

PENAEOID AND SERGESTOID SHRIMPS AND PRAWNS OF THE WORLD. KEYS AND DIAGNOSES FOR THE FAMILIES AND GENERA by Isabel Pérez Farfante and Brian Kensley. 1997. *Mémoires du Muséum national d'Histoire naturelle, Tome 175 Zoologie*. 233 pp. Muséum national d'Histoire naturelle, 57, rue Cuvier, F-75005 Paris, France. ISBN 2-856653-510-0. ISSN 1243-4442. 350 FF (ca. \$58). Hardcover.

The penaeoid and sergestoid shrimps comprise the Dendrobranchiata, a sub-order of the crustacean order Decapoda. This group is characterized by (a) highly branched gills and (b) a primitive mode of reproduction in which fertilized eggs are not incubated, as in other decapods, but instead are cast into the water, hatching later in the plankton as nauplius larvae. Dendrobranchiate shrimps, with about 500 described species, are important members of shallow and deepwater benthic faunas, and also contribute as well to the bathypelagic, mesopelagic and even planktonic communities of the world's oceans. Shrimp fisheries and aquaculture of the world are dominated by this group, especially members of the tropical and subtropical family Penaeidae.

Given their importance in marine communities, commerce, and the phylogeny of decapod crustaceans, one might expect that the taxonomy of the group might be well worked out. However, this is not altogether the case, and therefore the present volume is particularly welcome. There is no lack of expertise by the authors. Isabel Pérez Farfante is a world's authority on penaeoid shrimps, an Emeritus Research Scientist with the National Marine Fisheries Service (NMFS) in Miami, Florida, following a distinguished tenure in the NMFS Systematics Laboratory at the U.S. National Museum of Natural History (NMNH). Brian Kensley, Curator in the Department of Invertebrate Zoology at the NMNH, is a eminent expert in decapod and isopod crustaceans. They have put together the definitive volume on the taxonomy of dendrobranchiate families and genera.

The organization and format of the volume make it a pleasure to use. There are diagnoses for and keys to the two superfamilies, 7 families, and 56 genera of the Dendrobranchiata. For each genus is provided a synonymy, type species, type locality, thorough diagnosis complete with a branchial formula in tabular form, and a section entitled "Species." The latter includes not only described species, together with author and date of publication, but also their geographic distribution. For some genera, there is a "Remarks" section in which additional information and justifications for taxonomic decisions are presented. For each genus, there is an illustration of a complete individual of one species, along with figures of the male (petasma) and female (thelycum) genitalia, the cornerstones of dendrobranchiate systematics, as well as the seminal receptacles of the female when present. As graciously acknowledged by the authors and formally stated on the title page, the majority of the excellent, highly detailed illustrations were rendered by Molly Kelly Ryan of the NMNH.

The authors have made sure that this volume can be used by any biologist. There is an extensive glossary in which the highly specialized terminology associated with dendrobranchiate taxonomy is made clear. A glossary of terms is worth little without explanatory illustrations. In keeping with the high utility of the volume, the authors have provided clear, well-labeled, and easy-to-understand diagrams. A schematic diagram of a penaeoid shrimp is given. The basics of eye, antennal, pereopod, telson, thelycum and petasma are portrayed, as are the details of carapace sculpturing, teeth and spines. As anyone who has struggled with the

frustrating subtleties of morphology of penaeoideans and sergestoideans will appreciate, these diagrams and the glossary are not only welcome but quite necessary. The bibliography gives the complete reference for all author and date citations used in the text. There is an useful index to taxa in which pagination for major entries and figures of a taxon are distinguished for easy reference.

Substantial revisions of some penaeoid genera are made in this volume. Perhaps the one which will summon the most attention involves the genus *Penaeus* s.l., so well-known because of its importance in fisheries and aquaculture. The former subgenera *Farfantepenaeus*, *Fenneropenaeus*, *Litopenaeus*, *Marsupenaeus*, and *Melicertus* are raised in rank to genus alongside *Penaeus* s.s. Thus, for example, the commercially important shrimps of the Gulf of Mexico, i.e., the white, brown and pink shrimps, are now *Litopenaeus setiferus*, *Farfantepenaeus aztecus* and *F. duorarum*, respectively. A familiar "white shrimp" of the Pacific, so valuable in fisheries and aquaculture, is now *Litopenaeus vannamei*. Although using these new names will seem a bit inconvenient and cumbersome to many, these changes simply reflect biological reality and are a must. For example, the white shrimps, *Litopenaeus*, have a very different reproductive morphology and biology than any of the other genera formerly grouped under *Penaeus*. In *Litopenaeus*, mating is not associated with female molting, occurs just before female spawning, and the spermatophores are applied externally. In the other genera formerly included in *Penaeus* s.l., mating occurs just after a female molt, spawning occurs some time after mating, and spermatophores are deposited in seminal receptacles of varying structure. These differences in reproductive biology are indicative of the large genealogical gap between *Litopenaeus* and these other genera. The former inclusion of these six genera in one genus (*Penaeus* s.l.) made impossible the rationale designation of characters and character states for cladistic analyses. The changes made in *Penaeus* s.l. as well as others made in the volume will make realistic phylogenetic analyses possible.

Other notable revisions includes that of the penaeoid genus *Trachypenaeus* s.l., now represented by four genera, *Trachypenaeus* s.s., *Trachysalambria* (a resurrected name), *Megokris* and *Rimapenaeus*, the latter two of which are newly proposed and diagnosed in the volume. Thus, the familiar "trachypenaeid" species of the Gulf of Mexico are now *Rimapenaeus similis* and *R. constrictus*. The genus *Plesiopenaeus* (Aristeidae) undergoes some changes, with one species removed and placed in a newly diagnosed genus, *Austropenaeus* (*A. nitidus*) and yet another in a genus with the resurrected name *Aristaeopsis* (*A. edwardsiana*). The generic name *Pelagopenaeus* (Penaeidae) is given nomenclatorial validity. The authors recognize that even further revisions may be needed as more biological information on described species becomes available. For example, the considerable morphological variation within the genus *Parapenaeopsis* (Penaeidae) suggests to the authors that several genera will eventually be recognized from its species.

This volume is a "mother lode" of information ready for mining by students of phylogeny, biogeography, comparative functional morphology and adaptation. All the taxa, from genera to higher categories, are presented with an exhaustive list of their characters. The information for a cladistic analysis based on morphology is all there; the interested investigator has to supply the evolutionary polarities and do the analysis. Molecular phylogenies for this group can be compared to or integrated with those generated from these morphological data. All described species are given with their geographical distributions; a biogeographical analysis of the penaeoid and sergestoid shrimps begs to be done. For those interested in making hypotheses based on any important set of dendrobranchiate

characters, e.g., evolutionary trends indicated by branchial characters (fuller complement = primitive, reduced = derived), the raw data for all genera are clearly given. The adaptive nature of and evolutionary trends in some characters, e.g., the complex grooving and sculpturing on the carapace, have hardly been speculated on, much less analyzed. Yet the complete presentation of the details on these characters should stimulate functional morphologists to make hypotheses on function (e.g., hydrodynamic, burrowing, antipredator) which could then be tested experimentally with living shrimps.

Dendrobranchiate shrimp are not particularly diverse in their general body morphology and cheliped structure when compared to the other great group of decapod shrimps, the carideans. However, there has obviously been a great deal of selection on and evolution in reproductive structures in dendrobranchiates. The diversity of form and, presumably, function in the genitalia (male petasma, female thelycum) and associated structures (male sperm plugs, female seminal receptacles) in penaeoid and sergestoid shrimps is truly amazing and is the greatest of any decapod group. This volume documents and displays that variability in reproductive morphology in a way that should stir this and future generations of functional morphologists into action. The possible role of these reproductive structures in copulatory courtship, paternity assurance and cryptic female choice should appeal to evolutionary biologists studying mating systems, mating strategies, and sexual selection.

This is a handsome volume, enclosed in a hardcover adorned with a striking color design, worthy of the valuable material enclosed within. In the case of this systematic masterpiece, one *can* judge a book by its cover. For about \$58 U.S., it is a bargain.—*Raymond T. Bauer, Department of Biology, University of Southwestern Louisiana, Lafayette, Louisiana 70504-2451.*