Naming Names (and Often Changing Them): A Native Fish Hobbyist's Guide to Zoological Nomenclature

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Every species of plant, animal, fungus, moneran, and protist known to science has been assigned a formal scientific name uniquely its own. These names are recognized by scientists and naturalists, whatever their native language, all over the world. Over 1.4 million species have been named so far, but the job is nowhere near completion.

Depending on the estimate, another 10 million living species, perhaps as many as 100 million species, have yet to be discovered (Wilson, 1992). If we were to print the name of every *known* species one to a line in the same type size you see here, in the same page format, it would fill a book around 15,000 pages long. Subsequent volumes of newly described species could add another 1.1 million pages! Our planet is teeming with so many different forms of life that there is no practical way of compiling, nor publishing, a comprehensive "Life on Earth" catalogue.[1]

Every year around 15,000 new species are described (Bank, 2001). Most of them small and hard-to-find, such as bacteria, fungi, nematodes, and insects. In the comparatively small world of fishes, around 250 new species are described each year (Berra, 2001). Ichthyologists estimate that once poorly known geographic areas are surveyed, and new equipment (such as deep-sea submersibles) become more widely available, the total known fish fauna will rise from around 27,300 currently known species to around 31,500 (Berra, 2001). Each of these species will ultimately be assigned a name, using a system devised by Swedish naturalist Carl Linné (1707-1778).

The Father of Taxonomy

Linné was frustrated by the inconsistent ways his fellow naturalists referred to various plants and animals. Some of the names they used were long and unwieldy. Others were changed at whim. The name of a well-known species in one publication had a different name in another. With a large increase in the number of species being brought into Europe from Africa, Asia and the Americas, Linné saw a need for a workable and universal system of biological nomenclature. His solution was a binomial (two-part) name consisting of a genus (the first part of the name) and the species (the second part). Linné also devised a hierarchical taxonomic system (species, genus, family, order, etc.) in which organisms are classified based on anatomical similarities.[2] Although Linné was not the first to use binomials, he was the first to use them

[1] And this is only *extant* species we're talking about. Biologists generally believe that 99% of all plant and animal species that have ever lived on Earth have already gone extinct without fossil evidence of their existence.

[2] This was by no means a perfect system, as unrelated animals of similar appearance—eels, snakes and worms, for example—were classified together, but it was an important first step to bringing some semblance of order to classification. Although plants and animals are now classified based on evolutionary relationships, not anatomy, Linné's taxonomic categories remain.

consistently; for this reason the first validly described plants date from his *Species Plantarum* (1753), and the first validly described animals date from the tenth edition of his *Systema Naturae* (1758). Names proposed before these two works were invalidated unless Linné had chosen to retain them.[3] As the father of taxonomy (the science of naming organisms and their classification), Linné got first dibs at naming names.

Anatomy of a Scientific Name

Scientific names are often referred to as "Latin names." Since Latin was the language of scholarship in 17th-century Europe, scientific names were originally written in Latin. (Linné even Latinized his own name to Carolus Linneaus, by which he is officially known.) Today, nearly any word or name from any language can be used to form a scientific name as long as it's not offensive. Most scientific names attempt to denote a distinguishing characteristic of the species being described, whether it's a distinctive physical trait (such as color, size, or an anatomical feature), a behavior, a preferred habitat, or a geographic location.[4] Many names commemorate people. Known as patronyms, these names originally honored the patrons who financially supported the researcher's work (Winston, 1999). Now they may also honor anyone who's important to the author, be it a mentor, esteemed colleague, spouse, lover, child or grandchild, celebrity, or the person who discovered the species or first brought it to the author's attention. Events, organizations, institutions and local indigenous cultures may also be honored. (Naming a species after yourself is tacky and likely sets you up for ridicule among your peers.) Patronymic names are usually identified by the addition of the possessive suffixes *–ae* (for women) and *–i* or *–ii* (for men).

Sometimes the etymology of a name is enigmatic; the name has no obvious association to the organism it describes, and the author didn't bother to reveal its meaning. For example, what did Edward Drinker Cope have in mind when he named the Rio Grande chub *Clinostomus* (now *Gila*) *pandora*? No one knows. (Best guess: the fish's uncertain taxonomic placement was a Pandora's box, or a source of troubles for Cope and future taxonomists.) Fortunately, enigmatic names are pretty much a thing of the past as modern taxonomists are required —or at least consider it good manners—to fully explain their nomenclatural choices.

Sometimes, though, a taxonomist gets playful and may propose names based on puns, metaphors, literary allusions, and the occasional inside joke (often a good-natured jab at a colleague's expense). Such names tend to reveal more about the person doing the naming than the species being named, and as such are generally frowned upon, but there are no formal rules against them. Dinosaurs and obscure invertebrates tend to have the wackier names, but they do occur among fishes every now and again. The box on the next page has a few choice examples.

Whatever its etymology, a scientific name must always be shown in italics, underlined, or else set apart in some fashion so that you know it's a scientific name. The generic name always starts with a capital letter; the specific name is always lower case. Specific names can never have any diacritical marks (such as accent marks or apostrophes), but they may be hyphenated (like the gravel chub, *Erimystax x-punctatus*).

Often you will see scientific names with the author's name and the date of authorship following it. An author is the person (or persons) who first officially proposed the name in a publication. Sometimes listing the author's name helps in identifying the species, especially when two closely related species have similar looking epithets (silverjaw minnow, *Notropis buccatus* Cope 1865, and smalleye shiner, *Notropis buccula* Cross 1953). Having the date with the name helps researchers in locating relevant literature. Many times the author's name is given in parentheses. This means that the species has been assigned to a genus other than the one in which it was originally described.

When a species is divided into two or more subspecies, a third word is added to its name. The third name of the nominate, or original, form of the species repeats the specific name (as in Atlantic sturgeon, *Acipenser oxyrinchus oxyrinchus*). Any newly described subspecies are assigned a third name that's different, as in the Gulf sturgeon, *Acipenser oxyrinchus desotoi*.

The anatomy of a scientific name of a representative North American freshwater fish (yellow perch, *Perca flavescens*) is illustrated in Fig. 1.

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[3] One exception: The first validly described spiders date from Carl Clerck's *Aranei Svecici*, also from 1758.

[4] Sometimes a descriptive name misrepresents the species it's attempting to describe. North America provides two examples (both cited in Jenkins and Burkhead, 1994). The name of the shiner genus *Notropis* means "keeled back," but shiners have backs that are smooth. When Rafinesque established this genus for the emerald shiner (*N. atherinoides*) in 1818, the specimen he used had a ridged, or keeled, back, probably due to shrinkage. When Lacapède described the black bass genus *Micropterus* (meaning "small fin") in 1802, the specimen he used had a damaged dorsal fin. Had Lacapède used a normal specimen, he likely would given the genus a different name. Although *Notropis* and *Micropterus* are descriptively misleading, the rules of nomenclature dictate that once a validly assigned name is attached to a fish, even a bad name, the fish is pretty much stuck with it forever.

Some curious fish names

Most scientific names denote a distinguishing physical attribute of the organism being described (e.g., color, size, unique anatomical feature). Many names honor the species' discoverer, a wealthy benefactor, a colleague, a spouse, someone famous in his or her field, or even an organization or institution. But sometimes names are proposed for less than purely academic reasons. Biology is rife with examples. Here are a few from the world of fishes:

• Smithsonian ichthyologist Charles F. Girard (1822-1895) was fond of naming minnow genera after Native American words (e.g., *Agosia*, *Dionda*, *Nocomis*) simply because he liked the sound of them and was tired of Latin and Greek. Don't look for meaning in these names. There is none.

• Goby taxonomist Edward O. Murdy named a genus of mudskipper from New Guinea *Zappa* in honor of rock legend Frank Zappa "for his articulate and sagacious defense of the First Amendment of the U.S. Constitution."

• New Zealand ichthyologist Chris Paulin named two viviparous brotulas—*Bidenichthys beeblebroxi* and *Fiordichthys slartibartfasti*—after characters in Douglas Adams' *The Hitchhiker's Guide to the Galaxy*. Both fishes have attributes that remind Paulin of these characters.

• Nijssen and Isbrucker named a *Corydoras* catfish *narcissus* because the discoverers had the temerity to insist that it be named after them.

• The robust size of Scripps Institution of Oceanography scientist Richard Rosenblatt inspired his colleagues to name a robust deepwater cardinalfish *Rosenblattia robusta*.

For more nomenclatural curiosities, visit this website: *home.earthlink.net/~misaak/taxonomy.html*.

A Few Simple Rules

Anyone can name (describe) a species or subspecies, even non-taxonomists. A *Boston Globe* columnist, for example, named a subspecies of cutthroat trout (*Oncorhynchus clarki behnkei*) in a book about fly fishing (Montgomery, 1995). Professional taxonomists usually discourage descriptions by amateurs because the descriptions often contain errors and, as in Montgomery's case, appear in non-scientific publications that many taxonomists overlook. But Montgomery's name is nevertheless available (acceptable for use) because it met criteria established by the International Commission on Zoological Nomenclature (ICZN):

1) The name appeared in a printed publication that is readily available. Theses and websites are not valid publications for taxonomic purposes. (After 1999, CD-ROMs and other non-printed media are acceptable if they are deposited in at least five major publicly accessible libraries that are identified in the work itself.)
2) After 1999, the name is explicitly indicated as being new.
3) The name is binomial (trinomial for subspecies), written in the Latin alphabet (as opposed to Arabic, Chinese, and other languages that use a different lettering system).
4) The name is accompanied by a statement that explains how the species (or subspecies) differs from other closely related species (or subspecies).
5) No other species or subspecies name had been previously published for the same taxon, accompanied by a valid description.
6) The name is unique to the genus; no two species or subspecies in the same genus can possess the same name.

That's it, really. Describing a species isn't all that complicated.

Making sure one has a species that *needs* describing, however, requires more work. Opinions differ on what constitutes a species (a topic for a future article). A literature search must be conducted in order to comply with item #5. And the description should be peer reviewed—critically examined by other experts in the field—before it is published, preferably in a reputable scientific journal. Regrettably, not every taxonomist adheres to these standards. Sometimes poor descriptions are rushed into print because of competitiveness, ego, or the academic pressure to publish. Sometimes taxonomists are mistaken about the distinctiveness of what they're describing. And sometimes they're just sloppy. At best their names are assigned to a nomenclatural purgatory called the synonymy—a list of names applied to a species but considered to be invalid. (Such names may rise out of synonymy when new data justifies their recognition.) At worst the taxonomist may suffer some professional embarrassment.

One of the grand old men of American ichthyology, Henry Weed Fowler (1878-1965), had to swallow his pride in

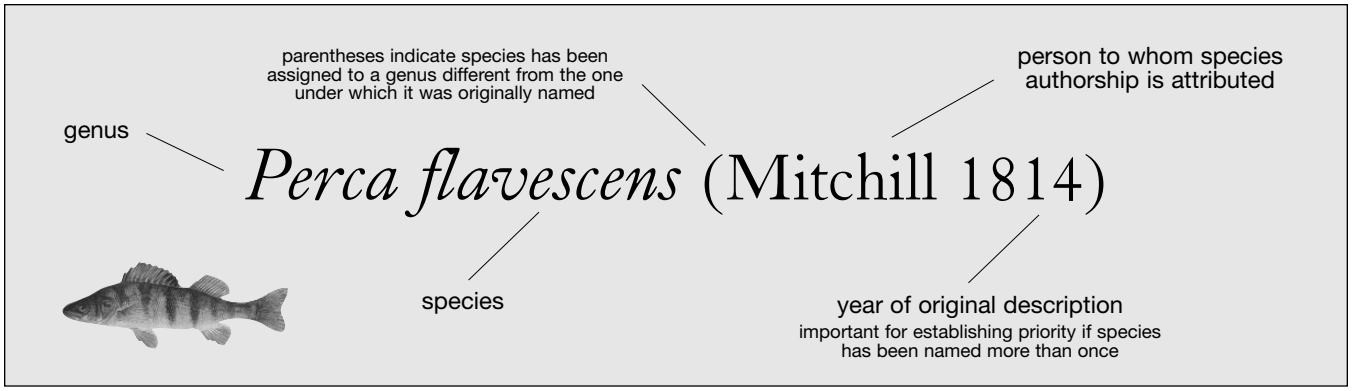

Fig. 1.
Anatomy of the scientific name of yellow perch. Illustration courtesy New York State Department of Environmental Conservation.

1938 when he described a new species of sea bass from Hong Kong. Fowler inexplicably did not recognize the fish for what it was, the common and familiar largemouth bass of North America, which had been introduced into several Hong Kong reservoirs before World War II (Smith-Vaniz and Peck, 1997; Hay and Hodgkiss, 1981). Fowler's reputation survived, but the name he proposed, *Pikea sericea*, will forever be a monument to the lesson that good taxonomists—even great ones like Fowler—can never be too careful.

Why Scientific Names Change

For all the work taxonomists put in making sure their names stand the test of time, many of them don't. Taxonomy is a dynamic process, which means, for better or worse, that names change. This can be frustrating to non-scientists and scientists alike. Still, such changes usually occur for good reason and not at the whim of a bookish academic with nothing better to do. Names changes occur for primarily three reasons:

1) A previously described but overlooked name has priority. Example: In 1968, James D. Williams described the pygmy sculpin (*Cottus pygmaeus*) from Alabama. Little did he know that a Finnish sculpin, *Cottus quadricornis pygmaeus*, had been described in an obscure Finnish journal in 1932. Although the Finnish sculpin's name is no longer used, it's considered "preoccupied" and forever fixed to its specimen. Dr. Williams redescribed the pygmy sculpin in 2000 and assigned it a new name, *Cottus paulus.* (Source: Williams, 2000.)
2) A species is shown to be the same species as one already described. Example: The rainbow trout was known for decades as *Salmo gairdneri*. But new biochemical and anatomical data revealed that the rainbow trout of the Pacific Northwest is the same species as the Kamchatka trout of Asia. Since the Asian species was described first (1792), its name has priority. *Salmo gairdneri* is now *Oncorhynchus mykiss*, and fly fishing publishers have been updating their texts ever since. (Source: Smith and Stearley, 1989.)
3) The species is placed in a different genus. This is the most common cause of nomenclatural changes, although it can be said that the name doesn't change, just the genus. Generic changes are usually the result of researchers continuing to explicate the phylogenetic relationships between closely related taxa. Sometimes when the genus is changed, a slight change in the spelling of the specific name is required if it does not agree with the gender of the new generic name. Example: the walleye, formerly *Stizostedion vitreus*, is now S*ander vitreum.* (Source: Nelson et al., 2004.)

Names may change for other reasons too arcane to discuss here. And names may change only to be changed back for the sake of nomenclatural stability. The Topeka shiner, an endangered minnow from the central U.S., is a case in point. Its name was changed from *Notropis topeka* to *Notropis tristis* when two ichthyologists rooting around a Paris museum found a specimen labeled *Notropis tristis* that had been described in 1856 but was later lost and forgotten. Examination showed it to be identical to *N. topeka*, which was described 27 years later. Since *tristis* was described first, its name had priority. Thus, the name was changed (Mayden and Gilbert, 1989). A petition was later filed with the ICZN to retain *topeka* since virtually every text on North American fishes uses it.[5] Unlike

[5] One prominent reference that doesn't use *topeka* is the commonly used volume on freshwater fishes in the Peterson field guide series (Page and Burr, 1991). This has caused *tristis* to live on longer than it deserves.

the change of *Salmo gairdneri* to *Oncorhynchus mykiss*, which reflected that rainbow trout naturally occurred on both sides of the Pacific, changing *topeka* to *tristis* demonstrated nothing and would cause more confusion than it was worth. Common sense prevailed and *N. topeka* was officially retained to keep the nomenclatural apple cart from tipping unnecessarily (ICZN, 1995).

The Importance of Biological Nomenclature

Careful and accurate nomenclature is needed to help us keep track of our planet's immeasurable biodiversity and communicate effectively about it. There's no doubt that many hobbyists and non-scientists avoid scientific names when shorter, easier-to-pronounce common (or vernacular) names are available. Indeed, for most everyday applications it makes little sense to use *Lepomis macrochirus* when bluegill gets the job done with 55% fewer letters.

The trouble is, common names have their limitations. With more than 1,100 fish species in our continental fresh waters, it's impossible to assign every one a short and pithy moniker. Is *Cottus hubbsi* any more difficult to pronounce or memorize than Columbia mottled sculpin? Another problem is that multiple common names are often used for the same species. Mexicans refer to the bluegill as *mojarra de agallas azules*. In Québec it's *crapet à oreilles bleues*. Even among speakers of English a fish can be known by several vernacular names. Ask a kid in the South what kind of panfish he's put on his stringer and he is just as likely to say bream as he is bluegill. Ask a kid in England if he's caught any bream and he'll think you're referring to a slimy brown relative of the carp (*Abramis brama*). Ask a Japanese biologist if nonindigenous bluegill are decimating the native fishes of his country and he may not know what you're talking about. Rephrase the question using *Lepomis macrochirus* and you've struck a common ground despite the difference in local names.

I hope that hobbyists can better appreciate a fish when they know something about how it was named. Take the Umpqua chub, *Oregonichthys kalawatseti*. It's a fairly drab and little-known minnow from the Umpqua River, a Pacific tributary, in the southwestern corner of Oregon. *Oregonichthys* simply means "fish of Oregon." Its specific name *kalawatseti* contains a provocative touch of poetry, history and even justice. Say its describers, "Oregon once had a remarkable diversity of native peoples with more native languages than all of Europe. The Kalawatset, a tidewater Umpqua people best known for attacking Jedidiah H. Smith in 1828, were part of this lost human diversity and serve to forewarn of a parallel decline in diversity of Oregon's native freshwater fishes" (Markle et al., 1991).

With this attempt to demystify scientific names, I hope they enjoy greater use among aquarium hobbyists and amateur naturalists in the same way gardeners casually use *Rhododendron* and *Chrysanthemum*.

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