Names are tags, like codes or passwords, that form a link between nature and our information about nature.

If this link is broken information is lost.

"Nomina si nescis, perit et cognito rerum"

[Who knows not the names, knows not the subject] Linnaeus, Criticca Botanica, 1773.
Biosystematics

Describing species = assigning names to groups (populations) = classification

Identification

Character evolution

Descriptions

Classification

Phylogeny

Biogeography

Biosystematics - readings

Lecture 5: Nomenclature & Classification


Naming

Basically a two step process

1. Taxonomist finds something thought to be unnamed, "new"

2. A name is given by publishing (according to the rules of nomenclature) at which point the name is introduced to the literature, i.e. it is "official"

NOTE: currently the publication can be in any of a large variety of formats and is not required to be registered with a central database of names.

Naming

Step 1 - "Is it a new species?" (minimum)

1. Are the diagnostic (unique) characters constant across large samples within the genus?

2. Have you compared the new species with descriptions of all its congeners? (globally?)

3. If the group has not been revised (well), have you examined the primary type specimens of all congeners?

Naming

Step 1 - "Is it a new species?" (better)

1. Do you have samples large enough to obtain statistically significant differences in quantitative traits?

2. Do you have DNA data that indicates a "gap" exists between the new species and congeners?

3. Do you have data that indicate reproductive barriers exist? (e.g. courtship songs, pheromones)

Naming

Comment on uniqueness…

- Early taxonomists dealt mostly with the "obvious" cases - wide phenotypic gaps

- Current taxonomists deal more & more with difficult cases: cryptic species, incipient species, etc. - narrow gaps

- Taxon dependent (e.g. birds vs insects)
Naming
Step 2 - Publishing
- See Winston (1999) Describing species
- Rules of International Code of Zoological Nomenclature must be followed (for animals) - this lecture

History of the Code
Linnaean system of binominal nomenclature
- Vast improvement over phrase names and prior naming systems BUT...
- No stability, Linnaeus & users of his system would change names to “improve” them (e.g. change the name to better reflect distribution)
- Lamarck, 1798, criticized lack of rules, instability, & chaos under the Linnaean system

History of the Code
Problem: no rules to ensure species were known by a single name
- Early 1800s exploration of tropics revealed immense & surprising diversity
- To stabilize names, in 1813 a Swiss botanist, Augustin Pyramus de Candolle, introduced the concept of Priority

History of the Code
Priority - oldest name is used
- Starting at a fixed date:
  - 1758 - zoology (except spiders in Clerck’s 1757 publication)
  - 1753 - botany
- Exceptions exist for cases when principle of priority would result in extreme, if temporary, instability

History of the Code
The first Zoological Code
- 1843 the “Strickland” code
- Formed by members of the Strickland Commission, including Charles Darwin
- Revisions resulted in two competing codes
- A governing body, International Commission for Zoological Nomenclature, 1895

ICZN - goals for the code
Conflicting goals of taxonomic classification (not nomenclature)
- provide a unique, stable name (ideally, would never change)
- provide a natural classification (requires change if new data reveal new relationships)
<table>
<thead>
<tr>
<th>ICZN - goals for the code</th>
<th>Key elements of the ICZN</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Promote stability</td>
<td>(International Code of Zoological Nomenclature)</td>
</tr>
<tr>
<td>2. Promote universality</td>
<td>1. Neutrality - doesn’t infringe on taxonomic judgment</td>
</tr>
<tr>
<td>3. Names will be unique &amp; distinct</td>
<td>2. Will not solve rank placement problems</td>
</tr>
<tr>
<td>- By establishing rules for:</td>
<td>Nomenclature ≠ Taxonomy</td>
</tr>
<tr>
<td>- Publication</td>
<td></td>
</tr>
<tr>
<td>- Priority</td>
<td></td>
</tr>
<tr>
<td>- Typification</td>
<td></td>
</tr>
<tr>
<td><strong>Current Code: edition 4, 1999.</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nomenclature:</th>
<th>More Key elements of the ICZN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provisions for the formation and use of a system of names <strong>(rules)</strong></td>
<td>(International Code of Zoological Nomenclature)</td>
</tr>
<tr>
<td>e.g. nomenclatural status of a name - its standing in nomenclature, does it conform to the rules?</td>
<td>1. <strong>Typification</strong> - the name-bearing <strong>type</strong>, all names are tied to a type specimen</td>
</tr>
<tr>
<td><strong>Taxonomy:</strong> The theory &amp; practice of classifying organisms <strong>(opinions)</strong></td>
<td>2. <strong>Principle of Priority</strong> - oldest name is valid</td>
</tr>
<tr>
<td>e.g. taxonomic status of a name - is it valid, is it unique to one species?</td>
<td>3. <strong>Principle of Stability</strong> - case by case basis to prefer stability over priority (in rare cases)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Priority &amp; Stability</th>
<th>Priority &amp; Stability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Priority works to</td>
<td><strong>Nomina obita (a nomen oblitum)</strong> - “forgotten name” - many cases of unknown publications</td>
</tr>
<tr>
<td>1) Recognize first scientist to publish and</td>
<td>an older name not used in over 50 years can be suppressed as a nomen oblitum if following the principle of priority would destabilize usage</td>
</tr>
<tr>
<td>2) Promote stability because there can only be one “first” publication whereas there can be many arguments for “better” names</td>
<td>imagine if someone found an older name for <em>Drosophila melanogaster!</em></td>
</tr>
<tr>
<td>3) However, there are exceptions…</td>
<td></td>
</tr>
</tbody>
</table>
Systematics - BIO 615

Priority & Stability

Nomina oblita (a nomen oblitum) - "forgotten name"

- e.g. Nicrophorus americanus Olivier 1790
  - well known name

- Nicrophorus orientalis Herbst 1784
  - never used name

When invoked the valid name becomes a nomen protectum

ICZN Rules

Failure to follow the rules of proper publishing can result in a nomen nudum - a "naked name," a name that was not published properly - fails to be established

a nomen nudum is not available

an available name has been published properly, is available for use as a taxon name

ICZN Rules - publication

To be available a name must:

1. Be published in the meaning of article 8
   8.1.1 + 8.1.2 +
   "8.1.3 it must have been produced in an edition containing simultaneously obtainable copies by a method that assures numerous identical and durable copies"

Web pages do not assure identical or durable copies

ICZN Rules - publication

To be available a name must:

2. Be spelled using only the 26 letters of the Latin alphabet

3. Be a word (e.g. not ‘cabadg’)

Also recommendations (not requirements):

- e.g. do not use unmodified vernacular (common) names, or offensive names

ICZN Rules - publication

Recent case of the new monkey described without a type specimen - photo only.


Caused a debate - Justified due to conservation status? Small population size?

Bad idea to describe new species based on photos only.

No voucher for independent verification.

ICZN Rules - publication

Amendment of Articles 8, 9, 10, 21 and 78 - ZooKeys 219: 1–10, doi: 10.3897/zookeys.219.3944

*The requirements for electronic publications are that:

1) The work be registered in ZooBank before it is published

2) That the work itself state the date of publication and contain evidence that registration has occurred

3) That the ZooBank registration state both the name of an electronic archive intended to preserve the work and the ISSN or ISBN associated with the work.
"It's no good to science if it's running around free."

Link Olson

**Example of simple synonymy list**

**Nicrophorus americanus** Olivier, 1790

**Synonyms:**

Silpha (*Nicrophorus*) orientalis Herbst, 1784:77 [nomen oblitum]

*Nicrophorus americanus* Olivier, 1790:(no. 10):6

*Nicrophorus virginicus* Frölich, 1792:123

*Nicrophorus grandis* Fabricius, 1792a:247 [type: ZMUC, 2 specimens]

Valid name = senior synonym
other, invalid synonyms = junior synonyms

Some species, e.g. swan mussel, *Anodonta cygnea*, have hundreds of synonyms (400+)

**Example of bibliographic synonymy list**

*Nicrophorus insularis* Grouvelle, 1893: 161

Type locality: "Sumatra", Indonesia

Type depository: MNHN: Paris [!]

1893       Grouvelle: 161 (JA: descriptions in French)  >> Orig. comb.: Necrophorus insularis [!]

1903       Portevin: 331 (JA: descriptions in French)  >> as valid species

1920       Portevin: 399 (JA: descriptions in French)  >> as valid species

1922       Portevin: 55 (JA: descriptions in French)  >> New syn./status as N. nepalensis var. insularis

1923       Portevin: 307 (JA: key, descriptions in French)  >> as N. nepalensis var. insularis

1926a     Portevin: 208 (Book: revision: key, descriptions & catalog in French)  >> as N. nepalensis var. insularis

1928       Hatch: 129 (Book Chapter: catalog in English)  >> as N. nepalensis var. insularis

1964b     Hlisnikovsky: 244 (JA: descriptions in German)  >> New status as N. nepalensis form insularis [ab. intended?]

1975       Emetz & Schawaller: 230 (JA: checklist in German (English summary))  >> as N. nepalensis ab. insularis

1990       Hanski & Niemelä: 149 (Book Chapter: in English)  >> New status as valid species

1991       Hanski & Krikken: 195 (Book Chapter: in English)  >> as valid species

2001       Peck: 94 (JA: in English)  >> as valid species

* = design. lectotype

**Example of bibliographic synonymy list**

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1893       Grouvelle: 161 (JA: descriptions in French)  >> Orig. comb.: Necrophorus insularis [!]

1903       Portevin: 331 (JA: descriptions in French)  >> as valid species

1920       Portevin: 399 (JA: descriptions in French)  >> descrip. of variation: 1 unavailable name

1926a     Portevin: 253 (Book: revision: key, descriptions & catalog in French)  >> New syn. of N. nepalensis var. insularis

1928       Hatch: 129 (Book Chapter: catalog in English)  >> as syn. of N. nepalensis var. insularis

1993       Kozminykh: 67 (JA: key, descriptions, regional in Russian)  >> as syn. of N. nepalensis

herein  >> REVISED SYNONYM of N. insularis Grouvelle

**Reading a Synonomy list (table)**

*Methia neycydalea* (Fabricius) NEW COMBINATION

*Saperda neycydalea* Fabricius, 1798: 148

*Saperda neycydalina*; Fabricius, 1801: 332. Schoenherr, 1817:439 UNJUSTIFIED EMENDATION

*Methia pusilla*; Salle, 1889: 468 (not Newman, 1840). MISIDENTIFICATION

*Thia jamaicensis* Gahan 1902: 44. NEW SYNONYMY

**Homonyms**

Two or more available names having the same spelling established for different taxa

**primary homonymy** - originally identical

Careosnina snail genus

Careosnina moth genus

**secondary homonymy** - later combined with the same generic name

homonyms across the plant & animal kingdoms are OK eg. Pieris & Pieris
Homonyms

**secondary homonym** - later combined with the same generic name

Ptomascopus morio Kraatz 1887

_Nicrophorus morio_ Motschulsky 1841

OK.. Until _P. morio_ is moved into the genus _Nicrophorus_ by Chapman in 1955

Then: _N. morio_ (Kraatz, 1887) - homonym of _N. morio_ Motschulsky 1841

---

Without the genus or author, an epithet is not necessarily unique!

**NOTE:** epithet ≠ species name

Among the ~7,000 species of non-marine Alaskan arthropods:

<table>
<thead>
<tr>
<th>epithet</th>
<th>count</th>
</tr>
</thead>
<tbody>
<tr>
<td>alaska</td>
<td>2</td>
</tr>
<tr>
<td>alaskae</td>
<td>6</td>
</tr>
<tr>
<td>alaskaensis</td>
<td>2</td>
</tr>
<tr>
<td>alaskana</td>
<td>8</td>
</tr>
<tr>
<td>alaskanum</td>
<td>2</td>
</tr>
<tr>
<td>alaskanus</td>
<td>9</td>
</tr>
<tr>
<td>alaskense</td>
<td>4</td>
</tr>
<tr>
<td>alaskensis</td>
<td>64</td>
</tr>
</tbody>
</table>

---

Types

“name bearers” - anchors to all formal names representative for the population

Regardless of opinions on species demarcations / limits / boundaries the type **always belongs** to the name with which it was published

A new name **must** have a declared type specimen (article 72.3 ICZN ed 4) as of 1999

---

**example**

Dr. Fraunhofer has been studying a snail species, _Hendersonia occulata_.

She finds this species has been cited 37 times in the literature.
Dr. Fraunhofer decides to check the type specimen & finds it in the Linnaean collection in London. Surprisingly, the holotype looks like this.

Further study reveals that the species everyone thought to be *H. occulata* isn’t. The actual *H. occulata* turns out to be rare & unstudied and the species everyone thought to be *H. occulata* is undescribed!

Why types? Why not descriptions?
Descriptions are interpretations of observations. Types are things (objective).

No type & poor description = *nomen dubium*.

Primary types - single specimen linked to name
1. **Holotype** - one specimen chosen by author in original description
2. **Lectotype** - one specimen taken from a type series during revisionary work
3. **Neotype** - all types lost, reviser may designate a new specimen as primary type

Types - secondary types
Many older names have no holotype but instead have a type series = **syntypes**

- when a lectotype is chosen from a syntype series the remaining specimens become **paralectotypes**
- when a holotype is designated, other specimens used become **paratypies**

These are secondary types and have no ‘legal’ standing.

Types - locality
The locality from which the holotype was collected is the **type locality**.

This is the best place to collect specimens if one is designating a neotype.

*Note on priority* - if two names have same date & month is unknown, “first reviser” gets to choose the valid name.
Systematics - BIO 615

Types above species group

The type of a genus is the type species - anchors the genus name

- anchors the genus name
  a) original designation
  b) subsequent designation
  c) monotypy (only one species in genus)

The family group name when writing in English is "a noun in the nominative plural"

Examples:
"The Tenebrionidae are widespread."
"The tenebrionids are widespread."
"That tenebrionid is black."

NEVER "That Tenebrionidae is black."

(see also the word 'data')

Classification

Femoria (Ectodermia) populella
Genus (subgenus) specific epithet

Apatosaurus (=Brontosaurus) giganteus
Genus (synonym of genus) specific epithet

Informal groupings:
  species group
  species complex

Terms - from lecture & readings

Priority Nomen dubium
Stability Primary type
ICZN Holotype
Typification Lectotype
Nomen oblitum Neotype
Nomen nudum Secondary type
Available (name) Paratype
Valid (name) Parallectotype
Syntypes (senior/junior, objective, subjective) Syntype
Primary & secondary homonymy Type locality
Type species
Type genus
### You should be able to

- Describe the conflicting goals of the code of nomenclature
- Describe the difference between nomenclature and taxonomy
- Describe the difference between an available name and a valid name
- Understand a synonymy table
- Explain any of the terms on the previous slide
- Explain why type specimens are so important
- Know how many names are in a species name