*** W.J. de Wilde & Duyfjes, 2013 (Lythraceae): *Thai Forest Bulletin (Botany)* 41: 93-96.
***Lagerstroemia vanosii*** W.J. de Wilde & Duyfjes, 2013 (Lythraceae): *Thai Forest Bulletin (Botany)* 41: 93-96.
***Mallotus tokiae*** Welzen, 2013 (Euphorbiaceae): *Thai Forest Bulletin (Botany)* 41: 85-89.
***Miliusa butonensis*** Chaowasku & Kessler, 2013 (Annonaceae): *European Journal of Taxonomy* 54: 1-21.
***Miliusa codonantha*** Chaowasku, 2013 (Annonaceae): *Willdenowia* 43: 101-105.
***Miliusa fragrans*** Chaowasku & Kessler, 2013 (Annonaceae): *Nordic Journal of Botany* 31: 680-699.
***Miliusa hirsuta*** Chaowasku & Kessler, 2013 (Annonaceae): *Nordic Journal of Botany* 31: 680-699.
***Miliusa intermedia*** Chaowasku & Kessler, 2013 (Annonaceae): *Nordic Journal of Botany* 31: 680-699.
***Miliusa nakhonsiana*** Chaowasku & Kessler, 2013 (Annonaceae): *Nordic Journal of Botany* 31: 680-699.
***Miliusa sessilis*** Chaowasku & Kessler, 2013 (Annonaceae): *Nordic Journal of Botany* 31: 680-699.
***Miliusa thailandica*** Chaowasku & Kessler, 2013 (Annonaceae): *Nordic Journal of Botany* 31: 680-699.
***Miliusa umpangensis*** Chaowasku & Kessler, 2013 (Annonaceae): *Nordic Journal of Botany* 31: 680-699.
***Miliusa viridiflora*** Chaowasku & Kessler, 2013 (Annonaceae): *European Journal of Taxonomy* 54: 1-21.
***Ptychopyxis esdras*** Stoops, 2013 (Euphorbiaceae): *Nordic Journal of Botany* 31: 94-112.
***Specklinia absurda*** Bogarín, Karremans & R. Rincón, 2013 (Orchidaceae: Pleurothallidinae): *Phytotaxa* 115(2): 31-41.
***Trichocentrum pupulinianum*** Bogarín & Karremans, 2013 (Orchidaceae): *Orchids* 82(2): 106-110.
***Winitia*** Chaowasku, 2013 (Annonaceae): *Systematics and Biodiversity* 11: 195-207.
***Winitia expansa*** Chaowasku, 2013 (Annonaceae): *Systematics and Biodiversity* 11: 195-207.

## Fungi

***Entoloma bloxamii var. rubellum*** (Scop.: Gillet) Morgado & Noordeloos, 2013 (Entolomataceae): *Persoonia* 31: 159-178.
***Entoloma brunneosericeum*** Noordeloos, Vila & Suarez, 2013 (Entolomataceae): *Studies in Entoloma*, Fungi non delineati 66: 3-62.
***Entoloma caesiollamellatum*** (Noordeloos & Wolfel) Noordeloos & Morgado, 2013 (Entolomataceae): *Persoonia* 31: 159-178.
***Entoloma fumosobrunneum*** Noordeloos & Morgado, 2013 (Entolomataceae): *Persoonia* 31: 1591-78.
***Entoloma ochreoprunuloides*** Noordeloos & Morgado, 2013 (Entolomataceae): *Persoonia* 31: 159-178.
***Entoloma ochreoprunuloides forma hyacinthinum*** Noordeloos & Morgado, 2013 (Entolomataceae): *Persoonia* 31: 159-178.
***Entoloma pseudofavrei*** Noordeloos & Vila, 2013 (Entolomataceae): *Studies in Entoloma*, *Fungi non delineati* 66: 3-62.
***Entoloma pseudoprunuloides*** Noordeloos & Morgado, 2013 (Entolomataceae): *Persoonia* 31: 159-178.

## Fossil animals

***Bystrowicrinus westheadi*** S.K. Donovan, 2013 (Crinoidea): *Proceedings of the Yorkshire Geological Society* 59: 211-218.
***Crioceratites (Binelliceras) angulicostatiformis*** Hoedemaeker, 2013 (Ammonitoidea, Crioceratitidae): *Revue de paleobiologie* 32(1): 1-209.
***Crioceratites (Balearites) oicasensis*** Hoedemaeker, 2013 (Ammonitoidea, Crioceratitidae): *Revue de Paleobiologie* 32(1): 1-209.
***Crioceratites (Balearites) theodomirensis*** Hoedemaeker, 2013 (Ammonitoidea, Crioceratitidae): *Revue de Paleobiologie* 32(1): 1-209.
***Pseudothurmannia subgenus Kakabadziella*** Hoedemaeker, 2013 (Ammonitoidea, Crioceratitidae): *Revue de paleobiologie* 32(1): 1-209.
***Pseudothurmannia (Kakabadziella) caravacaensis*** Hoedemaeker, 2013 (Ammonitoidea, Crioceratitidae): *Revue de Paleobiologie* 32(1): 1-209.
***Pseudothurmannia (Kakabadziella) ohmi valbonnettensis*** Hoedemaeker, 2013 (Ammonitoidea, Crioceratitidae): *Revue de Paleobiologie* 32(1): 1-209.
***Pseudothurmannia (Kakabadziella) tornajensis*** Hoedemaeker, 2013 (Ammonitoidea, Crioceratitidae): *Revue de Paleobiologie* 32(1): 1-209.
***Pseudothurmannia (Pseudothurmannia) arundicostata*** Hoedemaeker, 2013 (Ammonitoidea, Crioceratitidae): *Revue de Paleobiologie* 32(1): 1-209.
***Pseudothurmannia (Pseudothurmannia) dissiticostata*** Hoedemaeker, 2013 (Ammonitoidea, Crioceratitidae): *Revue de paleobiologie* 32(1): 1-209.
***Pseudothurmannia (Pseudothurmannia) perevoluta*** Hoedemaeker, 2013 (Ammonitoidea, Crioceratitidae): *Revue de Paleobiologie* 32(1): 1-209.
***Roamerella*** S.K. Donovan & L.W. van den Hoek Ostende, 2013 (Brachiopoda, Lingulata; Devonian): *Cretaceous Research* 40: 1-2.

## Porifera

***Antho (Antho) atlantidae*** van Soest, Beglinger & de Voogd, 2013 (Microcionidae): *Zoologische Mededelingen Leiden* 87(4): 275-404.
***Antho (Antho) nuda*** van Soest, Beglinger & de Voogd, 2013 (Microcionidae): *Zoologische Mededelingen Leiden* 87(4): 275-404.
***Artemisina incrustans*** van Soest, Beglinger & de Voogd, 2013 (Microcionidae): *Zoologische Mededelingen Leiden* 87(4): 275-404.
***Artemisina melanoides*** van Soest, Beglinger & de Voogd, 2013 (Microcionidae): *Zoologische Mededelingen Leiden* 87(4): 275-404.
***Clathria (Axosuberites) papillata*** van Soest, Beglinger & de Voogd, 2013 (Microcionidae): *Zoologische Mededelingen Leiden* 87(4): 275-404.
***Clathria (Cornulotrocha) cheliglomerata*** van Soest, Beglinger & de Voogd, 2013 (Microcionidae): *Zoologische Mededelingen Leiden* 87(4): 275-404.
***Clathria (Microciona) ascensionis*** van Soest, Beglinger & de Voogd, 2013 (Microcionidae): *Zoologische Mededelingen Leiden* 87(4): 275-404.
***Clathria (Microciona) aurea*** van Soest, Beglinger & de Voogd, 2013 (Microcionidae): *Zoologische Mededelingen Leiden* 87(4): 275-404.
***Clathria (Microciona) bicleistochelifera*** van Soest, Beglinger & de Voogd, 2013 (Microcionidae): *Zoologische Mededelingen Leiden* 87(4): 275-404.
***Clathria (Microciona) boavistae*** van Soest, Beglinger & de Voogd, 2013 (Microcionidae): *Zoologische Mededelingen Leiden* 87(4): 275-404.
***Clathria (Microciona) calloides*** van Soest, Beglinger & de Voogd, 2013 (Microcionidae): *Zoologische Mededelingen Leiden* 87(4): 275-404.
***Clathria (Microciona) cancapseptima*** van Soest, Beglinger & de Voogd, 2013 (Microcionidae): *Zoologische Mededelingen Leiden* 87(4): 275-404.
***Clathria (Microciona) capverdensis*** van Soest, Beglinger & de Voogd, 2013 (Microcionidae): *Zoologische Mededelingen Leiden* 87(4): 275-404.
***Clathria (Microciona) conchicola*** van Soest, Beglinger & de Voogd, 2013 (Microcionidae): *Zoologische Mededelingen Leiden* 87(4): 275-404.
***Clathria (Microciona) gorgadensis*** van Soest, Beglinger & de Voogd, 2013 (Microcionidae): *Zoologische Mededelingen Leiden* 87(4): 275-404.
***Clathria (Microciona) hjorti*** van Soest, Beglinger & de Voogd, 2013 (Microcionidae): *Zoologische Mededelingen Leiden* 87(4): 275-404.
***Clathria (Thalysias) minutoides*** van Soest, Beglinger & de Voogd, 2013 (Microcionidae): *Zoologische Mededelingen Leiden* 87(4): 275-404.
***Clathria (Thalysias) vacata*** van Soest, Beglinger & de Voogd, 2013 (Microcionidae): *Zoologische Mededelingen Leiden* 87(4): 275-404.
***Placospongia santodomingoae*** Becking, 2013 (Placospongiidae): *Zookeys*, 298: 39-76.

## Cnidaria: Octocorallia

***Parasphaerasclera*** McFadden & Ofwegen, 2013 (Alcyonacea): *ZooKeys* 346: 59-83.
***Parasphaerascleridae*** McFadden & Ofwegen, 2013 (Alcyonacea): *ZooKeys* 346: 59-83.
***Sphaerasclera*** McFadden & Ofwegen, 2013 (Alcyonacea): *ZooKeys* 346: 59-83.

## Platyhelminthes

***Dendrocoelum mariae*** Stocchino & Sluys, 2013 (Tricladida, Dendrocoelidae): *Journal of Cave and Karst Studies* 75: 93-112.
***Dendrocoelum nuraghum*** Stocchino & Sluys, 2013 (Tricladida, Dendrocoelidae): *Journal of Cave and Karst Studies* 75: 93-112.
***Dendrocoelum vesiculosum*** Stocchino & Sluys, 2013 (Tricladida, Dendrocoelidae): *Journal of Cave and Karst Studies* 75: 93-112.
***Dugesia effusa*** Sluys, 2013 (Tricladida, Dugesiidae): *Zoological Journal of the Linnean Society* 169: 523-547.
***Dugesia improvisa*** Sluys & Solà, 2013 (Tricladida, Dugesiidae): *Zoological Journal of the Linnean Society* 169: 523-547.
***Dugesia naiadis*** Sluys, 2013 (Tricladida, Dugesiidae): *Zoological Journal of the Linnean Society* 169: 523-547.
***Dugesia parasagitta*** Sluys & Solà, 2013 (Tricladida, Dugesiidae): *Zoological Journal of the Linnean Society* 169: 523-547.
***Dugesia superioris*** Stocchino & Sluys, 2013 (Tricladida, Dugesiidae): *ZooKeys* 313: 25-43.
***Phagocata obscura*** Stocchino & Sluys, 2013 (Planariidae): *Journal of Cave and Karst Studies* 75: 93-112.
***Recurva*** Sluys, 2013 (Tricladida, Dugesiidae): *Zoological Journal of the Linnean Society* 169: 523-547.
***Recurva conjuncta*** Sluys, 2013 (Tricladida, Dugesiidae): *Zoological Journal of the Linnean Society* 169: 523-547.
***Recurva postrema*** Sluys & Solà, 2013 (Tricladida, Dugesiidae): *Zoological Journal of the Linnean Society* 169: 523-547.

## Annelida

***Kinabaluensis inobongensis*** Kappes, 2013 (Hirudinea, Haemadipsidae, Tritetrabdella): *Contributions to Zoology* 82: 185-197.
***Kinabaluensis kinabaluensis*** Kappes, 2013 (Hirudinea, Haemadipsidae, Tritetrabdella): *Contributions to Zoology* 82: 185-197.

## Mollusca: Gastropoda

***Afripupa misaliensis*** Gittenberger & van Bruggen, 2013 (Vertiginidae): *Zoologische Mededelingen* 87(2-5): 235-273.
***Avakubia biokoensis*** de Winter & Vastenhout, 2013 (Streptaxidae): *African Invertebrates* 54(2): 605-663.
***Avakubia crystallum*** de Winter, 2013 (Streptaxidae): *African Invertebrates* 54(2): 605-663.
***Avakubia fruticicolada*** de Winter & Vastenhout, 2013 (Streptaxidae): *African Invertebrates* 54(2): 605-663.
***Avakubia occidentalis*** de Winter, 2013 (Streptaxidae): *African Invertebrates* 54(2): 605-663.
***Avakubia ortizdezaratorum*** de Winter & Vastenhout, 2013 (Streptaxidae): *African Invertebrates* 54(2): 605-663.
***Avakubia semenguei*** de Winter & Vastenhout, 2013 (Streptaxidae): *African Invertebrates* 54(2): 605-663.
***Avakubia subacuminata*** de Winter & Vastenhout, 2013 (Streptaxidae): *African Invertebrates* 54(2): 605-663.
***Metafruticicola crassicosta*** Bank, Gittenberger & Neubert, 2013 (Hygromiidae): *Archiv für Molluskenkunde* 142: 67-136.
***Metafruticicola monticola*** Bank, Gittenberger & Neubert, 2013 (Hygromiidae): *Archiv für Molluskenkunde* 142: 67-136.
***Metafruticicola nicosiana maasseni*** Bank, Gittenberger & Neubert, 2013 (Hygromiidae): *Archiv für Molluskenkunde* 142: 67-136.
***Metafruticicola pieperi*** Bank, Gittenberger & Neubert, 2013 (Hygromiidae): *Archiv für Molluskenkunde* 142: 67-136.
***Metafruticicola rugosissima*** Bank, Gittenberger & Neubert, 2013 (Hygromiidae): *Archiv für Molluskenkunde* 142: 67-136.
***Metafruticicola uluborulensis*** Bank, Gittenberger & Neubert, 2013 (Hygromiidae): *Archiv für Molluskenkunde* 142: 67-136.
***Microcystina rowsoni*** Gittenberger & van Bruggen, 2013 (Euconulidae): *Zoologische Mededelingen* 87(2-5): 235-273.
***Pseudavakubia*** de Winter & Vastenhout, 2013 (Streptaxidae): *African Invertebrates* 54(2): 605-663.
***Pseudavakubia atewaensis*** de Winter, 2013 (Streptaxidae): *African Invertebrates* 54(2): 605-663.
***Pseudavakubia ghanaensis*** de Winter, 2013 (Streptaxidae): *African Invertebrates* 54(2): 605-663.
***Pseudavakubia liberiana*** de Winter, 2013 (Streptaxidae): *African Invertebrates* 54(2): 605-663.
***Pseudavakubia majus*** de Winter & Vastenhout, 2013 (Streptaxidae): *African Invertebrates* 54(2): 605-663.
***Pupisoma (Ptychopatula) misaliensis*** Gittenberger & van Bruggen, 2013 (Valloniidae): *Zoologische Mededelingen* 87(2-5): 235-273.
***Truncatellina bhutanensis*** Gittenberger, Leda & Sherub, 2013 (Vertiginidae): *Basteria* 77(1-3): 29-32.

## Mollusca: Bivalvia

***Cyclochlamys wakensis*** Dijkstra & Raines, 2013 (Cyclochlamydidae): *Basteria* 77: 17-21.
***Cyclopecten comptulus*** Dijkstra & Maestrati, 2013 (Propeamussiidae): *Zoosystema* 35: 361-375.
***Cyclopecten erythraeensis*** Dijkstra & Janssen, 2013 (Propeamussiidae): *Archiv für Molluskenkunde* 142: 181-214.
***Cyclopecten meteorae*** Dijkstra & Janssen, 2013 (Propeamussiidae): *Archiv für Molluskenkunde* 142: 181-214.
***Parvamussium lamellatum*** Dijkstra & Maestrati, 2013 (Propeamussiidae): *Zoosystema* 35: 361-375.
***Parvamussium largoi*** Dijkstra, 2013 (Propeamussiidae): *Vita Malacologica* 10: 19.
***Parvamussium orbiculatum*** Dijkstra & Maestrati, 2013 (Propeamussiidae): *Zoosystema* 35: 469-479.
***Parvamussium perspicuum*** Dijkstra & Maestrati, 2013 (Propeamussiidae): *Zoosystema* 35: 469-479.
***Parvamussium scutulatum*** Dijkstra & Maestrati, 2013 (Propeamussiidae): *Zoosystema* 35: 361-375.
***Parvamussium vesiculosum*** Dijkstra & Maestrati, 2013 (Propeamussiidae): *Zoosystema* 35: 361-375.
***Propeamussium arabicum*** Dijkstra & Janssen, 2013 (Propeamussiidae): *Archiv für Molluskenkunde* 142: 181-214.

## Arthropoda: Arachnida: Acari

***Albia ilikensis*** Smit, 2013 (Aturidae): *Zootaxa* 3716: 207-235.
***Albia papuaensis*** Smit, 2013 (Aturidae): *Zootaxa* 3716: 207-235.
***Australiobates elongatus*** Smit, 2013 (Hygrobatidae): *Zootaxa* 3716: 207-235.
***Axonopsella bisetosa*** Smit, 2013 (Aturidae): *Zootaxa* 3716: 207-235.
***Djeboa curtipalpis*** Pešić & Smit, 2013 (Mideopsidae): *Zootaxa* 3720: 1-75.
***Djeboa ghanaensis*** Pešić & Smit, 2013 (Mideopsidae): *Zootaxa* 3720: 1-75.
***Djeboa wondergemi*** Pešić & Smit, 2013 (Mideopsidae): *Zootaxa* 3720: 1-75.
***Dropursides*** Smit, 2013 (Hygrobatidae): *Zootaxa* 3716: 207-235.
***Dropursides aberratus*** Smit, 2013 (Hygrobatidae): *Zootaxa* 3716: 207-235.
***Hydrobaumia purpurea*** Smit, 2013 (Anisitsiellidae): *Zootaxa* 3716: 207-235.
***Koenikea sentaniensis*** Smit, 2013 (Unionicolidae): *Zootaxa* 3716: 207-235.
***Limnesia multiscutata*** Smit, 2013 (Limnesiidae): *Zootaxa* 3716: 207-235.
***Limnesia vogelkop*** Smit, 2013 (Limnesiidae): *Zootaxa* 3716: 207-235.
***Mellamunda tasmanica*** Smit, 2013 (Athienemanniidae): *Subterranean Biology* 10: 37-42.
***Neumania silvestris*** Smit, 2013 (Unionicolidae): *Zootaxa* 3716: 207-235.

***Oxus manokwariensis*** Smit, 2013 (Oxidae): *Zootaxa* 3716: 207-235.
***Partidomomonia elongata*** Smit, 2013 (Momoniidae): *Subterranean Biology* 10: 37-42.
***Recifella fluviatilis*** Smit, 2013 (Unionicolidae): *Zootaxa* 3716: 207-235.
***Unionicola novaeguineae*** Smit, 2013 (Unionicolidae): *Zootaxa* 3716: 207-235.
***Wandesia minuta*** Smit, 2013 (Hydryphantidae): *Subterranean Biology* 10: 37-42.

## Arthropoda: Crustacea

***Hamodactylus macrophthalmus*** Fransen & Rauch, 2013 (Decapoda, Caridea, Palaemonidae): *Zootaxa* 3635: 286-296.
***Ingolfiella botoi*** Vonk & Jaume, 2013 (Amphipoda, Ingolfiellidae): *Marine Biodiversity*, doi 10.1007/s12526-013-0193-0.
***Nippontonia christellae*** Fransen, 2013 (Decapoda, Caridea, Palaemonidae): *Zootaxa* 3694: 343-357.

## Arthropoda: Insecta: Odonata

***Drepanosticta burbachi*** Dow, 2013 (Platystictidae): *Odonatologica* 42: 203-210.
***Eoargiolestes*** Kalkman & Theischinger, 2013 (Argiolestidae): *International Journal of Odonatology* 16: 1-52.
***Luzonargiolestes*** Kalkman & Theischinger, 2013 (Argiolestidae): *International Journal of Odonatology* 16: 1-52.
***Matticnemis*** Dijkstra, 2013 (Platycnemididae): *International Journal of Odonatology* 16: 269-274.
***Solomonargiolestes*** Kalkman & Theischinger, 2013 (Argiolestidae): *International Journal of Odonatology* 16: 1-52.
**Podolestinae** Kalkman & Theischinger, 2013 (Odonata): *International Journal of Odonatology* 16: 1-52.
***Pyrrhoargiolestes*** Kalkman & Theischinger, 2013 (Argiolestidae): *International Journal of Odonatology* 16: 1-52.
***Pyrrhoargiolestes lamington*** Kalkman, Richards & Polhemus, 2013 (Argiolestidae): *International Journal of Odonatology* 16: 53-65.
***Pyrrhoargiolestes yela*** Kalkman, Richards & Polhemus, 2013 (Argiolestidae): *International Journal of Odonatology* 16: 53-65.
***Spesbona*** Dijkstra, 2013 (Platycnemididae): *International Journal of Odonatology* 16: 269-274.
***Stenocypha*** Dijkstra, 2013 (Chlorocyphidae): *International Journal of Odonatology* 16: 269-274.

## Arthropoda: Insecta: Hymenoptera

***Apodesmia bruniclypealis*** Li & van Achterberg, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Apodesmia melliclypealis*** Li & van Achterberg, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Apsilocera acuticristata*** Mitroiu & van Achterberg, 2013 (Pteromalidae): *Zootaxa* 3717(4): 448-468.
***Apsilocera bicristata*** Mitroiu & van Achterberg, 2013 (Pteromalidae): *Zootaxa* 3717(4): 448-468.
***Apsilocera cornuta*** Mitroiu & van Achterberg, 2013 (Pteromalidae): *Zootaxa* 3717(4): 448-468.
***Apsilocera dentata*** Mitroiu & van Achterberg, 2013 (Pteromalidae): *Zootaxa* 3717(4): 448-468.
***Apsilocera dupla*** Mitroiu & van Achterberg, 2013 (Pteromalidae): *Zootaxa* 3717(4): 448-468.
***Apsilocera elongata*** Mitroiu & van Achterberg, 2013 (Pteromalidae): *Zootaxa* 3717(4): 448-468.
***Apsilocera fulvipennis*** Mitroiu & van Achterberg, 2013 (Pteromalidae): *Zootaxa* 3717(4): 448-468.
***Apsilocera longicornis*** Mitroiu & van Achterberg, 2013 (Pteromalidae): *Zootaxa* 3717(4): 448-468.
***Apsilocera maculata*** Mitroiu & van Achterberg, 2013 (Pteromalidae): *Zootaxa* 3717(4): 448-468.
***Apsilocera obtusicristata*** Mitroiu & van Achterberg, 2013 (Pteromalidae): *Zootaxa* 3717(4): 448-468.
***Apsilocera palliclava*** Mitroiu & van Achterberg, 2013 (Pteromalidae): *Zootaxa* 3717(4): 448-468.
***Apsilocera tuberculata*** Mitroiu & van Achterberg, 2013 (Pteromalidae): *Zootaxa* 3717(4): 448-468.
***Areotetes*** Li & van Achterberg, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Areotetes albiferus*** Li & van Achterberg, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Areotetes carinuliferus*** Li & van Achterberg, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Areotetes striatiferus*** Li & van Achterberg, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Coleopioides*** Li & van Achterberg, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Coleopioides diversinotum*** Li & van Achterberg, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Coleopioides postpectalis*** Li & van Achterberg, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Epimicta sulciscutum*** Zheng, Chen & van Achterberg, 2013 (Braconidae): *Zootaxa* 3613(2): 190-194.
***Ficobracon codonatus*** Huang & van Achterberg, 2013 (Braconidae): *Zootaxa* 3640(3): 465-472.
***Ficobracon rhiknosus*** Huang & van Achterberg, 2013 (Braconidae): *Zootaxa* 3640(3): 465-472.
***Fopius dorsopiferus*** Li, van Achterberg & Tan, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Indiopius chenae*** van Achterberg & Li, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Opiognathus aulaciferus*** Li & van Achterberg, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Opiognathus brevibasalis*** Li & van Achterberg, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Opius cheni*** Li & van Achterberg, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Opius crenuliferus*** Li & van Achterberg, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Opius malarator*** Li, van Achterberg & Tan, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Opius monilipalpis*** Li & van Achterberg, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Opius pachymerus*** Li & van Achterberg, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Opius songi*** Li & van Achterberg, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Opius wengi*** Li & van Achterberg, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Opius youi*** Li & van Achterberg, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Opius zengi*** Li & van Achterberg, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Paroplitis vietnamensis*** van Achterberg & Fernández-Triana, 2013 (Braconidae): *Zootaxa* 3722(4): 549-568.
***Phaedrotoma acuticlypealis*** Li & van Achterberg, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Phaedrotoma angiclypeata*** Li & van Achterberg, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Phaedrotoma antenervalis*** Li & van Achterberg, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Phaedrotoma depressa*** Li & van Achterberg, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Phaedrotoma depressiclypealis*** Li & van Achterberg, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Phaedrotoma flavisoma*** Li & van Achterberg, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Phaedrotoma nigrisoma*** Li & van Achterberg, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Phaedrotoma protuberator*** Li & van Achterberg, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Phaedrotoma rugulifera*** Li & van Achterberg, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Phaedrotoma semiplanata*** Li & van Achterberg, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Phaedrotoma striatinota*** Li & van Achterberg, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Phaedrotoma vermiculifera*** Li & van Achterberg, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Rhogadopsis latipennis*** Li & van Achterberg, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Rhogadopsis longicaudifera*** Li & van Achterberg, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Rhogadopsis maculosa*** Li, van Achterberg & Tan, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Rhogadopsis obliqua*** Li & van Achterberg, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Rhogadopsis sculpturator*** Li & van Achterberg, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Snellenius nigellus*** Long & van Achterberg, 2013 (Braconidae): *Tạp chí sinh học* 35(3): 272-280.
***Snellenius similis*** Long & van Achterberg, 2013 (Braconidae): *Tạp chí sinh học* 35(3): 272-280.
***Utetes longicarinatus*** Li & van Achterberg, 2013 (Braconidae): *ZooKeys* 268: 1-186.
***Vadumasonium vardyorum*** van Achterberg & Broad, 2013 (Braconidae): *Journal of Hymenoptera Research* 33: 91-98.
***Xynobius notauliferus*** Li & van Achterberg, 2013 (Braconidae): *ZooKeys* 268: 1-186.

## Arthropoda: Insecta: Diptera

***Archimicrodon malukensis*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Carreramyia megacera*** Reemer, 2013 (Syrphidae): *ZooTaxa* 3697: 1-88.
***Carreramyia tigrina*** Reemer, 2013 (Syrphidae): *ZooTaxa* 3697: 1-88.
***Ceratophya argentinensis*** Reemer, 2013 (Syrphidae): *ZooTaxa* 3697: 1-88.
***Ceratrichomyia angolensis*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Ceratrichomyia bullabucca*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Diopsina fluegeli*** Feijen & Feijen, 2014 (Diopsidae): *Tijdschrift voor Entomologie* 156: 161-189.
***Domodon*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Domodon zodiacus*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Furcantenna nepalensis*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Heliodon*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Heliodon doris*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Heliodon elisabethanna*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Heliodon tiber*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Hypselosyrphus amazonicus*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Hypselosyrphus helvus*** Reemer, 2013 (Syrphidae): *ZooTaxa* 3697: 1-88.
***Hypselosyrphus marshalli*** Reemer, 2013 (Syrphidae): *ZooTaxa* 3697: 1-88.
***Hypselosyrphus maurus*** Reemer, 2013 (Syrphidae): *ZooTaxa* 3697: 1-88.
***Hypselosyrphus pingo*** Reemer, 2013 (Syrphidae): *ZooTaxa* 3697: 1-88.
***Hypselosyrphus pseudorhoga*** Reemer, 2013 (Syrphidae): *ZooTaxa* 3697: 1-88.
***Hypselosyrphus vexillipennis*** Reemer, 2013 (Syrphidae): *ZooTaxa* 3697: 1-88.
***Indascia gigantica*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Indascia spathulata*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Kryptopyga sulawesiana*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Laetodon*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Masarygus palmipalpus*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Menidon*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Mermerizon*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Mermerizon inbio*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Mermerizon mellosus*** Reemer, 2013 (Syrphidae): *ZooTaxa* 3697: 1-88.
***Mermerizon mesmerizes*** Reemer, 2013 (Syrphidae): *ZooTaxa* 3697: 1-88.

***Metadon*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Metadon achterbergi*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Microdon hauseri*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Microdon mandarinus*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Microdon shirakii*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Microdon yunnanensis*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Paramixogaster brunettii*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Paramixogaster sacki*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Peradon*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Piruwa*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Pseudomicrodon polistoides*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Pseudomicrodon smiti*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Rhopalosyrphus abnormoides*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Rhopalosyrphus ecuadoriensis*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Rhopalosyrphus oreokawensis*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Rhopalosyrphus robustus*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Stipomorpha crematogastri*** Reemer, 2013 (Syrphidae): *ZooTaxa* 3697: 1-88.
***Stipomorpha dichromata*** Reemer, 2013 (Syrphidae): *ZooTaxa* 3697: 1-88.
***Stipomorpha elcopala*** Reemer, 2013 (Syrphidae): *ZooTaxa* 3697: 1-88.
***Stipomorpha fallax*** Reemer, 2013 (Syrphidae): *ZooTaxa* 3697: 1-88.
***Stipomorpha maculipennis*** Reemer, 2013 (Syrphidae): *ZooTaxa* 3697: 1-88.
***Stipomorpha mendax*** Reemer, 2013 (Syrphidae): *ZooTaxa* 3697: 1-88.
***Stipomorpha panamana*** Reemer, 2013 (Syrphidae): *ZooTaxa* 3697: 1-88.
***Stipomorpha spuria*** Reemer, 2013 (Syrphidae): *ZooTaxa* 3697: 1-88.
***Stipomorpha zophera*** Reemer, 2013 (Syrphidae): *ZooTaxa* 3697: 1-88.
***Sulcodon*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Thompsodon*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Thompsodon conspicillifrons*** Reemer, 2013 (Syrphidae): *ZooKeys* 288: 1-213.
***Ubristes ictericus*** Reemer, 2013 (Syrphidae): *ZooTaxa* 3697: 1-88.
***Ubristes jaguarinus*** Reemer, 2013 (Syrphidae): *ZooTaxa* 3697: 1-88.

## Arthropoda: Insecta: Lepidoptera

***Pectinivalva (Menurella) quintiniae*** Hoare & van Nieukerken, 2013 (Nepticulidae): *Zookeys* 278: 1-64.
***Pectinivalva (Menurella) tribulatrix*** van Nieukerken & Hoare, 2013 (Nepticulidae): *Zookeys* 278: 1-64.
***Pectinivalva (Menurella) xenadelpha*** van Nieukerken & Hoare, 2013 (Nepticulidae): *Zookeys* 278: 1-64.
***Trifurcula (Glaucolepis) chretieni*** Z.Laštuvka, A. Laštuvka. & van Nieukerken, 2013 (Nepticulidae): *Tijdschrift voor Entomologie* 156: 191-210.
***Trifurcula (Glaucolepis) megaphallus*** van Nieukerken, Z.Laštuvka & A.Laštuvka, 2013 (Nepticulidae): *Tijdschrift voor Entomologie* 156: 191-210.
***Trifurcula (Glaucolepis) siciliae*** Z.Laštuvka, A.Laštuvka. & van Nieukerken, 2013 (Nepticulidae): *Tijdschrift voor Entomologie* 156: 191-210.

## Arthropoda: Insecta: Coleoptera

***Bolbochromus dumogensis*** Krikken & Li, 2013 (Geotrupidae): *Zootaxa* 3731: 495-519.
***Bolbochromus malayensis*** Li & Krikken, 2013 (Geotrupidae): *Zootaxa* 3731: 495-519.
***Bolbochromus mindanaicus*** Krikken & Li, 2013 (Geotrupidae): *Zootaxa* 3731: 495-519.
***Bolbochromus minutus*** Li & Krikken, 2013 (Geotrupidae): *Zootaxa* 3731: 495-519.
***Bolbochromus nomurai*** Li & Krikken, 2013 (Geotrupidae): *Zootaxa* 3731: 495-519.
***Bolbochromus pumilus*** Krikken & Li, 2013 (Geotrupidae): *Zootaxa* 3731: 495-519.
***Bolbochromus sinensis*** Krikken & Li, 2013 (Geotrupidae): *Zootaxa* 3731: 495-519.
***Malacotheria wanati*** Beenen, 2013 (Chrysomelidae): *Genus* 24(1): 65-108.
***Metacycla daccordii*** Beenen, 2013 (Chrysomelidae): *Entomologische Zeitschrift* 123(4): 173-183.
***Metalepta lojaensis*** Beenen, 2013 (Chrysomelidae) *Entomologische Zeitschrift* 123(4): 173-183.
***Metacycla loptani*** Beenen, 2013 (Chrysomelidae): *Entomologische Zeitschrift* 123(4): 173-183.
***Metrioidea astridae*** Beenen, 2013 (Chrysomelidae): *Genus* 24(1): 65-108.
***Metrioidea aurantiaca*** Beenen, 2013 (Chrysomelidae): *Genus* 24(1): 65-108.
***Metrioidea brunneipennis*** Beenen, 2013 (Chrysomelidae): *Genus* 24(1): 65-108.
***Metrioidea decorata*** Beenen, 2013 (Chrysomelidae): *Genus* 24(1): 65-108.
***Metrioidea glabella*** Beenen, 2013 (Chrysomelidae): *Genus* 24(1): 65-108.
***Metrioidea hirtipennis*** Beenen, 2013 (Chrysomelidae): *Genus* 24(1): 65-108.
***Metrioidea ingeborgae*** Beenen, 2013 (Chrysomelidae): *Genus* 24(1): 65-108.
***Metrioidea janbezdeki*** Beenen, 2013 (Chrysomelidae): *Genus* 24(1): 65-108.
***Metrioidea monteithi*** Beenen, 2013 (Chrysomelidae): *Genus* 24(1): 65-108.
***Metrioidea pilifera*** Beenen, 2013 (Chrysomelidae): *Genus* 24(1): 65-108.
***Metrioidea undulata*** Beenen, 2013 (Chrysomelidae): *Genus* 24(1): 65-108.
***Onthophagus aceroides*** Krikken & Huijbregts, 2013 (Scarabaeidae): *Zootaxa* 3619: 501-525.
***Onthophagus baiyericus*** Krikken & Huijbregts, 2013 (Scarabaeidae): *Zootaxa* 3619: 501-525.
***Onthophagus bituberoculus*** Krikken & Huijbregts, 2013 (Scarabaeidae): *Zootaxa* 3619: 501-525.
***Onthophagus daymanus*** Krikken & Huijbregts, 2013 (Scarabaeidae): *Zootaxa* 3619: 501-525.
***Onthophagus dissidentatus*** Krikken & Huijbregts, 2013 (Scarabaeidae): *Zootaxa* 3619: 501-525.
***Onthophagus kokocellosus*** Krikken & Huijbregts, 2013 (Scarabaeidae): *Zootaxa* 3619: 501-525.
***Onthophagus kokodentatus*** Krikken & Huijbregts, 2013 (Scarabaeidae): *Zootaxa* 3619: 501-525.
***Onthophagus kokopygus*** Krikken & Huijbregts, 2013 (Scarabaeidae): *Zootaxa* 3619: 501-525.
***Onthophagus kukali*** Krikken & Huijbregts, 2013 (Scarabaeidae): *Zootaxa* 3619: 501-525.
***Onthophagus ofianus*** Krikken & Huijbregts, 2013 (Scarabaeidae): *Zootaxa* 3619: 501-525.
***Pseudadimonia brachelytra*** Beenen, 2013 (Chrysomelidae): *Entomologische Zeitschrift* 123(4): 173-183.
***Pseudoshaira bituberculata*** Beenen, 2013 (Chrysomelidae): *Entomologische Zeitschrift* 123(4): 173-183.
***Shairoidea*** Beenen, 2013 (Chrysomelidae) *Entomologische Zeitschrift* 123(4): 173-183.
***Shairoidea laevicollis*** Beenen, 2013 (Chrysomelidae): *Entomologische Zeitschrift* 123(4): 173-183.
***Shairoidea rotundipennis*** Beenen, 2013 (Chrysomelidae): *Entomologische Zeitschrift* 123(4): 173-183.
***Shairoidea stricticollis*** Beenen, 2013 (Chrysomelidae): *Entomologische Zeitschrift* 123(4): 173-183.

## Lissamphibia

***Triturus ivanbureschi*** Arntzen & Wielstra, 2013 (Salamandridae): *Zootaxa* 3682: 441-453.

## 2014

***Bathysalenia skylari*** Jagt, Jackson & van der Ham, 2014

Jagt, J.W.M., Jackson, J. & van der Ham, R.W.J.M. 2014. *Bathysalenia skylari*, a new late Turonian (Late Cretaceous) saleniid echinoid from central Texas, USA. *Cretaceous Research* 51: 70-74.

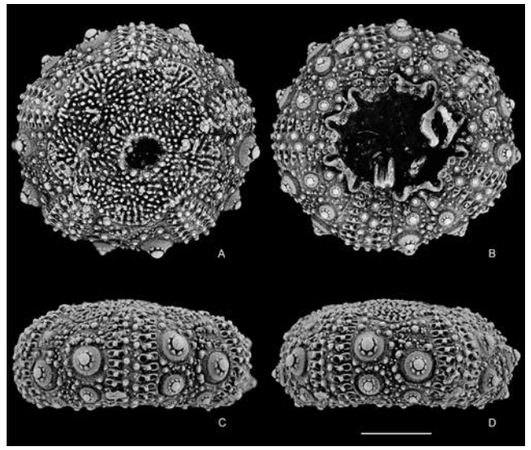



Photo: B.W.M. van Bakel.

***Blastomussa vivida*** Benzoni, Arrigoni & Hoeksema, 2014

Benzoni, F., Arrigoni, R., Waheed, Z., Stefani, F. & Hoeksema, B.W. 2014. Phylogenetic relationships and revision of the genus *Blastomussa* (Cnidaria: Anthozoa: Scleractinia) with description of a new species. *Raffles Bulletin of Zoology* 62: 358-378.

Photo: B.W. Hoeksema.

***Cycloseris boschmai*** Hoeksema, 2014

Hoeksema B.W. 2014. The "*Fungia patella* group" (Scleractinia, Fungiidae) revisited with a description of the mini mushroom coral *Cycloseris boschmai* sp. n. *ZooKeys* 371: 57-84.

Photo: B.W. Hoeksema.



***Derris solorioides*** Sirich. & Adema, 2014

Sirichamorn, Y., Adema, F.A.C.B. & van Welzen, P.C. 2014. Derris solorioides (Fabaceae), a new limestone species with true-paniculate inflorescences from North-Central Thailand. *Blumea* 59: 98-102.

**Fig. 1.** a. Habit and habitat; b. young pod; c. flower; d. young inflorescence, showing the leaf-like bracts subtending the lowermost lateral branches; e. mature pods, showing a seed and the dark area of the pericarp around seed; f. inflorescences. Photos: Y. Sirichamorn.

***Dugesia bifida*** Stocchino & Sluys, 2014

Stocchino, G. A., Sluys, R. & Manconi, R. 2014. A new and aberrant species of Dugesia (Platyhelminthes, Tricladida, Dugesiidae) from Madagascar. *ZooKeys* 425: 71-88.

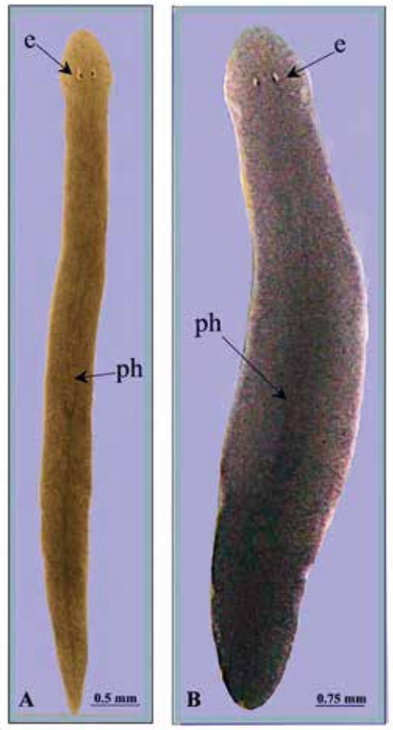



**Fig. 1.** Habitus of (A) living fissiparous and (B) ex-fissiparous animal.

***Ficus cornelisiana*** Chantaras. & Y.Q.Peng, 2014

Chantarasuwan, B., Peng, Y.-Q., Baas, P., Rasplus, J.-Y., van Heuven B.J. & van Welzen, P.C. 2014. *Ficus cornelisiana*, a new species of *Ficus* subsection *Urostigma* (Moraceae) from the Sino-Himalayan region. *Blumea* 59: 6-9.

**Fig. 1.** a. Twig with leaves and figs; b. twigs with young leaves and figs; c. fig in longitudinal section, note the cadudous basal bracts. Photos: Yan-Qiong Peng.

***Lactarius aestivus*** Nuytinck & Ammirati, 2014

Nuytinck, J. & Ammirati, J.F. 2014. A new species of *Lactarius* section *Deliciosi* (Russulales, Basidiomycota) from western North America. *Botany* 92 (10): 767-774, 10.1139/cjb-2014-0102.




***Opecarcinus cathyae*** van der Meij, 2014

van der Meij S.E.T. 2014. A new species of *Opecarcinus* Kropp & Manning, 1987 (Crustacea: Brachyura: Cryptochiridae) associated with the stony corals *Pavona clavus* (Dana, 1846) and *P. bipartita* Nemenzo, 1980 (Scleractinia: Agariciidae). *Zootaxa* 3869: 44-52.

Photo: B.T. Reijnen/S.E.T. van der Meij.

## Plantae (fossil plants)

***Chiropteris monteagnellii*** Kustatscher, Dell'Antonio & van Konijnenburg-van Cittert, 2014 (Pteridophyta indet.): *Acta Palaeontologica Polonica* 59: 741-755.

***Cladophlebis ladinica*** Kustatscher, Dell'Antonio & van Konijnenburg-van Cittert, 2014 (Pteridophyta, Osmundaceae): *Acta Palaeontologica Polonica* 59: 741-755.

***Dicranophyllum gallicum* var *inversum*** van der Pas, Poppe, van Konijnenburg-van Cittert, van Waveren, 2014 (Dicranophyllales): *Abstract book 9th European Palaeobotany – Palynolgy Conference, Padova 2014*: 294.

***Germaropteris martinsii*** (Germar 1839) Kustatscher, Kerp & van Konijnenburg-van Cittert, 2014 (Seedferns, Peltaspermaceae): *Review of Palaeobotany and Palynology* 208: 65-82.

***Phlebopteris fiemmensis*** Kustatscher, Dell'Antonio & van Konijnenburg-van Cittert, 2014 (Pteridophyta, Matoniaceae): *Acta Palaeontologica Polonica* 59: 741-755.

***Selaginellites coburgensis*** van Konijnenburg-van Cittert, Kustatscher, K.Bauer, Pott, Schmeissner, Dütsch & Krings, 2014 (Lycophyta, Selaginellaceae): *Neues Jahrbuch für Geologie und Palaeontologie Abhandlungen* 272: 115-127.

## Plantae

***Ammannia herbacea*** W.J. de Wilde & Duyfjes, 2014 (Lythraceae): *Blumea* 59(1): 14.

***Begonia gambutensis*** Ardi & D.C. Thomas, 2014 (Begoniaceae): *Edinburgh Journal of Botany* 71(2): 259-268.

***Begonia siregarii*** Ardi & D.C. Thomas, 2014 (Begoniaceae): *Edinburgh Journal of Botany* 71(2): 259-268.

***Caulerpa section Cliftonii*** Draisma, Prud'homme van Reine & G. Belton, 2014 (Chlorophyta, Caulerpaceae): *Journal of Phycology* 50: 1020-1034.

***Caulerpa subgenus Cliftonii*** Draisma, Prud'homme van Reine & G. Belton, 2014 (Chlorophyta, Caulerpaceae): *Journal of Phycology* 50: 1020-1034.

***Derris solorioides*** Sirich & Adema, 2014 (Fabaceae): *Blumea* 59: 98-102.

***Epidendrum jorge-warneri*** Karremans & Hágsater, 2014 (Orchidaceae ): *Lankesteriana* 13(3): 259-282.

***Ficus cornelisiana*** Chantaras. & Y.Q. Peng, 2014 (Moraceae): *Blumea* 59: 6-9.

***Guatteria darienensis*** Susana Arias & Maas, 2014 (Annonaceae): *Phytotaxa* 173(2): 149-156.

***Juncus batrachium*** Veldk., 2014 (Juncaceae): *Blumea* 59: 142-143.

***Lankesteriana*** Karremans, 2014 (Orchidaceae): *Lankesteriana* 13(3): 319-332.
***Meiogyne bidwillii*** (Benth.) D.C. Thomas, Chaowasku & R.M.K. Saunders, 2014 (Annonaceae): *Systematic Botany* 39(2): 396-404.
***Meiogyne heteropetala*** (F.Muell.) D.C. Thomas, Chaowasku & R.M.K. Saunders, 2014 (Annonaceae): *Systematic Botany* 39(2): 396-404.
***Meiogyne insularis*** (A.C.Sm.) D.C. Thomas, Chaowasku & R.M.K. Saunders, 2014 (Annonaceae): *Systematic Botany* 39(2): 396-404.
***Meiogyne trichocarpa*** (Jessup) D.C. Thomas, Chaowasku & R.M.K. Saunders, 2014 (Annonaceae): *Systematic Botany* 39(2): 396-404.
***Miliusa astiana*** Chaowasku & Kessler, 2014 (Annonaceae): *Nordic Journal of Botany, Early View*: 2-EV.
***Miliusa cambodgensis*** Chaowasku & Kessler, 2014 (Annonaceae): *Nordic Journal of Botany* 32: 298-307.
***Miliusa ninhbinhensis*** Chaowasku & Kessler, 2014 (Annonaceae): *Nordic Journal of Botany* 32: 298-307.
***Monanthotaxis paniculata*** P.H. Hoekstra, 2014 (Annonaceae): *Phytotaxa*: 186: 106-112.
***Monolophus amplexicaulis*** (Suksathan) Veldk. & Mood, 2014 (Zingiberaceae): *Gardens' Bulletin Singapore* 66: 215-231.
***Monolophus appendiculatus*** (K. Larsen & Triboun) Veldk. & Mood, 2014 (Zingiberaceae): *Gardens' Bulletin Singapore* 66: 215-231.
***Monolophus bolavenensis*** (Picheans. & Koonterm) Veldk. & Mood, 2014 (Zingiberaceae): *Gardens' Bulletin Singapore* 66: 215-231.
***Monolophus bracteatus*** (K. Larsen & S.S. Larsen) Veldk. & Mood, 2014 (Zingiberaceae): *Gardens' Bulletin Singapore* 66: 215-231.
***Monolophus chayanianus*** (Tiyaw.) Veldk. & Mood, 2014 (Zingiberaceae): *Gardens' Bulletin Singapore* 66: 215-231.
***Monolophus jirawongsei*** (Picheans. & Mokkamul) Veldk. & Mood, 2014 (Zingiberaceae): *Gardens' Bulletin Singapore* 66: 215-231.
***Monolophus khaomaenensis*** (Picheans. & Mokkamul) Veldk. & Mood, 2014 (Zingiberaceae): *Gardens' Bulletin Singapore* 66: 215-231.
***Monolophus kuapii*** (K. Larsen) Veldk. & Mood, 2014 (Zingiberaceae): *Gardens' Bulletin Singapore* 66: 215-231.
***Monolophus larsenii*** (Suksathan & Triboun) Veldk. & Mood, 2014 (Zingiberaceae): *Gardens' Bulletin Singapore* 66: 215-231.
***Monolophus limianus*** (Mokkamul & Picheans.) Veldk. & Mood, 2014 (Zingiberaceae): *Gardens' Bulletin Singapore* 66: 215-231.
***Monolophus pedemontanus*** (Triboun & K. Larsen) Veldk. & Mood, 2014 (Zingiberaceae): *Gardens' Bulletin Singapore* 66: 215-231.
***Monolophus petelotii*** (K. Larsen) Veldk. & Mood, 2014 (Zingiberaceae): *Gardens' Bulletin Singapore* 66: 215-231.
***Monolophus phulangkaensis*** (Picheans.) Veldk. & Mood, 2014 (Zingiberaceae): *Gardens' Bulletin Singapore* 66: 215-231.
***Monolophus phuluangensis*** (Picheans. & Mokkamul) Veldk. & Mood, 2014 (Zingiberaceae): *Gardens' Bulletin Singapore* 66: 215-231.
***Monolophus phutokensis*** (Picheans.) Veldk. & Mood, 2014 (Zingiberaceae): *Gardens' Bulletin Singapore* 66: 215-231.
***Monolophus phuwoaensis*** (Picheans. & Koonterm) Veldk. & Mood, 2014 (Zingiberaceae): *Gardens' Bulletin Singapore* 66: 215-231.
***Monolophus saksuwaniae*** (K. Larsen) Veldk. & Mood, 2014 (Zingiberaceae): *Gardens' Bulletin Singapore* 66: 215-231.
***Monolophus satunensis*** (Picheans.) Veldk. & Mood, 2014 (Zingiberaceae): *Gardens' Bulletin Singapore* 66: 215-231.
***Monolophus saxicola*** (K. Larsen) Veldk. & Mood, 2014 (Zingiberaceae): *Gardens' Bulletin Singapore* 66: 215-231.
***Monolophus sikkimensis*** (King ex Baker) Veldk. & Mood, 2014 (Zingiberaceae): *Gardens' Bulletin Singapore* 66: 215-231.
***Monolophus sirirugsae*** (Ngamr.) Veldk. & Mood, 2014 (Zingiberaceae): *Gardens' Bulletin Singapore* 66: 215-231.
***Monolophus tamdaoensis*** (Picheans. & Inthar.) Veldk. & Mood, 2014 (Zingiberaceae): *Gardens' Bulletin Singapore* 66: 215-231.
***Platystele catiensis*** Karremans & Bogarín, 2014 (Orchidaceae): *Lankesteriana* 13(3): 259-282.
***Platystele sylvestrei*** Karremans & Bogarín, 2014 (Orchidaceae): *Lankesteriana* 13(3): 259-282.
***Platystele tica*** Karremans & Bogarín, 2014 (Orchidaceae): *Lankesteriana* 13(3): 259-282.
***Rinorea calcicola*** Velzen & Wieringa, 2014 (Violaceae): *Phytotaxa* 167: 267-275.
***Thismia megalongensis*** C.Hunt, G.Steenbeeke & V. Merckx, 2014 (Thismiaceae): *Telopea* 16: 165-174.
***Zygogynum whitmoreanum*** Vink, 2014 (Winteraceae): *Blumea* 59: 161.

## Fungi

***Lactarius aestivus*** Nuytinck & Ammirati, 2014 (Basidiomycota, Russulaceae): *Botany* 92(10): 767-774.
***Lactarius glabrigracilis*** Wissitrassameewong & Nuytinck, 2014 (Basidiomycota, Russulaceae): *Phytotaxa* 188(4): 181-197.

## Fossil animals

***Andrenopteryx*** Dewulf & Engel, 2014 (Hymenoptera, Anthophila): *ZooKeys* 389: 35-48.
***Bathysalenia skylari*** Jagt, Jackson & van der Ham, 2014 (Euechinoidea, Salenioida): *Cretaceous Research* 51: 70-74.
***Euglossopteryx*** Dehon & Engel, 2014 (Hymenoptera, Apidae): *PLoS ONE* 9(10): e108865.
***Euglossopteryx biesmeijeri*** de Meulemeester, Michez & Engel, 2014 (Hymenoptera, Apidae): *PLoS ONE* 9(10): e108865.
***Garganornis ballmanni*** Meijer, 2014 (Aves, Anseriformes): *Comptes Rendus Palevol* 13: 19-26.
***Hoplitomeryx devosi*** van der Geer, 2014 (Artiodactyla, Cervoidea, Hoplitomerycidae): *Zootaxa* 3847(1): 1-32.
***Hoplitomeryx kriegsmani*** van der Geer, 2014 (Artiodactyla, Cervoidea, Hoplitomerycidae): *Zootaxa* 3847(1): 1-32.
***Hoplitomeryx macpheei*** van der Geer, 2014 (Artiodactyla, Cervoidea, Hoplitomerycidae): *Zootaxa* 3847(1): 1-32.
***Kozlowskia latorensis*** Martínez Chacón & Winkler Prins, 2014 (Productida, Productidae): *Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen* 272(2): 129-145.
***Ophiocamax hystrix*** Jagt, Thuy, S.K. Donovan, Stöhr, Portell, Pickerill, D.A.T. Harper, Lindsay & T.A. Jackson, 2014 (Ophiuroidea): *Geological Magazine* 151: 381-393.
***Palaeoloxodon lomolinoi*** van der Geer, Lyras, van den Hoek Ostende, de Vos & Drinia. 2014 (Proboscidea, Elephantidae): *Palaeogeography, Palaeoclimatology, Palaeoecology* 404: 133-144.
***Paragonaster(?) haldixoni*** Jagt, Thuy, S.K. Donovan, Stöhr, Portell, Pickerill, D.A.T. Harper, Lindsay & T.A. Jackson, 2014 (Asteroidea): *Geological Magazine* 151: 381-393.
***Protohabropoda*** Dehon & Engel, 2014 (Hymenoptera, Apidae): PLoS ONE 9(10): e108865.
***Scontromeryx*** van der Geer, 2014 (Artiodactyla, Cervoidea, Hoplitomerycidae): *Zootaxa* 3847 (1): 1-32.

## Porifera

***Antho (Acarnia) pellita*** van Soest, Meesters & Becking, 2014 (Microcionidae): *Zootaxa* 3878(5): 401-443.
***Aplysina sciophila*** Rützler, Piantoni, van Soest & Díaz, 2014 (Aplysinidae): *Zootaxa* 3805(1): 1-129.
***Calyx magnoculata*** van Soest, Meesters & Becking, 2014 (Phloeodictyidae): *Zootaxa* 3878(5): 401-443.
***Caminus carmabi*** van Soest, Meesters & Becking, 2014 (Geodiidae): *Zootaxa* 3878(5): 401-443.
***Characella poecillastroides*** van Soest, Meesters & Becking, 2014 (Pachastrellidae): *Zootaxa* 3878(5): 401-443.
***Clathria (Microciona) acarnoides*** van Soest, Meesters & Becking, 2014 (Microcionidae): *Zootaxa* 3878(5): 401-443.
***Discodermia adhaerens*** van Soest, Meesters & Becking, 2014 (Theonellidae): *Zootaxa* 3878(5): 401-443.
***Geodia cribrata*** Rützler, Piantoni, van Soest & Díaz, 2014 (Geodiidae): *Zootaxa* 3805(1): 1-129.
***Geodia curacaoensis*** van Soest, Meesters & Becking, 2014 (Geodiidae): *Zootaxa* 3878(5): 401-443.
***Mycale (Aegogropila) africamucosa*** van Soest, Beglinger & de Voogd, 2014 (Mycalidae): *Zoölogische Mededelingen Leiden* 88(4): 59-109.
***Mycale (Aegogropila) syringosimilis*** van Soest, Beglinger & de Voogd, 2014 (Mycalidae): *Zoölogische Mededelingen Leiden* 88(4): 59-109.
***Mycale (Aegogropila) tenerifensis*** van Soest, Beglinger & de Voogd, 2014 (Mycalidae): *Zoölogische Mededelingen Leiden* 88(4): 59-109.
***Mycale (Carmia) atropha*** van Soest, Beglinger & de Voogd, 2014 (Mycalidae): *Zoölogische Mededelingen Leiden* 88(4): 59-109.
***Mycale (Carmia) guineensis*** van Soest, Beglinger & de Voogd, 2014 (Mycalidae): *Zoölogische Mededelingen Leiden* 88(4): 59-109.
***Mycale (Naviculina) cruzi*** van Soest, Beglinger & de Voogd, 2014 (Mycalidae): *Zoölogische Mededelingen Leiden* 88(4): 59-109.
***Mycale (Paresperella) janvermeuleni*** van Soest, Beglinger & de Voogd, 2014 (Mycalidae): *Zoölogische Mededelingen Leiden* 88(4): 59-109.
***Mycale (Rhaphidotheca) verdensis*** van Soest, Beglinger & de Voogd, 2014 (Mycalidae): *Zoölogische Mededelingen Leiden* 88(4): 59-109.
***Mycale (Zygomycale) sierraleonensis*** van Soest, Beglinger & de Voogd, 2014 (Mycalidae): *Zoölogische Mededelingen Leiden* 88(4): 59-109.
***Myrmekioderma laminatum*** Rützler, Piantoni, van Soest & Díaz, 2014 (Heteroxyidae): *Zootaxa* 3805(1): 1-129.
***Neopetrosia dutchi*** van Soest, Meesters & Becking, 2014 (Petrosiidae): *Zootaxa* 3878(5): 401-443.
***Neopetrosia eurystomata*** van Soest, Meesters & Becking, 2014 (Petrosiidae): *Zootaxa* 3878(5): 401-443.
***Neopetrosia ovata*** van Soest, Meesters & Becking, 2014 (Petrosiidae): *Zootaxa* 3878(5): 401-443.
***Niphates arenata*** Rützler, Piantoni, van Soest & Díaz, 2014 (Niphatidae): *Zootaxa* 3805(1): 1-129.
***Pachastrella pacoi*** van Soest, Meesters & Becking, 2014 (Pachastrellidae): *Zootaxa* 3878(5): 401-443.
***Parahigginsia strongylifera*** van Soest, Meesters & Becking, 2014 (Heteroxyidae): *Zootaxa* 3878(5): 401-443.
***Phorbas aurantiacus*** Rützler, Piantoni, van Soest & Díaz, 2014 (Hymedesmiidae): *Zootaxa* 3805(1): 1-129.
***Placospongia caribica*** Rützler, Piantoni, van Soest & Díaz, 2014 (Placospongiidae): *Zootaxa* 3805(1): 1-129.
***Plakinastrella stinapa*** van Soest, Meesters & Becking, 2014 (Plakinidae): *Zootaxa* 3878(5): 401-443.
***Prosuberites carriebowensis*** Rützler, Piantoni, van Soest & Díaz, 2014 (Suberitidae): *Zootaxa* 3805(1): 1-129.
***Rhaphidhistia belizensis*** Rützler, Piantoni, van Soest & Díaz, 2014 (Trachycladidae): *Zootaxa* 3805(1): 1-129.
***Siphonodictyon occultum*** Rützler, Piantoni, van Soest & Díaz, 2014 (Phloeodictyidae): *Zootaxa* 3805(1): 1-129.
***Tetralophophora*** Rützler, Piantoni, van Soest & Díaz, 2014 (Plakinidae): *Zootaxa* 3805(1): 1-129.

***Tetralophophora mesoamericana*** Rützler, Piantoni, van Soest & Díaz, 2014 (Plakinidae): *Zootaxa* 3805(1): 1-129.
***Timea diplasterina*** Rützler, Piantoni, van Soest & Díaz, 2014 (Timeidae): *Zootaxa* 3805(1): 1-129.
***Timea oxyasterina*** Rützler, Piantoni, van Soest & Díaz, 2014 (Timeidae): *Zootaxa* 3805(1): 1-129.
***Wigginsia curlewensis*** Rützler, Piantoni, van Soest & Díaz, 2014 (Acarnidae): *Zootaxa* 3805(1): 1-129.
***Xestospongia purpurea*** Rützler, Piantoni, van Soest & Díaz, 2014 (Petrosiidae): *Zootaxa* 3805(1): 1-129.

## Cnidaria: Octocorallia

***Complexum*** van Ofwegen, Aurelle & Sartoretto, 2014 (Plexauridae): *Zookeys* 462: 1-10.
***Complexum pusillium*** van Ofwegen, Aurelle & Sartoretto, 2014 (Plexauridae): *Zookeys* 462: 1-10.
***Melithaea hendersoni*** Reijnen, McFadden, Hermanlimianto & van Ofwegen, 2014 (Melithaeidae): *Molecular Phylogenetics and Evolution* 70: 383-401.
***Melithaea mcqueeni*** Reijnen, McFadden, Hermanlimianto & van Ofwegen, 2014 (Melithaeidae): *Molecular Phylogenetics and Evolution* 70: 383-401.
***Melithaea shanni*** Reijnen, McFadden, Hermanlimianto & van Ofwegen, 2014 (Melithaeidae): *Molecular Phylogenetics and Evolution* 70: 383-401.
***Melithaea thorpeae*** Reijnen, McFadden, Hermanlimianto & van Ofwegen, 2014 (Melithaeidae): *Molecular Phylogenetics and Evolution* 70: 383-401.
***Melithaea wright*** Reijnen, McFadden, Hermanlimianto & van Ofwegen, 2014 (Melithaeidae): *Molecular Phylogenetics and Evolution* 70: 383-401.

## Cnidaria: Scleractinia

***Blastomussa vivida*** Benzoni, Arrigoni & Hoeksema, 2014 (incertae sedis): *Raffles Bulletin of Zoology* 62: 358-378.
***Cycloseris boschmai*** Hoeksema, 2014 (Fungiidae): *ZooKeys* 371: 57-84.

## Platyhelminthes

***Dugesia bifida*** Stocchino & Sluys, 2014 (Tricladida, Dugesiidae): *ZooKeys* 425: 71-88.

## Annelida

***Turbocavus secretus*** Prentiss, Vasileiadou, Faulwetter, Arvanitidis & ten Hove, 2014 (Polychaeta, Sabellida): *Zootaxa* 3900(2): 204-222.

## Mollusca: Gastropoda

***Bothropoma mediocarinata*** Reich & Wesselingh, 2014 (Colloniidae): *Annalen des Naturhistorischen Museums in Wien*, Serie A 116: 5-126.
***Clessiniella*** Zallot, Groenenberg, de Mattia, Fehér & Gittenberger, 2014 (Cochlostomatidae): *Basteria* 78(4-6): 63-88.
***Dalfreddia*** Zallot, Groenenberg, de Mattia, Fehér & Gittenberger, 2014 (Cochlostomatidae): *Basteria* 78(4-6): 63-88.
***Imerezia*** Zallot, Groenenberg, de Mattia, Fehér & Gittenberger, 2014 (Cochlostomatidae): *Basteria* 78(4-6): 63-88.
***Lovcenia*** Zallot, Groenenberg, de Mattia, Fehér & Gittenberger, 2014 (Cochlostomatidae): *Basteria* 78(4-6): 63-88.
***Plectostoma davisoni*** Liew, Vermeulen, Marzuki & Schilthuizen, 2014 (Diplommatinidae): *Zookeys* 393: 1-107.
***Plectostoma dindingensis*** Liew, Vermeulen, Marzuki & Schilthuizen, 2014 (Diplommatinidae): *Zookeys* 393: 1-107.
***Plectostoma ikanensis*** Liew, Vermeulen, Marzuki & Schilthuizen, 2014 (Diplommatinidae): *Zookeys* 393: 1-107.
***Plectostoma kayiani*** Liew, Vermeulen, Marzuki & Schilthuizen, 2014 (Diplommatinidae): *Zookeys* 393: 1-107.
***Plectostoma kubuensis*** Liew, Vermeulen, Marzuki & Schilthuizen, 2014(Diplommatinidae): *Zookeys* 393: 1-107.
***Plectostoma mengaburensis*** Liew, Vermeulen, Marzuki & Schilthuizen, 2014 (Diplommatinidae): *Zookeys* 393: 1-107.
***Plectostoma relauensis*** Liew, Vermeulen, Marzuki & Schilthuizen, 2014 (Diplommatinidae): *Zookeys* 393: 1-107.
***Plectostoma tenggekensis*** Liew, Vermeulen, Marzuki & Schilthuizen, 2014 (Diplommatinidae): *Zookeys* 393: 1-107.
***Plectostoma tohchinyawi*** Liew, Vermeulen, Marzuki & Schilthuizen, 2014 (Diplommatinidae): *Zookeys* 393: 1-107.
***Plectostoma whitteni*** Liew, Vermeulen, Marzuki & Schilthuizen, 2014 (Diplommatinidae): *Zookeys* 393: 1-107.
***Plesiotrochus hasibuani*** Reich & Wesselingh, 2014 (Plesiotrochidae): *Annalen des Naturhistorischen Museums in Wien*, Serie A 116: 27.
***Rissoina banyungantiensis*** Reich & Wesselingh, 2014 (Rissoidae): *Annalen des Naturhistorischen Museums in Wien*, Serie A 116: 5-126.
***Rissolina reticuspiralis*** Reich & Wesselingh, 2014 (Rissoidae): *Annalen des Naturhistorischen Museums in Wien*, Serie A 116: 5-126.
***Wagneriola*** Zallot, Groenenberg, de Mattia, Fehér & Gittenberger 2014. (Cochlostomatidae): *Basteria* 78(4-6): 63-88.

## Arthropoda: Arachnida: Araneae

***Crassignatha danaugirangensis*** Miller *et al.*, 2014 (Araneae, Symphytognathidae): *Biodiversity Data Journal* 2: e1076.

## Arthropoda: Arachnida: Acari

***Africasia acuticoxalis*** Smit & Pešić, 2014 (Athiennemanniidae): *Zootaxa* 3876: 1-71.
***Albaxona mahuaensis*** Smit & Pešić, 2014 (Aturidae): *Zootaxa* 3876: 1-71.
***Albia crocker*** Smit & Pešić, 2014 (Aturidae): *Zootaxa* 3876: 1-71.
***Arrenurus hastinapurensis*** Smit & Pešić, 2014 (Arrenuridae): *Ecologica Montenegrina* 1: 109-112.
***Atractides borneoensis*** Smit & Pešić, 2014 (Hygrobatidae): *Zootaxa* 3876: 1-71.
***Atractides crockerensis*** Smit & Pešić, 2014 (Hygrobatidae): *Zootaxa* 3876: 1-71.
***Atractides elburzensis*** Pešić, Smit & Saboori 2014 (Hygrobatidae): *Ecologica Montenegrina* 1: 30-48.
***Atractides neospatiosus*** Smit & Pešić, 2014 (Hygrobatidae): *Zootaxa* 3876: 1-71.
***Atractides sabahensis*** Smit & Pešić, 2014 (Hygrobatidae): *Zootaxa* 3876: 1-71.
***Aturus borneoensis*** Smit & Pešić, 2014 (Aturidae): *Zootaxa* 3876: 1-71.
***Axonopsis caeca*** Smit & Pešić, 2014 (Aturidae): *Zootaxa* 3876: 1-71.
***Axonopsis latipalpis*** Smit & Pešić, 2014 (Aturidae): *Zootaxa* 3876: 1-71.
***Axonopsis longigenitalis*** Smit & Pešić, 2014 (Aturidae): *Zootaxa* 3876: 1-71.
***Axonopsis rugose*** Smit & Pešić, 2014 (Aturidae): *Zootaxa* 3876: 1-71.
***Axonopsis truncate*** Smit & Pešić, 2014 (Aturidae): *Zootaxa* 3876: 1-71.
***Bharatohydracarus africanus*** Smit, 2014 (Hungarohydracaridae): *Acarologia* 54: 39-45.
***Erebaxonopsis kipungitensis*** Smit & Pešić, 2014 (Aturidae): *Zootaxa* 3876: 1-71.
***Frontipodopsis suturalis*** Smit & Pešić, 2014 (Frontipodopsidae): *Zootaxa* 3876: 1-71.
***Hydrachna cordata*** Smit, 2014 (Hydrachnidae): *Zootaxa* 3827: 170-186.
***Hydrachna curtiscutata*** Smit, 2014 (Hydrachnidae): *Zootaxa* 3827: 170-186.
***Hydrachna longiscutata*** Smit, 2014 (Hydrachnidae): *Zootaxa* 3827: 170-186.
***Hydrachna novaehollandica*** Smit, 2014 (Hydrachnidae): *Zootaxa* 3827: 170-186.
***Hydrachna queenslandica*** Smit, 2014 (Hydrachnidae): *Zootaxa* 3827: 170-186.
***Hygrobates acutipalpis*** Smit & Pešić, 2014 (Hygrobatidae): *Zootaxa* 3876: 1-71.
***Hygrobates hamatoides*** Smit & Pešić, 2014 (Hygrobatidae): *Zootaxa* 3876: 1-71.
***Hygrobates striatus*** Smit & Pešić, 2014 (Hygrobatidae): *Zootaxa* 3876: 1-71.
***Javalbia borneoensis*** Smit & Pešić, 2014 (Aturidae): *Zootaxa* 3876: 1-71.
***Javalbia kinabaluensis*** Smit & Pešić, 2014 (Aturidae): *Zootaxa* 3876: 1-71.
***Javalbia magniseta*** Smit & Pešić, 2014 (Aturidae): *Zootaxa* 3876: 1-71.
***Javalbia montana*** Smit & Pešić, 2014 (Aturidae): *Zootaxa* 3876: 1-71.
***Javalbia reticulate*** Smit & Pešić, 2014 (Aturidae): *Zootaxa* 3876: 1-71.
***Javalbia solitaria*** Smit & Pešić, 2014 (Aturidae): *Zootaxa* 3876: 1-71.
***Javalbia uncinata*** Smit & Pešić, 2014 (Aturidae): *Zootaxa* 3876: 1-71.
***Kawamuracarus biscutatus*** Smit, 2014 (Limnesiidae): *Acarologia* 54: 39-45.
***Limnochares spinose*** Smit & Pešić, 2014 (Limnocharidae): *Zootaxa* 3876: 1-71.
***Ljania inconspicua*** Smit & Pešić, 2014 (Aturidae): *Zootaxa* 3876: 1-71.
***Ljania obliterate*** Smit & Pešić, 2014 (Aturidae): *Zootaxa* 3876: 1-71.
***Monatractides epiales*** Pešić & Smit, 2014 (Torrenticolidae): *Zootaxa* 3840: 1-72.
***Monatractides euterpe*** Pešić & Smit, 2014 (Torrenticolidae): *Zootaxa* 3820: 1-80.
***Monatractides heracles*** Pešić & Smit, 2014 (Torrenticolidae): *Zootaxa* 3840: 1-72.
***Monatractides melpomene*** Pešić & Smit, 2014 (Torrenticolidae): *Zootaxa* 3820: 1-80.
***Monatractides minuta*** Pešić & Smit, 2014 (Torrenticolidae): *Zootaxa* 3840: 1-72.
***Monatractides morpheus*** Pešić & Smit, 2014 (Torrenticolidae): *Zootaxa* 3840: 1-72.
***Monatractides phantasos*** Pešić & Smit, 2014 (Torrenticolidae): *Zootaxa* 3840: 1-72.
***Monatractides phobetor*** Pešić & Smit, 2014 (Torrenticolidae): *Zootaxa* 3840: 1-72.
***Monatractides polyhymnia*** Pešić & Smit, 2014 (Torrenticolidae): *Zootaxa* 3820: 1-80.
***Monatractides terpsichore*** Pešić & Smit, 2014 (Torrenticolidae): *Zootaxa* 3820: 1-80.
***Monatractides thalia*** Pešić & Smit, 2014 (Torrenticolidae): *Zootaxa* 3820: 1-80.
***Monatractides urania*** Pešić & Smit, 2014 (Torrenticolidae): *Zootaxa* 3820: 1-80.
***Monatractides subgenus Vietsclio*** Pešić & Smit, 2014 (Torrenticolidae): *Zootaxa* 3820: 1-80.
***Neoatractides erato*** Pešić & Smit, 2014 (Torrenticolidae): *Zootaxa* 3820: 1-80.
***Neoatractides sunadaensis*** Pešić & Smit, 2014 (Torrenticolidae): *Zootaxa* 3840: 1-72.
***Neoatractides uniscutatus*** Pešić & Smit, 2014 (Torrenticolidae): *Zootaxa* 3840: 1-72.
***Oxus fuscus*** Smit & Pešić, 2014 Zootaxa (Oxidae): *Zootaxa* 3876: 1-71.
***Protzia borneoensis*** Smit & Pešić, 2014 (Hydryphantidae): *Zootaxa* 3876: 1-71.
***Pseudotorrenticola borneoensis*** Pešić & Smit, 2014 (Torrenticolidae): *Zootaxa* 3840: 1-72.
***Sperchon kinabaluensis*** Smit & Pešić, 2014 (Sperchontidae): *Zootaxa* 3876: 1-71.

***Sperchonopsis orientalis*** Smit & Pešić, 2014 (Sperchontidae): *Zootaxa* 3876: 1-71.
***Thoracophoracarus koreanus*** Smit & Pešić, 2014 (Arrenuridae): *Systematic & Applied Acarology* 19: 431-434.
***Thoracophoracarus uniacetabulatus*** Smit & Pešić, 2014 (Arrenuridae): *Zootaxa* 3876: 1-71.
***Torrenticola borneoensis*** Pešić & Smit, 2014(Torrenticolidae): *Zootaxa* 3840: 1-72.
***Torrenticola calliope*** Pešić & Smit, 2014 (Torrenticolidae): *Zootaxa* 3820: 1-80.
***Torrenticola kinabaluensis*** Pešić & Smit, 2014 (Torrenticolidae): *Zootaxa* 3840: 1-72.
***Torrenticola neoindica*** Pešić & Smit, 2014 (Torrenticolidae): *Zootaxa* 3840: 1-72.
***Torrenticola sabahensis*** Pešić & Smit, 2014 (Torrenticolidae): *Zootaxa* 3840: 1-72.
***Torrenticola schilthuizeni*** Pešić & Smit, 2014 (Torrenticolidae): *Zootaxa* 3840: 1-72.

## Arthropoda: Crustacea

***Ingolfiella maldivensis*** Vonk & Jaume, 2014 (Amphipoda, Ingolfiellidae): *ZooKeys* 449: 69-79.
***Metaniphargus shiroi*** Vonk & Gable, 2014 (Amphipoda, Hadziidae): *Zoological Science* 31: 491-499.
***Opecarcinus cathyae*** van der Meij, 2014 (Decapoda, Brachyura, Cryptochiridae): *Zootaxa* 3869(1): 44-52.

## Arthropoda: Insecta: Odonata

***Allocnemidinae*** Dijkstra, Kalkman, Dow, Stokvis & van Tol, 2014 (Odonata): *Systematic Entomology* 39: 68-96.
***Amphicnemis triplex*** Dow, 2014 (Coenagrionidae): *Odonatologica* 43: 67-77.
***Bornargiolestes fuscus*** Dow, 2014 (Incertae sedis): *Journal of Threatened Taxa* 6: 5700-5711.
***Bornargiolestes reelsi*** Dow, 2014 (Incertae sedis): *Journal of Threatened Taxa* 6: 5700-5711.
***Calicnemia fortis*** Dow, Zia, Naeem & Rafi, 2014 (Platycnemididae): *Zootaxa* 3869: 338-342.
***Coperini*** Dijkstra, Kalkman, Dow, Stokvis & van Tol, 2014 (Odonata): *Systematic Entomology* 39: 68-96.
***Devadattidae*** Dijkstra, Kalkman, Dow, Stokvis & van Tol, 2014 (Odonata): *Systematic Entomology* 39: 68-96.
***Idiocnemidinae*** Dijkstra, Kalkman, Dow, Stokvis & van Tol, 2014 (Odonata): *Systematic Entomology* 39: 68-96.
***Nososticta rufipes*** Theischinger & Kalkman, 2014 (Platycnemidae): *International Journal of Odonatology* 17: 217-222.
***Onychargiinae*** Dijkstra, Kalkman, Dow, Stokvis & van Tol, 2014 (Odonata): *Systematic Entomology* 39: 68-96.
***Onychogomphus marijanmatoki*** Dow, 2014 (Gomphidae): *Zootaxa* 3795: 181-186.
***Palaiargia benkeni*** Orr, Kalkman, Richards, 2014 (Platycnemidae): *International Journal of Odonatology* 16: 309-325.
***Palaiargia clarillii*** Orr, Kalkman, Richards, 2014 (Platycnemidae): *International Journal of Odonatology* 16: 309-325.
***Palaiargia quandti*** Orr, Kalkman, Richards, 2014 (Platycnemidae) International Journal of Odonatology 16: 309-325.
***Palaiargia tydecksjuerging*** Orr, Kalkman, Richards, 2014 (Platycnemidae): *International Journal of Odonatology* 16: 309-325.
***Prodasineura yulan*** Dow & Ngiam, 2013 (Platycnnemididae): *Zootaxa* 3670: 87-90.
***Protostictinae*** Dijkstra, Kalkman, Dow, Stokvis & van Tol, 2014 (Odonata): *Systematic Entomology* 39: 68-96.
***Sangabasis bukid*** Villanueva & Dow, 2014 (Coenagrionidae): *Zootaxa* 3815: 1-28.
***Sangabasis bulba*** Villanueva & Dow, 2014 (Coenagrionidae): *Zootaxa* 3815: 1-28.
***Sangabasis cahilogi*** Villanueva & Dow, 2014 (Coenagrionidae): *Zootaxa* 3815: 1-28.
***Sangabasis carmelae*** Villanueva & Dow, 2014 (Coenagrionidae): *Zootaxa* 3815: 1-28.
***Sangabasis feliculoi*** Villanueva & Dow, 2014 (Coenagrionidae): *Zootaxa* 3815: 1-28.
***Sangabasis hamis*** Villanueva & Dow, 2014 (Coenagrionidae): *Zootaxa* 3815: 1-28.
***Sangabasis zamboanga*** Villanueva & Dow, 2014 (Coenagrionidae): *Zootaxa* 3815: 1-28.
***Teinobasis aquila*** Theischinger & Kalkman, 2014 (Coenagrionidae): *Odonatologica* 43: 143-168.
***Teinobasis lieftincki*** Theischinger & Kalkman, 2014 (Coenagrionidae): *Odonatologica* 43: 143-168.
***Teinobasis michalskii*** Theischinger & Kalkman, 2014 (Coenagrionidae): *Odonatologica* 43: 143-168.
***Teinobasis splendens*** Theischinger & Kalkman, 2014 (Coenagrionidae): *Odonatologica* 43: 143-168.
***Telosticta iban*** Dow, 2014 (Platystictidae): *Zootaxa* 3784: 74-78.

## Arthropoda: Insecta: Hemiptera: Heteroptera

***Geovelia hispida*** Ye, Chen & Bu, 2014 (Veliidae): *The Pan-pacific Entomologist* 90(1): 19-22.

## Arthropoda: Insecta: Hymenoptera

***Andrena antoinei*** Michez & de Meulemeester, 2014 (Hymenoptera, Anthophila): *PLoS ONE* 9(10): e108865.
***Bombus cerdanyensis*** Dehon, de Meulemeester & Engel, 2014 (Hymenoptera, Apidae): *PLoS ONE* 9(10): e108865.
***Dinotrema brevis*** van Achterberg & Vikberg, 2014 (Braconidae): *Zoologische Mededelingen Leiden* 88(1): 1-8.
***Euagathis breviantennata*** van Achterberg & Sharkey, 2014 (Braconidae): *Journal of Hymenoptera Research* 36: 1-25.
***Euagathis pallitarsis*** van Achterberg & Sharkey, 2014 (Braconidae): *Journal of Hymenoptera Research* 36: 1-25.
***Euagathis setosimaculata*** van Achterberg & Sharkey, 2014 (Braconidae): *Journal of Hymenoptera Research* 36: 1-25.
***Gasteruption aciculatum*** van Achterberg, 2014 (Gasteruptiidae): *ZooKeys* 458: 1-188.
***Gasteruption agrenum*** van Achterberg, 2014 (Gasteruptiidae): *ZooKeys* 458: 1-188.
***Gasteruption brevibasale*** van Achterberg & Saure, 2014 (Gasteruptiidae): *ZooKeys* 458: 1-188.
***Gasteruption coriacoxale*** van Achterberg, 2014 (Gasteruptiidae): *ZooKeys* 458: 1-188.
***Gasteruption flavimarginatum*** van Achterberg, 2014 (Gasteruptiidae): *ZooKeys* 458: 1-188.
***Gasteruption heminitidum*** van Achterberg, 2014 (Gasteruptiidae): *ZooKeys* 458: 1-188.
***Gasteruption henseni*** van Achterberg, 2014 (Gasteruptiidae): *ZooKeys* 458: 1-188.
***Gasteruption ischnolaimum*** van Achterberg, 2014 (Gasteruptiidae): *ZooKeys* 458: 1-188.
***Gasteruption nigrapiculatum*** van Achterberg, 2014 (Gasteruptiidae): *ZooKeys* 458: 1-188.
***Gasteruption paglianoi*** van Achterberg & Saure, 2014 (Gasteruptiidae): *ZooKeys* 458: 1-188.
***Gasteruption pseudolaticeps*** van Achterberg, 2014 (Gasteruptiidae): *ZooKeys* 458: 1-188.
***Gasteruption punctifrons*** van Achterberg, 2014 (Gasteruptiidae): *ZooKeys* 458: 1-188.
***Gasteruption schmideggeri*** van Achterberg & Saure, 2014 (Gasteruptiidae): *ZooKeys* 458: 1-188.
***Gasteruption scorteum*** van Achterberg, 2014 (Gasteruptiidae): *ZooKeys* 458: 1-188.
***Gasteruption smitorum*** van Achterberg, 2014 (Gasteruptiidae): *ZooKeys* 458: 1-188.
***Idiastoides*** Braet & van Achterberg, 2014 (Braconidae): *Zootaxa* 3869(2): 189-197.
***Idiastoides keltimi*** Braet & van Achterberg, 2014 (Braconidae): *Zootaxa* 3869(2): 189-197.
***Jezonogonalos elliptifera*** Chen, van Achterberg, He & Xu, 2014 (Trigonalyidae): *ZooKeys* 385: 1-207.
***Jezonogonalos jiangliae*** Chen, van Achterberg, He & Xu, 2014 (Trigonalyidae): *ZooKeys* 385: 1-207.
***Jezonogonalos luteata*** Chen, van Achterberg, He & Xu, 2014 (Trigonalyidae): *ZooKeys* 385: 1-207.
***Jezonogonalos nigrata*** Chen, van Achterberg, He & Xu, 2014 (Trigonalyidae): *ZooKeys* 385: 1-207.
***Leptotrema wilhelmense*** Braet & van Achterberg, 2014 (Braconidae): *Zootaxa* 3869(2): 189-197.
***Lycogaster angustula*** Chen, van Achterberg, He & Xu, 2014 (Trigonalyidae): *ZooKeys* 385: 1-207.
***Lycogaster flavonigrata*** Chen, van Achterberg, He & Xu, 2014 (Trigonalyidae): *ZooKeys* 385: 1-207.
***Lycogaster nigralva*** Chen, van Achterberg, He & Xu, 2014 (Trigonalyidae): *ZooKeys* 385: 1-207.
***Metopheltes clypeoarmatus*** Reshchikov & van Achterberg, 2014 (Ichneumonidae): *Biodiversity Data Journal* 2: e1061.
***Mirax caspiana*** Farahani, Talebi, van Achterberg & Rakhshani, 2014 (Braconidae): *Annales Zoologici (Warszawa)* 64(4): 677-682.
***Miropotes orientalis*** Fernández-Triana & van Achterberg, 2014 (Braconidae): *Tijdschrift voor Entomologie* 157: 59-77.
***Neurogenia auco*** Reshchikov & van Achterberg, 2014 (Ichneumonidae): *Tijdschrift voor Entomologie* 157: 123-135.
***Orthogonalys cheni*** Chen, van Achterberg, He & Xu, 2014 (Trigonalyidae): *ZooKeys* 385: 1-207.
***Orthogonalys clypeata*** Chen, van Achterberg, He & Xu, 2014 (Trigonalyidae): *ZooKeys* 385: 1-207.
***Orthogonalys robusta*** Chen, van Achterberg, He & Xu, 2014 (Trigonalyidae): *ZooKeys* 385: 1-207.
***Parasapyga boschi*** van Achterberg, 2014 (Sapygidae): *ZooKeys* 369: 61-77.
***Parasapyga yvonnae*** van Achterberg, 2014 (Sapygidae): *ZooKeys* 369: 61-77.
***Perilitus luteoides*** Madl & van Achterberg, 2014 (Braconidae): *Linzer biologische Beiträge* 46(1): 5-220.
***Phaenocarpa manuelae*** Madl & van Achterberg, 2014 (Braconidae): *Linzer biologische Beiträge* 46(1): 5-220.
***Phanerotoma andamanensis*** Gupta & van Achterberg, 2014 (Braconidae): *Zootaxa* 3856(4): 595-600.
***Protohabropoda pauli*** de Meulemeester & Michez, 2014 (Hymenoptera, Apidae): *PLoS ONE* 9(10): e108865.
***Pseudogonalos angusta*** Chen, van Achterberg, He & Xu, 2014 (Trigonalyidae): *ZooKeys* 385: 1-207.
***Ropalidia parartifex*** Tan & van Achterberg, 2014 (Vespidae): *ZooKeys* 391: 1-35.
***Sigalphus anjae*** van Achterberg, 2014 (Braconidae): *Zoologische Mededelingen Leiden* 88(2): 9-18.
***Taeniogonalos bucarinata*** Chen, van Achterberg, He & Xu, 2014 (Trigonalyidae): *ZooKeys* 385: 1-207.
***Taeniogonalos cordata*** Chen, van Achterberg, He & Xu, 2014 (Trigonalyidae): *ZooKeys* 385: 1-207.
***Taeniogonalos geminata*** Chen, van Achterberg, He & Xu, 2014 (Trigonalyidae): *ZooKeys* 385: 1-207.
***Taeniogonalos sculpturata*** Chen, van Achterberg, He & Xu, 2014 (Trigonalyidae): *ZooKeys* 385: 1-207.
***Taeniogonalos subtruncata*** Chen, van Achterberg, He & Xu, 2014 (Trigonalyidae): *ZooKeys* 385: 1-207.
***Taeniogonalos triangulata*** Chen, van Achterberg, He & Xu, 2014 (Trigonalyidae): *ZooKeys* 385: 1-207.
***Taeniogonalos tricolorisoma*** Chen, van Achterberg, He & Xu, 2014 (Trigonalyidae): *ZooKeys* 385: 1-207.
***Taeniogonalos uncifera*** Chen, van Achterberg, He & Xu, 2014 (Trigonalyidae): *ZooKeys* 385: 1-207.
***Teranishia crenulata*** Chen, van Achterberg, He & Xu, 2014 (Trigonalyidae): *ZooKeys* 385: 1-207.
***Teranishia glabrata*** Chen, van Achterberg, He & Xu, 2014 (Trigonalyidae): *ZooKeys* 385: 1-207.
***Teresirogas billbrysoni*** Quicke & van Achterberg, 2014 (Braconidae): *Zootaxa* 3881: 237-257.
***Teresirogas prestonae*** Quicke & van Achterberg, 2014 (Braconidae): *Zootaxa* 3881: 237-257.
***Teresirogas williamsi*** Quicke & van Achterberg, 2014 (Braconidae): *Zootaxa* 3881: 237-257.

***Therophilus vizekae*** Madl & van Achterberg, 2014 (Braconidae): *Linzer biologische Beiträge* 46(1): 5-220.

## Arthropoda: Insecta: Diptera

***Callicera exigua*** Smit, 2014 (Syrphidae): *Zootaxa* 3779: 585-590.
***Callicera scintilla*** Smit, 2014 (Syrphidae): *Zootaxa* 3779: 585-590.
***Domodon peperpotensis*** Reemer, 2014 (Syrphidae): *Tijdschrift voor Entomologie* 157: 27-57.
***Microdon colakriki*** Reemer, 2014 (Syrphidae): *Tijdschrift voor Entomologie* 157: 27-57.
***Peradon satyricus*** Reemer, 2014 (Syrphidae): *Tijdschrift voor Entomologie* 157: 27-57.
***Peradon sciarus*** Reemer, 2014 (Syrphidae): *Tijdschrift voor Entomologie* 157: 27-57.

## Arthropoda: Insecta: Coleoptera

***Clitenososia vazquezi*** Beenen, 2014 (Chrysomelidae): *Genus* 25: 451-457.
***Diacantha kippenbergi*** Beenen, 2014: (Chrysomelidae): *Entomologische Blätter und Coleoptera* 110: 83-86.
***Radymna latifrons*** Beenen, 2014 (Chrysomelidae): *Entomologische Blätter und Coleoptera* 110: 83-86.
***Radymna maculicollis*** Beenen, 2014 (Chrysomelidae): *Entomologische Blätter und Coleoptera* 110: 83-86.

## Pisces

***Upeneus nigromarginatus*** Bos, 2014 (Mullidae): *Raffles Bulletin of Zoology* 62: 745-753.

# Staff

# Research staff

## Sector management

| | |
|---|---|
| Prof. dr. J.C. (Koos) Biesmeijer | Scientific director from 1 February 2013 |
| Prof. dr. Erik F. Smets | Scientific director,<br>Director National Herbarium of the Netherlands. Chair of Systematic Botany and Scientific director Hortus botanicus, Leiden University, Extraordinary professor, KU Leuven |
| Dr. Jan van Tol | Associate director for Research and Education |

## Research Coordination Office

| | |
|---|---|
| Dr. Johan B. Mols | Head of Research Coordination Office |
| Mr. Jan-Willem Mantel | Project secretary |
| Mrs. Cynthia Crul | Assistant Research Coordinator Office, from 1 June 2013 |
| Mrs. Ate A. Cohen | Coordinator Naturalis Expert Center |
| Mrs. Connie G.G. Baak | Editor |
| Dr. J.D. (Hans) Kruijer | Editor |
| Mrs. Anne Dangremond | Registrator CONVERIS, from 13 August until 30 September 2013 |
| Mrs. Edit Lajtos | Registrator CONVERIS, from 1 April 2013 until 31 March 2014 |
| Mrs. Carla Janssen | Registrator CONVERIS, from 9 October until 8 December 2013 |
| Mr. Huub J. Sijben | Administrator CONVERIS, from 7 July 2014 |
| Mrs. Maria J. Schilder | Digitisation, from 13 March until 4 April 2014 |

## Department of Botany

| Name | Position | Expertise |
|---|---|---|
| Prof. dr. Erik F. Smets | Scientific director,<br>Head of the department from 1 January 2014 | Systematics, phylogeny, morphology, anatomy, floral development (incl. evo-devo), biogeography, flowering plants. |
| Dr. H. (Leni) Duistermaat | Senior researcher | Plant taxonomy, Flora, Netherlands, Poaceae, Amischotolype, SE Asia, Peninsular Malaysia. |
| Dr. József Geml | Senior researcher | DNA metabarcoding, phylogeography, root-associated fungi, soil community ecology, climate change. |
| Dr. Barbara Gravendeel | Senior researcher,<br>Biodiversity Chair University of Applied Sciences Leiden | Ancient DNA, evo-devo, next generation sequencing, comparative genomics, orchids, wildlife forensics. |
| Dr. Raymond W.J.M. van der Ham | Senior researcher | Pollen, plant macrofossils, oak galls, drifting seeds, Dutch ferns, bee plants, simplicia, fossil echinoids, Bathonian fossils. |
| Dr. Peter H. Hovenkamp | Senior researcher | Pteridophytes, systematics, historical biogeography, phylogeny. |
| Dr. Frederic P. Lens | Senior researcher | Secondary woodiness, species distribution modelling, structure-function relationships, wood anatomy, xylem hydraulics. |
| Dr. Marco C. Roos | Senior researcher,<br>Education coordinator,<br>Head of the department until 31 December 2013 | Systematics, phylogeny, biogeography, biodiversity, Tree of Life, Malesia. |
| Prof. dr. Marc S.M. Sosef | Senior researcher,<br>Head of NHN Wageningen until 30 September 2013 | Taxonomy, phylogeny, biodiversity assessment, speciation, classification, biogeography, tropical Africa, Gabon, Pleistocene refuges, climate change, Begonia, Ochnaceae, Poaceae. |
| Dr. Michael Stech | Senior researcher | Bryology, systematics, phylogenetics, biogeography. |
| Dr. Daniel C. Thomas | Senior researcher,<br>until 30 September 2014 | Alpha-taxonomy, phylogenetics, historical biogeography, molecular divergence time analyses, ancestral area reconstructions. |
| Prof. dr. Peter C. van Welzen | Senior researcher | Malesia, Euphorbiaceae, Sapindaceae, phylogeny, biogeography. |
| Dr. Jan J. Wieringa | Senior researcher | Biosystematics, geography, phytogeography, plant taxonomy, biodiversity, zoology, Fabaceae, West Africa, Gabon, Caesalpinioideae, Begonia, Fabales, Orthoptera. |
| Dr. Vincent S.F.T. Merckx | Research fellow | Mycoheterotrophy, evolution, biogeography, phylogenetics, mycorrhizal interactions. — VENI project funded by NWO. |
| Dr. Timo van der Niet | Research fellow | Speciation, pollination, phenotype, sapromyophily, phylogenetics, natural history, flower shape. |
| Dr. Hans ter Steege | Research fellow | Tree-diversity, Amazon, functional traits, carbon, dynamics, conservation. |
| Dr. Tinde R. van Andel | Postdoc | African diaspora, medicinal plants, ritual plants, women's health, traditional medicine, West Africa, Guianas, non-timber forest products, migrant ethnobotany. - Vidi project funded by NWO. |
| Dr. Edu Boer | Postdoc,<br>until 31 December 2014 | emote sensing, GIS, spatial modelling, Rweb databasing, identification keys. — Project funded by Nederlandse Voedsel en Warenautoriteit. |
| Dr. Hugo J. de Boer | Postdoc,<br>until 31 December 2014 | DNA barcoding, plant trade, ethnobotany, systematics, Cucurbitaceae, women's health, molecular identification, tropical botany. — TASENE project funded by WOTRO. |
| Dr. Jorinde Nuytinck | Postdoc,<br>from 1 April 2013 | *Lactarius*, *Lactifluus,* Russulaceae, Russulales, fungi, taxonomy, systematics, nomenclature, phylogeny, phylogeography, species delimitation, evolution, morphology, microscopy, ectomycorrhiza. — Project funded by Rijksherbariumfonds Dr. E. Kits van Waveren. |
| Dr. Sylvia Mota de Oliviera | Postdoc | Bryophytes, epiphytes, Amazon, canopy, Guianas. — Project funded by the Alberta Mennega Stichting and Stichting Van Eeden Fonds. |

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|---|---|---|
| Dr. Niels Raes | Postdoc | Biodiversity, biogeography, macroecology, ecology, species distribution modelling, evolution, vegetation classification, GIS, global climate change, palaeoclimate. — NWO ALW open programme project, and project funded by WWF, the Netherlands. |
| Dr. Herre Stegenga | Postdoc, until 31 December 2014 | Phycology, life histories and systematics of the Acrochaetiaceae, the Netherlands, red algae, eutrophication. — Project funded by GiMaris. |
| Dr. Erica Tetetla Rangel | Postdoc | Biodiversity patterns, landscape ecology, ecological niche modelling, tropical biomes. — Project funded by CONACyT, Mexico. |
| Ms. Mega Atria | PhD candidate | Biogeography and evolution of the rattan *Calamus javensis* Bl. (Arecaceae, Calamoideae) complex. — Fellowship DIKTI Indonesia. Promotor: P.C. van Welzen. |
| Ms. Pulchérie Bissiengou | PhD candidate | Systematics, evolution and historical biogeography of the family Ochnaceae, with emphasis on the genus *Campylospermum*. — WUR Sandwich Scholarship & Fellowship FORENET. Promotor: M.S.M. Sosef. Daily supervisors: J.J. Wieringa and L.W. Chatrou. PhD defence: 19 December 2014, Wageningen University. |
| Ms. Marina Bonfim Santos | PhD candidate, from 1 November 2013 | Molecular phylogeny and morphological evolution of the moss family Leucobryaceae (Bryophyta, Dicranidae). — Fellowship CAPES, Brazil. Promotor: E.F. Smets. Daily supervisor: M. Stech. |
| Dr. Bhanumas Chantarasuwan | PhD candidate | Taxonomy, systematics, and biogeography of *Ficus* subsection *Urostigma* (Moraceae). — Fellowship Royal Thai Government. Promotor: P.C. van Welzen. PhD defence: 3 September 2014, Leiden University. |
| Dr. Tanawat Chaowasku | PhD candidate | The Miliuseae revisited: Phylogenetic, taxonomic, and palynological studies in a major clade of Annonaceae. — Fellowship Royal Thai Government. Promotor: E.F. Smets. Daily supervisors: L.W. Chatrou and D. Thomas. PhD defence: 27 March 2014, Leiden University. |
| Mr. Nicolas F. Davin | PhD candidate | Evolution of secondary woodiness: driver of island plant radiations? Promotor: E.F. Smets. Daily supervisor: F.P. Lens. |
| Ms. Sofia I. Fernandes Gomes | PhD candidate, from 1 June 2014 | Evolution of mycorrhizal specificity in flowering plants. Promotor: E.F. Smets. Daily supervisor: V.S.F.T. Merckx. |
| Mr. Renato Gama Dias Neto | PhD candidate | Phylogeographical patterns between the rain forest and the amazon forest: An approach with the family Dicranaceae s.l. (Bryophyta) and other haplolepideous mosses. — Fellowship CAPES, Brazil. Promotor: E.F. Smets. Daily supervisor: M. Stech. |
| Mr. Paul H. Hoekstra | PhD candidate | Living apart together - on niche evolution in African lianas. — Wageningen University & Naturalis. Promotor: E.F. Smets. Daily supervisors: L.W. Chatrou and J.J. Wieringa. |
| Mr. Adam P. Karremans | PhD candidate | Niche differentiation in the epiphytic orchid genus *Specklinia* and close relatives in Pleurothallidinae. — Fellowship Universidad de Costa Rica. Promotor: E.F. Smets. Daily supervisor: B. Gravendeel. |
| Mr. Berhane Kidane Mengesha | PhD candidate, discontinued August 2014 | Ethnobotany and ecology of wild edible and medicinal plants in South Omo Zone. — Fellowship Nuffic. Promotors: M.S.M. Sosef and L.J.G. van der Maesen. Daily supervisor: T.R. van Andel. |
| Dr. Annick S. Lang | PhD candidate | Phylogeny and species delimitation within the moss genus *Dicranum* Hedw. Promotor: E.F. Smets. Daily supervisor: M. Stech. PhD defence: 8 October 2014, Leiden University. |
| Mr. Constantijn B. Mennes | PhD candidate | Diversification of mycoheterotrophic angiosperms. Promotor: E.F. Smets. Daily supervisor: V.S.F.T. Merckx. |
| Mr. Luis N. das Neves Morgado | PhD candidate | Biodiversity and habitat partitioning of arctic ectomycorrhizal fungi and their role in vegetation change due to climatic changes. Promotor: E.F. Smets. Daily supervisors: J. Geml and M.E. Noordeloos. |
| Mrs. Anita Mulder | PhD candidate, from 1 June 2014 | Functional genomics of orchids. — Doctoral Grant funded by NWO. Promotor: E.F. Smets. Daily supervisors: B. Gravendeel and P.M. Schlüter. |
| Mr. Edwin T. Pos | PhD candidate | Unraveling Amazon tree diversity: The importance of dispersal in maintaining species richness in Amazonian forests. Promotor: W.F. Laurance. Daily supervisor: H. ter Steege. |
| Mr. André van Proosdij | PhD candidate | What determines species diversity in Central African plants? — Wageningen University. Promotor: M.S.M. Sosef. Daily supervisors: J.J. Wieringa and N. Raes. |
| Ms. Diana K. Quiroz | PhD candidate, | Do not fear the supernatural! The relevance of ritual plant use for traditional culture, nature conservation, and human health in western Africa. — Vidi project T.R. van Andel funded by NWO. Promotor: M.S.M. Sosef. Daily supervisor: T.R. van Andel. |
| Mr. Saroj Ruchisansakun | PhD candidate, from 1 October 2013 | Systematics, evolution, and pollination biology of Balsaminaceae in SE Asia. – Fellowship Thai Institute for the Promotion of Teaching Science and Technology. Promotor: E.F. Smets. Daily supervisor: T. van der Niet. |
| Ms. Rachel Schwallier | PhD candidate | Niche differentiation of tropical pitcher plants. — Private funding. Promotor: E.F. Smets. Daily supervisors: B. Gravendeel and N. Raes. |
| Ms. Tatiana A. Semenova | PhD candidate | Biodiversity and habitat partitioning of root-associated fungi and their role in vegetation change due to climatic changes. — ALW open programme funded by NWO. Promotor: E.F. Smets. Supervisor: J. Geml. |

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|---|---|---|
| Dr. Yotsewate Sirichamorn | PhD candidate | Systematics and biogeography of Aganope, Brachypterum and Derris (Fabaceae) in Asia. —Fellowship Commission on Higher Education Thailand. Promotor: P.C. van Welzen. PhD defence: 30 September 2014, Leiden University. |
| Dr. Alexandra M. Towns | PhD candidate | Fertility and fontanels: Women's knowledge of medicinal plants for reproductive health and childcare in western Africa. — Vidi project T.R. van Andel funded by NWO. Promotor: E.F. Smets. Daily supervisor: T.R. van Andel. PhD defence: 28 November 2013, Leiden University. |
| Ms. Sarina Veldman | PhD candidate, from 1 February 2013 | Identifying and monitoring trade in wild-harvested medicinal plants by means of genomic-based DNA barcoding. — TASENE project funded by WOTRO. Promotor: S.L. Baldauf. Daily supervisors: H.J. de Boer and B. Gravendeel. |
| Dr. Robin van Velzen | PhD candidate | Evolution of associations between *Cymothoe* butterflies and the *Rinorea* host plants in tropical Africa. Promotor: M.S.M. Sosef. Daily supervisor: F.J. Bakker. PhD defence: 11 December 2013, Wageningen University. |
| Ms. Tamara J.J. Vernimmen | PhD candidate | Impact of man and climate on a unique tropical ecosystem. — NWO ALW Open programme. Promotors: E.F. Smets and P. Baas. |
| Mr. Wout J. Holverda | Botanical assistant | Flora of the Netherlands. |
| Dr. A.J. (Bert) Lever | Programme Coordinator Caribbean Netherlands, from 1 August 2014 | Naturalis Dutch Caribbean Project. |
| Dr. Soraya E.C. Sierra Daza | Project manager | Biodiversity, data mobilization, e-taxonomy, floras, faunas, infrastructure and collaboration projects interoperability, legacy literature, technical and semantic interoperability, sustainability, systematics, taxonomy. — ProiBiosphere project funded by EU FP7. |
| Mrs. R. (Chequita) Bhikhi | Project assistant, from 1 September 2014 | - |
| Mr. Bardo A. Cornelder | Teaching assistant, from 12 May 2014 until 11 July 2014, and from 20 October 2014 | - |
| Mrs. Susana Arias Guerrero | Project assistant, from 1 March 2014 | - |
| Mr. Thomas D. Hamann | Project assistant, until 23 March 2014 and from 20 October 2014 | - |
| Mrs. G.H. (Eva) Kralt | Project assistant, from 6 May 2013 until 5 May 2014 | - |
| Mrs. Hester M. Stekelenburg | Project assistant, from 29 November 2014 | - |

## Research associates and correspondents

Dr. Frits A.C.B. Adema; Prof. dr. Pieter Baas; Dr. Max J. van Balgooy; Dr. Olaf Banki; Mrs. Chequita Bhikhi; Mrs. Rosa Delia Búcaro; Mr. Jean Claessens; Prof. dr. A. (Toine) Cleef; Dr. Thomas L.P. Couvreur; Mrs. Ruth Cozien; Dr. Roy H.J. Erkens; Dr. Christina Flann; Mr. Jan Hengstmengel; Mr. Wilbert Hetterscheid; Mr. Leonardus M. Jalink; Mrs. Marion J. Jansen-Jacobs; Dr. Jan de Koning; Mr. M.J.H. (Joop) Kortselius; Mr. Carel Kreutz; Mrs. Hiltje Maas; Prof. dr. Paul J.M. Maas; Prof. dr. David J. Mabberley; Prof. dr. L.J.G. (Jos) van der Maesen; Dr. I.M. (Inga) Melcher; Mr. Rene C.M.J. van Moorsel; Mr. Emile Nat; Dr. M.E. (Chiel) Noordeloos; Dr. Willem Prud'homme van Reine; Dr. Jeanette W.A. Ridder-Numan; Dr. Colin E. Ridsdale; Mr. Harry C. Roskam; Mr. Andre Schuiteman; Mr. Erik Simons; Dr. Claudia C. Soliz Gamboa; Dr. Anastasia Stefanaki; Dr. A. (Dries) Touw; Dr. Jan-Frits Veldkamp; Dr. Jaap J. Vermeulen; Dr. Wim Vink; Dr. Eduard F. de Vogel; Mr. Lubbert Westra; Dr. Willem J.J.O. de Wilde; Dr. Brigitta E.E. de Wilde-Duijfjes; Mr. Jaap Wisman; Dr. Ben J.M. Zonneveld.

## Department of Geology

| Name | Position | Expertise |
|---|---|---|
| Dr. Leo M. Kriegsman | Head of the department, Senior researcher | Metamorphic geology, petrology, tectonics, geodynamics, volcanology. |
| Dr. Steve K. Donovan | Senior researcher | Palaeozoic and Mesozoic invertebrates, Echinodermata, Crinoidea, UK, Antilles, Jamaica, trace fossils, crabs, barnacles, history of geology. |
| Dr. Lars W. van den Hoek Ostende | Senior researcher | Fossil microvertebrates, the fossil insectivores of the Neogene, and mainly the Miocene. |
| Dr. Willem Renema | Senior researcher | Fossil foraminifera, stratigraphy, palaeoenvironment, biogeography. |
| Dr. Anne S. Schulp | Senior researcher, from 1 February 2013 | Mesozoic macrovertebrates, mosasaurs, dinosaurs, dinosaur tracks, stable isotopes, biomechanics, palaeopathology, Maastrichtian. |
| Dr. Isabel van Waveren | Senior researcher | Permian, Carboniferous, fossil plant taphonomy, early conifers, differential growth. |
| Dr. Frank P. Wesselingh | Senior researcher | Fossil Mollusca, Cenozoic, biodiversity, landscape evolution, taxonomy, turnover, extinction, immigration. |
| Dr. J.C. (Hanco) Zwaan | Senior researcher | Mineralogy, natural history, geology, gemmology, emerald, pearls. |
| Dr. Martin Brazeau | Research fellow, until 31 August 2013 | Devonian fishes. — ERC Starting grant project 'The origin of jawed vertebrates and the evolution of morphology in deep time' funded by EU. |
| Dr. Martin Rücklin | Research fellow, from 15 April 2013 | Palaeozoic fishes, developmental evolution, assembly of body plans, vertebrates, palaeontology. — First year within the ERC Starting grant project 'The origin of jawed vertebrates and the evolution of morphology in deep time' funded by EU. |
| Dr. Laura J. Cotton | Postdoc, from 18 March 2013 | 'Biotic and abiotic drivers of shifting marine tropical biodiversity hotspots during the Eocene-Oligocene'. — ALW open programme, funded by NWO. |
| Mr. Menno Booi | PhD candidate | Gymnosperms from the Early Permian of Jambi (Sumatra, Indonesia) and their implications for palaeoecology and palaeogeography. — Private funding. Promotor J.H.A. van Konijnenburg-van Cittert. Daily supervisor: I. van Waveren. |

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|---|---|---|
| Mr. Hylke F. Bosma | PhD candidate | Late Cretaceous conifers from Western and Central Europe. — Private funding. Promotor: J.H.A. van Konijnenburg-van Cittert. |
| Dr. Alexandra A.E. van der Geer | PhD candidate | The impact of isolation: Evolutionary processes in *Hoplitomeryx*. Promotor J. Reumer. Daily supervisor: J. de Vos. PhD defence: 12 May 2014, Utrecht University. |
| Mr. Pepijn Kamminga | PhD candidate | Ecomorphology in sharks. Promotor: M. Richardson. Daily supervisor: M. Brazeau. |
| Ms. P.A. (Anneke) Madern | PhD candidate | The rise and fall of a Miocene hotspot: palaeobiogeography of the early Vallesian mammals of the Vallès-Penedès (Catalonia, Spain). Promotor: P.C. van Welzen. Daily supervisor: L. van den Hoek Ostende. |
| Dr. Vibor Novak | PhD candidate | Larger benthic foraminifera in Miocene carbonates of Indonesia. — ITN grant funded by EU. Promotor: L.J. Lourens. Daily supervisor: W. Renema. PhD defence: 24 October 2014, Utrecht University. |
| Dr. Sonja Reich | PhD candidate | Seagrass mollusks as a model group for paleoecological and paleodiversity studies. — ITN grant funded by EU. Promotor: L.J. Lourens. Daily supervisor: F.P. Wesselingh. PhD defence: 24 June 2014, Utrecht University. |
| Ms. Marianne K. van Abbe | Project assistant | - |
| Ms. Delia S. van Oijen | Project assistant, from 1 June 2014 | - |

### Research associates and correspondents

Dr. Paul C.H. Albers; Dr. Antonio Alvarez-Valero; Dr. Charles E.S. Arps; Mr. Barry W.M. van Bakel; Dr. Gert D. van den Bergh; Mr. Johannes van der Burgh; Mr. Leon P.A.M. Claessens; Mrs. Francien E. Dieleman; Dr. M. (Thijs) Freudenthal; Dr. Alexandra A.E. van der Geer; Dr. Renate Helwerda; Mrs. Veronica Hernandez-Ballarin; Dr. Anneke H. van Heteren; Dr. Ph.J. (Flip) Hoedemaeker; Mr. Anton C. Janse; Mr. Arie W. Janssen; Mr. Nico M.M. Janssen; Dr. Jaap Klein; Prof. dr. J.H.A. (Han) van Konijnenburg-van Cittert; Mr. Wim J. Kuijper; Mr. Bernie M. Landau; Mr. Jacob Leloux; Prof. dr. George A. Lyras; Dr. Hanneke J.M. Meijer; Dr. Tom Meijer; Dr. Kenneth A. Monsch; Dr. Freddy A.D. van Nieulande; Dr. J.G.M. (Han) Raven; Dr. Paul Storm; Dr. Ahmed F. Tmalla; Mr. Simon R. Troelstra; Dr. John de Vos; Dr. Cor F. Winkler Prins.

## Department of Marine Zoology

| Name | Position | Expertise |
|---|---|---|
| Dr. Bert W. Hoeksema | Head of the department, Senior researcher | Marine biodiversity, marine biogeography, marine conservation, stony coral taxonomy, coral phylogeny, coral symbionts, reef coral ecology. |
| Dr. Charles H.J.M. Fransen | Senior researcher | Crustacea, Decapoda, Caridea, taxonomy, phylogeny, historical biogeography, phylogenetic ecology. |
| Dr. Dick S.J. Groenenberg | Senior researcher | DNA, phylogeny, natural history collections, taxonomy, evolution, identification. |
| Dr. Leen P. van Ofwegen | Senior researcher | Octocoral taxonomy, phylogeny, marine biodiversity. |
| Dr. Martien J.P. van Oijen | Senior researcher | Fish-eating and shrimp-eating haplochromine cichlids, natural history collections. |
| Dr. Ronald Vonk | Senior researcher | Stygofauna, shallow marine interstitial and fossil crustaceans, fishes, island biogeography, subterranean habitats. |
| Dr. Nicole J. de Voogd | Senior researcher | Marine biodiversity, marine biogeography, sponge taxonomy, sponge symbionts, reef coral ecology, marine lakes. |
| Dr. Katja T.C.A. Peijnenburg | Research fellow, from 1 April 2013 | Marine zooplankton, chaetognaths, pteropods, marine invertebrates, phylogeography, phylogeny, marine lakes, morphometrics, molecular markers, mitogenomics, ocean acidification, molecular evolution. |
| Ms. Alice K. Burridge | PhD candidate | Evolution in marine planktonic gastropods. — Naturalis and University of Amsterdam. Promotor: S.B.J. Menken and J. Huisman. Daily supervisor: K.T.C.A. Peijnenburg. |
| Ms. Sancia E.T. van der Meij | PhD candidate | The evolutionary history of parasitic coral gall crabs and their coral hosts. Promotor: E. Gittenberger. Daily supervisors: B.W. Hoeksema and C.H.J.M. Fransen. |
| Mr. Bastian T. Reijnen | PhD candidate | Evolution of parasite-host interactions in the sea. Promotor: E. Gittenberger. Daily supervisors: L.P. van Ofwegen and B.W. Hoeksema. |
| Mr. Kaveh Samimi Namin | PhD candidate | The Persian Gulf as a model environment for assessing global warming effects on reef corals. — Private funding. Promotor: E. Gittenberger. Daily supervisors: B.W. Hoeksema and L.P. van Ofwegen. |
| Ms. Zarinah Waheed | PhD candidate | The position of Malaysia in the world's centre of maximum marine biodiversity: Exploring the boundaries of the Coral Triangle. — Fellowship Malaysian Government. Promotor: E. Gittenberger. Daily supervisor: B.W. Hoeksema. |
| Mrs. Cessa Rauch | Project assistant, from 15 September until 26 October 2014 | - |
| Mr. Francisco Rocha Pires | Project assistant, from 15 January until 19 December 2014 | - |

### Research associates and correspondents

Dr. Lisa E. Becking; Dr. Ir. Arthur B. Bos; Ir. Marco A. Faasse; Dr. Arjan Gittenberger; Dr. Harry A. ten Hove; Prof. dr. J.A.J. (Hans) Metz; Dr. Annelies C. Pierrot-Bults; Mrs. Marjolein Rensing; Dr. Jacco C. van Rijssel; Dr. Eugenia M. Nijgh de Sampayo; Dr. Nadia K. Santodomingo Aguilar; Dr. Rob W.M. van Soest; Prof. dr. Gerard van der Velde; Mrs. Wallie H. de Weerdt; Mr. Marnix M. de Zeeuw.

## Department of Terrestrial Zoology & Supra-departmental programs

| Name | Position | Expertise |
|---|---|---|
| Dr. Jan van Tol | Associate director, Head of the department | Odonata, Platystictidae, phylogeny, biogeography, Southeast Asia, DNA barcoding, biodiversity informatics, zoological nomenclature. |

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|---|---|---|
| Prof. dr. J.C. (Koos) Biesmeijer | Scientific director | Pollination, bees, crops, ecosystem services, identification keys, tropical forest, pollinators, fragmentation, invasive species, social insects, honeybees, social behaviour. |
| Dr. ing. C. (Kees) van Achterberg | Senior researcher, until 31 May 2013 | Hymenoptera, taxonomy, systematics and phylogeny of Braconidae, Stephanidae, Pamphiliidae and Heloridae. |
| Dr. J.W. (Pim) Arntzen | Senior researcher | European amphibians, systematics, biogeography and hybrid zones, evolutionary biology, master control (Hox) genes, gene flow. |
| Dr. Tom van Dooren | Senior researcher, until 31 January 2013 | Bioinformatics. |
| Mr. Tom Hakbijl | Researcher | Entomoarchaeology, palaeo-ecology, stored product arthropods, cultural entomology. |
| Dr. Herman de Jong | Senior researcher | Systematic entomology, Diptera, Tipulidae, biogeography. |
| Mr. Roy M.J.C. Kleukers | Senior researcher | European Invertebrate Survey, faunistics and taxonomy of European Orthoptera. |
| Dr. Jeremy A. Miller | Senior researcher | Araneae, spiders, biodiversity, cybertaxonomy, impact of land use on invertebrate ecosystems. |
| Dr. Erik J. van Nieukerken | Senior researcher | Lepidoptera, leaf miners, systematics, web based taxonomy, biogeography, insect-plant relationships. |
| Prof. dr. Menno Schilthuizen | Senior researcher | Speciation, land snails, beetles, left-right asymmetry, chirality, genitalia, predator-prey interactions, *Cepaea*, Cholevidae, Diplommatinidae, *Albinaria*, Borneo, Malaysia, Crete, the Netherlands, invasive species. |
| Dr. Ronald Sluys | Senior researcher | Platyhelminthes, Tricladida, systematics, phylogeny, biogeography, biodiversity, birds. |
| Dr. Sandrine A. Ulenberg | Senior researcher, until 31 October 2014 | Biosystematics of Lepidoptera, Hymenoptera: Chalcidoidea, pest risk assessment, speciation, natural history. |
| Dr. Rutger A. Vos | Senior researcher | Phyloinformatics, genomics, bioinformatics, computational biology, software engineering. |
| Dr. A.J. (Ton) de Winter | Senior researcher | Non-marine Mollusca, taxonomy, biogeography, Africa, slugs, Arionidae, Streptaxidae, invasive species, anatomy, phylogeny, Europe, Atlantic Islands. |
| Mr. Berry van der Hoorn | Program manager | Nature of the Netherlands. |
| Dr. Luisa G. Carvalheiro | Postdoc, from 1 September 2013 until 30 June 2014 | Community ecology, food webs, plant-insect interactions, biodiversity dynamics, ecosystem services, pollinators. — STEP project funded by EU. |
| Dr. K.-D.B. (KD) Dijkstra | Postdoc, from 8 September until 31 December 2014 | Odonata, phylogeny, biogeography, biodiversity. |
| Dr. Heike Kappes | Postdoc, until 30 September 2014 | 'Determinants of species diversity at 14 spatial scales in tropical microsnails from endangered limestone habitats'. – ALW Open programme funded by NWO. |
| Dr. Thibaut M. de Meulemeester | Postdoc | Systematics of bee cryptic taxa and bee fossils, morphometrics, bumblebee nest architecture, tools for identification and monitoring of bees, wing shape. |
| Dr. Freek J. Vonk | Postdoc, from 1 October 2014 | Venom, reptiles, snakes, accessory gland, genome, evolution. – Veni project 'Assembling an arsenal: molecular basis of the venom-system in snakes' funded by NWO. |
| Dr. Ben M. Wielstra | Postdoc, until 30 June 2013 | uropean amphibians, systematics, Ebiogeography and hybrid zones, evolutionary biology. |
| Mr. Jesus Aguirre Gutierrez | PhD candidate | Pollinator distribution across time and spatial scales in the Netherlands. Promotor: J.C. Biesmeijer. Daily supervisor: E.E. van Loon. |
| Mr. Camiel Doorenweerd | PhD candidate | Evolution and diversification of leafmining Lepidoptera and northern hardwood forest trees. Promotor: S.B.J. Menken. Daily supervisor: E.J. van Nieukerken. |
| Dr. Vincent J. Kalkman | PhD candidate | Studies on phylogeny and biogeography of damselflies (Odonata) with emphasis on the Argiolestidae. Promotor: P.C. van Welzen. Daily supervisor: J. van Tol. PhD defence: 19 December 2013, Leiden University. |
| Dr. Philippe J.R. Kok | PhD candidate | Islands in the sky: species diversity, evolutionary history and patterns of endemism of the Pantepui herpetofauna. – Private funding. Promotors: E. Gittenberger and E.F. Smets. Daily supervisor: M.S. Hoogmoed. PhD defence: 28 May 2013, Leiden University. |
| Dr. Thor-Seng Liew | PhD candidate | 'The evolution of shell form in tropical terrestrial microsnails'. —ALW open programme funded by NWO. Promotors: M. Schilthuizen and P. Brakefield. PhD defence: 18 June 2014, Leiden University. |
| Mrs. Aafke Oldebeuving | PhD candidate, from 1 September 2014 | 'The role of floral volatiles in host specificity and host shifts in the fig-fig wasp mutualism'. — Doctoral grant funded by NWO. Promotor: J.C. Biesmeijer. Daily supervisors: J.C. Biesmeijer and J.J.M. van Alphen. |
| Drs. André J. van Loon | Data Editor | European Invertebrate Survey, faunistics. |
| Mr. Sander Bakker | Project assistant, from 9 June 2014 until 25 September 2014 | - |
| Mr. Pasquale Ciliberti | Project assistant, from 15 October until 15 December 2013 | - |
| Mrs. Olga J.P. Crapels | Project assistant, from 1 February 2014 | - |
| Mr. W.R.C. van Esch | Project assistant | - |
| Mr. Guido O. Keijl | Project assistant | - |
| Mr. Leon M. Marshall | Project assistant, from 1 June 2014 until 31 July 2014 | - |
| Mr. Rob Portegies | Project assistant | - |
| Mrs. Dominique van der Sterren | Project assistant, until 31 August 2014 | - |
| Dr. Jaap J. Vermeulen | Project assistant, from 1 July 2014 until 30 November 2014 | - |

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| Mr. Mart K. Vogel | Project assistant, from 28 July 2014 | - |
| Mr. Rob de Vries | Project assistant, from 5 April 2013 until 31 May 2013 | - |
| Mrs. Irma T.M. Jorritsma | Editor Nature of the Netherlands Year report, from 1 June 2013 until 31 October 2013 | - |
| Dr. Hannes Hettling | Bioinformatics, from 1 February 2014 | - |
| Mr. Serrano W. Pereira | Bioinformatics, from 1 February 2014 | - |

### Research associates, correspondents and EIS

Prof. dr. Ing. Kees van Achterberg; Prof. dr. Jacques J.M. van Alphen; Dr. Berend Aukema; Prof. dr. Ruud A. Bank; Mr. Ron A. Beenen; Dr. Matty P. Berg; Dr. Leo H.M. Blommers; Dr. A.S.H. (Bram) Breure; Dr. Claartje M.A. ten Broek; Dr. A.C. (Dolf) van Bruggen; Dr. Pingping Chen; Mr. Ed O. Colijn; Dr. Christa L. Deeleman-Reinhold; Mr. Henk Dekker; Mr. Henk H. Dijkstra; Dr. K.-D B. Dijkstra; Dr. Tom J.M. van Dooren; Dr. J.P. (Hans) Duffels; Dr. Willem N. Ellis; Dr. W.N. (Marien) Faber; Dr. Hans R. Feijen; Mrs. J.J. (Cobi) Feijen-van Soest; Dr. Frietson Galis; Dr. Haio B.P.E. Gernaat; Dr. Cees Gielis; Prof. dr. Edi Gittenberger; Dr. Matti K. Hämäläinen; Dr. Peter J. van Helsdingen; Mr. Dirk Jan Hermes; Dr. Rienk de Jong; Dr. Ing. Vincent J. Kalkman; Dr. Joris Michiel Koene; Mr. Bram Koese; Dr. Bas Kokshoorn; Mr. Jacques C. Koster; Mr. Jan Krikken; Mrs. Annemarie Kroon; Mr. Peter H.C. Lina; Mrs. Monica Lodi; Mr. Henk P.M.G. Menkhorst; Dr. Iva Njunjic; Dr. Jinze Noordijk; Dr. Pjotr Oosterbroek; Dr. Willy de Prins; Dr. Menno Reemer; Dr. Johan van Rooijen; Dr. Franklin D. Ross; Mr. Harry Smit; Mr. John T. Smit; Ir. D.M. (Menno) Soes; Dr. Max Sparreboom; Dr. Dennis R. Uit de Weerd; Dr. Ben M. Wielstra; Annie C.M. Zuiderwijk.

## Laboratories

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|---|---|
| Dr. Arjen G.C.L. Speksnijder | Head of Laboratories, from 16 May 2013 |
| Ms. Els Baalbergen | Molecular laboratory, until September 2013 |
| Mr. Kevin Beentjes | Molecular laboratory |
| Mr. Roland P.T. Butôt | Molecular laboratory |
| Dr. Rory Dow | Molecular laboratory |
| Mrs. J.E.M. (Elza) Duijm | Molecular laboratory |
| Mr. Marcel C.M. Eurlings | Molecular laboratory |
| Ms. Sofia I. Fernandez Gomes | Molecular laboratory, from 6 January 2014 until 31 May 2014 |
| Mr. Kasper P. Hendriks | Molecular laboratory, from 15 January 2013 until 28 December 2013 |
| Mr. Martijn de Jong | Molecular laboratory |
| Ms. Aline M. Nieman | Molecular laboratory |
| Mr. Frank R. Stokvis | Molecular laboratory |
| Dr. Oscar Vorst | Molecular laboratory, until 31 August 2013, and from 1 March 2014 |
| Mr. C. (Kees) van den Berg | Morphology laboratory |
| Mr. C.M. (Marco) Brand | Morphology laboratory, until 5 July 2013 |
| Mr. Thijmen Breeschoten | Morphology laboratory, from 7 January 2013 until 15 March 2013 |
| Mrs. Bertie-Joan van de Heuven | Morphology laboratory |
| Mr. J.C. (Sjaak) Koster | Morphological laboratory, until 31 July 2014 |
| Mr. Rob J.A. Langelaan | Morphology laboratory |
| Mr. Dirk van der Marel | Geology laboratory |
| Mr. Maarten van ‘t Zelfde | GIS laboratory |
| Mr. Youri Lammers | Bioinformatics, from 11 February 2013 |
| Dr. Klaas Vrieling | DNAmarkerpoint |

### Volunteers

Mr. J.E. (Eric) Buter; Mr. J.M. (Hans) de Groot; Mr. Wim Star.

# Extramural functions

| | |
|---|---|
| T.R. van Andel | Journal of Ethnobiology and Ethnomedicine (member of editorial board, since 2013)<br>Treub Foundation for Tropical Research (member of board, since 2010)<br>Hortus Botanicus Amsterdam (member of board, since 2009)<br>Van Eeden Fund for botanical research in Suriname and Dutch Antilles (member of board, since 2009) |
| J.C. Biesmeijer | UN IPBES Pollinator Assessement (coordinating lead author, 2014-2016)<br>Functional Biodiversity, University of Amsterdam (professor by special appointment, since 2012)<br>Journal BioRisk (member of editorial board, since 2010)<br>Contributions to Zoology (member of editorial board, since 2010)<br>Apimondia, Standing Commission for Bee-flora and pollination (president, 2009) |
| H.J. de Boer | Phytotaxa (associate editor, since 2014)<br>Journal of Ethnobiology and Ethnomedicine (associate editor, since 2013)<br>PhytoKeys (associate editor, since 2012)<br>Uppsala Botanical Society, K.V. Ossian Dahlgrens Scholarship Fund (member of board, 2009-2014)<br>Uppsala Botanical Society, Elias Fries Scholarship Fund (member of board, since 2007) |
| S.K. Donovan | Journal of Latin American and Caribbean History (member of editorial board, since 2014)<br>GeoResJ (executive editor, since 2013)<br>Proceedings of the Geologists’ Association (member of editorial board, since 2013)<br>Fellow of the Geological Society of America (2013)<br>Proceedings of the Yorkshire Geological Society (member of editorial board, since 2012)<br>Palaeontographical Society (secretary, since 2011)<br>Geological Journal (UK) (member of editorial board, since 2007; book review editor, since 2009) |
| C. Doorenweerd | Dutch Entomological Society microlepidoptera Section ‘Snellen’ (secretary, since 2014) |
| H. Duistermaat | Stichting Nationale Plantencollectie Collectiecommissie (SNP) (since 2013)<br>Nationale Database Flora en Fauna (member of validation team, since 2010) |
| C.H.J.M. Fransen | World Register of Marine Species (WoRMS) (editor, since 2011)<br>Crustaceana Monographs series (editor, since 2010)<br>Stichting L.B. Holthuis Fonds (treasurer and secretary, since 2008)<br>Arquipélago (Bulletin of the University of the Azores, Life and Marine Sciences) (member of advisory board, since 2001)<br>Stichting Jan Joost ter Pelkwijk Fonds (treasurer and secretary, since 1992)<br>Crustaceana (member of editorial board, since 1986) |

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|---|---|
| J. Geml | Mycological Society of America Biodiversity Specific Expertise Committee (member, since 2014)<br>Persoonia (co-editor-in-chief, since 2012)<br>MycoKeys (editor, since 2011)<br>Diversity (editor, since 2009) |
| B. Gravendeel | University of Applied Sciences, Leiden (Biodiversity Chair, since 2012)<br>Taxon (assistant editor, since 2010)<br>Netherlands Organisation for Scientific Research: Earth and Life Sciences Open Program (evaluation committee, member since 2011)<br>IUCN/SSC Orchid Specialist Group (member, since 2011)<br>Studiegroep Europese en Mediterrane Orchideeën (SEMO) (member, since 2010)<br>KNNV Werkgroep Europese Orchideeën (WEO) (member, since 2000) |
| R.W.J.M. van der Ham | Grana (editor, since 2010) |
| L. van den Hoek Ostende | New and Old World Database (NOW) (associate coordinator, since 2014)<br>Regional Committee on Neogene Stratigraphy (RCMNS) (member of committee, since 2013)<br>Comptes Rendus Palevol (associate editor, since 2011) |
| B.W. Hoeksema | Netherlands Organisation for Scientific Research: Earth and Life Sciences. Research programme Netherlands Caribbean (member of committee for programme development, 2013)<br>AcroporaNet (member of board, since 2010)<br>Treub Foundation for Tropical Research (member of board, since 2010)<br>Marine Biodiversity (associate editor, since 2008)<br>World Register of Marine Species (WoRMS) (editor, and member of steering committee, since 2008)<br>ZooKeys (editor, since 2008)<br>Scientific Committee for Oceanographic Research (SCOR) (member for the Netherlands, 2004-2014) |
| H. Kappes | Akademie für ökologische Landesforschung (Münster) (member, since 2007)<br>Arbeitskreis Mollusken NRW (deputy chairman, since 2005) |
| A.P. Karremans | Icones Orchidacearum (editor, since 2011)<br>Lankesteriana (managing editor, since 2011) |
| R.M.J.C. Kleukers | Entomologische Tabellen (editor-in-chief, since 2008)<br>Articulata (member of Wissenschaftliche Beirat, since 2005)<br>Nederlandse Faunistische Mededelingen (editor-in-chief, since 2000)<br>SoortenNL (member of board, since 2000) |
| L.M. Kriegsman | Hans de Bruijne Stichting (member, until 2014)<br>Museologia Scientifica (member of editorial board, since 2007)<br>Geotectonic Research (associate editor, since 2003) |
| F.P. Lens | I.W. Bailey Award (member of committee, 2014)<br>Journal of Plant Hydraulics (associate editor, since 2014)<br>New Phytologist (advisory board member of section Physiology & Development, since 2013)<br>University of Bordeaux Visiting Professor (2013)<br>International Association of Wood Anatomists (editor special issue 4, 2013)<br>FPS COST Action FP1106 Studying Tree Responses to extreme Events: a SynthesiS (STReESS) (management committee representative for the Netherlands, since 2012)<br>International Association of Wood Anatomists (executive secretary, since 2011)<br>International Association of Wood Anatomists Journal (associate editor, since 2009) |
| S.E.T. van der Meij | World Register of Marine Species (WoRMS) (taxonomic editor (*Cryptochiridae*), since 2014) |
| J.A. Miller | International Society of Arachnology (member of council, since 2013)<br>Plazi (member, since 2013)<br>Biodiversity Data Journal (deputy editor-in-chief, since 2012)<br>California Academy of Sciences (research associate, since 2009)<br>ZooKeys (editor, since 2008)<br>Zootaxa (editor, since 2008) |
| J.B. Mols | Dutch node of Global Biodiversity Information Facility - NL-BIF - (member of board, since 2009)<br>Martha Tilaar Foundation (treasurer, since 2009)<br>Professor Lam Fund (secretary and treasurer, since 2007)<br>“Leidse Bibliotheekstichting” Collectanea Botanica (treasurer, since 2007) |
| E.J. van Nieukerken | Fauna Europaea project (steering committee, since 2014; group coordinator Lepidoptera)<br>Tijdschrift voor Entomologie (associate editor, since 2014; editor-in-chief, 1998-2013)<br>Society for Management of Electronic Biodiversity Data (member of council, until 2013)<br>Societas Europaea Lepidopterologica (general secretary, since 2011)<br>Scratchpads, Vibrant project (ambassador, since 2011)<br>ZooKeys (editor, since 2008)<br>Werkgroep Vlinderfaunistiek (chair, since 2007)<br>Nota Lepidopterologica (editor, since 2000) |
| J. Nuytinck | Dutch Mycological Society (NMV) (member of Scientific Committee and Committee for Dutch names of mushrooms, since 2013) |
| L.P. van Ofwegen | Zookeys (editor) |
| K.T.C.A. Peijnenburg | Dutch Scientific Committee on Oceanic Research (SCOR) (member, since 2014)<br>Journal of Plankton Research (member of editorial board, since 2012)<br>Journal of Sea Research (member of editorial board, since 2011) |
| A.S.J. van Proosdij | Van Eeden-fonds (Van Eeden Foundation) (secretary, since 2009) |
| W. Renema | Frontiers of Biogeography (editor, since 2013)<br>Palaeontological Association (member of council, 2008-2011)<br>Indo-Pacific Ancient Ecosystems Group (IPAEG) (co-founder, since 2006) |
| M.C. Roos | Foundation for International Nature Conservation - Van Tienhoven Stichting - (member of board, since 2005)<br>Teaching Committee Biology, Leiden University (1999-2014; chairman, 2009-2014)<br>Treub Society for Tropical Research (financial control committee, since 1997; member of board, since 1993)<br>Newsletter Treub Foundation for Tropical Research (editor, since 1993)<br>Foundation Flora Malesiana (secretary, since 1991) |
| M. Schilthuizen | Heredity (editor, since 2013)<br>Research School Production Ecology & Resource Conservation (member research committee, since 2013)<br>Netherlands Prize for Zoology (member selection committee, since 2012)<br>Netherlands Organisation for Scientific Research: Earth and Life Sciences Open Program (member evaluation committee, since 2010)<br>Stichting Bargerveen (member of board, 2009-2014)<br>Contributions to Zoology (editor, 2008-2013)<br>Treub Foundation for Tropical Research (member of board, since 2008)<br>Heimans & Thijsse Foundation (member of board, since 2007)<br>Royal Society’s “SouthEast Asia Rainforest Research Programme”, SEARRP (member, since 2001) |

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|---|---|
| A.S. Schulp | Teylers Museum, Haarlem (honorary curator of palaeontology, since 2014) |
| | Natuurhistorisch Museum Maastricht (guest researcher, since 2013) |
| | Paleobiologische Kring KNGMG (member of committee, since 2013) |
| | Museum Hofland, Laren (member of advisory board, since 2010) |
| | Society of Vertebrate Paleontology Program for Scientists from Economically Developing Nations (member of committee, since 2009) |
| | Faculty of Earth and Life Sciences, Amsterdam VU University (guest researcher, since 2006) |
| R. Sluys | Species Diversity (member of editorial board, since 1996) |
| E.F. Smets | Royal Flemish Academy of Belgium for Science and the Arts (member, since 2013) |
| | European Journal of Taxonomy (member of advisory editorial board, since 2012) |
| | Graduate School for Production Ecology and Resource Conservation (PE&RC) (member of board, since 2012) |
| | National Authority for Data concerning Nature (member of committee of scientific advisors, since 2012) |
| | Natural History Museum Stuttgart and the Natural History Museum Karlsruhe (member of scientific advisory board, since 2012) |
| | Fungal Biodiversity Centre, CBS-KNAW (member of scientific advisory board, since 2011) |
| | International Organisation for Systematic and Evolutionary Biology (member of council, since 2011) |
| | Feddes Repertorium (member of advisory board, since 2009) |
| | Leopold III-Fund for Nature Research and Nature Conservation, Belgium (member of board, since 2009) |
| | Alberta Mennega Foundation (member of board, since 2007) |
| | Professor Lam Fund (chair of board, since 2007) |
| | 'Leidse Bibliotheekstichting' Collectanea Botanica (chair of board, since 2007) |
| | Examination committee Biology, Leiden University (member, 2006-2013) |
| | Flora Malesiana Foundation (vice-chair of board, since 2006) |
| | National Geographic Nederland – België (member of advisory board, since 2006) |
| | Consortium of European Taxonomic Facilities (member of board of directors, since 2005) |
| | Dr. E. Kits van Waveren Foundation (chair of board, since 2005) |
| | Hortus botanicus Leiden (scientific director, since 2005) |
| | Katholieke Universiteit Leuven (special chair of Systematic Botany, since 2005) |
| | Linnean Society (foreign member, since 2005) |
| | Universiteit Leiden (chair of Systematic Botany, since 2005) |
| | National Botanic Garden of Belgium (member of scientific advisory board, since 1997) |
| | Alumni Society PDL, Belgium (member of board, since 1991) |
| M.S.M. Sosef | Flore d'Afrique Centrale (member of editorial team, since 2010) |
| | Plant Ecology and Evolution (member of editorial board, since 2010) |
| | Central Africa Red List Authority (member, since 2009) |
| | Global Taxonomy Initiative, Convention on Biological Diversity - national focal point (since 2006) |
| | Alberta Mennega Foundation (member of board, since 2005) |
| | Treub Foundation for Tropical Research (member of board, since 2005) |
| | ETI Bioinformatics (member of board, since 2004) |
| | Moabi Foundation (member of board, since 2004) |
| M. Stech | Bryophyte Diversity and Evolution (member of editorial board, since 2014) |
| | Tropical Biology (member of editorial board, until 2013) |
| H. ter Steege | Museu Paraense Emilio Goeldi, Belem, Para, Brazil (visiting professor, 2014 – 2016) |
| | Plant Ecology and Evolution, Royal Belgian Academy of Sciences (associate editor, since 2014) |
| | Programma Ecologia de Longue Duração MAUA, INPA, Manaus, Brazil (member, since 2014) |
| | Utrecht University (associate professor 0/0 aanstelling, since 2012) |
| | Continental Ecuador Vegetation Map Project, Ministry of the Environment, Ecuador (scientific advisor, since 2011) |
| | European Network for Neotropical Research in Evolution and Biogeography (ENNREB) (member, since 2010) |
| | International Science Committee of the Iwokrama International Centre for Rainforest Conservation and Development, Guyana (member, since 2009) |
| | Boletim do Museu Paraense Emílio Goeldi: Ciências Naturais (member of editorial board, since 2008) |
| | Schure-Beijerinck-Popping Fonds (KNAW) (member of board, 2008 - 2013) |
| | RAINFOR Network, Amazon Forest Inventory Network (member, since 2003) |
| | Amazon Tree Diversity Network (coordinator, since 2001) |
| | Association for Tropical Biology and Conservation (ATBC) (member, since 1990) |
| J. van Tol | Species 2000 (board of directors, since 2013) |
| | International Commission on Zoological Nomenclature (president since 2009; commissioner since 2001) |
| | ZooKeys (subject editor Odonata, since 2008) |
| | Dutch node of Global Biodiversity Information Facility (NL-BIF) (honorary treasurer, since 2006) |
| | International Journal of Odonatology (editor, since 1998) |
| | Deutsche Entomologische Zeitschrift (editor, since 1996) |
| N.J. de Voogd | Zootaxa (editor, since 2014) |
| | World Register of Marine Species – WoRMS - (editor, member of steering committee, since 2012) |
| | Journal of the Marine Biological Association of the United Kingdom (editor, since 2011) |
| F. Vonk | Toxins (member of editorial board, since 2013) |
| | Journal of Venom Research (member of editorial board, since 2011) |
| R. Vonk | World Register of Marine Species (WoRMS) (editor, since 2013) |
| | Contributions to Zoology (member of editorial board, since 2007) |
| | Fauna Europaea (taxonomic expert, since 2000) |
| R.A. Vos | Frontiers in Bioinformatics and Computational Biology (review editor, since 2011) |
| | PhyloInformatics Research Foundation (member of board, since 2010) |
| I.M. van Waveren | IGCP 575 UNESCO project (treasurer, since 2010) |
| | SYNTHESYS (member of selection committee for applications to the Netherlands, since 2009) |
| P.C. van Welzen | Flora Malesiana (chief editor, since 2013) |
| | School of Environmental and Rural Science of the University of New England, Armidale, NSW, Australia (adjunct professor, since 2011) |
| | Thai Forest Bulletin (editor, since 2009) |
| | Tropical Plant Biogeography UL (special chair, since 2008) |
| | Flora of Thailand (editor, since 2005) |
| | Flora of Thailand Project (member of scientific board, since 2005) |
| | International think tank 'Kerr on the Web' (member, since 2005) |
| F.P. Wesselingh | Cainozoic Research (associate editor, since 2011) |
| | Van der Lijn Prijs (member recommendation committee, since 2008) |
| | Netherlands Journal of Geosciences (member of editorial board, since 2005) |
| A.J. de Winter | ZooKeys (editor, since 2013) |
| J.C. Zwaan | Dr. Schürmann Foundation (member of board, since 2012) |
| | NEN Norm Commission on developing European CEN standard on Diamonds (member, since 2011) |
| | World Jewellery Confederation (CIBJO): Gemmological Commission (president, since 2011; vice-president, 2009-2011) |
| | International Gemmological Conference (ICG) (member of executive committee, since 2007) |
| | Federation of European Education in Gemmology (member of board, since 1996) |

# Conferences, symposia and workshops

In 2013 and 2014 the Sector Research and Education (co-)organized the following conferences, symposia and workshops:

## 2013

Symposium ‘Drivers of plant speciation: understanding the role of pollinators in shaping geographical variation in floral traits’, January 24, Drakensville, South Africa [T. van der Niet].

Workshop ‘E-platforms & e-tools for taxonomy’ as part of the EU funded pro-iBiosphere project, February 11-12, Leiden, the Netherlands [S.E.C. Sierra Daza].

Workshop ‘Legacy literature – Semantic mark-up generation, data quality and user-participation infrastructure’ as part of the EU funded pro-iBiosphere project, February 13, Leiden, the Netherlands [S.E.C. Sierra Daza].

Workshop ‘Prospective Literature – Toward Best Practices for data acquisition and curation using e-tools for taxonomy’ as part of the EU funded pro-iBiosphere project, February 13, Leiden, the Netherlands [S.E.C. Sierra Daza].

Symposium ‘Systematics as an integrative science’ during the Conference BioSyst. EU 2013. Global Systematics!, February 18-22, Vienna, Austria [E.F. Smets].

Session on Evolutionary and Ecological Wood Anatomy during the International Symposium on Wood Structure in Plant Biology and Ecology, April 17-20, Naples, Italy [F.P. Lens].

Workshop ‘Requirements of users of Flora, Fauna or Mycota publications or services’ as part of the EU funded pro-iBiosphere project, May 21, Berlin, Germany [S.E.C. Sierra Daza].

Workshop ‘Measuring and constraining the costs of delivering services’ as part of the EU funded pro-iBiosphere project, May 22, Berlin, Germany [S.E.C. Sierra Daza].

Workshop ‘Coordination and routes for cooperation’ as part of the EU funded pro-iBiosphere project, May 23, Berlin, Germany [S.E.C. Sierra Daza].

Member of Organizing Committee of 9th International Flora Malesiana Symposium ‘Contributions of Flora Malesiana to the welfare of people in Asia’, August 27-31, Bogor, Indonesia [E.F. Smets].

Workshop ‘How to improve technical cooperation and interoperability at the e-infrastructure level’ as part of the EU funded pro-iBiosphere project, October 8, Berlin, Germany [S.E.C. Sierra Daza].

Workshop ‘How to promote and foster the development & adoption of common mark-up standards & interoperability between schemas’ as part of the EU funded pro-iBiosphere project, October 8, Berlin, Germany [S.E.C. Sierra Daza].

Workshop ‘User engagement and benefits’ as part of the EU funded pro-iBiosphere project, October 9, Berlin, Germany [S.E.C. Sierra Daza].

Workshop ‘Towards sustainability towards service: Meeting to evaluate business models currently in use by partners and relevant non-partners’ as part of the EU funded pro-iBiosphere project, October 10, Berlin, Germany [S.E.C. Sierra Daza].

## 2014

Symposium ’Plant-animal interactions‘ at the 20th Congress of the Association for the Taxonomic Study of the Floral of Tropical Africa (AETFAT), 13-17 January, Stellenbosch, South Africa [T. van der Niet].

Workshop ‘Mark-up of biodiversity literature’ as part of the EU funded pro-iBiosphere project, February 10-11, Berlin, Germany [S.E.C. Sierra Daza].

Workshop ‘Alternative business models as part of the EU funded pro-iBiosphere project, February 11-12, Berlin, Germany [S.E.C. Sierra Daza].

Session on Tropical Ecology during the Netherlands Annual Ecology Meeting, February 11-12, Lunteren, the Netherlands [H. ter Steege].

Data Enrichment Hackathon as part of the EU funded pro-iBiosphere project, March 17-21, Leiden, the Netherlands [S.E.C. Sierra Daza & R.A. Vos].

Workshop ‘Phylogenetic Methods and barcoding’ Nederlandse Mycologische Vereniging, April 14, Wageningen, the Netherlands [J. Nuytinck].

IAWA bark workshop, May 16-28, Brotas, Brazil [F.P. Lens].

Model Evaluation Workshop as part of the EU funded pro-iBiosphere project, June 9 & 10, Meisse, Belgium [S.E.C. Sierra Daza].

WikiMedia training as part of the EU funded pro-iBiosphere project, June 11, Meisse, Belgium [S.E.C. Sierra Daza].

Workshop ‘Biodiversity Catalogue’ as part of the EU funded pro-iBiosphere project, June 11, Meisse, Belgium [S.E.C. Sierra Daza].

Final Conference EU funded pro-iBiosphere project, June 12, Meisse, Belgium [S.E.C. Sierra Daza].

Interim Workshop / Colloquium ‘It’s the season’ of the Regional Committee on Neogene Stratigraphy, September 5-7, Vienna, Austria [L.W. van den Hoek Ostende].

Workshop ‘Identifying and monitoring trade in Tanzanian wild-harvested orchids by means of DNA barcoding’ as part of the NWO funded TASENE project, November 25, Dar es Salaam, Tanzania [H.J. de Boer, B. Gravendeel, T.R. van Andel].

Workshop ‘Macroecology meets macroevolution: evolutionary dynamics of niches over phylogenies’ during the Joint 2014 Annual Meeting British Ecological Society and Société Française d’Ecologie December 9-12, Grand Palais, Lille, France [N. Raes & R.A. Vos].

# Academic recognitions

# Biodiversity Chair
## at Hogeschool Leiden

On November 12th 2013 Barbara Gravendeel presented the aim of this chair at the University of Applied Sciences for an audience of 250 invited guests in Leiden during a lecture entitled 'Biodiversity as inspiration for innovation'. Examples were given of newly developed products derived from natural history collections. The main motivation for funding this chair was explained, sc. to engage students and teachers in societally relevant practical work with the aim of ensuring that training in research skills in the educational curricula continues to be up-to-date.

## Teaching

Students and teachers from 5 Dutch Universities of Applied Sciences approached the chair over the past 2 years, indicating the large demand for biodiversity based applied education. A total of 16 students carried out internships lasting from 5 to 9 months, 14 students were co-supervised in 3-month Degree Minors specializing in Analytical Chemistry, Bioinformatics, Biology and Molecular Diagnostics, Forensic Science and Microbiology, and 11 teachers brushed up their research skills.

## Research

The demand for biodiversity based business initiatives is large, and the numerous stakeholders that initiated projects with the chair in the short period since its establishment reflect this.

The Dutch customs laboratory requested help with metabarcoding of confiscated products containing CITES protected plants. Herbal tablets and roots of slimming cactus (*Hoodia gordonii*), Indian Snakeroot (*Rauvolfia serpentina*), Gaharu (*Aquilaria*) and orchids were analyzed by matching DNA barcodes with data obtained from well identified herbarium material (Fig. 1). A special web based bioinformatics tool, the HTS barcode checker pipeline, was developed for fast and accurate data analysis. These studies were published in Biodiversity and Conservation, BMC Bioinformatics, Journal of Ethnobiology and Ethnomedicine, Journal of Forensic Sciences and TRAFFIC Bulletin.

The 100 Tomato Genome Sequencing Consortium consulted the chair for help with analyses of Ancient DNA of tomatoes stored in the herbarium to compare the genetic variation in the modern tomato (*Solanum* section *Lycopersicon*) with wild relatives by whole-genome sequencing. This study was published in Plant Journal.

Rijk Zwaan was aided with the identification of an unknown pathogen. This pathogen was identified using nondirected sequencing, in which the genomes of both the host plant and endosymbionts were retrieved. By using a host plant species with a known genome, the resulting reads could be filtered for nonhost reads after which the pathogen could be identified.

A molecular diagnostic tool was developed for Koppert Biological Systems to detect a strain of the biological control agent *Trichoderma harzianum*. Parts of the genome of this fungal species were mined for diagnostic markers. Subsequently, a quantitative PCR tool was developed for fast assessment of the degree of infection.

In collaboration with Praktijkonderzoek Plant & Omgeving (PPO) Bleiswijk, extracts of *Vanilla* pods and selected compounds were tested on fungal bio-assays. Results obtained provided the first scientific proof for the antimicrobial effects of extracts of orchids traditionally used as anti-itch plants. Cultivation requirements were calculated based on herbarium collections and a new biobased medicinal device preventing Candidiasis is currently being developed.

Members of the Pleistocene Mammal Society (WPZ) provided coprolites of extinct megafauna (*Bison priscus, Equus lenensis, Myotragus balearicus*). DNA and morphological analyses in combination with hindcast modelling of food species shed light on the reasons why these animals went extinct. These studies were published in Journal of Quaternary Science, Nature, Quaternary Research and The Holocene.


**Fig. 1.** Orchid tubers sold in 2014 (left) and ca. 1950 (right) on Turkish markets. Photos: Selay Kucukaladag and Barbara Gravendeel.

The Ministry of Economic Affairs asked for help with the investigation of a dead canid found by the roadside in the Noordoostpolder on July 2013. Combined microscopic, DNA and isotope analyses of the carcass and its stomach contents showed that it was a purebred wolf (*Canis lupus*) that was shot prior to illegal transport to our country. The city archive of Ghent provided material of a wolf trophy from Flanders (Fig. 2) that could be linked to documents dating back to the 16th century with Ancient DNA and isotopes. These studies were published in Lutra and Handelingen der Maatschappij voor Geschiedenis & Oudheidkunde. Funding was obtained from the Netherlands Organization for Scientific Research, Ministry of Education, Culture and Science, Generade, the European Union's Seventh Framework Programme sponsored DECATHLON project, TKI water and Kenniscentrum Plantenstoffen.

## Outreach

Fifteen interviews were given for national new spapers, radio and television about the first wolf found in 150 years in the Netherlands, 6 about new discoveries from coprolites of extinct megafauna, and 3 on genomic analyses of herbarium preserved tomatoes. Three invited lectures on Wildlife

**Fig. 2.** Right front paw of a mature male grey wolf (*Canis lupus*) killed by a trophy hunter in 1732. Photo: Michel Burez.

Forensics were given in Amsterdam, Groningen and Reunion and 2 on Metabarcoding for the Netherlands Bioinformatics Centre and Centre for Bioscience and Diagnostics.

# Awards 2013-2014

| Name | Award |
|---|---|
| H.J. de Boer | The King Carl XVI Gustaf of Sweden 50th Anniversary Award for Science, Technology and Environment. Research award for young scientists with regard to sustainable use of natural resources and biodiversity conservation (27 May 2013).<br>F.H.L. van Os-prize by the Nederlandse Vereniging voor Geneeskruidenonderzoek for his thesis ´Snake Gourds, Parasites and Mother Roasting: Medicinal Plants, plant repellants, and Trichosanthes (Cucurbitaceae) in Lao PDR' (14 June 2013). |
| L.G. Carvalheiro | Scientific Honours - Nature Research Highlight (doi: 10.1038/498008b), related to Carvalheiro *et al*., 2013. The bees are back in Europe. *Nature* 498, 8. doi: 10.1038/498008b (http://onlinelibrary.wiley.com/doi/10.1111/ele.12121/abstract) (06 June 2013). |
| T. Chaowasku | International Association for Plant Taxonomy (IAPT) Research Improvement Grant for Plant Systematics (2013). |
| S.K. Donovan | Fellow of the Geological Society of America in recognition of distinguished contributions to the geosciences (2013). |
| P. Kamminga | AllGenetics EMPSEP Award: First prize for best delegate talk at 19th European Meeting of PhD students in Evolutionary Biology (2013). |
| M. Schilthuizen | Second prize in Ig Nobel 24/7 Battle (2013). |
| R. Schwallier | P.E.O. ScholarAward for 2014-2015. This award is merit-based for women of the U.S. and Canada who are pursuing a doctoral level degree. The Scholar Award 'supports research for women who will make significant contributions in their fields' with a monetary award of $15,000. |
| E.F. Smets | Elected as Member of the Royal Flemish Academy of Belgium for Science and the Arts (2013). |
| A.M. Towns | Edmund H. Fulling award by the Society for Economic Botany - best contributed oral paper at the annual meeting of the Society for Economic Botany by a junior professional with a degree for no more than five year (2013). |
| H.J.C. Zwaan | Dr. Edward J. Gübelin Most Valuable Article Award – third place for the article: Zwaan, J.C., Jacob, D., Häger, T., Cavalcanti Neto, M.T.O. & Kanis, J. 2012. Emeralds from the Fazenda Bonfim region, Rio Grande do Norte, Brazil. *Gems & Gemology,* Vol. 48, No. 1, pp. 2-17 (2013). |



# Professor Lam Student Prize

Since 1963 the "*Stichting Rijksherbariumfonds Professor Lam*" aims to promote plant systematic research in its broadest sense. To implement this aim, the Board of the foundation decided in 2008 to reinstall the Professor Lam Student Prize. Each year the board of the "*Stichting Rijksherbariumfonds Professor Lam*" will award this Prize to one student (BSc, MSc or PhD) affiliated to then the National Herbarium of The Netherlands and now Naturalis for an outstanding article or book dealing with a Naturalis research related topic published in the preceding year. From 2010 onwards a special honors was given to the best paper by a BSc or MSc student, when the Professor Lam Student prize was awarded to a PhD.

In the period 2013-2014, the Professor Lam Student Prize 2012 & the Professor Lam Student Prize 2013 have been awarded.

## The laureates are:

2012: Mr. Robin van Velzen for the paper 'DNA Barcoding of Recently Diverged Species: Relative Performance of Matching Methods, *PlosOne* 7 (1): e30490. 2012. R. van Velzen, E. Weitschek, G. Felici & F.T. Bakker.

2013: Mr. Abishkar Subedi for the 'Collection and trade of wild-harvested orchids in Nepal, *Journal of Ethnobiology and Ethnomedicine* 9, article 64. A. Subedi, B. Kunwar, Y. Choi, Y. Dai, T. van Andel, R.P. Chaudhary, H.J. de Boer & B. Gravendeel.

# A.M. Buitendijk Fund

## History

From 1930 until her death in 1950 Alida M. Buitendijk has been associated with the museum, first as a writer 2nd class and eventually as Curator of the Arthropoda non-Insecta department. She left Naturalis a large bequest to meet study costs of those so designated by the director of the museum.

## Aim

The aim of the A.M. Buitendijk Fund is to financially support in journeys that contribute to the study of natural history or museum expert knowledge. In practice, the fund focuses on research that has a relatively large impact on Naturalis (ongoing research, collection, publications). Beneficiaries may include employees, visiting staff and volunteers.

## Recommendation Committee

B.W. Hoeksema (Department head Marine Zoology) & C. Pepermans (Head Library collections and Geological collections).

## Applications granted in 2013

| Title/Grant | Applicant | Naturalis supervisor(s) |
|---|---|---|
| Coral-killing sponges along an environmental disturbance gradient in the Spermonde Archipelago, South-West Sulawesi, Indonesia / Study travel Indonesia, grant € 1500 | Esther van der Ent - MSc student, University of Utrecht | N.J. de Voogd |
| Evolutionary analyses of modern sharks / Study travel USA, grant € 500 | Pepijn Kamminga - PhD candidate, Leiden University, Naturalis | M. Brazeau |
| Feeding behaviour and prey choice by *Drupella* snails at Koh Tao, Gulf of Thailand / Study travel to Thailand, grant € 1000 | Angelo Moerland - MSc student, Leiden University | B.W. Hoeksema |
| The Position of Malaysia in the world's centre of maximum marine biodiversity: exploring the boundaries of The Coral Triangle / Study travel Malaysia, grant € 1000 | Zarinah Waheed - PhD candidate, Naturalis | B.W. Hoeksema |

## Applications granted in 2014

| Title/Grant | Applicant | Naturalis supervisor(s) |
|---|---|---|
| Reef-dwelling Octocorals of Curaçao: an inventory on species richness and abundance / Study travel to Curaçao, grant € 400 | Yee Wah Lau - MSc student, Leiden University | B.T. Reijnen<br>L.P. van Ofwegen<br>B.W. Hoeksema |
| Hoe langer hoe beter? Een test van Darwin's theorie over co-evolutie in plant-bestuivingssytemen / Study travel to South Africa, grant € 400 | Harro de Moor - MSc student, University of Utrecht | T. van der Niet |
| Asymmetry in Handedness correlated to ecology in species of Pontoniinae / Study travel to Curaçao, grant € 400 | Cessa Rauch - MSc student, Leiden University | C.H.J.M. Fransen<br>B.W. Hoeksema |
| Infestation patterns and population genetic (Scleractinia) along the Curacao coast / Study travel to Curaçao, grant € 400 | Kaj van Tienderen - MSc student, University of Utrecht | S.E.T. van der Meij<br>B.W. Hoeksema |

# Jan Joost ter Pelkwijkfonds

## History

The foundation is named after Jan Joost ter Pelkwijk. He was a young enthusiastic biology student who assisted the Nobel prize laureate Niko Tinbergen for two years in the Zoological Laboratory at Leiden University. In 1942, at the age of 27 Ter Pelkwijk fell in a battle at the Java Sea when his ship was hit by the Japanese air force. In his memory, his father raised the Jan Joost ter Pelkwijkfonds.

## Aim

The aim of the Jan Joost ter Pelkwijkfonds is to facilitate scientific zoological research at or in cooperation with Naturalis Biodiversity Center. Staff members of Naturalis cannot apply for grants. Support is usually given to BSc, MSc, PhD students and foreign visitors that are not in the position to pay for their visit.

## Board

E. Gittenberger (chair), C.H.J.M. Fransen (secretary/ treasurer), G.R. de Snoo & Niko ter Pelkwijk.

## Applications granted in 2013

| Title/Grant | Applicant | Naturalis supervisor(s) |
|---|---|---|
| Coral-killing sponges along an environmental disturbance gradient in the Spermonde Archipelago, South-West Sulawesi, Indonesia | Esther van de Ent - MSc student Utrecht University | N.J. de Voogd |
| The case of *Proteus*: The authenticity of Paul Kammerer's pictures | Melanie van der Heiden - MSc student Leiden University | J.W. Arntzen |
| Establishing additional diagnostic DNA-barcodes of the family Cholevidae (Coleoptera) for the purpose of forensic science | Stefan Visser, Wesley van Oostenbrugge - Students Hogeschool van Amsterdam | M. Schilthuizen |

## Applications granted in 2014

| Title | Applicant(s) | Naturalis supervisor(s) |
|---|---|---|
| Reef-dwelling Octocorals of Curaçao: an inventory on species richness and abundance | Yee Wah Lau - MSc student Leiden University | L.P. van Ofwegen, B.T. Reijnen, B.W. Hoeksema |
| What happens where the crested newt (*Triturus cristatus*) meets with the marbled newt (*Triturus marmoratus*) | Maarten de Leeuw, Machiel Visser - MSc students Leiden University | J.W. Arntzen |
| Population characteristics and prey choice of *Drupella* spp. and *Morula spinosa* at Koh Tao, Gulf of Thailand | Angelo Moerland - MSc student Leiden University | B.W. Hoeksema |
| Does size matter? A test of Darwin's theory on co-evolution in pollinator-plant evolution | Harro de Moor - MSc student Leiden University | T. van der Niet |
| Asymmetry in handedness correlated to ecology in species of Pontoniinae (Crustacea, Decapoda) | Cessa Rauch - MSc student Leiden University | C.H.J.M. Fransen, B.W. Hoeksema |
| Infestation patterns and population genetic structure of galls crabs (Cryptochiridae) inhabiting corals (Scleractinia) along the Curaçao coast | Kaj van Tienderen - MSc student Leiden University | S.E.T. van der Meij, B.W. Hoeksema |

# Rijksherbariumfonds Dr. E. Kits van Waveren

## History

The foundation is named after Emile Kits van Waveren (1906-1995). He was a physician with keen interest in systematic mycology. As a honorary staff member of the Rijksherbarium (later Nationaal Herbarium Nederland) and under the guidance of Dr. Cornelis Bas, he contributed substantially to the taxonomy of various genera of Agarics, in particular the genus *Psathyrella*, for which he produced a European Monograph which is widely appreciated and used to date.

## Aim

The aim of the *Rijksherbariumfonds E. Kits van Waveren* is to promote systematic mycology, in particular of Agaricales, under auspices of the former Rijksherbarium, now part of Naturalis Biodiversity Center. This is mainly done by providing funds for the appointment of temporary scientific staff at Naturalis (so-called Kits van Waverenfellows).
In addition the foundation supports publications and provides travelling grants for honorary scientific staff.

## Board

E.F. Smets (chair), M.E. Noordeloos (secretary), B. Sanson (treasurer), A. Verbeken (UGent) & Th.W. Kuyper (WUR) (members).

## Applications granted in 2013-2014

| Title/Grant | Applicant | Naturalis supervisor(s) |
|---|---|---|
| Reconstruction of the evolution of the genus *Lactarius* (Russulales) | J. Nuytinck – Kits van Waverenfellow, Naturalis Biodiversity Center | J. Geml, E. F. Smets |
| Flora Agaricina Neerlandica - Study on the genus *Russula* | J. Wisman – Honorary staff Naturalis Biodiversity Center | J. Nuytinck |



# L.B. Holthuis Foundation

## History

The foundation is named after the late curator of Crustacea at Naturalis Biodiversity Center, Prof. dr. L.B Holthuis. He was the foremost carcinologists of his age. When he passed away in 2008, after working at the museum for 68 years, he left his 'Krabbelaria' to his successor Dr. Charles H.J.M. Fransen. Among this collection of 'krabbelaria' were stamps, coins, antique tiles, vases, carved ivory and all kinds of other artefacts depicting crabs, shrimps and lobsters from mugs to Chinese porcelain. Part of this collection has been auctioned after his death. The revenue from these auctions form the capital stock of the L.B. Holthuis Foundation.

## Aim

The aim of the L.B. Holthuis Foundation is to facilitate scientific carcinological research at or in cooperation with Naturalis. Support is usually given to BSc, MSc and PhD students and foreign visitors that are not in the position to pay for their visit.

## Board

B.W. Hoeksema (chair), C.H.J.M. Fransen (secretary/ treasurer) & P.M. Kroonenberg.

## Applications granted in 2013

| Title/Grant | Applicant | Naturalis supervisor(s) |
|---|---|---|
| Revision of the pontoniine shrimp genera *Phycomenes*, *Rapipontonia* and the *Periclimenes iridescens* species complex based on both morphological and molecular characters | Joni Eilbracht - MSc student Leiden University | C.H.J.M. Fransen, S. de Grave |
| Out of Grapsidae? On the phylogenetic origin of the gall crab family Cryptochiridae (Decapoda: Brachyura) | Sancia van der Meij - PhD student Leiden University | E. Gittenberger, B.W. Hoeksema, C.H.J.M. Fransen |

## Applications granted in 2014

| Title | Applicant | Naturalis supervisor(s) |
|---|---|---|
| Infestation patterns and population genetic structure of galls crabs (Cryptochiridae) inhabiting corals (Scleractinia) along the Curacao coast | Kaj van Tienderen - MSc student Leiden University | S.E.T. van der Meij, B.W. Hoeksema |
| Asymmetry in handedness correlated to ecology in species of Pontoniinae (Crustacea, Decapoda) | Cessa Rauch - MSc student Leiden University | C.H.J.M. Fransen, B.W. Hoeksema |

# Martin and Temminck fellowships

## Martin-fellowship

Intended applicants for the **Martin-fellowship** are young, promising researchers (pre- or postdoctoral), such as advanced MSc students, recent MSc graduates who are preparing for a PhD project, postdocs, or recent PhDs who are intending to elaborate part of their thesis or wish to prepare for a postdoctoral research project. Other young researchers can also apply. Collaboration with Naturalis scientific staff of one of the research departments is a prerequisite.

The fellowship is not intended to support visitors who only want to use Naturalis research collections. Publications resulting from a fellowship should carry Naturalis as address.

## Board

B.W. Hoeksema, L.M. Kriegsman & J. van Tol.

## Applications granted in 2013

| Title | Applicant | Naturalis counterpart |
|---|---|---|
| Paleoenvironmental reconstruction of the Villafranchian fossil site of Tegelen (Limburg) from ruminant ecomorphology | Gema M. Alcalde - Complutense University of Madrid, Madrid, Spain | L.W. van den Hoek Ostende |
| Larger benthic foraminifera in the Pleistocene | Belinda Dechnik - The University of Sydney, Sydney, Australia | W. Renema |
| Diversity of sponges in the Strait of Lembeh (North Sulawesi) | Tri Aryono Hadi - Research Centre for Oceanography (PPO-LIPI), Bitung, Indonesia | N.J. de Voogd |
| Octocorals of the Siboga Expedition to eastern Indonesia | Yosephine T. Hermanlimianto -Research Centre for Oceanography (PPO-LIPI), Jakarta, Indonesia | L.P. van Ofwegen |
| Microgastrinae (Hymenoptera: Braconidae) from the Arabian Peninsula | Jose Fernández-Triana - Canadian National Collection of Insects and Biodiversity Institute of Ontario, Ontario, Canada | C. van Achterberg |
| Diversity of mushroom corals in the Strait of Lembeh (North Sulawesi) | Bambang Hermanto - Research Centre for Oceanography (PPO-LIPI), Bitung, Indonesia | B.W. Hoeksema |
| Species composition of seven Crested Newt populations in a contact zone of *Triturus cristatus*, *T. dobrogicus* and *T. carnifex* in the Waldviertel (Austria) | Patricia Lagler - University of Natural Resources and Life Sciences, Vienna, Austria | J.W. Arntzen |
| Leafrollers (Lepidoptera, Tortricidae) of Vietnam: biodiversity, DNA barcoding and taxonomy | Svetlana V. Nedoshivina - Ulyanovsk State Pedagogical University, Ulyanovsk, Russia | E.J. van Nieukerken |
| The effect of temperature variability and life-history strategy on the response of coral to long-term increase in sea water temperature | Tries Razak - The University of Queensland, Brisbane, Australia | B.W. Hoeksema |
| Coral communities of the Persian Gulf | Kaveh Samimi-Namin - Five Oceans Environmental Services, Muscat, Oman | L.P. van Ofwegen, B.W. Hoeksema |
| Tropical western Pacific marine paleo-biodiversity: a micropaleontological approach | Moriaka Yasuhara - University of Hong Kong, Hong Kong, China | W. Renema |

## Applications granted in 2014

| Title | Applicant | Naturalis counterpart |
|---|---|---|
| Petrology and geochronology of ultra-high-temperature granulites from the Highland Complex of Sri Lanka | Prasanna L. Dharmapriya - University of Peradeniya, Peradeniya, Sri Lanka | L. Kriegsman |
| Plants for family health in the Dutch Caribbean | Michaela Hammer - Oregon State University, Corvallis, USA | T.R. van Andel |
| Reconstructing amphibian population connectivity in a heterogeneous landscape over a 35 year interval with the novel CircuitScape approach | Ruben Iosif - Ovidius University of Constanta, Pitesti, Rumenia | J.W. Arntzen |
| On the origin of Pontocaspian gastropods | Pavel D. Frolov - Geological Institute of the Russian Academy of Sciences, Moscow, Russia | F.P. Wesselingh |

| | | |
|---|---|---|
| A genomic framework for chaetognath taxonomy | Ferdinand Marlétaz - University of Oxford, Oxford, UK | K.T.C.A. Peijnenburg |
| Coral communities of the Persian Gulf | Kaveh Samimi-Namin - Five Oceans Environmental Services, Muscat, Oman | L.P. van Ofwegen, B.W. Hoeksema |
| Marine biodiversity on volcanic slopes | Singgih Afifa Putra - Bogor Agricultural University [IPB], Bogor, Indonesia | B.W. Hoeksema |
| Paleocene-Eocene larger Foraminifera in Cuba and Caribbean realm and transatlantic correlation of their biostratigraphy | Ana I. Torres Silva - University of Vienna, Vienna, Austria | W. Renema |

## Temminck-fellowship

Intended applicants for the **Temminck-fellowship** are experienced, internationally known scientists who, for example, wish to carry out some research during their sabbatical. Collaboration with Naturalis scientific staff of one of the research departments is a prerequisite. The fellowship is not intended to support visitors who only want to use Naturalis research collections. Publications resulting from a fellowship should carry Naturalis as address.

## Board

B.W. Hoeksema, L.M. Kriegsman & J. van Tol.

## Applications granted in 2013

| Title | Applicant | Naturalis counterpart |
|---|---|---|
| At Europe's eastern gate: ecosystem dynamics in and basin evolution in the Late Neogene of Anatolia | M. Cihat Alçiçek - Pamukkale University, Denizli, Turkey | L.W. van de Hoek Ostende |
| Soft corals of the family Xeniidae | Yehuda Benayahu - Tel Aviv University, Tel Aviv, Israel | L.P. van Ofwegen |
| Revision of the plant genus *Drypetes* (Putranjivaceae or Euphorbiaceae s.l.) in Malesia | Geoffrey A. Levin - University of Illinois, Champaign, USA | P.C. van Welzen |
| The vole fauna of Bicakci (Anatolia, Turkey) | Alexey S. Tesakov - Geological Institute of the Russian Academy of Sciences, Moscow, Russia | L.W. van de Hoek Ostende |

## Applications granted in 2014

| Title | Applicant | Naturalis counterpart |
|---|---|---|
| Soft corals of the family Xeniidae | Yehuda Benayahu - Tel Aviv University, Tel Aviv, Israel | L.P. van Ofwegen |
| A phylogenetic trifecta: cospeciation of corals, gall crabs and their parasites | Christopher B. Boyko - American Museum of Natural History, New York, USA | S.E.T. van der Meij, C.H.J.M. Fransen, B.W. Hoeksema |
| Exploring salamander morphospace by CT scan data, 3D geometric morphometrics and phylogeny | Ana Ivanović - University of Belgrade, Belgrade, Serbia | J.W. Arntzen |
| Hidden biodiversity in tropical rain forests: A case study on the ichneumonid wasps (Hymenoptera: Ichneumonidae) in northern Vietnam | Nhi Thi Pham - Institute of Ecology and Biological Resources, Hanoi, Vietnam | S.A. Ulenberg, C. van Achterberg |

## Publications

The above and earlier Martin- and Temminck fellowships resulted in the following publications (printed in 2013-2014) (in bold: research staff of Naturalis Biodiversity Center).


Fernández-Triana, J., Ward, D.F., Cardinal, S. & **van Achterberg, C.** 2013. A review of Paroplitis (Braconidae, Microgastrinae), and description of a new genus from New Zealand, *Shireplitis*, with convergent morphological traits. *Zootaxa* 3722: 549-568.

Hoare, R.J.B. & **van Nieukerken, E.J.** 2013. Phylogeny and host-plant relationships of the Australian Myrtaceae leafmining moth genus Pectinivalva (Lepidoptera: Nepticulidae), with new subgenera and species. *ZooKeys* 278: 1-64.

Ivanović, A. & **Arntzen, J.W.** 2014. Evolution of skull and body shape in *Triturus* newts reconstructed from three-dimensional morphometric data and phylogeny. *Biological Journal of the Linnean Society* 113: 243-255.

Ivanović, A., Uzum, N., **Wielstra, B.**, Olgun, K., Litvinchuk, S.N., Kalezic, M.L. & **Arntzen, J.W.** 2013. Is mitochondrial DNA divergence of Near Eastern crested newts (Triturus karelinii group) reflected by differentiation of skull shape? *Zoologischer Anzeiger* 252: 269-277.

Ivanović, A., Aljančič, G. & **Arntzen, J.W.** 2013. Skull shape differentiation of black and white olms (*Proteus anguinus anguinus* and *Proteus a. parkelj*): an exploratory analysis with micro-CT scanning. *Contributions to Zoology* 82: 107-114.

Ivanović, A., Cvijanović, M., Denoël, M., Slijepčević, M. & Kalezić, M.L. 2014. Facultative paedomorphosis and the pattern of intra- and interspecific variation in cranial skeleton: lessons from European newts (*Ichthyosaura alpestris* and *Lissotriton vulgaris*). *Zoomorphology* 133: 99-109.

McFadden, C.S. & **van Ofwegen, L.P.** 2013. A second, cryptic species of the soft coral genus Incrustatus (Anthozoa: Octocorallia: Clavulariidae) from Tierra del Fuego, Argentina, revealed by DNA barcoding. *Helgoland Marine Research* 67: 137-147.

McFadden, C.S. & **van Ofwegen, L.P.** 2013. Molecular phylogenetic evidence supports a new family of octocorals and a new genus of Alcyoniidae (Octocorallia, Alcyonacea). *ZooKeys* 346: 59-83.

McFadden, C.S., Brown, A.S., Brayton, C., Hunt, C.B. & **van Ofwegen, L.P.** 2014. Application of DNA barcoding in biodiversity studies of shallow-water octocorals: molecular proxies agree with morphological estimates of species richness in Palau. *Coral Reefs* 33: 275-286.

Poyarkov, N.A., Che, J., Min, M.S., Kuro-o. M., Yan, F., Li, C., Iizuka, K. & Vieites, D.R. 2012. Review of the systematics, morphology and distribution of Asian Clawed Salamanders, genus *Onychodactylus* (Amphibia, Caudata: Hynobiidae), with the description of four new species. *Zootaxa* 3465: 1-106.

**Reijnen, B.T.**, McFadden, C.S., Hermanlimianto, Y.T. & **van Ofwegen, L.P.** 2014. A molecular and morphological exploration of the generic boundaries in the family Melithaeidae (Coelenterata: Octocorallia) and its taxonomic consequences. *Molecular Phylogenetics and Evolution* 70: 383-401.

Reimer, J.D., Poliseno, A. & **Hoeksema, B.W.** 2014. Shallow-water zoantharians (Cnidaria, Hexacorallia) from the Central Indo-Pacific. *ZooKeys* 444: 1-57.

**van Ofwegen, L.P.** & Hermanlimianto, M.I.Y.T. 2014. Siboga plexaurids (Coelenterata: Octocorallia) re-examined. *Zoologische Mededelingen* 88: 19-58.

**van Ofwegen, L.P.**, Benayahu, Y. & McFadden, C.S. 2013. *Sinularia leptoclados* (Ehrenberg, 1834) (Cnidaria, Octocorallia) re-examined. *ZooKeys* 272: 29-59.




# Dr. Schürmann Foundation

## History

Dr Heinrich Moritz Emil Schürmann, may be considered as an eminent representative of the pre-Second-World-War generation of geologists. Born in Düsseldorf, Germany, he joined the *Bataafsche Petroleum Maatschappij* in 1913 after obtaining his doctor's degree at the *Rheinische Friedrich-Wilhelms-Universität Bonn*, and started his career as a geologist in Egypt with the Anglo-Egyptian Oil Fields Ltd. From 1914 to 1930 he worked in the Dutch East Indies. In 1930 he became Head of the Geology Division of Royal Dutch Shell in The Hague, a position which he retained until he retired in 1951.

Schürmann's interest and expertise covered many fields of geology, stretching from his services to the oil industry, obviously focussing on Phanerozoic hydrocarbon basins, to the Precambrian crystalline basement. In 1966 and 1974 Schürmann published two monumental monographs – both still consulted and cited - on the Precambrian of North Africa and adjacent northern Red Sea area.

Schürmann fostered numerous new initiatives, both internationally and in the Netherlands. He promoted isotope geochronology facilities in the Netherlands which, in 1962 led to the establishment of the Foundation for Isotope-Geological Research. His achievements were widely recognised and earned him, amongst others, the 'Van Waterschoot van der Gracht penning', the highest medal of distinction in the earth sciences in the Netherlands awarded by the Board of the KNGMG in 1972.

## Aim

In 1949 Schürmann established the *Stichting Dr. Schürmannfonds* (Dr. Schürmann Foundation), initially in order to ensure the safe-keeping of the Schürmann collection of mainly Precambrian minerals and rocks (later on this collection was donated to Naturalis), and later mainly to foster and promote research on the study of – in his time still poorly known – Precambrian terrains in general and the Precambrian of Egypt in particular.

## Board

A.B. Westerhof (chair), K. de Groot (treasurer), J.C. Zwaan (secretary), F.F. Beunk & W. Nijman.

## Research sponsored by the Schürmann Foundation

During its more than 60 years of existence, the Schürmann Foundation has financially supported fieldwork research on Precambrian terrains all over the world; since 1981 to a total of more than 200 projects. From 2002 to 2007 the Foundation also sponsored a special chair Precambrian System Earth (held by Professor Passchier) at the VU University Amsterdam to promote the integrated study of the early evolution of the Earth with emphasis on linking deep crustal and surface processes. In addition the chair aimed at strengthening Dutch geological research into the Precambrian and stimulating public outreach, as well as international scientific cooperation.

Long-term research programmes sponsored by the Schürmann Foundation in the last two decades have been and continue to be:

### Pilbara Project (1990-2006)

Sedimentological and structural-geological investigations in the granite-greenstone terrane of the west Australian Pilbara Craton (Ypma, Universities of Delft and Adelaide; Nijman and White, Utrecht University; Wijbrans, VU University Amsterdam); major aims have been the detailed structural history of the Archaean of especially the East Pilbara Craton and the reconstruction of its early Archaean sedimentary / volcanic environment.

### Zimbabwe Project (1995-2000)

Thrust deformation and sedimentation in the Zimbabwean greenstone belts (Dirks, previously University of Harare).

### Earth's Earliest Basins Project (since 1998)

A follow-up to the Pilbara project aiming at the reconstruction of the Archaean sedimentary

environment, its hydrothermal activity, signs of early life and structural control on the West Australian Pilbara and South African Barberton greenstone belts (Nijman, van Bergen, Utrecht University; de Wit, University of Cape Town; Kisch, Ben Gurion University, Israel).

### CLM (subcratonic lithospheric mantle) Project (since 2003)

Research programme conducted by Davies (VU University Amsterdam) focussing on the preservation and destruction of Archaean continents through the study of diamondiferous xenoliths in kimberlites in crustal remnants of the Tanzanian Craton, the Kaapvaal Craton, and the Aldan Shield of Siberia.

### Namibia Project (since 2003)

Tectonic evolution of Neoproterozoic mobile belts in Namibia (Kaoko- and Damara), with emphasis on extensive geologic mapping and structural-geologic analysis (Passchier, VU University Amsterdam / University of Mainz; Trouw, Federal University of Rio de Janeiro).

### Barberton Drilling Project (since 2010)

As a direct consequence of previous investigations in that area, Dutch geologists (Mason, van Bergen, Utrecht University; Vroon, VU University Amsterdam) now participate in an ICDP (International Continental Scientific Drilling Program) - supported drilling project in the Barberton greenstone belt.

Examples of smaller-scale fieldwork projects of the last decade sponsored by the Schürmann Foundation are Ultrahigh-temperature (UHT) metamorphism in the Bakhuis Mountain area of Western Suriname (since 2006), Stratigraphy and Sedimentology of the Palaeoproterozoic of Eastern India (since 2006), Paleoproterozoic Stratigraphy and Structures of the Bergslagen area in Central Sweden (since 2008), and recently Tectonics and sapphire formation in the Precambrian lower crust of central-eastern Sri Lanka (this project is carried out by Naturalis researchers L.M. Kriegsman and J.C. Zwaan).

The projects have resulted in a considerable number of MSc and PhD theses, and articles in peer-reviewed magazines.

## Blumea – Biodiversity, Evolution and Biogeography of Plants

*Blumea* is an international journal on the biodiversity, evolution and biogeography of plants, including topics on systematics, floristics, phylogeny, morphology and anatomy. For floristic studies, the focus is on tropical Africa south of the Sahara, tropical Southeast Asia with a strong emphasis on Malesia, and South America with emphasis on the Guianas. Papers in *Blumea* are subjected to peer review and are in English. *Blumea* is published three times a year, comprising c. 300 pages in total, in A4 format. *Blumea* is online via open access available through Ingenta: www.ingentaconnect.com/content/nhn/blumea.

***Editor-in-chief: P.H. Hovenkamp.***
***Associate editors: F. Adema, P.J.M. Maas, L.J.G. van der Maesen, M.S.M. Sosef & J.J. Vermeulen.***

| | 2013 | 2014 |
|---|---|---|
| Scient. papers | 40 | 24 |
| Total pages | 294 | 162 |
| SCI | 0.375 | 0.340 |

## Contributions to Zoology

*Contributions to Zoology* solicits highquality papers in all systematicsrelated branches of zoology and paleontology. Preference will be given to manuscripts dealing with conceptual issues and to integrative papers (e.g., palaeobiology *and* biodiversity, morphology *and* phylogeny *and* character state evolution, phylogeny *and* historical biogeography, systematics *and* bioinformatics, bioinformatics *and* biodiversity, habitat disturbance *and* biogeography, etc. etc.). Reviews and alphataxonomic contributions may be considered for publication, but acceptance will depend on their high quality and exceptional nature.

***Editor-in-chief: J.W. Arntzen.***
***Managing editor: S.E.T. van der Meij.***
***Associate editors: J.C. Biesmeijer, M. Brazeau, H. de Jong, V. Nijman, W. Renema, J. van Rooijen, R. Sluys, R.W.M. van Soest & R. Vonk.***

| | 2013 | 2014 |
|---|---|---|
| Scient. papers | 15 | 17 |
| Total pages | 208 | 330 |
| SCI | 2.029 | 1.656 |

## Entomologische Tabellen

In *Entomologische Tabellen* identification keys on the invertebrates of the Netherlands are published. It is a joined publication of the Nederlandse Entomologische Vereniging, European Invertebrate Survey – The Netherlands and Naturalis. *Entomologische Tabellen* is published on an irregular basis.

***Editors: O. Vorst, J. Noordijk & R.M.J.C. Kleukers.***

| | 2013 | 2014 |
|---|---|---|
| Volumes | 1 | 0 |
| Total pages | 92 | 0 |
| 2013: Volume 7: | De Nederlandse goudhaantjes (Chrysomelidae: Chrysomelinae) | |
| 2014: | - | |

## Flora Malesiana

*Flora Malesiana* is a systematic treatment of the tropical plant and fern species in the Malay Archipelago (Malaysia, Singapore, Brunei, Indonesia, Philippines, Timor Este, Papua New Guinea), estimated at 40,000 species. It is the first flora for the region. Therefore, a more or less monographic approach is used to describe the species including long detailed descriptions and full synonymy, and literature references. Up to now 21 volumes have been published in series I (no. 2 and 3, intended for vegetation descriptions and ecology have never been written) and 4 volumes in series II (so far covering c. 20% of the flora). Treatments are made by internationally renowned taxonomists. The instalments contain family treatments, single when concerning a large family (or at most 2 instalments as with Moraceae), several together when small families are involved. Every family has introductory chapters about morphology, anatomy, pollen, and other topics when of interest, followed by a key to the genera, keys per genus and species descriptions. The reader can, in conjunction with the digital family key produced by Kew and Leiden, use *Flora Malesiana* to identify species, to get information about plants, uses, references, anatomy, vernacular names, pollen, pollination, etc. Quite often *Flora Malesiana* contains the first drawings of species. A Flora Malesiana Dataportal is under construction: dev.etaxonomy.eu/dataportal/floramalesiana/

***Editor-in-chief: P.C. van Welzen.***

| | 2013 | 2014 |
|---|---|---|
| Volumes | 1 | - |
| Total pages | 140 | - |
| 2013: | Series 1: 21: 2 families: Lecythidaceae & Peraceae | |
| 2014: | - | |

## Flora of the Guianas

The *Flora of the Guianas* is a book series dedicated to the taxonomic treatment of all plant taxa occurring within the political territories of Guyana, Suriname and French Guiana. Based on studies of type specimens, herbarium collections, living plants, and all relevant literature, most of the treatments include also information on plant use, local names and ecological notes. Publication takes place in fascicles, each treating a single family or a group of related families, in the following series: A. Phanerogams; B. Ferns and Fern allies; C. Bryophytes; D. Algae; and E. Fungi and Lichens.
As an additional dissemination channel to the printed copies, the *Flora of the Guianas* has started to move towards an online platform: we want to make information freely available; to speed up publication; to offer more tools for data representation as well as for plant identification; and finally, to build up an updated and dynamic Flora available for different end-users, with approximately 15,000 plant species when finished.

***Editor: S. Mota de Oliveira.***
***Editorial board members: P. Acevedo-Rodríguez, P. Delprete, E. Lucas, O. Poncy, P. da Silva, N. Köster, B. Torke & D. Traag.***

| | 2013 | 2014 |
|---|---|---|
| Volumes | 1 | 1 |
| Total pages | 132 | 129 |
| 2013: | Cladoniaceae. Series E: Fungi and Lichens, fascicle 3. | |
| 2014: | Gentianaceae. Series A: Phanerogams, fascicle 30. | |

## Flore du Gabon

The *Flore du Gabon* series provides access to the information on the botanical wealth of this central African country, reputedly harbouring the richest lowland rain forest in Africa. The series was started in 1961 by the Muséum national d'Histoire naturelle (MNHN) in Paris. In 2005, a new editorial team was formed including Naturalis and two Gabonese colleagues. They developed a new and more concise format and rendered the goal to finish the series within 10 years. In 2014, Naturalis signed an MOU with the Botanic Garden Meeise (Belgium) to jointly support the production of this series. From 2015 onward, 2 or 3 volumes are expected to be published each year, in order to keep up a steady and high pace of production. With 11% of all plant species being endemic to the country and some 80% of its surface being covered with a highly diverse lowland rain forest, Gabon is a botanical paradise and biodiversity hotspot. The *Flore du Gabon* provides the essential tools for reliable identification, stressing the need for simple and straightforward identification keys, diagnostic descriptions and clarifying illustrations. As such, it hopes to assist researchers, foresters and conservationists alike and to contribute to the survival of Gabon's unique biodiversity. *Flore du Gabon* is published for Naturalis and the Botanic Garden Meise by Margraf Publishers.

***Editors: M.S.M. Sosef, J. Florence, L.N. Banak & H.P.B. Bourobou.***

| | 2013 | 2014 |
|---|---|---|
| Volumes | 1 | 0 |
| Total pages | 94 | 0 |
| 2013: | Volume 45: Clusiaceae, Malvaceae | |
| 2014: | - | |

## Gorteria

*Gorteria* is dedicated to research on the wild flora of the Netherlands. The taxa treated must occur in the Netherlands, but the studies may cover a much wider area. The journal aims to be useful for a broad scientific audience and botanical research arena (systematics, floristics, ecology, vegetation biology), and focuses on amateur botanists, as readers as well as authors. Especially papers on the identification and circumscription of critical or taxonomically challenging plant taxa are welcome. The journal is published in Dutch, with abstracts in English, and each volume consists of 6 fascicles. More information can be found on: www.nationaalherbarium.nl/gorteriaweb/.
In 2014, a special issue on the Dutch Brambles (*Rubus* L.) has been published as a triple issue of Gorteria, volume 36.
Since March 9, electronic versions of all *Gorteria* and *Gorteria Supplement* publications have been stored in the Naturalis repository: http://repository.naturalis.nl/ and are freely accessible to the public. Articles published in the current volume of *Gorteria* (Gorteria 37) will be accessible to the public after completion of the volume.

***Editor-in-chief: M.C. Roos.***
***Editors: H. Duistermaat, J.D. Kruijer, B. Odé, R.C.M.J. van Moorsel, J.G.B. Oostermeijer & E.J. Slootweg.***

# Publications 2013-2014

| | 2013 | 2014 |
|---|---|---|
| Scient. papers | 3 | 7 |
| Total pages | 63 | 167 |
| SCI | 0 | - |

## Natuur van Nederland

The *Natuur van Nederland* series is a continuation of the *Nederlandse Fauna* series. It is published by Naturalis in cooperation with KNNV Publishers and European Invertebrate Survey. Each volume offers an overview of a particular species group of the Dutch flora or fauna. Subjects tackled are taxonomy, distribution, status, identification, ecology and aspects of their biology. Presently, 11 volumes have been published. A new volume, on mammals of the Netherlands, is in advanced stage of preparation. Website: science.naturalis.nl/en/research/publications/natuur-van-nederland/.
***Editors-in-chief: G.O. Keijl & A.J. van Loon.***

## Nederlandse Faunistische Mededelingen

In the journal *Nederlandse Faunistische Mededelingen* original papers and short communications on the invertebrates of the Netherlands are published. It is especially targetting the working groups of the European Invertebrate Survey and related researchers with the aim to enhance the knowledge of Dutch biodiversity. The journal is published twice a year as a cooperation between the European Invertebrate Survey – The Netherlands and Naturalis. Additionally, supplements are published dealing with a specific topic. Most papers are in Dutch with an English summary.
***Editor-in-chief: R.M.J.C. Kleukers.***
***Editors: M.P. Berg, P.L.Th. Beuk, P.J. van Helsdingen, A. Kroon & M. Reemer.***

| | 2013 | 2014 |
|---|---|---|
| Scient. papers | 24 | 27 |
| Total pages | 250 | 207 |

## Persoonia – Molecular Phylogeny and Evolution of Fungi

*Persoonia* aims to publish papers dealing with molecular phylogeny and evolution of fungi. A further aim is to promote fungal taxonomy by employing a polythetic approach to clarify the true phylogeny and relationships within the fungi. The journal publishes highquality papers elucidating known and novel fungal taxa at the DNA level, and also strives to present novel insights into evolutionary processes and relationships. Papers to be considered include research articles and reviews. Papers are published using a Fast Track system. This implies that the papers are immediately published online and freely available through the internet via the Ingenta Connect website. Hard copy volumes are published twice a year, in A4 format and full colour, when the online published papers are bound. *Persoonia* is a journal published jointly by the Naturalis Biodiversity Center and the CBS-KNAW Fungal Biodiversity Center. Online papers in *Persoonia* can be found through www.ingentaconnect.com/content/nhn/pimj/preprints and www.persoonia.org.
***Editors-in-Chief: J. Geml & P.W. Crous.***

| | 2013 | 2014 |
|---|---|---|
| Scient. papers | 19 | 22 |
| Total pages | 427 | 600 |
| SCI | 4.225 | 5.3 |

## Scripta Geologica

*Scripta Geologica* publishes original papers and monographs dealing with the various branches of vertebrate and invertebrate palaeontology, palaeobotany/palynology, stratigraphy, petrology and mineralogy, including gemmology. The journal appears twice per calendar year, although it may be supplemented by special (thematic) issues. Each issue has its own serial number. The focus of the journal is systematics, although papers on all aspects of the subjects listed above are welcomed. Only original papers that have not been submitted or published elsewhere will be considered for publication. The electronic version of *Scripta Geologica* is available at www.scriptageologica.nl. Back articles of *Scripta Geologica* are available through www.repository.naturalis.nl.
***Managing editor: S.K. Donovan.***
***Editorial board: S.K. Donovan, L.W. van den Hoek Ostende, W. Renema & J.C. Zwaan.***

| | 2013 | 2014 |
|---|---|---|
| Scient. papers | 2 | 24 |
| Total pages | 321 | 455 |

## Zoologische Mededelingen

*Zoologische Mededelingen* publishes original papers and monographs dealing with various branches of vertebrate and invertebrate biology. The focus of the journal is systematics. The majority of the publications in *Zoologische Mededelingen* are the result of research projects of Naturalis, or are based mainly or entirely on specimens in the collections of Naturalis. Only original papers that have not been submitted or published elsewhere will be considered for publication. The journal is accessible through: http://www.zoologischemededelingen.nl/. Back articles of *Zoologische Mededelingen* are available through www.repository.naturalis.nl.
***Editor-in-chief: L.P. van Ofwegen.***
***Editorial board: C. van Achterberg, C.H.J.M. Fransen, L.P. van Ofwegen, M.J.P. van Oijen & A.J. de Winter.***

| | 2013 | 2014 |
|---|---|---|
| Scient. papers | 5 | 4 |
| Total pages | 412 | 109 |

This list includes the publications of permanent staff, students and honorary staff (names in **bold**) of Naturalis Biodiversity Center.

## 2013

### SCI publications


Abbott, R., Albach, D.I., Ansell, S., **Arntzen, J.W.**, Baird, S.J.E., Bierne, N., Boughman, J.W., Brelsford, A., Buerkle, C.A., Buggs, R., Butlin, R.K., Dieckmann, U., Eroukhmanoff, F., Grill, A., Cahan, S.H., Hermansen, J.S., Hewitt, G., Hudson, A.G., Jiggins, C., Jones, J., Keller, B., Marczewski, T., Mallet, J., Martinez-Rodriguez, P., Most, M., Mullen, S., Nichols, R., Nolte, A.W., Parisod, C., Pfennig, K., Rice, A.M., Ritchie, M.G., Seifert, B., Smadja, C.M., Stelkens, R., Szymura, J.M., Vainola, R., Wolf, J.B.W. & Zinner, D. 2013. Hybridization and speciation. *Journal of Evolutionary Biology* 26: 229-246.

**Aguirre-Gutierrez, J.**, **Carvalheiro, L.**, Polce, C., van Loon, E.E., **Raes, N.**, **Reemer, M.** & **Biesmeijer, J.** 2013. Fit-for-purpose: Species distribution model performance depends on evaluation criteria – Dutch hoverflies as a case study. *PLOS ONE* 8: e63708.

**Aliabadian, M.**, **Beentjes, K.**, **Roselaar, K.**, **van Brandwijk, H.**, Nijman, V. & **Vonk, R.** 2013. DNA barcoding of Dutch birds. *ZooKeys* (Special Issue) 365: 25-48.

Annan, A., Baldwin, H.J., Corman, V.M., Klose, S.M., Owusu, M., Nkrumah, E.E., Badu, E.K., Anti, P., Agbenyega, O., Meyer, B., Oppong, S., Sarkodie, Y.A., Kalko, E.K.V., **Lina, P.H.C.**, Godlevska, E.V., Reusken, C., Seebens, A., Gloza-Rausch, F., Vallo, P., Tschapka, M., Drosten, C. & Drexler, J.F. 2013. Human Betacoronavirus 2c EMC/2012-related Viruses in Bats, Ghana and Europe. *Emerging Infectious Diseases* 19: 456-459.

**Arntzen, J.W.**, McAtear, J., Recuero, E., **Ziermann, J.M.**, Ohler, A., **van Alphen, J.** & Martínez-Solano, I. 2013. Morphological and genetic differentiation of *Bufo* toads: two cryptic species in Western Europe (Anura, Bufonidae). *Contributions to Zoology* 82: 147-169.

**Arntzen, J.W.**, Recuero, E., Canestrelli, D. & Martínez-Solano, I. 2013. How complex is the *Bufo bufo* species group? *Molecular Phylogenetics and Evolution* 69: 1203-1208.

**Aukema, B.**, **Duffels, H.**, Günther, H., Rieger, Chr. & Strauss, G. 2013. New data on the Heteroptera fauna of La Palma, Canary Islands (Insecta: Hemiptera). *Acta Musei Moraviae, Scientiae Biologicae* 98: 459-493.

**Baalbergen, E.** & **Donovan, S.K.** 2013. Terrestrial arthropods from the Late Pleistocene of Jamaica: systematics, palaeoecology and taphonomy. *Geological Journal* 48: 628-645.

**Baas, P.**, Battigpaglia G., De Micco S., **Lens, F.** & Wheeler, E.A. 2013. Wood structure in plant biology and ecology. *IAWA Journal* 34: 329-509.

Bacela-Spychalska, K. & **van der Velde, G.** 2013. There is more than one 'killer shrimp': trophic positions and predatory abilities of invasive amphipods of Ponto-Caspian origin. *Freshwater Biology* 58: 730-741.

**Banaticla-Hilario, M.C.**, **Sosef, M.S.M.**, McNally, K., Hamilton, N.R.S. & van den Berg, R.G. 2013. Ecogeographic variation in the morphology of two Asian wild rice species *Oryza nivara* and *O. rufipogon*. *International Journal of Plant Sciences* 174: 896-909.

**Bank, R.A.**, **Gittenberger, E.** & Neubert, E. 2013: Radiation of an eastern Mediterranean landsnail genus: revision of the taxa belonging to *Metafruticicola* von Ihering 1892 (Gastropoda, Pulmonata: Hygromiidae). *Archiv für Molluskenkunde* 142: 67-136.

**Becking, L.E.** 2013. Revision of the genus *Placospongia* (Porifera: Hadromerida: Placospongiidae) in the Indo-West Pacific. *Zookeys* 298: 39-76.

**Becking, L.E.**, Cleary, D.F.R. & **de Voogd, N.J.** 2013. Sponges species composition abundance and cover in marine lakes and coastal mangroves in Berau, Indonesia. *Marine Ecology Progress Series* 481: 105-120.

**Becking, L.E.**, Erpenbeck, D., **Peijnenburg, K.T.C.A.** & **de Voogd, N.J.** 2013. Phylogeography of the sponge *Suberites diversicolor* in Indonesia: insights into the evolution of marine lake populations. *PLOS ONE* 8: e75996.

Beedessee, G., Ramanjooloo, A., Aubert, G., Eloy, L., Arva, D., **van Soest, R.W.M.**, Cresteil, T. & Marie, D.E.P. 2013. Ethyl acetate extract of the Mauritian sponge *Jaspis* sp. induces cell arrest in human promyelocytic leukemia cells. *Environmental Toxicology and Pharmacology* 36: 58-65.

Beedessee, G., Ramanjooloo, A., Suman-Boodhun, R., **van Soest, R.W.M.** & Marie, D.E.P. 2013. Acetylcholinesterase-inhibitory activities of the extracts from sponges collected in Mauritius waters. *Chemistry and Biodiversity* 10: 442-451.

Bellemain, E., Davey, M.L., Kauserud, H., Epp, L.S., Boessenkool, S., Coissac, E., **Geml, J.**, Edwards, M., Willerslev, E., Gussarova, G., Taberlet, P. & Brochmann, C. 2013. Fungal palaeodiversity revealed using high-throughput metabarcoding of ancient DNA from arctic permafrost. *Environmental Microbiology* 15: 1176-1189.

**Berg, C.C.**, Carauta, J.P.P. & Machado, A.F.P. 2013. *Ficus goiana*, a replacement name for a Brazilian species of fig (Moraceae). *Phytotaxa* 108: 54-56.
**Bissiengou, P.**, Chatrou, L.W., **Wieringa, J.J.** & **Sosef, M.S.M.** 2013. Taxonomic novelties in the genus *Campylospermum* (Ochnaceae). *Blumea* 58: 1–7. doi 10.3767/000651913X667817.
**Bissiengou, P.**, **Wieringa J.J.** & **Sosef M.S.M.** 2013. Taxonomic novelties in the genus *Campylospermum* (Ochnaceae). *Blumea* 58: 1-7.
Bogaerts, S., **Sparreboom, M.**, Pasmans, F., Almasri, A., Beukema, W., Shebab, A. & Amr, Z.S. 2013. Distribution, ecology and conservation of *Ommatotriton vittatus* and *Salamandra infraimmaculata* in Syria. *Salamandra* 49: 87-96.
Bogarin, D., **Karremans, A.**, Rincon, R. & **Gravendeel, B.** 2013. A new *Specklinia* (Orchidaceae: Pleurothallidinae) from Costa Rica. *Phytotaxa* 115: 31-41.
**Bos, A.R.**, Gumanao, G.S., Mueller, B. & Saceda, M.M. 2013. Management of crown-of-thorns sea star (*Acanthaster planci* L.) outbreaks: removal success depends on reef topography and timing within the reproduction cycle. *Ocean and Coastal Management* 71: 116-122.
**Bos, A.R.**, Gumanao, G.S., Mueller, B. & Saceda, M.M. 2013. Size at maturation, sex differences, and pair density during the mating season of the Indo-Pacific beach star *Archaster typicus* (Echinodermata: Asteroidea) in the Philippines. *Invertebrate Reproduction and Development* 57: 113-119.
Brambach, F., **Nooteboom, H.P.** & Culmsee, H. 2013. *Magnolia sulawesiana* described, and a key to the species of *Magnolia* (Magnoliaceae) occurring in Sulawesi. *Blumea* 58: 271-276.
**Breeschoten, T.**, Clark, D.R. & **Schilthuizen, M.** 2013. Evolutionary patterns of asymmetric genitalia in the beetle tribe Cyclocephalini. *Contributions to Zoology* 82: 95-106.
**Breure, A.S.H.** 2013. Annotated type catalogue of Orthalicoidea (Mollusca, Gastropoda) in the Museum für Naturkunde, Berlin. *ZooKeys* 279: 1-101.
**Cámara-Leret, R.**, **Ridder-Numan, J.W.A.** & **Veldkamp, J.F.** 2013. Revision of *Heteroblemma* gen. nov. (Dissochaeteae – Melastomataceae) from Malesia and Vietnam. *Blumea* 58: 229-240.
**Carvalheiro, L.G.**, Kunin, W.E., Keil, P., **Aguirre-Gutiérrez, J.**, **Ellis, W.N.**, Fox, R., Groom, Q., Hennekens, S., van Landuyt, W., Maes, D., van de Meutter, F., Michez, D., Rasmont, P., Ode, B., Potts, S.G., **Reemer, M.**, Roberts, S.G., Schaminee, J., Wallis de Vries, M.F. & **Biesmeijer, J.C.** 2013. Species richness declines and biotic homogenization have slowed down for NW-European pollinators and plants. *Ecology Letters* 16: 870-879.
Casewell, N.R., Wüster, W., **Vonk, F.J.**, Harrison, R.A. & Fry, B.G. 2013. Complex cocktails: the evolutionary novelty of venoms. *Trends in Ecology and Evolution* 28: 219-229.
Castoe, T.A., de Koning, A.P.J., Hall, K.T., Card, D.C., Schield, D.R., Fujita, M.K., Ruggiero, R.P., Degner, J.F., Daza, J.M., Gu, W., Reyes-Velasco, J., Shaney, K.J., Castoe, J.M., Fox, S.E., Poole, A.W., Polanco, D., Dobry, J., Vandewege, M.W., Li, Q., Schott, R.K., Kapusta, A.K., Minx, P., Feschotte, C., Uetz, P., Ray, D.A., Hoffmann, F.G., Bogden, R., Smith, E.N., Chang, B.S., **Vonk, F.J.**, Casewell, N.R., Henkel, C.V., Richardson, M.K., Mackessy, S.P., Bronikowsi, A.M., Yandell, M., Warren, W.C., Secor, S.M. & Pollock, D.D. 2013. The Burmese python genome reveals the molecular basis for extreme adaptation in snakes. *Proceedings of the National Academy of Sciences of the United States of America* 110: 20645-20650.
**Chantarasuwan, B.**, **Berg, C.C.** & **van Welzen, P.C.** 2013. A revision of *Ficus* subsection *Urostigma* (Moraceae). *Systematic Botany* 38: 653-686.
**Chaowasku, T.** 2013. *Miliusa codonantha* (Annonaceae), a new species from the Indian eastern Himalaya, with a new combination, *M. dioeca. Willdenowia* 43: 101-105.
**Chaowasku, T.** 2013. Request for a binding decision on whether *Huberia* DC.(Melastomataceae) and *Hubera* Chaowasku (Annonaceae) are sufficiently alike to be confused. *Taxon* 62: 412-412.
**Chaowasu, T.** & Keßler, P.J.A. 2013. Seven new species of *Miliusa* (Annonaceae) from Thailand. *Nordic Journal of Botany* 31: 680-699.
**Chaowasku, T.**, **van der Ham, R.W.J.M.** & Chatrou, L.W. 2013. Integrative systematics supports the establishment of *Winitia,* a new genus of Annonaceae (Malmeoideae, Miliuseae) allied to *Stelechocarpus* and *Sageraea. Systematics and Biodiversity* 11: 195-207.
Chen, D.-W., Chen, W., Liu, D., **van Ofwegen, L.**, Proksch, P. & Lin, W.-H. 2013. Asteriscane-type sesquiterpenoids from the soft coral *Sinularia capillosa*. *Journal of natural Products* 76: 1753-1763.
Cleary, D.F.R., **Becking, L.E.**, **de Voogd, N.J.**, Pires, A.C.C., Polónia, A.R.M., Egas, C. & Gomes, N.C.M. 2013. Habitat- and host-related variation in sponge bacterial symbiont communities in Indonesian waters. *FEMS Microbiology Ecology* 85: 465-482.
Collet, P., Méléard, S. & **Metz, J.A.J.** 2013. A rigorous model study of the adaptative dynamics of Mendelian diploids. *Journal of Mathematical Biology* 67: 569-607.
Collinson, M.E., Smith, S.Y., **van Konijnenburg-van Cittert, J.H.A.**, Batten, D.J., **van der Burgh, J.**, Barke, J. & Marone, F. 2013. New observations and synthesis of Paleogene heterosporous water ferns. *International Journal of Plant Sciences* 174: 350-363.
Costello, M.J., Bouchet, P., Boxshall, G., Fauchald, K., Gordon, D., **Hoeksema, B.W.**, Poore, G.C.B., **van Soest, R.W.M.**, Stöhr, S., Walter, T.C., Vanhoorne, B., Decock, W. & Appeltans, W. 2013. Global coordination and standardisation in marine biodiversity through the World Register of Marine Species (WoRMS) and related databases. *PLOS ONE* 8: e51629.
David, P., Vogel, G. & **van Rooijen, J.** 2013. On some taxonomically confused species of the genus *Amphiesma* Duméril, Bibron & Duméril, 1854 related to *Amphiesma khasiense* (Boulenger, 1890) (Squamata, Natricidae). *Zootaxa* 3694: 301-335.
de Roos, A.M. & **Metz, J.A.J.** 2013. Ontogenetic symmetry and asymmetry in energetics. *Journal of Mathematical Biology.* 66: 889-914.
**de Voogd, N.J.**, Cleary, D.F.R. & Dekker, F. 2013. The coral-killing sponge *Terpios hoshinota* invades Indonesia. *Coral Reefs* 32: 755.
**de Winter, A.J.** & **Vastenhout, N.** 2013. Revision of the Afrotropical land snail genus *Avakubia* Pilsbry, 1919, with description of *Pseudavakubia* gen.n. and eleven new species (Gastropoda Pulmonata: Streptaxidae). *African Invertebrates* 54: 605-663.
**de Zeeuw M.P.**, Westbroek I., **van Oijen M.J.P.** & Witte, F. 2013. Two new species of zooplanktivorous haplochromine cichlids from Lake Victoria, Tanzania. *ZooKeys* 256: 1-34.
Dicks, L.V., Abrahams, A., Atkinson, J., **Biesmeijer, J.**, Bourn, N., Brown, C., Brown, M.J.F., Carvell, C., Connolly, C., Cresswell, J.E., Croft, P., Darvill, B., Zylva, P., Effingham, P., Fountain, M., Goggin, A., Harding, D., Harding, T., Hartfield, C., Heard, M.S., Heathcote, R., Heaver, D., Holland, J., Howe, M., Hughes, B., Huxley, T., Kunin, W.E., Little, J., Mason, C., Memmott, J., Osborne, J., Pankhurst, T., Paxton, R.J., Pocock, M.J.O., Potts, S.G., Power, E.F., Raine, N.E., Ranelagh, E., Roberts, S., Saunders, R., Smith, K., Smith, R.M., Sutton, P., Tilley, L.A.N., Tinsley, A., Tonhasca, A., Vanbergen, A.J., Webster, S., Wilson, A. & Sutherland, W.J. 2013. Identifying key knowledge needs for evidence-based conservation of wild insect pollinators: a collaborative cross-sectoral exercise. *Insect Conservation and Diversity* 6(3): 435-446.
**Dijkstra, H.H.** & Janssen, R. 2013. Bathyal and abyssal Pectinoidea from the Red Sea and Gulf of Aden (Bivalvia: Propeamussiidae, Entoliidae, Pectinidae). *Archiv für Molluskenkunde* 142: 181-214.
**Dijkstra, H.H.** & Maestrati, P. 2013. New species and new records of bathyal living Pectinoidea (Bivalvia: Propeamussiidae: Pectinidae) from the Southwest Pacific. *Zoosystema* 35: 469-479.
**Dijkstra, H.H.** & Maestrati, P. 2013. Pectinoidea (Bivalvia: Propeamussiidae, Entoliidae and Pectinidae) from the Tarava Seamounts, Society Islands and the Tuamotu Archipelago (French Polynesia). *Zoosystema* 35: 361-375.
**Dijkstra, K.-D.B.** 2013. Three new genera of damselflies (Odonata: Chlorocyphidae, Platycnemididae). *International Journal of Odonatology* 16: 269-274.
**Dijkstra, K.-D.B.**, Bechli, G.H.P., Bybee, S.M., **Dow, R.A.**, Dumont, H.J., Fleck, G., Garrison, R.W., Hamalainen, M., **Kalkman, V.J.**, Karube, H., May, M.L., Orr, A.G., Paulson, D.R., Rehn, A.C., Theischinger, G., Trueman, J.W.H., **van Tol, J.**, von Ellenrieder, N. & Ware, J. 2013. The classification and diversity of dragonflies and damselflies (Odonata). *Zootaxa* 3703: 36-45.
**Dijkstra, K.-D.B.** & **Kalkman, V.J.** 2013. The 'African' genus *Argiagrion* is a Brazilian *Leptagrion* species and the 'Philippine' *Moroagrion* a European *Pyrrhosoma* (Odonata: Coenagrionidae). *International Journal of Odonatology* 16: 189-191.
**Dijkstra, K.-D.B., Kalkman, V.J., Dow, R.A., Stokvis, F.R.** & **van Tol, J.** 2013. Redefining the damselfly families: the first comprehensive molecular phylogeny of Zygoptera (Odonata). *Systematic Entomology* 39: 68-96. doi: 10.1111/syen.12035.
**Donovan, S.K.** 2013. A distinctive bioglyph and its producer: Recent *Gastrochaenolites* Leymerie in a peat pebble, North Sea coast of the Netherlands. *Ichnos* 20: 109-111.
**Donovan, S.K.** 2013. Giant crinoid stems from the Lower Carboniferous (Mississippian) of Northwest England. *Proceedings of the Yorkshire Geological Society* 59: 211-218.
**Donovan, S.K.** 2013. Misinterpreting by localism: transposing European geology and tectonics onto Jamaica and the Antilles. *Proceedings of the Geologists' Association* 124: 530-535.
**Donovan, S.K.** 2013. The cladid crinoid *Cupressocrinites* Goldfuss in the Devonian of SW England. *Proceedings of the Yorkshire Geological Society* 59: 255-259.
**Donovan, S.K.** & Jagt, J.W.M. 2013. Aspects of clavate borings in the type Maastrichtian (Upper Cretaceous) of the Netherlands and Belgium. *Netherlands Journal of Geosciences* 92: 133-143.
**Donovan, S.K.** & Jagt, J.W.M. 2013. *Rogerella* sp. infesting the pore pairs of *Hemipneustes striatoradiatus* (Leske) (Echinoidea: Upper Cretaceous, Belgium). *Ichnos* 20: 153-156.
**Donovan, S.K.** & Jagt, J.W.M. 2013. Site selectivity of the pit *Oichnus excavatus* Donovan and Jagt infesting *Hemipneustes striatoradiatus* (Leske) (Echinoidea) in the Type Maastrichtian (Upper Cretaceous, The Netherlands). *Ichnos* 20: 112-115.
**Donovan, S.K.** & Paul, C.R.C. 2013. Late Pleistocene land snails from 'red bed' deposits, Round Hill, south central Jamaica. *Alcheringa* 37: 273-284.
**Donovan, S.K.** & Pawson, D.J. 2013. An intersection in time and space: significance of modern invertebrate borings in Upper Cretaceous echinoids. *Ichnos* 20: 81-87.
**Donovan, S.K.** & **van den Hoek Ostende, L.W.** 2013. *Roamerella*, a new name for the genus *Roemerella* Akopyan in Akopyan et al., 1990 (Mollusca, Gastropoda; Upper Cretaceous), preoccupied by *Roemerella* Hall and Clarke, 1890 (Brachiopoda, Lingulata; Devonian). *Cretaceous Research* 40: 1-2.
**Donovan, S.K.** & **van Waveren, I.M.** & Portell, R.W. 2013. Island slopes and jumbled shell beds. *Journal of the Geological Society* 170: 527-534.
**Donovan, S.K.** & Webster, G.D. 2013. Platyceratid gastropod infestations of *Neoplatycrinus* Wanner (Crinoidea) from the Permian of West Timor: speculations on thecal modifications. *Proceedings of the Geologists' Association* 124: 988-993.
Douka, K., Bergman, C.A., Hedges, R.E.M., **Wesselingh F.P.** & Higham, T.F.G. 2013. Chronology of the Ksar Akil (Lebanon) and implications for the colonization of Europe by anatomically modern humans. *PLOS ONE* 8: e72931.
Eguchi, K., Fujiwara, Y., Hayashida, A., Horlad, H., Kato, H., Rotinsulu, H., Losung, F., Mangindaan, R.E.P., **de Voogd, N.J.**, Takeya, M. & Tsukamoto, S. 2013. Manzamine A, a marine-derived alkaloid, inhibits accumulation of cholesterol ester in macrophages and suppresses hyperlipidemia and atherosclerosis in vivo. *Bioorganic & Medicinal Chemistry* 21: 3831-3838.
**Eurlings, M.C.M.**, **Lens, F.**, Pakusza, C., Peelen, T., **Wieringa, J.J.** & **Gravendeel, B.** 2013. Forensic identification of Indian Snakeroot (*Rauvolfia serpentina* Benth. ex Kurz) using DNA barcoding. *Journal of Forensic Sciences* 58: 822-830.
Evans, D., Müller, W., Oron, S. & **Renema, W.** 2013. Eocene seasonality and seawater alkaline earth reconstruction using shallow-dwelling large benthic foraminifera. *Earth and Planetary Science Letters* 381: 104-115.
**Fearnhead, F.E.**, **Donovan, S.K.** & Ewin, T.A.M. 2013. Palaeobiology of *Floricolumnus* (col.) *girvanensis* Donovan & Clark (Crinoidea: Silurian) from the Girvan district, Ayrshire. *Scottish Journal of Geology* 49: 1-7.
Feary, D.A., Burt, J.A., Bauman, A.G., Al Hazeem, S., Abdel-Moati, M.A., Al-Khalifa, K.A., Anderson, D.M., Amos, C.,

Baker, A., Bartholomew, A., Bento, R., Cavalcante, G.H., Chen, C.A., Coles, S.L., Dab, K., Fowler, A.M., George, D., Grandcourt, E., Hill, R., John, D.M., Jones, D.A., Keshavmurthy, S., Mahmoud, H., Moradi Och Tapeh, M., Mostafavi, P.G., Naser, H., Pichon, M., Purkis, S., Riegl, B., **Samimi-Namin, K.**, Sheppard, C., Vajed Samiei, J., Voolstra, C.R. & Wiedenmann, J. 2013. Critical research needs. for identifying future changes in Gulf coral reef ecosystems. *Marine Pollution Bulletin* 72: 406-416.

Fernández-Triana, J., Ward, D.F., Cardinal, S. & **van Achterberg, C.** 2013. A review of *Paroplitis* (Braconidae, Microgastrinae), and description of a new genus from New Zealand, *Shireplitis,* with convergent morphological traits. *Zootaxa* 3722: 549-568.

**Fransen, C.H.J.M.** 2013. A new species of the sponge-associated pontoniine shrimp genus *Nippontonia* Bruce & Bauer, 1997 (Decapoda, Caridea, Palaemonidae) from Sabah, Malaysia. *Zootaxa* 3694: 343-357.

**Fransen, C.H.J.M.** & Rauch, C. 2013. *Hamodactylus macrophthalmus* spec. nov., a new coral-associated pontoniine shrimp (Decapoda, Caridea, Palaemonidae) from Indonesia. *Zootaxa* 3635: 286-296.

**Fransen, C.H.J.M.**, de Grave, S. & Sakihara, T.S. 2013. New records of *Vetericaris chaceorum* (Decapoda, Procaridídea) from Hawai'i. *Crustaceana* 86: 625-631.

**Fransen, C.H.J.M.** & **Reijnen, B.T.** 2013. Caught in speciation? A new host for *Conchodytes meleagrinae* Peters, 1852 (Decapoda, Caridea, Palaemonidae). *Zootaxa* 3721: 265-280.

**Freudenthal, M.**, **van den Hoek Ostende, L.W.** & Martín-Suárez, E. 2013. When and how did the Mikrotia fauna reach Gargano (Apulia, Italy)? *Geobios* 46: 105-109.

Friedman, M. & **Brazeau, M.D.** 2013. Palaeontology: A jaw-dropping fossil fish. *Nature* 502: 175-177.

Garibaldi, L.A., Steffan-Dewenter, I., Winfree, R., Aizen, M.A., Bommarco, R., Cunningham, S.A., Kremen, C., **Carvalheiro, L.G.**, Harder, L.D., Afik, O., Bartomeus, I., Benjamin, F., Boreux, V., Cariveau, D., Chacoff, N.P., Dudenhöffer, J.H., Freitas, B.M., Ghazoul, J., Greenleaf, S., Hipólito, J., Holzschuh, A., Howlett, B., Isaacs, R., Javorek, S.K., Kennedy, C.M., Krewenka, K., Krishnan, S., Mandelik, Y., Mayfield, M.M., Motzke, I., Munyuli, T., Nault, B.A., Otieno, M., Petersen, J., Pisanty, G., Potts, S.G., Rader, R., Ricketts, T.H., Rundlöf, M., Seymour, C.L., Schüepp, C., Szentgyörgyi, H., Taki, H., Tscharntke, T., Vergara, C.H., Viana, B.F., Wanger, T.C., Westphal, C., Williams, N. & Klein, A.M. 2013. Wild pollinators enhance fruit set of crops regardless of honey-bee abundance. *Science* 339: 1608-1611.

Gathier, G., Peelen, T., van Vugt, R., **van der Niet, T.** & **Gravendeel, B.** 2013. Forensic Identification of CITES protected Slimming Cactus (*Hoodia gordonii*) in Traditional African Medicines (TAMs) using DNA barcoding. *Journal of Forensic Sciences* 58: 1467-1471.

Ghahramanzadeh, R., Esselink, G., Kodde. L.P., **Duistermaat, H.**, van Valkenburg, J.L.C.H., Marashi, S.H., Smulders, M.J.M. & van de Wiel, C.C.M. 2013. Efficient distinction of invasive aquatic plant species from non-invasive related species using DNA barcoding. *Molecular Ecology Resources* 13: 21-31.

Gholamhosseini, A., Vardakis, M., Aliabadian, M., Nijman, V. & **Vonk, R.** 2013. Hybridization between sister taxa versus non-sister taxa: a case study in birds. *Bird Study* 2013: 1-7.

Giannini, T.C., Chapman, D.S., Saraiva, A.M., Alves-dos-Santos, I. & **Biesmeijer, J.C.** 2013. Improving species distribution models using biotic interactions: a case study of parasites, pollinators and plants. *Ecography* 36(6): 649-656.

Giles, S., **Rücklin, M.** & Donoghue, P.C.J. 2013. Histology of the placoderm dermal skeleton: implications for the nature of the ancestral gnathostome. *Journal of Morphology* 274: 627-644.

**Gittenberger, A.** & **Hoeksema, B.W.** 2013. Habitat preferences of coral-associated wentletrap snails (Gastropoda: Epitoniidae). *Contributions to Zoology* 82: 1-25.

González-Varo, J.P., **Biesmeijer, J.C.**, Bommarco, R., Potts, S.G., Schweiger, O., Smith, H.G., Steffan-Dewenter, I., Szentgyörgyi, H., Woyciechowski, M. & Vilà, M. 2013. Combined effects of global change pressures on animal-mediated pollination. *Trends in Ecology and Evolution* 9: 524-530.

Hardisty, A., Roberts, D. & The Biodiversity Informatics Community [including **van Tol, J.** & **Sierra, S.E.C.**]. 2013. A decadal view of biodiversity informatics: challenges and priorities. *BMC Ecology* 13: 1-23.

Harrath, A.H., **Sluys, R.**, Aldahmash, W., Al-Razaki. A. & Alwasel, S. 2013. Reproductive strategies, karyology, parasites, and taxonomic status of Dugesia populations from Yemen (Platyhelminthes: Tricladida: Dugesiidae). *Zoological Science* 30: 502-508.

Hausmann, A., Godfray, H.C.J., Huemer, P., Mutanen, M., Rougerie, R., **van Nieukerken, E.J.**, Ratnasingham, S. & Hebert, P.D.N. 2013. Genetic patterns in European geometrid moths revealed by the Barcode Index Number (BIN) system. *PLOS ONE* 8: E84518.

Heinrichs, J., Dong, S., Schäfer-Verwimp, A., Pócs, T., Feldberg, K., Czumaj, A., Schmidt, A.R., Reitner J., Renner, M.A.M., Hentschel, J., **Stech, M.** & Schneider, H. 2013. Molecular phylogeny of the leafy liverwort *Lejeunea* (Porellales): Evidence for a Neotropical origin, uneven distribution of sexual systems and insufficient taxonomy. *PLOS ONE* 8: e82547.

Hendriks, R.J.J., **Carvalheiro, L.G.**, **Kleukers, R.M.J.C.** & **Biesmeijer, J.C.** 2013. Temporal-spatial dynamics in Orthoptera in relation to nutrient availability and plant species richness. *PLOS ONE* 8: e71736.

Heus, F., **Vonk, F.J.**, Otvos, R.A., Bruyneel, B., Smit, A.B., Lingeman, H., Richardson, M., Niessen, W.M. & Kool, J. 2013. An efficient analytical platform for on-line microfluidic profiling of neuroactive snake venoms towards nicotinic receptor affinity. *Toxicon* 61: 112-124.

Hoare, R.J.B. & **van Nieukerken, E.J.** 2013. Phylogeny and host-plant relationships of the Australian Myrtaceae leafmining moth genus *Pectinivalva* (Lepidoptera: Nepticulidae), with new subgenera and species. *ZooKeys* 278: 1-64.

Hoban, S., **Arntzen, J.W.**, Bertorelle, G., Bryja, J., Fernandes, M., Frith, K., Gaggiotti, O., Galbusera, P., Godoy, J.A., Hauffe, H.C., Hoelzel, A.R., Nichols, R.A., Perez-Espona, S., Primmer, C., Russo, I-R.M., Segelbacher, G., Siegismund, H.R., Sihvonen, M., Sjogren-Gulve, P., Vernesi, C., Vila, C. & Bruford, M.W. 2013. Conservation Genetic Resources for Effective Species Survival (ConGRESS): Bridging the divide between conservation research and practice. *Journal for Nature Conservation* 21: 433-437.

Hoban, S., Gaggiotti, O., ConGRESS Consortium [including **Arntzen, J.W.**] & Bertorelle, G. 2013. Sample planning optimization tool for conservation and population genetics (SPOTG): a software for choosing the appropriate number of markers and samples. *Methods in Ecology and Evolution* 4: 299-303.

Hoban, S.M., Hauffe, H.C., Perez-Espona, S., **Arntzen, J.W.**, Bertorelle, G., Bryja, J., Frith, K., Gaggiotti, O.E., Galbusera, P., Godoy, J.A., Hoelzel, A.R., Nichols, R.A., Primmer, C., Russo, I.-R.M., Segelbacher, G., Siegismund, H.R., Sihvonen, M., Vernesi, C., Vila, C. & Bruford, M.W. 2013. Bringing genetic diversity to the forefront of conservation policy and management. *Conservation Genetic Resources* 5 : 593-598.

**Hoeksema, B.W.** 2013. Erratum to: Extreme morphological plasticity enables a free mode of life in *Favia gravida* at Ascension Island (South Atlantic). *Marine Biodiversity* 43: 173.

**Hoeksema, B.W.** & Benzoni, F. 2013. Multispecies aggregations of mushroom corals in the Gambier Islands, French Polynesia. *Coral Reefs* 32: 1041.

**Hoeksema, B.W.**, Scott, C. & True, J.D. 2013. Dietary shift in corallivorous *Drupella* snails following a major bleaching event at Koh Tao, Gulf of Thailand. *Coral Reefs* 32: 423-428.

**Hoeksema, B.W.** & **van der Meij, S.E.T.** 2013. Editorial: Corals, reefs and marine biodiversity. *Marine Biodiversity* 43: 1-6.

**Hoeksema, B.W.** & **van der Meij, S.E.T.** 2013. Gall crab city: an aggregation of endosymbiotic crabs inhabiting a colossal colony of *Pavona clavus*. *Coral Reefs* 32: 59.

**Hoeksema, B.W.**, **Waheed, Z.** & Alamaru, A. 2013. Out of sight: aggregations of epizoic comb jellies underneath mushroom corals. *Coral Reefs* 32: 1065.

**Hoeksema, B.W.** & Wirtz, P. 2013. Over 130 years of survival by a small, isolated population of *Favia gravida* corals at Ascension Island (South Atlantic). *Coral Reefs* 32: 551.

Holwerda, F.M., Beatty, B.L. & **Schulp, A.S.** 2013. Dental macro- and microwear in *Carinodens belgicus*, a small mosasaur from the Type Maastrichtian. *Netherlands Journal of Geosciences* 92: 267-274.

Hynson, N.A., **Merckx, V.S.F.T.**, Perry, B. & Treseder, K.K. 2013. Identities and distributions of the co-invading ectomycorrhizal fungal symbionts of exotic pines in the Hawaiian Islands. *Biological Invasions* 15: 2373-2385.

Iannilli, V. & **Vonk, R.** 2013. A new ingolfiellid (Crustacea, Amphipoda, Ingolfiellidae) from an anchialine pool on Abd al Kuri Island, Socotra Archipelago, Yemen. *ZooKeys* 302: 1-12.

Igulu, M.M., Nagelkerken, I., **van der Velde, G.** & Mgaya, Y.D. 2013. Mangrove fish production is largely fuelled by external food sources: A stable isotope analysis of fishes at the individual, species and community levels from across the globe. *Ecosystems* 16: 1336-1352.

Ivanović, A., Aljančič, G. & **Arntzen, J.W.** 2013. Skull shape differentiation of black and white olms (*Proteus anguinus anguinus* and *Proteus a. parkelj*): an exploratory analysis with micro CT-scanning. *Contributions to Zoology* 82: 107-114.

Ivanović, A., Üzüm, N., **Wielstra, B.**, Olgun, K., Litvinchuk, S.N., Kalezić, M.L. & **Arntzen, J.W.** 2013. Is mitochondrial DNA divergence of Near Eastern crested newts (*Triturus karelinii* group) reflected by differentiation of skull shape? *Zoologischer Anzeiger* 252: 269-277.

Janssen, R., van Baal, R.R. & **Schulp, A.S.** 2013. Bone damage in *Allopleuron hofmanni* (Cheloniidae, Late Cretaceous). In: Mulder, E.W.A., Jagt, J.W.M. & Schulp, A.S. (eds.), The Sunday's child of Dutch earth sciences - a tribute to Bert Boekschoten on the occasion of his 80th birthday. *Netherlands Journal of Geosciences* 92: 153-157.

Kabiri, K., Pradhan, B., **Samimi-Namin, K.** & Moradi, M. 2013. Detecting coral bleaching, using QuickBird multi-temporal data: A feasibility study at Kish Island, the Persian Gulf. *Estuarine, Coastal and Shelf Science* 117: 273-281.

Kabiri, K., Pradhan, B., Shafri, H.Z.M., Mansor, S.B. & **Samimi-Namin, K.** 2013. A novel approach to estimate diffuse attenuation coefficients for QuickBird satellite images: A case study at Kish Island, the Persian Gulf. *Journal of the Indian Society of Remote Sensing* 41: 797-806.

**Kalkman, V.J.,** Richards, S.J. & Polhemus, D.A. 2013. Two new species of Pyrrhargiolestes, with a key to the males (Odonata: Argiolestidae). *International Journal of Odonatology* 16: 53-65.

**Kalkman, V.J.** & Theischinger, G. 2013. Generic revision of Argiolestidae (Odonata), with four new genera. *International Journal of Odonatology* 16: 1-52.

**Kappes, H.** 2013. Genetics and morphology of the genus *Tritetrabdella* (Hirudinea, Haemadipsidae) from the mountainous rain forests of Sabah, Borneo, reveal a new species with two new subspecies. *Contributions to Zoology* 82: 185-197.

**Karremans, A.P.**, Bakker, F.T., Pupulin, F., Solano-Gómez, R. & Smulders, M.J.M. 2013. Phylogenetics of *Stelis* and closely related genera (Orchidaceae: Pleurothallidinae). *Plant Systematics and Evolution* 29: 151-176.

**Karremans, A.P.** & Bogarín, D. 2013. Three new species of *Dracontia* (Pleurothallidinae, Orchidaceae) from Costa Rica. *Systematic Botany* 38: 307-315.

Kartonegoro, A. & **Veldkamp, J.F.** 2013. A revision of *Creochiton* (Melastomataceae). *Blumea* 58: 217-227.

Kennedy, C.M., Lonsdorf, E., Neel, M.C., Williams, N.M., Ricketts, T.H., Winfree, R., Bommarco, R., Brittain, C., Burley, A.L., Cariveau, D., **Carvalheiro, L.G.**, Chacoff, N.P., Cunningham S.A. *et al*. 2013. A global quantitative synthesis of local and landscape effects on native bee pollinators across heterogeneous agricultural systems. *Ecology Letters*: 16: 584-599.

Kiran Raj, M.S., Sivadasan, M., **Veldkamp, J.F.**, Alfarhan, A.H. & Thomas, J. 2013. *Nanooravia*, a new genus of the subtribe Dimeriinae (Poaceae–Panicoideae–Andropogoneae) from India. *Nordic Journal of Botany* 31: 161-165.

Kiran Raj, M.S., Sivadasan, M., **Veldkamp, J.F.**, Alfarhan, A.H. & Thomas, J. 2013. Validation of *Nanooravia santapaui* (Poaceae-Panicoidese-Andropogoneae-Dimeriinae). *Nordic Journal of Botany* 31: 638.

Klietmann, J., Metscher, B.D., **van den Hoek Ostende, L.W.**, Nagel, D. & Rummel, M. 2013. First record of an upper deciduous molar in *Desmanella* (Uropsilinae, Talpidae, Mammalia). *Geobios* 46: 503-510.

Klietmann, J., Nagel, D., Rummel, M. & **van den Hoek Ostende, L.W.** 2013. Tiny teeth of consequence: Vestigal antemolars provide key to Early Miocene soricid taxonomy (Eulipotyphla: Soricidae). *Comptus Rendus Palevol* 12: 257-267.

**Koene, J.M.**, **Liew, T.S.**, Montagne-Wajer, K. & **Schilthuizen, M.** 2013. A syringe-like love dart injects male accessory gland products in a tropical hermaphrodite. *PLOS ONE* 8: e69968.

Kozlov, M.V., **van Nieukerken, E.J.**, Zverev, V. & Zvereva, E.L. 2013. Abundance and diversity of birch-feeding leafminers along latitudinal gradients in Northern Europe. *Ecography* 36: 1138-1149.

**Krikken, J.** 2013. Distinguishing *Bolboceras inaequale* Westwood, 1848 and two new relatives from India (Coleoptera, Geotrupidae, Bolboceratinae). *ZooKeys* 276: 55-66.

**Krikken, J.** & **Huijbregts, J.** 2013. New Guinea *Onthophagus*: taxonomy of ten small, unicolored new species (Coleoptera: Scarabaeidae: Scarabaeinae). *Zootaxa* 3619: 501-525.

**Krikken, J.** & Li, C.-L. 2013. Taxonomy of the Oriental genus *Bolbochromus*: a generic overview and descriptions of four new species (Coleoptera: Geotrupidae: Bolboceratinae). *Zootaxa* 3731: 495-519.

Lai, D., Geng, Z., Deng, Z., **van Ofwegen, L.**, Proksch, P. & Lin, W. 2013. Cembranoids from the soft coral *Sinularia rigida* with antifouling activities. *Journal of Agricultural and Food Chemistry* 61: 4585-4592.

**Lammers, Y.**, Kremer, D., Brakefield P.M., **Groenenberg, D.S.J.**, Pirovano, W. & **Schilthuizen, M.** 2013. SNP genotyping for detecting the 'rare allele phenomenon' in hybrid zones. *Molecular Ecology Resources* 13: 237-242.

Larrain, J., Quandt, D., **Stech, M.** & Muñoz, J. 2013. Lumping or splitting? The case of *Racomitrium* (Bryophytina: Grimmiaceae). *Taxon* 62: 1117–1132.

Lefranc, F., Nuzzo, G., Hamdy, N.A., Fakhr, I., Moreno y Banuls, L., van Goietshoven, G., Villani, G., Matthieu, V., **van Soest, R.**, Kiss, R. & Ciavatta, M.L. 2013. In vitro pharmacological and toxicological effects of norterpene peroxides isolated from the Red Sea sponge *Diacarnus erythreanus* on normal and cancer cells. *Journal of Natural Products* 76: 1541-1547.

**Lens, F.**, **Davin, N.**, **Smets, E.** & del Arco, M. 2013. Insular woodiness on the Canary Islands: a remarkable case of convergent evolution. *International Journal of Plant Sciences* 174: 992-1013.

**Lens, F.**, Tixier, A., Cochard, H., Sperry, J.S., Jansen, S. & Herbette, S. 2013. Embolism resistance as a key mechanism to understand plant adaptive strategies. *Current Opinion in Plant Biology* 16: 287-292.

Li, C-L, Yang, P-S, **Krikken, J.** & Wang, C-C. 2013. Three new species of *Bolbochromus* Boucomont (Coleoptera, Geotrupidae, Bolboceratinae) from Southeast Asia. *ZooKeys* 290: 39-54.

Li, X.Y., **van Achterberg, C.** & Tan, J.-C. 2013. Revision of the subfamily Opiinae (Hymenoptera, Braconidae) from Hunan (China), including thirty-six new species and two new genera. *ZooKeys* 268: 1-186.

Liu, H.-M., Jiang, R.-H., Guo, J., **Hovenkamp, P.**, Perrie, L.R., Shepherd, L., Hennequin, S. & Schneider, H. 2013. Towards a phylogenetic classification of the climbing fern genus *Arthropteris*. *Taxon* 62: 668-700.

Lomolino, M.V., **van der Geer, A.A.E.**, Lyras, G.A., Palombo, M.R., Sax, D. & Rozzi, R. 2013. Of mice and mammoths: generality and antiquity of the island rule. *Journal of Biogeography* 40: 1427-1439.

LPWG (= Borges, L., Bruneau, A., Cardoso, D., Crisp, M., Delgado-Salinas, A., Doyle, J.J., Egan, A., Herendeen, P.S., Hughes, C., Kenicer, G., Klitgaard, B., Koenen, E., Lavin, M., Lewis, G., Luckow, M., Mackinder, B., Malécot, V., Miller, J.T., Pennington, R.T., de Queiroz, L.P., Schrire, B., Simon, M.F., Steele, K., Torke, B., **Wieringa, J.J.**, Wojciechowski, M.F., Boatwright, S., de la Estrella, M., de Freitas Mansano, V., Prado, D.E., Stirton, C. & Wink, M.). 2013. Towards a new classification system for legumes: Progress report from the 6th International Legume Conference. *South African Journal of Botany* 89: 3-9.

LPWG (= Bruneau, A., Doyle, J.J., Herendeen, P., Hughes, C., Kenicer, G., Lewis, G., Mackinder, B.A., Pennington, R.T., Sanderson, M.J., Wojciechowski, M.F., Boatwright, S., Brown, G., Cardoso, D., Crisp, M., Egan, A., Fortunato, R.H., Hawkins, J., Kajita, T., Klitgaard, B., Koenen, E., Lavin, M., Luckow, M., Marazzi, B., McMahon, M.M., Miller, J.T., Murphy, D.J., Ohashi, H., de Queiroz, L.P., Rico, L., Särkinen, T., Schrire, B., Simon, M.F., Souza, E.R., Steele, K., Torke, B.M., **Wieringa, J.J.** & van Wyk, B.-E.). 2013. Legume phylogeny and classification in the 21st century: Progress, prospects and lessons for other species-rich clades. *Taxon* 62: 217-248.

Mackinder, B.A., Saslis-Lagoudakis, H., **Wieringa, J.J.**, Devey, D., Forest, F. & Bruneau, A. 2013. The tropical African legume *Scorodophloeus* clade includes two undescribed *Hymenostegia* segregate genera and *Micklethwaitia*, a rare, monospecific genus from Mozambique. *South African Journal of Botany* 89: 156-163.

Mackinder, B.A. & **Wieringa, J.J.** 2013. *Annea* gen. nov. (Detarieae, Caesalpinioideae, Leguminosae): a home for two species long misplaced in *Hymenostegia* sensu lato. *Phytotaxa* 142: 1-14.

Mackinder, B.A. & **Wieringa, J.J.** 2013. *Hymenostegia viridiflora* (Detarieae, Caesalpinioideae, Leguminosae), a new tree species from Cameroon. *Blumea* 58: 13-17.

Magni, P., Rajagopal, S., Como, S., Jansen, J.M., **van der Velde, G.** & Hummel, H. 2013. δ13C and δ15N variations in organic matter pools, *Mytilus* spp. and *Macoma balthica* along the European Atlantic coast. *Marine Biology* 160: 541-552.

McFadden, C.S. & **van Ofwegen, L.P.** 2013. A second, cryptic species of the soft coral genus *Incrustatus* (Anthozoa: Octocorallia: Clavulariidae) from Tierra del Fuego, Argentina, revealed by DNA barcoding. *Helgoland Marine Research* 67: 137-147.

McFadden, C.S. & **van Ofwegen, L.P.** 2013. Molecular phylogenetic evidence supports a new family of octocorals and a new genus of Alcyoniidae (Octocorallia, Alcyonacea). *ZooKeys* 346: 59-83.

**Meijer, H.J.M.**, Sutikna, T., Saptomo, W.E., Due, R.A., Wasisto, S., James, H.F., Morwood, M.J. & Tocheri, M.W. 2013. Late Pleistocene-Holocene non-Passerine Avifauna of Liang Bua (Flores, Indonesia). *Journal of Vertebrate Paleontology* 33: 877-894.

Mejia, E., Magranet, L.B., **de Voogd, N.J.**, Ten Dyke, K., Qiu, D., Shen, Y.Y., Zhou, Z. & Crews, P. 2013. Structures and cytotoxic evaluation of new and known acyclic ene-ynes from and American Samao *Petrosia* sp. sponge. *Journal of Natural Products* 76: 425-432.

**Mennes, C.B.**, **Smets, E.F.**, Moses, S.N. & **Merckx, V.S.F.T.** 2013. New insights in the long-debated evolutionary history of Triuridaceae (Pandanales). *Molecular Phylogenetics and Evolution* 69: 994-1004.

**Merckx, V.S.F.T.**, Kissling, J., Hentrich, H., Janssens, S.B., **Mennes, C.B.**, Specht, C.D. & **Smets, E.F.** 2013. The phylogenetic relationships of the mycoheterotrophic genus *Voyria* and the implications for the biogeographic history of the Gentianaceae. *American Journal of Botany* 100: 712-721.

Mestre, A., Aguilar-Alberola, J.A., Baldry, D., Balkis, H., Ellis, A., Gil-Delgado, J.A., Grabow, K., Klobucar, G., Kouba, A., Maguire, I., Martens, A., Mulayim, A., Rueda, J., Scharf, B., **Soes, M.**, Monros, J.S. & Mesquita-Joanes, F. 2013. Invasion biology in non-free-living species: interactions between abiotic (climatic) and biotic (host availability) factors in geographical space in crayfish commensals (Ostracoda, Entocytheridae). *Ecology and Evolution* 3: 5237-5253.

**Metz, J.A.J.** 2013. On the concept of individual in ecology and evolution. *Journal of Mathematical Biology.* 66: 635-647.

**Metz, J.A.J.** & de Kovel, C.G.F. 2013. The canonical equation of adaptive dynamics for Mendelian diploids and haplodiploids. *Interface Focus* 3: 20130025.

**Metz, J.A.J.** & Tran, V.C. 2013. Daphnias: from the individual based model to the large population equation. *Journal of Mathematical Biology* 66: 915-933.

**Miller, J.A.**, **Beentjes, K.K.**, **van Helsdingen, P.** & IJland, S. 2013. Which specimens from a museum collection will yield DNA barcodes? A time series study of spiders in alcohol. In: Nagy Z.T., Backeljau T., de Meyer M., Jordaens, K. (eds.), DNA barcoding: a practical tool for fundamental and applied biodiversity research. *ZooKeys* 365: 245-261.

Mitroiu, D. & **van Achterberg, C.** 2013. Revision of the Oriental species of *Apsilocera* Bouček (Hymenoptera, Pteromalidae), with description of twelve new species. *Zootaxa* 3717: 448-468.

**Morgado, L.N.**, **Noordeloos, M.E.**, Lamoureux, Y. & **Geml, J.** 2013. Multi-gene phylogenetic analyses reveal species limits, phylogeographic patterns, and evolutionary histories of key morphological traits in *Entoloma* (Agaricales, Basidiomycota). *Persoonia* 31: 159-178.

**Mota de Oliveira, S.** & **ter Steege, H.** 2013. Floristic overview of the epiphytic bryophytes of terra firme forests across the Amazon basin. *Acta Botanica Brasilica* 27: 347-363.

Mulder, E.W.A., Formanoy, P., Gallagher, W.B., Jagt, J.W.M. & **Schulp, A.S.** 2013. The first North American record of *Carinodens Belgicus* (Squamata, Mosasauridae) and correlation with the youngest in situ examples from the Maastrichtian type area: palaeoecological implications. In: Mulder, E.W.A., Jagt, J.W.M., & Schulp, A.S. (eds.). The Sunday's child of Dutch earth sciences – a tribute to Bert Boekschoten on the occasion of his 80th birthday. *Netherlands Journal of Geosciences* 92: 145-152.

Musters, K., **Kalkman, V.J.** & van Strien, A. 2013. Predicting rarity and trend of animals, plants and fungi using a universal list of traits and indicator groups. *Ecology and Evolution*: 3: 3401-3414 doi: 10.1002/ece3.699.

Nguyen, T.T., Martel, A., Brutyn, M., Bogaerts, S., **Sparreboom, M.**, Haesebrouck, F., Fisher, M.C., Beukema, W., Duong Van, T., Chiers, K. & Pasmans, F. 2013. A survey for *Batrachochytrium dendrobatidis* in endangered and highly susceptible Vietnamese salamanders (*Tylototriton* spp.). *Journal of Zoo and Wildlife Medicine* 44: 627-633.

**Novak, V.**, **Santodomingo, N.**, Rösler, A., Di Martino, E., Braga, J.C., Taylor, P.D., Johnson, K.G. & **Renema, W.** 2013. Environmental reconstruction of a late Burdigalian (Miocene) patch reef in deltaic deposits (East Kalimantan, Indonesia). *Palaeogeography, Palaeoclimatology, Palaeoecology* 374: 110-122.

Orr, A.G., **Kalkman, V.J.** & Richards, S.J. 2014. Four new species of *Palaiargia* Förster, 1903 (Odonata: Platycnemididae) from New Guinea with revised distribution records for the genus. *International Journal of Odonatology* 16: 309-325.

Otvos, R.A., Heus, F., **Vonk, F.J.**, Halff, J., Bruyneel, B., Paliukhovich, I., Smit, A.B., Niessen, W.M. & Kool, J. 2013. Analytical workflow for rapid screening and purification of bioactives from venom proteomes. *Toxicon* 76: 270-281.

Outomuro, D., **Dijkstra, K.-D.B.** & Johansson, F. 2013. Habitat variation and wing coloration affect wing shape evolution in dragonflies. *Journal of Evolutionary Biology* 26: 1866-1874.

Paalvast, P. & **van der Velde, G.** 2013. What is the main food source of the shipworm (*Teredo navalis*)? A stable isotope approach. *Journal of Sea Research* 80: 58-60.

Panahiazar, M., Sheth, A.P., Ranabahu, A., **Vos, R.A.** & Leebens-Mack, J. 2013. Advancing data reuse in phyloinformatics using an ontology-driven semantic web approach. *BMC Medical Genomics* 6 (Suppl 3): S5.

Peccoud, J., Piatscheck, F., Yockteng, R., Garcia, M., Sauve, M., Djiéto-Lordon, C., Harris, D.J., **Wieringa, J.J.**, Breteler, F.J., Born, C., McKey, D. & Blatrix, R. 2013. Multi-locus phylogenies of the genus *Barteria* (Passifloraceae) portray complex patterns in the evolution of myrmecophytism. *Molecular Phylogenetics and Evolution* 66: 824-832.

**Peijnenburg, K.T.C.A.** & Goetze, E. 2013. High evolutionary potential of marine zooplankton. *Ecology & Evolution* 3: 2765-2783.

Pérez-Harguindeguy, N., Díaz, S., Garnier, E., Lavorel, S., Poorter, H., Jaureguiberry, P., Bret-Harte, M.S., Cornwell, W.K., Craine, J.M., Gurvich, D.E., Urcelay, C., Veneklaas, E.J., Reich, P.B., Poorter, L., Wright, I.J., Ray, P., Enrico, L., Pausas, J.G., de Vos, A., Buchmann, N., Funes, G., Quetier, F., Hodgson, J.G., Thompson, K., Morgan, H.D., **ter Steege, H.**, van der Heijden, M.G.A. , Sack, L., Blonder, B., Poschlod, P., Vaieretti, V., Conti, G., Staver, A.C., Aquino, S. & Cornelissen, J.H.C. 2013. New handbook for standardized measurement of plant functional traits worldwide. *Australian Journal of Botany* 61, 167-234.

Pešić, V., Cook, D., Gerecke, R. & **Smit, H.** 2013. The water mite family Mideopsidae (Acari: Hydrachnidia): a contribution to the diversity in the Afrotropical region and taxonomic changes above species level. *Zootaxa* 3720: 1-75.

Pham, C.D., Hartmann, R., Muller, W.E.G., **de Voogd, N.J.**, Lai, D. & Proksch, P. 2013. Aaptamine derivatives from the Indonesian sponge *Aaptos suberitoides*. *Journal of Natural Products* 76: 103-106.

Polce, C., Termansen, M., **Aguirre-Gutiérrez, J.**, Boatman, N.D., Budge, G.E., Crowe, A., Garratt, M.P., Pietravalle, S., Potts, S.G., Ramirez, J.A., Somerwill, K.E. & **Biesmeijer, J.C.** 2013. Species distribution models for crop pollination: A modelling framework applied to Great Britain. *PLOS ONE* 8: e76308.

Racey, P.A., Hutson, A.M. & **Lina, P.H.C.** 2013. Bat rabies, public health and European bat conservation. *Zoonoses and Public Health. Special bat Issue* 50: 58-86.

**Raes, N.**, Saw, L.G., **van Welzen, P.C.** & Yahara, T. 2013. Legume diversity as indicator for botanical diversity on Sundaland, Southeast Asia. *South African Journal of Botany* 89: 265-272.

Ramanjooloo, A., Beedessee, G., Arya, D., **van Soest, R.W.M.**, Cretseil, T. & Marie, D.E.P. 2013. The apoptotic activity of one VLC fraction of the sponge *Petrosia tuberosa* on human cervical cells and the subsequent isolation of a bioactive polyacetylene. *Natural Product Communications* 8: 635-638.

**Reemer, M.** 2013. Taxonomic exploration of Neotropical Microdontinae (Diptera: Syrphidae) mimicking stingless bees. *ZooTaxa* 3697: 1-88.

**Reemer, M.** & Ståhls, G. 2013. Generic revision and species classification of the Microdontinae (Diptera: Syrphidae). *ZooKeys* 288: 1-213.

**Reemer, M.** & Ståhls, G. 2013. Phylogenetic relationships of Microdontinae (Diptera: Syrphidae) based on molecular and morphological characters. *Systematic Entomology* 38: 661-688.

Reichgelt, T., Parker, W.G., **van Konijnenburg-van Cittert, J.H.A.**, Martz, J.W. & Kürschner, W.M. 2013. The palynology of the Sonsela member (Late Triassic, Norian) at Petrified Forest NP, Arizona, USA. *Review Palaeobotany Palynology* 189: 18-28.

**Renema, W.**, Beaman, R.J. & Webster, J.D. 2013. Mixing of relict and modern tests of larger benthic foraminifera on the Great barrier Reef shelf margin. *Marine Micropaleontology* 101: 68-75.

Reumer, B.M., **van Alphen, J.J.M.** & Kraaijeveld, K. 2013. Population genetics of *Wolbachia*-infected, parthenogenetic and uninfected, sexual populations of *Tetrastichus coeruleus* (Hymenoptera: Eulophidae). *Molecular Ecology* 22: 4433-4444.

Rodrigues, H.D.D., Moreira, F.F.F., **Nieser, N., Chen, P.-p.**, Melo, A.L., Dias-Silva, K. & Giehl, N.F.S. 2013. The genus *Paravelia* Breddin, 1898 (Hemiptera: Heteroptera: Veliidae) in Brazil, with descriptions of eight new species. *Zootaxa* 3784(1): 001-047.

Rozzi, R., Winkler, D.E., **de Vos, J.**, Schulz, E. & Palombo, M.R. 2013. The enigmatic bovid *Duboisia santeng* (Dubois, 1891) from the Early-Middle Pleistocene of Java: A multiproxy approach to its paleoecology. *Palaeogeography, Palaeoclimatology, Palaeoecology* 377: 73-85.

Rueffler, C. & **Metz, J.A.J.** 2013. Necessary and sufficient conditions for R0 to be a sum of contributions of fertility loops. *Journal of Mathematical Biology* 66: 635-647.

Rueffler, C., **Metz, J.A.J.** & **van Dooren, T.J.M.** 2013. What life cycle graphs can tell about the evolution of life histories. *Journal of Mathematical Biology* 66: 225-279.

Sakai, E., Kato, H., Rotinsulu, H., Losung, F., Mangindaan, R.P., **de Voogd, N.**, Yokosawa, H. & Tsukamoto, S. 2013. Variabines A and B: new β-carboline alkaloids from the marine sponge *Luffariella variabilis*. *Journal of Natural Medicines* 68: 215-219.

Sandrock, C., Tanadini, L.G., Pettis, J.S., **Biesmeijer, J.C.**, Potts, S.G. & Neumann, P. 2013. Sublethal neonicotinoid insecticide exposure reduces solitary bee reproductive success. *Agricultural and Forest Entomology* 16: 119-128.

**Santodomingo, N.**, Reyes, J., Flórez, P., Chacón-Gómez, I.C., **van Ofwegen, L.P.** & **Hoeksema, B.W.** 2013. Diversity and distribution of azooxanthellate corals in the Colombian Caribbean. *Marine Biodiversity* 43: 7-22.

Sauvage, T., Payri, C., Draisma, S.G.A., **Prud'homme van Reine, W.F.**, Verbruggen, H., Belton, G.S., Gurgel, C.F.D., Gabriel, D., Sherwood, A.R. & Fredericq, S. 2013. Molecular diversity of the *Caulerpa racemosa-Caulerpa peltata* complex (Caulerpaceae, Bryopsidales) in New Caledonia, with new Australian records for *C. racemosa* var. *cylindracea. Phycologia* 52: 6-13.

Sawasdee, K., **Chaowasku, T.**, Lipipun, V., Dufat, T.H., Michel, S. & Likhitwitayawuid, K. 2013. Neolignans from leaves of *Miliusa mollis. Fitoterapia* 85: 49-56.

Sawasdee, K., **Chaowasku, T.**, Lipipun, V., Dufat, T.H., Michel, S. & Likhitwitayawuid, K. 2013. New neolignans and a lignan from *Miliusa fragrans,* and their anti-herpetic and cytotoxic activities. *Tetrahedron Letters* 54: 4259-4263.

**Schilthuizen, M.** 2013. Rapid, habitat-related evolution of land snail colour morphs on reclaimed land. *Heredity* 101: 247-252.

**Schilthuizen, M.** 2013. Something gone awry: unsolved mysteries in the evolution of asymmetric animal genitalia. *Animal Biology* 63: 1-20.

**Schilthuizen, M.** & Kellermann, V. 2013. Contemporary climate change and terrestrial invertebrates: evolutionary versus plastic changes. *Evolutionary Applications* 7: 56-67.

**Schilthuizen, M.** & **Lammers, Y.** 2013. Hybrid zones, barrier loci, and the 'rare allele phenomenon'. *Journal of Evolutionary Biology* 26: 288-290.

**Schilthuizen, M.**, **Liew, T.S.**, Liew, T.H., Berlin, P. King, J.P. & Lakim, M. 2013. Species diversity patterns in insular land snail communities of Borneo. *Journal of the Geological Society* 170: 539-545.

Scholz, A., Rabaey, D., Stein, A., Cochard, H., **Smets, E.** & Jansen, S. 2013. The evolution and function of vessel and pit characters with respect to cavitation resistance across 10 *Prunus* species. *Tree Physiology* 33: 684-694.

**Schulp, A.S.**, Schouten, R., Metten, L., van de Sande, A. & Bontenbal, A. 2013. Tracking consolidant penetration into fossil bone using neutron radiography. In: Mulder, E.W.A., Jagt, J.W.M. & Schulp, A.S. (eds.): The Sunday's child of Dutch earth sciences - a tribute to Bert Boekschoten on the occasion of his 80th birthday. *Netherlands Journal of Geosciences* 92: 177-180.

**Schulp, A.S.**, Vonhof, H.B., van der Lubbe, J.H.J.L., Janssen, R. & van Baal, R.R. 2013. On diving and diet: resource partitioning in type-Maastrichtian mosasaurs. In: Mulder, E.W.A., Jagt, J.W.M. & Schulp, A.S. (eds.), The Sunday's child of Dutch earth sciences - a tribute to Bert Boekschoten on the occasion of his 80th birthday. *Netherlands Journal of Geosciences* 92: 165-170.

Semenov, A.V., van Elsas, J.D., Glandorf, D.C.M., **Schilthuizen, M.** & de Boer, W.F. 2013. The use of statistical tools in field testing of putative effects of genetically modified plants on nontarget organisms. *Ecology & Evolution* 3: 2739-2750.

Shackelford, G., Steward, P.R., Benton, T.G., Kunin, W.E., Potts, S.G., **Biesmeijer, J.C.** & Sait, S.M. 2013. Comparison of pollinators and natural enemies: a meta-analysis of landscape and local effects on abundance and richness in crops. *Biological Reviews* 88: 1002-1021.

Shimizu, K., Iijima, M., Setiamarga, D.H.E., Sarashina, I., Kudoh, T., Asami, T., **Gittenberger, E.** & Endo, K., 2013. Left-right asymmetric expression of dpp in the mantle of gastropods correlates with asymmetric shell coiling. *EvoDevo* 4: 1-7.

Shirouzu, T., Watari, K., Ono, M., Koizumi, K., Saiki, I., Tanaka, C., **van Soest, R.W.M.** & Miyamoto, T. 2013. Structure, synthesis, and biological activity of a C-20 bisacetylenic alcohol from a marine sponge *Callyspongia* sp. *Journal of Natural Products* 76: 1337-1342.

Simaika, J.P., Samways, M.J., Kipping, J., Suhling, F. **Dijkstra, K.-D.B.**, Clausnitzer, V., Boudot J.-P. & Domisch, S. 2013. Continental-scale conservation prioritization of African dragonflies. *Biological Conservation* 157: 245-254.

**Sirichamorn, Y.**, **Adema, F.A.C.B.** & **van Welzen, P.C.** 2013. Proposal to conserve the name *Brachypterum* against *Solori* (Fabaceae). *Taxon* 62: 179-180.

Slik, F., Paoli, G., McGuire, K., Amaral, I., Barroso, J., Bastian, M., Blanc, L., Bongers, F., Boundja, P., Clark, C., Collins, M., Dauby, G., Ding, Y., Doucet, J.-L., Eler, E., Ferreira, L., Forshed, O., Frederiksson, G., Gillet, J.-F., Harris, D., Leal, M., Laumonier, Y., Malhi, Y., Mansor, A., Martin, E., Araujo-Murakami, A., Miyamoto, K., Nagamasu, H., Nilus, R., Nurtjahya, E., Oliveira, A., Onrizal, O., Parada-Gutierrez, A., Permana, A., Poorter, L., Poulsen, J., Ramírez, H., Reitsma, J., Rovero, F., Rozak, A., Sheil, D., Silva-Espejo, J., Silveira, M., Spironelo, W., **ter Steege, H.**, Stevart, T., Aguilar, G., Sunderland, T., Suzuki, E., Tang, J., Theilade, I., Heijden, G., Valkenburg, J., Do, T., Vilanova, E., Vos, V., Wich, S., Woll, H., Yoneda, T., Zang, R., Zhang, M.-G. & Zweifel, N. 2013. Large trees drive forest aboveground biomass variation in moist lowland forests across the tropics. *Global Ecology and Biogeography* 22: 1261-1271.

Slupik, A.A., **Wesselingh, F.P.**, Mayhew, D.F., **Janse, A.C.**, **Dieleman, F.E.**, van Strydonck, M., Kiden, P., Burger, A.W. & Reumer, J.W.F. 2013. The role of a proto-Schelde River in the genesis of the Southwestern Netherlands, inferred from the Quaternary successions and fossils in Moriaanshoofd Borehole (Zeeland, the Netherlands). *Netherlands Journal of Geosciences* 92: 69-85.

**Sluys, R.** 2013. The unappreciated, fundamentally analytical nature of taxonomy and the implications for the inventory of biodiversity. *Biodiversity and Conservation* 22: 1095-1105.

**Sluys, R.**, Solà, E., Gritzalis, K., Vila-Farré, M., Mateos, E. & Riutort, M. 2013. Integrative delineation of species of Mediterranean freshwater planarians (Platyhelminthes: Tricladida: Dugesiidae). *Zoological Journal of the Linnean Society* 169: 523-547.

**Smit, H.** 2013. New records of water mites mainly from Vogelkop, New Guinea (Acari: Hydrachnidia), with the description of one new genus and thirteen new species. *Zootaxa* 3716: 207-235.

**Smit, J.**, **Reijnen, B.T.** & **Stokvis, F.R.** 2013. Half of the European fruit fly species barcoded (Diptera, Tephritidae); a feasibility test for molecular identification. *Zookeys* 365: 279-305.

Solà, E., **Sluys, R.**, Gritzalis, K. & Riutort, M. 2013. Fluvial basin history in the Northeastern Mediterranean region underlies dispersal and speciation patterns in the genus *Dugesia* (Platyhelminthes, Tricladida, Dugesiidae). *Molecular Phylogenetics and Evolution* 66: 877-888.

**Sosef, M.S.M.** 2013. The genus *Idertia* (Ochnaceae). *Plant Ecology and Evolution* 146: 351-359.

Spikmans, F., van Tongeren, T., van Alen, T.A., **van der Velde, G.** & Op den Camp, H.J.M. 2013. High prevalence of the parasite *Sphaerothecum destruens* in the invasive top-mouth gudgeon *Pseudorasbora parva* in the Netherlands, a potential threat to native freswater fish. *Aquatic Invasions* 8: 355-360.

Staats, M., **Erkens, R.H.J.**, van de Vossenberg, B., **Wieringa, J.J.**, Kraaijeveld, K., Stielow, B., **Geml, J.**, Richardson, J.A. & Bakker, F.T. 2013. Genomic treasure troves: Complete genome sequencing of herbarium and insect museum specimens. *PLOS ONE* 8: e69189.

**Stech, M.**, **Veldman, S.**, Larraín, J., Muñoz, J., Quandt, D., Hassel, K. & **Kruijer, J.D.** 2013. Molecular species delimitation in the *Racomitrium canescens* complex (Grimmiaceae) and implications for DNA barcoding of species complexes in mosses. *PLOS ONE* 8: e53134.

Stocchino, G., **Sluys, R.**, Deri, P. & Manconi, R. 2013. Integrative taxonomy of a new species of planarian from the Lake Ohrid basin, including an analysis of biogeographical patterns in freshwater triclads from the Ohrid region (Platyhelminthes, Tricladida, Dugesiidae). *ZooKeys* 313: 25-43.

Stocchino, G., **Sluys, R.**, Marcia, P. & Manconi, R. 2013. Subterreanean aquatic planarians of Sardinia, with a discussion on the penial flagellum and the bursal canal sphincter in the genus *Dendrocoelum* (Platyhelminthes, Tricladida, Dendrocoelidae). *Journal of Cave and Karst Studies* 75: 93-112.

Stoltzfus, A., Lapp, H., Matasci, N., Deus, H., Sidlauskas, B., Zmasek, C.M., Vaidya, G., Pontelli, E., Cranston, K., **Vos, R.**, Webb, C.O., Harmon, L.J., Pirrung, M., O'Meara, B., Pennell, M.W., Mirarab, S., Rosenberg, M.S., Balhoff, J.P., Bik, H.M., Heath, T., Midford, P., Brown, J.W., McTavish, E.J., Sukumaran, J., Westneat, M., Alfaro, M.E. & Steele, A. 2013. Phylotastic making tree-of-life knowledge accessible, re-usable and convenient. *BMC Bioinformatics* 14: 158.

**Stoops, E.** & **van Welzen, P.C.** 2013. A revision of *Ptychopyxis* (Euphorbiaceae) in Southeast Asia. *Nordic Journal of Botany* 31: 94-112.

**Storm, P.**, Wood, R., Stringer, C., Bartsiokas, A., **de Vos, J.**, Kinsley, L., Aubert, M. & Grün, R. 2013. U-series and radiocarbon analyses of human and faunal remains from Wajak, Indonesia. *Journal of Human Evolution* 64: 356-365.

**Subedi, A.**, Kunwar, B., Choi, Y., Dai, Y., **van Andel, T.R.**, Chaudhary, R.P., **de Boer, H.J.** & **Gravendeel, B.** 2013. Collection and trade of wild-harvested orchids in Nepal. *Journal of Ethnobiology and Ethnomedicine* 9: 64.

Sulikowska-Drozd, A., Maltz, T. & **Kappes, H.** 2013. Brooding in a temperate zone land snail: seasonal and regional patterns. *Contributions to Zoology* 82: 85-94.

Sundermann, A., Gerhardt, M., **Kappes, H.** & Haase, P. 2013. Stressor prioritisation in riverine ecosystems: Which environmental factors shape benthic invertebrate assemblage metrics? *Ecological Indicators* 27: 83-96.

Swierts, T., **Peijnenburg, K.T.C.A.**, de Leeuw, C., Cleary, D.F.R., Hörnlein, C., Setiawan, E., Wörheide, G., Erpenbeck, D. & **de Voogd, N.J.** 2013. Lock, stock and two different barrels: comparing the genetic composition of morphotypes of the Indo-Pacific sponge *Xestospongia testudinaria*. *PLOS ONE* 8: e74396.

Szitenberg, A., **Becking, L.E.**, Vargas, S., Fernandez, J.C.C., **Santodomingo, N.K.**, Wörheide, G., Ilan, M., Kelly, M. & Huchon, D. 2013. Phylogeny of Tetillidae (Porifera, Demospongiae, Spirophorida) based on three molecular markers. *Molecular Phylogenetics and Evolution* 67: 509-519.

**ten Broek, C.M.A.**, Bots, J., Varela-Lasheras, I., Bugiani, M., **Galis, F.** & van Dongen, S. 2013. Amniotic fluid deficiency and congenital abnormalities both influence fluctuating asymmetry in developing limbs of human deceased fetuses. *PLOS ONE* 8: e81824.

**ter Steege, H.**, Pitman, N., Sabatier, D., Baraloto, C., Salomão, R., Guevara, J.E., Phillips, O., Castilho, C., Magnusson, B., Molino, J.-F., Monteagudo, A., Núñez Vargas, P., Montero, J.C., Feldpausch, T., Honorio, E., Killeen, T., Mostacedo, B., Vasquez, R., Leandro de Assis, R., Terborgh, J., Wittmann, F., Segalin de Andrade, A., Laurance, B., Laurance, S., Marimon, B.S, Marimon Jr, B.H., Vieira, I., Amaral, I., Brienen, R., Castellanos, H., Cárdenas, D., Duivenvoorden, J., Mogollón, H., Dionízia de Almeida Matos, F., Dávila, N., García, R., Stevenson, P., Costa, F., Emilio, T., Levis, C., Schietti, J., Souza, P., Alonso, A., Dallmeier, F., Duque, A., Piedade, M., Araujo-Murakami, A., Arroyo, L., Gribel, R., Fine, P., Peres, C., Toledo, M., Aymard, G., Baker, T., Cerón, C., Engel, J., Henkel, T., **Maas, P.**, Petronelli, P., **Stropp, J.**, Zartman, C.E., Daly, D., Neill, D., Silveira, M., Ríos Paredes, M., Chave, J., de Andrade Lima Filho, A., Møller Jørgensen, P., Fuentes, A., Schöngart, J., Cornejo Valverde, F., Di Fiore, A., Jimenez, E.M., Peñuela Mora, C., Phillips, J.F., Rivas, G., **van Andel, T.R.**, von Hildebrand, P., Hoffman, B., Zent, E.L., Malhi, Y., Prieto, A., Rudas, A., Ruschell, A., Silva, N., Vos, V., Zent, S., Adalardo de Oliveira, A., Cano Schutz, A., Gonzales, T., Trindade Nascimento, M., Ramirez-Angulo, H., Sierra, R., Tirado, M., Umaña Medina, M.N., van der Heijden, G., Vela, C., Vilanova Torre, E., Vriesendorp, C., Wang, O., Young, K.R., Baider, C., Balslev, H., Ferreira, C., Mesones, I., Torres-Lezama, A., Estela Urrego, L., Zagt, R., Alexiaides, M., Hernandez, L., Huamantupa-Chuquimaco, I., Milliken, W., Palacios, W., Pauletto, D., Valderrama, E., Gamarra, L.V., Dexter, K., Feeley, K., Lopez-Gonzalez, G. & Silman, M. 2013. Hyperdominance in the Amazonian Tree Flora. *Science* 342: 325.

Tosh, J., Dessein, S., Buerki, S., Groeninckx, I., Mouly, A., Bremer, B., **Smets, E.F.** & de Block, P. 2013. Evolutionary history of the Afro-Madagascan *Ixora* species (Rubiaceae): species diversification and distribution of key morphological traits inferred from dated molecular phylogenetic trees. *Annals of Botany* 112: 1723-1742.

**Uit de Weerd, D.R.** & **Gittenberger, E.** 2013. Phylogeny of the land snail family Clausiliidae (Gastropoda: Pulmonata). *Molecular Phylogenetics and Evolution* 67: 201-216.

**van Achterberg, C.** & Altenhofer, E. 2013. Notes on the biology of *Seleucus cuneiformis* Holmgren (Hymenoptera, Ichneumonidae, Ctenopelmatinae). *Journal of Hymenoptera Research* 31: 97-104.

**van Achterberg, C.** & Broad, G.R. 2013. Revision of the genus *Vadumasonium* Kammerer (Hymenoptera, Braconidae, Brachistinae). *Journal of Hymenoptera Research* 33: 91-98.

**van Achterberg, C.**, You, L.S. & Li, X.Y. 2013. *Hybrizon* Fallén (Hymenoptera, Ichneumonidae, Hybrizoninae) found in Hunan (China). *Journal of Hymenoptera Research* 30: 65-74.

**van Andel, T.R.** & **Carvalheiro, L.G**. 2013. Why urban citizens in developing countries use Traditional Medicines: The case of Suriname. *Evidence-based complementary and alternative medicine*, vol. 2013: Article ID 687197.

van Baal, R.R., Janssen, R., van der Lubbe, H., **Schulp, A.S.**, Jagt, J.W.M. & Vonhof, H.B. 2013. Oxygen and carbon stable isotope records of marine vertebrates from the type Maastrichtian, the Netherlands and Northeast Belgium (Late Cretaceous). *Palaeogeography, Palaeoclimatology, Palaeoecology* 392: 71-78.

Vanbergen, A.J., Baude, M., **Biesmeijer, J.C.**, Britton, N.F., Brown, M.J.F., Brown, M., Bryden, J., Budge, G.E., Bull, J.C., Carvell, C., Challinor, A.J., Connolly, C.N., Evans, D.J., Feil, E.J., Garratt, M.P., Greco, M.K., Heard, M.S., Jansen, V.A.A., Keeling, M.J., Kunin, W.E., Marris, G.C., Memmott, J., Murray, J.T., Nicolson, S.W., Osborne, J.L., Paxton, R.J., Pirk, C.W.W., Polce, C., Potts, S.G., Priest, N.K., Raine, N.E., Roberts, S., Ryabov, E.V., Shafir, S., Shirley, M.D.F., Simpson, S.J., Stevenson, P.C., Stone, G.N., Termansen, M. & Wright, G.A. 2013. Threats to an ecosystem service: pressures on pollinators. *Frontiers in Ecology and the Environment* 11: 251-259.

van den Brink, F.W.B., **van der Velde, G.** & Wijnhoven, S. 2013. Diversity, occurrence and feeding traits of caddisfly larvae as indicators for ecological integrity of river-floodplain habitats along a connectivity gradient. *Ecological Indicators* 25: 92-98.

van den Brink, F.W.B., **van der Velde, G.** & Wijnhoven, S. 2013. Seasonal changes in caddis larvae assemblages in river-floodplain habitats along a hydrological connectivity gradient. *Hydrobiologia* 716: 75-85.

van den Hof, K., Marcussen, T., van den Berg, R.G., Weeda, E.J. & **Gravendeel, B.** 2013. Fenotypische plasticiteit en nomenclatuur van het Melkviooltje (*Viola stagnina* - *V. persicifolia* nom.ambig. propos.). *Gorteria* 36: 60-84.

**van der Burgh, J.**, Collinson, M.E., **van Konijnenburg-van Cittert, J.H.A.**, Barke, J. & Brinkhuis, H. 2013. The freshwater fern *Azolla* (Azollaceae) from Arctic and Nordic sediments: new species and their stratigraphic distribution. *Review Palaeobotany Palynology* 194: 50-68.

van der Ent, A., Baker, A.J.M., **van Balgooy, M.M.J.** & Tjoa, A. 2013. Ultramafic Nickel laterites in Indonesia. *Journal of Geochemical Exploration* 125: 72-79.

**van der Geer, A.A.E.**, **Lyras, G.A.**, Lomolino, M., Palombo, M.R. & Sax, D. 2013. Body size evolution of palaeo-insular mammals: temporal variations and interspecific interactions. *Journal of Biogeography* 40: 1440-1450.

**van der Ham, R.W.J.M.** 2013. Moseikelgal algemeen in Nederland? *Gorteria* 36: 42-44.

**van der Maesen, L.J.G.** & **Wieringa, J.J.** 2013. Flora treatment of the Leguminosae-Papilionoideae of Gabon. *South African Journal of Botany* 89: 284-288.

**van der Maesen, L.J.G.** & Zijlstra, G. 2013. Proposal to conserve the name *Dunbaria* (Leguminosae, Papilionoideae) with a conserved type. Taxon 62: 181-183.

**van der Meij, S.E.T.** & **Hoeksema, B.W.** 2013. Distribution of gall crabs inhabiting mushroom corals on Semporna reefs, Malaysia. *Marine Biodiversity* 43: 53-59.

van Duinen, G.A., Vermonden, K., Bodelier, P.L.E., Hendriks, A.J., Leuven, R.S.E.W., Middelburg, J.J., **van der Velde, G.** & Verberk, W.C.E.P. 2013. Methane as a carbon source for the food web in raised bog pools. *Freshwater Science* 32: 1260-1272.

van Klink, R., Rickert, C., Vermeulen, R., **Vorst, O.**, Wallis de Vries, M.F. & Bakker, J.P. 2013. Grazed vegetation mosaics do not maximize arthropod diversity: Evidence from salt marshes. *Biological Conservation* 164: 150-157.

van Leeuwen, C.H.A., Huig, N., **van der Velde, G.**, van Alen, T.A., Wagemaker, C.A.M., Sherman, C.D.H., Klaassen, M. & Figuerola, J. 2013. How did this snail get here? Several dispersal vectors inferred for an aquatic invasive species. *Freshwater Biology* 58: 88-99.

**van Moorsel, R.** 2013. Korte mededeling. Over *Carex tomentosa* L. (Viltzegge). *Gorteria* 26: 22-23.

**van Ofwegen, L.P.**, Benayahu, Y. & McFadden, C.S. 2013. *Sinularia leptoclados* (Ehrenberg, 1834) (Cnidaria: Octocorallia) re-examined. *ZooKeys* 272: 29-59.

**van Oijen, M.J.P.** & **van der Meij, S.E.T.** 2013. The types of *Osteoglossum formosum* Müller & Schlegel, 1840 (Teleostei, Osteoglossidae). *Zootaxa* 3722: 361-371.

**van Oijen, M.J.P.**, Kawai, T. & Loots, I. 2013. Putative type specimens of *Satyrichthys* (Scorpaeniformes: Peristediidae) in the Bleeker collection of the Naturalis Biodiversity Center, Leiden, The Netherlands. *Zootaxa* 3670: 207-214.

**van Rijssel, J.C.** & Witte, F. 2013. Adaptive responses in resurgent Lake Victoria cichlids over the past 30 years. *Evolutionary Ecology* 27: 253-267.

van Strien, A.J., Termaat, T. **Kalkman, V.J.**, Prins, M., de Knijf, G., Gourmand A.-L., Houard, X., Nelson, B., Plate, C., Prentice, S., Regan, E., Smallshire, D., Vanappelghem, C. & Vanreuse, W. 2013. Occupancy modelling as a new approach to assess supranational trends using opportunistic data: a pilot study for the damselfly Calopteryx splendens. *Biodiversity Conservation* 22: 673-686.

**van Velzen, R.**, Wahlberg, N., **Sosef, M.S.M.** & Bakker, F.T. 2013. Effects of changing climate on diversification in tropical forest butterflies of the genus *Cymothoe* (Lepidoptera, Nymphalidae). *Biological Journal of the Linnean Society* 108: 546-564.

Vatanparast, M., Klitgård, B.B., **Adema, F.A.C.B.**, Pennington, R.T., Yahara, T. & Kajita, T. 2013. First molecular phylogeny of the pantropical genus *Dalbergia*: implications for infrageneric circumscription and biogeography. *South African Journal of Botany* 89: 143-149.

**Veldkamp, J.F.**, van den Boogaart, M.E.B., Heidweiller, J., van der Klaauw, M.A.F., de Koning, R., Kraaijeveld, A.R., **Sosef, M.S.M.** & Strucker, R.C.W. 2013. Revision of *Mnesithea* (Gramineae – Rottboelliinae) in Malesia and Thailand. *Blumea* 58: 277-292.

Verhofstad, M.J.J.M., Grutters, B.M.C., **van der Velde, G.** & Leuven, R.S.E.W. 2013. Effects of water depth on survival, condition and stable isotope values of three invasive dreissenid species in a deep freshwater lake. *Aquatic Invasions* 8: 157-169.

Verstraete, B., Janssens, S., Lemaire, B., **Smets, E.F.** & Dessein, S. 2013. Phylogenetic lineages in Vanguerieae (Rubiaceae) associated with *Burkholderia* bacteria in sub-Saharan Africa. *American Journal of Botany* 100: 2380-2387.

Verstraete, B., Janssens, S., **Smets, E.F.** & Dessein, S. 2013. Symbiotic ß-Proteobacteria beyond legumes: *Burkholderia* in Rubiaceae. *PLOS ONE* 8: e55260.

Verstraete, B., Lachenaud, O., **Smets, E.F.**, Dessein, S. & Sonké, B. 2013. Taxonomy and phylogenetics of *Cuviera* (Rubiaceae-Vanguerieae) and reinstatement of *Globulostylis* with the description of three new species. *Botanical Journal of the Linnean Society* 173: 407-441.

Vihotogbe, R., van den Berg, R.G. & **Sosef, M.S.M.** 2013. Morphological characterization of African bush mango trees (*Irvingia* species) in West Africa. *Genetic Resources and Crop Evolution* 60: 1597-1614.

Villier, B., **van den Hoek Ostende, L.W.**, **de Vos, J.** & Pavia, M. 2013. New discoveries on the giant hedgehog *Deinogalerix* from the Miocene of Gargano (Apulia, Italy). *Geobios* 46: 63-75.

**Vonk, F.J.**, Casewell, N.R., Henkel, C.V., Heimberg, A.M., Jansen, H.J., McCleary, R.J.R., Kerkkamp, H.M.E., **Vos, R.A.**, Guerreiro, I., Calvete, J.J., Wuster, W., Woods, A.E., Logan, J.M., Harrison, R.A., Castoe, T.A., de Koning, A.P.J., Pollock, D.D., Yandell, M., Calderon, D., Renjifo, C., Currier, R.B., Salgado, D., Pla, D., Sanz, L., Hyder, A.S., Ribeiro, J.M.C., **Arntzen, J.W.**, van den Thillart, G.E.E.J.M., Boetzer, M., Pirovano, W., Dirks, R.P., Spaink, H.P., Duboule, D., McGlinn, E., Kini, R.M. & Richardson, M.K. 2013. The king cobra genome reveals dynamic gene evolution and adaptation in the snake venom system. *Proceedings National Academy Sciences* 110: 20651-20656.

**Vonk, R.** & Jaume, D. 2013. A new ingolfiellid amphipod crustacean from sandy beaches on the Gura Ici Islands, western Halmahera (north Moluccas). *The Raffles Bulletin of Zoology* 61: 547-560.

**Waheed, Z.** & **Hoeksema, B.W.** 2013. A tale of two winds: species richness patterns of reef corals around the Semporna peninsula, Malaysia. *Marine Biodiversity* 43: 37-51.

Walker, P.D., Wijnhoven, S. & **van der Velde, G.** 2013. Macrophyte presence and growth form influence macroinvertebrate community structure. *Aquatic Botany* 104: 80-87.

Wei, P., Li, Z., **van Achterberg, C.**, Feng, G., Xiao, H. & Huang, D-W. 2013. Two new species of the genus *Ficobracon* van Achterberg and Weiblen (Hymenoptera: Braconidae) from China, expanding its host range. *Zootaxa* 3640: 465-472.

Weitschek, E., **van Velzen, R.**, Felici, G. & Bertolazzi, P. 2013. BLOG 2.0: a software system for character-based species classification with DNA barcode sequences. What it does, how to use it. *Molecular Ecology Resources* 13: 1043-1046.

Welker, F. & **Gravendeel, B.** 2013. Dung reveals goats' last days. *Nature* 503: 440.

**Wesselingh, F.P.**, **Janse, A.C.**, Vervoenen, M. & **van Nieulande, F.A.D.** 2013. New records of giant campanilid gastropods (Mollusca) from the southern North Sea Basin: implications for Eocene and Quaternary palaeogeography *Netherlands Journal of Geosciences* 92: 159-164.

**Wesselingh, F.P.**, Peters, W. & Munsterman, D. 2013. A brachiopod-dominated sea-floor assemblage from the Late Pliocene of the eastern Netherlands. *Netherlands Journal of Geosciences* 92: 171-176.

**Wielstra, B.**, Baird, A.B. & **Arntzen, J.W.** 2013. A multimarker phylogeography of crested newts (*Triturus cristatus* superspecies) reveals cryptic species. *Molecular Phylogenetics and Evolution* 67: 167-175.

**Wielstra, B.**, Crnobrnja-Isailović, J., Litvinchuk, S.N., **Reijnen, B.**, Skidmore, A.K., Sotiropoulos, K., Toxopeus, A.G., Tzankov, N., Vukov, T. & **Arntzen. J.W.** 2013. Tracing glacial refugia of *Triturus* newts based on mitochondrial DNA phylogeography and species distribution modeling. *Frontiers in Zoology* 10: 13.

**Wielstra, B.**, Litvinchuk, S.N., Naumov, B., Tzankov, N. & **Arntzen, J.W.** 2013. A revised taxonomy of crested newts in the *Triturus karelinii* group (Amphibia: Caudata: Salamandridae), with the description of a new species. *Zootaxa* 3682: 441-453.

**Wieringa, J.J.**, Mackinder, B.A. & **van Proosdij, A.S.J.** 2013. *Gabonius* gen. nov. (Leguminosae, Caesalpinioideae, Detarieae), a distant cousin of *Hymenostegia* endemic to Gabon. *Phytotaxa* 142: 15-24.

Wilkin, P., Suksathan, P., Keeratikiat, K., **van Welzen, P.C.** & Wiland-Szymanska, J. 2013. A new species from Thailand and Burma, *Dracaena kaweesakii* Wilkin & Suksathan (Asparagaceae subfamily Nolinoideae). *PhytoKeys* 26: 101-112.

Winkler, D.E., **van den Hoek Ostende, L.W.**, Schulz, E., Calandra, I., Gailer, J.-P., Landwehr, C. & Kaiser, T.M. 2013. Dietary divergence in space and time - Lessons from the dwarf-goat *Myotragus balearicus* (Pleisto-Holocene, Mallorca, Spain). *Mammalian Biology* 78: 430-437.

Xi, Z.-F., Bie, W., Chen, W., Liu, D., **van Ofwegen, L.**, Proksch, P. & Lin, W.-H. 2013. Sarcophyolides B-E, new cembranoids from the soft coral *Sarcophyton elegans*. *Marine Drugs* 2013: 3186-3196.

Yahara, T., Javadi, F., Onoda, Y., Paganucci de Queiroz, L., Faith, D.P., Prado, D.E., Akasaka, M., Kadoya, T., Ishihama, F., Davies, S., Slik, J.W.F., Yi, T., Ma, K., Bin, C., Darnaedi, D., Pennington, R.T., Tuda, M., Shimada, M., Ito, M., Egan, A.N., Buerki, S., **Raes, N.**, Kajita, T., Mimura, M., Tachida, T., Iwasa, Y., Smith, G.F., Victor, J.E. & Nkonki, T. 2013. Global legume diversity assessment: concepts, key indicators, and strategies. *Taxon* 62: 249-266.

Yamaguchi, M., Miyazaki, M., Kodrasov, M.P., Rotinsulu, H., Losung, F., Mangindaan, R.E.P., **de Voogd, N.J.**, Yokosawa, H., Nicholson, B. & Tsukamoto, S. 2013. Spongiacidin C, a pyrrole alkaloid from the marine sponge *Stylissa massa*, functions as a USP7 inhibitor. *Bioorganic and Medical Chemistry Letters* 23: 3884-3886.

Ye, Zh., **Chen, P.-p.** & Bu, W.-j. 2013. Contribution to the knowledge on the Oriental genus *Perittopus* Fieber, 1861 (Hemiptera: Heteroptera: Veliidae) with descriptions of four new species from China and Thailand. *Zootaxa* 3616(1): 31-48.

Zhang, J.R., Tang, X.L., Li, J., Li, P.F., **de Voogd, N.J.**, Ni, X.Q., Jin, X.J., Yao, X.J., Li, P.L. & Li, G.Q. 2013. Cytotoxic polyketide derivatives from the South China Sea Sponge *Plakortis simplex*. *Journal of Natural Products* 76: 600-606.

Zheng, M.-L., Chen, J.-H. & **van Achterberg, C.** 2013. The discovery of the rare genus *Epimicta* Foerster (Hymenoptera: Braconidae) in China, with a description of a new species. *Zootaxa* 3613: 190-194.

Zieliński, P., Nadachowska-Brzyska, K., **Wielstra, B.**, Szkotak, R., Covaciu-Marcov, S., Cogălniceanu, D. & Babik, W. 2013. No evidence for nuclear introgression despite complete mtDNA replacement in the Carpathian newt (*Lissotriton montandoni*). *Molecular Ecology* 22: 1884-1903.

Zieliński, P., **Wielstra, B.** & Babik, W. 2013. Genetic structure of the Carpathian newt suggests multiple Pleistocene refugia within the Carpathians. *Acta Biologica Cracoviensia Series Botanica* 55(suppl. 1): 35.

Zijlstra, G., Kustatscher, E. & **van Konijnenburg-van Cittert, J.H.A.** 2013. Proposal to conserve the name *Sphenozamites* (Brongn.) Miq. with a conserved type (fossil Cycadophyta: Bennettitales). *Taxon* 62: 185-186.

## Non-SCI publications

Alvarez-Sierra, M.A., Garcia-Paredes, I., Hernandez-Ballerin, V., **van den Hoek Ostende, L.W.**, Hordijk, K., Lopez-Guerrero, P., van der Meulen, A.J., Oliver, A. & Pelaez-Campomanes, P. 2013. Models of historical biogeography and continental biochronology. *Spanish Journal of Palaeontology* 28(2): 129-138.

Aslan, E.G., **Beenen, R.**, Bayram, F. & Aslan, B. 2013. *Chloropterus versicolor* (Morawitz) in Turkey: Indigeneity confirmed (Coleoptera: Chrysomelidae). *Journal of the Entomological Research Society* 15(2): 113-116.

**Aukema, B.** 2013. De wantsen van Nationaal Park De Meinweg (Hemiptera: Heteroptera). *Natuurhistorisch Maandblad* 102: 278-285.

**Aukema, B.**, **Duffels, H.**, Günther, H., Rieger, Chr. & Strauss, G. 2013. New data on the Heteroptera fauna of La Palma, Canary Islands (Insecta: Hemiptera). *Acta Musei Moraviae, Scientiae Biologicae* 98: 459-493.

**Beenen, R.** 2013. Contribution to the knowledge of Galerucinae of New Caledonia 2 (Coleoptera, Chrysomelidae). *Genus* 24: 65-108.

**Beenen, R.** 2013. Na bijna honderd jaar weer een vondst van de Zwarte gaffelaardvlo in Nederland. *Natuurhistorisch Maandblad* 102: 271-272.

**Beenen, R.** 2013. New species and a new genus of brachelytrous Galerucinae (Coleoptera: Chrysomelidae). *Entomologische Zeitschrift, Stuttgart* 123: 173-183.

Belgers, D., Zwakhals, K. & **van Helsdingen, P.J.** 2013. De bijzondere levensloop van de sluipwesp *Acrodactyla quadrisculpta* op de schaduwstrekspin *Tetragnatha montana* (Hymenoptera: Ichneumonidae, Araneae: Tetragnathidae). *Nederlandse Faunistische Mededelingen* 39: 1-6.

**Berg, M.P.** & den Ouden, A. 2013. De springstaart *Fasciosminthurus quinquefasciatus* nieuw voor de Nederlandse fauna (Collembola: Bourletiellidae). *Nederlandse Faunistische Mededelingen* 40: 1-8.

Beveridge, N.G.P., Rauch, C., Kessler, P.J.A., van Vugt, R.R. & **van Welzen, P.C.** 2013. A new way to identify living species of *Nepenthes* (Nepenthaceae): More data needed! *Carnivorous Plant Newsletter* 42: 122-128.

Bogarín, D. & **Karremans, A.P.** 2013. *Trichocentrum pupulinianum* (Orchidaceae). *Orchids (West Palm Beach)* 82(2): 106-110.

**Bos, A.R.** & Gumanao, G.S. 2013. Seven new records of fishes (Teleostei: Perciformes) from coral reefs and pelagic habitats in Southern Mindanao, the Philippines. *Marine Biodiversity Records* 6(e95): 1-6.

**Bos, A.R.** & Smits, H.M. 2013. First record of the dottyback *Manonichthys alleni* (Teleostei: Perciformes: Pseudochromidae) from the Philippines. *Marine Biodiversity Records* 6(e61): 1-2.

Bouma, H.W., de Boer, S.F., **de Vos, J.**, van Kampen, P.M. & Hogervorst, T. 2013. Mammal hip morphology and function: Coxa recta and Coxa rotunda. *The Anatomical Record* 296: 250-256.

Boumans, L., **de Jong, H.** & **Oosterbroek, P.** 2013. The originally East Palaearctic crane fly *Tipula* (*Platytipula*) *moiwana* (Matsumura, 1916) (Diptera, Tipulidae) found in Oslo, an addition to the Norwegian fauna. *Norwegian Journal of Entomology* 60: 159-162.

Bree, E. de, Bot, S. & **Smit, J.T.** 2013. De rode snuitvlieg *Rhingia rostrata* terug in Nederland (Diptera: Syrphidae). *Nederlandse Faunistische Mededelingen* 40: 15-21.

**Breure, A.S.H.** 2013. The Pantepui malacofauna: land snails of Churí-tepui and other tepuis in southern Venezuela and adjacent areas. In: Aubrecht, R. & Schlögl, J. (eds.), Venezuelan tepuis - their caves and biota: 113-124. Acta Geologica Slovaca - Monograph, Comenius University, Bratislava.

Busschers, F., van Heteren, S.V., Westerhoff, W., Bunnik, F., van Hees, E., **Wesselingh, F.**, Kerklaan, F., Kuitems, M., van Kolfschoten, T. & van Essen, H. 2013. Het stratigrafische raamwerk voor de geologische opbouw van het zandwingebied Maasvlakte 2. TNO 2012 R1131. 18 pp.

**Chaowasku, T.**, Keßler, P.J.A. & Chatrou, L.W. 2013. Phylogeny of *Miliusa* (Magnoliales: Annonaceae: Malmeoideae: Miliuseae), with descriptions of two new species from Malesia. *European Journal of Taxonomy* 54: 1-21.

Cock, M.J.W., **Biesmeijer, J.C.,** Cannon, R.J.C., Gerard, P.J., Gillespie, D., Jimenez, J.J., Lavelle, P.M. & Raina, S.K. 2013. The implications of climate change for positive of invertebrates to world agriculture contributions. *CAB Reviews* 2013(8), No. 028, 1-48.

Colijn, E., Heijerman, Th., **Vorst, O.**, Cuppen, J., van Maanen, B., van Nunen, F. & van de Sande, C. 2013. Kevers van de Meinweg (Coleoptera). *Natuurhistorisch Maandblad* 102: 292-310.

**de Meulemeester, T.** 2013. “Bee” a taxonomist! *pro-iBiosphere Newsletter* (2): 6.

**de Vogel, E.**, van Vugt, R., Perry, M., **Winkel, E.** & Hoogendijk, E. 2013. *Chelonistele maximae-reginae* (Orchidaceae), an attractive new species of unknown provenance. *Malesian Orchid Journal* 12(2013): 5-12.

**de Wilde, W.J.J.O.** & **Duyfjes, B.E.E.** 2013. Miscellaneous information on *Lagerstroemia* L. (Lythraceae). *Thai Forest Bulletin (Botany)* 41: 90-101.

**Dieleman, F.E.** 2013. Overzicht van strandvondsten van woelmuizen en andere kleine zoogdieren langs de Nederlandse stranden: stand van zaken 2013. *Afzettingen WTKG* 34(4): 144-172.

**Dijkstra, H.H.** 2013. Pectinoidea (Bivalvia: Propeamussiidae and Pectinidae) from the Panglao region, Philippine Islands. *Vita Malacologica* 10: 1-108.

**Dijkstra, H.H.** & Raines, B.K. 2013. A new living species of *Cyclochlamys* (Bivalvia, Pectinoidea, Cyclochlamydidae) from Wake Atoll (Pacific). *Basteria* 77: 17-21.

**Donovan, S.K.** 2013. A recent example of the boring *Gastrochaenolites lapidicus* Kelly and Bromley and its producing organism in north Norfolk, eastern England. *Bulletin of the Mizunami Fossil Museum* 39: 69-71.

**Donovan, S.K.** 2013. An unusual association of a Recent oyster and a slipper limpet. *Deposits* 35: 5.

**Donovan, S.K.** 2013. Curiouser and curiouser: more on reworked *Echinocorys* (Echinoidea; Late Cretaceous) on the beaches of north Norfolk, eastern England. *Swiss Journal of Palaeontology* 132: 1-4.

**Donovan, S.K.** 2013. Dear readers... *Deposits* 36: 3.

**Donovan, S.K.** 2013. Death of a small journal? *Journal of Scholarly Publishing* 44: 289-293.

**Donovan, S.K.** 2013. Features in the field: ignimbrites of the Yr Arddu syncline (Caradoc, Upper Ordovician). *Deposits* 35: 44-48.

**Donovan, S.K**. 2013. Mike Denness. *The Times*: April 24 (#70867): 49.

**Donovan, S.K.** 2013. Neoichnology of the parish church of All Saints, Freshwater, Isle of Wight. *Wight Studies: Proceedings of the Isle of Wight Natural History & Archaeological Society* 27: 70-75.

**Donovan, S.K.** 2013. Re: Philippe C. Baveye, ‘A short note on pointless reference formatting,’ JSP 44, 3 (April 2013): 283-8. *Journal of Scholarly Publishing* 45: 97-99.

**Donovan, S.K**. 2013. The editorial board: essential or superfluous? *Journal of Scholarly Publishing* 45: 87-90.

**Donovan, S.K**. 2013. Where are all the crinoids? An enigma of the Lower Carboniferous (Mississippian) White Peak of midland England. *Geology Today* 29: 108-112.

**Donovan, S.K.**, **Baalbergen, E.**, Ouwendijk, M., Paul, C.R.C. & **van den Hoek Ostende, L.W.** 2013. Review and prospectus of the Late Pleistocene fauna of the Red Hills Road Cave, Jamaica. *Cave and Karst Science* 40: 79-86.

**Donovan, S.K.** & Collins, J.S.H. 2013. Jamaican fossil crabs. *Deposits* 33: 13-19.

**Donovan, S.K**. & Jackson, T.A. 2013. Classic localities explained 11: The Miocene of Carriacou, the Grenadines, Lesser Antilles. *Geology Today* 29: 150-158.

**Donovan, S.K.** & Pickerill, R.K. 2013. On marls and marlstones. *Bulletin of the Mizunami Fossil Museum* 39: 127-128.

**Donovan, S.K.** & Riley, M. 2013. The importance of labels to specimens: an example from the Sedgwick Museum. *The Geological Curator*, 9: 509-514.

**Duistermaat, H.** 2013. Herbariummateriaal verzamelen nog van deze tijd? *FLORON Nieuws* 19: 22-23.

Ernst, W.H.O., **van Nieukerken, E.J.** & **Koster, J.C.** 2013. Waarom verhuizen rupsen van *Coleophora taeniipennella* (Lepidoptera: Coleophoridae) na het derde stadium van zomprus naar knopbies? *Entomologische Berichten, Amsterdam* 73(2): 42-47.

**Faasse, M.A.** 2013. Further dispersal of the sea-spider *Ammothea hilgendorfi* (Böhm, 1879) in the North Sea to The Netherlands. *BioInvasions Records* 2(4): 287-289.

**Faasse, M.A.** 2013. Northward dispersal of the tanaid *Zeuxo holdichi* to the Netherlands (Crustacea: Tanaidae). *Nederlandse Faunistische Mededelingen* 39: 95-98.

**Faasse, M.A.** 2013. The North American ostracod *Eusarsiella zostericola* (Cushman, 1906) arrives in mainland Europe. *BioInvasions Records* 2(1): 47-50.

**Feijen, H.R.** & **Feijen, C.** 2013. A revision of the genus *Diopsina* Curran (Diptera, Diopsidae) with description of a new species from Guinea-Bissau. *Tijdschrift voor Entomologie* 156: 161-189.

**Gassmann, D.** 2013. Auswirkungen der Nuklearkatastrophe von Fukushima auf Bläulinge. *Naturwissenschaftliche Rundschau* 7/2013: 361-362.

**Gassmann, D.** 2013. Flugverhalten von Stechmücken. *Naturwissenschaftliche Rundschau* 12/2013: 500-501.

**Gassmann, D.** 2013. Geruchssinn von Libellen. *Naturwissenschaftliche Rundschau* 3/2013: 145-146.

**Gielis, C.** & Mano, T. 2013. Additions to the Pterophoridae fauna of Japan. *Tinea* 22: 149-155.

**Gittenberger, A.**, Schrieken, N., Coolen, J.W.P. & **Gittenberger, E.** 2013. Shipwrecks, ascidians and *Modiolarca subpicta* (Bivalvia, Mytilidae, Musculinae). *Basteria* 77(4-6): 75-82.

**Gittenberger, A.**, Schrieken, N., Coolen, J. & Vlierhuis, W. 2013. The Jewel anemone *Corynactis viridis*, a new order for The Netherlands (Cnidaria: Corallimorpharia). *Nederlandse Faunistische Mededelingen* 41: 35-41.

**Gittenberger, A.** & van Loon, W. 2013. Sensitivities of marine macrozoobenthos to environmental pressures in The Netherlands. *Nederlandse Faunistische Mededelingen* 41: 79-112.

**Gittenberger, E.** 2013. *Spelaeodiscus dejongi* (Gastropoda, Pulmonata, Spelaeodiscidae), its classification hesitantly confirmed. *Basteria* 77: 86-88.

**Gittenberger, E.**, Leda, P. & Sherub, S. 2013. Bhutanese snails, the smallest one: *Truncatellina bhutanensis* spec. nov. (Gastropoda, Pulmonata, Vertiginidae). *Basteria* 77: 29-32.

**Gittenberger, E.** & **van Bruggen, A.C.** 2013. Land snails of the islet of Misali, off Pemba Island, Zanzibar, Tanzania. *Zoologische Mededelingen Leiden* 87: 235-273.

Gmelig Meyling, A. & **van Leeuwen, S.** 2013. Alle weekdieren van het Nederlandse Noordzeegebied in kaart gebracht. *Zoekbeeld* 3(1): 26-27.

Gmelig Meyling, A. & **van Leeuwen, S.** 2013. Verslag symposium 'Diversiteit mariene schelpdieren van Nederland'. *Zoekbeeld* 3(1): 17-19.

Groenen, F., Huisman, K.J. & **Doorenweerd, C.** 2013. *Phalonidia manniana*, een complex van twee soorten: *Ph. manniana* en *Ph. udana* (Lepidoptera: Tortricidae). *Entomologische Berichten (Amsterdam)* 73: 191-196.

Hágsater, E. & **Karremans, A.P.** 2013. *Epidendrum microanoglossum* Hágsater & Karremans, sp. nov. *Icones Orchidacearum (Mexico)* 14(10): t. 1457.

**Hoedemaeker, Ph.** 2013. Genus *Pseudothurmannia* Spath, 1923 and related subgenera *Crioceratites (Balearites)* Sarkar, 1954 and *C. (Binelliceras)* Sarkar, 1977 (Lower Cretaceous Ammonoidea). *Revue de Paleobiologie, Geneve* 32: 1-209.

**Hoeksema, B.W.** 2013. Met Naturalis in zee: De Straat van Lembeh. *Onderwatersport* 45(6): 50-53.

Huisman, K.J., **Koster, J.C.**, Muus, T.S.T & **van Nieukerken, E.J.** 2013. Microlepidoptera in Nederland, vooral in 2007-2010 – met een terugblik op 30 jaar faunistisch onderzoek. *Entomologische Berichten, Amsterdam* 73(3): 91-117.

IJland, S. & **van Helsdingen, P.J.** 2013. Spinnen van de Reijerscamp (Araneae), deel 2: Correcties. *Nieuwsbrief SPINED* 33: 19.

Jackson, T.A. & **Donovan, S.K.** 2013. Going green: chloritized tuffs from the Oligocene of Antigua. *Deposits* 36: 42-44.

**Janssen, A.W.**, **Renema, W.** & **Wesselingh, F.P.** 2013. Notes on the systematics, morphology and biostratigraphy of fossil holoplanktonic Mollusca, 23. A new pteropod, *Tibiella watupuruensis* spec. nov. (Thecosomata, Creseidae), from Eocene (early Bartonian) rocks of the Nanggulan Formation, Java (Indonesia). *Basteria* 77: 13-16.

**Kalkman, V.J.** & Orr, A.G. 2013. Field Guide to the damselflies of New Guinea. *Brachytron* 15: 3-120.

**Kappes, H.** 2013. Beeinflussen historische Meiler Gehäuseschnecken in bodensauren Buchenwäldern (Kermeter, Nationalpark Eifel)? *Decheniana* 166: 101-105.

**Kappes, H.** 2013. Effekte von Totholz und Kalk auf die Mollusken eines extrem bodensauren Waldes (Naturschutzgebiet Immerkopf, Bergisches Land, Nordrhein-Westfalen). *Mitteilungen der Deutschen Malakozoologischen Gesellschaft* 89: 7-16.

**Kappes, H.** 2013. Native species and urban heat islands. *Tentacle* 21: 29-30.

**Kappes, H.** & **Schilthuizen, M.** 2013. Snails on the rock: karst conservation. *Tentacle* 21: 31-32.

**Karremans, A.P.** & Bogarín, D. 2013. Costa Rica, land of endless orchids. *Orchids (West Palm Beach)* 82(7): 408-411.

**Karremans, A.P.** & Fernández, M. 2013. *Epidendrum inhibitiosum* Karremans & Mel. Fernández, sp. nov. *Icones Orchidacearum (Mexico)* 14(10): t. 1443.

**Karremans, A.P.** & Sánchez, L. 2013. *Epidendrum alieniferum* Karremans & Bogarín, Lankesteriana 12(1): 27. 2012. *Icones Orchidacearum (Mexico)* 14(10): t. 1402.

**Karremans, A.P.** & Smith, C.M. 2013. *Epidendrum bogarinii* Karremans & C.M. Sm., sp. nov. *Icones Orchidacearum (Mexico)* 14(10): t. 1412.

Katayama, T., Wilkinson, M.D., Micklem, G., Kawashima, S., Yamaguchi, A., Nakao, M., Yamamoto, Y., Okamoto, S., Oouchida, K., Chun, H.-W., Aerts, J., Afzal, H., Antezana, E., Arakawa, K., Aranda, B., Belleau, F., Bolleman, J., Bonnal, R.J., Chapman, B., Cock, P., Eriksson, T., Gordon, P., Goto, N., Hayashi, K., Horn, H., Ishiwata, R., Kaminuma, E., Kasprzyk, A., Kawaji, H., Kido, N., Kim, Y.J., Kinjo, A.R., Konishi, F., Kwon, K.-H., Labarga, A., Lamprecht, A.-L., Lin, Y., Lindenbaum, P., McCarthy, L., Morita, H., Murakami, K., Nagao, K., Nishida, K., Nishimura, K., Nishizawa, T., Ogishima, S., Ono, K., Oshita, K., Park, K.-J., Prins, P., Saito, T.L., Samwald, M., Satagopam, V.P., Shigemoto, Y., Smith, R., Splendiani, A., Sugawara, H., Taylor, J., **Vos, R.**, Withers, D., Yamasaki, C., Zmasek, C.M., Kawamoto, S., Okubo, K., Asai, K. & Takagi, T. 2013. The 3rd DBCLS BioHackathon: improving life science data integration with Semantic Web technologies. *Journal of Biomedical Semantics* 4: 6.

Kischlat, E.-E. & **Ross, F.D.** 2013. *Crocodilus viridis* denotes "Western Clade Nile Crocodile (new)" better than *C. suchus* formerly did. *Crocodile Specialist Group Newsletter* 32(3): 34-35.

**Krikken, J.** 2013. Oriental *Bolboceras*: Introduction to the genus and taxonomy of the *nigricans* group of species (Coleoptera: Geotrupidae: Bolboceratinae). *Tijdschrift voor Entomologie* 156: 35-56.

**Kruijer, H.** 2013. Book announcements. *Gorteria* 36(2): 52.

Laštůvka, Z., Laštůvka, A. & **van Nieukerken, E.J.** 2013. The *Bupleurum* (Apiaceae) feeding species of *Trifurcula* (*Glaucolepis*): new species, biology and distribution (Lepidoptera: Nepticulidae). *Tijdschrift voor Entomologie* 156(2): 191-210.

Lengkeek, W., Coolen, J., **Gittenberger, A.** & Schrieken, N. 2013. Ecological relevance of shipwrecks in the North Sea. *Nederlandse Faunistische Mededelingen* 41: 49-57.

Lewis, W. & **Gittenberger, A.** 2013. First record of a settled stomatopod *Platysquilla eusebia* in the North Sea (Malacostraca: Stomatopoda). *Nederlandse Faunistische Mededelingen* 41: 31-34.

Long, K.D. & **van Achterberg, K.** 2013. New records of the genus *Snellenius* Westwood, 1882 (Hymenoptera: Braconidae: Microgastrinae) from Vietnam, with description of two new species. *Tạp chí sinh học* 35(3): 272-280.

Malhado, A.C.M., Ladle, R.J., Whittaker, R.J., Atanásio, J., Neto, O., Malhi, Y. & **ter Steege, H.** 2013. The ecological biogeography of Amazonia. *Frontiers of Biogeography* 5: 103-112.

Martínez Chacón, M.L. & **Winkler Prins, C.F.** 2013. *Kozlowskia* (Productidina, Brachiopoda) del Bashkiriense superior/Moscoviense inferior (Carbonífero), Cordillera Cantábrica (N de España). Jornadas Sociedad Española de Paleontología 19. La Paleontología del Paleozoico. Real Jardín Botánico de Córdoba, 2013: 207-208.

**Miller, J.A.**, Belgers, D.M., **Beentjes, K.K.**, Zwakhals, K. & **van Helsdingen, P.** 2013. Spider hosts (Arachnida, Araneae) and wasp parasitoids (Insecta, Hymenoptera, Ichneumonidae, Ephialtini) matched using DNA barcodes. *Biodiversity Data Journal* 1: e992.

Moerdijk, P.W. & **Pouwer, R.** 2013. *Laevastarte quiespacis* nov. spec. (Mollusca, Bivalvia, Astartidae) from the Pliocene of The Netherlands. *Cainozoic Research* 10(1-2): 9-13.

Mood, J.D., Prince, L.M. & **Veldkamp, J.F.** 2013. The history and identity of *Boesenbergia longiflora* (Zingiberaceae) with five new, related taxa. *The Gardens' Bulletin Singapore* 65: 47-95.

**Mota de Oliveira, S.** 2013. Flora of the Guianas Newsletter 18: http://portal.cybertaxonomy.org/flora-guianas/sites/flora-guianas/files/field/pdf/FoG_Newsletter18.pdf.

**Nieser, N., Chen, P.-p.** & de Melo, A. 2013. A new species and synonymy in *Limnocoris* (Hemiptera: Heteroptera: Naucoridae) from Brazil – Acta Musei Moravize, *Scientiae biologicae* (Brno) 98(2): 335-346.

**Nuytinck, J.**, Dhooge, E. & Verbeken, A. 2013. *Lactarius* (Russulales) in Europe and North America: some look-alikes tested molecular- and morphologically. *Scripta Botanica Belgica* 51: 106-116.

**Nuytinck, J.** & Verbeken, A. 2013. A revision of *Lactarius* sect. Deliciosi (Russulales) in Europe. *Scripta Botanica Belgica* 51: 49-59.

**Oosterbroek, P.** 2013. *Rhypholophus bifurcatus* ook in Zuid-Limburg, evenals de andere twee Nederlandse *Rhypholophus*-soorten (Diptera, Limoniidae). *Vliegenmepper* 22(2): 10.

**Oosterbroek, P.**, Dek, N.-J. & **de Jong, H.** 2013. The cranefly *Tipula trifascingulata* new for the Netherlands (Diptera, Tipulidae). *Nederlandse Faunistische Mededelingen* 39: 43-48.

Parnell, J.A.N., Pedersen, H.A., Hodkinson, T.R., Balslev, H., **van Welzen, P.C.**, Simpson, D., Middleton, D.J., Esser, H.-J., Pooma, R., Utteridge, T. & Staples, G. 2013. Hybrids and the Flora of Thailand. *Thai Forest Bulletin (Botany)* 41: 1-9.

Peters, N. & **de Vos, J.** 2013. Brief description of some terrestrial mammal fossils from Mill-Langenboom (The Netherlands). *Cainozoic Research* 10(1-2): 15-22.

**Poeser, F.N.** 2013. Apropos guppys. *Viviparos* 2013(11): 36-40.

**Poeser, F.N.** 2013. Unsere Guppys und ihre Namen. *DATZ* 2013(12): 22-27.

**Pouwer, R.** 2013. Naturalis en mijn collectie. *Voluta* 19(1): 4-9.

Pullen, T. & **Zonneveld, B.J.M.** 2013. Het geslacht *Cotyledon* (10) *Cotyledon barbeyi*. *Succulenta* 92-1: 28-30.

Pullen, T., & **Zonneveld, B.J.M.** 2013. Het geslacht *Cotyledon* (11) *Cotyledon woodii*. *Succulenta* 92-2/3: 71-73.

Pullen, T. & **Zonneveld, B.J.M.** 2013. Het geslacht *Cotyledon* (12) *C. orbiculata*. *Succulenta* 92-4: 180-187.

Pupulin, F., **Karremans, A.P.** & Strigari, S. 2013. Taxonomy in watercolor: the *Specklinia endotrachys* group, part 1. *Die Orchidee* 64(5): 392-399.

Pupulin, F., **Karremans, A.P.** & Strigari, S. 2013. Taxonomy in watercolor: the *Specklinia endotrachys* group, part 2. *Die Orchidee* 64(6): 475-485.

Raad, H.J., Simons, G. & **Wesselingh, F.P.** 2013. De fossiele schelpen van de Nederlandse kust II. Rissoidae (deel 4). *Spirula* 391: 46-59.

**Reemer, M.** 2013. Review and phylogenetic evaluation of associations between Microdontinae (Diptera: Syrphidae) and ants (Hymenoptera: Formicidae). *Psyche* vol. 2013, Article ID 538316.

Roskam, J.C. & **Adema, F.A.C.B.** 2013. Easily overlooked galls caused by *Planetella gallarum* (Diptera, Cecidomyiidae) on *Carex trinervis* in the Netherlands. *Cecidology* 28: 52-55.

**Ross, F.D.** 2013. *Osteolaemus* syntype nose count was two. *Crocodile Specialist Group Newsletter* 32(3): 35.

**Ross, F.D.**, Kischlat, E.-E., van Tomme, M.P.A. & Ross, C.A. 2013. Seba's plate 106 makes much better sense now. *Crocodile Specialist Group Newsletter* 32(1): 36-39.

Sander, P.M., Klein, N., **Albers, P.C.H.**, Bickelmann, C. & Winkelhorst, H. 2013. Postcranial morphology of a basal Pistosauroidea (Sauropterygia) from the Lower Muschelkalk of Winterswijk, the Netherlands. *Paläontologische Zeitung.* doi: 10.1007/s12542-013-0181-5.

**Schilthuizen, M.** 2013. Menno Schilthuizen wil meer longreads. *Bionieuws*, 12 oktober 2013.

**Schilthuizen, M.** 2013. Menno Schilthuizen eert het kleine. *Bionieuws*, 18 juni 2013.

**Schilthuizen, M.** 2013. Menno Schilthuizen wantrouwt het persbericht. *Bionieuws*, 29 maart 2013.

**Schilthuizen, M.** 2013. Menno Schilthuizen noemt geen namen. *Bionieuws*, 19 januari 2013.

Schrieken, N., **Gittenberger, A.**, Coolen, J. & Lengkeek, W. 2013. Marine fauna of hard substrata of the Cleaver Bank and Dogger Bank. *Nederlandse Faunistische Mededelingen* 41: 69-78.

**Smit, H.** 2013. Three new hyporheic water mite species from Australia (Acari: Hydrachnidia). *Subterranean Biology* 10: 37-42.

**Smit, J.T.** 2013. De hottentottavilla *Villa hottentotta* toch op de Nederlandse lijst (Diptera: Bombyliidae). *Nederlandse Faunistische Mededelingen* 40: 23-233.

**Smit, J.T.** 2013. Duistere heiderouwzwever *Exoprosopa cleomene* duikt op in Nederlandse wolzwevercollectie (Diptera: Bombyliidae). *Nederlandse Faunistische Mededelingen* 39: 49-54.

Smith, V., Georgiev, T., Stoev, P., Biserkov, J., **Miller, J.**, Livermore, L., Baker, E., Mietchen, D., Couvreur, T., Mueller, G., Dikow, T., Helgen, K.M., Frank, J., Agosti, D., Roberts, D. & Penev, L. 2013. Beyond dead trees: integrating the scientific process in the Biodiversity Data Journal. *Biodiversity Data Journal* 1: e995.

**Towns, A.M.**, Potter, D. & Idrissa, S. 2013. Cultivated, caught, and collected: defining culturally appropriate foods in Tallé, Niger. *Development in Practice* 23: 169-183.

van Aartsen, J.J. & **Wesselingh, F.P.** 2013. De fossiele schelpen van de Nederlandse kust II, deel 6: Pyramidelloidea. *Spirula* 395: 178-186.

**van Achterberg, C.** 2013. De Nederlandse hongerwespen (Hymenoptera: Evanioidea: Gasteruptiidae). *Nederlandse Faunistische Mededelingen* 39: 55-87.

**van Bruggen, A.C.** 2013. An early (1850) 'handwritten' shell exchange catalogue of the Leiden Museum, with notes on the collectors Rethaan Macare and Tischbein. *Zoologische Mededelingen Leiden* 87: 207-233.
**van Bruggen, A.C.** 2013. Koninklijk Zoologisch-Botanisch Genootschap, the zoological garden in The Hague, 1863-1943, a retrospect after seventy years from the point of view of a zoologist. *Der Zoologische Garten N.F.* 82: 190-233.
van de Putte, K., **Nuytinck, J.** & Verbeken, A. 2013. *Lactarius volemus* (Russulales): from a traditional morphological species to a worldwide species complex. *Scripta Botanica Belgica* 51: 152-161.
**van der Ham, R.W.J.M.** 2013. Devonisch raadselfossiel: *Prototaxites*, op het strand bij Hoek van Holland. *Grondboor & Hamer* 67: 206-208.
**van der Ham, R.W.J.M.**, Cadée, G. & Kruiswijk, W. 2013. Walnoten, pecannoten en een vleugelnoot van de Nederlandse kust. *Het Zeepaard* 73: 96-103.
**van der Maesen, L.J.G.** 2013. Leguminosae-Papilionoideae in the Flora of Gabon: new species and nomenclatural notes. *Webbia* 68: 97-101.
**van der Velde, G.** & Klok, P.F. 2013. De invasieve Gekielde loofslak (*Hygromia cinctella*) in Nijmegen. *Spirula* 394: 151.
**van Helsdingen, P.J.** 2013. A quick scan of the spider fauna of the European part of Turkey. *Nieuwsbrief SPINED* 33: 29-38.
**van Helsdingen, P.J.** 2013. Dynamiek in de spinnenwereld: stand van zaken bij enkele soorten. *Nieuwsbrief SPINED* 33: 20.
**van Helsdingen, P.J.** 2013. Recente wijzigingen in nomenclatuur. *Nieuwsbrief SPINED* 33: 40.
**van Helsdingen, P.J.** 2013. Spin van het Jaar 2013: *Atypus affinis*. *Nieuwsbrief SPINED* 33: 40.
**van Helsdingen, P.J.**, IJland, S., **Noordijk, J.** & Wijnhoven, H. 2013. Arachniden van het Roerdal: 1000-soortendag met enkele aanvullingen (Arachnida: Araneae, Opiliones, Pseudoscorpiones). *Nieuwsbrief SPINED* 33: 21-28.
van Leeuwen, T., **Kriegsman, L.M.**, **van Tol, J.** & Schokkenbroek, J. 2013. The changing role of museums in the global scientific landscape. *Journal of Scientometric Research* 2: 137-145.
**van Oijen, M.** & **van Rijssel, J.** 2013. Bevlogen cichlidenexpert laat onschatbare erfenis na. In memoriam Frans Witte. *Bionieuws,* 2 maart 2013: 7.
**van Soest, R.W.M.**, **Beglinger, E.J.** & **de Voogd, N.J.** 2013. Microcionid sponges from Northwest Africa and the Macaronesian Islands (Porifera, Demospongiae, Poecilsclerida). *Zoologische Mededelingen* 276: 275-404.
**van Tol, J.** 2013. Catalogue of the Odonata of the World. Version 2013. CD-ROM, Species 2000.
van Valkenburg, J.L.C.H., **Duistermaat, H.** & **Boer, E.** 2013. Image-driven electronic identification keys for invasive plant species in the Netherlands. *Bulletin OEPP/EPPO Bulletin* 43(2): 250-254.
**van Welzen, P.C.** 2013. *Mallotus actinoneurus* and *Mallotus tokiae* (Euphorbiaceae), a new record and a new species for Thailand. *Thai Forest Bulletin (Botany)* 41: 85-89.
**van Welzen, P.C.**, Gadella, T.W.J., **Maas, P.J.M.**, Daly, D.C., Mori, S.A., Jorgensen, P.M., Obermüller, F.A., Kjellberg, F., Rønsted, N., **Chantarasuwan, B.** & **Lut, C.W.J.** 2013. In memoriam Cees Berg (2 July 1934 - 31 August 2012). *Blumea* 57: 199-206.
**Veldkamp, J.F.** 2013. Nomenclatural notes on *Boesenbergia* Kuntze (Zingiberaceae). *Philippine Journal of Science, Sp. Supplement*: 215-221.
**Veldkamp, J.F.** 2013. Nomenclatural notes on *Eugenia reinwardtiana* (Myrtaceae) and more or less associated names. *The Gardens' Bulletin Singapore* 65: 117-134.
Verbeken, A. & **Nuytinck, J.** 2013. Not every milkcap is a *Lactarius*. *Scripta Botanica Belgica* 51: 162-168.
Vila, J., Carbo, J., Caballero, F., Catala, S., Llimona, X. & **Noordeloos, M.E.** 2013. A first approach to the study if the genus *Entoloma* subgenus *Nolanea* s.l. using molecular and morphological data. *Studies in Entoloma*, Fungi non delineati 66: 3-62, 93-135 (iconography).
**Vorst, O.** 2013. On some Gipuzkoan Coleoptera, including several species new to the Iberian Peninsula. *Heteropterus (Revista de Entomología)* 13: 147-173.
**Vorst, O.** & Faasen, T. 2013. *Sulcacis bidentulus*, een nieuwe houtzwamkever voor de Nederlandse fauna (Coleoptera: Ciidae). *Nederlandse Faunistische Mededelingen* 39: 7-14.
**Waheed, Z.** & **Hoeksema, B.W.** 2013. Hard corals in the proposed Tun Mustapha Park, Kudat, Malaysia. Tun Mustapha Park Expedition report for the sponsors (Ministry of Science, Technology and Innovation, Malaysia and USAID Coral Triangle Support Partnership) and general public.
Wakeham-Dawson, A. & **Koster, J.C.** 2013. Lepidoptera of the Falkland Islands (3): A new and unique species of Momphidae. *Entomologist's Monthly Magazine* 149: 129-133.
**Wesselingh, F.P.**, Rijken, R. & **van Nieulande, F.A.D.** 2013. De fossiele schelpen van de Nederlandse kust II, deel 5: Epitoniidae. *Spirula* 395: 170-177.
**Wesselingh, F.**, **van Andel, T.R.** & **van Proosdij, A**. 2013. Uncovering past Caribbean biodiversity: a look into the collections of Naturalis. *BioNEWS* 5: 8.
**Wieringa, J.J.** & **Sosef, M.S.M.** 2013. The applicability of Relative Floristic Resemblance to evaluate the conservation value of protected areas. In: Beau, N., Dessein, S. & Robbrecht, E. (eds.), African plant diversity. Systematics and sustainable development. Proceedings of the AETFAT Congress 19 (Antananarivo, Madagascar, 26-30 April 2010). *Scripta Botanica Belgica* 50: 14-23.
**Winkler Prins, C.F.** & **Donovan, S.K.** 2013. "Ik, een geoloog". *Grondboor en Hamer* 67(2): 8-15.
Zappalà L., Biondi, A., Siscaro, G., Garzia, G.T., **van Achterberg, K.** & Desneux, N. 2013. Adattamento di limitatori indigeni di *Tuta absoluta* in Italia: il parassitoide *Bracon nigricans*. *Atti Accademia Nazionale Italiana di Entomologia* 110: 85-93.
**Zonneveld, B.J.M.** 2013. Een gekleurde mini *Jovibarba heuffelii*. *Succulenta* 92-5: 228-230.
**Zonneveld, B.J.M.** 2013. Het maken van een behaarde *Jovibarba heuffelii* die ook rood is. *Succculenta* 92-3: 115-118.
**Zonneveld, B.J.M.** 2013. *Jovibarba heuffelii.* Magic circle verkleurt van geel naar rood. *Succulenta* 92-1: 42-45.
**Zwaan, J.C.** 2013. Een bijzondere 'parel' getest. *Edelmetaal* 68: 35-37.
**Zwaan, J.C**. 2013. 5e Europees Gemmologisch Symposium. *Edelmetaal* 68 (juli/augustus): 44-45.
**Zwaan, J.C.** 2013. Gemstones come under the loupe at the 5th European Gemmological Symposium in the Netherlands. Gemewizard Gem Color ReportNewsletter, July/August/September, the Gemewizard blog, 2p.
**Zwaan, J.C.** 2013. Kristallen met spiraal-groeikenmerken/ Cristaux avec croissance en spirale (Exhibition 'Chiral Garden', by Irene Kopelman). *Le Journale de la Verrière* 3: 20.
**Zwaan, J.C**. 2013. Terug naar de bron. Op mijnenbezoek in Vietnam en Sri Lanka. *Edelmetaal* 68 (december): 24-27.

## Books

**Aukema, B.**, Rieger, Chr. & Rabitsch, W. 2013. Catalogue of Palaearctic Heteroptera 6. Supplement. Netherlands Entomological Society, Amsterdam. 629 pp.
**Baas, P.**, Battigpaglia G., De Micco S., **Lens, F.** & Wheeler, E.A. (eds.). 2013. Wood structure in plant biology and ecology. Brill, Leiden. 180 pp.
**Boer, E., Duistermaat, H.** & van Valkenburg, J.L.C.H. 2013. Waardplanten Anoplophora. Veldgids zomerkenmerken. NVWA, Utrecht. 56 pp.
**Boer, E., Duistermaat, H.** & van Valkenburg, J.L.C.H. 2013. Waardplanten Anoplophora. Veldgids winterkenmerken. NVWA, Utrecht. 56 pp.
de Bruyne, R., **van Leeuwen, S.**, Gmelig Meyling, A. & Daan, R. (eds.). 2013. Schelpdieren van het Nederlandse Noordzeegebied. Ecologische atlas van de mariene weekdieren (Mollusca). Tirion Natuur en Stichting ANEMOON. 416 pp.
**Ellis, W.N.**, Groenendijk, D., Huigens, M.E., Jansen, M.G.M., van der Meulen, J., **van Nieukerken, E.J.** & **de Vos, R.** 2013. Nachtvlinders belicht: dynamisch, belangrijk, bedreigd. [Moths enlightened. Dynamic, important, threatened.]. De Vlinderstichting, Wageningen en Werkgroep Vlinderfaunistiek, Leiden. 162 pp.
**Fransen, C.H.J.M.** (ed.). 2013. Freshwater malacostracans in Chilean inland waters. *Crustaceana* 86, Special Issue. 102 pp.
**Fransen, C.H.J.M.** (ser. ed.). 2013. Systematics of the Caligidae, copepods parasitic on marine fishes. *Crustaceana Monographs* 18. Brill Academic Publishers, Leiden. 448 pp.
Girmansyah, D., Santika, Y., Retnowati, A., Wardani, W., Haerida, I., Widjaja, E.A. & **van Balgooy, M.M.J.** 2013. Flora of Bali: An annotated checklist. Herbarium Bogoriense, Bogor, Indonesia. 158 pp.
**Gittenberger, A.** & **Kleukers, E.** (eds.). 2013. Oases of marine biodiversity in the Dutch North Sea. Nederlandse Faunistische Mededelingen 41 Special issue. European Invertebrate Survey & Naturalis, Leiden. 112 pp.
**Klein, J.** & Bogdanova, T. 2013. Fossilium Catalogus I: Animalia pars 151 Lower Cretaceous Ammonites VI: Douvilleiceratoidea & Deshayesitoidea. Margraf Publishers Weikersheim. 299 pp.
Leewis, R., **Duistermaat, L., Gittenberger, A.,** van der Have, T., **Soes, M.** & van Valkenburg, J. 2013. Veldgids exoten. KNNV Uitgeverij, Zeist. 192 pp.
**Merckx, V.S.F.T.** (ed.). 2013. Mycoheterotrophy. The biology of plants living on fungi. Springer, New York. 356 pp.
**Mota de Oliveira, S.** (ed). 2013. Flora of the Guianas, Series E, fascicle 3: Cladoniaceae. Kew Publishing, Kew. 132 pp.
**Sosef, M.S.M.,** Florence, J., Ngok Banak, L. & Bourobou Bourobou, H.P. (eds.). 2013. Clusiacea, Malvaceae. Flore du Gabon, 45. Margraf Publishers, Weikersheim. 94 pp.
**van der Burgh, J.** 2013. Index of Angiosperm leaf species names. Fossilium Catalogus Plantae 112. Backhuys Publishers & Margraf Publishers, Weikersheim. 160 pp.

## Chapters in Books

**Baas, P.** 2013. Wood anatomy. In: **van Welzen, P.C.** & Esser, H.-J. Peraceae. *Flora Malesiana* 21: 121-122.
**Baas, P.** & **Lens, F.** 2013. Wood anatomy. In: Prance, G.T. & Karawinata, E.K. Lecythidaceae. *Flora Malesiana* 21: 4-5.
Daan, R., de Bruyne, R., Wijnhoven, S., Kuijper, W., **Faasse, M.,** van Moorsel, G., Gmelig Meyling, A. & **van Leeuwen, S.** 2013. Tweekleppigen – Bivalvia. In: de Bruyne, R., **van Leeuwen, S.**, Gmelig Meyling, A. & Daan, R. (eds.). Schelpdieren van het Nederlandse Noordzeegebied. Ecologische atlas van de mariene weekdieren (Mollusca): 47-174.
Daan, R., Wijnhoven, S.,Dekker, R. & **van Leeuwen, S.** 2013. Leefgebieden voor weekdieren. In: de Bruyne, R., **van Leeuwen, S.**, Gmelig Meyling, A. & Daan, R. (eds.). Schelpdieren van het Nederlandse Noordzeegebied. Ecologische atlas van de mariene weekdieren (Mollusca): 23-34.
de Bruyne, R., Daan, R., **Faasse, M.**, **Kuijper, W.**, Wijnhoven, S., Gmelig Meyling, A. & **van Leeuwen, S.** 2013. Huisjesslakken – Gastropoda. In: de Bruyne, R., **van Leeuwen, S.**, Gmelig Meyling, A. & Daan, R. (eds.). Schelpdieren van het Nederlandse Noordzeegebied. Ecologische atlas van de mariene weekdieren (Mollusca): 175-262.
Fuwu, X., Wang, F. & **Nooteboom, H.P.** 2013. Davalliaceae. In: Wu, X., Raven, P.H. & Hong, D.Y. (eds.). Flora of China 2-3: 4, 6, 11, 535, 730, 749-757, 786.
**Hovenkamp, P.H.** 2013. Nephrolepidaceae. In: Parris, B.S., Kiew, R., Chung, R.C.K. & Saw, L.G. (eds.). Flora of Peninsular Malaysia, Series 1, vol. 2: 51-66.
**Hovenkamp, P.H.** 2013. Oleandraceae. In: Parris, B.S., Kiew, R., Chung, R.C.K. & Saw, L.G. (eds.). Flora of Peninsular Malaysia, Series 1, vol. 2: 67-71.
**Hovenkamp, P.H.** 2013. Polypodiaceae. In: Parris, B.S., Kiew, R., Chung, R.C.K. & Saw, L.G. (eds.). Flora of Peninsular Malaysia, Series 1, vol. 2: 97-198.
**Janssen, A.W.** & **Peijnenburg, K.T.C.A.** 2013. Holoplanktonic Mollusca: development in the Mediterranean Basin during the last 30 million years and their future. In: Goffredo, S. and Dubinsky, Z. (eds.). The Mediterranean Sea: its history and present challenges: 341-362.
**Kappes, H.** 2013. Snails and slugs as indicators of sustainable forest management. In: Kraus, D. & Krumm, F. (eds.). Integrative approaches as an opportunity for the conservation of forest biodiversity: 194-202.
Kuroki, M., **van Oijen, M.J.P.** & Tsukamoto, K. 2013. Eels and the Japanese: An inseparable, long-standing relationship. In: Tsukamoto, K. & Kuroki, M. (eds.). *Eels and Humans*: 91-108.
Kustatscher, E. & **van Konijnenburg-van Cittert, J.H.A.** 2013. Seed ferns from the European Triassic – an overview. In: Tanner, L.H., Spielmann, J.A. and Lucas, S.G. (eds.). The Triassic System. New Mexico Museum of Natural History and Science, Bulletin 61: 331-344.
**Merckx, V.S.F.T.** 2013. Mycoheterotrophy: an introduction. In: Merckx, V.S.F.T. (ed.). Mycoheterotrophy: The biology of plants living on fungi: 1-17.
**Merckx, V.S.F.T.**, Freudenstein, J.V., Kissling, J., Christenhusz, M.J.M., Stotler, R.E., Crandall-Stotler, B., Wickett, N., Rudall, P.J., **Maas-van de Kamer, H.** & **Maas, P.J.M.** 2013. Taxonomy and classification. In: **Merckx, V.S.F.T.** (ed.). Mycoheterotrophy: The biology of plants living on fungi: 19-101.

**Merckx, V.S.F.T., Mennes, C.B.**, Peay, K.G. & **Geml, J.** 2013. Evolution and diversification. In: **Merckx, V.S.F.T.** (ed.). Mycoheterotrophy: The biology of plants living on fungi: 215-244.

**Merckx, V.S.F.T., Smets, E.F.** & Specht, C.D. 2013. Biogeography and conservation. In: **Merckx, V.S.F.T.** (ed.). Mycoheterotrophy: The biology of plants living on fungi: 103-156.

**Nooteboom, H.P.** 2013. Davalliaceae. In: Parris, B.S., Kiew, R., Chung, R.C.K. & Saw, L.G. (eds.). Flora of Peninsular Malaysia Series I, volume 2, 73-96.

**Nooteboom, H.P.** 2013. Hypodematiaceae. In: Parris, B.S., Kiew, R., Chung, R.C.K. & Saw, L.G. (eds.). Flora of Peninsular Malaysia Series I, volume 2, 43-50.

**Raes, N.**, Filer, D. & Farjon, A. 2013. Modelled conifer diversity; a pilot study. In: Farjon, A. & Filer, D. (eds.). An atlas of the world's conifers: 483-486.

**Schulten, G.G.M.** 2013. Scoliidae Latreille 1802. In: Gerlach, J. (ed.). Odonata, Hemiptera, Hymenoptera and other insects of the Seychelles Islands. Nature Protection Trust of the Seychelles: 330-335.

Shugang, L. & **Nooteboom, H.P.** 2013. *Phymatosorus*. In: Wu, X., Raven, P.H. & Hong, D.Y. (eds.). Flora of China Vol. 2-3: 4, 760, 827-829.

**Sosef, M.S.M.** & Dauby, G. 2013. Clusiaceae. In: **Sosef, M.S.M.**, Florence, J., Bourobou, H. & Ngok Banak, L. (eds.). Flore du Gabon 45: 1-43.

**van Andel, T.**, Ruysschaert, S., van de Putte, K. & Groenendijk, S. 2013. What makes a plant magical? Symbolism and sacred herbs in Afro-Surinamese winti rituals. In: Voeks, R. & Rashford, J. (eds.). African Ethnobotany in the Americas: 247-284.

**van der Burgh, J.** 2013. Malvaceae. In: **Sosef, M.S.M.**, Florence, J., Ngok Banak, L. & Bourobou Bourobou, H.P. (eds.). Clusiaceae, Malvaceae. Flore du Gabon 45: 45-88.

**van der Geer, A.A.E.** & Dermitzakis, M. 2013. Caves and fossils: Palaeontology in Greek caves and fissures. In: Mavridis, F. & Jensen, J.T. Stable places and changing perceptions: cave archaeology in Greece: 83-98. British Archaeological Reports International Series 2558. Archaeopress.

**van der Ham, R.W.J.M.** 2013. Pollen morphology. In: Prance, G.T. & Kartawinata, E.K. Lecythidaceae. Flora Malesiana I, 21: 5-7.

**van der Ham, R.W.J.M.** 2013. Pollen morphology. In: **van Welzen, P.C.** & Esser, H.J. H.-J. Peraceae. Flora Malesiana I, 21: 122-123.

**van Leeuwen, S.** 2013. Bescherming van de Nederlandse mariene weekdieren. In: de Bruyne, R., **van Leeuwen, S.**, Gmelig Meyling, A. & Daan, R. (eds.). Schelpdieren van het Nederlandse Noordzeegebied. Ecologische atlas van de mariene weekdieren (Mollusca): 355-360.

**van Leeuwen, S.**, Daan, R. & Gmelig Meyling, A. 2013. Methodische verantwoording. In: de Bruyne, R., **van Leeuwen, S.**, Gmelig Meyling, A. & Daan, R. (eds.). Schelpdieren van het Nederlandse Noordzeegebied. Ecologische atlas van de mariene weekdieren (Mollusca): 13-22.

**van Leeuwen, S.**, Gmelig Meyling, A., de Bruyne, R. & Daan, R. 2013. Inleiding. In: de Bruyne, R., **van Leeuwen, S.**, Gmelig Meyling, A. & Daan, R. (eds.). Schelpdieren van het Nederlandse Noordzeegebied. Ecologische atlas van de mariene weekdieren (Mollusca): 9-12.

van Moorsel, G. & **van Leeuwen, S.** 2013. Effecten van menselijk gebruik op mariene weekdieren. In: de Bruyne, R., **van Leeuwen, S.**, Gmelig Meyling, A. & Daan, R. (eds.). Schelpdieren van het Nederlandse Noordzeegebied. Ecologische atlas van de mariene weekdieren (Mollusca): 343-354.

**van Welzen, P.C.** & Esser, H.-J. 2013. Peraceae. In: **Nooteboom, H.P.** (ed.), Flora Malesiana, ser. 1, 21: 119-133.

Wang, F.-G., Xing, F.-W. & **Hovenkamp, P.H.** 2013. *Arthropteris*. In: Wu, X., Raven, P.H. & Hong, D.Y. (eds.). Flora of China Vol. 2-3: 730-731.

**Wesselingh, F.P.** 2013. De oorsprong van de Nederlandse mariene weekdierfauna. In: de Bruyne, R., **van Leeuwen, S.**, Gmelig Meyling, A. & Daan, R. (eds.). Schelpdieren van het Nederlandse Noordzeegebied. Ecologische atlas van de mariene weekdieren (Mollusca): 35-38.

**Wesselingh, F.** & **ten Hove, H.A.** 2013. Wormen (Annelida). p. 116 in: Peters, N. 2013. Van reuzenhaai tot Chalicotherium. Fossielen uit Mill-Langenboom. Oertijdmuseum De Groene Poort, Boxtel. 158 pp., ills. ISBN 978 90 807642 3 1.

**Wesselingh, F.P.**, Wijnstekers, H. & Burger, A. 2013. Ongewervelde dieren – Weekdieren (Mollusca). In: Peters, N. 2013. Van Reuzenhaai tot *Chalicotherium*: Fossielen uit Mill-Langenboom: 90-103.

Witte, F., Kishe-Machumu, M.A., Mkumbo, O.C., Wanink, J.H., Goudswaard, P.C., **van Rijssel, J.C.** & **van Oijen, M.J.P.** 2013. The fish fauna of Lake Victoria during a century of human induced perturbations. In: Snoeks, J. & Getahun, A. (eds.). Proceedings of the Fourth International Conference on African Fish and Fisheries, Addis Adaba, Ethiopia, 22-26 September 2008. Zoological Documentation Online Series: 49-66.

Xing, F.-W., Wang, F.-G. & **Hovenkamp, P.H.** 2013. Nephrolepidaceae. In: Wu, X., Raven, P.H. & Hong, D.Y. (eds.). Flora of China Vol. 2-3: 727-729.

Yan, Y.-H., Qi, X.-P., Wenbo, L., Fuwu, X., Ding, M.-Y., Wang, F., Zhang, X.-C., Zhaohong, W., Serizawa, S., Prado, P., Funston, M., Gilbert, M.G. & **Nooteboom, H.P.** 2013. Dennstaedtiaceae. In: Wu, X., Raven, P.H. & Hong, D.Y. (eds.). Flora of China Vol. 2-3: 4, 7, 10, 11, 147-168.

Zhang, G.-M., Fuwu, X., Wang, F., Iwatsuki, K. & **Nooteboom, H.P.** 2013. Hypodematiaceae. In: Wu, X., Raven, P.H. & Hong, D.Y. (eds.). Flora of China Vol. 2-3: 4, 12, 535-540.

Zhang, X.-C. & **Hovenkamp, P.H.** 2013. Oleandraceae. In: Wu, X., Raven, P.H. & Hong, D.Y. (eds.). Flora of China Vol. 2-3: 747-748.

Zhang, X.-C., Kato, M. & **Nooteboom, H.P.** 2013. Dipteridaceae. In: Wu, X., Raven, P.H. & Hong, D.Y. (eds.). Flora of China Vol. 2-3: 4, 9, 10, 116-117.

Zhang, X.-C., Lu, S.-G., Lin, Y.-X., Qi, X.-P., Moore, S., Fuwu, X., Wang, F., **Hovenkamp, P.**, Gilbert, M.G., **Nooteboom, H.P.**, Pariss, B.S., Haufler, C., Kato, M. & Smith, A.R. 2013. Polypodiaceae. In: Wu, X., Raven, P.H. & Hong, D.Y. (eds.). Flora of China Vol. 2-3: 758-850.

Zhang, X.-C. & **Nooteboom, H.P.** 2013. *Gymnogrammitis*. In: Wu, X., Raven, P.H. & Hong, D.Y. (eds.). Flora of China Vol. 2-3: 4, 10, 759, 786.

Zhang, X.-C. & **Nooteboom, H.P.** 2013. *Lepidomicrosorium*. In: Wu, X., Raven, P.H. & Hong, D.Y. (eds.). Flora of China Vol. 2-3: 4, 760, 829-830.

Zhang, X.-C. & **Nooteboom, H.P.** 2013. *Leptochilus*. In: Wu, X., Raven, P.H. & Hong, D.Y. (eds.). Flora of China Vol. 2-3: 4, 9, 759, 760, 833-838.

Zhang, X.-C. & **Nooteboom, H.P.** 2013. *Microsorum*. In: Wu, X., Raven, P.H. & Hong, D.Y. (eds.). Flora of China Vol. 2-3: 4, 758, 760, 830-833.

Zhang, X.-C. & **Nooteboom, H.P.** 2013. *Neocheiropteris*. In: Wu, X., Raven, P.H. & Hong, D.Y. (eds.). Flora of China Vol. 2-3: 4, 759, 804-805.

Zhang, X.-C. & **Nooteboom, H.P.** 2013. *Neolepisorus*. In: Wu, X., Raven, P.H. & Hong, D.Y. (eds.). Flora of China Vol. 2-3: 4, 760, 806-808, 830.

Zhang, X.-C. & **Nooteboom, H.P.** 2013. Plagiogyriaceae. In: Wu, X., Raven, P.H. & Hong, D.Y. (eds.). Flora of China Vol. 2-3: 4, 9, 128-131.

Zhang, X.-C. & **Nooteboom, H.P.** 2013. *Tricholepidium*. In: Wu, X., Raven, P.H. & Hong, D.Y. (eds.). Flora of China Vol. 2-3: 4, 760, 805-806.

Zhang, X.-C., **Nooteboom, H.P.** & Kato, M. 2013. Selaginellaceae. In: Wu, X., Raven, P.H. & Hong, D.Y. (eds.). Flora of China Vol. 2-3: 1, 4, 5, 6, 8, 37-66.

## PhD theses

**Chirangi, M.M.** 2013. Afya Jumuishi. Towards interprofessional collaboration between traditional and modern medical practitioners in the Mara Region of Tanzania. PhD Thesis. Leiden University.

**Kalkman, V.J.** 2013. Studies on phylogeny and biogeography of damselflies (Odonata) with emphasis on the Argiolestidae. PhD Thesis. Leiden University.

**Kok, P.J.R.** 2013. Islands in the sky: species diversity, evolutionary history and patterns of endemism of the Pantepui herpetofauna. PhD Thesis. Leiden University.

**Sirichamorn, Y.** 2013. Systematics and biogeography of *Aganope*, *Brachypterum* and *Derris* (Fabaceae) in Asia. PhD Thesis. Leiden Univeristy.

**van Velzen, R.** 2013. Evolution of associations between *Cymothoe* butterflies and their *Rinorea* host plants in tropical Africa. PhD Thesis. Wageningen University.

# 2014

## SCI publications

Aflitos, S., Schijlen, E., Finkers, R., Smit, S., Wang, J., Zhang, G., Li, N., Mao, L., de Jong, H., Bakker, F., **Gravendeel, B.**, Breit, T., Dirks, R., Huits, H., Struss, D., Swanson-Wagner, R., van Leeuwen, H., van Ham, R.C.H.J., Fito, L., Guignier, L., Sevilla, M., Ellul, P., Ganko, E., Kapur, A., Reclus, E., de Geus, B., van de Geest, H., te Lintel Hekkert, B., van Haarst, J., Smits, L., Koops, A., Sanchez-Perez, G., van Heusden, A.W., Visser, R., Quan, Z., Min, J., Liao, L., Wang, X., Wang, G., Yue, Z., Yang, X., Xu, N., Schranz, E., **Smets, E.**, **Vos, R.A.**, Rauwerda, J., Ursem, R., Schuit, C., Kerns, M., van den Berg, J., Vriezen, W., Janssen, A., Jahrmann, T., Moquet, F., Bonnet, J. & Peters, S. 2014. Exploring genetic variation in the tomato (*Solanum* section *Lycopersicon*) clade by whole-genome sequencing. *Plant Journal* 80: 136-148.

Aliabadian, M., Nijman, V., Mahmoudi, A., Naderi, M., **Vonk, R.** & Vences, M. 2014. ExcaliBAR: a simple and fast software utility to calculate intra- and interspecific distances from DNA barcodes. *Contributions to Zoology* 83: 79-83.

Archer, C.R., Pirk, C.W.W., **Carvalheiro, L.G.** & Nicolson, S.W. 2014. Economic and ecological implications of geographic bias in pollinator ecology in the light of pollinator declines. *Oikos* 123: 401-407.

**Arias Guerrero, S.**, Sánchez Sánchez, D., **Maas, P.J.M.** & **Erkens, R.H.J.** 2014. *Guatteria darienensis* (Annonaceae), a new species from Panama and Colombia. *Phytotaxa* 173: 149-156.

**Arntzen, J.W.**, **Wielstra, B.** & Wallis, G.P. 2014. The modality of nine *Triturus* newt hybrid zones assessed with nuclear, mitochondrial and morphological data. *Biological Journal of the Linnean Society* 113: 604-622.

**Arntzen, J.W.**, Wilkinson, J.W., **Butôt, R.** & Martinez-Solano, I. 2014. A new vertebrate species native to the British Isles: *Bufo spinosus* Daudin, 1803 in Jersey. *Herpetological Journal* 24: 209-216.

Arrigoni, R., Kitano, Y.F., Stolarski, J., **Hoeksema, B.W.**, Fukami, H., Stefani, F., Galli, P., Montano, S., Castoldi, E. & Benzoni, F. 2014. A phylogeny reconstruction of the Dendrophylliidae (Cnidaria, Scleractinia) based on molecular and micromorphological criteria, and its ecological implications. *Zoologica Scripta* 43: 661-688.

**Baalbergen, E.**, **Helwerda, R.**, **Schelfhorst, R.**, Castillo Cajas, R.F., van Moorsel, C.H.M., Kundrata, R., Welter-Schultes, F.W., Giokas, S. & **Schilthuizen, M.** 2014. Predator-prey interactions between shell-boring beetle larvae and rock-dwelling land snails. *PLOS ONE* 9: e100366.

Baker, T.R., Pennington, R.T., Magallon, S., Gloor, E., Laurance, W.F., Alexiades, M., Alvarez, E., Araujo, A., Arets, E.J.M.M., Aymard, G., de Oliveira, A.A., Amaral, I., Arroyo, L., Bonal, D., Brienen, R.J.W., Chave, J., Dexter, K.G., di Fiore, A., Eler, E., Feldpausch, T.R., Ferreira, L., Lopez-Gonzalez, G., van der Heijden, G., Higuchi, N., Honorio, E., Huamantupa, I., Killeen, T.J., Laurance, S., Leano, C., Lewis, S.L., Malhi, Y., Marimon, B.S., Marimon Junior, B.H., Monteagudo Mendoza, A., Neill, D., Penuela-Mora, M.C., Pitman, N., Prieto, A., Quesada, C.A., Ramirez, F., Ramirez, A.H., Rudas, A., Ruschel, A.R., Salomao, R.P., de Andrade, A.S., Silva, J.N.M., Silveira, M., Simon, M.F., Spironello, W., **ter Steege, H.**, Terborgh, J., Toledo, M., Torres-Lezama, A., Vasquez, R., Guimaraes, V.I.C., Vilanova, E., Vos, V.A. & Phillips, O.L. 2014. Fast demographic traits promote high diversification rates of Amazonian trees. *Ecology Letters* 17: 527-536.

Barbosa, E.R.M., Tomlinson, K.W., **Carvalheiro, L.G.**, Kirkman, K., de Bie, S., Prins, H.H.T. & van Langevelde, F. 2014. Short-term effect of nutrient availability and rainfall distribution on biomass production and leaf nutrient content of savanna tree species. *PLOS ONE* 9: e92619.

Barbosa, E.R.M., van Langevelde, F., Tomlinson, K.W., **Carvalheiro, L.G.**, Kirkman, K., de Bie, S. & Prins, H.H.T. 2014. Tree species from different functional groups respond differently to environmental changes during establishment. *Oecologia* 174: 1345-1357.

Bauer, K., Kustatscher, E., Butzmann, R., Fischer, T.C., **van Konijnenburg-van Cittert, J.H.A.** & Krings, M. 2014. Ginkgophytes from the Upper Permian of the Bletterbach gorge (northern Italy). *Rivista Italiana di Paleontologia e Stratigrafia* 120: 271-279.

Belton, G.S., **Prud'homme van Reine, W.F.**, Huisman, M., Draisma, S.G.A. & Gurgel, C.F.D. 2014. Resolving phenotypic plasticity and species designation in the morphologically challenging *Caulerpa racemosa-peltata* complex (Caulerpaceae, Chlorophyta). *Journal of Phycology* 50: 32-54.

Benzoni, F., Arrigoni, R., **Waheed, Z.**, Stefani, F. & **Hoeksema, B.W.** 2014. Phylogenetic relationships and revision of the genus *Blastomussa* (Cnidaria: Anthozoa: Scleractinia) with description of a new species. *Raffles Bulletin of Zoology* 62: 358-378.

**Booi, M.**, **van Waveren, I.M.** & **van Konijnenburg-van Cittert, J.H.A.** 2014. Wood anatomical variability in Early Permian 'araucarioids'. *IAWA Journal* 35: 307-331.

**Bos, A.R.** 2014. *Upeneus nigromarginatus*, a new species of goatfish (Perciformes: Mullidae) from the Philippines. *Raffles Bulletin of Zoology* 62: 745-753.

Bots, J., **ten Broek, C.M.**, Belien, J.A., Bugiani, M., **Galis, F.** & van Dongen, S. 2014. Higher limb asymmetry in deceased human fetuses and infants with aneuploidy. *Scientific Reports* 4: 3703.

Braet, Y. & **van Achterberg, C.** 2014. A new genus and two new species of Alysiinae (Hymenoptera: Braconidae) from Papua New Guinea. *Zootaxa* 3869: 189-197.

Brazeau, M.D. & Friedman, M. 2014. The characters of Palaeozoic gnathostomes. *Zoological Journal of the Linnean Society* 170: 779-821.

Breeze, T.D., Vaissiere, B.E., Bommarco, R., Petanidou, T., Seraphides, N., Kozak, L., Scheper, J., **Biesmeijer, J.C.**, Kleijn, D., Gyldenkaerne, S., Moretti, M., Holzschuh, A., Steffan-Dewenter, I., Stout, J.C., Paertel, M., Zobel, M. & Potts, S.G. 2014. Agricultural policies exacerbate honeybee pollination service supply-demand mismatches across Europe. *PLOS ONE* 9: e82996.

**Breure, A.S.H.** 2014. The sound of a snail: two cases of acoustic defence in gastropods. *Journal of Molluscan Studies* 2014: 1-4.

**Breure, A.S.H.** & Ablett, J.D. 2014. Annotated type catalogue of the Bulimulidae (Mollusca, Gastropoda, Orthalicoidea) in the Natural History Museum, London. *ZooKeys* 392: 1-367.

**Breure, A.S.H.**, Álvarez-Lajonchère, L. & González Guillén, A. 2014. Color-full and eye-catching: an iconography of *Liguus* land shells (Gastropoda: Orthalicidae). *Archiv für Molluskenkunde* 143: 1-19.

Buckland, S., Cole, N.C., **Aguirre Gutierrez, J.**, Gallagher, L.E., Henshaw, S.M., Besnard, A., Tucker, R.M., Bachraz, V., Ruhomaun, K. & Harris, S. 2014. Ecological effects of the invasive Giant Madagascar Day Gecko on endemic Mauritian Geckos: applications of binomial-mixture and species distribution models. *PLOS ONE* 9: e88798.

Buden, D.W., de Queiroz, K., **van Rooijen, J.**, Stinson, D.W., Wiles, G.J. & Robert, S. 2014. New information and reappraisals concerning some alien and indigenous snake records from the federated states of Micronesia and the Mariana Islands. *Pacific Science* 68: 287-293.

Budiharta, S., Slik, F., **Raes, N.**, Meijaard, E., Erskine, P.D. & Wilson, K.A. 2014. Estimating the aboveground biomass of Bornean forest. *Biotropica* 46: 507-511.

**Burridge, A.K.** & Bjørklund, K.R. 2014. Inter- and intraspecific morphological variation of three *Hexacontium* (Radiolaria) species in three southern Norwegian fjords: *H. gigantheum*, *H. pachydermum* and *H. enthacanthum*. *Marine Micropaleontology* 110: 72-82.

**Burridge, A.K.**, Bjørklund, K.R., Kruglikova, S.B. & Hammer, Ø. 2014. Inter- and intraspecific morphological variation of four-shelled *Actinomma* taxa (Radiolaria) in polar and subpolar regions. *Marine Micropaleontology* 110: 50-71.

Busschers, F.S., **Wesselingh, F.P.**, Kars, R.H., Versluijs-Helder, M., Wallinga, J., Bosch, J.H.A., Timmner, J., Nierop, K.G.J., **Meijer, T.**, Bunnik, F.P.M. & de Wolf, H. 2014. Radiocarbon dating of late pleistocene marine shells from the southern North Sea. *Radiocarbon* 56: 1151-1166.

Camara, P.E.A.S., Carvalho-Silva, M. & **Stech, M.** 2014. A catalogue of Sematophyllaceae (Bryophyta) types deposited in Dutch herbaria. *Nova Hedwigia* 99: 145-155.

Campos, L.V., Gradstein, R., Uribe-Meléndez, J. & **ter Steege, H.** 2014. Additions to the Catalogue of Hepaticae of Colombia II. *Cryptogamie Bryologie* 35: 77-92.

Capinha, C., Rödder, D., Pereira, H.M. & **Kappes, H.** 2014. Response of non-native European terrestrial gastropods to new climates correlates with biogeographical and biological traits. *Global Ecology and Biogeography* 23: 857-866.

Capinha, C., **Vermeulen, J.J.**, bin Lakim, M., **Schilthuizen, M.** & **Kappes, H.** 2014. Susceptibility of tropical mountain forests to biological invasions from the temperate and subtropical zone, exemplified by *Zonitoides* (Gastropoda: Gastrodontidae). *Raffles Bulletin of Zoology* 62: 600-609.

**Carvalheiro, L.G.**, **Biesmeijer, J.C.**, Benadi, G., Fründ, J., Stang, M., Bartomeus, I., Kaiser-Bunbury, C.N., Baude, M., **Gomes, S.I.F.**, **Merckx, V.**, Baldock, K.C.R., Bennett, A.T.D., Boada, R., Bommarco, R., Cartar, R., Chacoff, N., Dänhardt, J., Dicks, L.V., Dormann, C.F., Ekroos, J., Henson, K.S.E., Holzschuh, A., Junker, R.R., Lopezaraiza-Mikel, M., Memmott, J., Montero-Castaño, A., Nelson, I.L., Petanidou, T., Power, E.F., Rundlöf, M., Smith, H.G., Stout, J.C., Temitope, K., Tscharntke, T., Tscheulin, T., Vilà, M. & Kunin, W.E. 2014. The potential for indirect effects between co-flowering plants via shared pollinators depends on resource abundance, accessibility and relatedness. *Ecology Letters* 17: 1389-1399.

Casanovas-Vilar, I., **van den Hoek Ostende, L.W.**, Furio, M. & **Madern, P.A.** 2014. The range and extent of the Vallesian Crisis (Late Miocene): new prospects based on the micromammal record from the Vallès-Penedès basin (Catalonia, Spain). *Journal of Iberian Geology* 40: 29-48.

Castoe, T.A., de Koning, A.P.J., Hall, K.T., Card, D.C., Schield, D.R., Fujita, M.K., Ruggiero, R.P., Degner, J.F., Daza, J.M., Gu, W., Reyes-Velasco, J., Shaney, K.J., Castoe, J.M., Fox, S.E., Poole, A.W., Polanco, D., Dobry, J., Vandewege, M.W., Li, Q., Schott, R.K., Kapusta, A., Minx, P., Feschotte, C., Uetz, P., Ray, D.A., Hoffmann, F.G., Bogden, R., Smith, E.N., Chang, B.S.W., **Vonk, F.J.**, Casewell, N.R., Henkel, C.V., Richardson, M.K., Mackessy, S.P., Bronikowsi, A.M., Yandell, M., Warren, W.C., Secor, S.M. & Pollock, D.D. 2014. The Burmese python genome reveals the molecular basis for extreme adaptation in snakes. *PNAS* 111: 3194-3194.

Centko, R.M., Steino, A., Rosell, F.I., Patrick, B.O., **de Voogd, N.J.**, Mauk, A.G. & Andersen, R.J. 2014. Indoleamine 2,3-Dioxygenase inhibitors isolated from the sponge *Xestospongia vansoesti*: structure elucidation, analogue, and biological activity. *Organic Letters* 16: 6480-6483.

Chamberlain, S., Vazquez, D.P., **Carvalheiro, L.G.**, Elle, E. & Vamosi, J.C. 2014. Phylogenetic tree shape and the structure of mutualistic networks. *Journal of Ecology* 102: 1234-1243.

**Chantarasuwan, B.**, **Baas, P.**, **van Heuven, B.J.**, Baider, C. & **van Welzen, P.C.** 2014. Leaf anatomy of *Ficus* subsection *Urostigma* (Moraceae). *Botanical Journal of the Linnean Society* 175: 882-893.

**Chantarasuwan, B.**, Peng, Y.-Q., **Baas, P.**, Rasplus, J.-Y., **van Heuven, B.J.** & **van Welzen, P.C.** 2014. *Ficus cornelisiana*, a new species of *Ficus* subsection *Urostigma* (Moraceae) from the Sino-himalayan region. *Blumea* 59: 6-9.

**Chaowasku, T.** & **Kessler, P.J.A.** 2014. *Miliusa cambodgensis* sp. nov. (Annonaceae) from Cambodia and *M. astiana*, *M. ninhbinhensis* spp. nov from Vietnam. *Nordic Journal of Botany* 32: 298-307.

**Chaowasku, T.**, **Thomas, D.C.**, **van der Ham, R.W.J.M.**, **Smets, E.F.**, **Mols, J.B.** & Chatrou, L.W. 2014. A plastid DNA phylogeny of tribe Miliuseae: insigts into relationships and character evolution in one of the most recalcitrant major clades of Annonaceae. *American Journal of Botany* 101: 691-709.

Chen, D., Cheng, W., Liu, D., **van Ofwegen, L.**, Proksch, P. & Lin, W. 2014. Capillosananes S-Z, new sesquiterpenoids from the soft coral *Sinularia capillosa*. *Tetrahedron Letters* 55: 3077-3082.

Chen, H-y., **van Achterberg, C.**, He, J-h. & Xu, Z-f. 2014. A revision of the Chinese Trigonalyidae (Hymenoptera, Trigonalyoidea). *ZooKeys* 385: 1-207.

Chen, X-x., Tang, P., Zeng, J., **van Achterberg, C.** & He, J-h. 2014. Taxonomy of parasitoid wasps in China: An overview. *Biological Control* 68: 57-72.

Cleary, D.F.R., Polónia, A.R.M., **Renema, W.**, **Hoeksema, B.W.**, Wolstenholme, J., Tuti, Y. & **de Voogd, N.J.** 2014. Coral reefs next to a major conurbation: a study of temporal change (1985-2011) in coral cover and composition in the reefs of Jakarta, Indonesia. *Marine Ecology Progress Series* 501: 89-98.

Collas, F.P.L., Koopman, K.R., Hendriks, A.J., **van der Velde, G.**, Verbrugge, L.H.N. & Leuven, R.S.E.W. 2014. Effects of desiccation on native and non-native molluscs in rivers. *Freshwater Biology* 59: 41-55.

Collins, J.S.H., **Donovan, S.K.** & Mellish, C. 2014. An illustrated guide to the fossil barnacles (Cirripedia) from the Crags (Plio-Pleistocene) of East Anglia. *Proceedings of the Geologists' Association* 125: 215-226.

**Cotton, L.J.**, Pearson, P.N. & **Renema, W.** 2014. Stable isotope stratigraphy and larger benthic foraminiferal extinctions in the Melinau Limestone, Sarawak. *Journal of Asian Earth Sciences* 79: 65-71.

Crippa, G., Angiolini, L., **van Waveren, I.M.**, Crow, M.J., Hasibuan, F., Stephenson, M.H. & Ueno, K. 2014. Brachiopods, fusulines and palynomorphs of the Mengkarang Formation (Early Permian, Sumatra) and their palaeobiogeographical significance. *Journal of Asian Earth Sciences* 79: 206-223.

Daletos, G., **de Voogd, N.J.**, Mueller, W.E.G., Wray, V., Lin, W.H., Feger, D., Kubbutat, M., Aly, A.H. & Proksch, P. 2014. Cytotoxic and protein kinase inhibiting nakijiquinones and nakijiquinols from the sponge *Dactylospongia metachromia*. *Journal of Natural Products* 77: 218-226.

**de Boer, H.J.** & Cotingting, C. 2014. Medicinal plants for women's healthcare in southeast Asia: a meta-analysis of their traditional use, chemical constituents, and pharmacology. *Journal of Ethnopharmacology* 151: 747-67.

**de Boer, H.J.**, Ouarghidi, A., Martin, G., Abbad, A. & Kool, A. 2014. DNA barcoding reveals limited accuracy of identifications based on folk taxonomy. *PLOS ONE* 9: e84291.

de Crop, E., **Nuytinck, J.**, van de Putte, K., Lecomte, M., Eberhardt, U. & Verbeken, A. 2014. *Lactifluus piperatus* (Russulales, Basidiomycota) and allied species in Western Europe and a preliminary overview of the group worldwide. *Mycological Progress* 13: 493-511.

Dehon, M., Michez, D., Nel, A., Engel, M.S. & **de Meulemeester, T.** 2014. Wing shape of four new bee fossils (Hymenoptera, Apoidea, Anthophila) provides insights to bee evolution. *PLOS ONE* 9: e108865.

de la Estrella, M., **Wieringa, J.J.**, Mackinder, B., van der Burgt, X., Devesa, J.A. & Bruneau, A. 2014. Phylogenetic analysis of the African genus *Gilbertiodendron* J.Léonard and related genera (Leguminosae-Caesalpinioideae-Detarieae). *International Journal of Plant Sciences* 175: 975-985.

Delfino, M. & **de Vos, J.** 2014. A giant crocodile in the Dubois Collection from the Pleistocene of Kali Gedeh (Java). *Integrative Zoology* 9: 141-147.

**de Wilde, W.J.J.O.** & **Duyfjes, B.E.E.** 2014. *Ammannia* (Lythraceae) in Malesia. *Blumea* 59: 11-18.

Dewulf, A., **de Meulemeester, T.**, Dehon, M., Engel, M.S. & Michez, D. 2014. A new interpretation of the bee fossil *Melitta willardi* Cockerell (Hymenoptera, Melittidae) based on geometric morphometrics of the wing. *ZooKeys* 389: 35-48.

**Dijkstra, K.-D.B.**, **Kalkman, V.J.**, **Dow, R.A.**, **Stokvis, F.R.** & **van Tol, J.** 2014. Redefining the damselfly families: a comprehensive molecular phylogeny of Zygoptera (Odonata). *Systematic Entomology* 39: 68-96.

**Dijkstra, K.-D.B.**, Monaghan, M.T. & Pauls, S.U. 2014. Freshwater biodiversity and aquatic insect diversification. *Annual Review of Entomology* 59: 143-163.

Dirkse, G.M., Reijerse, A.I. & **Duistermaat, H.** 2014. De ontrafeling van in Nederland ingeburgerde Amerikaanse herfstasters (*Symphyotrichum* Nees subg. *Symphyotrichum* sect. *Symphyotrichum*, Asteraceae). *Gorteria* 37: 1-24.

**Donovan, S.K.** 2014. Discussion on "The Gramscatho Basin, south Cornwall, UK: Devonian active margin successions" [Proceedings of the Geologists' Association 122 (2011) 568-615]. *Proceedings of the Geologists' Association* 125: 255-255.

**Donovan, S.K.** 2014. Enigmatic branching structures within Upper Devonian crinoids, north Devon, UK. *Lethaia* 47: 151-152.

**Donovan, S.K.** 2014. Pioneers of Jamaican geology and the Jamaica Group of the Geologists' Association (1955-1959). *Proceedings of the Geologists' Association* 125: 131-138.

**Donovan, S.K.** 2014. The trace fossil *Teredolites longissimus* Kelly and Bromley, 1984, from the Eocene of Curaçao. *Caribbean Journal of Science* 47: 181-185.

**Donovan, S.K.**, Ausich, W.I., Wilson, M.A. & Peter, M.E. 2014. A Middle Ordovician crinoid from the beach gravels of Ristna Cape, Hiiumaa Island, Estonia. *Proceedings of the Geologists' Association* 125: 96-98.

**Donovan, S.K.** & Fearnhead, F.E. 2014. A dearth of diplobathrids (Crinoidea) from the type Devonian System, southwest England. *Proceedings of the Yorkshire Geological Society* 60: 91-97.

**Donovan, S.K.**, Harper, D.A.T., Portell, R.W. & **Renema, W.** 2014. Neoichnology and implications for stratigraphy of reworked Upper Oligocene oysters, Antigua, West Indies. *Proceedings of the Geologists' Association* 125: 99-106.

**Donovan, S.K.** & Isted, J. 2014. *Teredolites* Leymerie in the Lower Greensand Group (Cretaceous) of the Isle of Wight and the problematic ichnology of reworked clasts. *Proceedings of the Geologists' Association* 125: 252-254.

**Donovan, S.K.**, Jagt, J.W.M. & Goffings, L. 2014. Bored and burrowed: an unusual echinoid steinkern from the Type Maastrichtian (Upper Cretaceous, Belgium). *Ichnos* 21: 261-265.

**Donovan, S.K.**, Lewis, D.N. & Bouman, R.A. 2014. Echinoid remains preserved in a Derbyshire screwstone (Mississippian, Viséan, Brigantian), UK. *Proceedings of the Yorkshire Geological Society* 60: 135-139.

**Donovan, S.K**. & Miller, R.F. 2014. The camerate crinoid *Scyphocrinites* Zenker in the Upper Silurian or Lower Devonian of New Brunswick, Canada. *Atlantic Geology* 50: 290-296.

**Donovan, S.K.** & Portell, R.W. 2014. Fossil echinoids from the Upper Pliocene Hopegate Formation of north central Jamaica. *Caribbean Journal of Science* 47: 125-139.

**Doorenweerd, C.**, **van Haren, M.M.**, **Schermer, M.**, **Pieterse, S.** & **van Nieukerken, E.J.** 2014. A Linnaeus NG (TM) interactive key to the Lithocolletinae of North-West Europe aimed at accelerating the accumulation of reliable biodiversity data (Lepidoptera, Gracillariidae). *ZooKeys* 422: 87-101.

Downing, A.S., van Nes, E.H., Balirwa, J.S., Beuving, J., Bwathondi, P.O.J. , Chapman, L.J., Cornelissen, I.J.M., Cowx, I.G., Goudswaard, C.P.C., Hecky, R.E., Janse, J.H., Janssen, A.B.G., Kaufman, L., Kishe-Machumu, M.A., Kolding, J., Ligtvoet, W., Mbabazi, D., Medard, M., Mkumbo, O.C., Mlaponi, E., Munyaho, A.T., Nagelkerke, L.A.J., Ogutu-Ohwayo, E., Ojwang, W.O., Peter, H.K., Schindler, D.E., Seehausen, O., Sharpe, D., Silsbe, G.M., Sitoki, L., Tumwebaze, R., Tweddle, D., van de Wolfshaar, K.E., van Dijk, H., van Donk, E., **van Rijssel, J.C.**, van Zwieten, P.A.M., Wanink, J., **Witte, F.** & Mooij, W.M. 2014. Coupled human and natural system dynamics as key to the sustainability of Lake Victoria's ecosystem. *Ecology and Society* 19: 31.

Draisma, S.G.A., **Prud'homme van Reine, W.F.** & Kawai, H. 2014. Corrigendum of "A revised classification of the Sphacelariales (Phaeophyceae) inferred from a *psb*C and *rbc*L based phylogeny". *European Journal of Phycology* 49: 576.

Draisma, S.G.A., **Prud'homme van Reine, W.F.**, Sauvage, T., Belton, G.S., Gurgel, C.F.D., Lim, P.E. & Phang, S.M. 2014. A re-assessment of the infra-generic classification of the genus *Caulerpa* (Caulerpaceae, Chlorophyta) inferred from a time-calibrated molecular phylogeny. *Journal of Phycology* 50: 1020-1034.

Elbgami, T., Kunin, W.E., Hughes, W.O.H. & **Biesmeijer, J.C.** 2014. The effect of proximity to a honeybee apiary on bumblebee colony fitness, development, and performance. *Apidologie* 45: 504-513.

El-Desoky, A.H., Kato, H., Eguchi, K., Kawabata, T., Fujiwara, Y., Losung, F., Mangindaan, R.E.P., **de Voogd, N.J.**, Takeya, M., Yokosawa, H. & Tsukamoto, S. 2014. Acantholactam and pre-*neo*-kauluamine, manzamine-related alkaloids from the Indonesian marine sponge *Acanthostrongylophora ingens*. *Journal of Natural Products* 77: 1536-1540.

Emilio, T., Quesada, C.A., Costa, F.R.C., Magnusson, W.E., Schietti, J., Feldpausch, T.R., Brienen, R.J.W., Baker, T.R., Chave, J., Alvarez, E., Araujo, A., Banki, O., Castilho, C.V., Honorio, C.E.N., Killeen, T.J., Malhi, Y., Oblitas Mendoza, E.M., Monteagudo, A., Neill, D., Alexander, P.G., Pena-Cruz, A., Ramirez-Angulo, H., Schwarz, M., Silveira, M., **ter Steege, H.**, Terborgh, J.W., Thomas, R., Torres-Lezama, A., Vilanova, E. & Phillips, O.L. 2014. Soil physical conditions limit palm and tree basal area in Amazonian forests. *Plant Ecology & Diversity* 7: 215-229.

**Erkens, R.H.J.**, Chatrou, L.W., **Chaowasku, T.**, **Westra, L.Y.Th.**, Maas, J.W. & **Maas, P.J.M.** 2014. A decade of uncertainty: Resolving the phylogenetic position of *Diclinanona* (Annonaceae), including taxonomic notes and a key to the species. *Taxon* 63: 1244-1252.

Farahani, S., Talebi, A.A., **van Achterberg, C.** & Rakhshani, E. 2014. A new species of the genus *Mirax* Haliday, 1833 (Hymenoptera: Braconidae: Miracinae) from Iran. *Annales Zoologici* 64: 677-682.

Farahani, S., Talebi, A.A., **van Achterberg, C.** & Rakhshani, E. 2014. A taxonomic study of Orgilinae and Microtypinae from Iran (Hymenoptera, Braconidae). *Spixiana* 37: 93-102.

Faria, V.V., Chiaramonte, G.E. & **van Oijen, M.J.P.** 2014. Publication date and author spelling for the hidden angelshark *Squatina occulta*. *Journal of Fish Biology* 84: 1185-1187.

**Fransen, C.H.J.M.** 2014. A second discovery of *Diapontonia maranulus* Bruce, 1986 (Crustacea: Decapoda: Palaemonidae) in the Caribbean. *Zootaxa* 3881: 591-596.

**Fransen, C.H.J.M. & Hoeksema, B.W.** 2014. Going for the stars: extending the host record for the reef-dwelling Emperor shrimp, *Periclimenes imperator* (Pontoniinae). *Marine Biodiversity* 44: 465-466.

Frausin, G., Lima, R.B.S., Hidalgo, A.F., **Maas, P.J.M.** & Pohlit, A.M. 2014. Plants of the Annonaceae traditionally used as antimalarials: a review. *Revista Brasileira de Fruticultura* 36: 315-337.

**Freudenthal, M.**, García-Alix, A., Rios, M., Ruiz-Sánchez, F., Martín-Suárez, E. & Delgado Huertas, A. 2014. Review of paleo-humidity parameters in fossil rodents (Mammalia): Isotopic vs. tooth morphology approach. *Palaeogeography, Palaeoclimatology, Palaeoecology* 395: 122-130.

Fung, S.-Y., Sofiyev, V., Schneiderman, J., Hirschfeld, A.F., Victor, R.E., Woods, K., Piotrowski, J.S., Deshpande, R., Li, S.C., **de Voogd, N.J.**, Myers, C.L., Boone, C., Andersen, R.J. & Turvey, S.E. 2014. Unbiased screening of marine sponge extracts for anti-inflammatory agents combined with chemical genomics identifies girolline as an inhibitor of protein synthesis. *ACS Chemical Biology* 9: 247-257.

Furusato, A., Kato, H., Nehira, T., Eguchi, K., Kawabata, T., Fujiwara, Y., Losung, F., Mangidaan, R.E.P., **de Voogd, N.J.**, Takeya, M., Yokosawa, H. & Tsukamoto, S. 2014. Acanthomanzamines A-E with new manzamine frameworks from the marine sponge *Acanthostrongylophora ingens*. *Organic Letters* 16: 3888-3891.

**Galis, F.**, Carrier, D.R., **van Alphen, J.**, **van der Mije, S.D.**, **van Dooren, T.J.**, **Metz, J.A.** & **ten Broek, C.M.** 2014. Fast running restricts evolutionary change of the vertebral column in mammals. *PNAS* 111: 11401-11406.

Garibaldi, L.A. & **Carvalheiro, L.G.** 2014. From research to action: practices to enhance crop yield through wild pollinators. *Frontiers in Ecology and the Environment* 12: 439-447.

Garratt, M.P.D., Breeze, T.D., Jenner, N., Polce, C., **Biesmeijer, J.C.** & Potts, S.G. 2014. Avoiding a bad apple: Insect pollination enhances fruit quality and economic value. *Agriculture Ecosystems & Environment* 184: 34-40.

Garratt, M.P.D., Coston, D.J., Truslove, C.L., Lappage, M.G., Polce, C., Dean, R., **Biesmeijer, J.C.** & Potts, S.G. 2014. The identity of crop pollinators helps target conservation for improved ecosystem services. *Biological Conservation* 169: 128-135.

Gaudant, J., García-Alix, A. & **Freudenthal, M.** 2014. Occurrence of pharyngeal teeth of the carp, *Cyprinus* Linnaeus (Teleostei, Cyprinidae) in the Middle and Upper Miocene of Andalusia (southern Spain): A puzzling disconnected palaeobiogeographical distribution. *Comptes Rendus Palevol* 14: 25-29.

**Geml, J.**, **Gravendeel, B.**, van der Gaag, K.J., **Neilen, M.**, **Lammers, Y.**, **Raes, N.**, **Semenova, T.A.,** de Knijf, P. & **Noordeloos, M.E.** 2014. The contribution of DNA metabarcoding to fungal conservation: diversity assessment, habitat partitioning and mapping red-listed fungi in protected coastal *Salix repens* communities in the Netherlands. *PLOS ONE* 9: e99852.

**Geml, J.**, Pastor, N., Fernandez, L., Pacheco, S., **Semenova, T.A.**, Becerra, A.G., Wicaksono, C.Y. & Nouhra, E.R. 2014. Large-scale fungal diversity assessment in the Andean Yungas forests reveals strong community turnover among forest types along an altitudinal gradient. *Molecular Ecology* 23: 2452-2472.

Ghorbani, A., **Gravendeel, B.**, Naghibi, F. & **de Boer, H.J.** 2014. Wild orchid tuber collection in Iran: a wake-up call for conservation. *Biodiversity and Conservation* 23: 2749-2760.

Gorelick, R., Fraser, D., **Zonneveld, B.J.M.** & Little, D.P. 2014. Cycad (Cycadales) chromosome numbers are not correlated with genome size. *International Journal of Plant Sciences* 175: 986-997.

**Gravendeel, B.**, Protopopov, A., Bull, I., **Duijm, E.**, Gill, F., **Niemann, A.**, Rudaya, N., Tikhonov, A.N., Trofimova, S., van Reenen, G.B.A., **Vos, R.**, Zhilich, S. & van Geel, B. 2014. Multi-proxy study of the last meal of a mid-Holocene Oyogos Yar horse, Sakha Republic, Russia. *The Holocene* 24: 1-9.

Grubich, J.R., **Bos A.R.** & Westneat, M.W. 2014. Fish Gristle: mechanical performance of IOPM ligaments among functionally diverse jaws. *Integrative and Comparative Biology* 54(1): E80.

Gruca, M., **van Andel, T.** & Balslev, H. 2014. Ritual uses of palms in traditional medicine in sub-Saharan Africa: a review. *Journal of Ethnobiology and Ethnomedicine* 10: 60.

Guo, X., Wang, J., **Thomas, D.C.**, Su, Y., Tan, Y.-H. & Saunders, R.M.K. 2014. Reassessing the taxonomic status of two enigmatic *Desmos* species (Annonaceae): Morphological and molecular phylogenetic support for a new genus, *Wangia*. *Journal of Systematics and Evolution* 52: 1-15.

Gupta, A., **Metz, J.A.J.** & Tran, V.C. 2014. A new proof for the convergence of an individual based model to the trait substitution sequence. *Acta Applicandae Mathematicae* 121: 1-27.

Gupta, A. & **van Achterberg, C.** 2014. A new species of *Phanerotoma* Wesmael (Hymenoptera: Braconidae: Cheloninae) from the Andaman Islands, India. *Zootaxa* 3856: 595-600.

Haelewaters, D., **Schilthuizen, M.** & Pfister, D.H. 2014. On *Diphymyces* (Laboulbeniales, Ascomycota) in Malaysian Borneo. *Plant Ecology and Evolution* 147: 93-100.

**Hamann, T.**, Müller, A., **Roos, M.**, **Sosef, M.** & **Smets, E.** 2014. Detailed mark-up of semi-monographic legacy taxonomic works using FlorML. *Taxon* 63: 377-393.

Hedenäs, L., Désamoré, A., Laenen, B., Papp, B., Quandt, D., González-Mancebo, J.M., Patiño, J., Vanderpoorten, A. & **Stech, M.** 2014. Three species for the price of one within the moss *Homalothecium sericeum* s.l. *Taxon* 63: 249-257.

Heermann, L., Scharf, W., **van der Velde, G.** & Borcherding, J. 2014. Does the use of alternative food resources induce cannibalism in a size-structured fish population? *Ecology of Freshwater Fish* 23: 129-140.

**Helwerda, R.A.** & **Schilthuizen, M.** 2014. Predation on Greek *Albinaria* (Pulmonata: Clausiliidae) by *Poiretia* (Pulmonata: Oleacinidae) and by an unknown organism making circular holes: possible drivers of shell evolution. *Journal of Molluscan Studies* 80: 272-279.

**Helwerda, R.A.** & **Wesselingh, F.P.** 2014. Revision of Scissurellidae, Anatomidae and Fissurellidae (Gastropoda: Vetigastropoda) from the Plio-Pleistocene of the Philippines. *Zootaxa* 3838: 183-194.

**Helwerda, R.A.**, **Wesselingh, F.P.** & Williams, S.T. 2014. On some Vetigastropoda (Mollusca, Gastropoda) from the Plio-Pleistocene of the Philippines with descriptions of three new species. *Zootaxa* 3755: 101-135.

Hoban, S., **Arntzen, J.W.**, Bruford, M.W., Godoy, J.A., Hoelzel, R., Segelbacher, G.,Vila, C. & Bertorelle, G. 2014. Comparative evaluation of potential indicators and temporal sampling protocols for monitoring genetic erosion. *Evolutionary Applications* 7: 984-998.

**Hoeksema, B.W.** 2014. The "*Fungia patella* group" (Scleractinia, Fungiidae) revisited with a description of the mini mushroom coral *Cycloseris boschmai* sp.n. *ZooKeys* 371: 57-84.

**Hoeksema, B.W.**, **Dekker, F.** & **de Voogd, N.J.** 2014. Free-living mushroom corals strike back by overtopping a coral-killing sponge. *Marine Biodiversity* 44: 3-4.

**Hoeksema, B.W.** & Lane, D.J.W. 2014. The mushroom coral fauna (Scleractinia: Fungiidae) of Brunei Darussalam (South China Sea) and its relation to the Coral Triangle. *Raffles Bulletin of Zoology* 62: 566-580.

**Hoeksema, B.W.** & Ocaña Vicente, O. 2014. First record of the Central Indo-Pacific reef coral *Oulastrea crispata* in the Mediterranean Sea. *Mediterranean Marine Science* 15: 429-436.

**Hoeksema, B.W.** & **ten Hove, H.A.** 2014. First record of a christmas tree worm in a mushroom coral (Loyalty Islands, Southwest Pacific). *Coral Reefs* 33: 717.

**Hoeksema, B.W.**, **Waheed, Z.** & **de Voogd, N.J.** 2014. Partial mortality in corals overgrown by the sponge *Terpios hoshinota* at Tioman Island, Peninsular Malaysia (South China Sea). *Bulletin of Marine Science* 90: 989-990.

**Hoekstra, P.H.**, Chatrou, L.W. & **Wieringa, J.J.** 2014. A new species of Monanthotaxis from Gabon with a unique inflorescence type for Annonaceae. *Phytotaxa* 186: 106-112.

**Hovenkamp, P.** 2014. A too modest proposal. *Cladistics* 30: 232-233.

Ingicco, T., **de Vos, J.** & Huffman, O.F. 2014. The oldest gibbon fossil (Hylobatidae) from insular Southeast Asia: evidence from Trinil, (East Java, Indonesia), Lower/Middle Pleistocene. *PLOS ONE* 9: e99531.

Ivanovic, A. & **Arntzen, J.W.** 2014. Evolution of skull and body shape in *Triturus* newts reconstructed from three-dimensional morphometric data and phylogeny. *Biological Journal of the Linnean Society* 113: 243-255.

Jacquemyn, H., Brys, R., **Merckx, V.S.F.T.**, Waud, M., Lievens, B. & Wiegand, T. 2014. Co-existing orchid species have distinct mycorrhizal communities and display strong spatial segregation. *New Phytologist* 202: 616-627.

Jagt, J.W.M., Jackson, J. & **van der Ham, R.W.J.M.** 2014. *Bathysalenia skylari*, a new late Turonian (Late Cretaceous) saleniid echinoid from central Texas, USA. *Cretaceous Research* 51: 70-74.

Jagt, J.W.M., Thuy, B., **Donovan, S.K.**, Stohr, S., Portell, R.W., Pickerill, R.K., Harper, D.A.T., Lindsay, W. & Jackson, T.A. 2014. A starfish bed in the Middle Miocene Grand Bay Formation of Carriacou, The Grenadines (West Indies). *Geological Magazine* 151: 381-393.

Käfer, J., **de Boer, H.J.**, Mousset, S., Kool, A., Dufay, M. & Marais, G.A. 2014. Dioecy is associated with higher diversification rates in flowering plants. *Journal of Evolutionary Biology* 27: 1478-90.

**Kappes, H.** & **Schilthuizen, M.** 2014. Habitat effects on slug assemblages and introduced species. *Journal of Molluscan Studies* 80: 47-54.

**Kappes, H.**, Tackenberg, O. & Haase, P. 2014. Differences in dispersal- and colonization-related traits between taxa from the freshwater and the terrestrial realm. *Aquatic Ecology* 48: 73-83.

**Kappes, H.** & Topp, W. 2014. Responses of forest snail assemblages to soil acidity buffer system and liming. *Ecological Research* 29: 757-766.

Katayama, T., Wilkinson, M.D., Aoki-Kinoshita, K.F., Kawashima, S., Yamamoto, Y., Yamaguchi, A., Okamoto, S., Kawano, S., Kim, J.-D., Wang, Y., Wu, H., Kano, Y., Ono, H., Bono, H., Kocbek, S., Aerts, J., Akune, Y., Antezana, E., Arakawa, K., Aranda, B., Baran, J., Bolleman, J., Bonnal, R.J.P., Buttigieg, P.L., Campbell, M.P., Chen, Y., Chiba, H., Cock, P.J.A., Cohen, K.B., Constantin, A., Duck, G., Dumontier, M., Fujisawa, T., Fujiwara, T., Goto, N., Hoehndorf, R., Igarashi, Y., Itaya, H., Ito, M., Iwasaki, W., Kalas, M., Katoda, T., Kim, T., Kokubu, A., Komiyama, Y., Kotera, M., Laibe, C., Lapp, H., Lütteke, T., Marshall, M.S., Mori, T., Mori, H., Morita, M., Murakami, K., Nakao, M., Narimatsu, H., Nishide, H., Nishimura, Y., Nystrom-Persson, J., Ogishima, S., Okamura, Y., Okuda, S., Oshita, K., Packer, N.H., Prins, P., Ranzinger, R., Rocca-Serra, P., Sansone, S., Sawaki, H., Shin, S.-H., Splendiani, A., Strozzi, F., Tadaka, S., Toukach, P., Uchiyama, I., Umezaki, M., **Vos, R.**, Whetzel, P.L., Yamada, I., Yamasaki, C., Yamashita, R., York, W.S., Zmasek, C.M., Kawamoto, S. & Takagi, T. 2014. BioHackathon series in 2011 and 2012: penetration of ontology and linked data in life science domains. *Journal of Biomedical Semantics* 5: 5.

**Kidane, B.**, **van Andel, T.R.**, **van der Maesen, L.J.G.** & Asfaw, Z. 2014. Use and management of traditional medicinal plants by Maale and Ari ethnic communities in southern Ethiopia. *Journal of Ethnobiology and Ethnomedicine* 10: 46.

**Kidane, B.**, **van der Maesen, L.J.G.**, **van Andel T.R.** & Asfaw, Z. 2014. Ethnoveterinary medicinal plants used by the Maale and Ari ethnic communities in southern Ethiopia. *Journal of Ethnopharmacology* 153: 274-282.

Kimura, K., Chiba, S. & **Koene, J.M.** 2014. Common effect of the mucus transferred during mating in two dart-shooting snail species from different families. *Journal of Experimental Biology* 217: 1150-1153.

Klietmann, J., Nagel, D., Rummel, M. & **van den Hoek Ostende, L.W.** 2014. Amphiperatherium and Erinaceidae of Petersbuch 28. *Bulletin of Geosciences* 89: 1-20.

Klietmann, J., Nagel, D., Rummel, M. & **van den Hoek Ostende, L.W.** 2014. Heterosorex and Soricidae (Eulipotyphla, Mammalia) of the fissure Petersbuch 28; microevolution as indicator of temporal mixing? *Comptes Rendus Palevol* 13: 157-181.

Kotrba, M., Huber, J. & **Feijen, H.R.** 2014. Coevolution of male and female genitalia in stalk-eyed flies (Diptera, Diopsidae). *Organisms, Diversity and Evolution* 14: 187-201.

**Kreutz, C.A.J.** & **Sosef, M.S.M.** 2014. (2278) Proposal to conserve the name *Serapias helleborine* (*Epipactis helleborine*) (Orchidaceae) with a conserved type. *Taxon* 63: 432-434. DOI http://dx.doi.org/10.12705/632.26 (IF 2.78).

Kudo, Y., Kato, H., Rotinsulu, H., Losung, F., Mangindaan, R.E.P., **de Voogd, N.J.** & Tsukamoto, S. 2014. Aaptoline A, a new quinoline alkaloid from the marine sponge *Aaptos suberitoides*. *Heterocycles* 88: 591-594.

Kuntner, M., Pristovšek, U., Cheng, R-C., Li, D., Zhang, S., Tso, I-M., Liao, C-P., **Miller, J.A.** & Kralj-Fišer, S. 2014. Eunuch supremacy: evolution of post-mating spider emasculation. *Behavioral Ecology and Sociobiology* 69: 117-126.

Kustatscher, E., Bauer, K., Butzmann, R., Fischer, T.C., Meller, B., **van Konijnenburg-van Cittert, J.H.A.** & Kerp, H. 2014. Sphenophytes, seed ferns and taeniopterids from the Upper Permian of Bletterbach (Dolomites, N-Italy). *Review of Palaeobotany and Palynology* 208: 65-82.

Kustatscher, E., Dell'Antonio, E. & **van Konijnenburg-van Cittert, J.H.A.** 2014. The ferns of the late Ladinian (Middle Triassic) flora from Monte Agnello (Dolomites, N-Italy). *Acta Palaeontologica Polonica* 59: 741-755.

**Lammers, Y.**, Peelen, T., **Vos, R.A.** & **Gravendeel, B.** 2014. The HTS barcode checker pipeline, a tool for automated detection of illegally traded species from high-throughput sequencing data. *BMC Bioinformatics* 15: 44.

**Lang, A.S.**, **Kruijer, J.D.** & **Stech, M.** 2014. DNA barcoding of Arctic bryophytes: an example from the moss genus *Dicranum* (Dicranaceae, Bryophyta). *Polar Biology* 37: 1157-1169.

**Lang, A.** & **Stech, M.** 2014. What's in a name? Disentangling the *Dicranum scoparium* species complex (Dicranaceae, Bryophyta). *Systematic Botany* 39: 369-379.

**Lang, A.S.**, Tubanova, D. & **Stech, M.** 2014. Species delimitations in the *Dicranum acutifolium* complex. *Journal of Bryology* 36: 279-290.

Lautenschlager, S. & **Rücklin, M.** 2014. Beyond the print - virtual paleontology in science publishing, outreach, and education. *Journal of Paleontology* 88: 727-734.

Leuven, R.S.E.W., Collas, F.P.L., Koopman, K.R., Matthews, J. & **van der Velde, G.** 2014. Mass mortality of invasive zebra and quagga mussels by desiccation during severe winter conditions. *Aquatic Invasions* 9: 243-252.

Lewis, S.M., Vahed, K., **Koene, J.M.**, Engqvist, L., Bussiere, L.F., Perry, J.C., Gwynne, D. & Lehmann, G.U.C. 2014. Emerging issues in the evolution of animal nuptial gifts. *Biology Letters* 10: 20140336.

**Liew, T.S.**, Kok, A.C.M., **Schilthuizen, M.** & Urdy, S. 2014. On growth and form of irregular coiled-shell of a terrestrial snail: *Plectostoma concinnum* (Fulton, 1901) (Mollusca: Caenogastropoda: Diplommatinidae). *PeerJ* 2: e383.

**Liew, T.S.** & **Schilthuizen, M.** 2014. Association between shell morphology of micro-land snails (genus *Plectostoma*) and their predator's predatory behaviour. *PeerJ* 2: 1e329.

**Liew, T.-S.**, **Vermeulen, J.J.**, bin Marzuki, M.E. & **Schilthuizen, M.** 2014. A cybertaxonomic revision of the micro-land-snail genus *Plectostoma* Adam (Mollusca, Caenogastropoda, Diplommatinidae), from Peninsular Malaysia, Sumatra and Indochina. *ZooKeys* 393: 1-107.

Liu, Z., Cheng, W., Liu, D., **van Ofwegen, L.**, Proksch, P. & Lin, W. 2014. Capnosane-type cembranoids from the soft coral *Sarcophyton trocheliophorum* with antibacterial effects. *Tetrahedron* 70: 8703-8713.

Lodge, D.J., Padamsee, M., Matheny, P.B., Aime, M.C., Cantrell, S.A., Boertmann, D., Kovalenko, A., Vizzini, A., Dentinger, B.T.M., Kirk, P.M., Ainsworth, A.M., Moncalvo, J.-M., Vilgalys, R., Larsson, E., Luecking, R., Griffith, G.W., Smith, M.E., Norvell, L.L., Desjardin, D.E., Redhead, S.A., Ovrebo, C.L., Lickey, E.B., Ercole, E., Hughes, K.W., Courtecuisse, R., Young, A., Binder, M., Minnis, A.M., Lindner, D.L., Ortiz-Santana, B., Haight, J., Laessoe, T., Baroni, T.J., **Geml, J.** & Hattori, T. 2014. Molecular phylogeny, morphology, pigment chemistry and ecology in Hygrophoraceae (Agaricales). *Fungal Diversity* 64: 1-99.

Machida, K., Abe, T., Arai, D., Okamoto, M., Shimizu, I., **de Voogd, N.J.**, Fusetani, N. & Nakao, Y. 2014. Cinanthrenol A, an estrogenic steroid containing phenanthrene nucleus, from a marine sponge *Cinachyrella* sp. *Organic Letters* 16: 1539-1541.

Machin-Sánchez, M., Le Gall, L., Neto, A.I., Rousseau, F., Cassano, V., Senties, A., Fujii, M.T., Diaz-Larrea, J., **Prud'homme van Reine, W.F.**, Borrillo, C. & Gil-Rodríguez, M.C. 2014. A combined barcode and morphological approach to the systematics and biogeography of *Laurencia pyramidalis* and *Laurenciella marilzae* (Rhodophyta). *European Journal of Phycology* 49: 115-127.

Mansino, S., Ruiz-Sánchez, F.J., **Freudenthal, M.** & Montoya, P. 2014. A new approach to the Late Miocene-Early Pliocene forms of the genus *Apocricetus*. *Apocricetus alberti* (Rodentia, Mammalia) from Venta del Moro (Cabriel Basin, Spain). *Proceedings of the Geologists' Association* 125: 392-405.

Martínez Chacón, M.L. & Winkler Prins, C.F. 2014. Kozlowskia (Productidina, Brachiopoda) from late Bashkirian/early Moscovian (Pennsylvanian), Cantabrian Mountains (N Spain). *Neues Jahrbuch für Geologie und Palaeontologie Abhandlungen* 272: 129-145.

Matthews, J., **van der Velde, G.**, bij de Vaate, A., Collas, F.P.L., Koopman, K.R. & Leuven, R.S.E.W. 2014. Rapid range extension of the invasive quagga mussel in relation to zebra mussel presence in The Netherlands and Western Europe. *Biological Invasion* 16: 23-42.

**Mayhew, D.F.**, **Dieleman, F.E.**, Slupik, A.A., **van den Hoek Ostende, L.W.** & Reumer, J.W.F. 2014. Small mammal assemblages from the Quaternary succession at Moriaanshoofd (Zeeland, the Netherlands) and their significance for correlating the Oosterschelde fauna. *Netherlands Journal of Geosciences* 93: 119-134.

McFadden, C.S., Brown, A.S., Brayton, C., Hunt, C.B. & **van Ofwegen, L.P.** 2014. Application of DNA barcoding in biodiversity studies of shallow-water octocorals: molecular proxies agree with morphological estimates of species richness in Palau. *Coral Reefs* 33: 275-286.

**Meijer, H.J.M.** 2014. A peculiar anseriform (Aves: Anseriformes) from the Miocene of Gargano (Italy). *Comptes Rendus Palevol*, 13(1): 19-26.

**Meijer, H.J.M.** 2014. The avian fossil record in Insular Southeast Asia and its implications for avian biogeography and palaeoecology. *PeerJ* 2:e295 http://dx.doi.org/10.7717/peerj.295.

**Merckx, V.S.F.T.** & **Smets, E.F.** 2014. *Thismia americana*, the 101st anniversary of a botanical mystery. *International Journal of Plant Sciences* 175: 165-175.

Merenyi, Z., Varga, T., **Geml, J.**, Orczan, A.K., Chevalier, G. & Bratek, Z. 2014. Phylogeny and phylogeography of the Tuber brumale aggr. *Mycorrhiza* 24: S101-S113.

**Miller, J.A.**, Miller, J.H., Pham, D-S. & **Beentjes, K.K.** 2014. Cyberdiversity: improving the informatic value of diverse tropical arthropod inventories. *PLOS ONE* 9: e115750.

Mitchard, E.T.A., Feldpausch, T.R., Brienen, R.V., Lopez-Gonzalez, G., Monteagudo, A., Malhi, Y., Baker, T.R., Lewis, S.L., Lloyd, J., Quesada, C.A., Gloor, M., **ter Steege, H.**, Meir, P., Alvarez, E.V., Araujo-Murakami, A., Arroyo, L., Aymard, G.A., Banki, O., Bonal, D., Brown, S., Cerón, C.E., Chama Moscoso, V., Chave, J., Comiskey, J.M., Corrales Medina, M., Costa, F.R.C., Cruz, A.P., Cuenca, W.P., Da Costa, L., de Souza, P.B., Di Fiore, A., Domingues, T., Erwin, T.L., Espejo, J.E., Ferreira, L., Germaine, A., Higuchi, N., Honorio Coronado, E.N., Levis, C., Killeen, T.J., Laurance, W.F., Magnusson, W.E., Marimon, B.S., Marimon Junior, B.H., Nascimento, M.T., Neill, D., Peñuela, M.C., Pitman, N., Peres, C.A., Polo, I.C.G., Prieto, A., Ramirez-Angulo, H., Rudas, A., Salomao, R.P., Schietti, J., Silva, N., Silveira, M., Stropp, J., Terborgh, J., Thomas, R.P., Toledo, M., Torres-Lezama, A., Valenzuela Gamarra, L., **van Andel, T.R.**, van der Heijden, G.M.F., Vargas, P.N., Vieira, I.C.G., Vilanova-Torre, E., Wang, O., Zartman, C.E. & Phillips, O.L. 2014. Markedly divergent estimates of Amazon forest carbon density from ground plots and satellites. *Global Ecology and Biogeography* 23: 935-946.

Mohammed, G.A., Abd-Elrazek, A.E.E., Hassanean, H.A., Youssef, D.T.A. & **van Soest, R.** 2014. New compounds from the Red Sea marine sponge *Echinoclathria gibbosa*. *Phytochemistry Letters* 9: 51-58.

Monteiro, M.T.F., **Mota de Oliveira, S.**, Luizão, F.J., Cândido, L.A., Ishida, F.Y. & Tomasella, J. 2014. Dissolved organic carbon concentration and its relationship to electrical conductivity in the waters of a stream in a forested Amazonian blackwater catchment. *Plant Ecology & Diversity* 7: 205-213.

Morozova, O.V., **Noordeloos, M.E.** & Vila, J. 2014. *Entoloma* subgenus *Leptonia* in boreal-temperate Eurasia: towards a phylogenetic species concept. *Persoonia* 32: 141-169.

Nakadera, Y., Blom, C. & **Koene, J.M.** 2014. Duration of sperm storage in the simultaneous hermaphrodite *Lymnaea stagnalis*. *Journal of Molluscan Studies* 80: 1-7.

Nakadera, Y., Swart, E.M., Hoffer, J.N.A., den Boon, O., Ellers, J. & **Koene, J.M.** 2014. Receipt of seminal fluid proteins causes reduction of male investment in a simultaneous hermaphrodite. *Current Biology* 24: 1-4.

Nielsen, S.N. & **Landau, B.** 2014. New *Scutellastra* (Gastropoda: Patellidae) species from the lower Miocene Navidad Formation of central Chile and the lower-middle Miocene Cantaure Formation of Venezuela. *The Nautilus* 128: 31-39.

Nouhra, E.R., Pastor, N., Becerra, A.G., Sarrionandia Areitio, E. & **Geml, J.** 2014. Greenhouse seedlings of *Alnus* showed low host intrageneric specificity and a strong preference for some *Tomentella* ectomycorrhizal associates. *Microbial Ecology* 69: 813-825.

**Nuytinck, J.** & Ammirati, J.F. 2014. A new species of *Lactarius* section *Deliciosi* (Russulales, Basidiomycota) from western North America. *Botany* 92: 767-774.

Orr, A.G., **Kalkman, V.J.** & Richards, S.J. 2014. Four new species of *Palaiargia* Förster, 1903 (Odonata: Platycnemididae) from New Guinea with revised distribution records for the genus. *International Journal of Odonatology* 16: 309-325.

Ouwendijk, M., **van den Hoek Ostende, L.W.** & **Donovan, S.K.** 2014. Fossil bats from the Late Pleistocene Red Hills Road Cave, Jamaica. *Caribbean Journal of Science* 47: 284-290.

Paalvast, P. & **van der Velde, G.** 2014. Long term anthropogenic changes and ecosystem service consequences in the northerm part of the complex Rhine-Meuse estuary. *Ocean & Coastal Management* 92: 50-64.

Page, C., Collinson, M.E. & **van Konijnenburg-van Cittert, J.H.A.** 2014. *Lygodium hians* (Pteridophyta: Schizaeaceae) – a ground-clothing template for the evolution of a modern climbing fern genus. *Adansonia* 36: 1-24.

Parra-Velandia, F.J., Zea, S. & **van Soest, R.W.M.** 2014. Reef sponges of the genus *Agelas* (Porifera: Demospongiae) from the Greater Caribbean. *Zootaxa* 3794: 301-343.

Peris-Felipo, F.J., Belokobylskij, S.A., **van Achterberg, C.** & Pérez-Fernández, T. 2014. *Dinotrema cavernicola* sp. n. (Hymenoptera, Braconidae, Alysiinae), a new species of the genus *Dinotrema* Foerster from caves of Spain. *Journal of Hymenoptera Research* 41: 47-56.

Pesic, V. & **Smit, H.** 2014. Torrenticolid water mites (Acari: Hydrachnidia: Torrenticolidae) from Ghana. *Zootaxa* 3820: 1-80.

Pesic, V. & **Smit, H.** 2014. Torrenticolid water mites (Acari: Hydrachnidia: Torrenticolidae) from Malaysian Borneo. *Zootaxa* 3840: 1-72.

Polce, C., Garratt, M.P., Termansen, M., Ramirez-Villegas, J., Challinor, A.J., Lappage, M.G., Boatman, N.D., Crowe, A., Endalew, A.M., Potts, S.G., Somerwill, K.E. & **Biesmeijer, J.C.** 2014. Climate-driven spatial mismatches between British orchards and their pollinators: increased risks of pollination deficits. *Global Change Biology* 20: 2815-2828.

Polcyn, M.J., Jacobs, L.L., Araújo, R., **Schulp, A.S.** & Mateus, O. 2014. Physical drivers of mosasaur evolution. *Palaeogeography, Palaeoclimatology, Palaeoecology* 400: 17-27.

Polonia, A.R.M., Cleary, D.F.R., Duarte, L.N., **de Voogd, N.J.** & Gomes, N.C.M. 2014. Composition of Archaea in seawater, sediment, and sponges in the Kepulauan Seribu reef system, Indonesia. *Microbial Ecology* 67: 553-567.

**Pos, E.**, Guevara Andino, J.E., Sabatier, D., Molino, J., Pitman, N., Mogollón, H., Neill, D., Cerón, C., Rivas, G., Di Fiore, A., Thomas, R., Tirado, M., Young, K.R., Wang, O., Sierra, R., García-Villacorta, R., Zagt, R., Palacios, W., Aulestia, M. & **ter Steege, H.** 2014. Are all species necessary to reveal ecologically important patterns? *Ecology and Evolution* 4: 4626-4636.

Prentiss, N.K., Vasileiadou, K., Faulwetter, S., Arvanitidis, C. & **ten Hove, H.A.** 2014. A new genus and species of Serpulidae (Annelida, Polychaeta, Sabellida) from the Caribbean Sea. *Zootaxa* 3900: 204-222.

Puga-Bernabeu, A., Webster, J.M., Beaman, R.J., Reimer, P.J. & **Renema, W.** 2014. Filling the gap: A 60 ky record of mixed carbonate-siliciclastic turbidite deposition from the Great Barrier Reef. *Marine and Petroleum Geology* 50: 40-50.

Quicke, D.L.J., Shaw, M.R., **van Achterberg, C.**, Bland, K.P., Butcher, B.A., Lyszkowski, R. & Zhang, Y.M. 2014. A new Australian genus and five new species of Rogadinae (Hymenoptera: Braconidae), one reared as a gregarious endoparasitoid of an unidentified limacodid (Lepidoptera). *Zootaxa* 3881: 237-257.

**Quiroz, D.**, **Towns, A.M.**, Legba, S.I., Swier, J., Brière, S., **Sosef, M.** & **van Andel, T.R.** 2014. Quantifying the domestic market in herbal medicine in Benin, West Africa. *Journal of Ethnopharmacology* 151: 1100-1108.

**Raes, N.**, Cannon, C.H., Hijmans, R.J., Piessens, T., Saw, L.G., **van Welzen, P.C.** & Slik, J.W.F. 2014. Historical distribution of Sundaland's Dipterocarp rainforests at Quaternary glacial maxima. *PNAS* 111: 16790-5.

Ramanjooloo, A., Cresteil, T., Lebrasse, C., Beedessee, G., Oogarah, P., **van Soest, R.W.M.** & Marie, D.E.P. 2014. α-Glucosidase inhibitory activity of marine sponges collected in Mauritius waters. *Natural Product Research* 29: 383-387.

Ramírez, M.J., Grismado, C.J., Labarque, F.M., Izquierdo, M.A., Ledford, J.M., **Miller, J.A.**, Haddad, C.R. & Griswold, C.E. 2014. The morphology and relationships of the walking mud spiders of the genus *Cryptothele* (Araneae: Zodariidae). *Zoologischer Anzeiger* 253: 382-393.

Recuero, E., Buckley, D., Garcia-Paris, M., **Arntzen, J.W.**, Cogalniceanu, D. & Martínez-Solano, I. 2014. Evolutionary history of *Ichthyosaura alpestris* (Caudata, Salamandridae) inferred from the combined analysis of nuclear and mitochondrial markers. *Molecular Phylogenetics and Evolution* 81: 207-220.

**Reijnen, B.T.**, McFadden, C.S., Hermanlimianto, Y.T. & **van Ofwegen, L.P.** 2014. A molecular and morphological exploration of the generic boundaries in the family Melithaeidae (Coelenterata: Octocorallia) and its taxonomic consequences. *Molecular Phylogenetics and Evolution* 70: 383-401.

**Reimer, J.D.**, Poliseno, A. & **Hoeksema, B.W.** 2014. Shallow-water zoantharians (Cnidaria, Hexacorallia) from the Central Indo-Pacific. *ZooKeys* 444: 1-57.

Reumer, J.W.F., **ten Broek, C.M.A.** & **Galis, F.** 2014. Extraordinary incidence of cervical ribs indicates vulnerable condition in Late Pleistocene mammoths. *PeerJ* 2: e318.

Röser, M., Wölk, A. & **Veldkamp, J.F.** 2014. In: Wölk, A. & Röser, M. Polyploid evolution, intercontinental biogeographical relationships and morphology of the recently described African oat genus *Trisetopsis* (Poaceae). *Taxon* 63: 785.

Rößler, R., Philippe, M., **van Konijnenburg-van Cittert, J.H.A.**, McLoughlin, S., Sakala, J. & Zijlstra, G. 2014. Which name should be kept for fossil wood of the Araucarioxylon-type? – Results of a poll. *Taxon* 63: 177-184.

**Rücklin, M.**, Donoghue, P.C.J., Cunningham, J.A., Marone, F. & Stampanoni, M. 2014. Developmental paleobiology of the vertebrate skeleton. *Journal of Paleontology* 88: 676-683.

Ruiz-Sánchez, F.J., **Freudenthal, M.**, Mansino, S., Crespo, V.D. & Montoya, P. 2014. *Apocricetus barrierei* (Rodentia, Mammalia) from La Bullana 2B and La Bullana 3 (Cabriel Basin, Valencia, Spain). Revision of the Late Miocene-Early Pliocene forms of the genus *Apocricetus*. *Paläontologische Zeitschrift* 88: 85-98.

Ruiz-Sánchez, F.J., Lacomba-Andueza, J.I., **Freudenthal, M.** & Alvarez-Sierra, M.A. 2014. A new species of *Vasseuromys* (Gliridae, Mammalia) from the Upper Oligocene of the Ebro Basin (Spain). *Paläontologische Zeitschrift* 88: 73-84.

Rützler, K., Piantoni, C., **van Soest, R.W.M.** & Diaz, M.C. 2014. Diversity of sponges (Porifera) from cryptic habitats on the Belize barrier reef near Carrie Bow Cay. *Zootaxa* 3805: 1-129.

Sakai, E., Kato, H., Rotinsulu, H., Losung, F., Mangindaan, R.E.P., **de Voogd, N.J.**, Yokosawa, H. & Tsukamoto, S. 2014. Variabines A and B: new beta-carboline alkaloids from the marine sponge *Luffariella variabilis*. *Journal of Natural Medicines* 68: 215-219.

Sandrock, C., Tanadini, L.G., Pettis, J.S., **Biesmeijer, J.C.**, Potts, S.G. & Neumann, P. 2014. Sublethal neonicotinoid insecticide exposure reduces solitary bee reproductive success. *Agricultural and Forest Entomology* 16: 119-128.

Santos Pimenta, L.P., **Schilthuizen, M.**, Verpoorte, R. & Choi, Y.H. 2014. Quantitative analysis of amygdalin and prunasin in *Prunus serotina* Ehrh. using (1) H-NMR spectroscopy. *Phytochemical Analysis* 25: 122-126.

Sawasdee, K., **Chaowasku, T.**, Lipipun, V., Michel, S., Jongbunprasert, V. & Likhitwitayawuid, K. 2014. Geranylated homogentisic acid derivatives and flavonols from *Miliusa umpangensis*. *Biochemical Systematics and Ecology* 54: 179-181.

Scarponi, D., **Landau, B.**, Janssen, R., Morgenroth, H. & Della Bella, G. 2014. Lectotype designation for *Murex nebula* Montagu 1803 (Mangeliidae) and its implications for *Bela* Leach in Gray 1847. *Zootaxa* 3884: 45-54.

Scheper, J., **Reemer, M.**, van Kats, R., Ozinga, W., van der Linden, G.T.J., Schaminee, J.H.J., Siepel, H. & Kleijn, D. 2014. Museum specimens reveal loss of pollen host plants as key factor driving wild bee decline in The Netherlands. *PNAS* 111: 17552-17557.

**Schilthuizen, M.** & Kellermann, V. 2014. Contemporary climate change and terrestrial invertebrates: evolutionary versus plastic changes. *Evolutionary Applications* 7: 56-67.

Schlecht, E., Zaballos, L.H.G., **Quiroz, D.**, Scholte, P. & Buerkert, A. 2014. Traditional land use and reconsideration of environmental zoning in the Hawf Protected Area, south-eastern Yemen. *Journal of AridEnvironments* 109: 92-102.

Schneider, J.V., **Bissiengou, P.**, Amaral, M.E., Tahir, A., Fay, M.F., Thines, M., **Sosef, M.S.M.**, Zizka, G. & Chatrou, L.W. 2014. Phylogenetics, ancestral state reconstruction, and a new infrafamilial classification of the pantropical Ochnaceae (Medusagynaceae, Ochnaceae s.str., Quiinaceae) based on five DNA regions. *Molecular Phylogenetics and Evolution* 78: 199-214. doi: 10.1016/j.ympev.2014.05.018 (IF 4.07).

Sher, H., Aldosari, A., Ali, A. & **de Boer, H.J.** 2014. Economic benefits of high value medicinal plants to Pakistani communities: an analysis of current practice and potential. *Journal of Ethnobiology and Ethnomedicine* 10: 71.

**Sirichamorn, Y.**, **Adema, F.A.C.B.** & **van Welzen, P.C.** 2014. *Derris solorioides* (Fabaceae), a new limestone species with true-paniculate inflorescences from North-Central Thailand. *Blumea* 59: 98-102.

**Sirichamorn, Y.**, **Adema, F.A.C.B.**, **Roos, M.C.** & **van Welzen, P.C.** 2014. Molecular and morphological phylogenetic reconstruction reveals a new generic delimitation of Asian *Derris* (Fabaceae): Reinstatement of *Solori* and synonymisation of *Paraderris* with *Derris*. *Taxon* 63: 522-538.

**Sirichamorn, Y.**, **Thomas, D.C.**, **Adema, F.A.C.B.** & **van Welzen, P.C.** 2014. Historical biogeography of *Aganope*, *Brachypterum* and *Derris* (Fabaceae, tribe Millettieae): insights into the origins of Palaeotropical intercontinental disjunctions and general biogeographical patterns in Southeast Asia. *Journal of Biogeography* 41: 882-893.

**Sluys, R.**, Vila-Farré, M., Álvarez-Presas, M., Riutort, M., Kawakatsu, M., Tulp, A. S. 2014. The diet and distribution of *Pentacoelum kazukolinda* (Kawakatsu & Mitchell, 1984), a maricolan planarian with a freshwater ecology. *Zoologica Scripta* 44: 72-91.

**Smit, H.** 2014. Australian water mites of the genus *Hydrachna* Müller, with the description of five new species (Acari: Hydrachnidia: Hydrachnidae). *Zootaxa* 3827: 170-186.

**Smit, H.** & Pesic, V. 2014. The first Asian record of the water mite genus *Thoracophoracarus* K. Viets (Hydrachnidsia: Arrenuridae). *Systematic & Applied Acarology* 19: 431-434.

**Smit, H.** & Pesic, V. 2014. Water mites from Mount Kinabalu and the Crocker Range, Borneo, Malaysia (Acari: Hydrachnidia), with the description of 34 new species. *Zootaxa* 3876: 1-71.

**Smit, J.T.** 2014. Two new species of the genus *Callicera* Panzer (Diptera: Syrphidae) from the Palaearctic region. *Zootaxa* 3779: 585-590.

**Sosef, M.S.M.**, 2014. Novitates Gabonenses 86. The *Begonia clypeifolia* complex (Begoniaceae) unravelled. *Plant Ecology and Evolution* 147: 224-236. doi: 10.5091/plecevo.2014.905 (IF 0.96).

Stocchino, G.A., **Sluys, R.** & Manconi, R. 2014. A new and aberrant species of *Dugesia* (Platyhelminthes, Tricladida, Dugesiidae) from Madagascar. *ZooKeys* 425: 71-88.

Strganac, C., Jacobs, L.L., Polcyn, M.J., Mateus, O., Myers, T.S., Salminen, J., May, S.R., Araújo, R., Ferguson, K.M., Gonçalves, A.O., Morais, M.-L., **Schulp, A.S.** & da Silva Tavares, T. 2014. Geological setting and paleoecology of the Upper Cretaceous Bench 19 Marine Vertebrate Bonebed at Bentiaba, Angola. *Netherlands Journal of Geosciences* December 2014: 1-16.

Strganac, C., Salminen, J., Jacobs, L.L., Polcyn, M.J., Ferguson, K.M., Mateus, O., **Schulp, A.S.**, Morais, M.-L., da Silva Tavares, T. & Gonçalves, A.O. 2014. Carbon isotope stratigraphy, magnetostratigraphy, and 40Ar/39Ar age of the Cretaceous South Atlantic coast, Namibe Basin, Angola. *Journal of African Earth Sciences* 99: 452-462.

Stropp, J., van der Sleen, P., Quesada, C.A. & **ter Steege, H.** 2014. Growth-defense trade-off does not explain tree habitat specialization in the upper Rio Negro. *Plant Ecology & Diversity* 7: 255-265.

Sun, J.Z., Jiang, C.S, Chen, X.Q, Chen, K.S., Zhen, X.C., **van Soest, R.W.M.** & Guo, Y.W. 2014. Topsendines A-F, new 3-alkylpyridine alkaloids from a Hainan sponge *Topsentia* sp. *Tetrahedron* 70: 3166-3171.

Swinkels, L.H., van de Ven, M.W.P.M., Stassen, M.J.M., **van der Velde, G.**, Lenders, H.J.R. & Smolders, A.J.P. 2014. Suspended sediment causes annual acute fish mortality in the Pilcomayo river (Bolivia). *Hydrological Processes* 28: 8-15.

Tan, J-L., **van Achterberg, K.** & Chen, X-X. 2014. Pictorial key to species of the genus *Ropalidia* Guérin-Méneville, 1831 (Hymenoptera, Vespidae) from China, with description of one new species. *ZooKeys* 391: 1-35.

Tan, J-L., **van Achterberg, K.**, Duan, M-J. & Chen, X-X. 2014. An illustrated key to the species of subgenus *Gyrostoma* Kirby, 1828 (Hymenoptera, Vespidae, Polistinae) from China, with discovery of *Polistes* (*Gyrostoma*) *tenuispunctia* Kim, 2001. *Zootaxa* 3785: 377-399.

Taviani, M., Angeletti, L., Çağatay, M.N., Gasperini, L., Polonia, A. & **Wesselingh, F.P.** 2014. Sedimentary and faunal signatures of the post-glacial marine drowning of the Pontocaspian Gemlik "lake" (Sea of Marmara). *Quaternary International* 345: 11-17.

Tedersoo, L., Bahram, M., Põlme, S., Kõljalg, U., Yorou, N.S., Wijesundera, R., Villarreal Ruiz, L., Vasco-Palacios, A.M., Thu, P.Q., Suija, A., Smith, M.E., Sharp, C., Saluveer, E., Saitta, A., Rosas, M., Riit, T., Ratkowsky, D., Pritsch, K., Põldmaa, K., Piepenbring, M., Phosri, C., Peterson, M., Parts, K., Pärtel, K., Otsing, E., Nouhra, E., Njouonkou, A.L., Nilsson, R.H., **Morgado, L.N.**, Mayor, J., May, T.W., Majuakim, L., Lodge, D.J., Lee, S.S., Larsson, K.-H., Kohout, P., Hosaka, K., Hiiesalu, I., Henkel, T.W., Harend, H., Guo, L., Greslebin, A., Grelet, G., **Geml, J.**, Gates, G., Dunstan, W., Dunk, C., Drenkhan, R., Dearnaley, J., de Kesel, A., Dang, T., Chen, X., Buegger, F., Brearley, F.Q., Bonito, G., Anslan, S., Abell, A. & Abarenkov, K. 2014. Global diversity and geography of soil fungi. *Science* 346: 1256688.

Terraneo, T.I., Berumen, M.L., Arrigoni, R., **Waheed, Z.**, Bouwmeester, J., Caragnano, A., Stefani, F. & Benzoni, F. 2014. *Pachyseris inattesa* sp. n. (Cnidaria, Anthozoa, Scleractinia): a new reef coral species from the Red Sea and its phylogenetic relationships. *ZooKeys* 433: 1-30.

Theischinger, G. & **Kalkman, V.J.** 2014. *Nososticta rufipes* sp. nov. from Misool, with notes on the other *Nososticta* species on the Bird's Head Peninsula and the Raja Ampat, Indonesia (Zygoptera: Platycnemididae). *International Journal of Odonatology* 17: 217-222.

Theischinger, G. & **Kalkman, V.J.** 2014. The genus *Teinobasis* on the Bird's Head Peninsula and the Raja Ampat Islands, Indonesia (Odonata: Coenagrionidae). *Odonatologica* 43: 143-168.

Thompson, C.E., **Biesmeijer, J.C.**, Allnutt, T.R., Pietravalle, S. & Budge, G.E. 2014. Parasite pressures on feral honey bees (*Apis mellifera* sp.). *PLOS ONE* 9: e105164.

**Towns, A.M.**, Eyi, S.M. & **van Andel, T.** 2014. Traditional medicine and childcare in Western Africa: Mothers' knowledge, folk illnesses, and patterns of healthcare-seeking behavior. *PLOS ONE* 9: e105972.

**Towns, A.M.**, **Quiroz, D.**, Guinee, L., **de Boer, H.** & **van Andel, T.** 2014. Volume, value and floristic diversity of Gabon's medicinal plant markets. *Journal of Ethnopharmacology* 155: 1184-1193.

**Towns, A.M.**, Ruysschaert, S., van Vliet, E. & **van Andel, T.** 2014. Evidence in support of the role of disturbance vegetation for women's health and childcare in Western Africa. *Journal of Ethnobiology and Ethnomedicine* 10: 42.

**Towns, A.M.** & **van Andel, T.R.** 2014. Comparing local perspectives on women's health with statistics on maternal mortality: an ethnobotanical study in Bénin and Gabon. *BMC Complementary and Alternative Medicine* 14: 113.

Trimbos, K.B., **Doorenweerd, C.**, Kraaijeveld, K., Musters, C.J.M., Groen, N.M., de Knijff, P., Piersma, T. & de Snoo, G.R. 2014. Patterns in nuclear and mitochondrial DNA reveal historical and recent isolation in the Black-tailed Godwit (Limosa limosa). *PLOS ONE* 9: e83949.

Tsukamoto, S., Takeuchi, T., Kawabata, T., Lato, H., Yamakuma, K.M., El-Desoky, A.H., Losung, F., Mangidaan, R.E.P., **de Voogd, N.J.**, Arata, Y. & Yokosawa, H. 2014. Halenaquinone inhibits RANKL-induced osteoclastogenesis. *Bioorganic & Medicinal Chemistry Letters* 24: 5315-5318.

**van Achterberg, C.** 2014. Revision of the genus *Parasapyga* Turner (Hymenoptera, Sapygidae), with the description of two new species. *ZooKeys* 369: 61-77.

**van Achterberg, C.**, Sharkey, M.J. & Chapman, E.G. 2014. Revision of the genus *Euagathis* Szépligeti (Hymenoptera, Braconidae, Agathidinae) from Thailand, with description of three new species. *Journal of Hymenoptera Research* 36: 1-25.

**van Achterberg, C.** & Talebi, A.A. 2014. Review of *Gasteruption* Latreille (Hymenoptera, Gasteruptiidae) from Iran and Turkey, with the description of 15 new species. *ZooKeys* 458: 1-188.

**van Andel, T.R.**, **de Boer, H.J.**, Barnes, J. & Vandebroek, I. 2014. Medicinal plants used for menstrual disorders in Latin America, the Caribbean, sub-Saharan Africa, south and southeast Asia and their uterine properties: A review. *Journal of Ethnopharmacology* 155: 992-1000.

**van Andel, T.R.**, van 't Klooster, C.I.E.A., **Quiroz, D.**, **Towns, A.M.**, Ruysschaert, S. & van den Berg, M. 2014. Local plant names reveal that enslaved Africans recognized substantial parts of the New World flora. *PNAS* 111: E5346-53.

van den Bos, V., Brinkkemper, O., Bull, I.D., Engels, S., **Hakbijl, T.**, Schepers, M., van Dinter, M., van Reenen, G. & van Geel, B. 2014. Roman impact on the landscape near castellum Fectio, The Netherlands. *Vegetation History and Archaeobotany* 23: 277-298.

van der Gaag, M., **van der Velde, G.**, Wijnhoven, S. & Rajagopal, S. 2014. Temperature dependent larval occurrence and spat settlement of the invasive brackish water bivalve *Mytilopsis leucophaeata* (Conrad, 1831) (Dreissenidae). *Journal of Sea Research* 87: 30-34.

**van der Geer, A.A.E.** 2014. Parallel patterns and trends in functional structures in island mammals. *Integrative Zoology* 9: 167-182.

**van der Geer, A.A.E.** 2014. Systematic revision of the family Hoplitomerycidae Leinders, 1984 (Artiodactyla: Cervoidea), with the description of a new genus and four new species. *Zootaxa* 3847: 1-32.

**van der Geer, A.A.E.**, Anastasakis, G. & Lyras, G.A. 2014. If hippopotamuses cannot swim, how did they colonize islands: a reply to Mazza. *Lethaia* 48: 147-150.

**van der Geer, A.A.E.**, Lyras, G.A., MacPhee, R.D.E., Lomolino, M. & Drinia, H. 2014. Mortality in a predator-free insular environment: the extinct dwarf deer from Crete. *American Museum Novitates* 3807: 1-29.

**van der Geer, A.A.E.**, Lyras, G.A., **van den Hoek Ostende, L.W.**, **de Vos, J.** & Drinia, H. 2014. A dwarf elephant and a rock mouse on Naxos (Cyclades, Greece) with a revision of the palaeozoogeography of the Cycladic Islands (Greece) during the Pleistocene. *Palaeogeography, Palaeoclimatology, Palaeoecology* 404: 133-144.

**van der Meij, S.E.T.** 2014. A new species of *Opecarcinus* Kropp & Manning, 1987 (Crustacea: Brachyura: Cryptochiridae) associated with the stony corals *Pavona clavus* (Dana, 1846) and *P. bipartita* Nemenzo, 1980 (Scleractinia: Agariciidae). *Zootaxa* 3869: 44-52.

**van der Meij, S.E.T.** 2014. Host species, range extensions, and an observation of the mating system of Atlantic shallow-water gall crabs (Decapoda: Cryptochiridae). *Bulletin of Marine Science* 90: 1001-1010.

**van der Meij, S.E.T.** & **Reijnen, B.T.** 2014. The curious case of *Neotroglocarcinus dawydoffi* (Decapoda, Cryptochiridae): unforeseen biogeographic patterns resulting from isolation. *Systematics and Biodiversity* 12: 503-512.

**van der Meij, S.E.T.** & Schubart, C.D. 2014. Monophyly and phylogenetic origin of the gall crab family Cryptochiridae (Decapoda: Brachyura). *Invertebrate Systematics* 28: 491-500.

**van der Niet, T.**, Peakall, R. & Johnson, S.D. 2014. Pollinator-driven ecological speciation in plants: new evidence and future perspectives. *Annals of Botany* 113: 199-211.

**van der Niet, T.**, Pirie, M.D., Shuttleworth, A., Johnson, S.D. & Midgley, J.J. 2014. Do pollinator distributions underlie the evolution of pollination ecotypes in the Cape shrub *Erica plukenetii*? *Annals of Botany* 113: 301-315.

van Dongen, S., **Galis, F.**, ten Broek, C., Heikinheimo, K., Wijnaendts, L.C., Delen, S. & Bots, J. 2014. No sexual dimorphism in human prenatal metacarpal ratios. *Early Human Development* 90: 157-160.

van Geel, B., Protopopov, A., Bull, I., **Duijm, E.**, Gill, F., **Lammers, Y., Nieman, A.**, Rudaya, N., Trofimova, S., Tikhonov, A., **Vos, R.A.**, Zhilich, S. & **Gravendeel, B.** 2014. Multiproxy diet analysis of the last meal of an early Holocene Yakutian bison. *Journal of Quaternary Science* 29: 261-268.

**van Konijnenburg-van Cittert, J.H.A.**, Kustatscher, E., Bauer, K., Pott, C., Schmeissner, S., Dütsch, G. & Krings, M. 2014. A Selaginellites from the Rhaetian of Wüstenwelsberg (Upper Franconia, Germany). *Neues Jahrbuch für Geologie und Palaeontologie Abhandlungen* 272: 115-127.

**van Ofwegen, L.**, Aurelle, D. & Sartoretto, S. 2014. A new genus of soft coral (Cnidaria, Octocorallia) from the Republic of Congo (Pointe-Noire Region). *ZooKeys* 462: 1-10.

**van Rijssel, J.C.**, Hoogwater, E.S., Kishe-Machumu, M.A., van Reenen, E., Spits, K.V., van der Stelt, R.C., Wanink, J.H. & **Witte, F.** 2014. Fast adaptive responses in the oral jaw of Lake Victoria cichlids. *Evolution* 69: 179-189.

**van Soest, R.W.M.**, Meesters, E.H.W.G. & Becking, E. 2014. Deep-water sponges (Porifera) from Bonaire and Klein Curaçao, Southern Caribbean. *Zootaxa* 3878: 401-443.

**van Tol, J.** 2014. The biological exploration of Northern Sulawesi by Alfred Russel Wallace (1823-1913) and other 19th century pioneers. *Crop Protection* 61: 105-106.

van Valkenburg, J.L.C.H., **Duistermaat, H.** & Meerman, H. 2014. *Baccharis halimifolia* L. in Nederland: waar blijft Struikaster? *Gorteria* 37: 25-30.

**van Velzen, R.** & **Wieringa, J.J.** 2014. *Rinorea calcicola* (Violaceae), an endangered new species from south-eastern Gabon. *Phytotaxa* 167: 267-275.

**van Welzen, P.C.**, **Pruesapan, K.**, Telford, I.R.H., Esser, H.-J. & Bruhl, J.J. 2014. Phylogenetic reconstruction prompts taxonomic changes in *Sauropus*, *Synostemon* and *Breynia* (*Phyllanthaceae* tribe *Phyllanteae*). *Blumea* 59: 77-94.

**van Welzen, P.C.**, Strijk, J.S., **van Konijnenburg-van Cittert, J.H.A.**, Nucete, M. & **Merckx, V.S.F.T.** 2014. Dated phylogenies of the sister genera *Macaranga* and *Mallotus* (Euphorbiaceae): Congruence in historical biogeographic patterns? *PLOS ONE* 9: e85713.

**Varela-Lasheras, I.** & **van Dooren, T.J.M.** 2014. Desiccation plasticity in the embryonic life histories of non-annual rivulid species. *EvoDevo* 5: 16.

**Veldkamp, J.F.** 2014. A new species of *Juncus* (*Juncaceae*) from Mt Kinabalu, Sabah -- recent speciation after long-distance dispersal. *Blumea* 59: 142-143.

**Veldkamp, J.F.** 2014. A revision of *Cenchrus* incl. *Pennisetum* (*Gramineae*) in Malesia with some general nomenclatural notes. *Blumea* 59: 59-75.

**Veldkamp, J.F.** & Verloove, F. 2014. *Bulbostylis thouarsii* (comb. nov.) is the correct name for *Scirpus puberulus* Poir., non Michx. (*Cyperaceae*). *Blumea* 59: 10.

Verbeken, A., Hampe, F., Wissitrassameewong, K., Hyde, K.D., Eberhardt, U. & **Nuytinck, J.** 2014. A new angiocarpous *Lactarius* species from Thailand. *Phytotaxa* 181: 163-170.

Verbeken, A., Stubbe, D., van de Putte, K., Eberhardt, U. & **Nuytinck, J.** 2014. Tales of the unexpected: angiocarpous representatives of the *Russulaceae* in tropical South East Asia. *Persoonia* 32: 13-24.

**Vermeulen, J.J.**, Phelps, J., & Thavipoke, P. 2014. Notes on *Bulbophyllum* (Dendrobiinae; Epidendroideae; Orchidaceae): two new species and the dilemmas of species discovery via illegal trade. *Phytotaxa* 184(1): 12-22.

**Vermeulen, J.J.**, Schuiteman, A. & **de Vogel, E.** 2014. Nomenclatural changes in *Bulbophyllum* (Orchidaceae; Epidendroideae). *Phytotaxa* 166: 101-113.

Verstraete, B., Moon, H.-K., **Smets, E.** & Huysmans, S. 2014. Orbicules in flowering plants: A phylogenetic perspective on their form and function. *Botanical Review* 80: 107-134.

Verstraete, B., Peeters, C., van Wyk, B., **Smets, E.**, Dessein, S. & Vandamme, P. 2014. Intraspecific variation in *Burkholderia caledonica*: Europe vs. Africa and soil vs. endophytic isolates. *Systematic And Applied Microbiology* 37: 194-199.

**Vihotogbé, R.**, Glèlè Kakaï, R., Bongers, F., **van Andel, T.R.**, **van den Berg, R.G.**, Sinsin, B. & **Sosef, M.S.M.** 2014. Impacts of the diversity of traditional uses and potential economic value on food tree species conservation status: case study of African bush mango trees (Irvingiaceae) in the Dahomey Gap (West Africa). *Plant Ecology and Evolution* 146: 109-125.

**Vihotogbé, R.,** Raes, N., van den Berg, R.G., Bongers, F.J., Sinsin, B. & **Sosef, M.S.M.** 2014. Does phenology distinguish bitter and sweet African Bush Mango trees (Irvingiaceae)? *Trees – Structure and Function*: doi 10.1007/s00468-014-1085-z (IF 2.15).

**Vink, W.** 2014. The *Winteraceae* of the Old World. VII. *Zygogynum* in the Solomon Islands (incl. Bougainville). *Blumea* 59: 155-162.

Volkmar, U., **Smets, E.F.**, Lenz, H. & Janssens, S.B. 2014. Intron evolution in a phylogenetic perspective: Divergent trends in the two copies of the duplicated *def* gene in *Impatiens* L. (Balsaminaceae). *Journal of Systematics and Evolution* 52: 134-148.

**Vonk, R.** & Gable, M. 2014. Infaunal zoogeography and intergeneric character blending: The case of *Metaniphargus shiroi* sp. nov. (Crustacea: Amphipoda: Hadziidae), from interstitial beach water on Akajima Island, the Kerama Islands, Southwestern Japan. *Zoological Science* 31: 491-499.

**Vonk, R.** & Jaume, D. 2014. *Ingolfiella maldivensis* sp. n. (Crustacea, Amphipoda, Ingolfiellidae) from coral reef sand off Magoodhoo island, Maldives. *ZooKeys* 449: 69-79.
**Vonk, R.** & Jaume, D. 2014. Syntopy in rare marine interstitial crustaceans (Amphipoda, Ingolfiellidae) from small coral islands in the Molucca Sea, Indonesia. *Marine Biodiversity* 44: 163-172.
Vossen, T., **Towns, A.**, Ruysschaert, S., **Quiroz, D.** & **van Andel, T.** 2014. Consequences of the trans-Atlantic slave trade on medicinal plant selection: Plant use for cultural bound syndromes affecting children in Suriname and western Africa. *PLOS ONE* 9: e112345.
Vrijdaghs, A., Flores-Olvera, H. & **Smets, E.** 2014. Enigmatic floral structures in *Alternanthera*, *Iresine*, and *Tidestromia* (Gomphrenoideae, Amaranthaceae). A developmental homology assessment. *Plant Ecology and Evolution* 147: 49-66.
Vukov, T.D., Cvijanović, M., **Wielstra, B.** & Kalezić, M.L. 2014. The roles of phylogeny and climate in shaping the variation in life-history traits observed in the newt genus *Triturus* (Caudata, Salamandridae). *Annales Zoologici Fennici* 51: 445-456.
**Waheed, Z.** & **Hoeksema, B.W.** 2014. Diversity patterns of scleractinian corals at Kota Kinabalu, Malaysia, in relation to exposure and depth. *Raffles Bulletin of Zoology* 62: 66-82.
Wei, S-J., Li, Q., **van Achterberg, K.** & Chen, X-X. 2014. Two mitochondrial genomes from the families Bethylidae and Mutillidae: Independent rearrangement of protein-coding genes and higher-level phylogeny of the Hymenoptera. *Molecular Phylogenetics and Evolution* 77: 1-10.
Welker, F., **Duijm, E.**, van der Gaag, K., van Geel, B., de Knijff, P., van Leeuwen, J., Mol, D., van der Plicht, J., **Raes, N.**, Reumer, J. & **Gravendeel, B.** 2014. Analysis of coprolites from the extinct mountain goat *Myotragus balearicus*. *Quaternary Research* 81: 106-116.
**Wielstra, B.** & **Arntzen, J.W.** 2014. Exploring the effect of asymmetric mitochondrial DNA introgression on estimating niche divergence in morphologically cryptic species. *PLOS ONE* 9: e95504.
**Wielstra, B.** & **Arntzen, J.W.** 2014. Kicking *Triturus arntzeni* when it's down: large-scale nuclear genetic data confirm that newts from the type locality are genetically admixed. *Zootaxa* 3802: 381-388.
**Wielstra, B.**, **Arntzen, J.W.**, van der Gaag, K., Pabijan, M. & Babik, W. 2014. Data concatenation, Bayesian concordance and coalescent-based analyses of the species tree for the rapid radiation of *Triturus* newts. *PLOS ONE* 9: e111011.
**Wielstra, B.**, **Duijm, E.**, Lagler, P., **Lammers, Y.**, Meilink, W.R.M., Ziermann, J.M. & **Arntzen, J.W.** 2014. Parallel tagged amplicon sequencing of transcriptome-based genetic markers for *Triturus* newts with the Ion Torrent next-generation sequencing platform. *Molecular Ecology Resources* 14: 1080-1089.
**Wielstra, B.**, Sillero, N., Vörös, J. & **Arntzen, J.W.** 2014. The distribution of the crested and marbled newt species (Amphibia: Salamandridae: Triturus) – an addition to the New Atlas of Amphibians and Reptiles of Europe. *Amphibia-Reptilia* 35: 376-381.
Wisitrassameewong, K., **Nuytinck, J.**, Hampe, F., Hyde, K.D. & Verbeken, A. 2014. *Lactarius* subgenus *Russularia* (Russulaceae) in South-East Asia: 2. Species with remarkably small basidiocarps. *Phytotaxa* 188: 181-197.
Wisitrassameewong, K., **Nuytinck, J.**, Hyde, K.D. & Verbeken, A. 2014. *Lactarius* subgenus *Russularia* (Russulaceae) in South-East Asia: 1. Species with very distant gills. *Phytotaxa* 158: 23-42.
Wu, Q.L., Li, Q., Gu, Y., Shi, B.C., **van Achterberg, C.**, Wei, S.J. & Chen, X.X. 2014. The complete mitochondrial genome of *Taeniogonalos taihorina* (Bischoff) (Hymenoptera: Trigonalyidae) reveals a novel gene rearrangement pattern in the Hymenoptera. *Gene* 543: 76-84.
Xue, B., **Thomas, D.C.**, **Chaowasku, T.**, Johnson, D.M. & Saunders, R.M.K. 2014. Molecular phylogenetic support for the taxonomic merger of *Fitzalania* and *Meiogyne* (Annonaceae): New nomenclatural combinations under the conserved name *Meiogyne*. *Systematic Botany* 39: 396-404.
Yamakuma, M., Kato, H., Matsuo, K., El-Desoky, A.H., Kawabata, T., Losung, F., Mangindaan, R.E.P., **de Voogd, N.J.**, Yokosawa, H. & Tsukamoto, S. 2014. 1-Hydroxyethylhalenaquinone: a new proteasome inhibitor from the marine sponge *Xestospongia*. *Heterocycles* 11: 2605-2610.
Yang, C., Wang, X., **Miller, J.A.**, de Blécourt, M., Ji, Y., Yang, C., Harrison, R.D. & Yu, D.W. 2014. Using metabarcoding to ask if easily collected soil and leaf-litter samples can be used as a general biodiversity indicator. *Ecological Indicators* 46: 379-389.
Yang, E.C., Peters, A.F., Kawai, H., Stern, R., Hanyuda, T., Müller, D.G., Strittmatter, M., **Prud'homme van Reine, W.F.** & Küpper, F.C. 2014. Ligulate *Desmarestia* (Desmarestiales, Phaeophyceae) revisited: *D. japonica* sp. nov. and *D. dudresnayi* differ from *D. ligulata*. *Journal of Phycology* 50: 149-166.
Ye, Z., **Chen, P-p.** & Bu, W-j. 2014. First record of the genus *Geovelia* Zimmermann, 1984 (Hemiptera: Heteroptera: Veliidae) from China, with description of a new species. *The Pan-Pacific Entomologist* 90: 16-22.
Ye, Z., Zhu, G-p., **Chen, P-p.**, Zhang, D.-I. & Bu, W-j. 2014. Molecular data and ecological niche modeling reveal the Pleistocene history of a semi-aquatic bug (*Microvelia douglasi*) in East Asia. *Molecular Ecology* 23: 3080-3096.
Zhang, M.-G., Zhou, Z.-K., Chen, W.-Y., Cannon, C.H., **Raes, N.** & Slik, J.W.F. 2014. Major declines of woody plant species ranges under climate change in Yunnan, China. *Diversity and Distributions* 20: 405-415.
Zhang, N.W., Zhao, J.J., **Lens, F.**, de Visser, J., Menamo, T., Fang, W., Xiao, D., Bucher, J., Basnet, R.K., Lin, K., Cheng, F., Wang, X.W. & Bonnema, G. 2014. Morphology, carbohydrate composition and vernalization response in a genetically diverse collection of Asian and European turnips (*Brassica rapa* subsp. *rapa*). *PLOS ONE* 9: e114241.
Zhong, R., Shao, C.L., **de Voogd, N.J.** & Wang, C.Y. 2014. Sesquiterpene derivatives and steroids from the sponge *Dactylospongia elegans* collected from the South China Sea. *Chemistry of Natural Compounds* 50: 759-761.
Zijlstra, G. & **van Konijnenburg-van Cittert, J.H.A.** 2014. A nomenclatural note on *Monanthesia* and *Bennettites*. *Review of Palaeobotany and Palynology* 203: 1-2.
Žikić, V., **van Achterberg, C.**, Stanković, S.S., Dubaić, J.B. & Četković, A. 2014. Review of the Gasteruptiidae (Hymenoptera: Evanioidea) from the territory of the former Yugoslavia, with three newly reported species. *Zootaxa* 3793: 573-586.
Zimmer, E.I., Ducrot, V., Jager, T., **Koene, J.M.**, Lagadic, L. & Kooijman, S.A.L.M. 2014. Metabolic acceleration in the pond snail *Lymnaea stagnalis*? *Journal of Sea Research* 94: 84-91.
Zizzari, Z.V., Smolders, I. & **Koene, J.M.** 2014. Alternative delivery of male accessory gland products. *Frontiers in Zoology* 11: 32.

## Non-SCI publications

**Aguirre Gutierrez, J.** 2014. Are plant species' richness and diversity influenced by fragmentation at a microscale? *International Journal of Biodiversity* 384698: 1-9.
Antonelli, A., Condamine, F.L., **Hettling, H.**, Nilsson, K.S., Nilsson, R.H., Oxelman, B., Sanderson, M.J., Sauquet, H., Scharn, R., Silvestro, D., Töpel, M. & **Vos, R.A.** 2014. SUPERSMART: ecology and evolution in the era of big data. *PeerJ PrePrints* 2: e501v1.
Ardi, W.H., Ardaka, I.M., Hartutiningsih, Lugrayasa, I.N. & **Thomas, D.C.** 2014. Two new species of *Begonia* (Begoniaceae) from Sulawesi, Indonesia. *Edinburgh Journal of Botany* 71: 259-268.
**Baas, P.** & **Veldkamp, J.F.** 2014. Dutch pre-colonial botany and Rumphius's Ambonese Herbal. *Allertonia* 13: 9-19.
**Beenen, R.** 2014. *Clitenososia vazquezi* sp. nov. from Kenya (Coleoptera: Chrysomelidae: Galerucinae). *Genus* 25: 451-457.
**Beenen, R.** 2014. *Diacantha kippenbergi*, a new African galerucine leaf beetle (Coleoptera, Chrysomelidae). *Entomologische Blätter und Coleoptera* 110: 83-86.
**Beenen, R.** 2014. Key to the species of *Radymna* Reitter, 1913 with taxonomic and faunistic comments and description of two new species (Coleoptera, Chrysomelidae, Galerucinae). *Entomologische Blätter und Coleoptera* 110: 87-100.
Bink, F.A., **Noordijk, J.** & ten Hoopen, J. 2014. Minibiotopen moet je ontdekken. *Entomologische Berichten* 74: 89-94.
Bink, J. & **van Helsdingen, P.J.** 2014. *Theridion hannoniae* (Denis, 1944) (Araneae, Theridiidae) nieuw voor Nederland. *Nieuwbrief SPINED* 34: 7-11.
Bosma, H.F. & **van Konijnenburg-van Cittert, J.H.A.** 2014. Revision of the Late Cretaceous conifer genus *Moriconia*. *Palaeobiodiversity and Palaeoenvironments* 94(2): 383-392.
**Búcaro, R.D.**, **Touw, A.** & **Stech, M.** 2014. Epiphytic mosses from the understory of a forest in El Zancudo ("Los Bolsones"), La Paz, Honduras. *Bryophyte Diversity and Evolution* 36: 45-50.
Cadée, G.C., **van der Ham, R.** & Kruiswijk, W. 2014. Black walnuts from the Dutch coast. *The Drifting Seed* 20: 6-7.
Ceulemans, L., **Landau, B.M.** & van Dingenen, F. 2014. *Carinofusus* gen. nov. from the Mio-Pliocene transition of western France. *Vita Malacologica* 12: 23-30.
**Chantarasuwan, B.**, **van der Ham, R.W.J.M.**, **van Heuven, B.-J.** & **van Welzen, P.C.** 2014. Pollen morphology of *Ficus* subsection *Urostigma* (Moraceae). *Thai Forest Bulletin: Botany* 42: 52-60.
**Claessens, J.** 2014. Ein Vorkommen von *Himantoglossum metlesicsianum* im Norden Teneriffas. *Berichten aus den Arbeitskreisen Heimische Orchideen* 31: 213-218.
**Claessens, J.** & Kleynen, J. 2014. Bijzondere bestuivers bij orchideeën, deel 1: Hommels als bestuivers van de Grote muggenorchis (Bumblebees as pollinators of *Gymnadenia conopsea*). *Natuurhistorisch Maandblad* 103: 30-32.
**Claessens, J.** & Kleynen, J. 2014. Bijzondere bestuivers bij orchideeën, deel 2: Bijen als bestuivers van de Grote keverorchis (*Neottia ovata*). *Natuurhistorisch Maandblad* 103: 140-142.
**Claessens, J.** & Kleynen, J. 2014. Bijzondere bestuivers bij orchideeën, deel 3: Honingbij en Hoornaar als bestuivers van de Brede wespenorchis. *Natuurhistorisch Maandblad* 103: 313-317.
**Claessens, J.** & Kleynen, J. 2014. The pollination of European orchids, part 3: *Limodorum* and *Epipactis*. *Journal of the Hardy Orchid Society* 11: 64-71.
**Claessens, J.**, Kleynen, J. & Ulrich, T. 2014. Widerbart - *Epipogium aphyllum* - Ergänzende Beobachtungen. *AGEO-Mitteilungen* 7: 32-38.
**Colijn, E.O.** 2014. Bereikt de Aziatische essenprachtkever ook Nederland? *Kijk op Exoten* 8: 2-3.
**Colijn, E.O.** 2014. Kevers op kadavers in Nederland, de stand van zaken. *Entomologische Berichten* 74: 60-67.
**Colijn, E.O.** 2014. Voorkom de vestiging van de Aziatische essenprachtkever. *Dierplagen Info* 17: 10-12.
**Colijn, E.O.** & Heijerman, Th. 2014. *Diachromus germanus*, na ruim een eeuw weer in Nederland (Coleoptera: Carabidae). *Natuurhistorisch Maandblad* 103: 205-209.
**de Boer, H.J.** & Kool, A. 2014. Identifying Medicinal Plant Roots in Trade: DNA barcoding in Morocco. *iBOL Barcode Bulletin* 5: 3.
de Bree, E., **Smit, J.T.** & Mortelmans, J. 2014. Blaaskopvliegen van het genus *Leopoldius* in de Benelux (Diptera, Conopidae). *Nederlandse Faunistische Mededelingen* 43: 55-66.
de Bree, E., van den Broek, R. & **Smit, J.T.** 2014. De gouden dennenstamjager *Choerades igneus* nieuw voor Nederland (Diptera, Asilidae). *Nederlandse Faunistische Mededelingen* 43: 47-54.
**de Vogel, E.**, **Winkel, E.** & van Vugt, R. 2014. *Dendrobium goodallianum*, a new species of section *Grastidium* from Papua New Guinea. *Malesian Orchid Journal* 14: 87-90.
**de Vos, J.** 2014. De zee neemt en de zee geeft. *Grondboor en Hamer* 4/5: 138-144.
de Winkel, M. & **Noordijk, J.** 2014. Een nieuwe renspin voor Nederland: *Philodromus fuscomarginatus* (Araneae: Philodromidae). *Entomologische Berichten* 74: 180-186.
Dirkse, G.M., **Duistermaat, H.** & **Zonneveld, B.J.M.** 2014. Morphology and genome weight of *Symphyotrichum* species (Asteraceae) along rivers in The Netherlands. *New Journal of Botany* 4: 134-142.
**Donovan, S.K.** 2014. An unnatural bridge in an artificial limestone environment, the Netherlands. *Cave and Karst Science* 41: 118-119.
**Donovan, S.K.** 2014. Chalk or Eocene echinoids? Implications of a chance observation. *Geological Curator* 10: 67-70.
**Donovan, S.K.** 2014. Palaeoecology and taphonomy of a fossil 'sea floor', in the Carboniferous Limestone of northern England. *Mercian Geologist* 18: 171-174.
**Donovan, S.K.** 2014. Reconstructing research networks: the importance of signed offprints. *Geological Curator* 10: 71-76.
**Donovan, S.K.** & Jagt, J.W.M. 2014. Ichnology of Late Cretaceous echinoids from the Maastrichtian type area (The Netherlands, Belgium) – 3. *Podichnus* Bromley and Surlyk and a crinoid attachment on the echinoid Echinocorys Leske from the Lixhe area, Belgium. *Bulletin of the Mizunami Fossil Museum* 40: 75-78.

**Donovan, S.K.**, Harper, D.A.T., Jackson, R.A. & Portell, R.W. 2014. A note on a coastal natural bridge in Antigua, West Indies. *Cave and Karst Science* 40: 105-108.

**Donovan, S.K.** & Lewis, D.N. 2014. An illustrated guide to the Silurian (Ludlow) crinoids of the southern Lake District. *Proceedings of the Cumberland Geological Society* 8: 180-191.

**Donovan, S.K.**, Lewis, D.N. & Ewin, T.A.M. 2014. Fossil seabeds. *Deposits* 37: 14-19.

**Doorenweerd, C.**, As, B. & Scheffers, J. 2014. Explosieve verspreiding van de lindevouwmot: nu ook in Nederland? *Entomologische Berichten* 74: 111-114.

**Duffels, H.** & Ellis, W. 2014. Cas Jeekel, myriapodoloog, bibliothecaris en museum-directeur. *Entomologische Berichten* 74: 166-169.

Eberhardt, U., Verbeken, A. & **Nuytinck, J.** 2014. DNA-barcoding, fungi and the German Barcode of Life Project (GBOL). *Zeitschrift für Mykologie* 80: 627-641.

Ervynck, A., van Strydonck, M., Boudin, M., **Gravendeel, B.**, Randi, E., Fabbri, E., Caniglia, R., Ottoni, C., Thieren, E., de Vuyst, W., Lievois, D. & van Neer, W. 2014. De poot van de wolf aan de poort van het Steen (deel 2). Radiokoolstofdatering en genetisch onderzoek van een historisch curiosum. *Handelingen der Maatschappij voor Geschiedenis & Oudheidkunde* 68: 3-11.

**Faasse, M.A.** 2014. Introduction of *Ptilohyale littoralis* to The Netherlands. *Marine Biodiversity Records* 7: 5.

**Faasse, M.A.** 2014. Sigalionide zeerupsen in Nederland, met *Fimbriosthenelais minor* nieuw voor Nederland (Polychaeta: Sigalionidae). *Nederlandse Faunistische Mededelingen* 42: 71-74.

**Faasse, M.A.** 2014. The Pacific amphipod *Monocorophium uenoi* (Stephensen, 1932) introduced to the Netherlands (NE Atlantic). *BioInvasions Records* 3: 29-33.

**Faasse, M.A.** & Melchers, M. 2014. The exotic jellyfish *Blackfordia virginica* introduced into the Netherlands (Cnidaria: Hydrozoa). *Nederlandse Faunistische Mededelingen* 43: 103-110.

**Faasse, M.A.** & van Haaren, T. 2014. Bamboewormen in Nederland, met *Micromaldane ornithochaeta* nieuw voor Nederland (Polychaeta: Maldanidae). *Nederlandse Faunistische Mededelingen* 43: 111-114.

Farahani, S., Talebi, A.A., Rakhshani, E., **van Achterberg, C.** & Sharkey, M. 2014. A contribution to the knowledge of Agathidinae (Hymenoptera: Braconidae) from Iran with description of a new species. *Versita Biologica* 69: 228-235.

Farahani, S., Talebi, A.A., **van Achterberg, C.** & Rakhshani, E. 2014. A review of species of the genus *Ascogaster* Wesmael (Hymenoptera: Braconidae, Cheloninae) from Iran. *Far Eastern Entomologist* 275: 1-12.

Fernández, M., Bogarín, D., **Karremans, A.P.** & Jiménez, D. 2014. New species and records of Orchidaceae from Costa Rica III. *Lankesteriana* 13: 259-282.

Fernández-Triana, J., **van Achterberg, C.** & Whitfield, J.B. 2014. Australasian endemic no more: four new species of *Miropotes* Nixon (Hymenoptera, Braconidae, Microgastrinae), with the first record from the Oriental region. *Tijdschrift voor Entomologie* 157: 59-77.

Filer, D.L. & **Wieringa, J.J.** 2014. Imaging specimens with BRAHMS – two very different approaches. *Oxford Plant Systematics* 20: 14-15.

Gand, G., Steyer, S., Chabard, D., Pellenard, P., Glé, L. & **van Waveren, I.M.** 2014. Études géologiques 2013 et projets 2014 sur l'Autunien du bassin d'Autun. *Bulletin de la Société d'Histoire Naturelle d'Autun* 206: 7-20.

Gato-Calvo, L., Vierna, J. & **de Boer, H.J.** 2014. Barcoding the trendy sweetener *Stevia*. *iBOL Barcode Bulletin* 6: 6-7.

Ghorbani, A., **Gravendeel, B.**, Zarre, S. & **de Boer, H.** 2014. Illegal wild collection and international trade of CITES-listed terrestrial orchid tubers in Iran. *Traffic Bulletin* 26: 18-24.

**Gravendeel, B.**, **Noordeloos, M.** & **Geml, J.** 2014. Nieuwe inzichten in de samenstelling van de paddestoelenflora in Kruipwilgstruweel dankzij DNA analyse. *Holland's Duinen* 64: 22-25.

Groenenboom, P. & **Zwaan, J.C.** 2014. Natuurlijke parels uit Zeeland. *Edelmetaal* 69: 18-21.

Hoedemaeker, P. 2014. Genus *Pseudothurmannia* Spath, 1923 and related subgenera *Crioceratites* (Balearites) Sarkar, and *C.* (Binelliceras) Sarkar, 1977 (Lower Cretaceous Ammonoidea). *Revue de Paléobiologie, Genève* 32: 2-209.

**Hoeksema, B.W.** 2014. De Koraaldriehoek als centrum van mariene biodiversiteit. *Cahier Biowetenschappen en Maatschappij* 33: 38-43.

**Hoeksema, B.W.** 2014. Met Naturalis in zee: Tour de Nouvelle-Calédonie. *Onderwatersport* 46: 38-41.

Hoste, I., **Duistermaat, L.**, Odé, B. & van Rossum, F. 2014. Nederlandse plantennamen in de Nouvelle Flore de la Belgique: verschillen tussen de 5de en 6de editie. *Dumortiera* 104: 83-88.

Hunt, C.A, Steenbeeke, G. & **Merckx, V.S.F.T.** 2014. *Thismia megalongensis* (Thismiaceae), a new species of Thismia from New South Wales. *Telopea* 16: 165-174.

IJland, S. & **van Helsdingen, P.J.** 2014. On some spiders (Arachnida, Araneae) from the surroundings of Castellabate, Italy. *Nieuwbrief SPINED* 34: 16-33.

Jagt, J.W.M. , **Leloux, J.** , van Rijsselt, E. & van Rijsselt, W. 2014. Vreemde koraalafdrukken op boormossels uit het Limburgs Krijt. *Grondboor & Hamer* 68(6): 192-196.

**Kalkman, V.J.** & Orr, A.G. 2014. Distribution and identification of *Rhodothemis* in the eastern part of the Indo-Australian Archipelago (Odonata: Libellulidae). *Faunistic Studies in South-East Asian and Pacific Island Odonata* 8: 1-9.

**Kalkman, V.J.** & Termaat, T. 2014. Wat vertellen de SNL-insecten ons? Dagvlinders, libellen en sprinkhanen geven een gemengd beeld. *Vakblad Natuur Bos Landschap* 108: 10-13.

**Karremans, A.P.** 2014. *Lankesteriana*, a new genus in the Pleurothallidinae (Orchidaceae). *Lankesteriana* 13: 319-332.

Kerckhof, F. & **Faasse, M.** 2014. *Boccardia proboscidea* and *Boccardiella hamata* (Polychaeta: Spionidae: Polydorinae), introduced mud worms new for the North Sea and Europe, respectively. *Marine Biodiversity Records* 7: e76.

**Kidane, B.**, **van der Maesen, L.J.G.**, **van Andel, T.**, Asfaw Z. & **Sosef, M.S.M.** 2014. Ethnobotany of wild and semi-wild edible fruits used by the Maale and Ari ethnic communities in southern Ethiopia. *Ethnobotany Research and Applications* 12: 455-471.

**Kleukers, R.M.J.C.** 2014. De noordelijkste vindplaats van de zompsprinkhaan in Nederland. *Entomologische Berichten* 74: 230-231.

Klietmann, J., Nagel, D., Rummel, M. & **van den Hoek Ostende, L.W.** 2014. Enlightning complexity. The Dimylidae of Petersbuch 28. *Palaeobiodiversity and Palaeoenvironments* 94: 463-479.

**Koese, B.**, van Maanen, B. & Boumans, L. 2014. De Negendoornige wintersteenvlieg: een nieuwe aanwinst voor de Roer en Nederland. *Natuurhistorisch Maandblad* 103: 217-220.

Koevoets, M.J., **Schulp, A.S.** & Troelstra, S.R. 2014. The age and provenance of the *Globidens timorensis* holotype. *Berita Sedimentologi* 30: 59-62.

**Kuijper, W.** 2014. De landslakken van de Heunsberg te Valkenburg aan de Geul in de middeleeuwen. *Natuurhistorisch Maandblad* 103: 299-303.

**Kuijper, W.** 2014. Waterbeestjes en ander leven, Meertje van de Blauwe Paal in de Amsterdamse Waterleidingduinen. *Duin* 37: 6-7.

**Landau B.**, Vermeij, G.J. & **Reich, S.** 2014. Classification of the Modulidae (Caenogastropoda, Cerithioidea), with new genera and new fossil species from the Neogene of tropical America and Indonesia. *Basteria* 78: 1-29.

**Landau, B.M.**, Harzhauser, M., İslamoğlu, Y. & de Silva, C.M. 2014. Errata and corrigenda to Systematics and palaeobiogeography of the gastropods of the middle Miocene (Serravallian) Karaman Basin, Turkey. *Cainozoic Research* 14: 91-92.

**Landau, B.M.** & Houart, R. 2014. New Muricidae (Mollusca: Neogastropoda) from the Lower Miocene Cantaure Formation of Venezuela. *Novapex* 15: 23-35.

**Landau, B.M.** & Vermeij, G.J. 2014. A revision of the fossil Fasciolariinae (Gastropoda, Neogastropoda, Fasciolariidae) from the Neogene Caribbean. *Vita Malacologica* 12: 3-21.

Lim, R.C.J., Ng, X.Y., Leong, P.K.F., Kurzweil, H., **Duistermaat, H.**, Chung, Y.F., Chen, J., Yeoh, J.S. & Tan, H.T.W. 2014. Rediscovery in Singapore of *Vrydagzynea lancifolia* Ridl. (Orchidaceae). *Nature in Singapore* 7: 1-7.

Madl, M. & **van Achterberg, C.** 2014. A catalogue of the Braconidae (Hymenoptera: Ichneumonoidea) of the Malagasy subregion. *Linzer Biologische Beiträge* 46: 5-220.

**Merckx, V.S.F.T.** & Wapstra, M. 2014. Further notes on the occurrence of Fairy Lanterns *Thismia rodwayi* F. Muell. (Thismiaceae) in Tasmania: vegetation associations. *The Tasmanian Naturalist* 135: 71-78.

**Miller, J.A.**, **Schilthuizen, M.**, Lilliendahl Burmester, J., van der Graaf, L., **Merckx, V.**, Jocqué, M., Kessler, P.J.A., Fayle, T.M., Breeschoten, T., Broeren, R., Bouman, R., Chua, W.-J., Feijen, F., Fermont, T., Groen, K., Groen, M., Kil, N.J.C., de Laat, H.A., Moerland, M.S., Moncoquet, C., Panjang, E., Philip, A.J., Roca-Eriksen, R., Rooduijn, B., van Santen, M., Swakman, V., Evans, M.N., Evans, L.J., Love, K., Joscelyne, S.H., Tober, A.V., Wilson, H.F., Ambu, L.N. & Goossens, B. 2014. Dispatch from the field: ecology of ground-web-building spiders with description of a new species (Araneae, Symphytognathidae). *Biodiversity Data Journal* 2: e1076.

Mood, J.D., **Veldkamp, J.F.**, Dey, S. & Prince, L.M. 2014. Nomenclatural changes in Zingiberaceae: *Caulokaempferia* is a superfluous name for *Monolophus* and *Jirawongsea* is reduced to *Boesenbergia*. *Gardens' Bulletin Singapore* 66: 215-231.

Mood, J.D., **Veldkamp, J.F.** & Prince, L.M. 2014. A new species and a new record of *Boesenbergia* (Zingiberaceae) from Thailand. *Gardens' Bulletin Singapore* 66: 207-214.

Morrone, O., Aliscioni, S.S., **Veldkamp, J.F.**, Pensiero, J.F., Zuloaga, F.O. & Kellogg, E.A. 2014. A revision of Old World species of *Setaria* (Poaceae: Panicoideae: Paniceae). *Systematic Botany Monographs* 96: 1-153.

Nonhof, C. & **van der Ham, R.** 2014. Muurflora in Delft. *Veldbericht* 119: 5-6.

**Noordijk, J.** 2014. Laatste populaties van de hooiwagen *Opilio parietinus* (Opiliones: Phalangiidae) in Nederland. *Entomologische Berichten* 74: 21-27.

**Noordijk, J.** 2014. Nieuwe vondsten van de Boomslankmier in het Roerdal. *Natuurhistorisch Maandblad* 103: 228-230.

**Noordijk, J.** & Bink, J. 2014. *Leiobunum religiosum* (Opiliones: Sclerosomatidae), een nieuwe hooiwagensoort voor de Nederlandse fauna. *Entomologische Berichten* 74: 138-142.

**Noordijk, J.**, Bink, J. & Wijnhoven, H. 2014. Uitbreiding van de hooiwagen *Astrobunus laevipes* (Opiliones). *Nederlandse Faunistische Mededelingen* 42: 11-17.

Pesic, V., **Smit, H.** & Saboori, A. 2014. Checklist of the water mites (Acari, Hydrachnidia) of Iran: Second supplement and description of one new species. *Ecologica Montenegrina* 1: 30-48.

Prieto, J., Angelone, C., Casanovas-Vilar, I., Gross, M., Hir, J., **van den Hoek Ostende, L.W.**, Maul Lutz, C. & Vasilyan, D. 2014. The small mammals from Gratkorn: an overview. *Palaeobiodiversity and Palaeoenvironments* 94: 135-162.

**Reemer, M.** 2014. A review of Microdontinae (Diptera: Syrphidae) of Surinam, with a key to the Neotropical genera. *Tijdschrift voor Entomologie* 157: 27-57.

**Reemer, M.** & **Smit, J.T.** 2014. Landgoed 't Hoosden: Schatkist vol glimmers en juweelzweefvliegen. *Natuurhistorisch Maandblad* 103: 103-109.

**Reemer, M.**, Stahls, G. & Rattel, E. 2014. Host fungus of *Agathomyia sexmaculata* (Diptera: Platypezidae) and notes on breeding biology. *Sahlbergia* 20: 36-41.

**Reich, S.**, **Wesselingh, F.P.** & **Renema, W.** 2014. A highly diverse molluscan seagrass fauna from the early Burdigalian (early Miocene) of Banyunganti (south-central Java, Indonesia). *Annalen des Naturhistorischen Museums in Wien, Serie A* 116: 5-126.

Reshchikov, A., Kumar, G. & **van Achterberg, C.** 2014. Review of Asiatic *Neurogenia* Roman, 1910 (Hymenoptera, Ichneumonidae) with description of three new species. *Tijdschrift voor Entomologie* 157: 123-135.

Reshchikov, A. & **van Achterberg, K.** 2014. Review of the genus *Metopheltes* Uchida, 1932 (Hymenoptera, Ichneumonidae) with description of a new species from Vietnam. *Biodiversity Data Journal* 2: e1061.

**Ross, F.D.** 2014. De Boer's (2011) even more unique *Osteolaemus nuchals*. *Crocodile Specialist Group Newsletter* 33: 34-35.

**Ross, F.D.** 2014. Huchzermeyer's (2003) left-bending trachea hypothesis. *Crocodile Specialist Group Newsletter* 33: 26-30.

**Ross, F.D.** 2014. *Magdalena crocodile* with supra-scapular superscales. *Crocodile Specialist Group Newsletter* 33: 33-34.

**Ross, F.D.** 2014. Something new and helpful in crocodilian cranial morphometrics. *Crocodile Specialist Group Newsletter* 33: 30.

**Ross, F.D.** 2014. When a whole big transverse row of nuchal scales becomes one individual superscute. *Crocodile Specialist Group Newsletter* 33: 22-23.
Santhosh Kumar, E.S., **Veldkamp, J.F.** & Shareef, S.M. 2014. Notes on *Eugenia gracilis*, *E. mooniana*, and *E. phillyreoides* (Myrtaceae). *Webbia* 69: 101-103.
**Schilthuizen, M.** 2014. Nude revelations: A few surprises in nudibranch behavior. *Natural History* Jul/Aug 2014: 14-15.
Schmitt, M., Bäse, W., **Beenen, R.**, Drovenik, B., Fritzlar, F., Geiser, E., Jäckel, R., Langer, M., Mauser, J., Ringel, H., Schöller, M. & Siede, D. 2014. Das Projekt ChryFaun - Faunistik der mitteleuropäischen Blatt- und Samenkäfer (Chrysomelidae s.l.). *Entomologische Blätter und Coleoptera* 110: 33-38.
**Smit, H.** 2014. The first hyporheic water mites from the Afrotropical region (Acari: Hydrachnidia), with new species of the genera *Kawamuracarus* Uchida and *Bharatohydracarus* Cook. *Acarologia* 54: 39-45.
**Smit, H.** & Pesic, V. 2014. A new *Arrenurus* species from India (Acari: Hydrachnidia: Arrenuridae). *Ecologica Montenegrina* 1: 109-112.
Smit, J. & **Smit, J.T.** 2014. A social parasitic *Polistes* wasp parasitized by a twisted-wing insect (Hymenoptera: Vespidae, Strepsiptera: Xenidae). *Entomologische Berichten* 74: 121-123.
**Smit, J.T.** 2014. Wiervliegen. - In: Cadee, G.C. Vloedmerken, bedreigde minimilieus op het strand. *Entomologische Berichten* 74: 9.
**Smit, J.T.** & de Bree, E. 2014. Het Sachalin-elfje *Melangyna pavlovskyi* nieuw voor Nederland (Diptera: Syrphidae). *Nederlandse Faunistische Mededelingen* 42: 29-32.
**Smit, J.T.** & Tuinstra, G. 2014. Een bijzondere vangst van een bijzondere prachtvlieg (Diptera, Ulidiidae). *Entomologische Berichte* 74: 261-263.
Steward, P.R., Shackelford, G., **Carvalheiro, L.G.**, Benton, T.G., Garibaldi, L.A. & Sait, S.M. 2014. Pollination and biological control research: are we neglecting two billion smallholders? *Agriculture & Food Security* 3: 5.
Sulikowska-Drozd, A. & **Kappes, H.** 2014. Molluscan associations with the clausiliid *Alinda biplicata* in floodplain forests at the North-Eastern edge of its range. *Folia Malacologica* 22: 21-30.
Tan, J-L., Chen, X-X. & **van Achterberg, K.** 2014. Description of the male of *Dolichovespula flora* Archer (Hymenoptera: Vespidae). *Entomotaxonomia* 36: 75-80.
Tavoosi Ajvad, F., Madadi, H., Sobhani, M. & **van Achterberg, C.** 2014. First report of *Dinocampus coccinellae* (Hym.: Braconidae) from Iran. *Journal of Entomological Society of Iran* 33: 77.
**Touw, A.** 2014. Original specimens kept in the herbarium of Naturalis Biodiversity Center (section Nationaal Herbarium Nederland) of Asian and South American moss taxa published by F. Dozy, J.H. Molkenboer, R.B. van den Bosch and C.M. van der Sande Lacoste. *http://www.repository.naturalis.nl/document/521325*.
**Touw, D.** 2014. Wat bezielde onze voorgangers uit de negentiende eeuw? [What inspired our passionate nineteenth century bryologists?]. *Buxbaumiella* 101: 1-44.
Turin, H., **Noordijk, J.**, van der Meer, F. & Boer, P. 2014. Hooiwagens, loopkevers en mieren in houtwallen in de Noardlike Fryske Wâlden. *Entomologische Berichten* 74: 119-129.
**van Achterberg, C.** 2014. Notes on the checklist of Braconidae (Hymenoptera) from Switzerland. *Mitteilungen der Schweizerischen Entomologischen Gesellschaft* 87: 213.
**van Achterberg, C.** 2014. *Sigalphus anjae* spec. nov. (Hymenoptera: Braconidae: Sigalphinae) from southern Vietnam. *Zoologische Mededelingen Leiden* 88: 9-18.
**van Achterberg, C.** & Vikberg, V. 2014. *Dinotrema brevis* spec. nov. (Hymenoptera: Braconidae: Alysiinae), a new brachypterous species from Finland. *Zoologische Mededelingen Leiden* 88: 1-8.
**van Balgooy, M.M.J.** & Widjaja, E.A. 2014. Flora of Bali: a provisional checklist. *Reinwardtia* 14(1): 219-221.
**van der Geer, A.A.E.** & **van den Hoek Ostende, L.** 2014. De dwergolifant en de rotsmuis van het vergeten eiland. *Cranium* 31: 33-37.
**van der Ham, R.** 2014. Drollen in de polder. *Veldbericht* 116: 2, 9.
**van der Ham, R.** 2014. Kersen in de polder. *Veldbericht* 119: 16.
**van der Ham, R.**, **Eurlings, M.** & van den Wollenberg, B. 2014. Het walnootassortiment van de Botanische Tuin. *Papyrus* 1: 14-16.
**van der Meij, S.E.T.**, **Reijnen, B.T.** & **Fransen, C.H.J.M.** 2014. Research of the Month: New biodiversity records for Curaçao. *BioNews* 13: 4-5.
**van der Velde, G.** 2014. Water space invaders 1: hoe exotische soorten onze wateren binnendringen. De tiende van Itersonlezing. *Papyrus* 2: 4-7.
van Dingenen, F., Ceulemans, L. & **Landau, B.M.** 2014. *Euroscaphella* nov. gen. (Gastropoda: Volutidae) in the Neogene of Europe, with the description of a new species: *Euroscaphella namnetensis* nov. sp. from the Mio-Pliocene transition of northwestern France. *Cainozoic Research* 14: 101-111.
van Dongen, S., **Galis, F.**, ten Broek, C., Heikinheimo, K., Wijnaendts, L.C., Delen, S. & Bots, J. 2014. When right differs from left: Human limb directional asymmetry emerges during very early development. *Laterality* 19: 591-601.
**van Helsingen, P.J.** 2014. Recente wijzigingen in nomenclatuur. *Nieuwbrief SPINED* 34: 4.
van Iersel, S., Swart, E.M., Nakadera, Y., van Straalen, N.M. & **Koene, J.M.** 2014. Effect of male accessory gland products on egg laying in gastropod molluscs. *Journal of Visualized Experiments* 88: e51698.
van Kessel, N., Dorenbosch, M., Kranenbarg, J., **van der Velde, G.** & Leuven, R.S.E.W. 2014. Invasieve grondels in de grote rivieren en hun effect op de beschermde Rivierdonderpad. *De Levende Natuur* 115: 122-128.
van Leeuwen, T., **Kriegsman, L.M.**, **van Tol, J.** & Schokkenbroek, J. 2014. The changing role of museums in the global scientific landscape. *Journal of Scientometric Research* 2: 137-145.
**van Ofwegen, L.P.** & Hermanlimianto, M.I.Y.T. 2014. *Siboga plexaurids* (Coelenterata: Octocorallia) re-examined. *Zoologische Mededelingen* 88: 19-58.
**van Soest, R.W.M.**, **Beglinger, E.J.** & **de Voogd, N.J.** 2014. *Mycale* species (Porifera: Poecilosclerida) of Northwest Africa and the Macaronesian Islands. *Zoologische Mededelingen* 88: 59-109.
**Veldman, S.**, de Boer, H.J., Otieno, J.N. & **Gravendeel, B.** 2014. Species assessment in African Orchid Cake. *iBOL Barcode Bulletin* 6: 10-11.
**Veldman, S.**, Otieno, J., **van Andel, T.R.**, **Gravendeel, B.** & **de Boer, H.J.** 2014. Efforts urged to tackle thriving illegal orchid trade in Tanzania and Zambia for chikanda production. *Traffic Bulletin* 26: 47-50.
**Vermeulen, J.J.** & **de Vogel, E.** 2014. A New Species of *Bulbophyllum* from Papua New Guinea. *Malesian Orchid Journal* 14: 97-99.
**Vermeulen, J.J.**, & Marzuki, M.E. 2014. *Charopa lafargei* (Gastropoda, Pulmonata, Charopidae), a new, presumed narrowly endemic species from Peninsular Malaysia. *Basteria* 78: 31-34.
**Vermeulen, J.J.**, & Rysy, W. 2014. Zwei neue Bulbophyllum-arten aus Neuguinea. *Die Orchidee* 65: 138-144.
**Vermeulen, J.J.** & Sieder, A. 2014. *Bulbophyllum viridescens* Ridl. and *B. elaphoglossum* Schltr.: similar but not the same. *Malesian Orchid Journal* 14: 91-96.
Vervoenen, M., **van Nieulande, F.**, Fraussen, K., **Wesselingh, F.P.** & **Pouwer, R.** 2014. Pliocene to Quaternary sinistral *Neptunea* species (Mollusca, Gastropoda, Buccinidae) from the NE Atlantic. *Cainozoic Research* 14: 17-34.
**Vonk, R.** 2014. Ypresian isopod crustaceans from Monte Bolca and Monte Postale (Italy). *Rendiconti della società geologica Italiana* 31: 223-224.
**Vos, R.A.**, Biserkov, J.V., Balech, B., Beard, N., Blissett, M., Brenninkmeijer, C., **van Dooren, T.**, Eades, D., Gosline, G., Groom, Q.J., **Hamann, T.D.**, **Hettling, H.**, Hoehndorf, R., Holleman, A., **Hovenkamp, P.**, Kelbert, P., King, D., Kirkup, D., **Lammers, Y.**, **DeMeulemeester, T.**, Mietchen, D., **Miller, J.A.**, Mounce, R., Nicolson, N., Page, R., Pawlik, A., **Pereira, S.**, Penev, L., Richards, K., Sautter, G., Shorthouse, D.P., Tähtinen, M., Weiland, C., Williams, A.R. & **Sierra, S.** 2014. Enriched biodiversity data as a resource and service. *Biodiversity Data Journal* 2: e1125.
**Weeda, E.J.**, Bijlsma, R.J. & **Gravendeel, B.** 2014. Wat voor oerwoud was het Beekbergerwoud. *Nieuwe Veluwe* 3: 28-30.
**Wesselingh, F.P.**, **van Nieulande, F.A.D.**, Fraussen, K., Moerdijk, P.W., Janssen, A.W., **Pouwer, R.** & Rijken, R. 2014. De fossiele schelpen van de Nederlandse kust II: Buccinoidea (deel 8). *Spirula* 401: 194-205.
Wijnhoven, H., **Noordijk, J.** & Heijerman, Th. 2014. Het hooiwagengenus *Trogulus* in Nederland (Opiliones: Trogulidae). *Nederlandse Faunistische Mededelinge* 42: 1-9.
**Winkler Prins, C.F.** 2014. La Universidad de Leiden y la Cordillera Cantábrica: una oportunidad faltada. *Tierra y Tecnología* 44: 21-27.
**Zonneveld, B.J.M.** 2014. Chimaeras nader bekeken. *Succulenta* 93: 72-76.
**Zonneveld, B.J.M.** 2014. Het maken van een hexaploïde *Sansevieria trifasciata*. *Succulenta* 93: 242-245.
**Zwaan, J.C.** 2014. Gem Notes: Bicoloured Grossular from Kambanga, Kenya. *Journal of Gemmology* 34: 195-197.
**Zwaan, J.C.** 2014. Gem Notes: Blue Kyanite from Tanzania. *Journal of Gemmology* 34: 198-200.
**Zwaan, J.C.** 2014. Gem Notes: Green Fluorite from Stak Nala, Pakistan. *Journal of Gemmology* 34: 192-194.
**Zwaan, J.C.** 2014. Synthetische diamant – een update. *Edelmetaal* 69: 30-33.
**Zwaan, J.C.** 2014. World Jewellery Confederation (CIBJO) Congres Moskou. *Edelmetaal* 69: 29-31.
**Zwaan, J.C.** & Groenenboom, P. 2014. Natural pearls from Edible 'True Oysters' in Zeeland, the Netherlands. *Journal of Gemmology* 34: 150-155.
**Zwaan, J.C.**, **van der Marel, D.M.** & Dommisse, H.A. 2014. The 'Sleeping Lion' Baroque Pearl: An Update. *Journal of Gemmology* 34: 248-253.

## Books

Atmadja, W.E. & **Prud'homme van Reine, W.F.** 2014. Checklist of the seaweed species biodiversity of Indonesia, with their distribution and classification. Green Algae (Chlorophyta) and Brown Algae (Phaeophyceae, Ochrophyta). Naturalis Biodiversity Center & Indonesian Institute of Sciences (LIPI). 60 pp.
**Dijkstra, K.-D.B.** & Clausnitzer, V. 2014. The Dragonflies and Damselflies of Eastern Africa: Handbook for all Odonata from Sudan to Zimbabwe. Studies in Afrotropical Zoology. Royal Museum of Central Africa, Belgium. 260 pp.
**Dijkstra, K.-D.B.** & Lewington, R. 2014. Guía de campo de las libélulas de España y de Europa. Ediciones Omega. 320 pp.
**Dijkstra, K.-D.B.** & Lewington, R. 2014. Libellen Europas: der Bestimmungsführer. Haupt Verlag. 320 pp.
**Donovan, S.K.** 2014. How Not to Alienate your Editor: Some Everyday Aspects of Academic Publishing. Lambert Academic Publishing. 116 pp.
**Hovenkamp, P.**, **Kessler, P.** & **van Uffelen, G.** (eds.). Planten uit de oertijd. Hortus Botanicus Leiden. 22 pp.
Hutson, A.M. & **Lina, P.H.C.** (eds.). Abstracts of the XIIIth European Bat Research Symposium, Šibenik, Croatia. 186 pp.
**Klein, J.** 2014. Fossilium Catalogus I: Animalia, Pars 152 - Lower Cretaceous Ammonites VII - Hoplitoidea & Engonoceratoidea. Backhuys Publishers - Margraf Publishers. 280 pp.
Koomen, P. & **Noordijk, J.** 2014. Entomofauna van de Noardlike Fryske Wâlden. Entomologische Berichten 74(6), 64 pp.
**Mota de Oliveira, S.** (ed.). Flora of the Guianas, series A (30): 139. Gentianaceae. Kew Publishers. 131 pp.
Neve, A. & **van der Ham, R.W.J.M.** 2014. Bijenplanten: nectar en stuifmeel voor honingbijen. EIS Kenniscentrum insecten en andere ongewervelden, Naturalis Biodiversity Center & KNNV Delfland. 511 pp.
Nieto, A., Roberts, S.P.M., Kemp, J., Rasmont, P., Kuhlmann, M., García Criado, M., **Biesmeijer, J.C.**, Bogusch, P., Dathe, H.H., De la Rúa, P., **de Meulemeester, T.**, Dehon, M., Dewulf, A., Ortiz-Sánchez, F.J., Lhomme, P., Pauly, A., Potts, S.G., Praz, C., Quaranta, M., Radchenko, V.G., Scheuchl, E., **Smit, J.**, Straka, J., Terzo, M., Tomozii, B., Window, J. & Michez, D. 2014. European Red List of Bees. Publication Office of the European Union.
Nonhof, C. & **van der Ham, R.** 2014. Muurflora 2014: Delft centrum en TU-noord. KNNV afdeling Delfland. 44 pp.
**Noordijk, J.** & ten Hoopen, J. 2014. Bijzondere biotopen. Entomologische Berichten 74(1-2). 100 pp.
Pasmans, F., Bogaerts, S., Janssen, H. & **Sparreboom, M.** 2014. Molche & Salamander halten und zuechten. NTV, Munster. 248 pp.
Pasmans, F., Bogaerts, S., Janssen, H. & **Sparreboom, M.** 2014. Salamanders Keeping and Breeding. NTV, Munster. 248 pp.
**Schilthuizen, M.** 2014. Darwins Peep Show. Atlas Contact. 352 pp.

**Schilthuizen, M.** 2014. Nature's Nether Regions: What the Sex Lives of Bugs, Birds, and Beasts Tell Us About Evolution, Biodiversity, and Ourselves. Viking Adult. 256 pp.
**Sparreboom, M.** 2014. Salamanders of the Old World. KNNV and Naturalis. 432 pp.
**van Andel, T.R.** & Ruysschaert, S. 2014. Medicinale en Rituele Planten van Suriname. LM Publishers. 400 pp.
van der Mark, C., Ates, R., de Boois, I., Bor, P., Buizer, B., van der Burgt, F., Camphuysen, K., Dekker, W., Driessen, F., den Hartog, K., Huijsman, M., Karremans, M., Oosterbaan, A., Otten, B.G., Perk, F., de Ruijter, E., de Ruijter, G., van Santbrink, J., Schoenmaker, A., **van Soest, R.**, **Stegenga, H.** & Tulp, A. (eds.). Zeeboek: determinatietabellen voor flora en fauna van de Nederlandse kust. Jeugdbondsuitgeverij, 's Graveland. 240 pp.
Viehberg, F., Matzke-Karasz, R., Park Boush, L., Smith, A. & **Fransen, C.H.J.M.** (eds.). The Recent and Fossil meet Kempf Database Ostracoda. Festschrift Eugen Karl Kempf. Proceedings of the 15th International German Ostracodologists' Meeting. Crustaceana Monographs. 251 pp.
Yeo, D.C.J., Cumberlidge, N., Klaus, S. & **Fransen, C.H.J.M.** (eds.). Advances in freshwater decapod systematics and biology. Crustaceana Monographs. 296 pp.

## Chapters in Books

**Arntzen, J.W.** 2014. Foreword. In: Sparreboom, M. Salamanders of the Old World. KNNV, Zeist, the Netherlands: 7.
Boudot, J.-P. & **Kalkman, V.J.** 2014. Chapter 5. Odonata (dragonflies and damselflies). In: Smith *et al*. The status and distribution of freshwater biodiversity in the Eastern Mediterranean. IUCN, Cambridge: 57-69.
bij de Vaate, A., **van der Velde, G.**, Leuven, R.S.E.W. & Heiler, K.C.M. 2014. Spread of the Quagga Mussel (*Dreissena rostriformis bugensis*) in Western Europe. In: Nalepa, T. & Schloesser, D.W. (eds.). Quagga and Zebra mussels: Biology, impacts and control. CRC Press, Boca Raton, FL. 2nd ed.: 83-92.
Brugge, B., Heijerman, Th., **Noordijk, J.**, van Noort, H. & Reydon, E. 2014. Over de loopkeverfauna van Texel. In: de Raad, J. & Kooistra, L. (eds.). Texel is anders – landschap, (cultuur)historie en natuur. Natuurmonumenten en Staatsbosbeheer: 206-211.
Chatrou, L.W., Pirie M.D., Rainer, H. & **Maas, P.J.M.** 2014. Annonaceae. In: Jørgensen, P.M., Nee, M.H. & Beck, S.G. (eds.). Catálogo de las Plantas Vasculares de Bolivia, Monogr. Syst. Bot. Missouri Bot. Gard. 127(1): 220-228. Missouri Botanical Garden Press, St. Louis.
de Loecker, D. & **Kuijper, W.J.** 2014. Recent bioturbation on the exposed sediment surface and sub-surface find layers at Neumark-Nord 2/0 (Saxony-Anhalt, Germany). In: Gaudzinski-Windheuser, S. & Roebroeks, W. (eds.). Multidisciplinary studies of the Middle Palaeolithic record from Neumark-Nord (Germany). Volume 1. Veröffentlichungen des Landesamtes für Denkmalpflege und Archäologie Sachsen-Anhalt – Landesmuseum für Vorgeschichte. Band 69: 221-239.
**de Vogel, E.** & Pedersen, H.Æ. 2014. 49. Coelogyne. In: Pedersen, H.Æ., Kurzweil, H., Suddee, S., de Vogel, E.F., Cribb, P.J., Chantanaorrapint, S., Watthana, S., Gale, S.W., Seelanan T. & Suwanphakdee, C. (eds.). Flora of Thailand 12(2): Orchidaceae 2: 387-434.
**de Vos, J.** 2014. Go back to the collecion. In: Cullum, A. & Martiius, A.W. (eds.). 52 things you should know about: Palaeontology: 58-59.
**de Vos, J.** 2014. The History of paleoanthropological research in Asia: reasons and priorities for future cooperation in research and preservation of sites and collections. In: Sanz, N. (ed.). Human origin sites and the World Heritage Convention in AsiaWorld Heritage Papers 39: 68-80.
**de Wilde, W.J.J.O.** & **Duyfjes, B.E.E.** 2014. Campanulaceae. In: Santisuk, T. & Balslev, H. (eds.). Flora of Thailand 11(4): Campanulaceae, Elatinaceae, Lythraceae, Onagraceae, Ruppliaceae, Sapotaceae, Staphyleaveae: 499-541, pl. CX-CXIV.
**de Wilde, W.J.J.O.** & **Duyfjes, B.E.E.** 2014. Lythraceae. In: Santisuk, T. & Balslev, H. (eds.). Flora of Thailand 11(4): Campanulaceae, Elatinaceae, Lythraceae, Onagraceae, Ruppliaceae, Sapotaceae, Staphyleaveae: 547-597, pl. CXV-CXXII.
**Donovan, S.K.** 2014. History of palaeontology (version 2.0). In: Encyclopedia of Life Sciences: 1-8.
**Duistermaat, H.** 2014. *Arctium* L. In: Rottenstreiter, W.K. (ed.). Exkursionsflora für Istrien: 218-219.
Ewolds, D., **Kuijper, W.** & Bottema-McGillavry, N. 2014. Macrobotanical remains and wood. In: Feiken, H. Dealing with biases. Three geo-archaeological approaches to the hidden landscapes of Italy. Proefschrift Rijksuniversiteit Groningen: 285-293.
**Fransen, C.H.J.M.** 2014. Anomurans. In: Carpenter, K.E & De Angelis, N. (eds.). The Living Marine Resources of the Eastern Central Atlantic: Introduction, Crustaceans, Chitons and Cephalopods Volume 1: 235-248.
**Fransen, C.H.J.M.** 2014. Shrimps and Prawns. In: Carpenter, K.E & De Angelis, N. (eds.). The Living Marine Resources of the Eastern Central Atlantic: Introduction, Crustaceans, Chitons and Cephalopods Volume 1: 37-196.
**Fransen, C.H.J.M.** 2014. Stomatopods. In: Carpenter, K.E & De Angelis, N. (eds.). The Living Marine Resources of the Eastern Central Atlantic: Introduction, Crustaceans, Chitons and Cephalopods Volume 1: 17-35.
**Fransen, C.H.J.M.** 2014. True Crabs. In: Carpenter, K.E & De Angelis, N. (eds.). The Living Marine Resources of the Eastern Central Atlantic: Introduction, Crustaceans, Chitons and Cephalopods Volume 1: 249-358.
**Gravendeel, B.**, Fischer, G., de Camargo Smidt, E.S., Sieder, A., van Vugt, R.R. & **Vermeulen, J.J.** 2014. Dendrobieae: 621. Bulbophyllum. In: Pridgeon, A.M., Cribb, P.J., Chase, M.W., & Rasmussen, F.N. (eds.). Genera Orchidacearum, Volume 6: Epidendroideae (Part 3): 4-51.
**Hoeksema, B.W.** 2014. De Koraaldriehoek als centrum van mariene biodiversiteit. In: van Straalen, N.M., Ridderinkhof, H. & Buiter, R. (eds.). Oceanen: Het Wilde Westen onder water: 38-43.
**Janssen, A.W.** & **Peijnenburg, K.T.C.A.** 2014. Holoplanktonic Mollusca: development in the Mediterranean Basin during the last 30 million years and their future. In: Goffredo, S. & Dubinsky, Z. (eds.). The Mediterranean Sea: Its History and Present Challenges: 341-362.
**Kuijper, W.** 2014. Een eiland in een zee van schelpdieren. In: de Raad, J. & Kooistra, L. (eds.). Texel is anders – landschap, (cultuur)historie en natuur. Natuurmonumenten en Staatsbosbeheer: 109-115.
**Kuijper, W.** 2014. Schelpen. In: Bakx, J.P. (ed.). Met rituelen ontsloten. Opgraving van een inheems-romeinse nederzetting langs de Woudselaan in de Harnaschpolder, gemeente Midden-Delfland. Delftse Archeologische Rapporten 107: 221-223.
**Kuijper, W.** 2014. Shells. In: Feiken, H. Dealing with biases. Three geo-archaeological approaches to the hidden landscapes of Italy. Proefschrift Rijksuniversiteit Groningen: 294-297.
**Kuijper, W.**, Lampe, S. & Slopsma, J. 2014. II-13 Schelpen. In: Driessen, M. & Besselsen, E. (eds.). Voorburg-Arentsburg. Een Romeinse havenstad tussen Rijn en Maas. Themata 7: 823-831.
**Kuijper, W.J.** 2014. Investigation of inorganic, botanical, and zoological remains of an exposure of Last Interglacial (Eemian) sediments at Neumark-Nord 2 (Germany). In: Gaudzinski-Windheuser, S. & Roebroeks, W. (eds.). Multidisciplinary studies of the Middle Palaeolithic record from Neumark-Nord (Germany). Volume 1. Veröffentlichungen des Landesamtes für Denkmalpflege und Archäologie Sachsen-Anhalt – Landesmuseum für Vorgeschichte. Band 69: 80-96.
**Kuroki, M.**, **van Oijen, M.J.P.** & **Tsukamoto, K.** 2014. Eels and the Japanese: An Inseparable, Long-Standing Relationship. In: Tsukamoto, K. & Kuroki, M. (eds.). Eels and Humans: 91-108.
Magallón, S., Pennington, R.T., Villaseñor, J.L., Rodríguez, P., Honorio Coronado, E.N., Foster, R., Harris, D. & **Wieringa, J.** 2014. The influence of regional history and ecological affinity in the angiosperm composition of Mexican lowland tropical rainforests. In: Stevens, W.D., Montiel, O.M., & Raven, P. Paleobotany and Biogeography: 287-325.
Murray, J.P., Grenyer, R., Wunder, S., **Raes, N.** & Jones, J.P.G. 2014. Can REDD+ deliver biodiversity co-benefits in Indonesia? In: Sills, E.O., Atmadja, S., Sassi, de A.E. Duchelle, C., Kweka, D., Resosudarmo, I.A.P. & Sunderlin, W.D. (eds.). REDD+ on the ground: A case book of subnational initiatives across the globe: 442-443.
**Smit, H.** 2014. First records of water mites from the United Arab Emirates. In: Van Harten, A. (ed.). Arthropod fauna of the UAE 5: 5-12.
**Stech, M.** & **Kruijer, J.D.** 2014. East Greenland bryophytes – biodiversity and importance as herbivore diet (BRYOGREEN). In: Jensen, L.M., Christensen, T.R. & Schmidt, N.M. Zackenberg Ecological Research Operations 19th Annual Report 2013: 94-95.
Struwe, L., Allogio, J., Cobb, L., Grant, J.R., **Jansen-Jacobs, M.J.**, Kinkade, M., Lepis, K.B., **Maas-van de Kamer, H.**, **Maas, P.J.M.**, & Palmer, M.I. 2014. Gentianaceae. In: Mota de Oliveira, S. (ed.). Flora of the Guianas, series A (30): 1-131.
Suhling, F., Sahlén, G., Gorb, S., **Kalkman, V.J.**, **Dijkstra, K-D.B.** & **van Tol, J.** 2014. Order Odonata. In: Thorp, J. & Rogers, D.C. (eds.). Ecology and General Biology: Thorp and Covich's Freshwater Invertebrates: 893-932.
**van Achterberg, C.** 2014. Order Hymenoptera, family Braconidae: The subfamily Homolobinae from the United Arab Emirates, with a review of the fauna of the Arabian Peninsula. In: Van Harten, A. (ed.). Arthropod fauna of the UAE 5: 426-433.
**van der Burgh, J.** 2014. Index of angiosperm leaf species names Q-R 1823-2012. In: van Amerom, H.W.J. (ed.). Fossilium catalogus II: Plantae pars 113: 1-110.
van der Jagt, I.M., Laarman, F.J., **Kuijper, W.**, **Nieman A.M.**, de Os, B.J.H. & **Zwaan, J.C.** 2014. Dierlijk Materiaal. In: Lauwerier, R.C.G.M. & de Kort, J.W. (eds.). Merovingers in een villa 2: 157-189.
van Kruining, M. & **Kuijper, W.** 2014. Animal bones. In: Feiken, H. Dealing with biases. Three geo-archaeological approaches to the hidden landscapes of Italy. Proefschrift Rijksuniversiteit Groningen: 298-304.
**van Soest, R.** & van Bragt, P. 2014. Sponzen. In: van der Mark, C., Ates, R., de Boois, I., Bor, P., Buizer, B., van der Burgt, F., Camphuysen, K., Dekker, W., Driessen, F., den Hartog, K., Huijsman, M., Karremans, M., Oosterbaan, A., Otten, B.G., Perk, F., de Ruijter, E., de Ruijter, G., van Santbrink, J., Schoenmaker, A., van Soest, R., Stegenga, H. & Tulp, A. (eds.). Zeeboek: determinatietabellen voor flora en fauna van de Nederlandse kust: 45-52.
**van Welzen, P.C.** 2014. Staphyleaceae. In: Santisuk, T. & Balslev, H. (eds.). Flora of Thailand 11(4): Campanulaceae, Elatinaceae, Lythraceae, Onagraceae, Ruppliaceae, Sapotaceae, Staphyleaveae: 656-666.
Veldman, S., Otieno, J., **Gravendeel, B.**, **van Andel, T.** & **de Boer, H.** 2014. Conservation of Endangered Wild Harvested Medicinal Plants: Use of DNA Barcoding. In: Gurib-Fakim, A. (ed.). Novel Plant Bioresources: Applications in Food, Medicine and Cosmetics: 81-88.

## PhD theses

**Bissiengou, P.** 2014. Systematics, evolution and historical biogeography of the family Ochnaceae, with emphasis on the genus *Campylospermum*. PhD Thesis. Wageningen University.
**Chantarasuwan, B.** 2014. Taxonomy, systematics, and biogeography of *Ficus* subsection *Urostigma* (Moraceae). PhD Thesis. Leiden University.
**Chaowasku, T.** 2014. The Miliuseae revisited: Phylogenetic, taxonomic, and palynological studies in a major clade of Annonaceae. PhD Thesis. Leiden University.
**Lang, A.S.** 2014. Phylogeny and species delimitation within the moss genus *Dicranum* Hedw. PhD Thesis. Leiden University.
**Liew, T.S.** 2014. The evolution of shell form in tropical terrestrial microsnails. PhD Thesis. Leiden University.
**Novak, V.** 2014. Larger benthic foraminifera in Miocene carbonates of Indonesia. PhD Thesis. Utrecht University.
**Reich, S.** 2014. Seagrass mollusks as a model group for paleoecological and paleodiversity studies. PhD Thesis. Utrecht University.
**Towns, A.M.** 2014. Fertility and Fontanels: Women's knowledge of medicinal plants for reproductive health and childcare in western Africa. PhD Thesis. Leiden University.
**van der Geer, A.A.E.** 2014. The impact of isolation: evolutionary processes in *Hoplitomeryx*. PhD Thesis. Utrecht University.