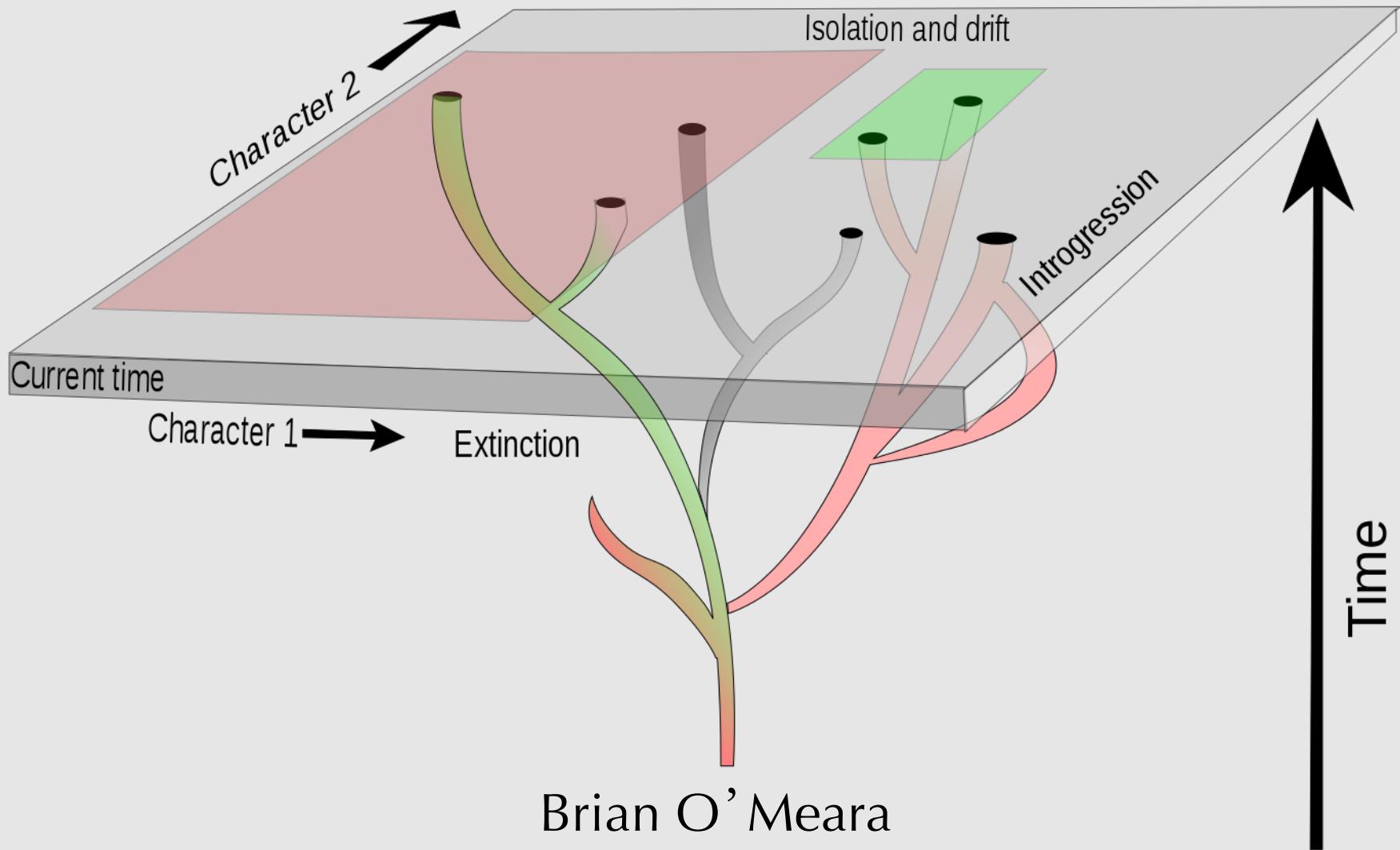


Systematics



Brian O'Meara
EEB464 Fall 2019

Learning objectives

- How new species are discovered
- How species are described
- Issues in systematics

Ecology & Evolutionary Biology

COLLEGE OF ARTS & SCIENCES

OCTOBER 10, 2013 BY ARMSWORTH

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New Species Discovered

A paper describing a new species of *Clematis* by EEB graduate student Aaron Floden appeared in the latest volume of the Journal of the Botanical Research Institute of Texas. The new species was discovered during biological survey work in the Ocoee River gorge (Polk Co., Tennessee) that is turning up previously unrecognized diversity in this geologically unique area not far from Knoxville. The survey is being conducted by a team that includes UT graduates Joey Shaw (University of Tennessee, Chattanooga) and Dwayne Estes (Austin Peay University) and UT Herbarium Director Eugene Wofford.

Clematis vinacea





Article

<https://doi.org/10.11646/zootaxa.4442.4.6>

<http://zoobank.org/urn:lsid:zoobank.org:pub:79EC674A-294C-4BF5-8615-E279D09700C4>

A new species of grass spider, *Agelenopsis riechertii*, from the Southwestern USA, with notes on its courtship behavior (Araneae: Agelenidae)

JENNIFER M. BOSCO¹ & ANGELA CHUANG^{1,2}

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²Corresponding author. E-mail: chuang@utk.edu

Abstract

We describe a new spider species of the genus *Agelenopsis* Giebel 1869 (Agelenidae) from adult males and females. *Agelenopsis riechertii* is found in dry desert scrub habitats in the southwestern United States. While *A. riechertii* is similar to other sympatric congeners (*A. aleena*, *A. aperta*, and *A. spatula*) in morphology and courtship behavior, it can be distinguished by an examination of its genitalia. Males possess an embolus that gradually narrows into a twisted tip which displays a convex edge from the lateral view. The female epigyna are harder to distinguish from congeners, but have a flatter anterior atrial edge that lacks strong bi-lobing. The spermatheca in female *A. riechertii* are also more elongate and comma-shaped than the other species. We describe the sequence of courtship behaviors exhibited by males, including the use of web pulses, abdomen wagging, and web flexing, in which males with fewer pauses, longer wagging bouts, and fewer web flexes are more likely to successfully copulate.



Raul654

Biological

Species are groups of interbreeding natural populations that are reproductively isolated from other such groups (Mayr 1995)

Genotypic cluster

A species is a [morphologically or genetically] distinguishable group of organisms that has few or no intermediates when in contact with other such clusters (Mallet 1995)

Recognition

A species is that most inclusive population of individual biparental organisms which shares a common fertilization system (Patterson 1985)

Cohesion

A species is the most inclusive population of individuals having the potential for phenotypic cohesion through intrinsic cohesion mechanisms (Templeton 1989)

Ecological

A species is a lineage (or a closely related set of lineages) which occupies an adaptive zone minimally different from that of any other lineage in its range and which evolves separately from all lineages outside its range (Van Valen 1976)

Evolutionary

A species is a single lineage of ancestral descendant populations or organisms which maintains its identity from other such lineages and which has its own evolutionary tendencies and historical fate (Wiley 1978, modified from Simpson, 1961)

Phylogenetic 1

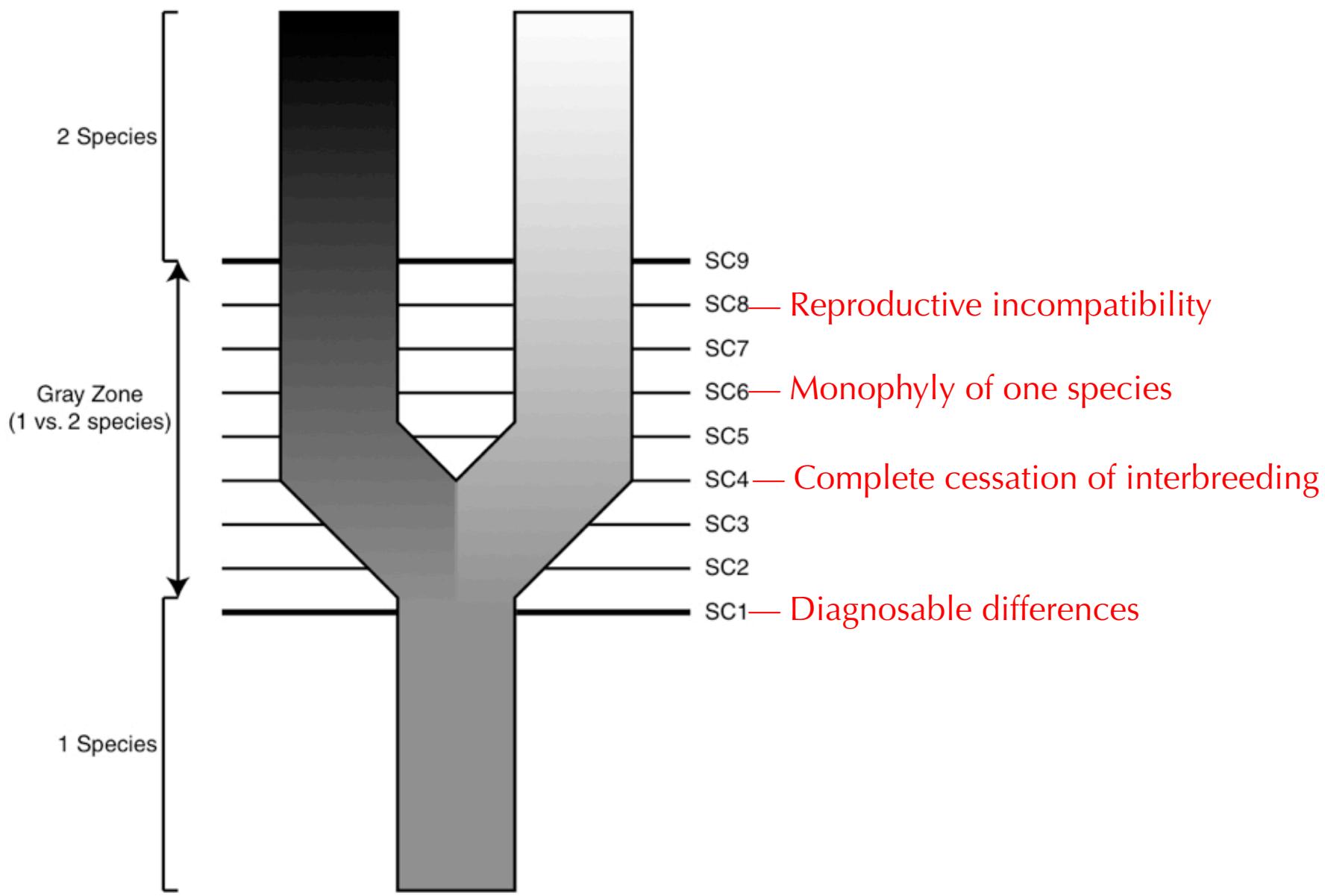
A phylogenetic species is an irreducible (basal) cluster of organisms that is diagnosably distinct from other such clusters, and within which there is a paternal pattern of ancestry and descent (Cracraft 1989)

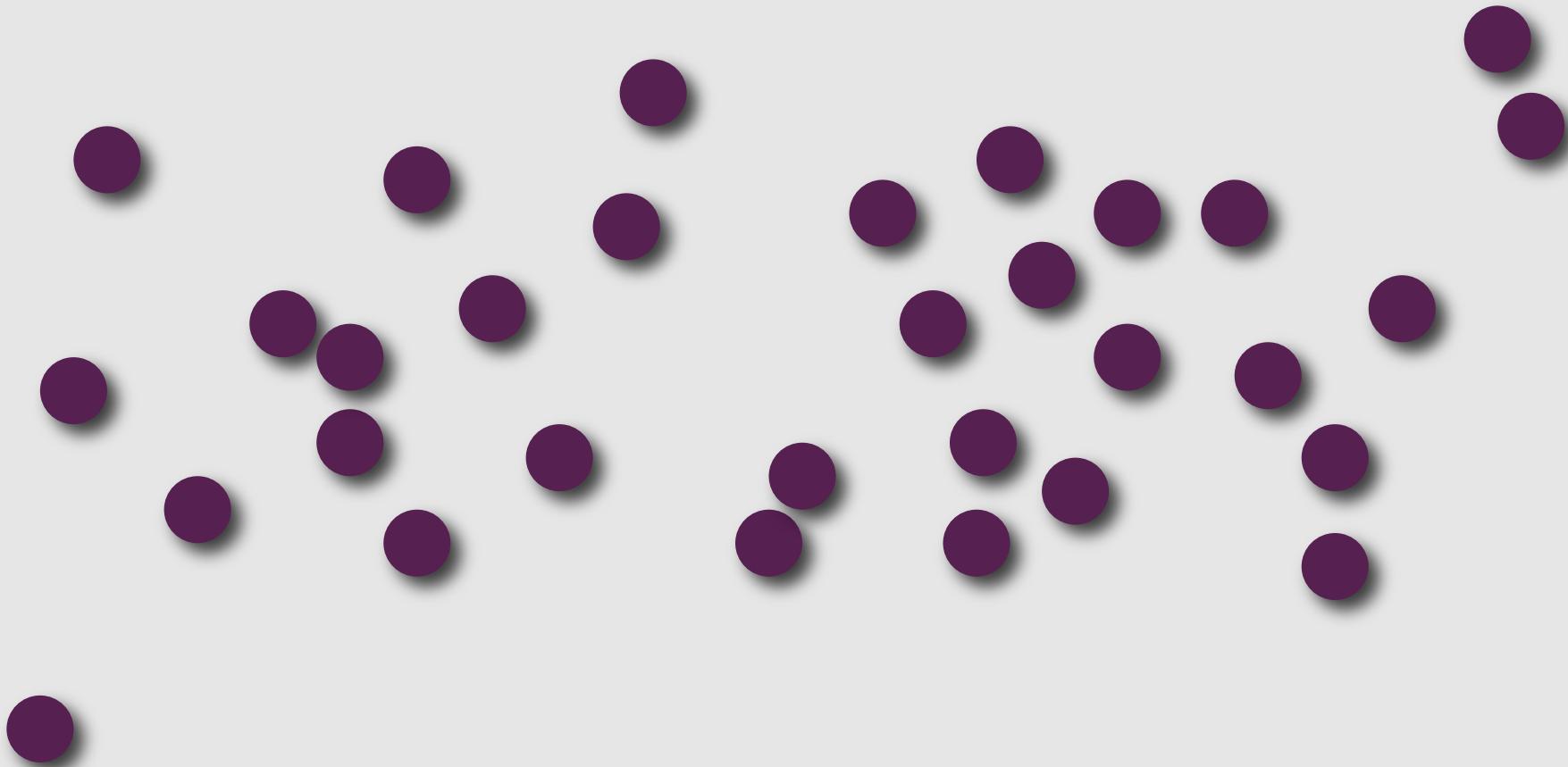
Phylogenetic 2

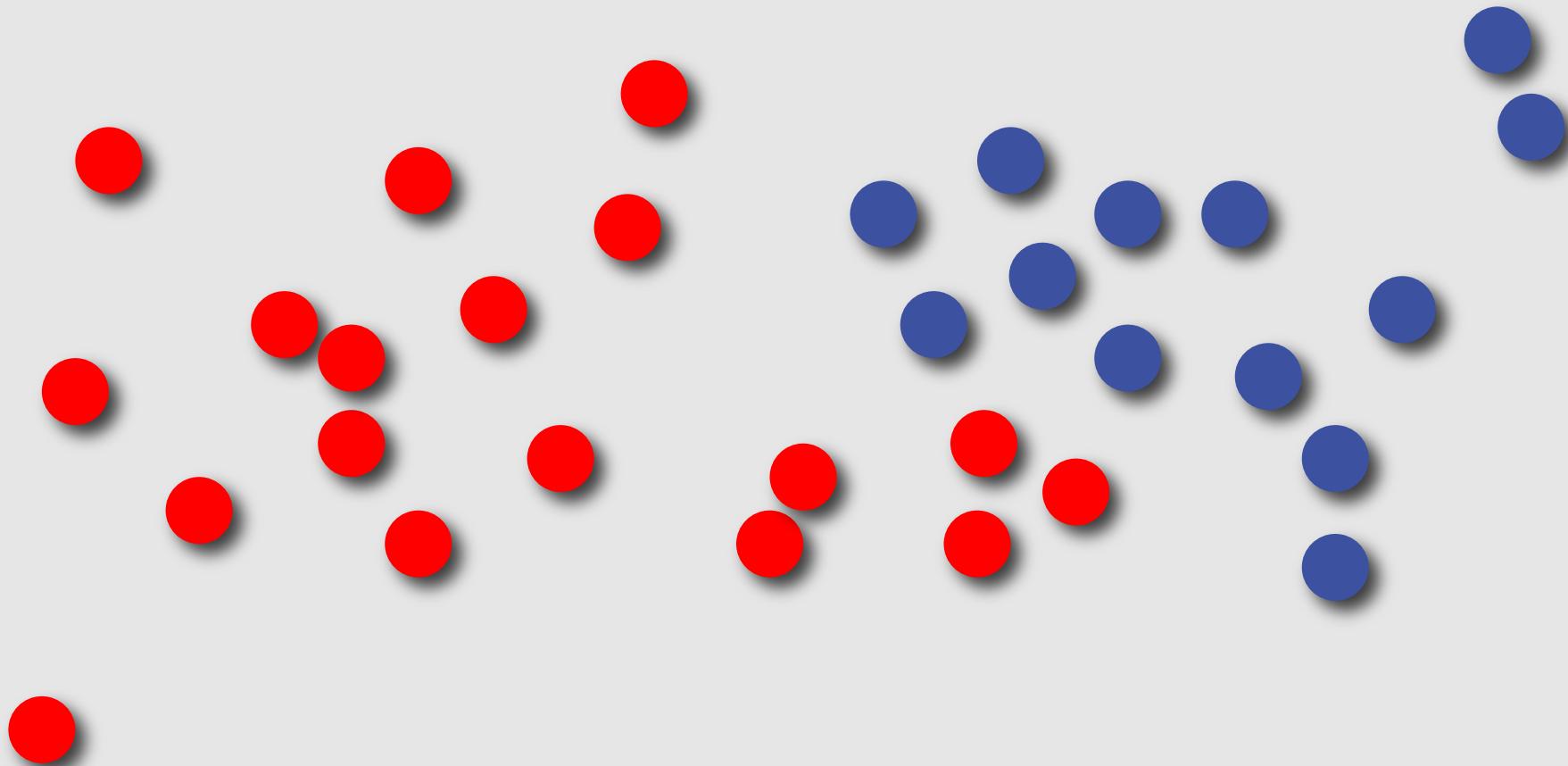
A species is the smallest [exclusive] monophyletic group of common ancestry (de Queiroz and Donoghue 1989)

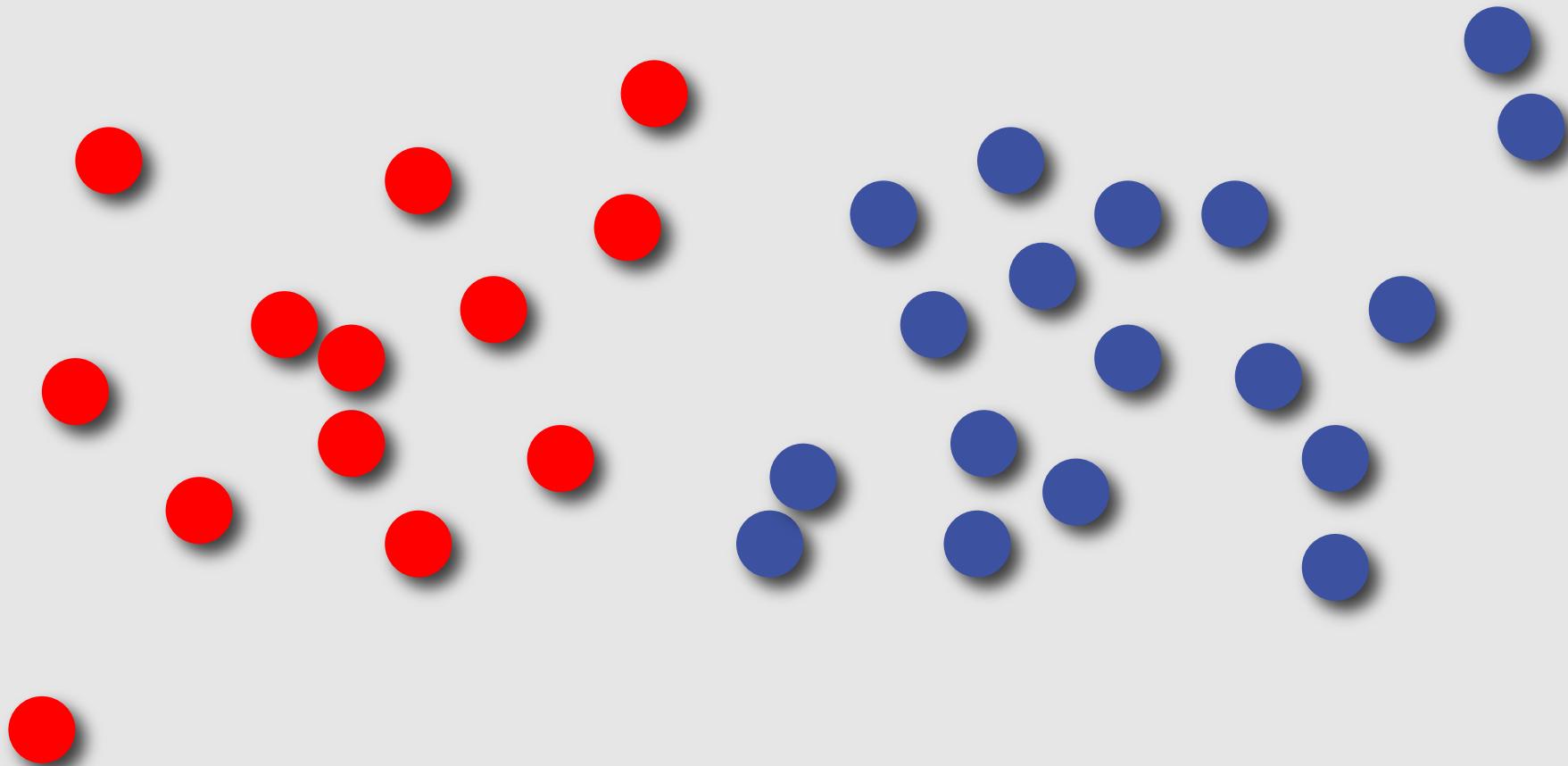
Genealogical

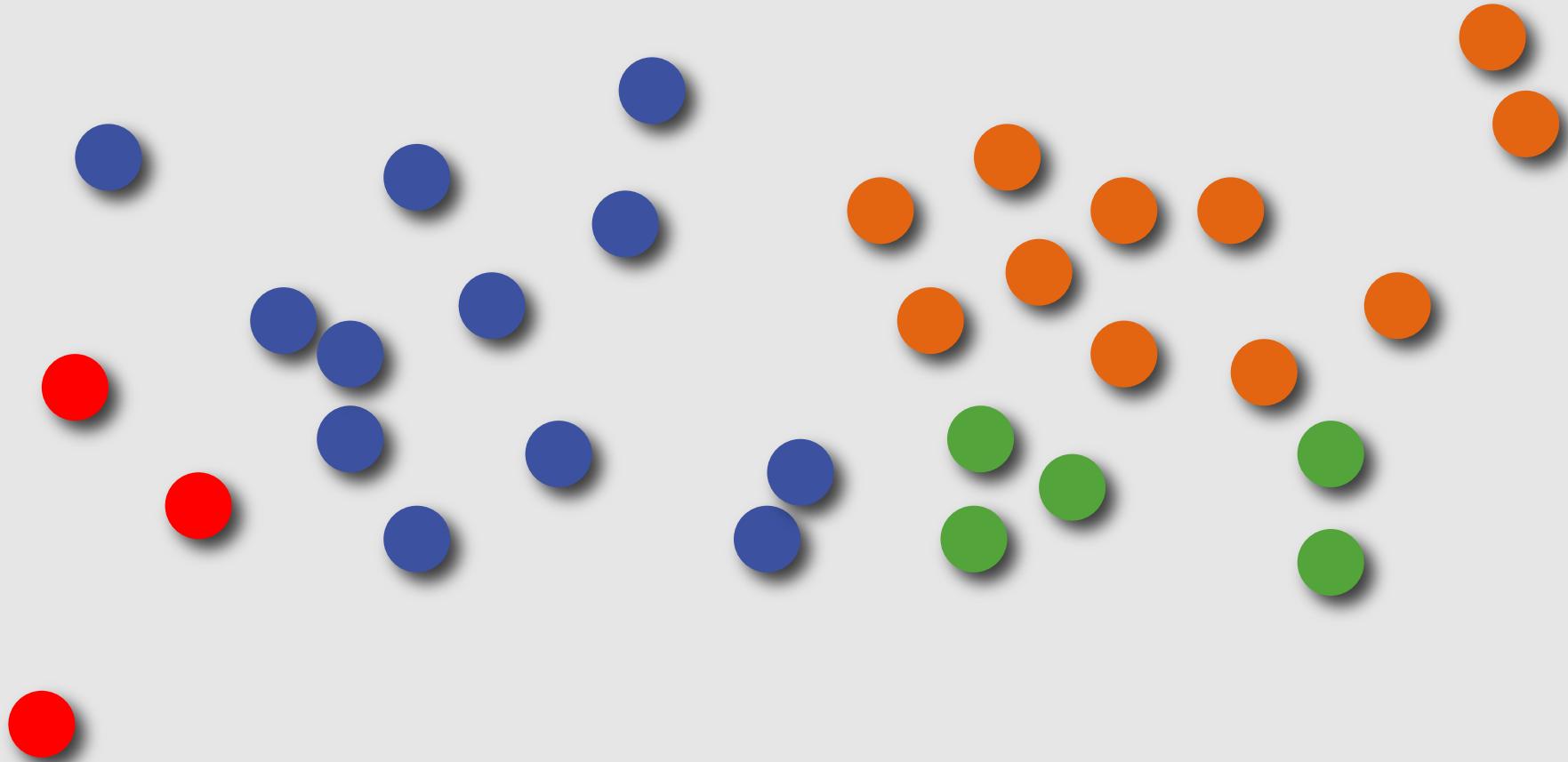
A species is a basal, exclusive group of organisms all of whose genes coalesce more recently with each other than with those of any organisms outside the group, and that contains no exclusive group within it (Baum and Donoghue 1995; Shaw 1998)

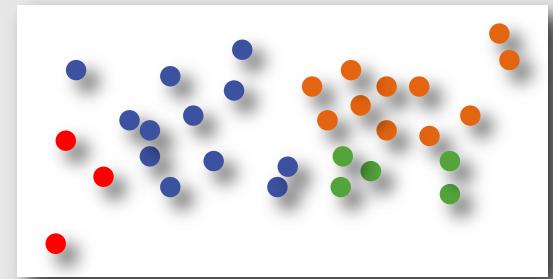
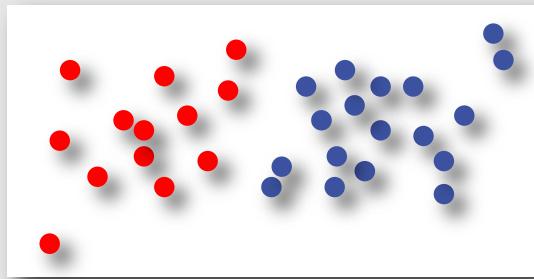
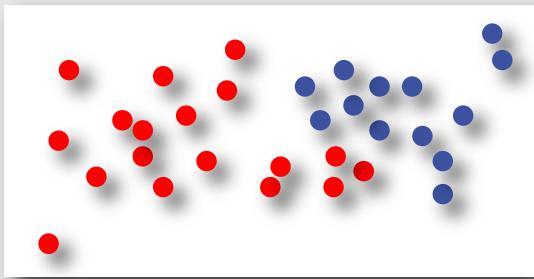












Stirling number of the second kind = number of ways
to divide n elements into k nonempty sets

For these 30 samples, there are 34,314,651,811,530
(34 trillion) ways to divide them into three species

There are 846,749,014,511,809,332,450,147
(8×10^{23}) total ways to divide them.

Biological

Species are groups of interbreeding natural populations that are reproductively isolated from other such groups (Mayr 1995)

Genotypic cluster

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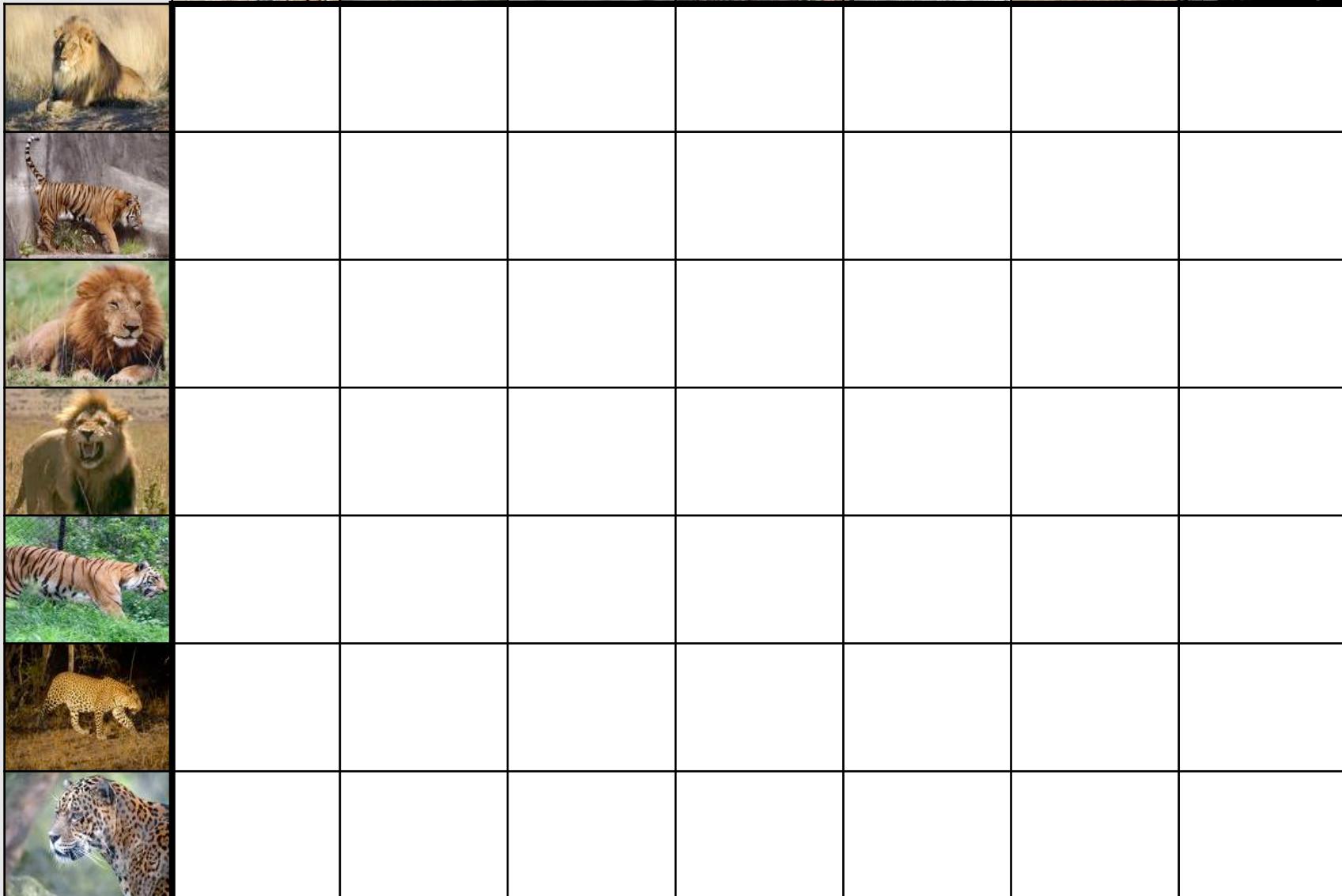
Genealogical

A species is a basal, exclusive group of organisms all of whose genes coalesce more recently with each other than with those of any organisms outside the group, and that contains no exclusive group within it (Baum and Donoghue 1995; Shaw 1998)

Female



Male



Female



Male

A male lion with a full, light brown mane, sitting in a grassy field.							
A tiger walking through dense foliage and rocks.							
A male lion with a full, light brown mane, sitting in a grassy field.							
A male lion with its mouth open, showing its teeth, in a grassy field.							
A tiger walking through tall green grass.							
A male leopard walking through tall grass.							
A close-up profile view of a male leopard's head and shoulders.							

Female



Male

A male lion with a large, full mane, sitting in the grass.							
A male tiger walking through dense foliage.							
A male lion with a large, full mane, sitting in the grass.						A lion sitting next to a young girl.	
A male lion with a large, full mane, sitting in the grass.				A female tiger standing in a grassy field.			
A male tiger walking through dense foliage.			A female lion walking through bushes.				
A male leopard walking through tall grass.							
A male leopard walking through tall grass.							

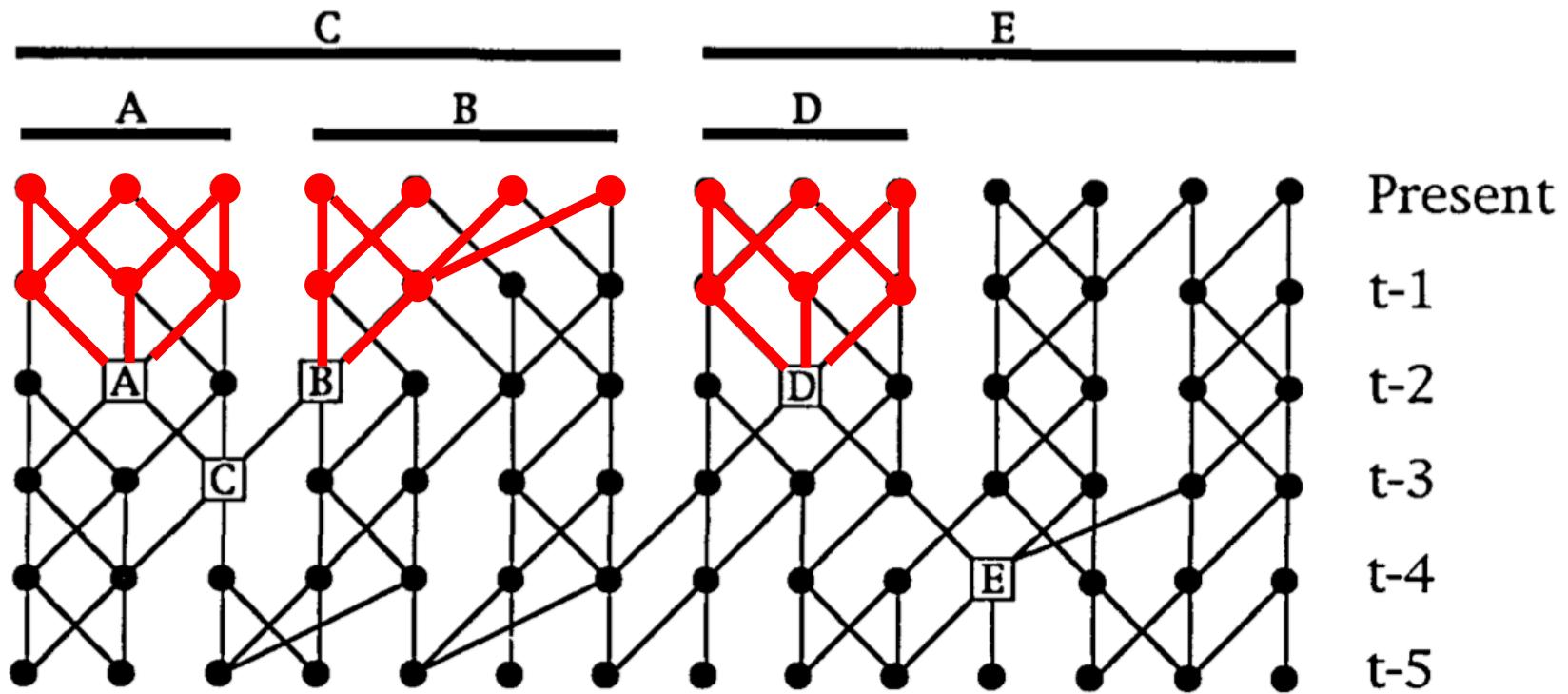


Figure 2. A hypothetical organismic genealogy for a population of biparental, hermaphroditic annuals. Time-limited exclusive groups (see text) are marked with a bar. One of the MRCAs of each exclusive group is labeled with the same letter as the group.

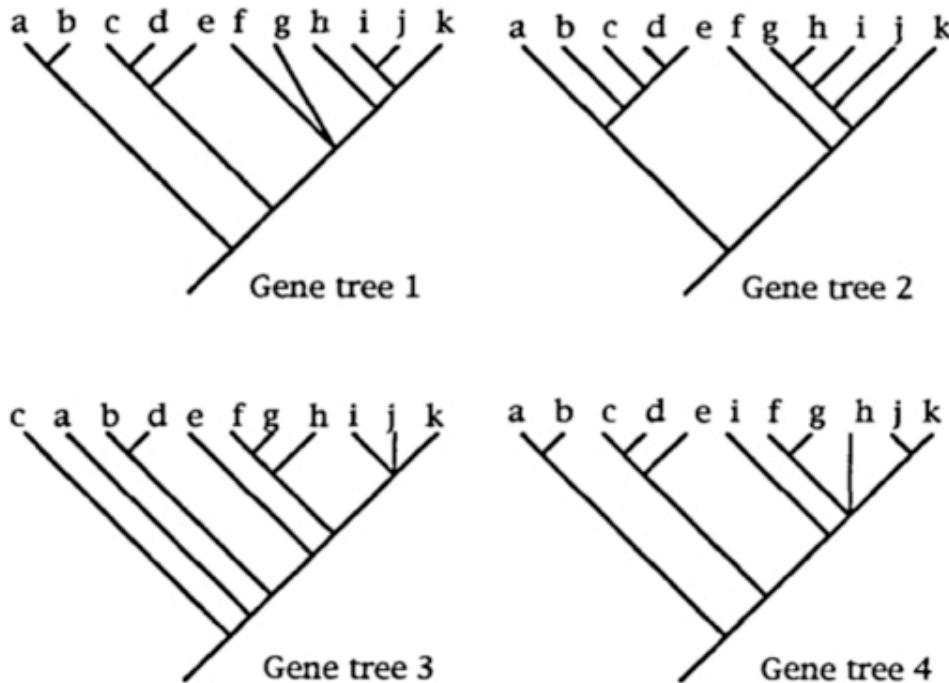


Figure 3. A worked example of the implementation of the genealogical species concept. Eleven organisms (a–k) are sampled from two geographic populations (a–e; f–k). From each individual, four unlinked genes are sequenced and gene trees constructed using standard phylogenetic procedures. Points of genetic concordance are identified using a strict consensus of these trees (see text).

Baum and Shaw. Genealogical perspectives on the species problem.
 Experimental and Molecular Approaches to Plant Biosystematics (1995) vol.
 53 pp. 289–303

GSC species

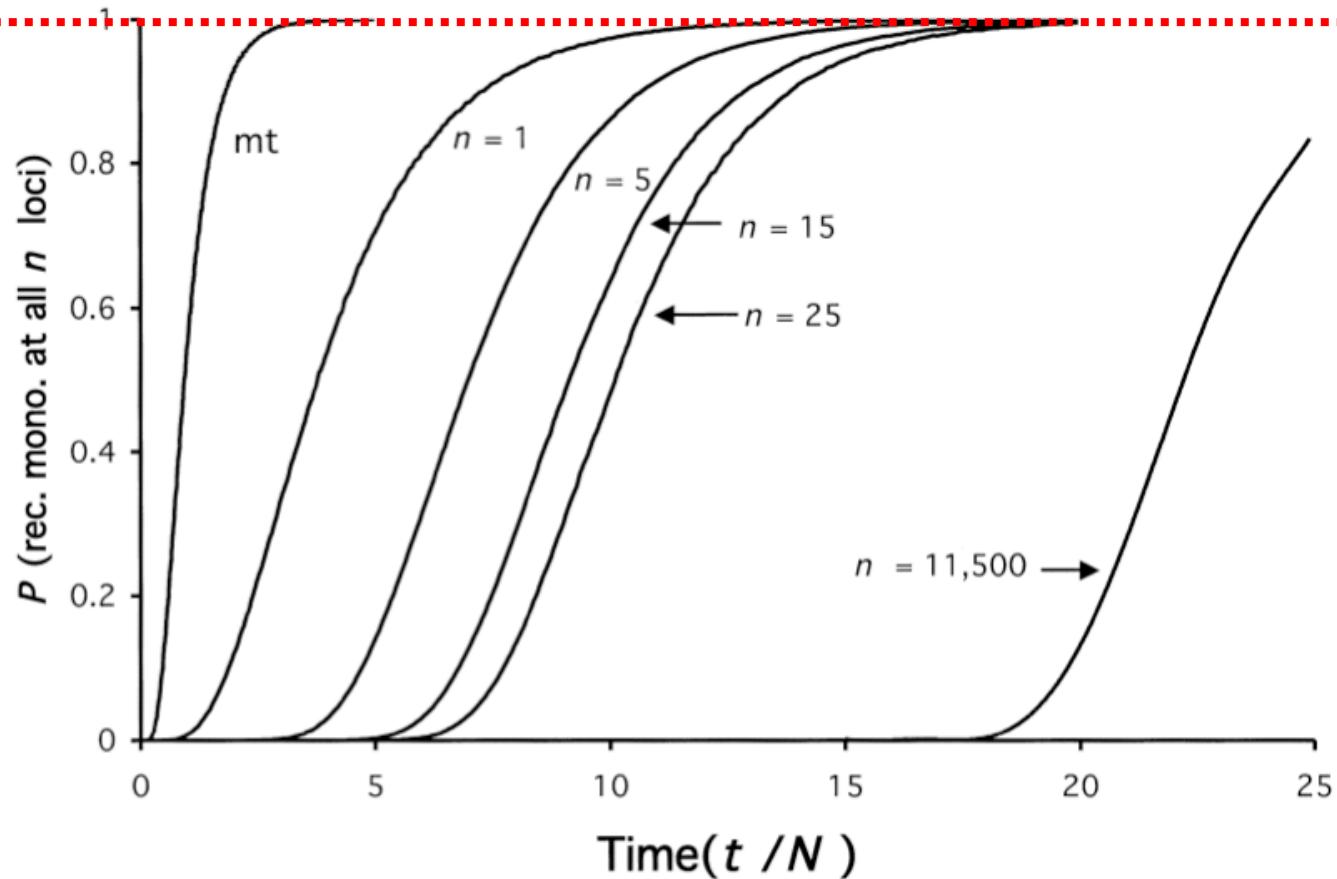


FIG. 1. Probabilities of observing reciprocal monophyly with time for populations that are genetically isolated. Curves are shown for a single mitochondrial locus and for samples of different numbers of nuclear loci. Time is measured in units of N generations, where N is the effective population size of each of the two descendant populations. mt, mitochondrial DNA, n , number of nuclear loci sampled. We assume that 100 alleles are sampled for each locus.

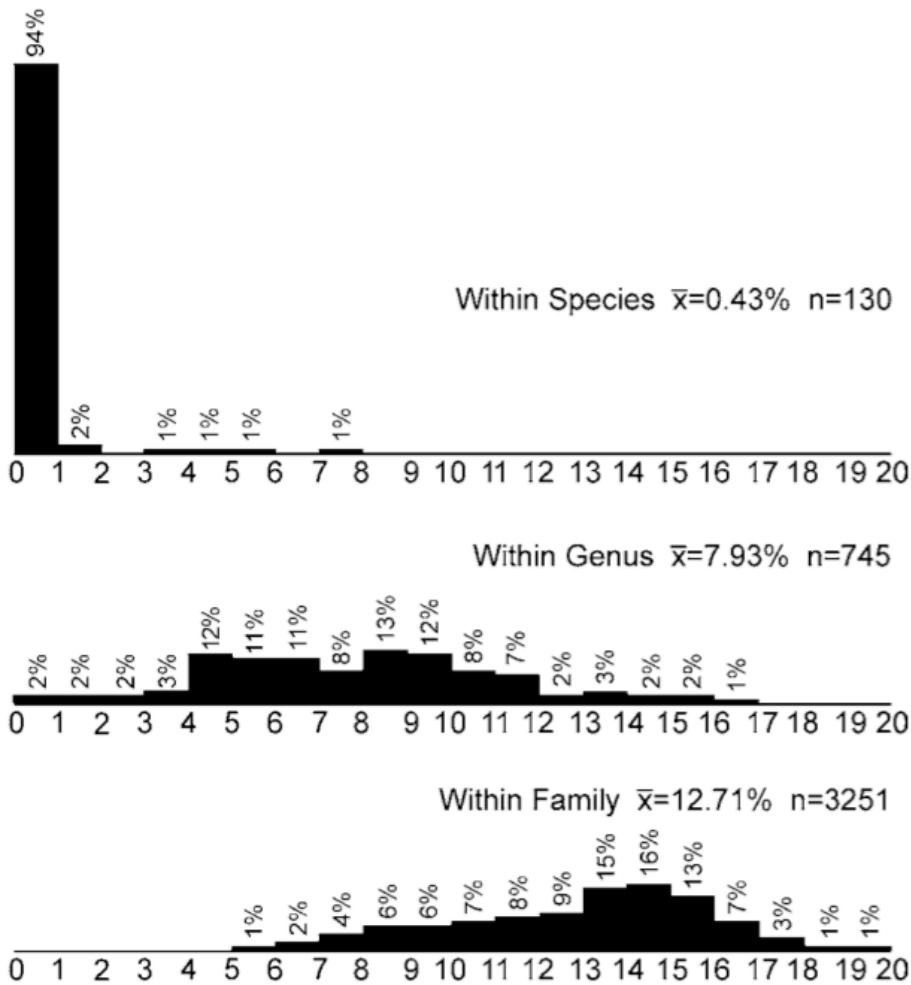


Figure 1. Comparison of Nucleotide Sequence Differences in COI among 260 Species of North American Birds

Pairwise comparisons between 437 COI sequences are separated into three categories: differences between individuals in the same species, differences between individuals in the same genus (not including intraspecific differences), and differences between individuals in the same family (not including intraspecific or intrageneric differences). DOI: 10.1371/journal.pbio.0020312.g001

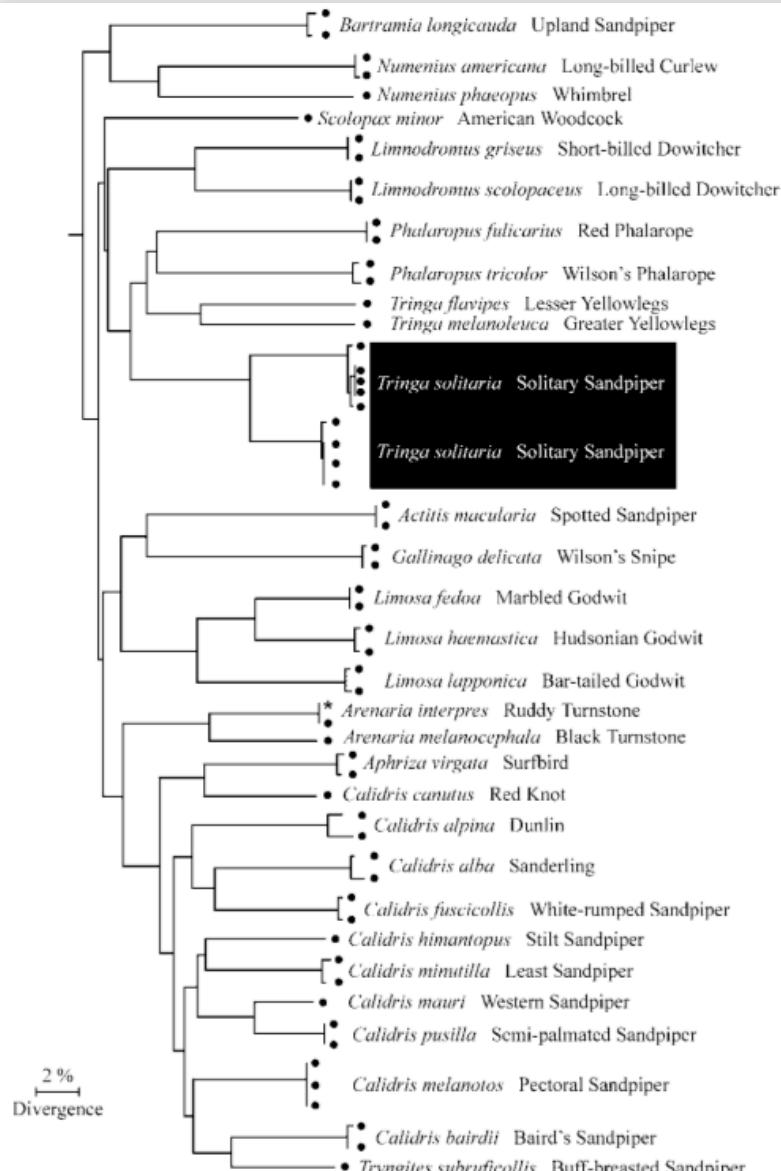


Figure 2. NJ Tree of COI Sequences from 30 Species in Family Scolapacidae (Sandpipers and Kin)

The divergent pair of clustered sequences of *Tringa solitaria* is highlighted. An asterisk indicates a COI sequence from GenBank. DOI: 10.1371/journal.pbio.0020312.g002

Rhytidoponera koumensis, sp.nov.

(Figs 31, 32, 37, 38)

Rhytidoponera numeensis; Emery (nec André), 1914, p. 395 (partim).



Type Material

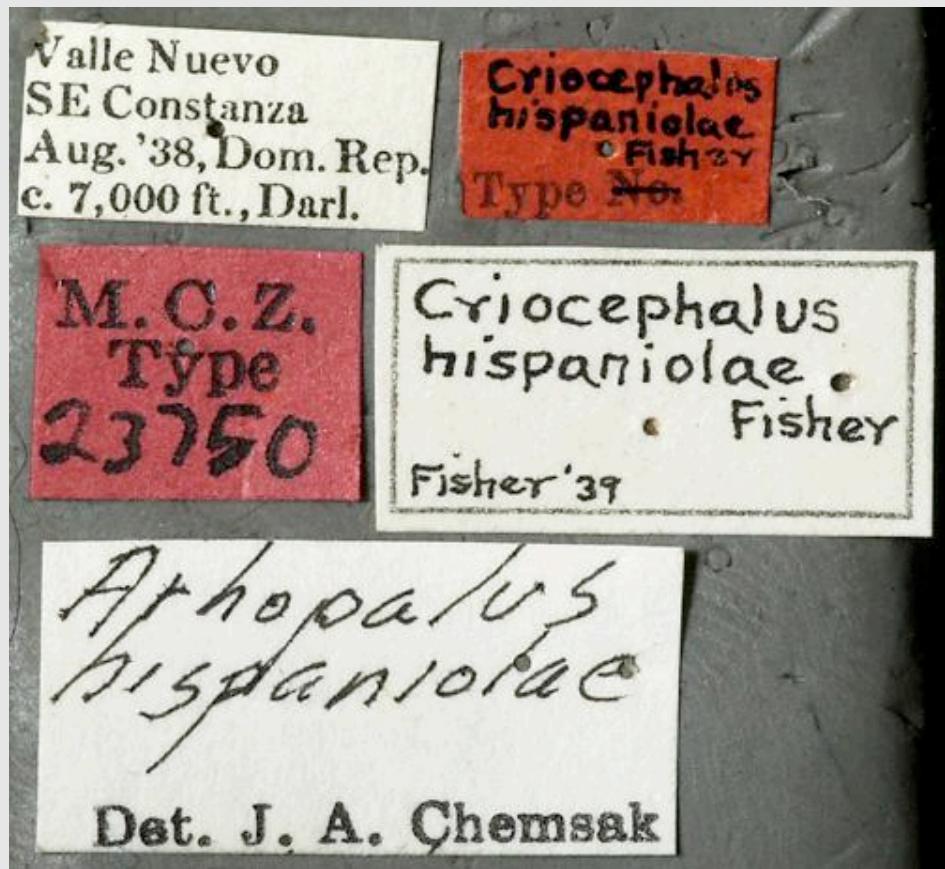
Holotype worker. New Caledonia: Grottes de Koum, 40 m, 20°32'S., 164°20'E., 3.v.1980, nest in soil, dry rainforest on limestone (P. S. Ward, acc. No. 4209) (ANIC Type No. 7583).

Paratype workers, one male: (1) A series of 3 accessions from Grottes de Koum, (P. S. Ward acc. Nos 4196, 4202, 4209) (ANIC, BPBM, BMNH, MCZ, MNHN, PSW). (2) A series of 7 workers from 9 km NNE. Koumac, 80 m, 20°29'S., 164°18'E., 3.v.1980, foraging on ground, rainforest (P. S. Ward acc. No. 4210) (ANIC, PSW).

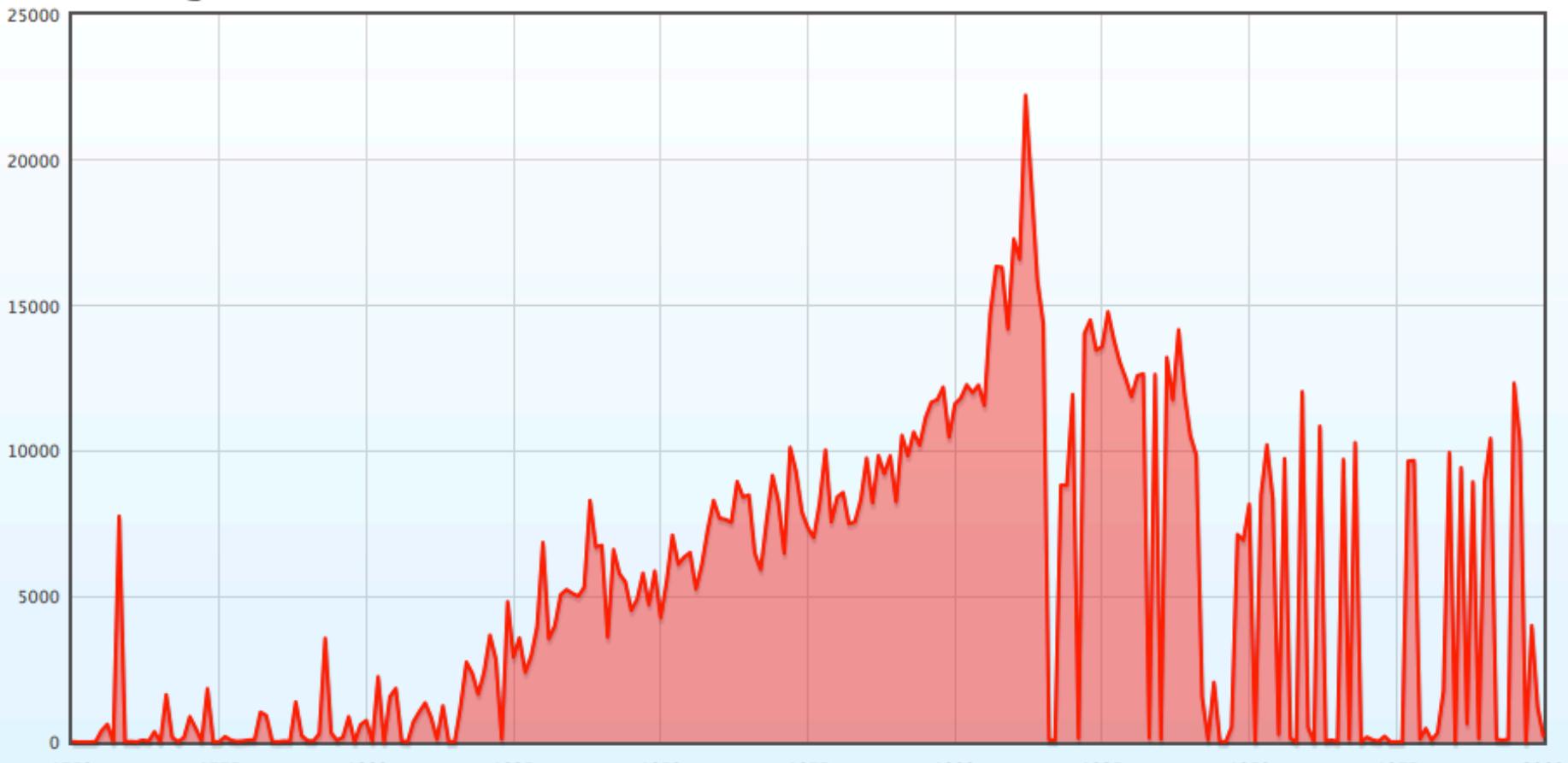
Non-paratypic material: Tchalabel, 5.v.1911 (Sarasin and Roux), 1 worker (MCSN). This worker is on a pin with an *opaciventris* worker and male.

Comments

The robust mesosoma, dark brown color, and broad subpetiolar process place *koumensis* in the *numeensis* group. It differs from *wilsoni* in size, shape of the petiolar node, shape of the subpetiolar process, sculptural details, and pilosity (SSC > 12 in *koumensis*, SSC < 12 in *wilsoni*). *R. koumensis* and *numeensis* are quite close, and are distinguishable primarily by the differences outlined in the key. The posterior margin of the subpetiolar process is sinuous, concave, or angled inward in *koumensis* (usually convex or angled outward in *numeensis*), so that the subpetiolar process is more slender than that of *numeensis* and the SPI values do not overlap. In addition, *koumensis* is larger and has a more setose fore femur (FSC 8-16 in *koumensis*, 0-9 in *numeensis*).



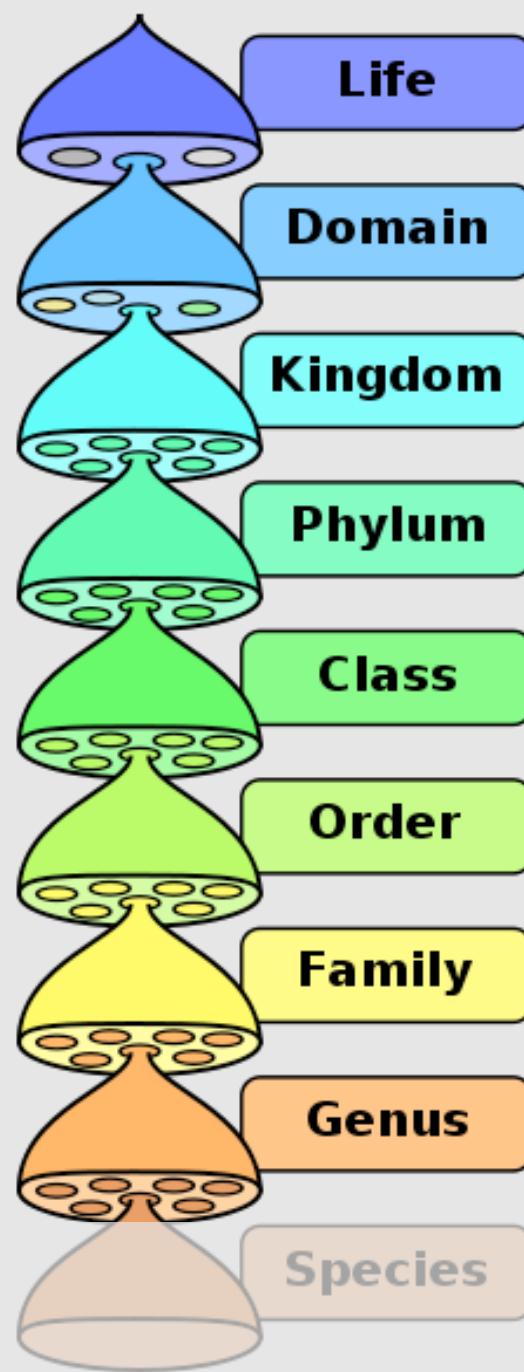
All Organisms from 1750 to 2000



<http://taxatoy.ubio.org/>

Species Discovered

Total: 1,306,762
1750 – 1923: 882,826
1923 – 1964: 304,539
1964 – 2000: 119,397



International Code of Zoological Nomenclature

International Code of Botanical Nomenclature

International Code of Nomenclature for Bacteria

International Code of Nomenclature for Cultivated Plants

Pieris rapae



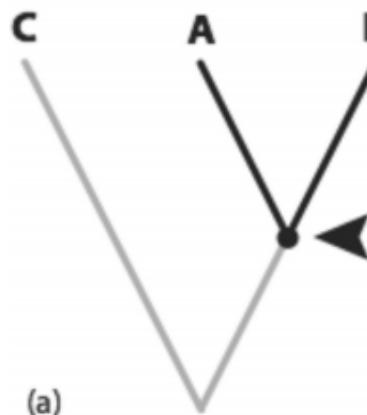
Sarefo

Pieris japonica



Stan Shebs

Node-based
last common
ancestor of A and B



Branch-based
first ancestor of
A but not of C



Apomorphy-based
first ancestor
of A to evolve X

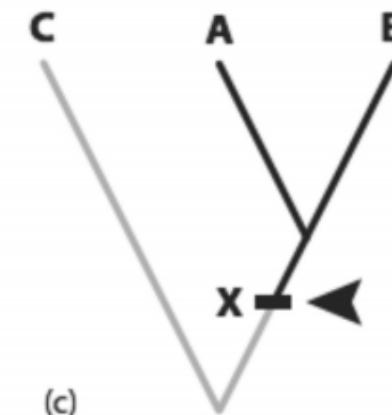


FIGURE 2. Three General Types of Phylogenetic Definitions. A node-based definition (a) associates a name with the clade originating with the last common ancestor of two or more specified species or organisms (A and B in this example). A branch-based definition (b) associates a name with the clade originating with the first ancestor of one (or more) specified species or organisms (A) that is not an ancestor of one or more other specified species or organisms (C). An apomorphy-based definition (c) associates a name with the clade originating with the first ancestor of a specified species or organism (A) to evolve a specified derived character state (X). Arrows point to the node (a), branch (b), and apomorphy (c) specified by the three definitions.

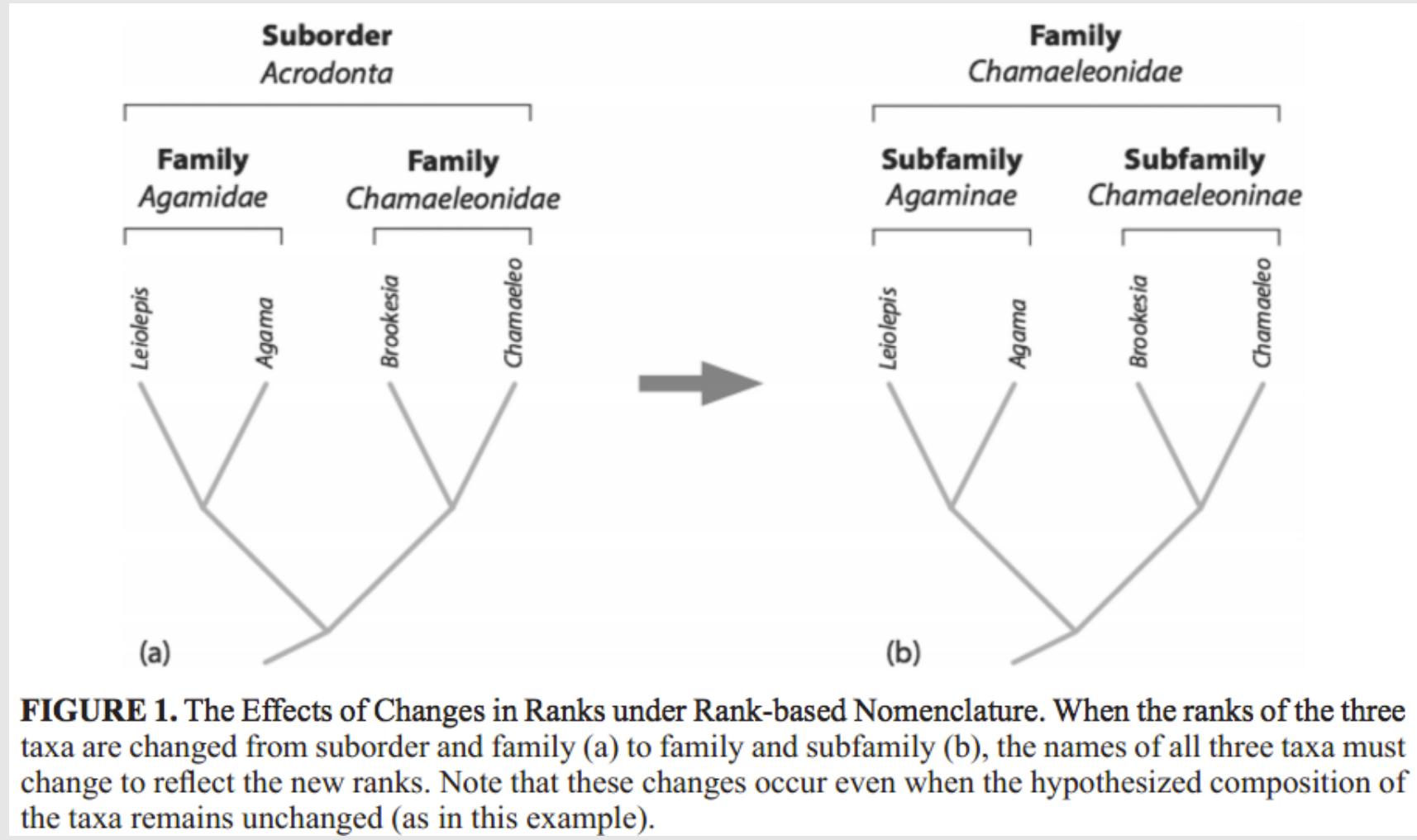


FIGURE 1. The Effects of Changes in Ranks under Rank-based Nomenclature. When the ranks of the three taxa are changed from suborder and family (a) to family and subfamily (b), the names of all three taxa must change to reflect the new ranks. Note that these changes occur even when the hypothesized composition of the taxa remains unchanged (as in this example).

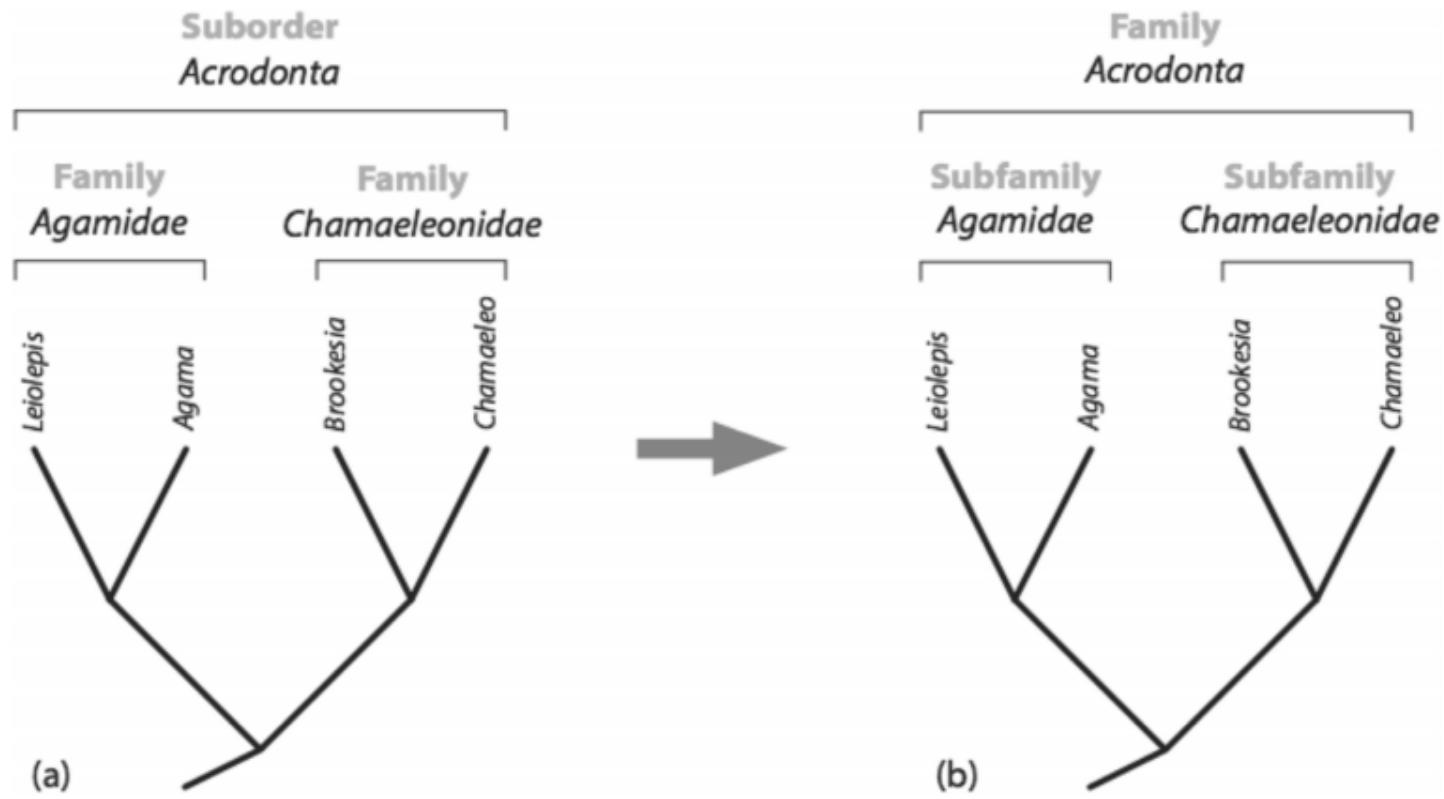
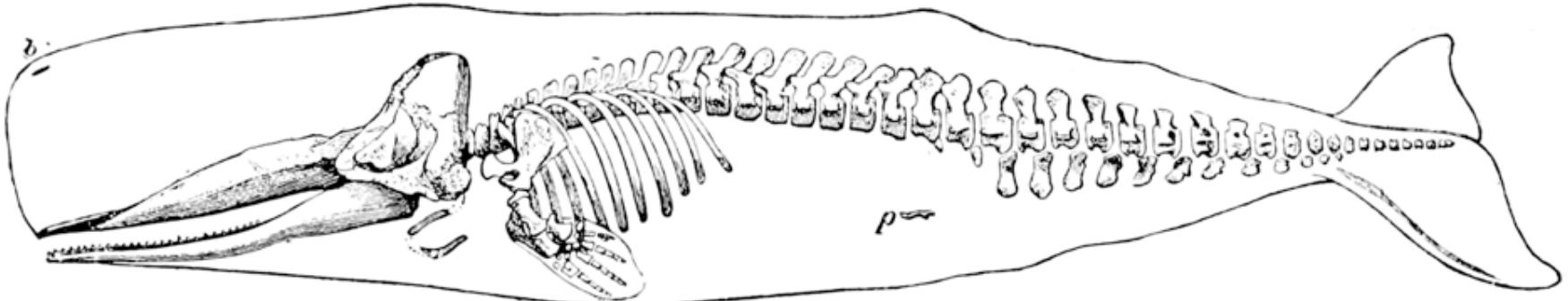


FIGURE 3. The (Absence of) Effects of Changes in Ranks under Phylogenetic Nomenclature. This example uses the same taxa and ranking schemes used to illustrate the effects of changes in ranks under rank-based nomenclature (Fig. 1). However, rather than applying the names using implicit rank-based definitions, the names are applied using the following phylogenetic definitions (based on species originally included in the taxa): *Agamidae* = the least inclusive clade containing both *Leiolepis guttata* and *Agama agama*; *Chamaeleonidae* = the least inclusive clade containing both *Brookesia superciliosa* and *Chamaeleo chamaeleon*; *Acrodonta* = the least inclusive clade containing both *Agama agama* and *Chamaeleo chamaeleon*. When the ranks of the three taxa are changed from suborder and family (a) to family and subfamily (b), the names of all three taxa remain unchanged because the application of names is based on phylogenetic relationships (which have not changed) and is independent of ranks. Compare this example with the same example under rank-based nomenclature (Fig. 1), in which the names of all three taxa change.



Physeter macrocephalus or
Physeter catodon

Example from Rod
Page

Physeter macrocephalus or *Physeter catodon*

We should follow MSW3, as it is what is used in nearly all other mammal articles on Wikipedia.
UtherSRG (talk) 04:59, 3 October 2008 (UTC)

Nope. The MSW3 is in error in this case. It will stay as *macrocephalus*. Tag! You're it. Jonas Poole (talk) 22:52, 3 October 2008 (UTC)

I'm not sure what the correct answer is here, but I'm also not sure what the basis is for stating that MSW3 is "in error". I checked the source (Encyclopedia of Marine Mammals) for the statement in the article that "However, most scientists, the International Code for Zoological Nomenclature, and the International Whaling Commission prefer *P. macrocephalus* over *P. catodon*", and it is not quite that definitive, only stating that "Currently, most, but not all, authorities prefer *P. macrocephalus*." Certainly, I've seen *P. macrocephalus* used in many references, including the Encyclopedia of Marine Mammals, but *P. catodon* has some prominent proponents as well, besides MSW3. So I am not sure what the best way to resolve this situation for Wikipedia is, but I don't think just presuming MSW3 is in error is it. MSW3 is, after all, the source for most mammal Latin names on Wikipedia. Is it possible to include both Latin names in the taxobox, since both are used by authoritative sources and the text explains the situation in more detail?
Rlendog (talk) 00:53, 4 October 2008 (UTC)

I didn't use the Encyclopedia of Marine Mammals. I used Whitehead's Sperm whales: social evolution in the ocean. And I'll be reverting it back to *macrocephalus*, again. :) Jonas Poole (talk) 00:51, 5 October 2008 (UTC)

Physeter macrocephalus or *Physeter catodon*

Please stop. MSW3 is the defacto standard used in the majority of mammal articles. It's only superceded when there is a preponderance of evidence against it, or when new species have been discovered. Neither of these are the case here, so MSW3 stands. - UtherSRG (talk) 04:33, 5 October 2008 (UTC)

So, basically its your f***ing bible? Well, I'm a man of little faith. I'll be reverting it back. You, my friend, may stop reverting it. It's quite annoying. Jonas Poole (talk) 22:16, 5 October 2008 (UTC)

UtherSRG is correct that MSW3 is the de facto standard for mammal classification. And it is valuable to maintain that consistency across the encyclopedia. But in this case there do seem to be a substantial amount of references (including by Hal Whitehead, who I wouldn't want to disagree with on Sperm Whales) that use *macrocephalus*. I don't think either is definitively incorrect and, given that there is not a single definitive correct species name, I'm not sure it is the place of Wikipedia to try to resolve the dispute one way or another. So I am more convinced than I was earlier that the appropriate solution is to include both Latin names in the taxobox and in the lead. Rlendog (talk) 01:22, 6 October 2008 (UTC)

Nicholson et al. 2012: Abstract: In this essay, we review concepts of taxonomic categories of anoles, reanalyze accumulated characteristics of these lizards, use these analyses to summarize the topology of the phylogenetic tree for anoles, and use consistent major branches of this topology to recommend a classification scheme for this large group of squamates. We then use this new taxonomy to draw inferences about the evolution of habitat use, as well as the geologic ages and geographic distribution of anole lineages. Our taxonomy eliminates problems of paraphyly inherent in previous classifications by elevating eight major lineages to generic status (*Anolis*, *Audantia*, *Chamaelinorops*, *Ctenonotus*, *Dactyloa*, *Deiroptyx*, *Norops*, and *Xiphosurus*), providing diagnoses of those genera, and then doing the same for species groups within each genus. With the exception of 19 species, the contents of our generic categories are consistent with all recent phylogenetic reconstructions. Thus, the revised taxonomy appears to provide a stable classification for at least 95% of the 387 species currently recognized and included in our treatment of the group



Genus	Latin Gender of Genus	Nicholson et al.	Reptile Database
Anolis	Masculine	loysianus	loysiana
Audantia	Feminine	haetiana	haetianus
Dactyloa	Feminine	aenea	aeneus
Dactyloa	Feminine	blanquillana	blanquillanus
Dactyloa	Feminine	eulaema	eulaemus
Dactyloa	Feminine	extrema	extremus
Dactyloa	Feminine	fasciata	fasciatus
Dactyloa	Feminine	frenata	frenatus
Dactyloa	Feminine	gemmosa	gemmosus
Dactyloa	Feminine	grisea	griseus
Dactyloa	Feminine	heteroderma	heterodermus
Dactyloa	Feminine	megalopitheca	megalopithecus
Dactyloa	Feminine	mira	mirus
Dactyloa	Feminine	neblinina	neblininus
Dactyloa	Feminine	nigrolineata	nigrolineatus
Dactyloa	Feminine	philopunctata	philopunctatus
Dactyloa	Feminine	propinqua	propinquus
Dactyloa	Feminine	pseudotrigrina	pseudotigrinus

Is A Radical Revision Of Anole Evolution In Order?

Posted on [October 12, 2012](#) by [Jonathan Losos](#)

Three weeks ago, I initiated a discussion on the [Anole Annals](#) blog about whether it is the right time to propose a new classification for the genus *Anolis*. I argued that it is the moment, and that it is the right moment.

What's In A Name?, Part II

Posted on [September 27, 2012](#) by [Luke Mahler](#)

Last week, I wrote a post on how the new classification for anoles proposed by Nicholson et al. 2012 might affect long term taxonomic stability for this group. That post generated some discussion, including, most recently, commentary by Kirsten Nicholson ... [Continue reading →](#)

A Case For Anolis

Posted on [October 1, 2012](#) by [George Gorman](#)

To some degree, we've already had lots of discussion about Nicholson et al.'s (2012) recent proposal that *Anolis* be fragmented into eight genera. Throughout the course of this discussion, several assumptions and comments have suggested that anole biologists might be compelled to implement Nicholson et al.'s (2012) proposal ... [Continue reading →](#)

Historical Perspective On Anole Genera

Posted on [October 1, 2012](#) by [Rich Glor](#)

Anolis has been recognized as an extraordinarily diverse and speciose genus for decades, but Nicholson et al. (2012) are not the first to propose a revision of the generic epithet.

large genus for decades, but Nicholson et al. (2012) are not the first to propose a revision of the generic epithet. ... [Continue reading →](#)

What's In A Name? Perhaps A Rose Is A Rose, An Anolis A Dactyloa?

Posted on [October 2, 2012](#) by [George Gorman](#)

A half century ago my graduate research was stimulated and influenced by the important unpublished Etheridgean thesis (Etheridge, "1959", 1960). As an E.E. Williams student, I was an adopter, user, and later coiner of informal names for seemingly natural evolutionary ... [Continue reading →](#)

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Enter scientific names to check

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Alternatively, you can upload a text file with an unlimited number of names in the Upload and Submit List tab. Your file MUST be plain text, with one name per line, and must have a .csv or .txt filename extension; word processor or spreadsheet files are NOT supported. You will receive an email notification when the list is done being processed. You can retrieve your results at that time in the Retrieve Results tab. Click the links above for more detailed [instructions](#) and other information.

[Click here for support](#)



Global Names Index BETA

Scientific Names Exchange ([about](#))

Scientific Names Repositories

Catalogue Of Life (2,138,842 names)



uBio NameBank (9,991,919 names)



uBio uses names and taxonomic intelligence to manage information about organisms.



ITIS (477,134 names)



The ITIS (Integrated Taxonomic Information System) is the result of a partnership of federal agencies formed to satisfy their mutual needs for scientifically credible taxonomic information.



EOL (1,960,480 names)



The Encyclopedia of Life (EOL) is an ambitious, even audacious project to organize and make available via the Internet virtually all information about life present on Earth.



GBIF (5,431,172 names)



GBIF is a global network of data providers that builds biodiversity information infrastructure and promotes the growth of biodiversity information content on the Internet

Names can be hard to do well, lots of conflict. Why bother? (discuss)