

## FISH TAXONOMY

In the last issue of Catch and Culture (Supplement # 1) one of the most important fish families, Cyprinidae, was described. In following issues of Catch and Culture, other important fish families of the Mekong basin will be covered. Before venturing further into the exciting world of Mekong fishes, this issue focuses on the general subject that enables us to distinguish the many species: **Fish Taxonomy**. Taxonomy is basically the science of correctly naming species. The term has often been confused with **fish identification**, which basically refers to the use of the latest taxonomic information to identify fishes. The job of the Fish Taxonomist is to name and classify species in a way that makes it easier for fisheries scientists, and other “users”, to correctly identify fish species during their work. In other words, fish taxonomy is practiced by very few, whereas fish identification is practised daily by many people.

Most readers of Catch and Culture have probably noticed the complicated scientific names of fish species written in brackets after the common name. These names are often difficult to pronounce and hard to remember. It is a lot easier for most of us to recall a name in our own language. So what do we need them for and what do they mean?

The problem with local names is that they are different from country to country and sometimes even between different regions within the same country. Communication and exchange of information across borders is absolutely essential to science as is consistent identification of species. Therefore, we must be able to refer to any fish species by a name that is common to everybody, anywhere in the world. This is the only way we can ensure that we talk about the same species.

All fishes (and other animals and plants) are therefore given unique names. These names are divided into two components derived from the classical old European languages Latin or Greek. It was the Swedish naturalist Carl von Linné (1707-1778) who developed the current binomial (two part) naming system. He actually got so engrossed in naming things he even managed to re-name himself in the process (to Carolus Linnaeus). The first part of a scientific name is called the generic name (e.g., *Hypsibarbus*) and the second is the species name (e.g., the Genus *Hypsibarbus* contains at least 7 species in the Mekong, one is *Hypsibarbus lagleri* Rainboth, 1996). Every fish, therefore, belongs first to a genus and second has its own unique species name. A genus is a group of very similar and closely related species. The name of a person and year appearing after the species name refer to the name of the taxonomist who first officially described and named the species and the year of publication of the description (the comma between these is optional). By convention, this “authority” name is enclosed in brackets if another taxonomist has later changed the genus name (i.e., moved the species to another genus, something taxonomists frequently do). But conventions forbid taxonomists to change the species name once it has been published (unless it is accidentally the same as a prior existing name). However, species names can be declared invalid in cases where the species is later considered to be the same as another previously described species. In all circumstances the name published first takes precedence (even if considered inappropriate).

In cases where taxonomists are unsure whether a fish is different enough from others to warrant it being called a different species they can declare (name) it a sub-species or variety of an existing species. Some even go further with sub-sub species or sub-varieties. This process is controversial but fortunately uncommon with fish; although widespread with plants.

Genera are subsequently grouped into **families**, e.g. *Hypsibarbus* belongs to the family Cyprinidae together with other genera such as *Cirrhinus*, *Probarbus*, *Barbodes* and *Henicorhynchus* (see last issue of Catch and Culture). Some other important fish families in the Mekong include Cobitidae (loaches), Pangasiidae (river catfishes), Siluridae (sheatfishes), Bagridae (Bagrid catfishes) and Gobiidae (gobies). In total, there are about 65 fish families occurring in the Mekong. Families are again grouped into **orders**. For example, the three families Pangasiidae, Siluridae and Bagridae all belong to the order Siluriformes (catfishes). Other important orders are Cypriniformes (carps and minnows) and Perciformes (spiny rayed fishes). Orders are grouped into **classes**. In the Mekong, only two fish classes are encountered: Chondrichthyes (the cartilaginous fish class), which includes sharks, rays and sawfish, and Osteichthyes (the bony fish class) which includes all other Mekong fishes. Finally, classes are grouped into **phyla**. All fish species in the world belong to the same phylum, **Chordata** (the vertebrates - with a backbone), which also includes mammals, birds, amphibians and reptiles. In this way, the approximately 739 fish species presently known from the Mekong basin are grouped into 276 genera, 65 families, 19 orders, two classes and one phylum.

By convention the species name (i.e., genus + species) is always written in italics to signify it is the recognised scientific name. The family, order, class etc. should never be in italics.

### **Why do the names change?**

This is a good question. The answer is partly that taxonomists make mistakes and/or disagree with each other. Sometimes new evidence comes to light showing linkages between two or more previously described species enabling them to be “combined”. The degree of difference between fish which justifies them being called a different species (or for that matter genus, family or order etc.) is somewhat arbitrary. But in nature fish of the same species can vary greatly from one place to another, often gradually over distances. Sometimes sampling at two extremes of the population will result in two named species, only for later sampling in the middle of the distribution to reveal their relationships (thus requiring the last to be named to have its name changed to the first). It is common in freshwaters for fish from different river basins to be named separately by different taxonomists. Later studies sometimes reveal the species to be the same.

The thing which maintains the differences in characteristics between “species” is reproductive isolation. It is a prerequisite that for two or more species to be considered separate their populations must not interbreed in the wild (interbreeding under artificial conditions does not count). If they did interbreed, of course, their genes would mix and they would eventually have the same characteristics and be, in effect, the same species.

In recent years the study of organisms at the genetic level (e.g., differences or similarities in their DNA or genes) has become more common. It is becoming an important tool in taxonomy although there is considerable debate over the definition of a “species” at the genetic level. For most practical purposes in the Mekong, taxonomists still use traditional means of describing the fish. This is fortunate for the rest of us because they are based mainly upon characteristics visible to the naked eye in the field.

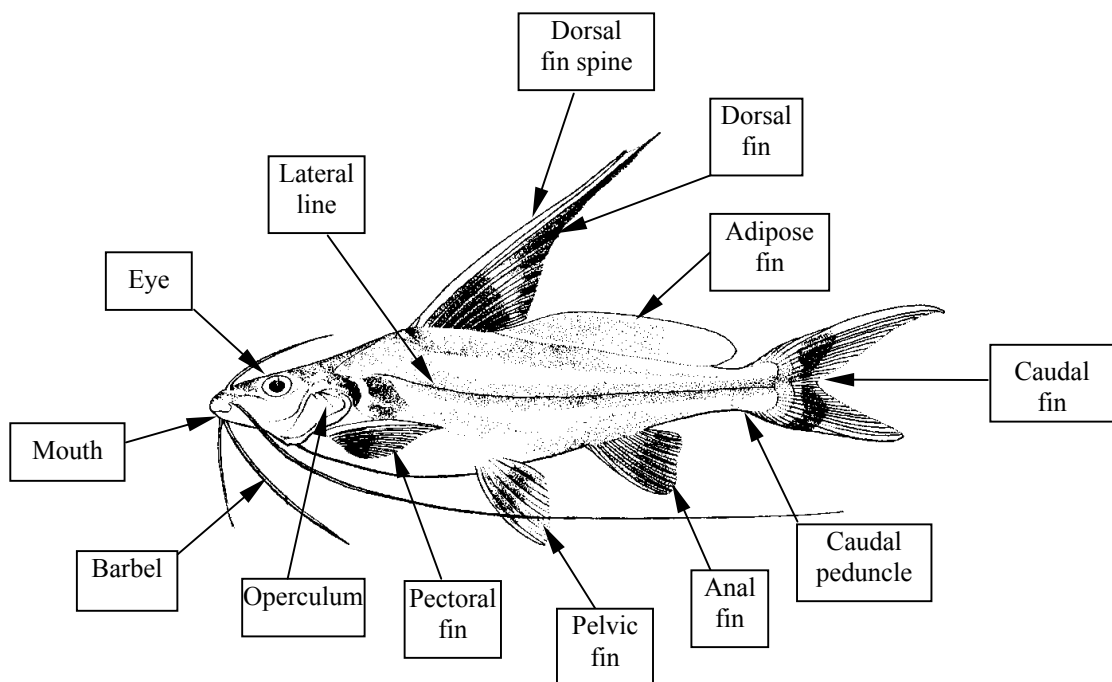
### What are the Tools of Taxonomy?

The taxonomist uses several characteristics or identification parameters. These can be divided into four main groups:

- 1) Parameters that can be measured: eg. standard length, snout length, fin length, and eye diameter. Because fish differ in size these parameters are often expressed in relation to each other. For example, the head length of a species may be stated as a percentage of its body length (as part of a description of its overall shape).
- 2) Anatomical parts that can be counted: eg. vertebrae, fin-rays, spines, teeth and scales. The absence of any of these from the fish can be equally as important.
- 3) The appearance and position of body structures: e.g. the lateral line, teeth and scales and the coloration (of live fish).
- 4) Chromosome numbers and genetic parameters such as DNA sequences (requiring sophisticated measuring techniques).

In figure 1 and 2, some of the important anatomical terms and measurements used by the taxonomist, and subsequently by “fish identifiers”, are shown.

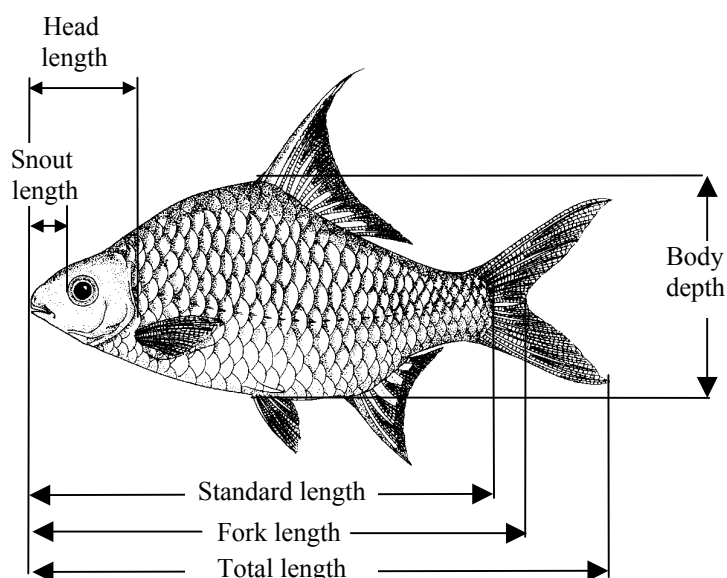
*Figure 1. Important anatomical terms used in fish taxonomy and identification and how they are used*



Mouth: Size and position of mouth. Mouth protrusible or not protrusible. Mouth with teeth or without teeth, position of teeth in the mouth.  
 Teeth: Number, size, shape and kind of teeth.

Barbels:	Number of barbels, their size and position.
Snout:	Snout length.
Operculum:	Operculum present or not, with or without spine(s).
Eye:	Eye diameter, eye color in fresh specimens, position of eyes. Distance between eyes (interorbital space) in relation to eye diameter or snout length.
Head:	Head shape. Head length in relation to standard length, eye diameter or barbel length
Predorsal scales:	Number of scales from head to dorsal fin.
Dorsal fin:	Number of dorsal fins, length of the fin(s), number of fin rays, with or without spine(s).
Pelvic fins:	Position in relation to dorsal and pectoral fins, number of fin rays, united or not united into a disc.
Pectoral fins:	Present or absent, with or without spines, position in relation to pelvic fins, length of the fins.
Anal fin:	Length of the fin, number of fin rays.
Caudal fin:	Present or absent. Caudal fin separate or continuous with dorsal and anal fin.
Dorsal fin spines:	Present or absent. Number of spines. Smooth or with serrations. If serrated number of serrations.
Adipose fin:	Present or absent. Size of the fin.
Lateral line:	Complete or incomplete. The number of lateral line scales.
Caudal peduncle:	Number of scales around caudal peduncle.
Scales:	Present or absent. Scale shape and type.

**Figure 2. Important measurements used in fish taxonomy and identification.**



One of the most important jobs for the taxonomist is to help the rest of us identify the species we encounter during our work as fisheries scientists. One way of doing this is through the development of keys. A key is basically a tool which guides you, step by step, through the process of identifying a species you are not familiar with.

*Fishes of the Cambodian Mekong*, written by Dr. Walter Rainboth, is an example of such a key. In this key the first step is to try to find out which order or family the species belong to. On pages 26 to 50 all the orders and families (present in the Mekong) are listed, with all their characteristics and a small illustration of a species from each family. By going through all the orders and family descriptions, and carefully examining the specimen concerned, it is possible to find out which family it belongs to. The experienced fisheries scientist can often skip this step, because he or she will be acquainted with most of the families.

Once the family is known we go to the section of the book describing the genera and species of the family. This procedure can sometimes be quite difficult, because many Mekong species are very similar. So when you come up with a species name compare it carefully with the drawing, and check whether it fits the description including details of distribution and biology. The best is to compare with a preserved specimen if a reference collection is available.

Let us again use the genus *Hypsibarbus* as an example. In *Fishes of the Cambodian Mekong*, the distinguishing characters of the genus *Hypsibarbus* are (1) serrated dorsal fin spine; (2) 8 branched pelvic fin rays; (3) skin of lower lip discontinuous with lower jaw, separated by a shallow groove; (4) anal fin base 60% of head length; (5) black scale margins give a reticulated colour pattern.

If your fish fits all these five characters, you can conclude that it has the generic name *Hypsibarbus*. Six species are currently described under this genus in the Mekong. In order to identify your fish, you have to look at it in more detail and you will probably have to start counting scales. If, for example, you count 16 scale rows around the caudal peduncle, the species is *Hypsibarbus malcolmi*. If you only counted 14 scale rows, it can be any of the other species. Then, you may count the number of horizontal scale rows between the lateral line and dorsal fin origin. If you counted 5, the species is *Hypsibarbus lagleri*. If you only counted 4, you have still not decided and you may then have to count microscopic structures like gill rakers (small spine-like structures attached to the gill arches).

This process appears to be very long and tedious. However, as you gain experience and begin to know what to look for, it will become easier. Eventually, you will be able to identify many species immediately. With more experience, it becomes more interesting to visit fish markets or Mekong fishers and check out their catch.