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**Common and Scientific Names of Aquatic
Invertebrates from
the United States and Canada: Mollusks.
Second Edition**

by D. D. TURGEON, J. F. QUINN JR., A. E. BOGAN, E. V. COAN, F. G. HOCHBERG JR., W. G. LYONS, P. M. MIKKELSEN, R. J. NEVES, C. F. E. ROPER, G. ROSENBERG, B. ROTH, A. SCHELTEMA, F. G. THOMPSON, M. VECCHIONE & J. D. WILLIAMS. 1998. Common and scientific names of aquatic invertebrates from the United States and Canada: Mollusks. 2nd Edition. American Fisheries Society, Special Publication 26, Bethesda, Maryland. ix + 526 pp. (incl. 16 pls.). ISBN 1-888569-01-8 (paper); ISSN 0097-0638. US\$ 59.00 (includes CD).

In the pages of this journal, informative book reviews typically close with a sentence like "of lasting value to a wide spectrum of readers" or "a fine field companion for work or pleasure on the reefs of the Indo-Pacific." These concluding sentences typically identify the audience as well as the publication's value to that audience. As I read this work (hereafter referred to as "the Checklist") I looked for similar information to incorporate into my final sentence, but unfortunately a clear user group and purpose were not forthcoming. Therefore, I begin my review with what could have been the final sentence: a commendable and Herculean compilation of scientific and common names of northern American mollusks that has yet to identify its larger audience. Moreover, because of the uneven implementation of the principles that were supposed to guide its production, its overall value and usefulness are seriously compromised.

I cannot deny that a handful of colleagues will find this volume a useful source of names for reporting molluscan catch statistics and for legal and regulatory documents. The fact that terrestrial and freshwater taxa are more likely to be mentioned in regulatory documents probably accounts for the better documentation and preparation of these sections compared to the marine groups. However, I doubt that the value of the Checklist will extend to scientific writing or to the professional shell collectors [sic] (p. 13) whom the authors claim will welcome the standardization of scientific and common names provided by this volume. Perhaps Riedl (1983:5) expressed it best [translated here from German], "Wanting to collect constant names is the misleading hope of the dilettante; to become aware of the order itself is the rewarded struggle of the expert."

Much of my conclusion results from my inability to find clear statements as to what the Checklist is supposed to do, and disappointment in how the individual contributors applied (or failed to apply) the American Fisheries Society's own principles (pp. 14-16)

and the AMU/CSM resolutions (pp. 16-17) to their respective sections. In the final wash, a mixture of rank-driven shuffling, fiat, and phylogenetic tree pruning seems to have controlled much of the production of this chimera.

In the foreword the AFS charge is clear: "*The Committee [on Names of Aquatic Invertebrates] shall be responsible for studying and reporting on matters concerning common and scientific names of aquatic invertebrates and shall prepare checklists of names to achieve uniformity and avoid confusion in nomenclature*" (p. vii). Because the International Code of Zoological Nomenclature (ICZN) already provides oversight to achieve uniformity and avoid confusion in scientific names, I assume that the focus of the AFS charge must be directed primarily at common names. In the Checklist's introduction, the AFS charge is restated and limited as follows: "Our goal is to keep the scientific nomenclature of this list up to date while achieving uniformity and avoiding confusion in the common names of the mollusks of the United States and Canada" (p. 11). Note that both charges focus only on nomenclature - not systematics, taxonomy, or classification. This is an important distinction and one that is often blurred in our field (and in this Checklist).

The proposal of names and resolution of nomenclatural problems traditionally are dealt with using algorithmic procedures such as the application of the ICZN (B. Roth, personal communication). Algorithms are well suited here because they possess three key features: (1) algorithms are substrate neutral; (2) algorithms consist of small, simple steps; and (3) algorithms have guaranteed results (Dennett, 1995:51). Like the Articles and recommendations of the IZCN, many of the AFS principles and the AMU/CSM resolutions provide algorithmic procedures governing the generation and application of common names.

Until very recently, algorithmic procedures were rarely used in taxonomy. Instead, taxonomy has been strongly dependent on the researcher and his or her wisdom, judgment, and intuition; the results were never guaranteed, even with identical data and training. Recently, the introduction of cladistic methods using explicit assumptions and character analyses has provided workers with an algorithmic procedure to reconstruct phylogenies. If the method, data and assumptions are identical, it makes no difference whether the algorithms are executed in a laboratory in California or on a veranda in New South Wales. The hypothesis of relationships will be the same. And most importantly, it can be redone, updated or modified, and repeatedly tested.

Although taxonomy, nomenclature, and even biodiversity itself (see Dennett, 1995) can be viewed as results of algorithmic processes, there is no such validation for the arbitrary assignment of taxonomic ranks or categories to taxa discovered through

taxonomic study. Taxonomic ranks are clearly non-algorithmic in their creation and are almost certain to remain so. They are therefore also the most problematic components to apply and justify in systematic studies.

The AFS principles and the AMU/CSM resolutions provided a set of algorithmic procedures for the creation and emendation of the Checklist. Examples include, "No two species on a list shall have the same primary name," "Names shall not violate the tenets of good taste," "Names intended to honor persons ... are discouraged in that they are without descriptive value," and "The most current literature should be used for systematic classification." In addition to these internal Checklist procedures for common names and the limited classification format, there is also the ICZN for scientific names. We also have a rapidly expanding, recent literature of phylogenetic hypotheses of molluscan relationships available for producing meaningful, phylogenetically-based classifications. Unfortunately, in many cases in the Checklist the algorithmic procedures were either not followed or discarded in favor of the old, comfortable "canonical taxonomy" (I thank Barry Roth for coining this very appropriate term; see, for example, *Veliger* 38:81, 1995). In canonical systematics authorities make subjective and untestable taxonomic decisions by fiat, which are shoehorned into rank-driven classifications, and compete in the scientific and popular literature for acceptance. In this brand of systematics, algorithmic procedures are restricted to ICZN nomenclature.

The Checklist sets the stage for its use of canonical systematics early on by setting up phylogenetic systematics as a straw man. In the introduction it is stated that scientific names are "intended" to provide supposed systematic [evolutionary] relationships. This is demonstrably incorrect - historically and even today in many instances. Bartsch, Gould, Pilsbry, Clench, and Keen were all fine taxonomists and together described thousands of taxa. But I do not believe for a minute that they thought they were reconstructing the evolutionary history of groups that they monographed. Keen was explicit about this in her *Sea Shells of Tropical West America* (Keen, 1971); when her former student James H. McLean organized his contributed sections to reflect evolutionary relationships among taxa, and not alphabetically as in the rest of volume, she provided an advisory notice at the beginning of Dr. McLean's section (1971:308). With the exception of W. H. Dall (Lindberg, 1998), few North American malacologists were interested in studying and incorporating evolutionary relationships into their classifications until the late 1960's and early 1970's. Thus, we are burdened with almost 100 years of canonical taxonomic work that likely reflects little in the way of phylogenetic relationships among taxa. (See Winsor [1995] for the issues surrounding the application of phylogenetic

classifications and the history of this debate in England.)

The fallacy that current molluscan classifications are phylogenetically based is clearly exposed in the very next sentence where the authors points out that "... new systematic research and phylogenetic analysis, currently very active areas in malacology, often show that previous ideas of relationships between taxa are wrong and that one or more taxa must be reclassified." Why then should this happen so often? The simplest answer is that most current molluscan classifications are not based on evolutionary relationships. Instead, they were built on overall similarity or on heavily weighted, personal concepts of "good" characters (e.g., radula characters, shell structure, gill morphology). Only in the last ten years or so has phylogenetic systematics begun to provide alternative hypotheses of relationships. Phylogenetic studies often contradict earlier classifications and can lead to extensive reclassifications of groups. However, the incorporation of published reclassifications of this kind into the Checklist appears to have been uneven.

The plan of the list (p. 12) states that the classification used in the Checklist "approximates" the systematic arrangement of taxa advocated by recent phylogenetic analyses. However, phylogenetic arrangements can not be pruned and grafted to conform to political and ecological boundaries or popular sensibilities and remain meaningful representations of relationships. Exclusion of taxa that were included in a phylogenetic analysis will likely produce paraphyletic groupings that confound relationships, and destroys the classification's usefulness in estimating biodiversity and biogeographic distributions - two of the stated goals of the Checklist.

Examples of "approximating the systematic arrangement of taxa advocated by recent phylogenetic analyses" while maintaining traditional groupings include the presence of the "Archaeogastropoda" - a blatantly paraphyletic group that refuses to go away in spite of repeated attacks by both evolutionary systematists and cladists alike (Graham, 1985; Salvini-Plawen & Haszprunar, 1987; Ponder & Lindberg 1997). In the Checklist's incarnation of the "Archaeogastropoda" the Neritopsina are removed from the group, but the taxon Cocculinidae remains grouped within the Archaeogastropoda despite the insightful work of Haszprunar (1988a) and others. While the authors correctly point out that the inclusion of the Cocculinidae within the Neritopsina by Ponder & Lindberg (1997) is not well supported, moving the Cocculinidae to the end of the list of "Archaeogastropoda" to place them next to the Neritopsina does not reflect this uncertainty in this supposedly phylogenetic arrangement of taxa. Because branch segments can freely rotate at their nodes in a cladogram it is possible to place the terminal branch label Neogastropoda next to the terminal branch label

Patellogastropoda in most gastropod phylogenies. We could then list the taxon names from left to right (or right to left) and have Neogastropoda next to the Patellogastropoda. However, the fact that they are in juxtaposition to one another in no way indicates a close relationship unless they are also sister taxa. These nuances cannot be simply mixed in an amalgamation of traditional canonical systematic practices and phylogenetic classification.

However, the real travesty in the Checklist classification is the absence of the taxon Caenogastropoda. Caenogastropoda was proposed almost 40 years ago by Cox (1960) and subsequently appeared in every meaningful study of gastropod systematics (Bieler, 1991). It is mentioned only once in the Checklist in a footnote to the Gastropoda (p. 56). The absence of the Caenogastropoda from the Checklist seems to hinge on the following statement in the footnote. "Because of the continuing evolution of the higher classification of gastropods, the conflicts between the existing classifications, and the constraints imposed by the nature of this list, we have adopted an arrangement that borrows elements from current classifications and phylogenies while maintaining the utility of and a degree of familiarity with the list for the nonsystematist."

All of these justifications are demonstrably false. Instability in higher gastropod classification? With the exception of the placement of the hydrothermal vent taxa, Neritopsina, and Cocculinidae, the "higher" classification of the Gastropoda has been relatively stable for almost ten years (Haszprunar, 1988b; Bieler, 1991:table 1; Ponder & Lindberg, 1997). Prior to Haszprunar's (1988b) all-out assault on Thiele's (1925) gastropod classification, Thiele's system was already suspect with the proposal of Neritopsina by Yonge (1947), Cox's (1960) proposal of Caenogastropoda, and Golikov & Scarlato's (1976) classification. Most remaining conflicts are within the larger groupings (i.e., Vetigastropoda, Caenogastropoda), and not questions of monophyly or the relative relationships of the higher taxa used in classification. Constraints imposed by the list? They must have been unwritten for there is nothing in the AFS principles or AMU/CSM resolutions that prevents the use of a modern systematic framework. To the contrary, Resolution 20 states that "*The most current literature should be used for systematic classification*", and the plan of the list sought to "approximate the systematic arrangement of advocated by recent phylogenetic analyses, *particularly in the gastropods*" (emphasis added). As argued above there is no algorithm or procedure for combining canonical and phylogenetic classifications, and the results of such mischief do not yield practical or utilitarian classifications. Instead, the "higher gastropod classification" used in the Checklist is unique and is not found in any other systematic treatment of the gastropods. It therefore can not be familiar to anyone.

Paradigm changes in science often produce a Tower of Babel effect with different groups of practitioners speaking languages that are unintelligible to one another. The shift from a canonical to a phylogenetic systematics has had such an effect and its residues are acutely apparent in the Checklist. For example, Mikkelsen's (1996) phylogenetic analysis unequivocally supports the demise of the traditional organization of Cephalaspidea. However, her findings are not included in the Checklist because of the "strictures of the organization of this list" (again, the mysterious and secret "list constraints" that are not shared with the reader), and "pending more explicit statements of relationships." Currently, there is no more explicit statement of relationships than the cladogram produced by Mikkelsen's phylogenetic analysis. Perhaps more data or another outgroup might produce a different tree, but it would certainly not be a "more explicit statement of relationships", just a different one. Another confusing rationalization occurs in the footnotes to the Conidae. Here the authors discuss the classification of Taylor et al. (1993), and concede that it "is better supported by anatomical and radular data than any previous one," but then go on to suggest that "...a more 'comfortable' arrangement would have had these four subfamilies in a family of their own."

Personally, I would be comfortable with four elements - air, water, fire and earth. I can keep all of the them and their elemental and essential qualities in my head, and easily visualize the transformation of water into air by the addition of fire. I cannot keep 112 elements and associated information like atomic number and weights, and electron configuration in my head, nor can I mentally solve the simplest chemical reactions without an aid called the Periodic Table. This table reflects our current and best understanding of the elements, and more importantly allows us to do superior and more predictive science than the Aristotelian elements. Perhaps our classifications have reached the point where ranks and suffixes are no longer sufficient to represent our knowledge, and maybe we require aids like cladograms and indented listings to represent our best understanding of molluscan classification¹

One of the most meritorious undertakings of the Checklist framers was the inclusion of Resolution 10 - "Justification should be presented when necessary to explain inclusion or deletion of a scientific or common

¹This analogy is not as far-fetched as it may initially appear. The conception of the Linnaean classification scheme was guided by Linnaeus's belief in a Special Creation, perfection of species, and natural groupings that reflected intelligent design. Phylogenetic classification assumes and seeks to represent descent with modification. The philosophical distance between these two positions is just as great as that between the Aristotelian elements and the Periodic Table.

name. (This is a procedural *requirement* [emphasis added] of all editions after the first.)" However, this requirement is too often ignored or shammed throughout the volume. While many of the Checklist authors provided citations to peer-reviewed, primary literature, others used the footnotes to point to seashell trading cards, privately printed and distributed photocopies, and even other checklists to justify nomenclatural choices. According to my copy of the OED a justification is "the action of justifying or showing something to be just, right or proper." This could be brief, but I assume it would have to contain some explanatory material.

The most blatant lack of justifications for nomenclatural changes is in eastern Pacific bivalves where wholesale changes are referenced to another checklist and therein to another footnote creating a virtual loop of vagueness (see also Resolution 14). For example, in the AFS Checklist (p. 194) *Psephidia stephensae* is considered "to be a synonym of *N. cymata*; *P. stephensae* is deleted." Checking the supposed justification for this deletion in the cited reference (Coan & Scott, 1997:25) we find, "We regard *Psephidia stephensae* Hertlein and Grant, 1972, as a synonym of *Nutricola cymata*." This is a fiat (OED: "an authoritative pronouncement, decree, command, order") and contains no more information than the action that it supposedly justifies. It remains to be seen whether the long-awaited volume on the marine bivalves of the northeastern Pacific Ocean (Coan & Scott, in prep.) will provide explanations for the multitude of changes made in both checklists. In marked contrast to those who ignored Resolutions 10 and 14, other authors (especially in the terrestrial and freshwater sections) used this resolution to remove and undo unsubstantiated nomenclatural and distributional changes from the first volume.

Other inconsistent applications of the principles and resolutions include the discouraging of patronymics (AFS Principle 6). So while Hemphill lost his slug and Dall, Gould, and Pilsbry their tuskshells, Carpenter kept his carditid, Oldroyd her penshell, and Bartsch his shipworm. There are also some strange biogeographic conventions. Taxa that occur in both the Gulf of Mexico and the tropical eastern Pacific (e.g., *Aplysia parvula*) are listed only as "A" (western Atlantic Ocean including the Gulf of Mexico) because the Pacific Ocean that touches the coast of Mexico is outside the area of coverage of the list. How does one use this list to evaluate biodiversity given this kind of data? There are also logic problems with the exclusion of Hawaiian taxa from the Checklist. One of the reasons Hawaii is excluded from the Checklist is because "its fauna is of Indo-Pacific origin." Does this mean that the fauna covered in the Checklist must have originated in the US and Canada with the exception of the introduced taxa in Appendix 4? Absolutely not: Marinovich (1983),

Vermeij et al., (1990), Lindberg (1991), McLean (1984), and others have convincingly demonstrated biotic interchange between North America and the temperate regions of Asia and South America. There is also substantial overlap of the Arctic fauna (which is covered in the Checklist) with the faunas of Greenland, Iceland, and Arctic Europe. Was it assumed that widely dispersed Arctic taxa originated in North America and subsequently migrated out of New World to facilitate their inclusion in the Checklist?

While the AFS charge was clear, the authors' goals laudable, and the principles and resolutions unambiguous and comprehensible, the 2nd edition of "Mollusks" does not overcome the past and, regrettably, some of the present practices of molluscan taxonomy. The appendices of endangered and threatened mollusks, extinct mollusks and introduced mollusks are useful and welcomed additions, but the remaining three appendices ("For readers who are relatively new to the field of malacology,...") seem out of place and passé. They also provide little information for the neophyte. For example, the illustration of chiton anatomy in the appendix "Introduction to North American Mollusks" shows only a mouth, anus and gills in addition to the requisite plates and girdle. Evidently, these animals do not reproduce or have other life functions. Anatomical illustrations of bivalves, scaphopods, gastropods, and cephalopods show those taxa to be better endowed, but not so the aplacophorans. The coiled monoplacophoran protoconch, debunked by Lindberg (1985) and Wingstrand (1985) makes a return appearance in this appendix as well. The Checklist's introductory materials and many of the appendices are almost identical to the introductory material of the first edition of *American Seashells* (Abbott, 1954) - *Man and Mollusks, Life of [Mollusks], Collecting North American Mollusks, Guide to the Molluscan Literature*. It's all there; even the dedication to the esteemed author of two editions of *American Seashells* - R. Tucker Abbott.

What about the third edition of the Checklist? A limited view of the future is on the CD that accompanies the Checklist volume. Adobe Acrobat® Reader 3.0.1 is supplied on the disc and with it the user can display on-screen facsimiles of the Checklist. The display is in the form of several related documents and each document is searchable. Ten years from now it is unlikely that hard copy of the third edition of the Checklist will need to be produced. The future most likely contains distributed taxonomic resources, where individual researchers maintain their most recent monographic treatments, data, and classifications on the World Wide Web (or whatever the web becomes). Rather than open a book, we will likely send our electronic assistants to the Checklist URL (e.g., www.IBM.checklist.org) to access a meta-database of distributed taxonomic resources that will then be queried and the results (and supporting data) returned

to you in the blink of an eye. For those who cannot wait ten years, the book/CD combination is available from AFS Publication Fulfillment, P.O. Box 1020, Sewickley, PA 15143 USA.

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