

BIG4 field workshop

June 5-11 2016, Havraníky, Czech Republic





BIG4 Field workshop, June 5-11 2016, Havraníky, Czech Republic

Modern Methods of Systematic Research

Viktor Senderov (@vsenderov)

Bulgarian Academy of Sciences/ Pensoft, Sofia Bulgaria

Advisor: Prof. L. Penev

PhD Financed through the EU Marie-Sklodovska-Curie Program

Grant Agreement Nr. 642241

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 642241





Biodiversity Data Journal 4: e8080
doi: [10.3897/BDJ.4.e8080](https://doi.org/10.3897/BDJ.4.e8080)



Editorial

Challenges with using names to link digital biodiversity information

David Patterson[‡], Dmitry Mozzherin[§], David Peter Shorthouse^l, Anne Thessen^{¶, #}

Issues with names as identifiers

1. Many names for one taxon (synonyms and other cases)
2. Misspelled names
3. Same name for multiple taxons (homonyms)
4. Chresonyms : scientific name as used by others
5. Taxon concept

But

With reclassification, GenBank contained unique canonical name-strings of almost 400,000 (398,740) species and infraspecies of which about 82% could be matched to name-strings in Catalogue of Life. After elimination of known synonyms, 257,702 species name-strings and 20,566 infraspecies matched entries in Catalogue of Life. These represented 13.5% and 1.1%, respectively, of the original name-strings in GenBank and 52.4% and 4.2% of all of the unique canonicalized name-strings.

Definition (*Taxon*)

A set of organisms in nature that form a natural group according to a species concept.

What can a *taxon circumscription* include?

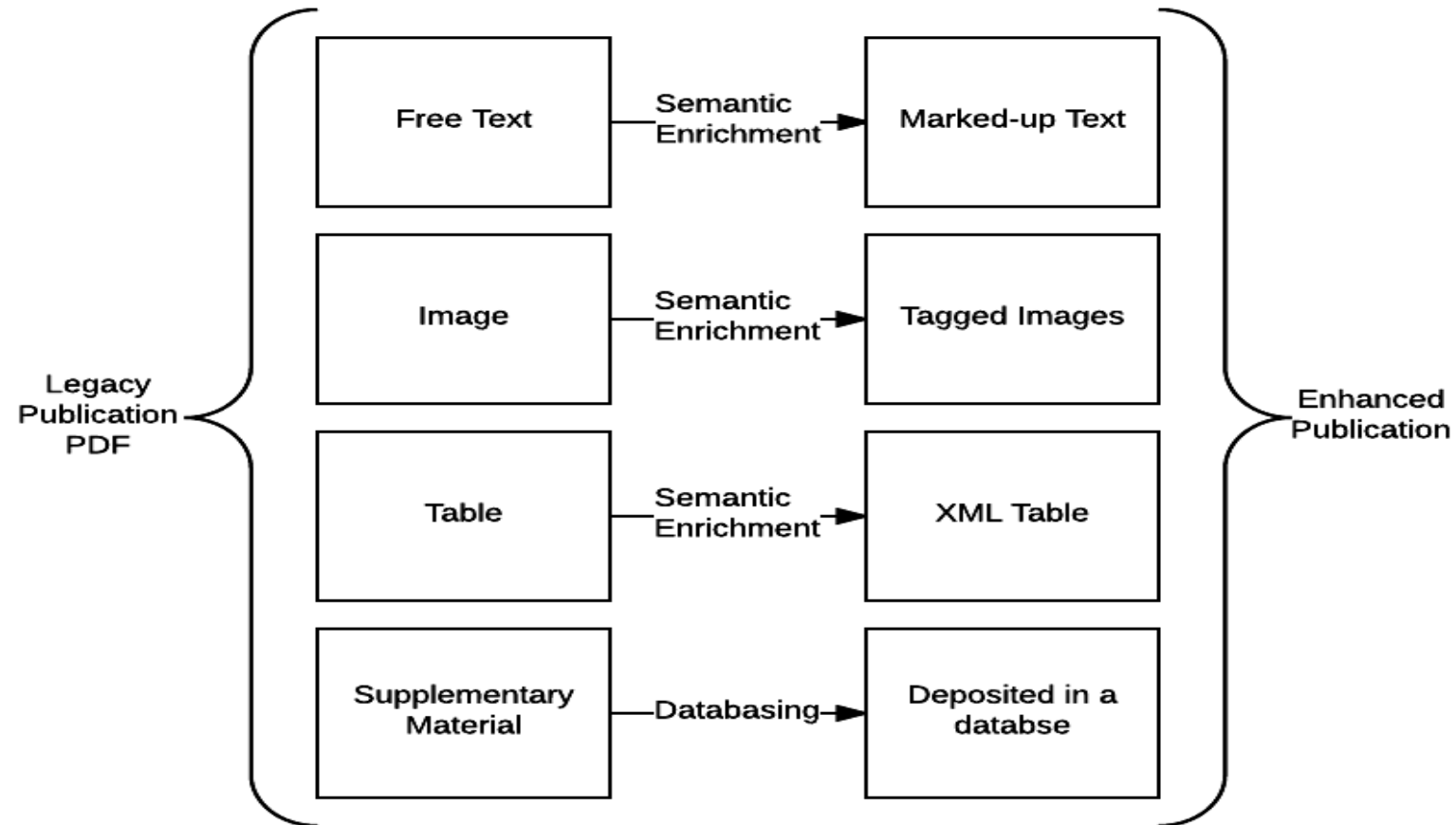
- ▶ Textual descriptions of traits that the organisms in the taxon exhibit
- ▶ Citations of voucher specimens (**types**)
- ▶ Technical drawings
- ▶ Photographs
- ▶ High-resolution 3D imaging
- ▶ Genetic information
- ▶ Comparison to closely related taxa (**diff**)

See <http://zookeys.pensoft.net/about#TaxonomicTreatments>

Need for machine-readable data

Since Karl Popper science is moving in the direction of providing **falsifiable hypotheses**, i.e. there must a formally defined algorithm operating on experimental data that could potentially (given the data) disprove the hypothesis. In order to accomplish this, taxonomic data must be made available in machine-readable format, and machine computable format.

Information extraction from a biodiversity publication



Taxonomic impediment

- ▶ The Taxonomic Impediment: “**worldwide shortage of taxonomists**”
- ▶ Majority of **species undescribed**
- ▶ A lot of “**dark taxa**”: unnamed OTU's

Rod Page, iPhylo blogspot, 12 April 2011

Turbo Taxonomy

Riedel *et al.* *Frontiers in Zoology* 2013, **10**:15
<http://www.frontiersinzoology.com/content/10/1/15>



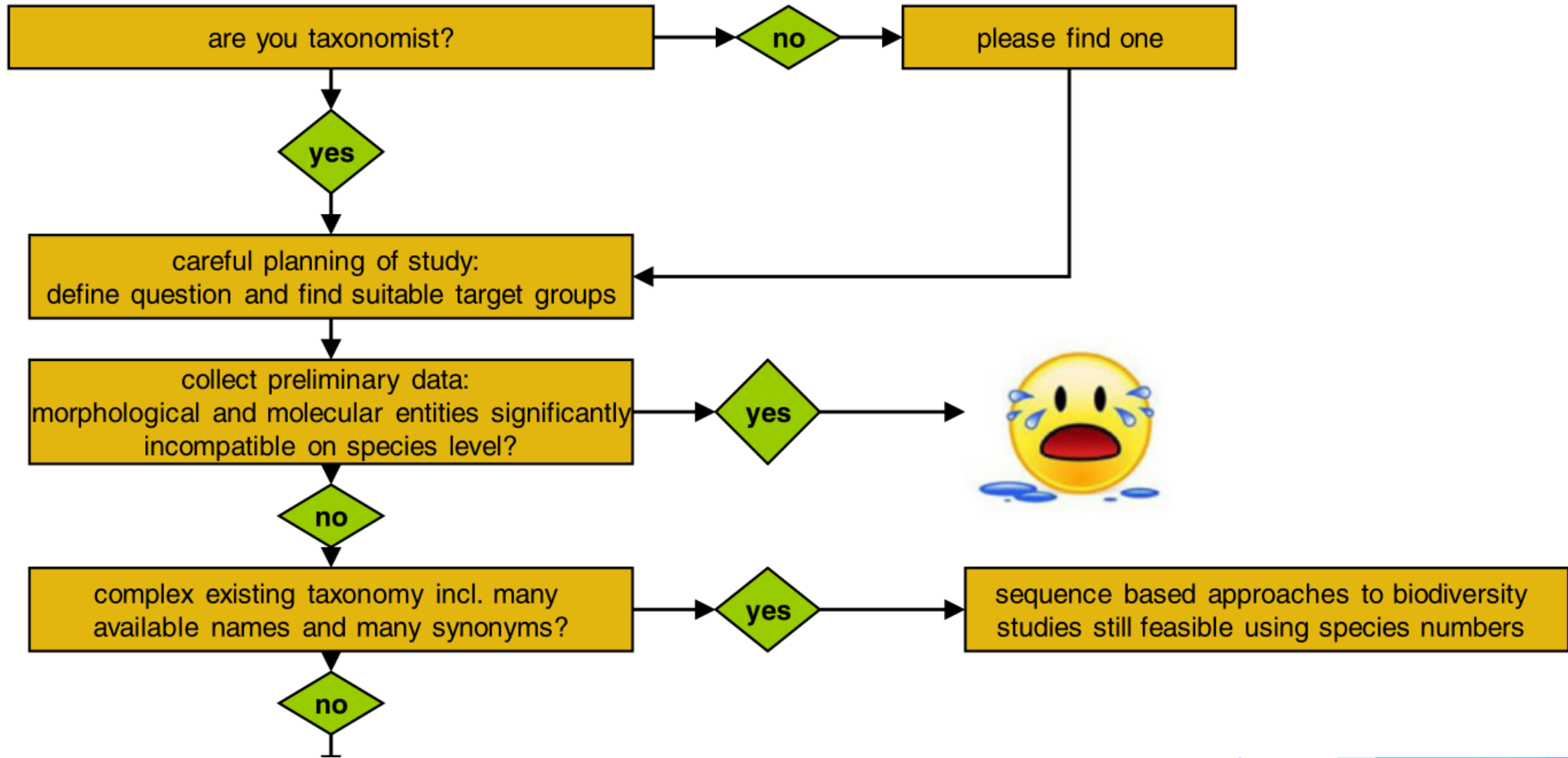
FRONTIERS IN ZOOLOGY

DEBATE

Open Access

Integrative taxonomy on the fast track - towards more sustainability in biodiversity research

Alexander Riedel^{1*}, Katayo Sagata², Yayuk R Suhardjono³, Rene Tänzler⁴ and Michael Balke^{4,5}



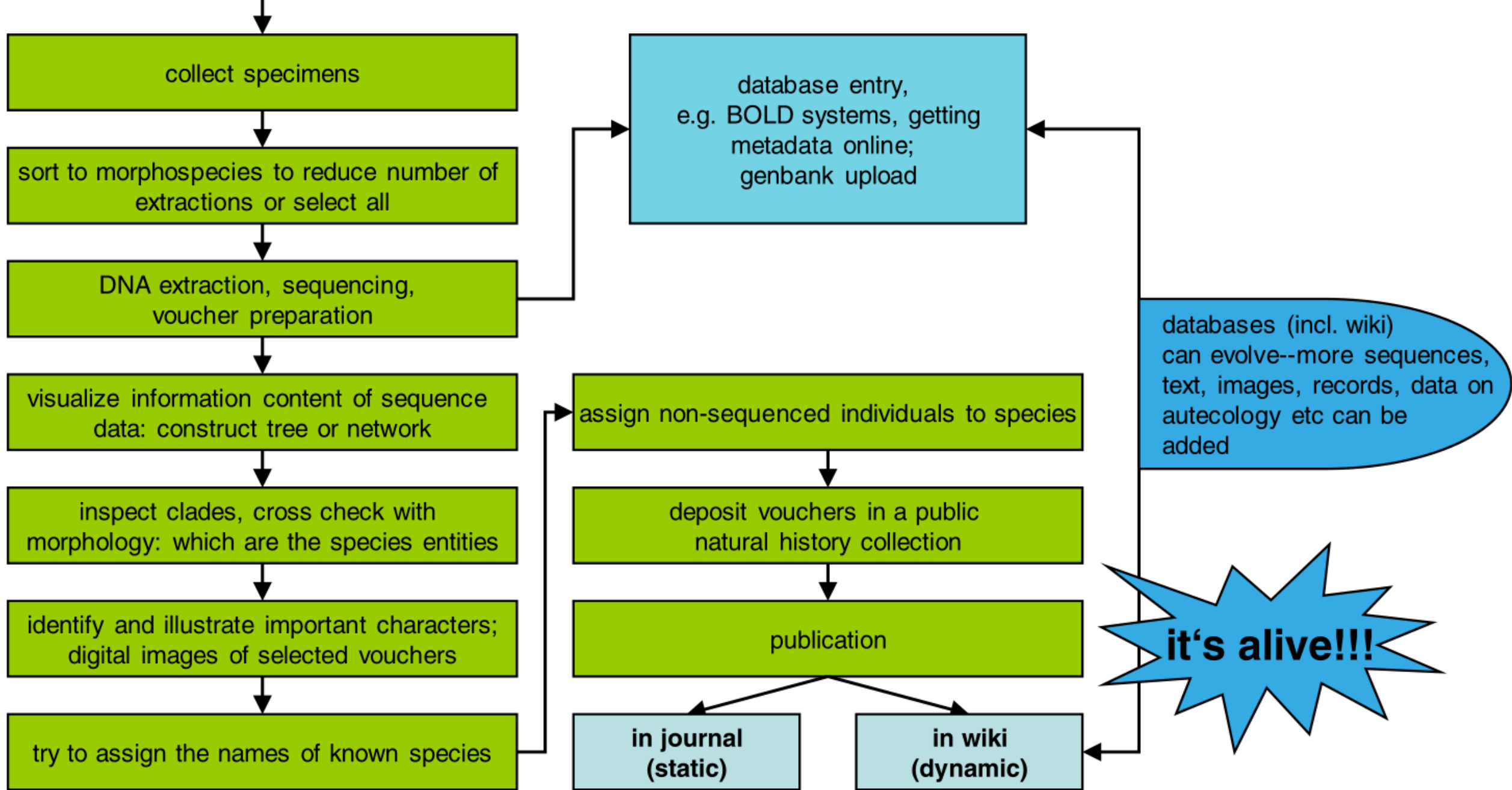


Figure 1 Flow chart of the turbo-taxonomy approach, from project design to publication.

Holistic Taxonomy

“Eupolybothrus cavernicolus Komerički & Stoev sp. n. (Chilopoda: Lithobiomorpha: Lithobiidae): the first eukaryotic species description combining transcriptomic, DNA barcoding and micro-CT imaging data”

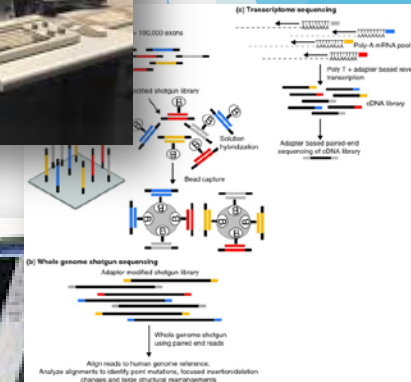
Komericki & Stoev (2013):

doi: [10.3897/BDJ.1.e1013](https://doi.org/10.3897/BDJ.1.e1013)

Methods of holistic taxonomy

- ▶ Morphological study with a Zeiss microscope
- ▶ SEM images
- ▶ Mitochondrial Cytochrome C Oxidase Subunit I gene sequencing
- ▶ Full transcriptome sequencing
- ▶ Micro-CT scanning
- ▶ Video of living specimen

Slide borrowed from Stoev.



Cybertypes

“Micro-computed tomography: Introducing new dimensions to taxonomy”

Faulwetter et al. (2013)

doi: 10.3897/zookeys.263.4261

“Micro-CTvlab: A web based virtual gallery of biological specimens using X-ray microtomography (micro-CT).”

Keklikoglou et al. (in press). Biodiversity Data Journal.