

# Newsletter #24

December 2010



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## Special issue of 'Biodiversity Informatics'



A special issue of the Biodiversity Informatics journal is out now. It is entitled 'Towards a Global Strategy and Action Plan for Discovery and Publishing of Natural History Collections Data' and focuses on recommendations to ensuring an easier access to and improved quality of the world's natural history collections data. The audience is both the public, the collections research- and curatorial communities as well as the funding agencies.

These recommendation were prepared by a GBIF task group chaired by Drs. Walter Berendsohn and James Macklin. In addition to the recommendation, this issue includes articles on the value of digitisation, approaches in estimating extent of data, demand-driven digitisation and discovery of non-digitized collections.

Find this issue at:

<https://journals.ku.edu/index.php/jbi>

## SOS – Funding species conservation



IUCN, World Bank and Global Environment Facility (GEF) have joined forces to build the conservation fund "Save Our Species (SOS)". SOS will combine resources and funding experience from the World Bank and GEF, the science of IUCN and the private sector's resources and ingenuity to ensure sufficient funding goes to species conservation projects where it will have the most impact. SOS will focus on conservation of threatened species and their habitats.

Learn more about SOS at:

<http://www.sospecies.org/>

## EU missed halting the loss of biodiversity by 2010



An new EU report shows that EU has missed its target of halting the loss of biodiversity by 2010. Implementing the Commission's Biodiversity Action Plan did not relieve the extensive pressure on the number of habitats and species stemming from changes in land use, pollution, invasive species and climate change.

The report reviews around one hundred fifty different activities by the EU and the EU Member States in the period from the launch of the Biodiversity Action Plan in 2006 until 2010 and does also contain a synthesis of the performance of individual Member States and an update of the biodiversity indicators (SEBI 2010).

However, not all is bad news. The realization of the action plan's many activities has provided important experience, and EU has already implemented a new strategy which has as its specific target to halt the loss of biodiversity and the degradation of ecosystem services in the EU by 2020, and to restore them in so far as feasible, while stepping up the EU contribution to averting global biodiversity loss. The adoption of this strategy will be very valuable in the execution of EU's post-2010 strategy. Here the biodiversity and ecosystem issues will play into the planned reforms of such important areas as fishery, agricultural and regional policies. This may prove to be very important in having both a reducing impact on the biodiversity loss as well as providing potential sources for financing of biodiversity conservation and restoration.

Read the full report at:

[http://ec.europa.eu/environment/nature/biodiversity/comm2006/index\\_en.htm](http://ec.europa.eu/environment/nature/biodiversity/comm2006/index_en.htm)

Newsletter (European Distributed Institute of Taxonomy)  
 Publisher: the European Distributed Institute of Taxonomy  
 Publication Director: Mr. Bertrand-Pierre Galey  
 ISSN: 1958-5152

## Missouri Botanical Garden signs MoU joining the Convention on Biological Diversity

The Missouri Botanical Garden (MOBOT) joined the Convention on Biological Diversity's Consortium of Scientific Partners at the Tenth meeting of the Conference of the Parties to the Convention on Biological Diversity (COP 10) in October in Nagoya, Japan.

MOBOT is now the twelfth member of the Consortium, which includes several EDIT partners such as The Smithsonian National Museum of Natural History, The Museum national d'Histoire naturelle Paris, The Royal Botanic Gardens Kew, The Royal Belgian Institute of Natural Sciences and the Royal Botanic Garden of Edinburgh.

MOBOT will in particular be devoting its efforts to the objectives of the Convention's Global Strategy for Plant Conservation. Objectives which were updated at COP 10 and now states that plant diversity should be 1) well understood, documented and recognized, 2) urgently and effectively conserved and 3) used in a sustainable and equitable manner. One of MOBOT's main contributions will be a task pertaining to the first objective, namely an online flora of all known plants to be published by 2020.



## Encyclopedia of Life Selects New Director

The Encyclopedia of Life (EOL) has nominated Dr. Erick Mata as new executive director. Dr. Jim Edwards has retired from the position and now serves as a Senior Advisor to EOL.

Dr. Mata is currently the Director of Biodiversity Informatics and Education at the National Biodiversity Institute of Costa Rica. He has also been sitting at the Board in GBIF committees and worked as the Coordinator of the Inter American Biodiversity Information Network Species and Specimen Thematic Network.

## EU supports COP10 Outcomes



The Parties to the Convention on Biological Diversity closed the Nagoya Biodiversity Summit (COP10) by adopting decisions on three inter-linked goals to meet the challenges of the continued loss of biodiversity. They are in short:

- A new ten year Strategic Plan to guide international and national efforts to meet the objectives of the Convention on Biological Diversity.
- A resource mobilisation strategy that provides the way forward to developmental assistance in support of biodiversity.
- A new international protocol on access to the benefits from the use of the genetic resources.

The three goals are warmly welcomed by the EU, which promises to help implement these measures to halt the ongoing biodiversity reduction, and the European Environment Agency which will adjust its actions to these objectives, while also keep providing assistance to the policymakers of Europe in their efforts of implementing these actions.

For more information:

<http://www.cbd.int/nagoya/outcomes/>



## The critical economic importance of biodiversity

The Economics of Ecosystems and Biodiversity (TEEB) has published a final report on economical benefits provided by the natural world. The report has synthesized thousands of studies, examined valuation methods, policy instruments, etc. It shows that the costs caused by degradation of ecosystems and loss of biodiversity are unaffordable for our societies.

TEEB is hosted by UNEP and has The European Commission as one of its major funders.

TEEB report available at:

<http://www.teebweb.org/>

## FORTHCOMING EVENTS



### 5<sup>th</sup> International Conference of The International Biogeography Society

7-11 Jan. 2011, Crete, Greece

The program starts off with pre-conference workshops and field trips. The topics discussed at the workshop will be Spatial Analysis in Macroecology, Communicating Biogeography and Phylogenetic Analysis in Macroecology

The conference organizes several symposia on the following topics: Mediterranean biogeography; Comparative Phylogeography; Biogeography and Ecology and Analytical advances in macroecology and biogeography.

For more information and registration go to:  
<http://www.biogeography.org/html/Meetings/2011/index.html>

### 2011 ASLO Aquatic Sciences Meeting

13-18 Febr. 2011 San Juan, Puerto Rico, USA

The ASLO Aquatic Sciences Meeting brings together scientists of all aquatic disciplines from around the world. It will take place in the beautiful settings of the island of Puerto Rico

At this year's meeting the focus be on the challenges of global change in relation to the impact of humans on aquatic systems.

Visit meeting homepage for more info:  
<http://www.aslo.org/meetings/sanjuan2011/>



### Behavior 2011

25-30 July, Bloomington, Indiana, USA

This is the first-ever joint meeting of the International Ethological Conference (IEC) and the Animal Behavior Society (ABS). The organizers are planning an exiting event with a program including plenaries, symposia, workshops, roundtables and even festivals

Visit conference website for more information  
<http://www.indiana.edu/~behav11/>



### Annual Conference of the Society for Tropical Ecology

21-24 February 2011, Frankfurt, Germany

The conference takes place at Goethe University, Campus Bockenheim and this year's theme will discuss the "Status and Future of Tropical Biodiversity". Several different thematic sessions will take place and among the proposed are at this stage such interesting topics as:

- The Andean biodiversity hotspot and its future
- East African mountain forests
- African Savannas Biodiversity
- Tropical island biodiversity
- Ecological networks and ecosystem functioning
- Hotspot Wallacea
- Biodiversity science and biodiversity policy
- Tropical ecologists at work: how to find a job
- Tropical Aquatic Ecosystems
- Conservation of tropical landscapes

Visit conference webpage for full information:  
<http://www.gtoe-conference.de/>



### Global Conference on Entomology

5-9 March 2011, Chiang Mai, Thailand

The conference is organized by the Century Foundation, Bangalore. It will provide the opportunity to learn about the advances of recent entomological research in a wide array of scientific areas such as systematics, forest entomology, insect genetics, toxicology, medical and veterinary entomology and much more...

More information at:  
<http://entomology2011.com/>

K. Articus-Lepage (RBINS)

## EDIT Taxonomy Success Story 7

This is the seventh instance of the EDIT Taxonomy Success Stories, in which we try to chronicle the use of taxonomy in inventive, unusual or unsuspected ways. Success stories will also be used to disseminate the use of taxonomy in EDIT's public awareness activities, notably within the International Year for Biodiversity 2010. If you would like to submit a success story, please contact [Kristina.Articus@naturalsciences.be](mailto:Kristina.Articus@naturalsciences.be).

# Raising awareness of taxonomy within its historic context

One of the things that makes taxonomy so attractive is the interconnection with other disciplines. Taxonomy is about organisms; it is about botany, zoology and mycology; however, it is also about history, geography, art and people. Covering such a large variety of topics gives the possibility to reach out at large as well. Here I would like to present two initiatives that treat taxonomy within its historical context and which are well suited to attract the adult audience.

The museum "Schloss Gottorf" in Northern Germany brought recently back to life the historic baroque garden of Gottorf, which has been open to the public since 2007.



Fig. 1. The baroque garden of Gottorf Castle

This garden was established by the county Friedrich III of Schleswig-Holstein-Gottorf in 1636 and was the first Italian like terrace baroque garden in central Europe.

A florilegium by Simon Holtzbecker documents eleven hundred and eighty flowers of the garden, many of them exotic. The paintings are especially beautiful and received the name "The Codex of Gottorf". However, due to the Nordic war in the 18th century the region changed its status and became Danish. The codex was transferred together with the library of the castle to the royal collections in Copenhagen. The impressive globe, one of the attractions in the garden, was taken to St. Petersburg and soon the garden was completely abandoned.

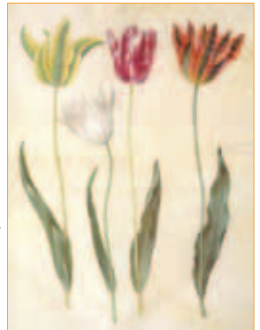


Fig. 2. *Tulipa gesneriana* illustration.



Fig. 3. Codex Band 4

As the codex lacked a front cover, the origin of this document was soon forgotten. First in the 1980ies, Dr. Helga de Cuveland was able to trace back the document to the baroque garden of Gottorf. The codex served as important source for reconstructing the garden. Some of the original plant species could even be traced back in the surroundings of the castle.

They are now grown at the University of Kiel to be planted later on in the garden. The garden and the beautiful flower paintings are now accessible for the public.

The second example comes from even further north: In Uppsala, Sweden, the Provinces of Uppsala and Kronoberg are working on the nomination of "The Rise of Systematic Biology" as a UNESCO world heritage. This initiative brings attention to the historic sites on which the work of Carl Linnaeus and his collaborators is based. Carl Linnaeus, professor of medicine at Uppsala University, turned nature observations into a discipline on its own. He established a system to classify organisms and was able to convince the scientific community to use the binominal nomenclature system invented by him. Linnaeus had many students and collaborated with several colleagues in Europe. "The Rise of Systematic Biology" thus includes sites used by Linnaeus and his collaborators to develop their ideas. Here we find the historic botanic garden

in Uppsala, where Linnaeus presented plants arranged in accordance with his system, and other gardens important to him and his scientific network (as e.g. the Hortus botanicus in Leiden, Netherlands and the Jardin des Plantes



Fig. 4. The Systematic Biology logo in Paris, France). Also important collection sites crucial to the development of taxonomy are included, e.g. in Australia and Japan. This tentative nomination for the world heritage is unique, since for the first time living plants are included as authentic elements. The excursion trails around Uppsala, where Linnaeus used to guide his students still exist today, and three hundred plant populations still remain since his days. Furthermore, a research project inspired by the planned nomination aims at identifying living descendants of the plants that Linnaeus once cultivated collected and included in his herbarium.

In 2013 it will be decided if the "Rise of Systematic Biology" receives the status as a world heritage. However, already the process itself towards a nomination raises the profile of these sites enormously and the visibility of taxonomy as well.

More information about the baroque garden in Gottorf, Germany: [www.schloss-gottorf.de/](http://www.schloss-gottorf.de/) «Der Gottorfer Codex von Hans Simon Holtzbecker » Helga de Cuveland, 1989

More information about the "The Rise of Systematic Biology"  
<http://whc.unesco.org/en/tentativelists/5491/>  
<http://www.c.lst.se/templates/versamhetstart.aspx?id=7586>

Contact person: Dr. Mariette Manktelow: [Mariette.Manktelow@lansstyrelsen.se](mailto:Mariette.Manktelow@lansstyrelsen.se)



## EDIT Year 5 Event: Science Conference

The EDIT Year 5 Event will be the last general meeting of the EDIT contract period. It will take place at the Muséum national d'Histoire naturelle in Paris between the 17<sup>th</sup> and 19<sup>th</sup> January, 2011. As usual, the main event will be the scientific conference. This year entitled "Information in the age of biodiversity loss - Taxonomy in the 21st Century". As EDIT is drawing to an end we only find it appropriate to look at the current status of taxonomy and what lays ahead. We are therefore happy to present to our readers the abstracts of the presentations on the Science Conference, which we hope will constitute a picture of modern taxonomy and where it is going.

### Monitoring biodiversity: The who, what and why ?

Dominique Richard  
Manager of the European Topic Centre on Biological Diversity

As stressed by the Encyclopedia of Earth, the etymology of the term 'monitoring' derives from the Latin *monēre*: to warn (that is, "something or someone that warns, an overseer). It connotes the act of observing something and keeping track, on a regular or ongoing basis with a view to collect information.

Applied to biodiversity, monitoring should ideally encompass its three recognised components i.e genetic, species and ecosystems but also the interrelations between them. The scale issue is important to address: although in both cases essential to evaluate successes and failures of management decisions, monitoring biodiversity has a different meaning for the manager of a protected site than for a policy maker negotiating biodiversity conservation in strategic international fora. It has also a different meaning for a taxonomist involved in All Taxa Inventories, keeping records of all observed species than for an ecologist that looks for indicator species to detect changes in environmental conditions.

The presentation will try to capture these different perspectives and highlight what are the specific policy expectations from a biodiversity monitoring.

### Discovery: filling the knowledge gap

Philippe Bouchet  
Muséum national d'Histoire naturelle, Paris

We belong to the first generation of scientists that are simultaneously aware that (a) the magnitude of biodiversity is several to many times the number of described species, and that (b) a third or half will probably become extinct by the middle or the end of this century. This places a special duty on taxonomists and natural history museums.

The decline in the taxonomic work force has been lamented in many blue prints and position papers. Yet, in the last hundred years, there have never been so many authors of taxonomic publications describing so many new species as today. What fuels, then, our perception that there *is* a «Taxonomic Impediment»? Modern sampling programmes are generating hundred to thousand times as many specimens as the small-scale field trips of our predecessors: we *have* a taxonomic impediment because we have come to realize and document the real magnitude of biodiversity. We like to think that the solutions to the taxonomic bottlenecks of describing and naming species are technical and technological, and that the rescue will come from new software, new equipment or new databases. In this presentation, without minimizing the role of such technological advances, I will defend the view that much of the barriers to speeding up the description of biodiversity are attitudes: our own attitudes within the scientific community and the attitudes of society in general

## Winners and Losers in the Future Ocean: Insights from Millions of Samples

Rainer Froese, Das Leibniz-Institut für Meereswissenschaften an der Universität Kiel (IFM-GEOMAR)

In 2003 I proposed a project to create standardized range maps for all species in the Oceans. Eight years later we have compiled an atlas ([www.aquamaps.org](http://www.aquamaps.org)) with maps for over eleven thousand species, the largest of its kind. Maps are created automatically based on an analysis of millions of point data such as provided by museum collections, and on general knowledge about distribution and depth ranges, extracted from the scientific literature and readily available in online databases such as FishBase and SeaLifeBase. Preferences of species for habitats and environmental conditions are used to define their environmental envelopes. Global databases with environmental conditions are then used to predict the likelihood of occurrence of species, showing suitable habitat within their native range, globally, and also under a global change scenario for 2050.

A overlay across all maps reveals the expected patterns of marine biodiversity, with highest diversity in the western central Pacific. Transects reveal more detailed patterns, such as higher species richness at seamounts and ridges.

A preliminary analysis of winners and losers in the future Ocean with regard to changes in the size of the native area suggests that polar species will be the big losers, with shrinking ranges and invasions by other species. Also, tropical species may lose native range as surface waters get too hot and they have to retract to deeper waters. Temperate species may be the winners, because they gain more area towards the poles than they lose at the border to the subtropics. Examples of winners and loser will be given.

## Reverse Taxonomy

Pedro W. Crous. CBS-KNAW Fungal Biodiversity Centre, Utrecht,

Recent results from large scale DNA sequencing projects have shown that most biodiversity on earth is actually very small, represented in insects and microbes. Fungi represent a relatively unexplored group of organisms of which only the most common examples are known at species level. A conservative estimate based on the number of unique fungi per plant species suggest that at least 1.5 M species of fungi should occur on plants, of which around 7 % have been described to date. Many habitats, ecosystems and host plants have never been investigated, and thus their microbial inhabitants remain unknown. Over the past ten years, mycologists have on average described 1250 species per year, meaning that it will take 1120 years to simply describe the number of taxa we estimate to occur on plants.

How to expedite the description of novel, and recognition of known fungal biodiversity, is a topic that has resulted in much discussion in recent years. In my laboratory, we are approaching this via a technique best named "reverse taxonomy". We collect numerous samples, which we bring back to the laboratory for processing, culturing, DNA extraction, amplification and sequencing. Results are compared to existing sequences in GenBank, and our own databases. This approach leads us to relatively quickly spot novelties, which then gives us the opportunity to go back and do the morphology. Doing this as a final step, in contrast to doing this initially, saves a lot of time. It also paves the way for a more accurate naming system supported by DNA data, which in some cases may be more relevant for trade and quarantine, for instance.

Taxonomists should embrace the virtual laboratory, and deposit data in databases such as GenBank, TreeBase and BOLD, with metadata in MycoBank, and links to other user communities such as GBIF and EOL. Molecular techniques, new sequencing platforms, and the accessibility of these data will play a central role in future taxonomy.

## From data, information to knowledge

Samy Gajji, Global Biodiversity Information Facility (GBIF)

Access to biodiversity-related information is increasing rapidly through the internet. However, a major obstacle to transforming these data into knowledge is a lack of digital species-occurrence data and associated heterogeneity of data formats.

Through GBIF, scientists can publish specimen and observation databases online to global standards, while retaining ownership and custodianship, and thus become part of a growing distributed global network of shared biodiversity data. For many research communities, GBIF has been instrumental in enabling link-up of their distributed information resources -more than two hundred million primary biodiversity data records are currently accessible through the GBIF portal. The information in the GBIF network is vital to the range of scientific communities investigating impacts of global change on species, crops, forestry, aquatic and livestock resources and related ecosystems services. GBIF has demonstrated the feasibility of linking existing data-holding institutions and individuals at national, regional and thematic levels to enable global on-line access to widely distributed, but related, datasets.

However, much more is needed to create the capacity to observe, monitor and model global environmental and social change. We will present the opportunities and challenges in producing and sharing biodiversity data as well as highlighting the GBIF state-of-the network in enabling the discovery and use of primary biodiversity data for scientists.

## Keeping up on-line - the PBI Solanum experience

Sandra Knapp, The Natural History Museum, London

Before the initiation of the EDIT project, the National Science Foundation of the United States began a funding stream dedicated to the acceleration of taxonomic work on a global scale – the Planetary Biodiversity Inventory program. The program was characterized as “mission to an almost unknown planet”, and funding was allocated to international teams working on the species-level taxonomy of large, monophyletic groups. “PBI Solanum: a worldwide treatment”, a monograph of the some fifteen hundred species of the large angiosperm genus *Solanum* (Solanaceae) was one of four projects funded in the first PBI round in 2004, and as such has been an experiment in not only pulling together a large team to undertake species-level description in a group that had not been revised since the mid-19th century, but also in assembling and presenting this new information on-line.

Involving those who want to be involved in web-based taxonomy is easy; involving those specialists we needed was more challenging. I will outline the pitfalls we avoided, the traps we fell into and some of the lessons we have learned in this first attempt to create an on-line taxonomy for a large group. I will also present some of the challenges we face in the future for maintaining and up-dating this web monograph, both social and technological. Solutions are out there, but accessing these and implementing them in communities not in the mainstream of this new type of work can be daunting; it will be worth it in the end though, without a doubt!

## Satisfying audiences in the information age: content creation, flow, and curation challenges for Encyclopedia of Life and its partners

Cynthia Parr, Encyclopedia of Life, National Museum of Natural History, Washington DC

Encyclopedia of Life (<http://www.eol.org>) was established to provide easy access to rich, accurate information about all extant species on Earth. Rather than specializing on taxonomy, nomenclature, identification, occurrence or distribution data, we aim to provide summaries of biological knowledge or links across many subjects, for all regions, that will meet the needs of multiple audiences. We understood that much of this information already exists online, often in scattered, overlapping and conflicting resources of varying quality. Much of the information is either not available digitally or is not readily reusable. Moreover, different audiences seem to place different demands on what information we present and how. To address these challenges EOL has created a Content Curation Community, combining aggregation and large-scale digitization with community-based content creation and quality control. Based on surveys, interviews, workshops, and experience, we have recently developed a new content strategy that balances our quest for completeness with the need to identify and prioritize taxa in high information demand.

We are implementing major improvements to our systems to better support and provide incentives for partners, curators, contributors, and consumers. It may be that information needed by scientists will be welcomed by or easily modified for the general public, and tools designed for the general communities may be useful to scientists. Finally, we are evaluating the biodiversity informatics landscape and EOL's role in it via network analysis. This will enable the wider community to establish effective data flow practices to ensure that specialists and their projects maximize scientific productivity while having the broadest possible impact.

## DEST: anchoring taxonomy in the 21st century

Isabella Van de Velde, Royal Belgian Institute of Natural Sciences, Brussels. EDIT Work Package 8 'Training and Public Awareness'

The increasing need of sound taxonomic information and expertise has been repeatedly and loudly acclaimed widely at international fora, the more so as the last decades are witnessing a continuous loss of taxonomic expertise. Hence, as taxonomy is disappearing in academic curricula, taxonomic expertise is eroding at a fast pace, so that also the transfer of taxonomic knowledge and skills to new generations is steadily declining.

Within the framework of the EU funded project EDIT, the Distributed European School of Taxonomy (DEST) has been established by leading taxonomists of EDIT and other international partners, providing a high quality training that prepares students for future taxonomic careers. Part of EDIT's financial means supported trainees to attend the courses in the form of individual grants.

The DEST currently involves a network of around 100 taxonomic experts from 60 institutions. In 2008, the Expert-in-training programme and Summer School were launched. The Expert-in-training programme provides the opportunity to acquire, and to strengthen, taxonomic research skills through individual on-the-job training. The Summer Schools train students in 'Best Field Practices' for basic taxonomic research, biodiversity studies, and conservation biology. As the number of dedicated taxonomic training courses is limited, the Modern Taxonomy theoretical course programme, launched in 2010, provides future professionals with a solid basic taxonomic training. Still, one of the challenges will be to integrate the course programme into university curricula.

The DEST was evaluated as being a successful EDIT product and partners involved in the present training activities have a strong interest to continue collaboration beyond the EDIT project.

# Streamlining Taxonomic Publication

Vladimir Blagoderov (NHM), Teodor Georgiev (Pensoft),  
Lyubomir Penev (Pensoft), Simon Rycroft (NHM),  
Ben Scott (NHM), Vincent Smith (NHM)

The way taxonomists work has not change much since the times of Linnaeus. Despite exciting progress in information handling and dissemination with the introduction of internet, most taxonomists use computers as advanced versions of card files and typewriters, rarely – as calculators. Meanwhile, computer technologies could and should relieve scientists of routine tasks. One of the most tedious and least interesting jobs is the preparation of manuscripts for publication. Different bibliographic styles, formats of descriptions, even punctuation sometimes – all these have to be kept in mind while writing. How many different versions were e-mailed between co-authors, reviewers and editors?

The purpose of EDIT IRG “Streamlining of Fungus Gnats Taxonomy” grant was to simplify and speed up the process of publication of taxonomic results. We started with following premises:

- 1) Authors should worry about their data, not the formatting of the manuscript
- 2) Atomised taxonomic data are stored and edited in one accessible place – a Scratchpad
- 3) The publisher receives the manuscript in a format that allows easiest layout and styling
- 4) Taxonomic information is published on the same date online and in print and widely disseminated



Fig. 1. Selecting illustrations for manuscript

In collaboration with Pensoft Publishers we adopted an easy workflow:

1. An author creates a Publication project within a Scratchpad to which only a restricted set of users (co-authors) have access. The author(s) also complete several fields providing additional information required for the article (e.g., title, author's details etc.).
2. The author(s) prepare species pages (including descriptions, images, specimens etc.) within the Scratchpad. In the case of a new taxon description author(s) use a temporary name (a placeholder). This placeholder acts as a surrogate for the final taxon name to ensure that the new name is not disclosed until the description has been published. The placeholder is linked (tagged) to data on the site, and the placeholder taxon name is linked to the final name. The author(s) select data to be included in the manuscript (fig. 1). Additional sections are added to the manuscript using a structure that will accommodate most taxonomic descriptions (fig. 2). When the preparation

Title	Operation
Introduction	\$\$\$ Remove
Material and Methods	\$\$\$ Remove
Synonymy	\$\$\$ Remove
Paleogeometra	\$\$\$
<i>Lygellomimoides2</i> taxon description	\$\$\$ term fields
Discussion	\$\$\$
Biology	\$\$\$ Remove
Discussion	\$\$\$ Remove
Paleogeometra exsiccata	\$\$\$
<i>Lygellomimoides2</i> species 1 taxon description	\$\$\$ term fields
Biology	\$\$\$ Remove
Discussion	\$\$\$ Remove
Paleogeometra	\$\$\$
<i>Paleogeometra</i> taxon description	\$\$\$ term fields
Discussion	\$\$\$ Remove
Paleogeometra exsiccata	\$\$\$
<i>Paleogeometra exsiccata</i> taxon description	\$\$\$ term fields
Biology	\$\$\$
Discussion	\$\$\$ Remove
Paleogeometra affinis	\$\$\$
<i>Paleogeometra affinis</i> taxon description	\$\$\$ term fields
Discussion	\$\$\$ Remove
Phylogenetic analysis	\$\$\$ Remove
Add section	\$\$\$ (action executed on the published or to be published taxon description)

Figure 2. Changing structure of manuscript

stage is complete, the author(s) preview the manuscript to make sure it is satisfactory (fig. 3).



Figure 3. Manuscript preview

3. Author(s) submit the manuscript, which creates an archive of the manuscript components. The submission process automatically generates an XML representation of the document using the TaxPub document schema (<http://sourceforge.net/projects/taxpub/>). This document is automatically sent to the journal ZooKeys, although it could be sent to other journals able to accept TaxPub files.
4. ZooKeys organises the peer review. Reviewer's comments are sent by e-mail back to the corresponding author.
5. Author(s) revise their manuscript and supporting data on their Scratchpad in response to the reviewers' comments.
6. Author(s) re-submit the manuscript, which generates an updated XML file that is automatically sent back to ZooKeys. The publisher parses the final accepted XML document, adding additional XML mark-up for nomenclatural acts required by ZooBank registration, in addition to other semantic enhancements (Penev et al. 2010).
7. ZooKeys publishes the paper adding DOIs for the paper and supplementary material. The printed published paper includes a link back to the Publication project (manuscript) on the Scratchpad. Besides the archived version of the Publication project, with identical content to the printed paper, the Scratchpad includes dynamic versions of taxon page showing updated descriptions or other materials that have been added

after publication. New taxa descriptions are registered online by the journal's editorial office. In the future, ZooBank will receive an XML file from ZooKeys and create new records for published nomenclatural acts. The manuscript is submitted to Pub Med / PubMedCentral for optimal distribution and archival purposes

8. The finally published paper appears in four formats: 1) high-resolution, full-color print version (2) PDF identical to the printed version; (3) HTML to provide links to external resources and semantic enhancements to published texts for interactive reading; (4) XML version compatible to PubMedCentral archiving (based on TaxPub schema), thus providing a machine-readable copy to facilitate future data mining.
9. The manuscript and all supplementary data are unlocked on the Scratchpad and made public on the day of printed publication. At this time the place-holder taxon names are automatically substituted by the final published taxon name.

It took two month of programmer's time to write a working prototype. Description of methodology together with discussion on semantic enhancement of taxonomic publication and two model papers were published in the anniversary issue of ZooKeys (Blagoderov et al., 2010a, b, Brake & Tschinhaus, 2010, Penev et al., 2010). Examples of Scratchpad Publication module can be found at <http://sciaroidea.info/node/44428> and <http://milichiidae.info/node/15295>. Compared to the generation of publications from the CDM described in Hoffmann et al. (2010) our approach has following advantages:

- 1) Co-authors can work simultaneously changing underlying data of the manuscript online, thus ensuring that data published online and on paper are identical
- 2) Manuscript formatting is done by publisher
- 3) XML output allows easy semantic enhancement and wider dissemination of taxonomic data

4) Online publication is completely ICZN and ICBN compliant since it is identical to and published simultaneously with the printed version

We are positive that the future of taxonomic publication lies with internet, although it will require some change of paradigm – scientist should start spending more time on generating data and proving hypotheses and less time formatting scientific papers.

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