

The basics of ZOOLOGICAL NOMENCLATURE

Yves Samyn

Royal Belgian Institute of Natural Sciences
Vautierstraat 29
B-1000 BRUSSELS (Belgium)
(yves.samyn@naturalsciences.be)



C. Linnaeus – father of nomenclature

History of scientific nomenclature

Taxa have always been named and classified (*e.g.* Greek and Roman naturalists; medieval herbalists; folk taxonomists)

- Names used by Pre-Linnaean naturalists:
 - ✓ Latin
 - ✓ *nomina specifica*; binominal, trinominal or even polynominal names (*e.g.* *Iris perpusilla saxatilis Norbonensis acaulis ferme*)
 - ✓ names inconsistent and often paragraphs long serving as diagnosis, description and as key to identification
 - ✓ constantly changing names
- Linnaeus' 18th century taxonomic system [cf. *Species plantarum* (1753) and *Systema naturae* (1758)]
 - ✓ Latin
 - ✓ *nomina trivialia*; always binominal in structure
 - ✓ name divorced from diagnosis and description



standards, sense and stability for animal names in science

- 1758** Formal starting point = 10th Edition of Linnaeus's Systema Naturae (also Clerck's Aranei Svecici)
- 1842 Strickland Code (botany and zoology)
- 1889 First ICZ meeting (Paris); tentative adoption of a set of rules
- 1901 Fifth ICZ meeting (Berlin); "International Rules of Zoological Nomenclature"; published as Règles Internationales de la Nomenclature Zoologique (French, English & German)
- 1961** First edition of the Code of Zoological Nomenclature
- 1964** Second edition
- 1985** Third edition (glossary added; French = English)
- 1988 Launch of fourth edition project
- 1995 Draft of fourth edition released by Secretariat
 - Distribution of hard copies; Discussion forum on internet; New concepts and provisions published in Bull. Zool. Nomenclature
- 1999** Fourth edition (current edition)
 - Takes effect from 1 January 2000
- 2005 Launch of fifth edition project (was foreseen for **2012**)

WHY nomenclature? NAMES!

Scientific names are the unique and unambiguous identifiers of a taxon and ensure that we are talking about the same organism regardless of our geographic location or language



bad taxonomy



can
KILL

Will the edible stone fish stand up?

*Want to know? Ask
the scientific name
to a taxonomist*



HOW are scientific names formed?

Codes!

The 4 codes hold universally accepted rules for assigning scientific names



Greuter, W., et al. (eds), 2000. International Code of Botanical Nomenclature (St Louis Code). Regnum Vegetabile 138. Koeltz Scientific Books, Königstein.



Trehane, P., et al. (eds). 1995. International Code of Nomenclature for Cultivated Plants. Adapted by the International Committee for the Nomenclature of Cultivated Plants of the I.U.B.S. Regn. Veget. 133.



Sneath, P.H.A., et al. (eds), 1992. International Code of Nomenclature of Bacteria. Washington (+ : Skerman, V.D.B. et al., 1980. Approved Lists of Bacterial Names).



International Commission on Zoological Nomenclature, 1999. International Code of Zoological Nomenclature, 4th edition. Adopted by the I.U.B.S. The International Trust for Zoological Nomenclature, London.

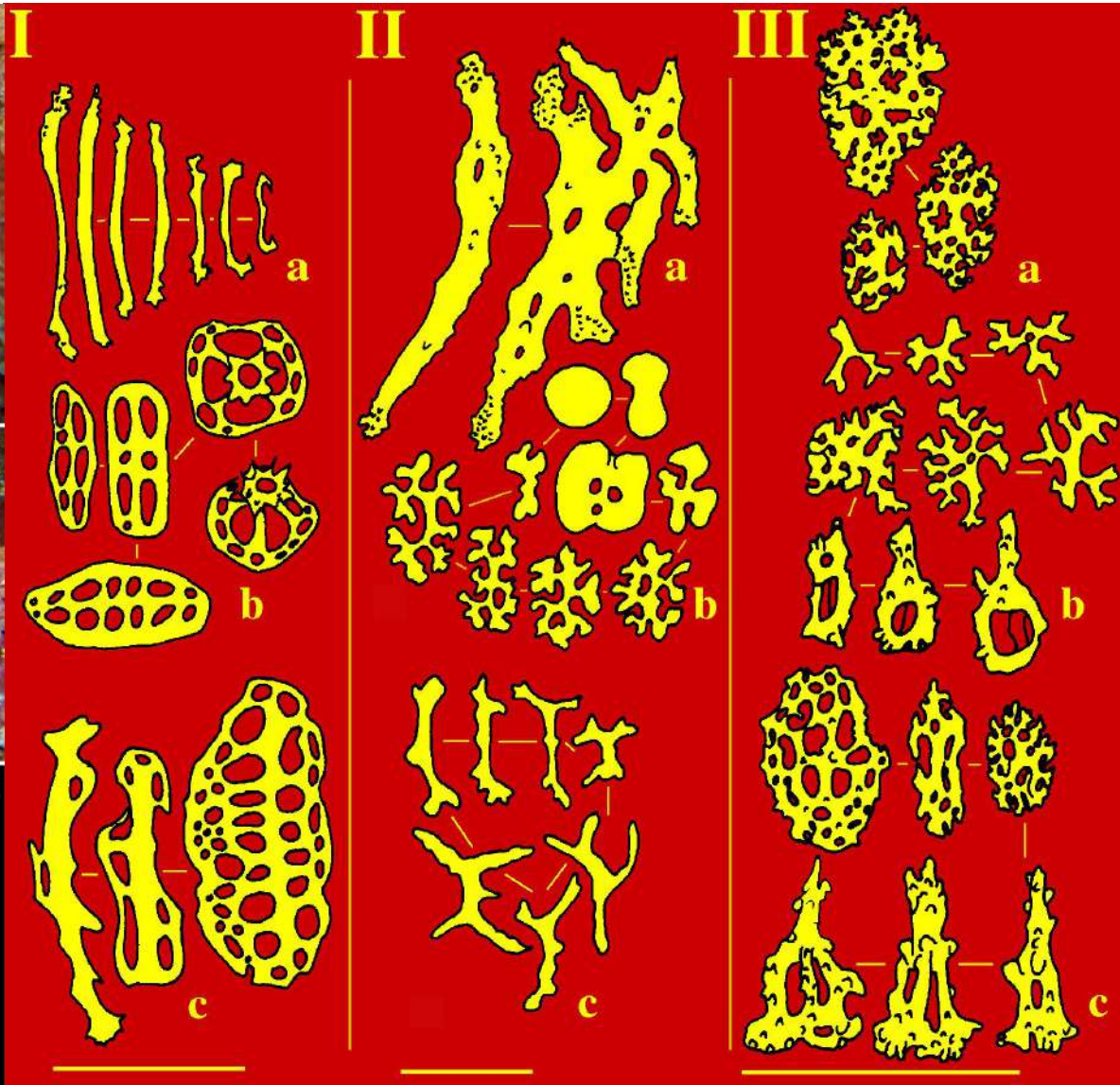
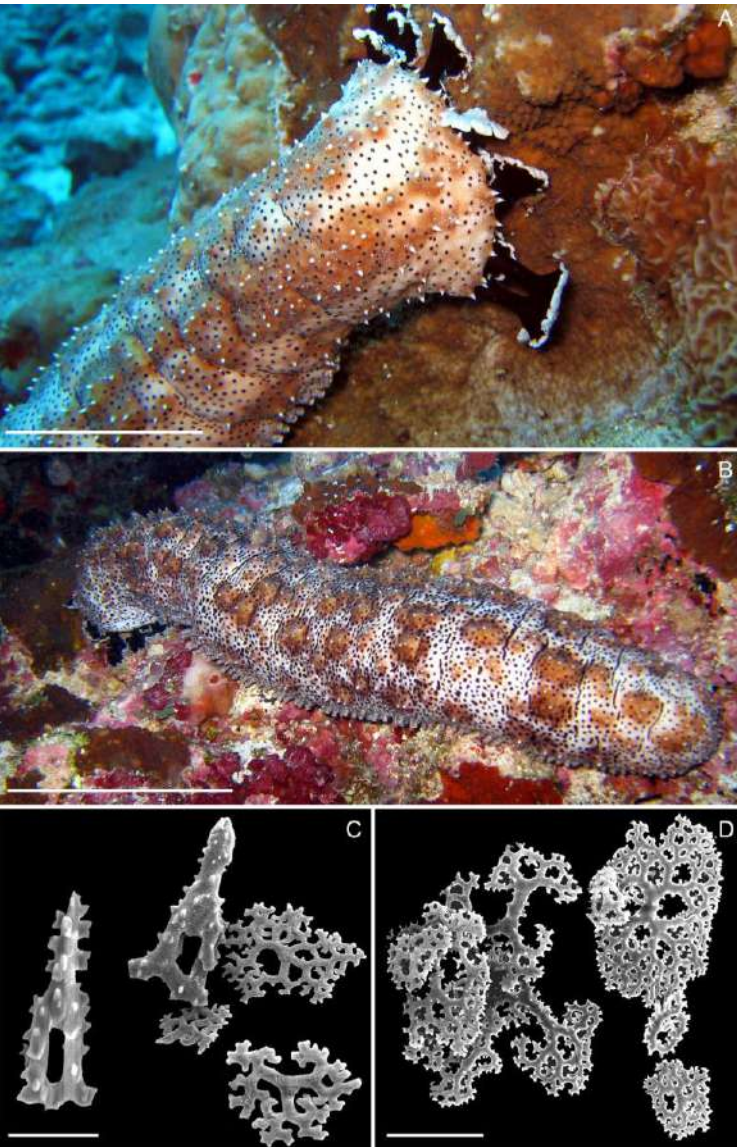


“The objects of the Code are to promote stability and universability in the scientific names of animals and to ensure that the name of each taxon is unique and distinct.

All its provisions and recommendations are subservient to those ends and none restricts the freedom of taxonomic thought or actions”

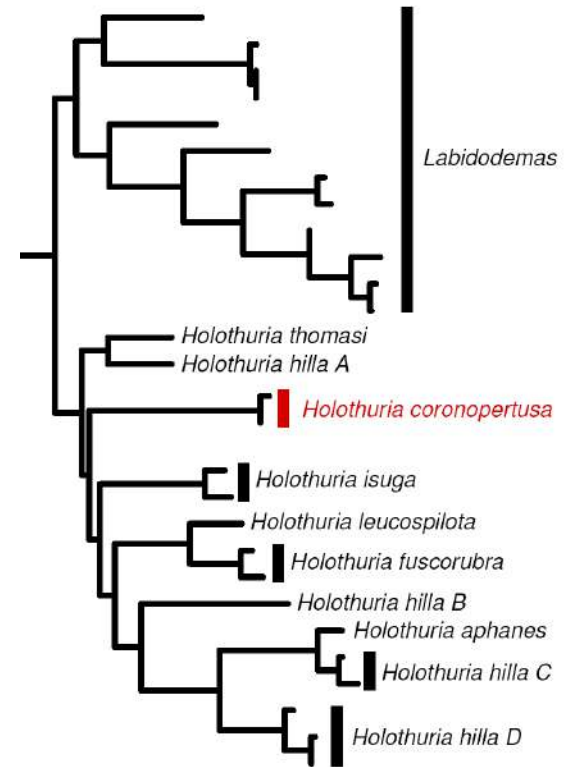
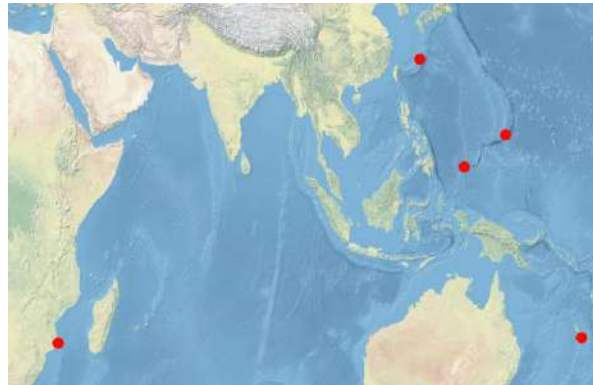
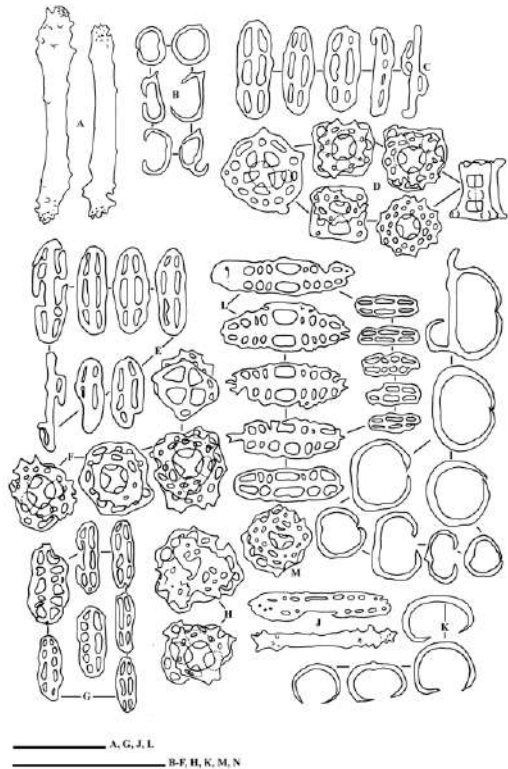
(ICZN 1999: 2)

WHY do names change anyway?



Holothuria graeffei Semper, 1868 => *Bohadschia graeffei* (Semper, 1868)
=> *Pearsonothuria graeffei* (Semper, 1868)

Holothuria (Stichothuria) coronopertusa Cherbonnier, 1980



Now: *Holothuria (Mertensiothuria) coronopertusa* Cherbonnier, 1980

Formation & treatment



Vernacular name

Black teatfish

Original name

Mülleria nobilis Selenka, 1867

→ *Only the generic name commences with an upper-case letter*

Name corrected to

Muelleria nobilis Selenka, 1867

→ *'ü' is not a Latin letter; it's replaced by 'ue' (similarly 'ñ' is replaced by 'n', 'œ' by 'oe')*

Species transferred to other genus

Holothuria nobilis (Selenka, 1867)

→ *Name of author and date are enclosed in parentheses*

Subgenus recognised in genus

Holothuria (Microthele) nobilis (Selenka, 1867)

→ *Subgeneric name is interpolated in parentheses between generic and specific names. Like the generic name it is capitalized*

Ruling PRINCIPLES of nomenclature

Only a tool! Not science!!



Taxonomy = science

The taxonomist decides on the utilised principles (e.g. cladistics or phenetics); science knows no authority

Nomenclature = tool

Taxonomists artificially produce names; no science involved, so rules can be imposed on this process



Nomenclature only follows taxonomy

Ruling PRINCIPLES of nomenclature

Principle of binominal nomenclature ('two' words)

Principle of Typification (identity of a name relies on its type, not on its description)

Principle of Priority ("the oldest fool is always right")

Principle of the First Reviser ('the fastest is right')

Principle of Synonymy (1 taxon can only have one name)

Principle of Homonymy [1 name can apply to only 1 taxon (but see independence of codes)]

Principle of Coordination (name established for one rank simultaneously establishes names for other ranks in the same group)

But!

- Interpretation and administration
- No "case-laws"

PRINCIPLE of binominal nomenclature



Binomens

Mülleria nobilis Selenka, 1867

Muelleria nobilis Selenka, 1867

Holothuria nobilis (Selenka, 1867)

Holothuria (Microthele) nobilis (Selenka, 1867)



Trinomens

[*Holothuria impatiens* var. *bicolor* H.L. Clark, 1938]

Holothuria impatiens bicolor H.L. Clark, 1938

Holothuria (Thymiosycia) impatiens bicolor
H.L. Clark, 1938

PRINCIPLE of typification

Art. 61.1. Each nominal taxon in the family, genus or species groups has actually or potentially a name-bearing type. The fixation of the name bearing type of a nominal taxon provides the objective standard of reference for the application of the name it bears.

61.1.1. The valid name from a taxon is determined only from the name-bearing type(s)

61.1.2. Objectivity through typification is continuous through the hierarchy of names, from species to family group

61.1.3. Once fixed name-bearing types are stable and provide objective continuity in the application of names

PRINCIPLE of typification

- ⇒ Types are international standards for scientific names
- ⇒ Identity of a name relies only on its type, not on its description or diagnosis

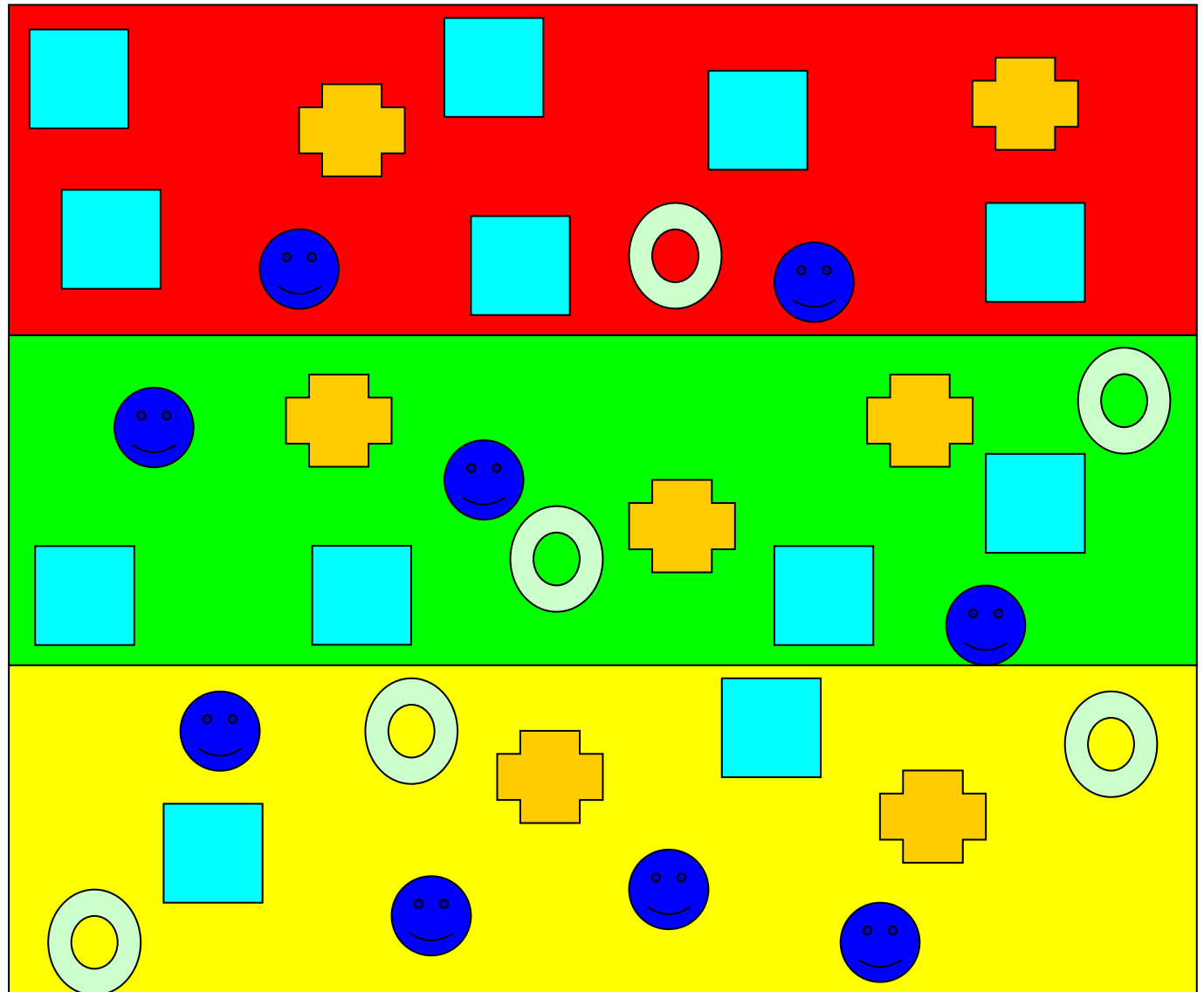
Note: The principle of typification has nothing to do with typological thinking!


Field situation

 *Location 1*

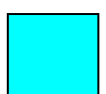
 *Location 2*


 *Location 3*



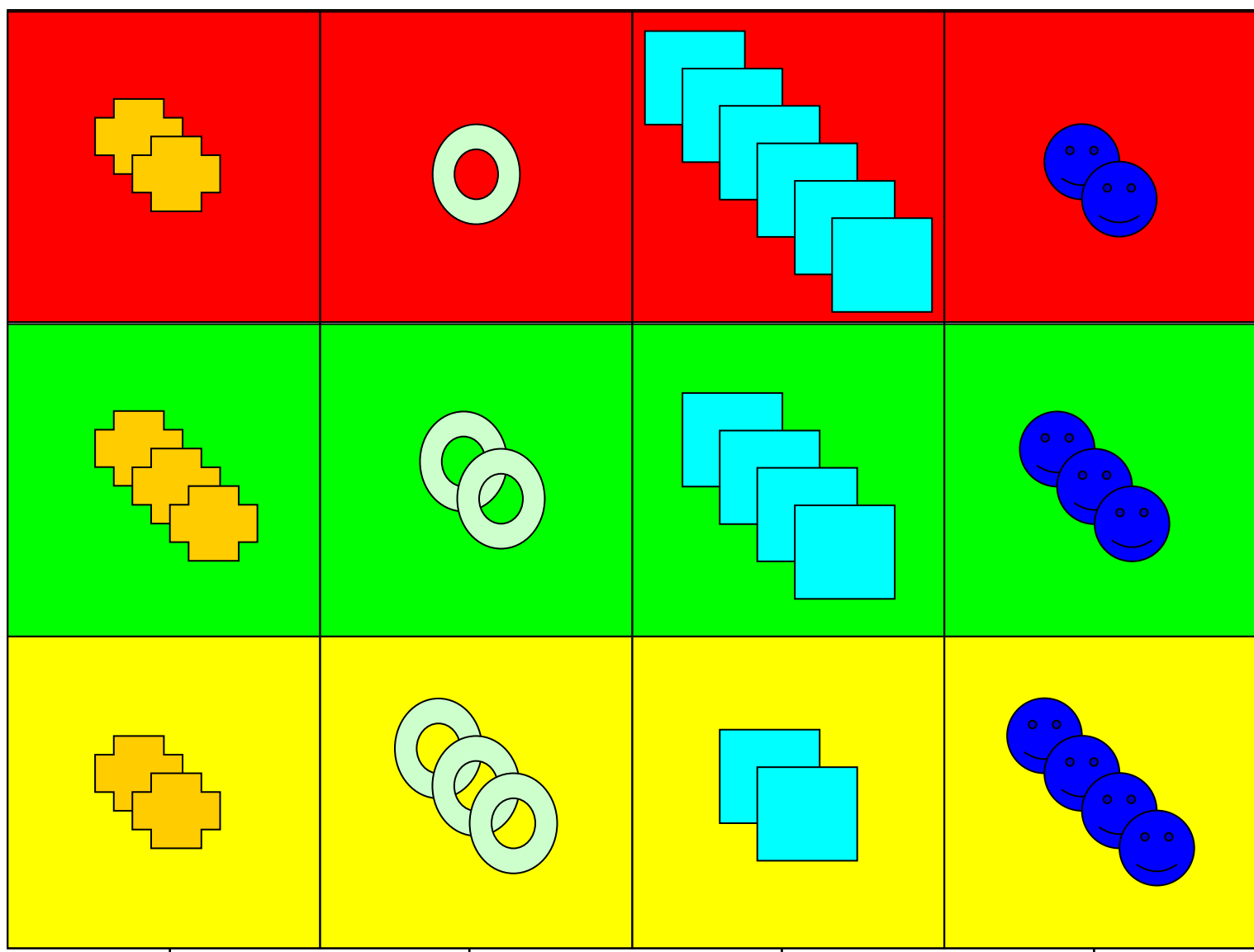

Species 1


Species 2


Species 3


Species 4

Taxonomic situation



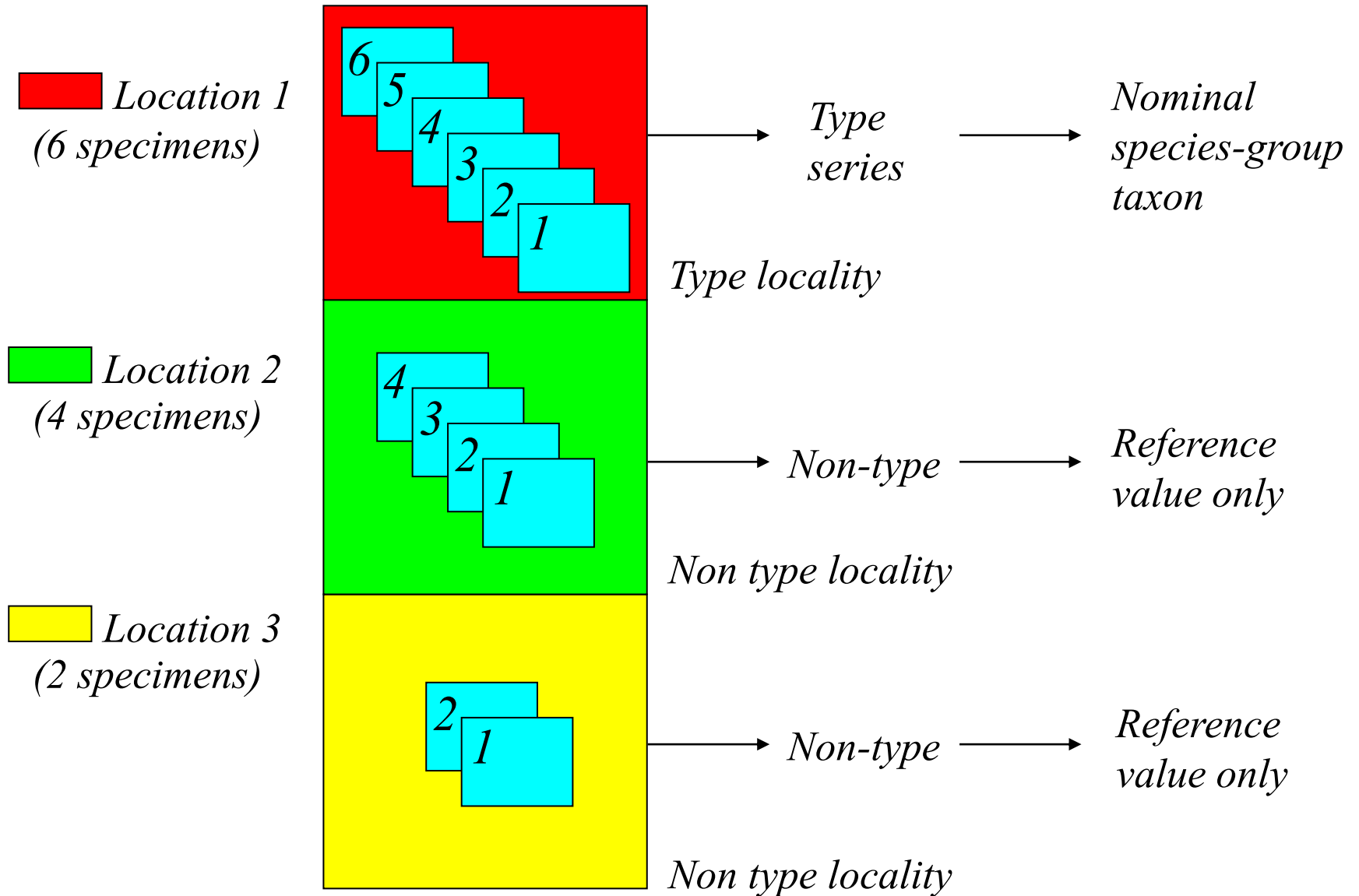
↓
known species

↓
known species

↓
*Unknown (new?)
species*

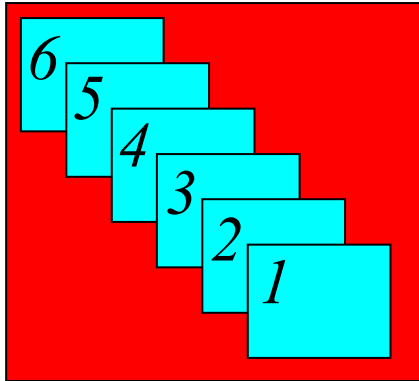
↓
known species

Taxonomic situation

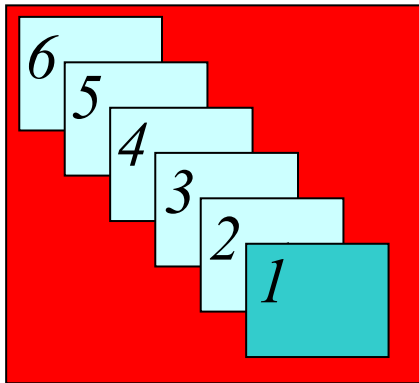


Nomenclatural situation

original designation



***Syntypes:** all the specimens in the type series that collectively constitute the name-bearing type.*

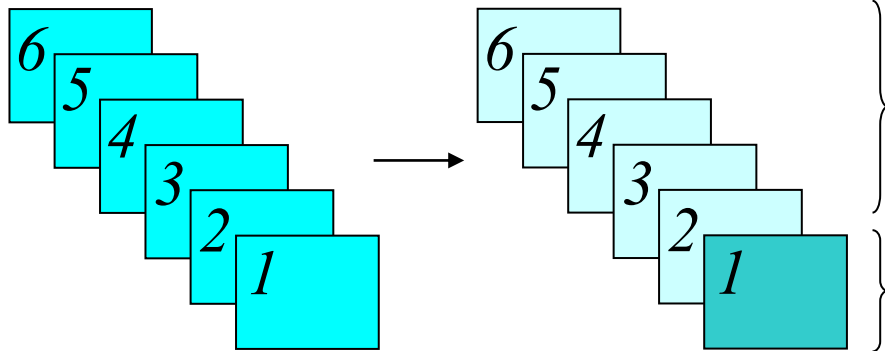


***Paratypes:** remaining specimens of the original type series*

***Holotype:** the single specimen upon which a new species-group taxon is based*

Nomenclatural situation

Subsequent designation

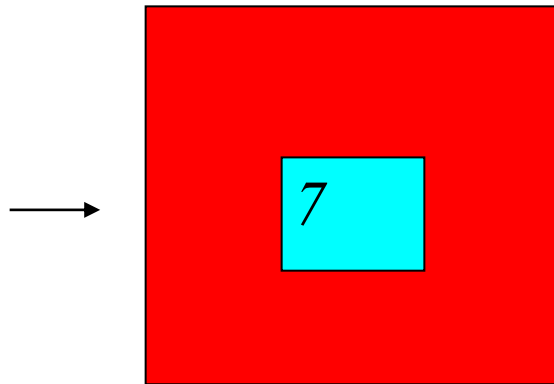


syntypes

Paralectotypes: each specimen of the former syntype series remaining after lectotype designation

Lectotype: one of the syntypes designated as the single-name bearing type specimen

all name-bearing types lost



Neotype: the single specimen designated as the name-bearing type when no name-bearing type specimen (i.e. holotype, lectotype, syntype or prior neotype) remains. Specimen must come as near as possible from the type locality.

Types of TYPES

Original designation

(=fixed in original publication)

Holotype: the single specimen upon which a new species-group taxon is based in the original publication

Paratypes: remaining specimens of the original type series (see also allotype, isotype)

Syntypes: specimens of a type series that collectively constitute the name-bearing type

Subsequent designation

(=fixed in subsequent publication)

Lectotype: a syntype designated as the single-name bearing type specimen, after the establishment of a nominal species or subspecies

Paralectotypes: each specimen of the former syntype series remaining after lectotype designation

Neotype: the single specimen designated as the name-bearing type when no name-bearing type specimen is believed to be extant.

Types of TYPES

Terms not regulated or recognised by the ICZN

Allotype: a designated specimen of opposite sex of the holotype (cf. Recomm 72A)

Cotype: a term formerly used for either syntype or paratype

Genotype: a term formerly used to designate the holotype

Topotype: a term formerly utilised for a specimen originating from the type locality (the geographical place of capture, collection or observation of the name-bearing type of a nominal species or subspecies) of the species or subspecies to which it is thought to belong, whether or not the specimen is part of the type series

Hypotype is a specimen that was not part of the original type series of the species, but is known from a published description, figure, or listing

Isotype: duplicate material of the holotype, collected at the same time and place by the same collector (botany)

For typification in the family group (see chapter 14 ICZN)

For typification in the genus group (see chapter 15 ICZN)

For typification in the species group (see chapter 16 ICZN)

PRINCIPLE of typification by example

Genus *Pinus* Linnaeus, 1753 (pine trees)

Taxonomy: five distinct genera

Genus 1 : *P. cedrus*

Genus 2 : *P. larix*

Genus 3 : *P. picea*, *P. balsamea*

Genus 4 : *P. abies*

Genus 5 : *P. sylvestris*, *P. pinea*, *P. cembra*, *P. strobus*, *P. taeda*

Q: Who's the real *Pinus*?

Type of *Pinus* = *P. sylvestris*; hence Genus 5

Others: new genus names (*Cedrus*, *Larix*, *Picea* and *Abies*, respectively)

PRINCIPLE of priority

Basic aim of zoological nomenclature is to get stable and universal scientific names

Availability & Validity

Name to be used = valid name

Valid name is chosen from available names

THUS:

- Available name can be valid or not
- Unavailable name can never valid

Availability exists under (*all*) strict conditions (cf. Chapter 4: Criteria of availability):

e.g.

- Date of publication
- Format of name
- ...

Principle
of
Priority
(or usage)

PRINCIPLE of priority

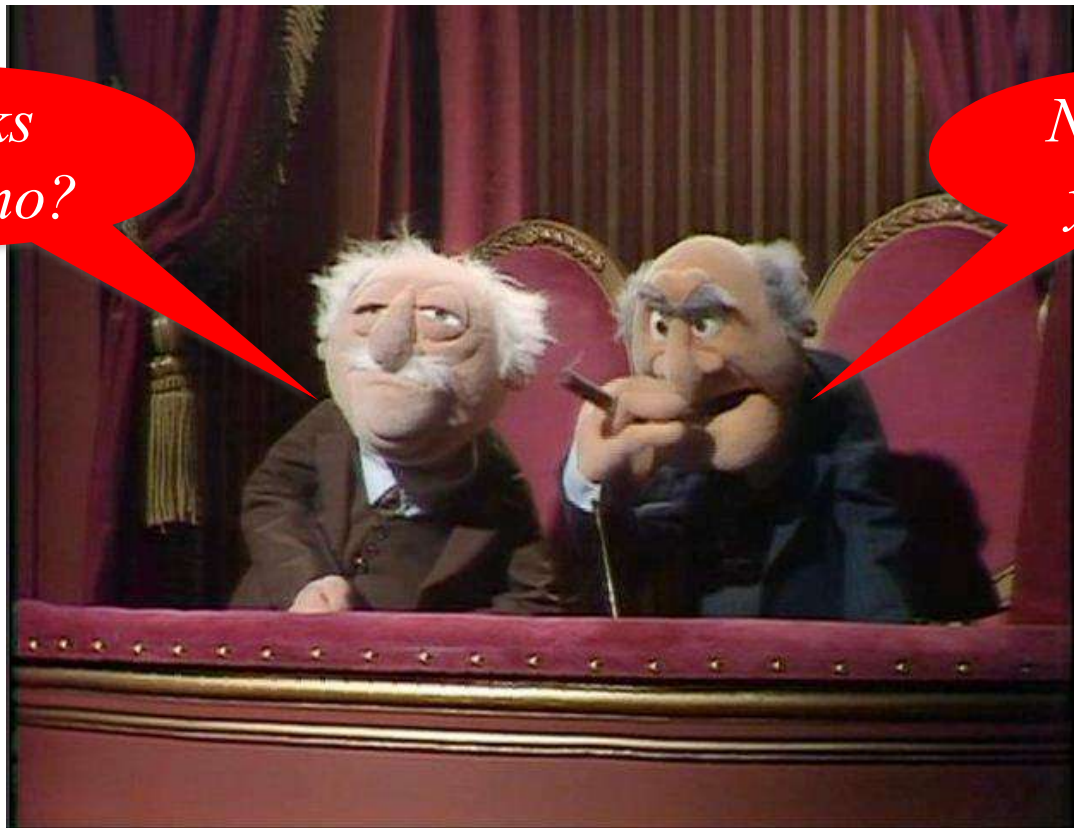
Art. 23.1. The valid name of a taxon is the oldest available name applied to it, unless that name has been invalidated or another name is given precedence by any provision of the Code or by any ruling of the Commission

- Validity of synonyms
- Relative precedence of homonyms
- Correctness of spellings
- Validity of nomenclatural acts
 - Principle of first reviser
 - Fixation of name-bearing types

But with recognition of the purpose of the Code, *i.e.* **STABILITY**

“The Oldest Fool is Always Right”

*Looks
good no?*



*Nah, too
young!*

PRINCIPLE of priority an example

Taxonomists recognise two distinct species are recognised; how to name them?



Name given:

Holothuria scabra var. *versicolor* Conand, 1986

Later raised to

Holothuria scabra versicolor Conand, 1986

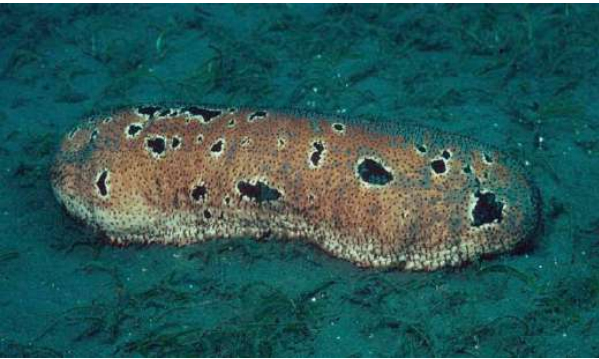


Name given:

Holothuria scabra Jaeger 1833

The name *versicolor* is however not available (art 15.2) and cannot be made available by subsequent action (art 45.5.1)

PRINCIPLE of priority an example



Holothuria scabra var. *versicolor* Conand, 1986 is a *nomen nudum*

Which name to use?

The first available (=oldest or senior) synonym:

Holothuria timama Lesson, 1830

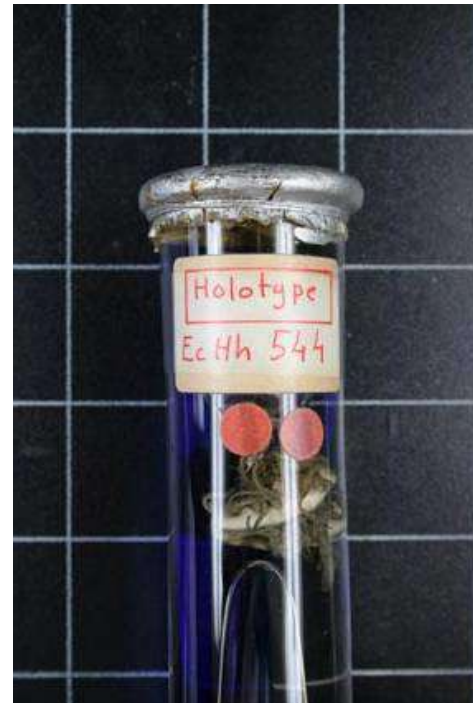
But this name has been suppressed by the ICZN
(Opinion 762)

Which name then?

The next available subjective synonym

Holothuria tigris Brandt, 1835 harms stability

Holothuria aculeata Semper, 1868?

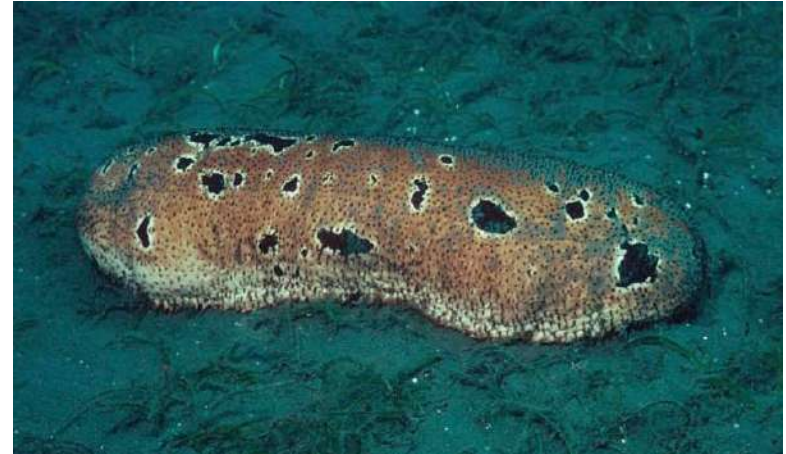


PRINCIPLE of priority an example

Holothuria aculeata Semper, 1868?



Holothuria aculeata Semper, 1868



Holothuria sp. nov.

More: Massin Cl. et al. 2009. Taxonomy of the heavily exploited Indo-Pacific sandfish complex. ZJLS 155: 40-59

PRINCIPLE of synonymy

Synonym: each of two or more names of the same rank used to denote the same taxonomic taxon
(2 or more names = 1 taxon)

- *Nomenclatural* (= *objective, homotypic*) synonyms
- *Taxonomic* (= *subjective, heterotypic*) synonyms
(most common)
- Junior synonym: the latter of the synonyms established
- Senior synonym: the earlier of the synonyms established

PRINCIPLE of synonymy subjective synonyms



Each of two or more names whose synonymy is only a matter of individual opinion

Holothuria decorata Marenzeller, 1882
Holothuria fasciola Quoy & Gaimard, 1833
Holothuria flammea Quoy & Gaimard, 1833
Stichopus flammeus Brandt, 1835
Holothuria fuscopunctata Quoy & Gaimard, 1833
Stichopus gyrifer Selenka, 1867
Holothuria hilla Lesson, 1830
Labidodemas leucopus Haacke, 1880
Holothuria macleari Bell, 1884
Holothuria minax Théel, 1886
Labidodemas neglectum Haacke, 1880
Holothuria ondaatjei Bell, 1887
Holothuria zihuatanensis Caso, 1964

“Oldest fool” →

PRINCIPLE of synonymy

objective synonyms



Each of two or more different names applied to one and the same taxon based on the same type

Penaeus setifer (Linnaeus, 1767)

Cancer setiferus Linnaeus, 1767

Astacus setiferus (Linnaeus, 1767)

Cancer (Gammarellus) setiferus Linnaeus, 1767

“Objective synonym”



Penaeus fluviatilis Say, 1818 (an objective synonym of *Cancer setiferus* L., 1767, through the type selection by Holthuis, 1964, Bull. zool. Nomencl., 21(3):233).

PRINCIPLE of homonymy

Homonym (in the species group): each of two or more available specific or subspecific names having the same spelling which were established for different nominal taxa (1 name = 2 or more taxa)

- Originally combined with the same generic name (Primary homonym)
- Subsequently combined with the same generic name (Secondary homonym)

PRINCIPLE of homonymy

an example in the genus group

Argus Bohadsch, 1761 (gastropod);

Argus Scopoli, 1763 (butterfly);

Argus Scopoli, 1777 (butterfly);

Argus Poli, 1791 (mollusk);

Argus Temminck, 1807 (bird);

Argus Lamarck, 1817 (hesperid);

Argus Boisduval, 1832 (lycaenid);

Argus Walckenaer, 1836 (arachnid);

Argus Gray, 1847 (mollusk);

Argus Gerhard, 1850 (lycaenid)

Only the oldest name is valid,
all the rest are junior homonyms

How to find these? *Nomenclator zoologicus*

PRINCIPLE of homonymy

an example in the species group

| | |
|--|---|
| BULLETIN DU Musée royal d'Histoire naturelle de Belgique Tome X, n° 21. Bruxelles, juin 1934. | MEDEDEELINGEN VAN HET Koninklijk Natuurhistorisch Museum van België Deel X, n° 21. Brussel, Juni 1934. |
|--|---|

SYNTOMIDIDAE AUS DEM BRÜSSELER MUSEUM,
von M. HERING (Berlin).

5. *Syntomis leopoldi* spec. nov.

1 ♂ von Siam N., Prae (Mekami), 21-II-1932 (Prince Léopold).

Die neue Art stellt am nächsten der *S. pectoralis* Wlkr., von der sie sich aber sogleich durch die 5 (anstatt 2) rosaroten Segmente des Abdomens unterscheiden lässt.

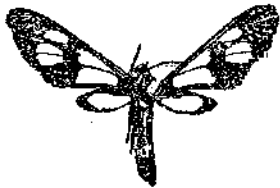
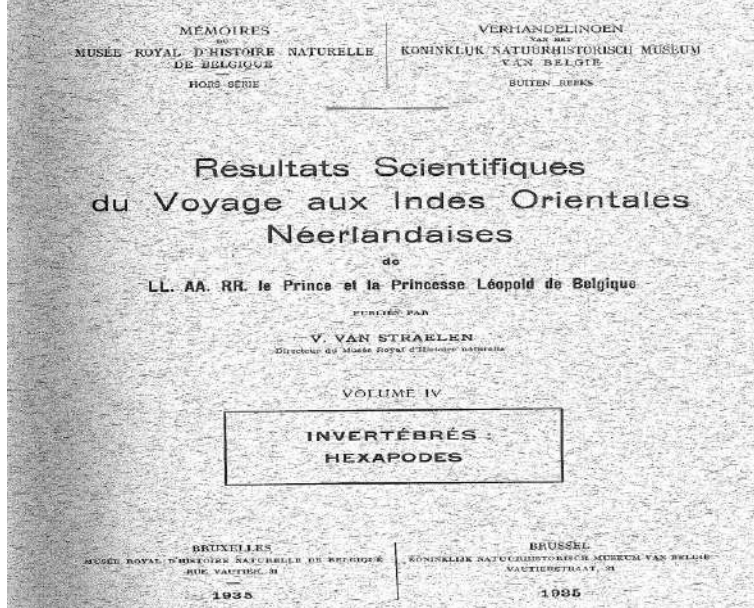


Fig. 2. — *Syntomis leopoldi* spec. nov. × 2.





PRINCIPLE of homonymy

an example in the species group

1. *Syntomis leopoldi* sp. nov.

Pl. I, fig. 1 ♂.

♂. Antenna with very short setae, and even shorter (less than half as long) cilia; fuscous. Palpus fuscous. Head with frons ochraceous orange, vertex fuscous. Thorax with patagium ochraceous orange, tegula ochraceous orange and fuscous mixed, metathorax with a fuscous longitudinal stripe. Pectus ochraceous orange and fuscous. Legs fuscous. Forewing with retinaculum apparently aborted; fuscous, the markings in orange buff to ochraceous orange; a streak between costa and cell from wing-base to end of cell; a large spot filling distal half of cell; an oval spot beyond cell between bases of veins R_2 and M_1 , a smaller one between veins M_2 and M_3 , a larger one between veins M_3 and Cu_1 , and a smaller one between veins Cu_1 and Cu_2 ; a long streak between cell, Cu_2 and anal vein, proximal half broad, distal half narrow; a narrow streak between anal vein and inner margin extending from base to middle of inner margin. Hindwing with frenulum delicate; fuscous, proximal two-thirds almost filled by a large orange buff to ochraceous orange spot, the distal half of which is divided by a tongue of fuscous directed basad. Underside similar to upper side. Expanse: 40 mm.

Holotype ♂. Celebes, Menado, Tondano-Menado, Tonsea Lama, 24.II.1929 (Van Braekel).



PRINCIPLE of homonymy

an example in the species group

Replacement name needed for
the pre-occupied name
Syntomis leopoldi

Nomen novum; nom. nov.; n.n.



***Alvania subcalathus* Monterosato in Dautzenberg &
Fischer, 1906**

(Figs. 4-5, 13-14)

Rissoa calathus ; Manzoni, 1868: 251-252, pl.10 fig. 9 (non
R.calathus Forbes & Hanley, 1850).

Rissoa calathus var. *manzoni* ; Jeffreys, 1884: 111 [n.n.].

Alvania subcalathus Monterosato in Dautzenberg & Fischer,
1906: 47-48.

Turbona calathus manzonii Nordsieck, 1972: 184, pl. R VII 9.

Turbona leacocki ; Nordsieck & Talavera, 1979: pl. 14 fig. 44
(non *Rissoa leacocki* Watson, 1873).

Alvania manzonii ; Gofas, 1989: 40 (lectotype selected).

~~Calathus subcalathus~~
Calathus ^{subcalathus} mangoni
(non Forb. & Harley)
Canarias & Madag.
Montrosato (ex Mangoni)
19.7.98
Journ. Conch. 1868, pl. 9.



~~Calathus~~
Subcalathus
montros.
= Calathus (non
Forb. & Harley)
Mangoni - Journ.
Conch. 1868, pl.
9, fig. 9 (Comore
& Andive)
(Dedit Mangoni)

paralectotypes of
Alvario subcalathus
Mont. in Dtz. & F. 1906
(see Hoenselaer & Modenbeck,
1998)

Criteria of AVAILABILITY

- Name or nomenclatural act must be *Published*;
- Scientific names must be spelled using the 26 letters of the *Latin Alfabet*;
- Consistent application of *binominal nomenclature* in the work in which the new name or nomenclatural act is published;
- *Derivation*: a name may be derived from any language, or even an arbitrary combination of letters if this is formed to be used as a word (not cbafdg);

Criteria of AVAILABILITY

- Names to be used as valid when proposed
- Publication of a name as a synonym does not thereby make the name available;
- **New requirements for species-group names published after 1999:**
 - **Explicit indication of name as intentionally new**
(n.sp., gen. nov., nom. nov.,...)
 - **Fixation of name-bearing types explicit designation & deposition**

Article 10. Provisions conferring availability

[10.1.](#) General conditions to be met

[10.2.](#) Availability of infrasubspecific names

[10.3.](#) Availability of names proposed for collective groups and ichnotaxa

[10.4.](#) Availability of names for divisions of genera

[10.5.](#) Availability of names of taxa later but not at first classified as animals

[10.6.](#) Effect of invalidity upon availability

[10.7.](#) Availability of names not listed in a relevant adopted Part of the List of Available Names in Zoology

Article 11. Requirements

[11.1.](#) Publication

[11.2.](#) Mandatory use of Latin alphabet

[11.3.](#) Derivation

[11.4.](#) Consistent application of binominal nomenclature

[11.5.](#) Names to be used as valid when proposed

[11.6.](#) Publication as a synonym

[11.7.](#) Family-group names

[11.8.](#) Genus-group names

[11.9.](#) Species-group names

[11.10.](#) Deliberate employment of misidentifications

Article 12. Names published before 1931

[12.1.](#) Requirements

[12.2.](#) Indications

[12.3.](#) Exclusions

Article 13. Names published after 1930

[13.1.](#) Requirements

[13.2.](#) Family-group names

[13.3.](#) Genus-group names

[13.4.](#) Combined description of new genus-group taxon and new species.

[13.5.](#) Combined description of new family-group taxon and new genus.

[13.6.](#) Exclusions

Article 14. Anonymous authorship of names and nomenclatural acts

Article 15. Names and nomenclatural acts published after 1960

[15.1.](#) Conditional proposal

[15.2.](#) Names published after 1960 with the term "variety" or "form" excluded

Article 16. Names published after 1999

[16.1.](#) All names: intention of authors to establish new nominal taxa to be explicit.

[16.2.](#) Family-group names: type genus to be cited

[16.3.](#) Genus-group names: ichnotaxa and collective groups

[16.4.](#) Species-group names: fixation of name-bearing types to be explicit

Article 17. Names found to denote more than one taxon, or taxa of hybrid origin, or based on parts or stages of animals or on unusual specimens

Article 19. Status of emendations, incorrect spellings, and mandatory changes

[19.1.](#) Unjustified emendations and incorrect spellings

[19.2.](#) Justified emendations

[19.3.](#) Multiple original spellings

[19.4.](#) Mandatory changes

Article 20. Genus-group names ending in -ites, -ytes, or -ithes given to fossils

What's in a name? Nomenclature as a metalanguage

Scientific names are Latin

Rules of Latin linguistics apply:

e.g. agreement in gender

Thyonidium magnum Ludwig, 1882

Phyllophorus magnus; Ludwig 1889-92

Neothyonidium magnum; Heding & Panning 1954

Massinium magnum; Samyn & Thandar 2003



Formation of species names

Rules of Latin linguistics apply:

e.g. agreement in gender

Thyonidium magnum Ludwig, 1882

Phyllophorus magnus; Ludwig 1889-92

Neothyonidium magnum; Heding & Panning 1954

Massinium magnum; Samyn & Thandar 2003



When named:

After **features**: adjectives

After **other species**: noun in apposition, adjective

After **people**: noun in genitive case

After **places**: adjectival toponym

Formation of species names

One-letter difference:

Genus ***Eucosma*** (Moths, Northern Mexico:
Kearfoot, 1907)

E. fandana

E. gandana

E. handana

E. kandana

E. mandana

E. nandana

E. pandana

E. randana

E. sandana

E. tandana

E. vandana

E. wandana

E. xandana

E. yandana

E. zandana



Formation of species names

Can be long

Gammaracanthuskytodermogammarus loricatobaicalensis

Dybowski, 1927 (an amphipod)

Can be short

Ia io Thomas, 1902 (a bat)

Can be a lot of fun

Ytu brutus Spangler, 1980 (a waterbug)

Stanksopp (*Phallus impudicus*)
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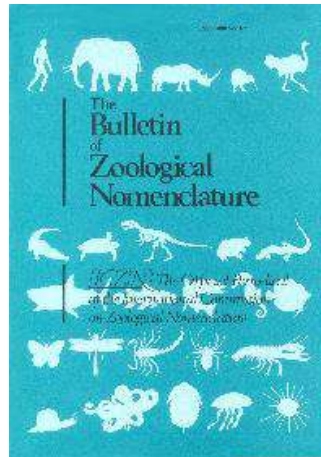
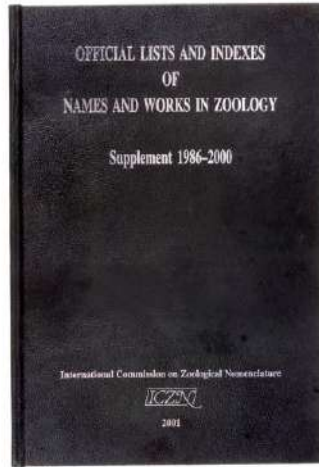
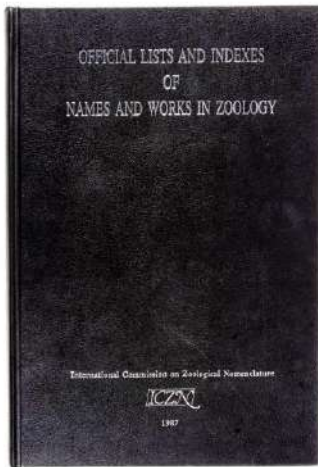
Phallus impudicus Linnaeus, 1753



Clitoria ternatea Linnaeus, 1753

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- <http://scientific.thomson.com/support/products/zr/zoological-glossary/>
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Using sea cucumbers to illustrate the basics of zoological nomenclature

Yves Samyn,¹ Alexander Kerr,² Mark O'Loughlin,³ Claude Massin,⁴ David L. Pawson,⁵ Francis W.E. Rowe,⁶ Scott Smiley,⁷ Francisco Solís-Marín,⁸ Ahmed S. Thandar,⁹ Didier VandenSpiegel¹⁰ and Gustav Paulay¹¹

Abstract

In addition to a brief account of the need to have unique and unambiguous scientific names for taxa, this paper, annotated with examples of sea cucumbers, explains the basics of zoological nomenclature. In doing so it aims to reduce the confusion that exists among various breeds of end-users of taxonomists who may not fully understand the seemingly arbitrary and often volatile nature of scientific names. This paper also aims to provide teachers and students with a comprehensible account of the basic principles of zoological nomenclature.



Thank you for
your attention