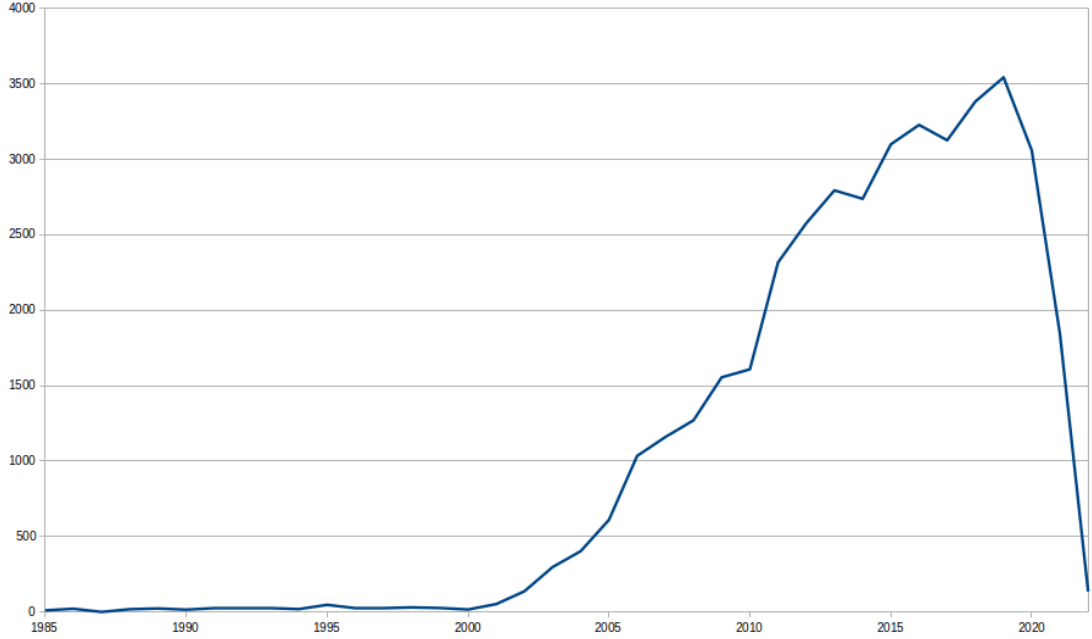
Taxonomy Corpus Analysis: Preliminary Data

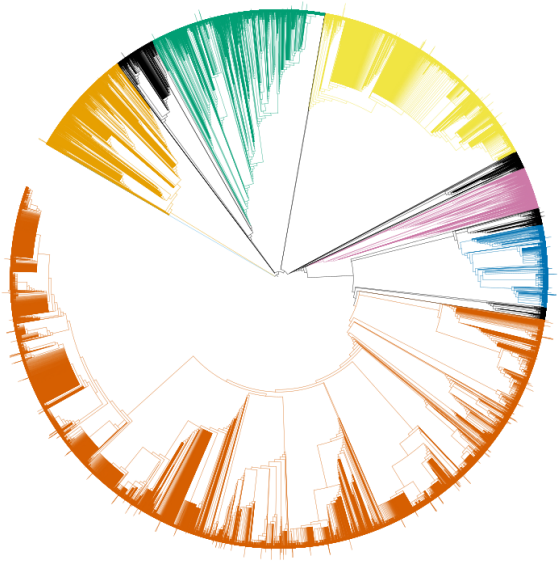
Workshop on Taxonomic Disorder, 6/12/2022

Charles H. Pence
@pence@scholar.social

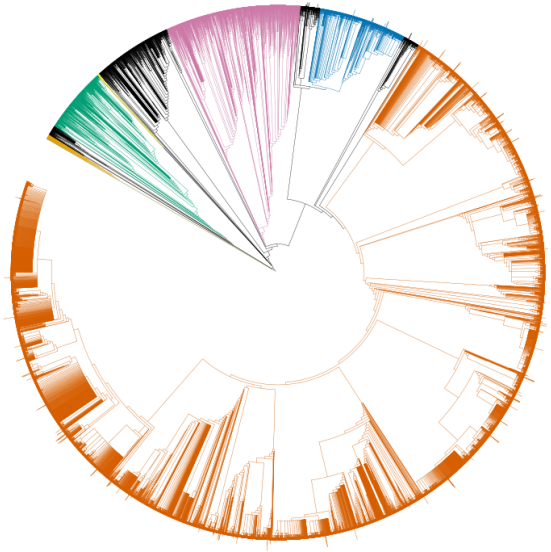
UCLouvain
Institut supérieur de philosophie (ISP)

Journal	Publisher	Size
Zootaxa	Magnolia Press	31,348
ZooKeys	Pensoft	4,940
PhytoKeys	Pensoft	820
Journal of Hymenoptera Research	Pensoft	382
MycoKeys	Pensoft	315
Zoosystematics and Evolution	Pensoft	153
Insecta Mundi	Center for Systematic Entomology	1,367
European Journal of Taxonomy	Museum National d'Histoire Naturelle	1,105

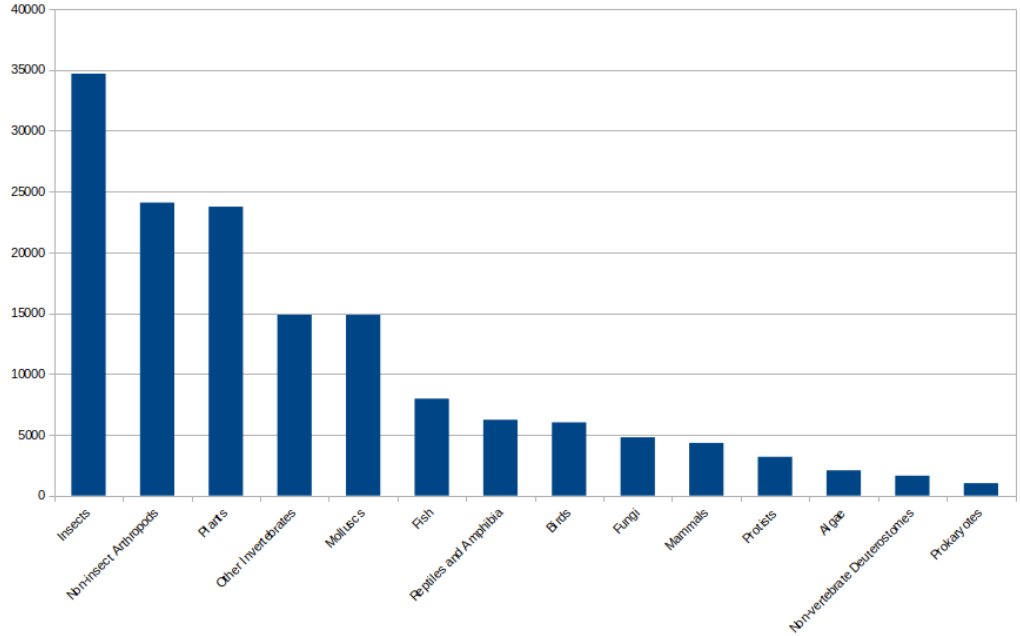

4000
3500
3000
2500
2000
1500
1000
500
0
1985
1990
1995
2000
2005
2010
2015
2020



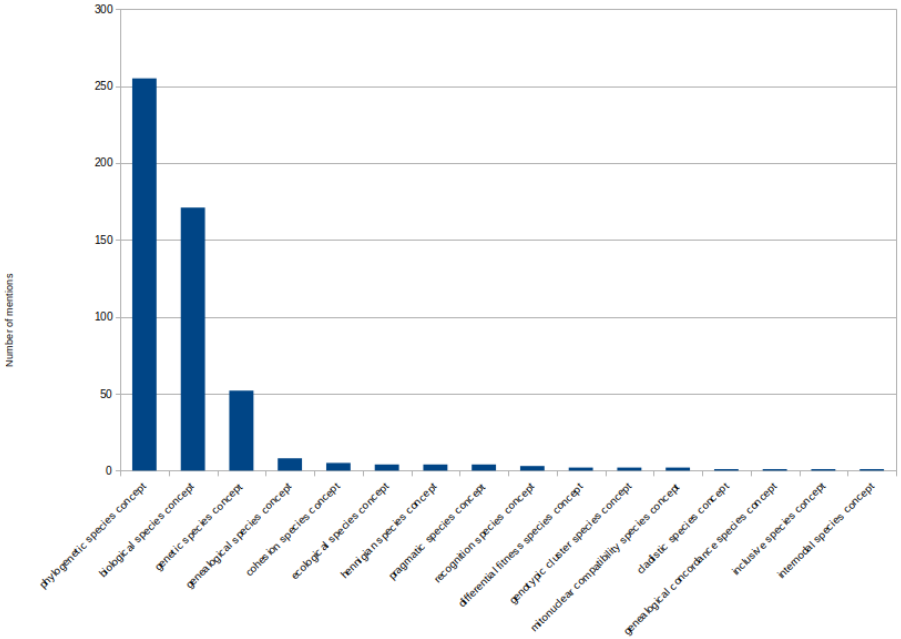
Complete Open Tree of Life



Corpus


40000
35000
30000
25000
20000
15000
10000
5000
0
Insects
Non-insect Arthropods
Plants
Other Invertebrates
Molluscs
Fish
Reptiles and Amphibia
Birds
Fungi
Mammals
Protists
Algae
Non-vertebrate Deuterostomes
Prokaryotes

Phylo-Phenetic Species Concept
Phylogenetic Species Concept
Genic Species Concept
Cohesion Species Concept
Genealogical Concordance Species Concept
Genotypic Cluster Species Concept
Genetic Species Concept
Ecological Species Concept
Recognition Species Concept
Genealogical Species Concept
Biological Species Concept
Differential Fitness Species Concept
Compilospecies Concept
Cladistic Species Concept
Hennigian Species Concept
Internodal Species Concept
Mitonuclear Compatibility Species Concept
Pragmatic Species Concept
Inclusive Species Concept
Biosimilarity Species Concept


Number of mentions
300
250
200
150
100
50
0
phylogenetic species concept
biological species concept
genetic species concept
genealogical species concept
cohesion species concept
ecological species concept
hennigian species concept
pragmatic species concept
recognition species concept
differential fitness species concept
genotypic cluster species concept
mitonuclear compatibility species concept
cladistic species concept
genealogical concordance species concept
inclusive species concept
intermodal species concept

Taxa × Species Concepts

The top 5% of non-zero proportions of documents mentioning both the given taxon and the given species concept:

- **Phylogenetic Species Concept:** Protists, Mammals, Birds, Reptiles & Amphibia, Fish
- **Biological Species Concept:** Mammals, Birds

Topic Modeling

Briefly: a kind of unsupervised dimensionality reduction that you can run on a corpus of text. Take documents, normally locations in a 172M-dimensional space (number of word types), and reduce that to 125-D.

(go to live graph:)

https://cpence.codeberg.page/taxonomy-analyses/

Interpreting a Topic

Topic 16: popular in mammals

- 0.027*"colombia"
- 0.016*"specie"
- 0.013*"type"
- 0.013*"peru"
- 0.010*"locality"
- 0.010*"venezuela"
- 0.010*"ecuador"
- 0.009*"panama"
- 0.008*"distribution"
- 0.007*"brazil"
- 0.007*"key"
- 0.006*"rica"
- 0.006*"del"
- 0.006*"costa"
- 0.006*"genus"
- 0.006*"male"
- 0.006*"america"
- 0.006*"san"
- 0.006*"neotropical"
- 0.005*"cat"

Interpreting a Topic

Topic 16: popular in mammals

- 0.027*"colombia"
- 0.016*"specie"
- 0.013*"type"
- 0.013*"peru"
- 0.010*"locality"
- 0.010*"venezuela"
- 0.010*"ecuador"
- 0.009*"panama"
- 0.008*"distribution"
- 0.007*"brazil"
- 0.007*"key"
- 0.006*"rica"
- 0.006*"del"
- 0.006*"costa"
- 0.006*"genus"
- 0.006*"male"
- 0.006*"america"
- 0.006*"san"
- 0.006*"neotropical"
- 0.005*"cat"

Okay: Central and South American collection sites

Topic 31:

- 0.016*"male"
- 0.016*"genitalia"
- 0.013*"specie"
- 0.009*"female"
- 0.009*"fig"
- 0.008*"brown"
- 0.008*"lepidoptera"
- 0.007*"scale"
- 0.007*"long"
- 0.006*"slide"
- 0.006*"white"
- 0.006*"line"
- 0.006*"new"
- 0.006*"bursae"
- 0.006*"short"
- 0.005*"dark"
- 0.005*"coll"
- 0.005*"forewing"
- 0.005*"holotype"
- 0.005*"leg"

Cautious hypothesis: Lepidopteran anatomy, especially reproductive

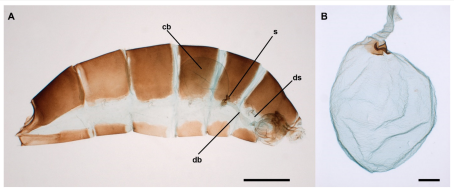
Interpreting a Topic

But wait.

Our lepidopteran reproductive anatomy topic is unusually significant in one group... **in papers that mention molluscs.**

...what?

One Hypothesis



bursa copulatrix, *Leptophobia aripa*

genus *Bursa*, *Bursa granularis*

Some Cool Topics

Topic 9: traditional specimen collection terms

- 0.029*"specie"
- 0.012*"forest"
- 0.012*"habitat"
- 0.010*"area"
- 0.008*"find"
- 0.007*"collect"
- 0.007*"site"
- 0.007*"study"
- 0.007*"record"
- 0.006*"population"
- 0.006*"range"
- 0.006*"high"
- 0.005*"specimen"
- 0.005*"occur"
- 0.005*"know"
- 0.004*"individual"
- 0.004*"region"
- 0.004*"number"
- 0.004*"sample"
- 0.004*"distribution"

Popular in every taxon **except** non-insect arthropods, fish, and fungi.

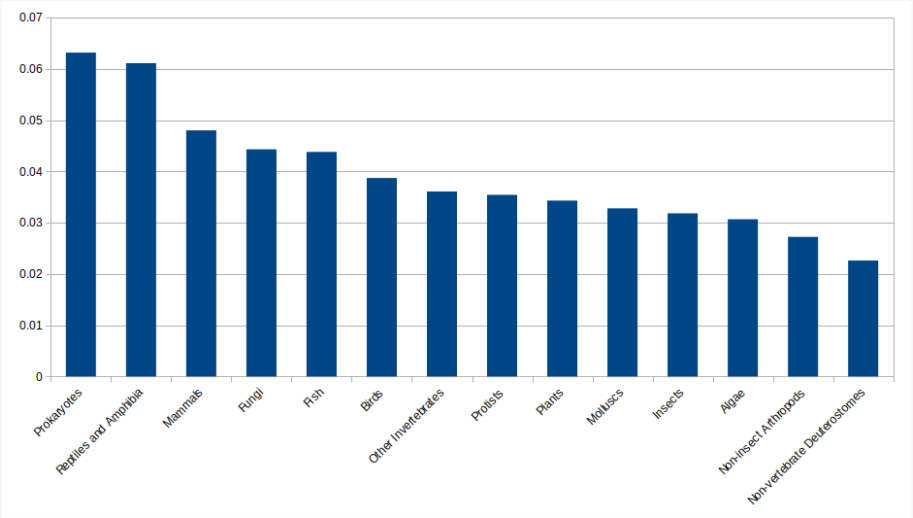
Some Cool Topics

Topic 64: molecular phylogenetics

- 0.021*"specie"
- 0.017*"sequence"
- 0.016*"analysis"
- 0.011*"molecular"
- 0.010*"dna"
- 0.008*"phylogenetic"
- 0.007*"tree"
- 0.007*"clade"
- 0.007*"gene"
- 0.007*"specimen"
- 0.007*"study"
- 0.007*"morphological"
- 0.006*"support"
- 0.006*"group"
- 0.006*"genetic"
- 0.006*"coi"
- 0.006*"datum"
- 0.006*"base"
- 0.005*"table"
- 0.005*"population"

Among the **top-20 most significant probabilities** in reptiles and amphibia, birds, fish, fungi, and mammals; top-5% in every other group

Molecular Methods



How about disagreement?

Ask the model: what topics are likely to pick words like "disagree," "disagreement," "dispute," "revision," or "revise"?

For disagreement terms: topics 120 and 43
For revision terms: also 43, as well as 108

What are those topics about?

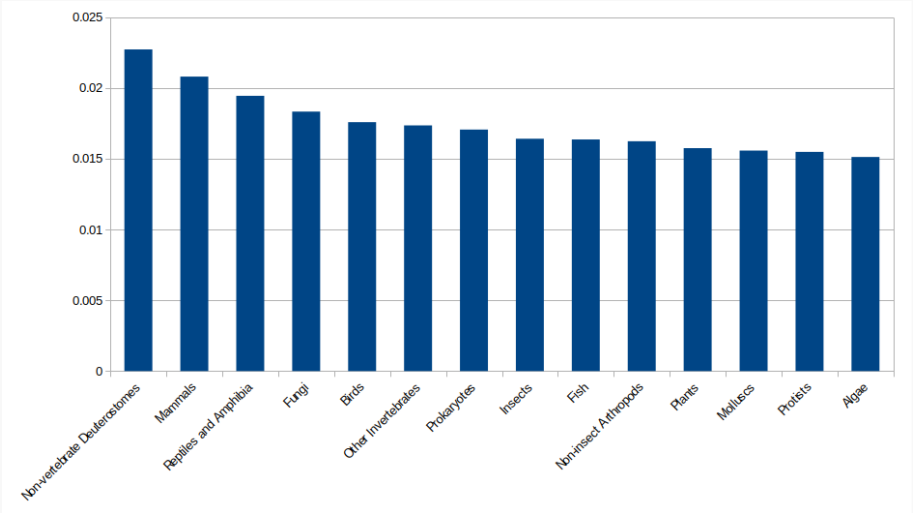
Topic 108 (revision)

- 0.015*"specie"
- 0.009*"limb"
- 0.009*"cladocera"
- 0.007*"alona"
- 0.007*"sinev"
- 0.006*"lake"
- 0.006*"solanum"
- 0.006*"group"
- 0.006*"kotov"
- 0.005*"record"
- 0.005*"van"
- 0.005*"postabdomen"
- 0.005*"portion"
- 0.005*"mol"
- 0.005*"fig"
- 0.005*"distribution"
- 0.005*"genus"
- 0.005*"bor"
- 0.004*"head"
- 0.004*"parthenogenetic"

Topic 120 (disagreement)

- 0.018*"character"
- 0.013*"genera"
- 0.011*"taxon"
- 0.011*"group"
- 0.010*"specie"
- 0.010*"genus"
- 0.009*"phylogenetic"
- 0.008*"include"
- 0.007*"analysis"
- 0.007*"family"
- 0.007*"relationship"
- 0.005*"phylogeny"
- 0.005*"clade"
- 0.005*"morphological"
- 0.005*"classification"
- 0.005*"support"
- 0.005*"press"
- 0.005*"new"
- 0.005*"consider"
- 0.004*"present"

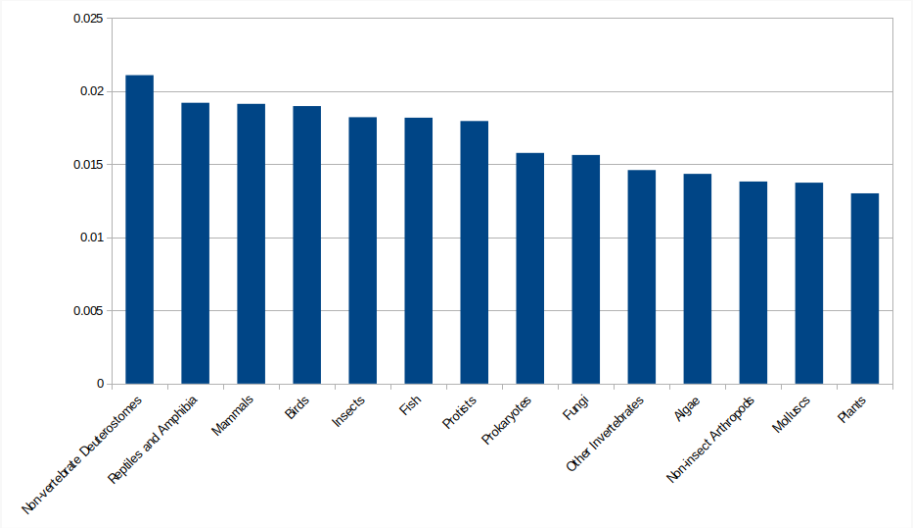
Topic 120 (disagreement — phylogeny)



Topic 43 (disagreement)

- 0.015*"specie"
- 0.011*"name"
- 0.010*"description"
- 0.010*"new"
- 0.008*"publish"
- 0.007*"author"
- 0.007*"nomenclature"
- 0.007*"code"
- 0.007*"publication"
- 0.006*"type"
- 0.006*"article"
- 0.006*"zoological"
- 0.006*"original"
- 0.006*"synonym"
- 0.006*"work"
- 0.006*"list"
- 0.006*"valid"
- 0.005*"international"
- 0.005*"available"
- 0.005*"note"

Topic 43 (disagreement — “new species”)



Coming Soon

Geocoding: how do taxa, topics, and species concepts correlate with mentions of geographic locations?

Help us brainstorm!

charles@charlespence.net
https://pencelab.be
@pence@scholar.social