UDC Biology Revision Project: First Stage: Class 59 Vertebrates

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ABSTRACT: The paper presents and describes the work on the revision of the zoology of vertebrates, which is published in E&C 32 and introduced in UDC MRF 2010. This is the first stage of a larger project of revision, correction and update affecting all tables related to systematics (zoology, botany, microbiology and virology) to be undertaken from 2011-2013. The first part of the paper briefly introduces the current systems of classification of living and extinct beings, and explains how different perspectives with respect to the arrangement of biological entities have been reflected (or not) in the UDC schedules. The second part gives an overview of problems detected in UDC prior to this revision and explains solutions that were implemented in UDC MRF 2010 indicating tools and methods used in this work.

1. Sorting Out the 'Chaos' of Life

Systematic biology or systematics, on the one hand, univocally designates any organism by using the binomial nomenclature "genus + species", e.g. *Canis lupus* for wolves, or *Panthera leo* for lions. On the other hand, by placing a particular species in a certain position within a scheme, e.g. an evolutionary tree, according to particular, well-specified criteria (morphological, evolutionary, and/or genetic similarities), it allows the recognition of a set of relations (equality, subordination, etc.) which, from a biological point of view, have a series of precise meanings such as evolutionary derivation, evolutionary differentiation, etc.

The work of classifying all forms of life into structured systems has been the subject of debates throughout the history of science and controversies among scholars and researchers are still very common. Followers of the different classification principles are arguing for and initiating constant evolution and reformulation of the scheme.

Modern taxonomy has its roots in the work of Swedish botanist and zoologist Carl Linnaeus. In his "Systema Naturae" (1735-1758) he used and popularised the binomial nomenclature,[1] which provides simple, practical, unique and stable names for every organism, in contrast with common/folk names used until that time. He also developed a logical hierarchy, a structure which grouped living beings into categories known as taxonomic groups or taxa: *domains*, kingdoms, *phyla*, classes, orders, *families*, genera and species,[2] each superior rank containing all subordinated taxa (generic hierarchic relationships). The original criterion for classification in this first taxonomy was structural similarity of the species, and the final results were simple lists, rather than trees.

This system was later improved by adapting it to the Darwin/Wallace principle of common descent or "theory of organic or biological evolution". Following the publication of Charles Darwin's "On the Origin of Species" (1859), it became evident that classifications should reflect the phylogeny of organisms, their descent by evolution. This led to evolutionary taxonomy, also called evolutionary systematics or,

[1] Binomial nomenclature was actually created by Gaspard and Jean Bauhin in 1596. Linnaeus used it in a consistent way for the first time. The system is still employed nowadays.

[2] Those taxa in italics were not originally used by Linnaeus, but added in modern times, as well as others subdivisions of these ranks (not listed here).

in modern context, simply Linnaean taxonomy, which classifies living and extinct beings in a tree by using a combination of phylogenetic (evolutionary) relationships and those morphological features originally utilized by Linnaeus. Evolutionary taxonomy is the most widely accepted classification system in Biology nowadays; as major traits, it keeps binomial nomenclature and the hierarchical system of ranks/taxa, their definition and naming being strictly regulated by nomenclature codes.[3]

Despite its high acceptance in scientific circles, Linnaean taxonomy has been criticized in recent times. It is said to put an excessive emphasis on evolution (although, in the vast majority of cases, phylogenies are unknown), and to lack clear, explicit methods for classification. The main alternative to this traditional, rank-based system is Cladistics, also called phylogenetic systematics. Building on the work of German entomologist Willi Hennig ("Phylogenetic Systematics", 1966), this method is based on classifying organisms into clades, consisting of all the descendants of common ancestors and the ancestor itself. Hennig viewed the hierarchic Linnaean classification as a general reference system, but he argued that the utility of these schemes could only be maximized if they accurately reflected the phylogenetic relationships of the organisms involved. Therefore, Cladistics focuses on these phylogenetic relationships, in so far these can be detected, rather than structural similarity, taking advantage of the latest discoveries in genetics, especially in DNA sequencing methods.

Cladists assert that the hierarchy of the evolutionary tree is so deep and complex that it cannot be represented by a fixed number of levels. Therefore, phylogenetic systematics omits obligatory ranks and uses phylogenetic definitions instead of taxa names.[4] The clades and their relations are represented in cladograms: diagrams which show ancestral relationships between species. PhyloCode[5] and the Phylogenetic Diversity Index (both under development) work as rules for naming clades.

Taxonomy field has been undergoing major changes in recent times. An increasing number of scholars, previously using Linnaean taxonomy, have moved on to Cladistics and have since published academic literature studying, developing or simply using the system. At the same time Cladistics has equally become a subject of severe criticism (cf. Nixon, Carpenter & Stevenson, 2003). Although this scheme does not provide details or solutions for many important issues yet, it is being continually developed and improved, and it may prevail. However, until new evidence and clearer results are provided by cladists, Linnaean taxonomy is still considered the most solid option regarding the classification of organisms.

UDC schedules have used the Linnaean system from its first editions, and through this revision, this classification structure will be preserved. But, since the growing presence of Cladistics in academic sources cannot be ignored, some of its less controversial elements will be incorporated. By doing this, UDC systematics sections will benefit from the best of both classification currents, carefully avoiding the existing problems and conflicts.

2. The UDC systematic tables

UDC schedules organize living beings in the main class 5, specifically in subclasses 57, 58 and 59.

Following the Linnaean approach, organisms are ordered from simple to complex, i.e. from viruses to

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[3] The nomenclature codes are the International Code of Zoological Nomenclature (ICZN), the International Code of Botanical Nomenclature (ICBN, including fungi and cyanobacteria), the International Code of Nomenclature of Bacteria (ICNB) and others. There is a draft of a BioCode that would join all the existing Nomenclature Codes, and the PhyloCode for regulating phylogenetic (Cladistics) nomenclature.

[4] Phylogenetic taxonomy. Wikipedia. http://en.wikipedia.org/wiki/Phylogenetic_nomenclature

[5] http://www.ohio.edu/phylocode/

animals; and based on the biological knowledge of the time, e.g. the old division in kingdoms. Viruses are classed under class *578 Virology*. Bacteria and micro-organisms in general, are classified under class *579 Microbiology*, especially under class *579.8 Classification and systematics of micro-organisms*. That class includes class *579.81 Phototrophic bacteria* and class *579.88 Rickettsias*. *Mycoplasmas*. None of them have been revised since the creation of MRF in 1993.

Plants are organised under class *58 Botany*, within class *582 Systematic botany* (last revised in 1997, E&C 19). Interesting cases are *582.23 Bacteria* (revised in 1997, E&C 19), *582.24 Protista (Protoctista). Chromista. Protozoa* (revised in 1997, E&C 19), *582.26/.27* and *582.28 Fungi (Eumycota, Eumycetes). True fungi. Moulds. Mycology* (revised in 1997, E&C 19). These classes, for instance, are no longer considered a part of the Plantae kingdom, the subject of study of Botany. Finally, animals are grouped in class *59 Zoology* (partially revised in 1999, E&C 21), under class *592/599 Systematic zoology*.

A brief comparison between UDC systematic schedules and current, up-to-date taxonomies detected the following problems:

a) Outdated structure
   Both biological taxonomy and UDC classification need a clear and complete structure in order to accurately reflect the elements contained and their links. Outdated schemes usually lack important items, and many of them may be misplaced, thus reflecting erroneous relationships (the logic of hierarchy being disturbed) and providing incorrect information about included organisms. In the revision process, a number of outdated subdivisions and classes that needed correction and an alignment with the modern academic literature were detected.

b) Outdated and missing terminology
   Valid terminology is a key component of every classification. It is the main source of language terms, and provides both the main and the complementary access points. Outdated vocabulary, even if still useful, may be misleading if not properly identified and labelled. Equally, missing vocabulary means a serious deficiency of access points in the classification. These problems were found in UDC in both structurally outdated and in correct sections of the schedule.

c) Incorrect terminology, placement and relations
   Misspellings, typographic mistakes and "false synonyms" are formal errors that mar a controlled vocabulary: when searched/browsed, the correct versions of these terms cannot be found and thus, access points are lost. On the other hand, terminology may be incorrect in content, or be misplaced within the classification scheme, because of an outdated structure or a mistake when placing it and this may motivate erroneous relationships.

d) Artificial, UDC specific, separation of organisms
   The UDC approach to the classification of organisms by subsuming phenomena to the form of knowledge (disciplines) within which they are studied (disciplinary knowledge organization) causes some difficulties when it comes to biological entities. Systematic zoology and botany are divided into two tables, one belonging to Palaeontology and the other, to Zoology/ Botany; this way, the tree of Life is artificially separated into "extinct" (fossil) and "living" species. If this action only affected strictly extinct and strictly living classes, the division would not represent a serious problem; but there are many biological groups containing both types of organisms, and thus, there is an unnecessary (and sometimes hard to manage) duplication of terms.

The measures adopted to counteract these problems are detailed in the following section.

3. Revision Overview

3.1. Formulating General Revision Guidelines

The revision affecting systematics of vertebrates is part of a larger biology revision project, comprising the review of the entire facet of systematic biology in UDC. The knowledge, experience and feedback received in this initial stage will be used as a basis for the work ahead.

The revision of a classification used in practice over a long period of time such as UDC, has serious constraints. These usually lead to some kind of compromise between what may be the most logical structure and what can actually be fitted into the existing schedule, given the lack of available unused notations. Hence, the starting position of each revision is that the new structure has to fit somehow in the existing "incorrect" structure and changes should be always made in such a way that they disturb the system of use in the least possible way while improving logic and presentation. When it comes to systematic biology, changes were required in many sections. Occasionally entire arrays required moving to a more appropriate location, or particular set of classes were inaccurately placed within an array. Because of the fact that there were not many empty notations in class 59 available to be used for expansions, all changes entailed a careful analysis before being implemented. This was particularly so with respect to the following issues:

a) Cancellation of a notation in order to remove a class or concept from one hierarchy and to introduce it somewhere else was approached with utmost caution. One of the most important principles in revising UDC is that cancelled numbers should not be reused[6] and this principle was fully respected in class 59.

b) Change of class caption (text change) belonging to an existing notation in order to introduce a new concept i.e. class renaming, can be performed only when this represents a reasonable broadening or narrowing of the scope of the existing class. In any other instance, a cancellation and a posterior relocation should be considered as the only course of action (leading to point a) above).[7]

In order to avoid difficulties, the extant classification was kept as undisturbed as possible and good use was made of all available empty notations in the class. In addition to this, the existing classes were improved with correct and unambiguous naming and by providing detailed notes. Adding of new spans or range classes to improve the hierarchy, and creation of complex captions were extensively deployed throughout all revised classes. The objective was to achieve a structure that is more adequate and up-to-date with respect the modern biological science with an improved inner consistency and logic.

The idea is that upon this revision the UDC tables should support classification of different classes of living entities organized in ranks by Linnaean taxonomy, as well as access to some Cladistics terminology. Due to the abundance of Linnaean ranks (around 20) and the impossibility and impracticality of reflecting all of them in UDC schedules, only the most historically important and traditional ranks were included: phyla, some subphyla, classes, orders and some families. In the current revision it is intended that, whenever possible, systematic tables provide the level of detail up to "family", i.e. rank "family" becoming the lowest-level classes or basic divisions in UDC schedule. Valuable information on inferior ranks "genus" and "species" has been noted in the Including note of each class, where appropriate. As

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[6] The practice of cancelling one notation and immediately re-using the same notation in an entirely different meaning causes great difficulties in library collections using UDC for systematic arrangements and is considered highly undesirable approach in revising of the schedule.

[7] This principle ensures that even if collections continue in using the old number in its previous scope of meaning, in any given information exchange at least partial semantics can be preserved and documents indexed using such UDC numbers will remain classified correctly to a certain extent.

an exception, a few common species will be kept or added, having their own independent class number (e.g. horses, kangaroos, or dolphins), in cases when these concepts are frequently used and needed in many subject areas. Also, some ranks not included until now in UDC (suborders, superfamilies, subfamilies) were sparsely provided in the revised scheme; they were included as range or span classes in particular places where they were necessary for a better organization and understanding of the UDC schedule and the biological scheme it represents.

It is important to note that these taxonomic ranks (phylum class, etc.) are not indicated in class captions. Therefore, "class Mammalia" is simply quoted as "Mammalia". If explanations on this issue are required, they may be included in the class' notes. With this rule we achieve two goals:

a) Levels of biological classification may be reordered, e.g. a subfamily may become a family, and an order may become a suborder according to new authors and their discoveries. The entities a taxon comprises may change slightly, too. However, the name, e.g. "Mammalia", is usually respected. Therefore, if updating changes are needed for UDC in the future, they will affect just the notes, where the taxon-level, its links with other taxa and the entities the particular taxon comprises may be possibly described, and not the main structure of the UDC tables.

b) Even if Cladistics is a rank-free system, i.e. it does not use the Linnaean taxa/ranks, they share many of their most common names — i.e. Linnaean scientists have "class Mammalia" and cladists have a clade named "Mammalia". Therefore, a cladist and a Linnaean scientist will share e.g. the term "Lagomorpha" but not "order Lagomorpha" as a classification name. The meaning of the term may be different for both of them (they may include a different array of entities within it, according to their approach to taxonomy), but the term itself is still valid for them. Hence, UDC may be used by both of them in order to classify their documents, even if, at the moment, cladists should not take into account the notes of each UDC class (based on Linnaean taxonomy and, therefore, supposedly meaningless to them).

For the sake of consistence and homogeneity, captions do not include a description of the entities being comprised in the taxon. Even if the inclusion of common names of representative species may be of some help in certain simple cases, e.g. "Lagomorpha. Rabbits and hares", it can be problematic in others, because:

a) The list of entities included in a taxon may be too long, e.g. "Rodentia: Mice, hamsters, lemmings, Guinea pigs... and a long etc.

b) If the list is too long and it is reduced for the sake of brevity and usefulness, it may create unnecessary inconsistencies (all classes include all their members, but some do not) and confusions: users believing in the rule that "entities inside a class are quoted in its caption" may search in other classes for what they are looking if they do not find a result for their query in a class-caption that was reduced.

c) Common names are too general, and they may lead to confusion, e.g. in the current proposal there are up to 5 classes that may be described with the term "Possum". Obviously, they may be described with more special terms "Ringtail possums", "Brushtail possums", etc. but this may lead to the problem described in point d).

d) Some English common names for living beings have no translation in other languages, thus creating an unnecessary problem when translating UDC schedules. For instance, in the example explained in c) above, there would not be a proper, univocal translation into Spanish for "Ringtail possums", "Brushtail possums", "Striped possums", etc.

Throughout the revised tables, classes' captions (notation descriptions) are intended to remain as simple as possible, even if in some particular cases, complex captions have been used. These complex captions are proposed in the following cases:

a. To group equivalent-level taxa such as a series of subfamilies, superfamilies or suborders, especially: (1) when they are small taxa belonging to a common upper taxon that has been cancelled or is not shown in the schedule, e.g.

(+) 599.228 Burramyidae. Acrobatidae. Hypsiprymnodontidae. Tarsipedidae

And: (2) when these small, equivalent, related taxa cannot be provided with their own notation because they are unimportant or there is a lacking of space in the schedule.

b. To group non-equivalent related taxa, e.g. a taxon and its subtaxon. This rule has been applied only when the subtaxon is the only subgroup of the taxon and therefore, they are equivalent terms in practice, e.g.

(!) 599.311 Pholidota. Manidae
Including: Pangolins, scaly anteaters, or trenggilings (...)
IN: *Pholidota comprises a single living family, Manidae* (...)

Because of obvious reasons, complex captions do not include a description of the entities they comprise. This description has been placed in the Including note instead.

Span or range notation was used throughout the table whenever new upper taxa widely used in scientific literature needed to be included in a hierarchy in which there was no empty notation available. The range of these new taxa, if not obvious, may be explained in an "Including" note at a later stage. Equally, any complementary explanation may also be included, preferably in the general information note (IN) field.

3.2. Unifying schedules

The division of the Tree of Life into an "extinct" and a "living" section is an artificial approach based on a disciplinary point of view which does not work well for systematics. Based on this approach, for instance, a group as Mammals is divided into organisms studied by Palaeontology (species known through their fossil remains) and those studied by Zoology (living and recently extinct species).

The division would not cause any issues if it would be a simple placing of strictly extinct classes into Palaeontology schedules and strictly living classes in Zoology. But many animal and vegetal groups have both extinct and living species, and therefore, they should be present in both schedules. Up until now, the practical solution provided by UDC was the use of parallel divisions: taking Zoology tables as the reference model, Palaeontology can be subdivided in parallel.

With this revision we unified all vertebrates, living and extinct, into a single schedule Zoology. Strictly extinct groups have their captions labelled with an "(extinct)" qualifier. If the palaeontological aspect of a particular zoological group needs to be expressed, the Palaeontology classes (and the parallel division system) are still valid. And if just the zoological aspect is needed, complete (and not divided) groups are thoroughly described in Zoology, saving complicated re-directions and cross-references.

The unification of all vertebrates in a single schedule, as introduced with this revision, could lead to further improvements of the UDC synthetic structure, e.g. the conversion of these tables into auxiliary numbers that may be easily combined with other main numbers to denote specific subjects from a faceted approach point-of-view.

3.3. Updating of the structure

Facing the second problem of current UDC systematics stated above entailed a previous careful review of available taxonomy tables supported by modern scientific literature. These sources were useful for building preliminary drafts of how UDC schedules should look like (see Section 5).

Once preliminary drafts of correct systematics classification were built, they were compared with current UDC schedules. Problematic areas were detected, and a proper solution was defined and included in the proposal, according to the rules mentioned in the section "General guidelines" above. In most cases, adding notes, range classes or new, missing classes was enough for updating the structure; but groups such as *598.1 Reptiles* required significant structural changes, comprising both the inclusion of a high number of new classes and the cancellation and re-location of existing, wrongly placed ones.

3.4. Correcting, updating and adding terminology

Many terms included in class *59 Vertebrates* were incorrect or outdated. Substantial vocabulary was missing, or did not follow scientific guidelines regarding designation of organisms.

We made sure that captions included the Latin name of the taxon, since these terms are regulated by international standards and are more universally understandable and easy to identify and translate accurately (an important feature to be taken into account for non-English UDC editions). English equivalences of Latin terms have been included in captions only when they were clear and well known, e.g. "Mammalia. Mammals"; "Aves. Birds"; "Pisces. Fishes"; "Insectivora. Insectivorous mammals"; "Chiroptera. Bats"; etc. For the rest of cases, equivalences were added in the Including note, where appropriate.

Including notes play a central role in this proposal, providing space for vocabulary expansion, without complicating and expanding class captions. In the basic, lowest-level classes (taxon-level "family"), these notes have been used to provide a description of the entities the class includes, e.g.

(!) 599.324.7 Caviidae
Including: Cavies or Guinea pigs (genera Cavia, Galea, and Microcavia);
maras or Patagonian hares (genus Dolichotis); rock cavies (genus Kerodon);
and the Capybara or Water Hog (genus Hydrochoerus)

The text of notes has been written in a concise style, reflecting the main species or groups of species by using the English common names and their Latin genera. This way, if the common denominations are unknown to UDC users or have no translation or equivalence in other languages, their internationally accepted and regulated Latin counterparts (genera) become the main reference for classification. Also, adding this Latin vocabulary provides a good opportunity to connect UDC with modern taxonomy tables and to enrich alphabetical indexes (and derived thesauri).

Just a selection of species has been included in these notes, and just a selection of genera for these species. Therefore, the list of entities described in each class is not always comprehensive. When the list of species was too long (because of the importance of the biological taxon, e.g. some groups within Rodentia), the better-known or commonest species have been placed in the first place. This way, the most-known species may be found in an easier way, e.g.

(!) 599.325.1 Leporidae
Including: The European Rabbit (genus Oryctolagus); hares and jackrabbits
(genus Lepus); rabbits and cottontails (genus Sylvilagus); red rock hares
(genus Pronolagus); and striped rabbits (genus Nesolagus)

Another convention introduced to assist in understanding the terminology is based on the presentation of names in English. When groups of species with a common name have been listed, these names are not preceded with a definite article. On the other hand, when a single species has been quoted, its name is preceded with 'the' and it begins with an initial capital letter, e.g.

(+) 599.323.46 Deomyinae
Including: Spiny mice (genus Acomys); the Link Rat (genus Deomys); brush-furred rats (genus Lophuromys); and the Rudd's Mouse (genus Uranomys)

Every group of species (or single species) in the Including note text have been separated by a semicolon, except when there are just two elements. This way, it is clear when the schedule is quoting several species belonging to a single genus, or groups with no genus indicated (because they belong to too many genera), e.g.

(!) 599.322.2 Sciuridae. Gliridae
Including: Sciuridae comprises tree squirrels (genus Sciurus); American red squirrels (genus Tamiasciurus); "true" flying squirrels (genera Petinomys and Hylopetes); prairie dogs (genus Cynomys); chipmunks (genus Tamias); Oriental giant squirrels (genus Ratufa); the Pygmy Squirrel (genus Sciurillus); dwarf squirrels (genus Microsciurus); palm squirrels (genus Funambulus); Asian ornate squirrels (genera Callosciurus and Sundasciurus); spiny and ground squirrels; African squirrels; marmots (genus Marmota); and susliks (genus Spermophilus). Gliridae includes dormice

[NB. "Flying squirrels" have too many genera, so they are not quoted; anyways, they are an independent group of the following one, "Prairie dogs". If a comma is used here instead of a semicolon, confusions may arise, and user may believe that both "flying squirreles" and "prairie dogs" belong to "genus Cynomys". The same case happens with "African squirrels". Note "the Pigmy Squirrel", a single species in high caps and with definite article. Also note "Spiny and ground squirrels", a group of species (no article, low caps) with no genera added].

In upper-level classes (phylum, class, order, etc., all of them above basic, lowest-level classes "family"), including notes comprise, when appropriate, a general description, equivalent to the list of entities in the lowest-level classes, e.g.

(!) 599.1 Prototheria
Including: Monotremata (extant monotremes or egg-laying mammals) and related extinct species

When upper-level classes cannot be subdivided, e.g. when it is a class containing small subclasses that do not need to have their own notation, these notes describe the subclasses and the entities they comprise, e.g.

(+) 599.234 Peramelemorphia
Including: Thylacomydae (the Bilby, genus Macrotis); Chaeropodidae (the Pig-footed Bandicoot, genus Chaeropus); and Peramelidae (bandicoots, genera Isodon, Perameles, Peroryctes, Echymipera, and Microperoryctes)

In complex captions including equivalent taxa, these notes describe the entities comprised by each item in the caption (see "Sciuridae. Gliridae" above). Complex captions describing subordinated taxa have been treated as simple captions (see "Pholidota. Manidae" above). For both cases, explanations, definitions or concepts have been placed in a general information note (IN) when necessary.

For the update of terminology, scope notes (SN) were used. In this proposal, they include the following indications, when necessary:

a. "Class here..." renamed classes, i.e. old classes that have a new name, especially where confusion may arise, e.g.

(+) 597.315.6 Squatiniformes. Squatinidae
Including: Angel sharks (genus Squatina)
SN: *Class here outdated taxon Squatinomorphi*
IN: *Squatiniformes comprises a single living family: Squatinidae*

b. "Class here..." revised classes, i.e. classes that are situated in new places, e.g.

(!) 599.324.7 Caviidae
SN: *Class here the Capybara*
IN: *The Capybara used to be included in an independent taxon: Hydrochaeriedae*

Explanations related to the re-classification have been added in an "IN" note, where appropriate.

c. "Use this number to denote..." and "Class here..." in general. e.g.

(!) 597.31 Elasmobranchii
SN: *Class here sharks in general*

d. "For X, see Y", e.g.

(+) 597.6/.9 Amphibia
SN: *Class here amphibians in general. For herpetology, see 598.1*

e. "Not to be confused with", plus a redirection to a class with its notation — common name, and class and notation between brackets, e.g.

(+) 598.166.2 Bipedidae
Including: Ajolotes (genus Bipes)
SN: *Not to be confused with the Axolotl (under 597.97 Ambystomidae)*

General information notes (IN) have been used in this proposal for adding complementary, extended information that is not essential for understanding or disambiguating the meaning of the class but may be useful in providing access points. They typically contain the following information:

a. Explanation of alternative names, especially when disused but still common, e.g.

(+) 597.23 Anaspida (fossil)
IN: *Anaspida used to be called Anaspidiformes*

(!) 597.2 Agnatha. Ostracoderms
IN: *Agnatha is also known as Cephalaspidomorphi*

b. Explanation of alternative classification, especially when disused but still common., e.g.

(!) 597.523 Osteoglossiformes. Hiodontiformes
IN: *Hiodontiformes used to be included in Osteoglossiformes*

(!) 597.554.1 Aulopiformes
IN: *Aulopiformes is sometimes included in an independent taxon, Cyclosquamata*

(+) 597.72 Ichthyophiidae
IN: *A number of species belonging to formerly independent taxon Uraeotyphlidae are sometimes included here*

c. Information on incorrect and alternative spellings or names, e.g.

(!) 597.8 Anura
IN: *Anura is sometimes incorrectly termed Salientia*

(+) 598.182.2 Crocodylia
IN: *Also spelled Crocodilia*

d. Explanation of subordinated taxa in the same caption, e.g.

(!) 597.21 Petromyzontiformes. Petromyzontidae
IN: *Petromyzontiformes comprises a single living family: Petromyzontidae*

e. General information that may be useful for UDC users, e.g.

(+) 598.1/.2 Sauropsida
IN: *Sauropsida is a group of amniotes that comprises all existing reptiles and birds, including dinosaurs*

f. Brief explanation of the reasons for redirections and use of new terminology, and other comments, e.g.

(!) 597.44 Halecomorphi
IN: *From a scientific point of view, class Halecomorphi is deprecated. It is preserved in UDC for convenience of subject indexing*

(+) 598.116/.119 Parareptilia (fossil)
IN: *Parareptilia is an outdated taxon that has been revived in recent years by Cladistics. Even if its range is still debated, it basically includes fossil Anapsida*

We will try to apply the same principles of presentation and formatting consistently in further stages of the revision throughout all biology classes. The plan is also to make full use of UDC MRF database fields such as editorial note, notation history and concept history to indicate all information relevant for tracing the changes and resources used in this revision and making sure that there is an accurate link between cancelled classes and classes replacing them. During the biology revision project we will also start to utilise more frequently other features of the database such as keyword index field, subject alphabetical index field and mapping fields. We hope that in this way biology schedules will become a powerful tool for online use while retaining their practicality, scalability and usability in all levels of printed editions.

4. Sources and references

The following online databases were used as references:

- The Species 2000 & ITIS Catalogue of Life. http://www.catalogueoflife.org/
- Tree of Life web project. http://tolweb.org/tree/

- Encyclopaedia of Life. http://www.eol.org/
- The Taxonomicon & Systema Naturae 2000. http://taxonomicon.taxonomy.nl/
- The Paleobiology Database. http://paleodb.org/

As additional sources for particular sections, the resources listed below were also taken into account:

- **Hartwig, Walter Carl** [ed.] (2002). *The Primates Fossil Record*. Cambridge: University Press.
- **Mayr, Ernest; Bock, W.J.** (2002). Classifications and other ordering systems. *Journal of Zoological Systematics and Evolutionary Research*, 40, 169-194. Berlin: Blackwell Verlag, http://www.mobot.org/plantscience/resbot/EvSy/PDF/Bock-2002-class-Mayr.pdf.
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