

Nomenclature, Types

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International Commission on Zoological Nomenclature

The International Commission on Zoological Nomenclature (ICZN) provides and regulates the system for ensuring that every animal has a unique and universally accepted scientific name. Its financial and management affairs are handled by the International Trust for Zoological Nomenclature (ICZN), a charity (not-for-profit company) registered in the U.K.

This is essential to all areas of zoology including medical and veterinary science, agriculture, horticulture, the environment and conservation and geology and palaeontology. The maintenance of taxonomic standards and a consistent and universal nomenclature are fundamental to current efforts to conserve biological diversity and it is the unique role of the commission to maintain such international standards nomenclature.

The commission was set up in 1895. It consists of 25 members from 20 countries. It operates in two main ways. First, it publishes the International Code of Zoological Nomenclature containing the rule universally accepted as governing the application of scientific names to all organisms which are treated as animals. Secondly, it gives rulings on individual nomenclatural problems brought to its attention, so as to achieve internationally acceptable solutions. Several million species of animals are recognised and more than 2000 new generic names and 15000 new specific names are added to the zoological literature every year. With such a multiplicity of names, problems are bound to occur. The commission operates through its quarterly journal, the Bulletin of Zoological Nomenclature,

in which problems needing a formal decision by the commission are published for discussion by the zoological community.

The commission is under the auspices of the International Union of Biological Sciences (IUBS). The American Association for Zoological Nomenclature and the European Association for Zoological Nomenclature facilitate liaison between zoologists and the ICZN and provide financial support for ICZN.

Nomenclature

The international code of zoological nomenclature is a system of rules and recommendations authorized by the International Congresses of Zoology. It deals with a set a regulations in zoological nomenclature. The object of “code is to promote stability and universality in the scientific names of animals and ensure that each name is unique and distinct. All its provisions are subservient to these ends” (Mayr, 1969). The valid rules of zoological nomenclature are contained in a document entitled, ‘The International Code of Zoological Nomenclature’.

Zoological Nomenclature is a system of scientific names applied to taxonomic units of animals inclusive of both extant and extinct groups.

In finfish taxonomy, certain rules are to be strictly followed in establishing the validity of a taxon. The Linnaean hierarchial system is followed in the classification of finfishes. The Linnaean hierarchy is a structure of categorical ranks for taxa where each category except the lowest includes one or more subordinate categories. The generally accepted categories are as follows:

- Kingdom
- Phylum
- Subphylum
- Class
- Subclass
- Superorder
- Order

Suborder
Superfamily
Family
Subfamily
Genus
Subgenus
Species
Subspecies

Normally, in the classification of finfishes the six categories namely, species, genus, family, order, class and phylum are followed. In this hierarchical system, the higher category or higher taxon includes kingdom to genus level, species and subspecies are designated as lower taxon.

A finfish order always ends with 'formes' (e.g. Cypriniformes, Clupeiformes, etc.), Superfamily has a standardized ending 'oidea' (e.g. Clupeoidea, etc.), Family of finfish ends with 'idae' (e.g. Scombridae, Sciaenidae, etc.) and tribe ends with 'ini' (e.g. Carangini, etc.).

The binomial nomenclature used for animals and plants is largely derived from Latin, as are the names used for higher taxa such as families and orders. The words listed below are the common adjectives and other modifiers that repeatedly occur in the systematic names of many organisms. Not all the words or parts of words used in scientific names for living things are derived from Latin. Some are derived from Greek, some from languages local to the places where the organisms are found and many from the names of the people who first described a species or other taxon. However, all are treated grammatically as if they

were Latin words. In particular, this means that to indicate possession, the endings *-a* and *-us* turn into *-ae* and *-i* respectively and non-Latin names of people add *-i* if male and *-ii* if female. This list of Latin and Greek words commonly used in systematic names is intended to help those unfamiliar with classical languages understand and remember the scientific names of organisms.

Naming with latin/ greek words

Latin/Greek word or part word	Language L = Latin; G = Greek; LG = similar in both languages	English translation
<i>albus</i>	L	white
<i>arcturus</i>	L	northern
<i>argentatus</i>	L	silvery
<i>australis</i>	L	southern
<i>bengalensis</i>	L	Bengal, India
<i>borealis</i>	L	northern
<i>brachy</i>	G	short
<i>carbo</i>	L	coal
<i>caulos</i>	G	stem, stalk
<i>caudatus</i>	L	tailed
<i>cephalus</i>	G	head
<i>chloro</i>	G	green
<i>-cola</i>	L	-dweller

<i>cristatus</i>	L	Crested
<i>cyano</i>	G	blue-green
<i>dactylus</i>	G	finger or toe
<i>deca</i>	G	ten
<i>dermis</i>	G	skin
<i>di-</i>	G	two-
<i>diplo-</i>	G	double
<i>dodeca</i>	G	twelve
<i>dolicho-</i>	G	elongated
<i>domesticus</i>	L	domestic or house
<i>dorsalis</i>	L	back
<i>dukhunensis</i>	L	Deccan plateau, India
<i>echinus</i>	G	spine
<i>ennea</i>	G	ninety
<i>erythro</i>	G	red
<i>familiaris</i>	L	common

<i>flora</i>	L	flower
<i>folius</i>	L	leaf
<i>fuscus</i>	L	dark brown
<i>fulvus</i>	L	yellow
<i>gaster</i>	G	belly
<i>glycis</i>	G	sweet
<i>halo</i>	G	salt
<i>hecta</i>	G	hundred
<i>hendeca</i>	G	eleven
<i>hepta</i>	G	seven
<i>heptaconta</i>	G	seventy
<i>hexa</i>	G	six
<i>hexaconta</i>	G	sixty
<i>hibernicus</i>	L	Irish
<i>horlensis</i>	L	garden
<i>icosa</i>	G	twenty
<i>indicus</i>	L	Indian

<i>lateralis</i>	L	side
<i>leucus</i>	G	white
<i>lineatus</i>	L	lined or striped
<i>ludovicani</i>	L	Lewis's
<i>maculatus</i>	L	spotted
<i>major</i>	L	greater
<i>maximus</i>	L	largest
<i>melanus</i>	G	black
<i>minimus</i>	L	smallest
<i>minor</i>	L	smaller
<i>mono-</i>	G	one-
<i>montanus</i>	L	mountains
<i>morphos</i>	G	shape
<i>morph-</i>	G	shape
<i>mauro-</i>	G	dark
<i>niger</i>	L	black
<i>nona</i>	L	nine

<i>nothos</i>	G	false, bastard
<i>notos</i>	G	southern
<i>novaehollandiae</i>	L	Australian
<i>novaeselandiae</i>	L	New Zealand
<i>noveboracensis</i>	L	New York
<i>obscurus</i>	L	dark
<i>occidentalis</i>	L	western
<i>octa</i>	G	eight
<i>octacota</i>	G	eighty
<i>oeos-</i>	G	tubular
<i>officinalis</i>	L	medicinal
<i>orientalis</i>	L	eastern
<i>ortho-</i>	G	straight
<i>pachys</i>	G	thick, stout
<i>parvus</i>	L	small
<i>pedi-</i>	L	feet
<i>pelagius</i>	G	oceanic

<i>penta-</i>	G	five-
<i>pentaconta</i>	G	fifty
<i>petra</i>	G	rocky, stony
<i>phyllo</i>	G	leaf
<i>phyton</i>	G	plant
<i>platy</i>	G	flat
<i>protos</i>	G	first
<i>pteron</i>	G	wing
<i>punctatus</i>	L	spotted
<i>rhiza</i>	G	root
<i>rhytis</i>	G	wrinkled
<i>rubra</i>	L	red
<i>-rostra-</i>	L	beak
<i>rufus</i>	L	red
<i>sativus</i>	L	filling (food)
<i>saurus</i>	G	lizard
<i>sinensis</i>	L	Chinese

<i>stoma</i>	G	mouth, opening
<i>striatus</i>	L	striped
<i>sylvi</i>	L	forest, wild
<i>letra-</i>	G	four-
<i>tetraconta</i>	G	forty
<i>tinctorius</i>	L	dyeing
<i>tomentosus</i>	L	furry
<i>tri-</i>	LG	three-
<i>trich-, thrix</i>	G	hair
<i>triconta</i>	G	thirty
<i>-ura</i>	G	of the tail
<i>uni</i>	L	one
<i>variabilis</i>	L	variable
<i>variegatus</i>	L	variegated
<i>ventrus</i>	L	belly
<i>verrucosus</i>	L	rough skinned
<i>viridis</i>	L	green

<i>volans</i>	L	flying
<i>vulgaris</i>	L	common

Law of Priority

The valid name of the genus, species or subspecies must be the oldest name that fulfils the requirements of the Law of Priority. This important rule was agreed upon in order to avoid confusion in the application of scientific names and to eliminate duplication. In general, names published earlier take precedence over the names of the same rank published latter. If other names are subsequently published for the same taxon, they become synonyms (invalid names). If more than one name for a single taxon or identical names for different taxa are published simultaneously, it becomes the privilege of the first reviser to select one of these names as the valid one and to place the others in synonymy.

Binominal nomenclature

Like all other animals, the binomenclature system standardized by Linnaeus is followed in scientific naming of finfishes. The binomen i.e. the scientific designation of the species consisting of a generic and species name e.g. *Thryssa malabarica*. *Thryssa* is a genus name and *malabarica* is species name. The genus name should start with capital letter and the species name should be in small letter. Since the scientific names of the species are italicized, the genus and species name have to be underlined separately. When a subgenus is used in combination with generic and species name in classifying a species taxon, the subgenus should be placed in parenthesis between genus and species. It should not be counted as one of the words in the binominal name of species or trinominal name of a subspecies. E.g. *Osteochilius (Osteochilichthys) nashii* (Day). If a subspecies is to be named, trinominal system has to be followed e.g. *Cirrhinus mrigala mrigala* (Hamilton and Buchanan).

The generic group name must be in a noun in the nominative singular or be treated as such. The species group must be a simple word of more than one letter, or a compound word and must be or treated as (i) an adjective in a nominative singular agreeing in gender with a generic with a generic name (e.g. *Gasterosteus aculeatus*); (ii) a noun in the nominative singular standing in opposition to the generic name (e.g. *Cichlasoma maculicauda*); (iii) a noun in the genitive singular such occurs in patronymic (e.g. *Trachinotus russelli*, *Epinephalus clarki*, *Mipterus peronii* - Single 'i' relates to male while double 'ii' relates to female), (iv) an adjective used as a substantive in the genitive case, derived from the species name of an organism with which the animal in question is associated, (v) name in genitive plural usually indicating something about the habitat

(e.g. *Alepes djedaba*, *Solenostomus tuiticorensis*) and character of the species (e.g. *Eleutheronema tetradactylum*, *Nibeia maculata*). A species group name can also be published in combination with genus group name but the latter need not be valid or even available (e.g. *Atropus atropus*).

In naming a finfish family, a valid genus contained in the family should be given and must be in the nominative plural e.g. Ariidae - genus *Arius*.

Authorship

The author (authors) of a scientific name is (are) the person (persons) who erect the species of the first type. The names of author (authors), when cited follows the scientific names of the species thus erected (e.g. *Scomberoides commersonianus* Lacepede, 1802, *Sardinella longiceps* Valenciennes). Citing the original author (authors) not only give credit to the individual (individuals) but also fixes responsibility for the name and aids in locating the original description. If a species group taxon was described in a given genus and latter transferred to another genus, the name of the author (authors) of the species group name should be enclosed in parentheses [e.g. *Arius sona*(Hamilton, 1822) = *Tachysurus sona* (Hamilton, 1822); *Amblygaster sirm* (Walbaum, 1792) = *Sardinella sirm*(Walbaum, 1792)].

If it is desired to cite the names of both the original author of a species group name and of the reviser who transferred it to another genus, the names of the reviser should follow in parentheses that enclose the original author (e.g. *Scomberoides tala* (Cuvier) Smith Vaniz (1973)).

Validity

Validity is a term that refers to the rights of names in relation to homonyms and synonyms. Synonyms are different names used for the same species. Homonym is the identity in spelling of available names denoting different species group taxa within the same genus or objectively different taxa within the genus group or within the family group. The earliest published synonym is referred as the senior synonym and latter synonyms are junior synonyms.

Two kinds of synonyms-one consists of names that objectively refer to the same thing, such as a new name for supposedly preoccupied name or names based on the same specimen or illustration. These are called objective synonyms. In subjective synonyms, the names are based on different materials.

Emendations

Any demonstrably intentional change in the original spelling of a name is emendation. There are two types of emendations. In justified emendation, the correction of an incorrect original spelling and the name thus emended takes the date and authorship of the original spelling. In unjustified emendation, the name thus emended has status in nomenclature with its own date and author.

History of Aquaculture in India

1. Holotype or type

The single specimen designated or indicated as 'the type' by the original author at the time of publication of the original description.

2. Syntype

If there is no holotype, then all the specimens of the type series are syntypes. Syntypes may include specimens not seen by the author but were based upon previously published description or figures upon which he founded his taxon in whole or in part.

3. Paratype

After the holotype has been labelled, the remaining specimens of the type should be labelled as 'paratype' in order to clearly identify the components of the original type series.

4. Lectotype

It is one of the series of syntypes. Selection of lectotype should be undertaken only by a specialist during revision work. It should never be done merely in order to add a type specimen to the collection. If the description of a species is clearly based on particular specimen, that specimen should be made the lectotype.

5. Neotype

A specimen selected on type subsequent to the original description in cases where the original types are known to be destroyed and were suppressed by the commission.

6. Allotype

A paratype of opposite sex to the holotype.

7. Topotype

Specimen from the type locality collected there subsequent to the original description.

8. Paratopotype or Isotype

A specimen other than holotype taken at the same place as the holotype and included in the original description.

Nomenclature change

Nomen nudum

A species name published without satisfying the condition of availability is generally called as *Nomen nudum*.

Nomen dubium

The name of a nominal species for which available evidence is insufficient to permit recognition of the zoological species to which it was applied.

Nomen oblitum

A name that has been remained unused as a senior synonym in the primary zoological literature for more than fifty years is to be considered as forgotten name.

Nomen conservandum

A name preserved by the action of commission and placed on the appropriate official list.

Periods of classification

1. First period

Even the primitive tribes were often excellent naturalists. Hippocrates (460 – 377 B.C) enumerated different kinds of animals. Aristotle (383 – 322 B.C) was the Father of Classification. He described that animals can be characterized according to their way of living, their action, their habits and their bodily parts. However, he did not supply an orderly, fully consistent classification of animals. Of all the preLinnaean authors, the one who arrived at the most Natural Higher Classification was John Ray (1627 – 1705).

2. Second period (Linnaean and his contemporarian)

The great Swedish naturalist Linnaeus (1707 – 1778) exerted such an important influence on the entire subsequent development of classification of organisms. Hence, he was called "Father of Taxonomy". The binomial method of nomenclature was for the first time applied by him to the animals in the 12th edition of his "Systema Naturae" (1758).

He followed Aristotle's idea of the essential features of living things and his logic.

3. Third period (The empirical approach)

The hundred years between the 12th edition of his “Systema Naturae” and the publication of “Darwin’s origin of species” was a period of subtle. Lamarek (1744 – 1829) who lived during this period had no visible influence on these developments except for some purely practical contribution he made to the classification of invertebrates. Cuvier (1789 – 1832) was far more influential during this period. A steady and enormous increase in the number of known animals characterized this period.

Voyages all over the globe acquainted zoologists with the animals of Africa, Australia and America.

4. Fourth period (Darwin and phylogeny)

Charles Darwin encountered so many phenomena of distribution, variation, structure and adaptation during his voyage. Taxonomists began to accept evolution. The German biologist Ernst Haeckel proposed the term ‘protista’. His phylogentic trees and speculations greatly stimulated the taxonomy.

5. Fifth period (Population systematics)

Study of intraspecific variation was the objective of population systematics. It is not an alternative to classical taxonomy but only an extension.

6. Sixth period

This period is characterized by renewed examination of whole theory of taxonomy and development of biochemical and molecular markers to study the intraspecific variation.

Generic level identification

The purpose of a key is to facilitate identification of a taxon. This goal is achieved by presenting appropriate diagnostic characters in a series of alternative choices. Keys form a good tool for taxonomic analysis. In the preparation of keys, a taxonomist should select and evaluate the diagnostic taxonomic characters. In this sense, keys are an integral part of taxonomic procedure as well as means of presenting findings. A good key should be dichotomous and should not offer more than two alternatives at any point. The alternative should be clear cut and precise. The style of the key should be like telegraphic code similar to taxonomic description of finfish species. The phrases should be separated by semicolons. While preparing the key, the primary contrasting characters of each couplet should be diagnostic and definitive. Supporting supplemental characters should also be added.

Generally, two types of keys are used in taxonomy. They are:

i) Indented key and ii) Bracket key.

Indented key

A - Body normal, not tapering to a point; caudal fin forked.

B - No scutes before or behind pelvic fin base; maxilla tip blunt; anal fin origin well behind last dorsal fin ray - *Engraulis*.

BB - Scutes present along belly, needle like; maxilla tip pointed; anal fin origin under last dorsal fin ray.

C - Scutes needle like, present only before pelvic fin base - *Stolephorus*.

CC - Scutes present before and behind pelvic fin base - *Thryssa*.

AA - Body tapering to a point; caudal fin not forked - *Coilia*.

The indented key has an advantage that the relationship of various divisions can be seen very quickly. But this key will be a very long key, alternatives may be widely separated and it is wasteful of space.

Bracket key

The second type of key in most of the fish taxonomical studies is the bracket key. This has the advantage that the couplets are composed of alternatives and are side by side so that comparisons could be made easily. This key is also more economical and space of because it is not indented. When properly constructed, this key will run forward or backward with equal facility by following numbers indicating the path that the various choices follow. The main disadvantage is that the relationship is not apparent to the eye.

1.	Body elongate, tail long and tapering; caudal fin not forked; upper pectoral rays produced as long filaments.	<i>Coilia</i>
	Body moderately long, caudal forked; pectoral rays normal.	2
2.	Prominent silvery lateral stripe present.	<i>Stolephorus</i>
	No silvery lateral stripes.	3
3.	Upper pectoral ray produced.	<i>Setipinna</i>
	Upper pectoral ray not produced.	4
4.	No abdominal scutes in front of ventral fin.	<i>Thrissina</i>
	Abdominal scutes extends from isthmus to vent.	<i>Thryssa</i>