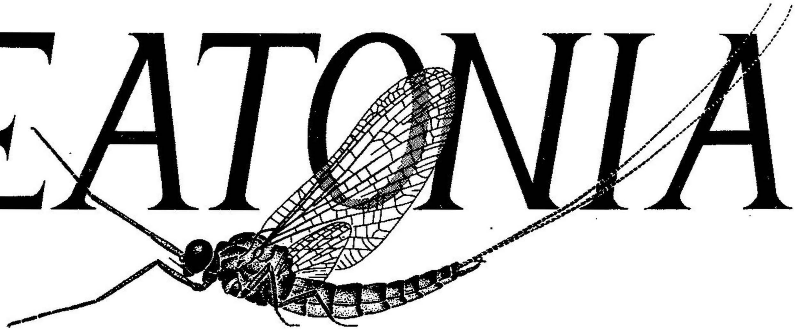
3-31-1977

Eatonia No. 23, Mar. 31, 1977

William L. Peters

Janice Peters

EATONIA



No. 23 Florida A & M University, Tallahassee

A small change is made in the masthead of Eatonia beginning with this issue, as the time between sending Eatonia to press and the time we mail the complete issue grows longer. At this writing, Eatonia #21-22 has been in press over eight months, but it is expected any day. Mechanical breakdown will account for the delay on that issue, and we do hope that problems will eventually be eliminated. This is all in the way of an apology, for we are sorry for the long time between issues. This issue of Eatonia (#23) covers literature received through December 31, 1976. The date it is submitted to press appears on the last page. The date of first mailing is that stamped on the masthead.

As universities in Tallahassee try to economize, journals which we used to search regularly have been discontinued. Thus we continue to request reprints of any works which contain data on Ephemeroptera. To all you who have sent reprints, notes, or suggestions, we give our sincere thanks. We especially thank U. Jacob who prepared the beautiful drawings heading various subsections of this issue.

A regular examination of mailing lists is now required by law in Florida. We have been trying to meet this requirement with the least amount of inconvenience to you and to us. Anyone who has published (check Eatonia Index to see if your work has been cited), or corresponded, or otherwise communicated with us over the last two years is assumed to be interested in continuing to receive Eatonia. If we have not heard from a person for two years, we send a letter inquiring about their interest in the newsletter and their correct address. If unanswered, the name is dropped from the mailing list. So, if you would be so kind as to check your address, and drop us a note if incorrect or if we haven't heard from you recently, it would save us a bit of trouble. Also, if you are now receiving Eatonia but have no interest in continuing, a note to that effect would certainly be appreciated.

Individuals who wish to request Eatonia should write the editor, University P. O. Box 111, Florida A & M University. University and institutional library requests should be addressed to Dr. N. E. Gaymon, Director of Libraries, University P. O. Box 78, Florida A & M University, Tallahassee, Florida 32307.

AUTHORSHIP OF THE FAMILIES SIPHLONURIDAE, PALINGENIIDAE AND POTAMANTHIDAE

By J. G. Peters and M. D. Hubbard

L. Arvy recently called our attention to the following publication: E. de Selys-Longchamps, 1888, Catalogue raisonné des Orthoptères et des Névroptères de Belgique, Ann. Soc. Entomol. Belg., 32:103-203. In this work the mayflies, or "Famille des Éphémérides," are divided into four subfamilies — Palingénines (p. 147), Éphémérines (p. 147), Potamanthines (p. 148), and Siphlurines (p. 150). De Selys-Longchamps specifically indicated that these names were taken from the unpublished list of H. Albarda. Albarda's list subsequently appeared in 1889 (Tijdschr. Entomol., 32:211-376): Palingéniines (p. 256), Potamanthines (p. 257), Siphlurines (p. 262). The Ephemerinae contained only Ephemera in the 1888 paper, while in 1889 Albarda limited the name Ephemeridae to the family and included Ephemera in the Palingeniinae. Palingeniinae also included genera of the current families Polymitarcyidae and Oligoneuriidae; Siphlurinae included Heptageniidae and Ametropodidae; Potamanthinae included all remaining nominal genera.

While limits of Albarda's subfamilies were quite different from those in use today, the paper appears to represent the first use of family-group names for the Palingeniidae and Potamanthidae, and their authorship would therefore go to Albarda in Selys-Longchamps, 1888. Ephemeridae Leach, 1815 had been established previously, but Siphluridae presents more of a problem. Siphluridae Albarda, 1888 is based on the unjustified emendation of Siphlonurus Eaton, 1868 to Siphlurus by Eaton (1871), as are Siphlurini Banks, 1900, Siphluridae Jakobson and Bianki, 1905, Siphluridae Klapálek, 1909, and others. As an unjustified emendation, Siphlurus becomes a junior objective synonym of Siphlonurus so that the family name Siphluridae can no longer be changed to Siphlonuridae by simply correcting the spelling (as has been done in the past). Siphluridae Albarda, 1888 has priority over the first use of Siphlonuridae since Siphlurus was the generic name accepted by entomologists in the late 1800s, although it might be argued that Siphlurus was never a valid generic name. The question of priority need not concern us seriously, since Siphlonuridae has definitely won general acceptance; for this reason, Article 40 of the International Code of Zoological Nomenclature (1964) requires that it be maintained or conserved in the interests of stability.

Clemens (1915) resurrected Siphlonurus and pointed out that Siphlurus was invalid, but he did not construct a family-group name. As far as we can ascertain, Ulmer (1920) was first to use Siphlonuridae. For this situation, Recommendation 40A (Int. Code Zool. Nomencl. 1964) suggests that the year when the family was originally proposed be listed in parentheses after the author and date of the name being conserved, i.e. Siphlonuridae Ulmer, 1920 (1888).

In summary, authorships of these families now read:

Palingeniidae Albarda in Selys-Longchamps, 1888

Potamanthidae Albarda in Selys-Longchamps, 1888

Siphlonuridae Ulmer, 1920 (1888)

We sincerely thank Dr. Arvy for referring us to the publications of H. Albarda and E. de Selys-Longchamps. We also acknowledge W. L. Peters and G. F. Edmunds, Jr. for assistance in interpreting the International Code of Zoological Nomenclature.

News and Notes

The collections and reprints of V. K. Mayo have been deposited at the University of Arizona. Inquiries or requests concerning this material should be addressed to C. A. Olson, Assistant Curator, Department of Entomology, University of Arizona, Tucson, Arizona 85721, USA.

* * * * *

E A T O N I A

A NEWSLETTER FOR EPHEMEROPTERISTS

Prepared by the S. H. Coleman Library, Florida A & M University

in cooperation with

School of Science and Technology, Florida A & M University

Department of Biology, University of Utah

Janice G. Peters - Editor
William L. Peters and George F. Edmunds, Jr. - Editorial Committee

This public document was promulgated at an annual cost of $620.00 or $0.33 per copy for the purposes of (1) acquainting all workers with the current research of others, (2) promoting increased knowledge of the literature, especially among workers recently entering the field, and (3) promoting more precise methods and techniques of studying Ephemeroptera.

In describing an underwater observatory to study Simuliidae in their natural habitat, Mokry (1975, Verh. Int. Ver. Theor. Angew. Limnol. 19:1546-1549) noted an unidentified "mayfly" species which emerged, mated, and oviposited under ice. This was an unfortunate error and re-examination of photographic material has shown it to be a trichopteran, probably Dolophiloides distinctus (Walker) Family Philopotamidae, as subsequent studies have shown this species to emerge all year round here as it does elsewhere [Ross, H. H., 1944, Ill. Nat. Hist. Bull. 23(1): 326 pp.]

- Joseph E. Mokry

* * * * *

The Fifteenth International Congress of Entomology was held in Washington, D.C. (USA), from August 19 to 27, 1976. Many papers contained data on Ephemeroptera. The symposium on Insects in Stream Ecosystems, organized by J. B. Wallace and moderated by H. H. Ross, included papers by G. B. Wiggins and R. Mackay on "Exploring the systematics-ecology interface in aquatic insects," S. Ulfstrand on "Microdistribution of stream insects," and J. R. Sedell on "Detritus processing streams." The symposium titled Role of Arthropods in Forest Ecosystems included presentations by R. V. Vannote on "The role of aquatic arthropods," and two papers by N. H. Anderson and J. R. Sedell on "Aquatic insects in relation to processing of large particulate organic matter in coniferous forest stands" and "Leaf processing by invertebrates in the streams of the Coast and Cascade Ranges of the coniferous forest biome."

G. F. Edmunds spoke on "Distribution and dispersal patterns of Ephemeroptera" in a symposium on Continental Drift and Historical Biogeography (moderated by W. L. Peters), F. M. Carpenter on "The geological history and evolution of insects" in a symposium on Diversity of Insects and the Dominance of the Land, and W. Wichard on "Chloride cells and chloride epithelia of aquatic insects" in Osmoregulation and Active Transport. R. J. Wooton included Ephemeroptera in a poster session presentation entitled "Functional considerations in insect wing design;" J. R. Voshell, Jr. and G. M. Simmons, Jr. presented "Aquatic insects of a new reservoir" at the same event. Ephemeroptera were also discussed in the following presented papers: L. Berner, "Distributional patterns of southeastern mayflies;" B. A. Federici, "An iridovirus from an ephemeropteran (Family Baetidae);" S. B. Fiance, "Distribution of mayflies and stoneflies at Hubbard Brook, N.H.: Effects of acidic precipation;" J. Kukalová-Peck, "Evolution in ontogeny of Paleoptera;" E. L. Smith, "Insect appendages: homology and function of the constituent parts, and evolution of the terminalia in the ectognathous Apterygota, and the Paleoptera;" and J. O. Solem, "Daily periodicity in Leptophlebia vespertina L. and L. marginata L. (Ephemeroptera)." We apologize for any significant papers which we might have missed, but papers were often scheduled opposite each other. Besides the very enjoyable receptions held during the Congress, a special reception was held at the U.S. National Museum commemorating the opening of their exhibit "Insect Zoo" in conjunction with the 15th International Congress. We thank the organizing committee for their work and hospitality during this international meeting.

* * * * *

The Mayflies of North and Central America, by George F. Edmunds, Jr., Steven L. Jensen, and Lewis Berner, 1976, University of Minnesota Press, Minneapolis. 330 p. $28.50.

Pictet's "Éphémérines," published in 1843 (plates in 1845) was the first taxonomic monograph on Ephemeroptera. Eaton's second monograph on the Ephemeridae, published from 1883 to 1888, covered the entire known mayfly fauna and all previous literature. In 1935, Needham, Traver and Hsu published The Biology of Mayflies with keys, descriptions, and literature to all known North American species north of Mexico. Major, comprehensive works covering the world or broad geographic regions such as North America are rare. Now Edmunds, Jensen and Berner have added another work to the North American list, continuing the dubious tradition of publishing a book synthesizing our knowledge of North American Ephemeroptera every 40-50 years. The Mayflies of North and Central America does not replace The Biology of Mayflies, which still contains the most complete assemblage of descriptions to North American species ever published. The Mayflies of North and Central America is the essential supplement updating keys, morphological characters, genera and generic limits, classification, and distribution of North American species and genera.

The book is dedicated to Jay R Traver, but once more editors have added a period to the middle initial (thinking it must stand for something, which it does not). The book begins with a discussion of the biological role of mayflies, followed by a section on methods. "Methods" includes an excellent, well-illustrated, and rather complete account of standard methods used today to collect, preserve, and mount specimens. (Appendix II lists names and addresses of equipment suppliers, which should be useful for a few years.) Following the methods are discussions of classification, use of keys, terminology, and distribution, all leading to the adult and nymphal keys to the genera.

The discussion of classification in the introduction and under separate families is excellent. While one system of classification is used in the book, it is not presented as the only possible system. Different approaches and problems in interpreting phylogeny are discussed. Understanding this, a system of classification is used that seems best in the light of current knowledge. Incidentally, in higher classification of Ephemeroptera, the subfamilies are relatively stable: there is less disagreement about their composition than about families or superfamilies.

Some of the keys use standard characters that have been used before, but many couplets were designed especially for this book. In this laboratory we (Peters, Flowers, Pescador, Hubbard, Savage, Fink) have been using the keys as much as possible in recent months trying to discover problems and to check their validity. Areas where problems might be expected include the keys to female imagos of Heptageniidae and keys to the imagos of Baetidae with two marginal intercalaries in the fore wings. A supplemental character in the metascutellar hump has been added to the sometimes difficult wing characters for these Baetidae. So far, these couplets have worked very well and we commend the authors for their initiative in developing the use of new characters. Couplet 56 to the nymphs of Metretopus and Siphloplecton will not work for all species, but L. Berner is finishing a revision of the Metretopodidae which will contain a new key to differentiate nymphs of these genera. Notice too the discussion (p. 244) of an undescribed species of Ephemerella (Dannella) whose nymph will not key to the correct subgenus, the unkeyed references to nymphs of Homothraulus or a similar genus from Texas (couplet 65 and p. 224), and the general discussion of problems in keying Baetidae (p. 155). We might also mention that the auxiliary character of two caudal filaments will separate adults of Baetidae from adults of Hagenulopsis, Caenidae, and Tricorythidae (3 tails) more quickly than venational characters in imagos without hind wings (couplet 11 — outside the range of Hagenulopsis, wing shape alone will suffice). This is not a true criticism, but it has presented problems to beginning students. Other couplets are more complex — even difficult — by necessity. We remind readers to check the valuable sections on "Use of Keys" (p. 31) and "Problem Couplets" (p. 35). Here the authors, having anticipated problems, discuss supplemental characters and distributions to those more difficult key couplets.

The inclusion of Central America presents some problems, especially in the keys. Central America is rich in mayflies but poorly collected. Almost every new collection we see contains at least one undescribed genus of Leptophlebiidae. An exact generic determination may not always be possible in the Baetidae and Leptophlebiidae, as should become evident from reading the discussions which accompany the families and genera of these families.

Although unpublished when the book was written, McCafferty and Edmunds ([77], this Eatonia) have placed the Pentageniinae as a subfamily of the Palingeniidae. With this change, only two of the extant families of mayflies recognized by the authors are not found in North America, namely Prosopistomatidae and Siphlaenigmatidae. We should caution potential users that, in spite of this, the keys should be used only with extreme caution outside of North or Central America.

Following the keys is a general section summarizing knowledge of mayfly habitats, feeding, life cycles, and swarm behavior, given as an introduction to the more detailed discussions under individual families and genera. The format for these discussions is based on Berner's (1959) "Tabular summary..." in that species and their distributions are listed in tabular form for each genus. Keys to species are not given nor are they cited if they appear in such reference works as Biology of Mayflies, Berner's (1950) "Mayflies of Florida," or Burks' (1953) "Mayflies of Illinois." When the best keys to species are elsewhere, reference is given to those publications. Keys do not exist for many genera because species are poorly known or known only from one stage. Instead, the authors give a complete literature section covering all taxonomic works on North America since 1935 so that it should be possible to find descriptions of species known from a region without long library search. A further aid is Appendix I, which gives the current name for no longer valid names or name combinations of the last 41 years. Used with Biology of Mayflies, the literature and placement of North American species is complete-to-date.

The discussion of the biology of individual genera is a mixture of published and formerly unpublished information. References to sources are given in some cases (most notably C. P. Alexander's notes on the rare Siphlonisca), but often not. Valuable as it may be to incorporate as much general information as possible into a book of this nature, the unattributed data do present difficulties as the source, strength, and value of both published and formerly unpublished information must still be determined. We also feel it necessary to re-emphasize the authors' introductory cautions: much of what is known of mayfly biology rests in single, isolated reports of an observational nature which may not hold true elsewhere; the larger the genus, the fewer the generalizations which can be made from a single report on a single species; and, isolated reports tell nothing of significant ecological factors affecting behavior.

The authors tried to avoid new synonyms and changes of generic status in the book. Most name changes were published separately in taxonomic journals, but a few remain: Tricorythodes fallax Traver is synonymized with T. minutus Traver (p. 259), and Euthyplocia bullocki Navas is transferred to the genus Chaquihua (p. 281). Further, Leptohyphes murdochi Allen is given as an emendation of L. murdocki (p. 254) since the misspelling of an individual's name in original publication is clear evidence of inadvertent error. Also, Hermanellopsis is treated as an independent genus, rather than a subgenus of Hermanella (p. 222).

The book is well prepared and mistakes are relatively rare, although further study will probably refine the limits of genera even more than in this book. Most species of Leptohyphes do have denticles on the claws (Allen, 1967, Can. Entomol. 99:350-374), and it is the apical denticle that is largest on claws of Pseudocloeon. The illustrator who prepared many of the figures is A. V. (not A. W.) Provonsha, the author of Baetis quebecensis is Hubbard (1974, J. Kans. Entomol. Soc. 47:348) and not McDunnough, McCafferty (1975) does key the nymphs of Potamanthus, and one misplaced comma on page 47 reverses the meaning of a sentence on geographic affinities of Hexagenia. The authors are trying to say that the idea of a boreal origin for Hexagenia is not supported by the presence of any closely related European counterparts; an austral origin seems slightly more likely because a related subgenus occurs in South America, but the origin of Hexagenia is unclear. We might add one other correction here that was not available to the authors: the southeastern records of Acanthametropus are from the Savannah River and not from Upper Three Runs, a tributary in South Carolina.

The book is well illustrated with the majority of the 432 figures prepared originally for the book. Thirty-seven figures are of whole nymphs representing every family, subfamily, and some of their more variable representatives in North America. This is a valuable addition to the book, as any questions arising from the use of keys should be resolved by a comparison of the figures. Certain figures are likely to be criticized for morphological inaccuracies, but not to such a degree that they interfere with the keys. Some male genitalia figures are dorsal views, others are ventral views, so that the subgenital plate can not be distinguished from the basal segment of the forceps in a few cases. Certain figures are quite accurate, others more schematic, and a few inaccurate — figures labeled "Homothraulus sp." or "Homothraulus sp. (Argentina)" appear to have been drawn from a genus quite similar to Farrodes.

The book was written over many years, so that small inconsistencies appear between sections. Again, this will not interfere with the use of the keys or the importance of the book. The massive accumulation of figures and data on North and Central American mayflies was a major undertaking, and the result is remarkable. It is a beautiful book, a useful book, and an essential book for the library of everyone working on North or Central American Ephemeroptera.

- William L. and J. G. Peters

* * * * *

Hatches: A Complete Guide to Fishing the Hatches of North American Trout Streams, by Al Caucci and Bob Nastasi, 1975, Comparahatch, Ltd., New York. 320 p. $15.95.

This is the most handsome and in some ways the best of the treatments of mayflies by North American fly-fishing enthusiasts. The photographs are good to excellent, and the 144 color portraits of mayflies in the plates make the book a worthwhile addition to a taxonomic library on mayflies of North America. The drawings are adequate. There is also a fair amount of good mayfly biology that is useful to mayfly workers. This book treats only the species having hatches of importance to fly fishermen, and the significant information is limited to those species with which the authors have had experience. It is obvious that the authors have worked hard at attempting to master the taxonomy but they were handicapped by inadequate access to the literature.

Although this is a rather valuable book in many ways, it suffers from some fundamental problems. It should have been read by several mayfly workers with regional competence to check the identification of the species; the value to taxonomists or fishermen of the photographs and the biological data depends on the correct identification of the species. I would like to see any misidentifications corrected in notes in Eatonia as quickly as they are discovered. Secondly, the book suffers from a variety of annoying lapses in spelling, composition and in misuse of words that suggest inadequate editing.

The authors are to be applauded for their attempt to introduce the family classification concept into fly-fisherman entomology, but the results, as I will show below, sometimes fall short. The family concept that they chose to use is closest to that of Burks (1953). They were aware, however, of the more restricted usage of family names.

The book is not quite as richly illustrated as it appears at first glance. Many of the color photos reappear in black and white and one or more cropped parts may appear again. This might be for convenience of the reader but the frequent left to right reversals and switches from horizontal to vertical format leave me in doubt about the intent. This practice backfires when the authors label the same photograph as one species in black and white and as another species when it is in color. The drawings are somewhat diagrammatic but they are useful and adequate. It is hard to escape the conclusion that many were drawn from the illustrations published by others, rather than from specimens.

Users of this book should note the following errors in identifying illustrations. The black and white photo correctly identified as Ephemerella flavilinea on p. 103 appears as a color photo on the third page of plates where, incorrectly, it is called Ephemerella glacialis. [The black and white photo of E. glacialis (the correct name is now E. grandis ingens) printed on pages 93 and 103 is correctly identified.]

The color figure labeled Ephemerella simplex is a species of the bicolor group (now the subgenus Eurylophella). The elongated segments 8 and 9 are not found in the simplex group (now the subgenus Dannella), and the elongated posterolateral spines on abdominal segments 2 and 3 are not found in E. simplex.

The color photograph labeled Paraleptophlebia packi appears not to be that species, unless the characteristic prominent mandibular tusks have been broken off. Paraleptophlebia packi and three other western species have large tusks that make them very distinctive.

The color photograph labeled "Siphlonurus nymph (Western species)" is actually a species of Ameletus. This misidentification almost certainly led to the error of stating that good populations of Siphlonurus occurred in fast water. Good populations of Ameletus are indeed found in fast water, but not Siphlonurus.

Wing drawing C on p. 125 and again on p. 141 is incorrectly labeled as Brachycercus; actually it is of Tricorythodes. Probably this error results from redrawing the figures from Leonard and Leonard's Michigan trout stream book.

There are numerous cases of previously unpublished additions to the biology of various species. The account of "Hexagenia" recurvata, now Litobrancha recurvata, is an important contribution to the biology of a little known species. There are excellent photographs of the nymphs and adults. Specimens are uncommon in insect collections and collections from knowledgeable fishermen would be most welcome. The statement that "recurvata is more widely distributed than limbata" is not true except perhaps in the fishing experience of the authors.

The authors state that Tricorythodes cast their subimago skins in the air. If someone can explain to this reviewer how a subimago can pull the wings from the subimago skin in the air, I can accept this repeated claim. I have seen Tricorythodes, Caenis, Brachycercus and Ephoron alight to shed the subimago skin. But all of these genera frequently have the skin trailing from the caudal filaments and it drops to the water. Until better evidence is found, I will continue to believe that these mayflies must alight to free the wings.

They report that they found good numbers of Ephemerella mollitia (which they misspell as mollita) in the West (Yellowstone Park area), but I do not know of this species outside of California. Perhaps they found E. aurivillii.

Ephemerella lacustris is briefly discussed but is unknown to the authors. I known this species only from Yellowstone Lake where it is abundant. Specimens which I have seen from creeks or rivers that have been identified as lacustris are inermis; the records in Swisher and Richard's Selective Trout, to which Caucci and Nastasi refer, need to be checked.

The treatment of Ephemerella glacialis, grandis and doddsi is somewhat confused. Ephemerella grandis is now known to be a geographically variable species of which the form previously called glacialis has larger dorsal tubercles; the names glacialis and ingens were proposed for this form at nearly the same time, but ingens is the prior name. By definition of subspecies as geographical units, Ephemerella grandis ingens and E. g. grandis do not occur in the same streams; at the localities referred to, the populations would be referable to E. g. ingens but the populations would be strongly intergrading with E. g. grandis. In streams in the area discussed, individual specimens might key to grandis, and others to glacialis using the keys of Traver in Needham, Traver and Hsu, 1935. The complex taxonomy of this group was worked out by Allen and Edmunds in their 1962 revision of the subgenus Drunella. Although Ephemerella doddsi overlaps in its occurrence with Ephemerella grandis, generally in any stream E. doddsi is in the cooler upstream portion and/or the cool tributaries, and is replaced downstream by E. grandis. The two species may occur together in the same stream section, but usually fishermen will find only one of the two at any one place where their ranges overlap.

The editing is somewhat haphazard. There are many misspellings of scientific names (e.g., confuscus for confusus, lacaustris for lacustris, Baetis divinctus and parvis for B. devinctus and parvus, and Hydropsche for Hydropsyche); the fact that some names are spelled correctly and incorrectly on different pages suggests that these are editing lapses. On page 47 the titles "The Swimmers" and "The Burrowers" are transposed. A quick reading by one taxonomic entomologist would have corrected the following errors. When names are given as binomials, the generic name is in Roman letters, the species name in italics, such as "Ephemera guttulata" or "Isonychia bicolor." When they list the subspecies pacifica of Ephemerella hecuba, they list it as "Hecuba pacifica." Biological terms in error are arche-type for archetype, wing veination for venation, pene for penis, synonymity for synonymy, and femurs for femora.

As with practically all of the entomological fly fishermen, the authors do not fathom the reasons for most taxonomic changes and the use of rules of nomenclature. They do not use Biological Abstracts and Zoological Record, hence they are unaware of most of the literature. For mayflies, a subscription to Eatonia would have opened the way to the needed publications. Their knowledge of species names rests largely on Edmunds' 1962 paper on type localities which was the most recent check list. They have knowledge of only a few subsequent papers.

The statement that "there are eleven verified species [of Leptophlebia] ... which are accepted by the International Commission of Zoological Nomenclature" represents a misunderstanding of the role of I.C.Z.N. The I.C.Z.N. is also given responsibility for Potamanthus and Ephoron being in families other than Ephemeridae. The repeated statements such as "dorothea is a member of the Ephemerella genus" rather than "a member of the genus Ephemerella" seem awkward to the taxonomist.

In one case my own error led them to use the name Epeorus vitrea rather than E. vitreus.

Such problems as the use of the "groups" rather than the subgeneric names in Ephemerella and the inability of the authors to find reference to Ephemerella lacustris could have been solved if the authors knew how to find the literature.

The authors are mistaken concerning the importance of two genera of Heptageniidae to anglers. Mayflies of the genus Cinygmula are abundant in a wide variety of western trout streams and several species in a stream will give long seasonal emergence, frequently from June to October. Major hatches occur in the Provo, Weber, and Duchesne rivers in Utah, the Firehole and Madison in Yellowstone Park, the Metolius in Oregon and numerous other prime trout waters. They are also abundant in the many smaller headwater streams. Rhithrogena morrisoni and R. hageni form major hatches in the West, and R. robusta is a large mayfly that has abundant hatches in headwater streams. These two genera cannot be dismissed as "minor" or of "little or no value" in the West. Also, in the Pacific Northwest I have seen some good hatches of Cinygma, a third supposedly unimportant genus, but except in a few local areas Cinygma is not of the same importance as Cinygmula and Rhithrogena.

They list Baetis spinosus as an important western hatch but it is an eastern species.

In the realm of trivia, although Charles Wetzel may have been first to publish the common name White-Gloved Howdy for Isonychia bicolor, J. G. Needham used this name in the 1920's when that species was known as Isonychia albomanicata, a name meaning white-handed. In 1928, Needham and Christenson also applied a number of common names to mayflies and stoneflies.

The problem of having a family classification that will serve the needs of professional entomologists and fishermen is not as difficult as it might seem. We both prefer that our classification groups bring together forms sharing similar structure and behavior, although some biologists (including this reviewer) add to this a concern also for the evolutionary origins and relationships of the taxonomic groups.

The authors have most nearly followed the classification of Burks, but they simplify the classification for the needs of fly fishermen. These attempts to modify the classification to suit fly fishermen do not always turn out well. On page 185 we find that "Potamanthus and Ephoron genera are not technically listed under the Ephemeridae family; instead they belong to the closely related families of Potamanthidae and Polymitarcidae respectively. However, for angling purposes, we believe these genera are best presented by grouping them together with the Ephemera and Hexagenia genera." But on page

226 we find that "Through the years, the Potamanthus nymph-forms were usually mistaken for burrowers. This is probably due to their being classified in the Ephemeridae (which indicates all true burrowing insects [sic!]). However, these agile nymphs are not burrowers at all, but are of the crawling and slower swimming types..." A summary of the argument is that it is for the convenience of fishermen to lump Potamanthus with Ephemera and Hexagenia but that this leads fishermen astray about the biology of Potamanthus.

Young Potamanthus larvae do burrow, but the more mature ones seen by fishermen do not. If Caucci and Nastasi had used Ephemeridae in the sense of Burks (1953) for all Ephemeroidea in the sense of Edmunds (1962), the subfamilies would have been of value. I believe that the evidence is substantial that the modifications of the gills and legs for burrowing arose independently in the Ephemeridae and Polymitarcyidae and that the two groups should therefore be grouped separately.

The only difficulty for fishermen in dividing the genera considered into Ephemeridae, Potamanthidae and Polymitarcyidae would be learning to spot the larval differences between Ephoron and the true Ephemeridae. The adults pretty well separate on abdominal color patterns alone.

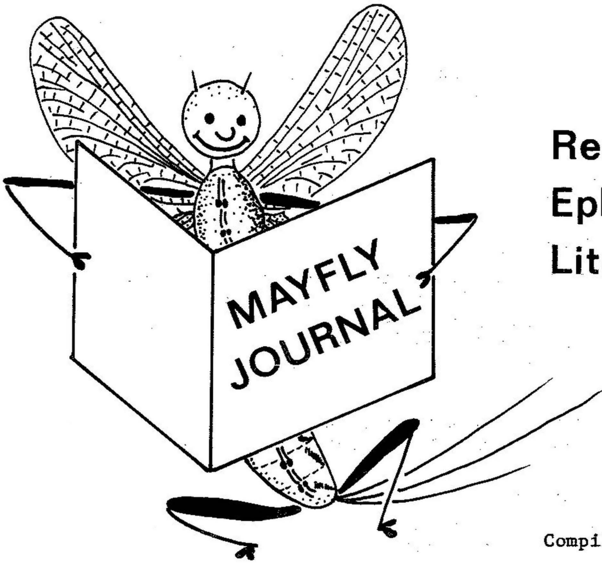
I find the grouping of the Siphlonuridae, Baetidae and Metretopodidae together as Baetidae to be counterproductive. The Baetidae, in the strict sense, are absolutely distinctive as adults with their wing venation, turbinate eyes in the male, etc. The larvae are equally distinct. Callibaetis could (without a hand lens) be confused with a Siphlonurus, but the long antennae of Callibaetis and the short antennae in Siphlonurus are enough to distinguish the two with the naked eye. Ameletus larvae are sometimes confused with the true Baetidae, but are seldom so when seen alive. The authors confused Ameletus with Siphlonurus, not with Baetidae. Siphloplecton resembles the siphlonurids as larvae, but if it is lumped there for the convenience of the fishermen, the cubital area of the adult forewings is totally different than that of the Siphlonuridae and the entire venation has no resemblance to that of true Baetidae. The convenience of recognizing the three families as separate for the larvae is well established, but the hodgepodge of adults lumped together as Baetidae by Caucci and Nastasi have nothing in common that allows their recognition except the fact that they are "two-tailed" (as are Baetisca and some Ephemeridae). It may be difficult to separate the tiny Caenidae and the Tricorythidae as two families, but only because of size. Tricorythodes is related to the Ephemerellidae and Caenis and Brachycercus are related to Neoephemeridae. The wing venation of Caenidae is very different than that of the Tricorythidae, but for the fisherman, the thorax of tricorythid mayflies is blackish or gray and that of the caenids tan to mahogany.

The family classification has biological as well as morphological meaning. For example, the egg mass that forms a ball on females of Tricorythodes resembles the egg mass of Ephemerella, not the rupturing of the female body on the water surface as in the Caenidae. Subimagoes of true Baetidae emerge from the nymphal exoskeleton at the surface of the water; the larvae of Siphlonuridae crawl from the water before the subimago emerges.

If the family classification is to prove useful to fishermen, I would plead that modifications consider both adults, larvae and biology.

- George F. Edmunds, Jr.
University of Utah

* * * * * * * * * * * * * * *



Recent Ephemeroptera Literature

Compiled by

William L. Peters and G. F. Edmunds, Jr.

Adamus, P. R. & A. R. Gaufin

[1] -1976. A synopsis of Nearctic taxa found in aquatic drift. Am. Midl. Nat., 95:198-204, 1 table.

Алимов, А. Ф. (Alimov, A. F.)

[2] -1975. Ephemeroptera и Megaloptera, p. 130-132, figs. 77-81, IN: Эколого-фаунистический обзор зообентоса озер. [Ephemeroptera and Megaloptera, p. 130-132, figs. 77-81, IN: Ecological-faunistic survey of the zoobenthos of the lakes.] Тр. Зоол. Инст. Акад. Наук СССР, Изд. "Наука," Ленингр. (Tr. Zool. Inst. Akad. Nauk SSSR, Izd. "Nauka," Leningr.) [Биол. Прод. Сев. Озер, 1 (Biol. Prod. Sev. Ozer, 1)], 56:121-155, figs. 72-94, tables 79-84.

Алимов, А. Ф. & Н. П. Финогенова (Alimov, A. F. & N. P. Finogenova)

[3] -1975. Общие особенности видового состава и количественного развития бентоса озер, p. 153-155, fig. 94, tables 83-84, IN: Эколого-фаунистический обзор зообентоса озер. [General features of species composition and of quantitative development of the lakes' benthos, p. 153-155, fig. 94, tables 83-84, IN: Ecological-faunistic survey of the zoobenthos of the lakes.] Тр. Зоол. Инст. Акад. Наук СССР, Изд. "Наука," Ленингр. (Tr. Zool. Inst. Akad. Nauk SSSR, Izd. "Nauka," Leningr.) [Биол. Прод. Сев. Озер, 1 (Biol. Prod. Sev. Ozer, 1)], 56:121-155, figs. 72-94, tables 79-84.

[4] -1975. Биоценозы и продуктивность бентоса. [Biocoenoses and productivity of the benthos.] Тр. Зоол. Инст. Акад. Наук СССР, Изд. "Наука," Ленингр. (Tr. Zool. Inst. Akad. Nauk SSSR, Izd. "Nauka," Leningr.) [Биол. Прод. Сев. Озер, 1 (Biol. Prod. Sev. Ozer, 1)], 56:156-195, figs. 95-133, tables 85-111.

[5] -1975. Продуктивность бентоса, p. 150-167, figs. 64-74, tables 71-76, IN: Бентос. [Productivity of benthos, p. 150-167, figs. 64-74, tables 71-76, IN: Benthos.] Тр. Зоол. Инст. Акад. Наук СССР, Изд. "Наука," Ленингр. (Tr. Zool. Inst. Akad. Nauk SSSR, Izd. "Nauka," Leningr.) [Биол. Прод. Сев. Озер, 2 (Biol. Prod. Sev. Ozer, 2)], 57:116-167, figs. 49-74, tables 69-76.

Алимов, А. Ф. & В. Н. Никулина (Alimov, A. F. & V. N. Nikulina)

[6] -1974. Продуктивность сообществ обрастаний в оз. Зеленетском. [The productivity of fouling organism associations in Lake Zelenetskoe.] Гидробиол. Ж. (Gidrobiol. Zh.), 10:29-35, 2 figs., 4 tables.

Allan, J. D.

[7] -1975. Faunal replacement and longitudinal zonation in an alpine stream. Verh. Int. Ver. Theor. Angew. Limnol., 19:1646-1652, 2 figs., 2 tables.

Allen, R. K. & G. F. Edmunds, Jr.

[8] -1976. Hyrtanella: a new genus of Ephemerellidae from Malaysia (Ephemeroptera). Pan-Pac. Entomol., 52:133-137, 6 figs.

[9] -1976. A revision of the genus Ametropus in North America (Ephemeroptera: Ametropididae). J. Kans. Entomol. Soc., 49:625-635, 17 figs.

Armitage, P. D.

[10] -1976. A quantitative study of the invertebrate fauna of the River Tees below Cow Green reservoir. Freshw. Biol., 6:229-240, 5 figs., 5 tables.

Arvy, L., J. Peters & R. Sowa

[11] -1976. Compte rendu de la 2e conférence internationale sur les Éphéméroptères. Ann. Biol., 15:283-285.

Arvy, L. & W. L. Peters

[12] -1976. Liste des Éphéméroptères-hôtes de parasites, de commensaux et autres associés. Ann. Parasitol. Hum. Comp., 51:121-141.

Arvy, L. & R. Sowa

[13] -1976. Recherche sur les parasites internes des Éphéméroptères de la région de Cracovie. Ann. Parasitol. Hum. Comp., 51:111-120, 10 figs., 2 maps, 1 table.

Auber, J.

[14] -1976. La muscle et sa structure, p. 355-386, 403-405, figs. 203-230, IN: Grassé, P.-P., Traité de Zoologie, 8(4). Masson, Paris.

Байкова, О. Я. (Bajkova, O. Ya.)

[15] -1975. Новый род поденки из Приморья (Ephemeroptera: Heptageniidae). [New genus of Ephemeroptera from the Primor'ye (Ephemeroptera: Heptageniidae).] Изв. Сиб. Отд. Акад. Наук СССР, Сер. Биол. (Izv. Sib. Otd. Akad. Nauk SSSR, Ser. Biol.), 1:54-57, 8 figs.

Balloch, D., C. E. Davies & F. H. Jones

[16] -1976. Biological assessment of water quality in three British rivers: the North Esk (Scotland), the Ivel (England) and the Taf (Wales). Water Pollut. Control, 75:92-114, 9 figs., 10 tables.

Bankieris, G. & J. A. Barker

[17] -1976. A season comparison of benthic invertebrates: Broken Sword and Tymochtee Creeks, p. 253, IN: Baker, D. B., W. B. Jackson & B. L. Prater [eds.], Proc. Sandusky River Basin Symp., Heidelberg Coll., Ohio, 1975. U.S. Gov. Print. Off., Wash., D.C., (1976-653-346). 475 p. [Abstr.] [1]

Bass, J. A. B.

[18] -1976. Studies on Ephemerella ignita (Poda) in a chalk stream in Southern England. Hydrobiologia, 49:117-121, 4 figs.

[1] distributed by: U.S.E.P.A., 230 S. Dearborn St., Chicago, Illinois 60604, USA

Benda, R. S. & M. A. Proffitt

[19] -1974. Effects of thermal effluents on fish and invertebrates, p. 438-447, 6 tables, IN: Gibbons, J. W. & R. R. Scharitz [eds.], Thermal Ecology. AEC Symp. Ser. (CONF 730505), Natl. Tech. Inf. Serv., Springfield, Va. 670 p.

Blomberg, O., J. Itämies & K. Kuusela

[20] -1976. Insect catches in a blended and a black light-trap in northern Finland. Oikos, 27:57-63, 4 figs., 3 tables.

Boerger, H. & H. F. Clifford

[21] -1975. Emergence of mayflies (Ephemeroptera) from a northern brown-water stream of Alberta, Canada. Verh. Int. Ver. Theor. Angew. Limnol., 19: 3022-3028, 1 fig., 4 tables.

Bournaud, M. & M. Thibault

[22] -1973. Étude bibliographique: la dérive des organismes dans les eaux courantes. Ann. Hydrobiol., 4:11-49, 4 figs., 4 tables, 1 appendix.

Brittain, J. E.

[23] -1976. The temperature of two Welsh lakes and its effect on the distribution of two freshwater insects. Hydrobiologia, 48:37-49, 11 figs., 2 tables.

Бродский, А. К. & В. П. Иванов (Brodsky, A. K. & V. P. Ivanov)

[24] -1975. Аэродинамические особенности полета насекомых: III. Обтекание крыльев поденки Ephemera vulgata L. (Ephemeroptera). [Aerodynamic aspects of insect flight: III. The vortex of wings of Ephemera vulgata L. (Ephemeroptera).] Вестн. Ленингр. Унив., Биол. (Vestn. Leningr. Univ., Biol.), 1:7-10, 3 figs.

Carnevali, M. D. C. & A. Saita

[25] -1975. Ultrastructural pattern differences in some muscle fibres of nimphal Ephemera danica (Ephemeroptera). J. Submicrosc. Cytol., 7:219-230, 13 figs.

Caspers, N.

[26] -1975. Untersuchungen über Individuendichte, Biomasse und kalorische Äquivalente des Makrobenthos eines Waldbaches. Investigations on the abundance, the biomass and the caloric equivalents of the makrobenthos in a woodland-brooklet. Int. Rev. Gesamten Hydrobiol., 60:556-566, 6 tables.

Chaisemartin, C.

[27] -1975. Effets des chromates (K_2CrO_4) sur le métabolisme respiratoire et la balance hydro-minérale tissulaire chez deux larves-nymphes du macrobenthos dulçaquicole. C. R. Séances Soc. Biol. Fil., 169:384-390, 2 figs.

Chutter, F. M.

[28] -1975. Variation in the day-time drift of a Natal river. Verh. Int. Ver. Theor. Angew. Limnol., 19:1728-1735, 3 figs., 5 tables.

Cummins, K. W.

[29] -1975. The importance of different energy sources in freshwater ecosystems, p. 50-54, 3 figs., IN: Productivity of World Ecosystems (Proc. Symp. 5 General Assembly U.S. Special Committee I.B.P.). Natl. Acad. Sci., Wash., D.C. 166 p.
[30] -1976. The ecology of running waters, theory and practice, p. 277-293, 2 figs., 2 tables, IN: Baker, D. B., W. B. Jackson & B. L. Prater [eds.], Proc. Sandusky River Basin Symp., Heidelberg Coll., Ohio, 1975. U.S. Gov. Print. Off., Wash., D.C. (1976-653-346). 475 p. [see footnote previous page]

Dahlberg, M. D. & J. C. Conyers

[31] -1974. Winter fauna in a thermal discharge with observations on a macrobenthos sampler, p. 414-422, 1 fig., 2 tables, IN: Gibbons, J. W. & R. R. Scharitz [eds.], Thermal Ecology. AEC Symp. Ser. (CONF 730505), Natl. Tech. Inf. Serv., Springfield, Va. 670 p.

Duvel, W. A., Jr., R. D. Volkmar, W. L. Specht & F. W. Johnson

[32] -1976. Environmental impact of stream channelization. Water Resourc. Bull., 12:799-812, 4 figs., 2 tables.

Échaubard, M. & A. Neveu

[33] -1975. Perturbations qualitatives et quantitatives de la faune benthique d'un ruisseau à truites, la Couze Pavin (Puy-de-Dôme) dues aux pollutions agricoles et urbaines. Ann. Stn. Biol. Besse-en-Chandesse (1974-75), 9: 1-24, 18 figs., 6 tables.

Финогенова, Н. П. (Finogenova, N. P.)

[34] -1975. Ephemeroptera, p. 122, IN: Бентос. [Benthos.] Тр. Зоол. Инст. Акад. Наук СССР, Изд. "Наука," Ленингр. (Tr. Zool. Inst. Akad. Nauk SSSR, Izd. "Nauka," Leningr.) [Биол. Прод. Сев. Озер, 2 (Biol. Prod. Sev. Ozer, 2)], 57:116-167, figs. 49-74, tables 69-76.

Flössner, D.

[35] -1976. Biomasse und Produktion des Makrobenthos der mittleren Saale. Limnologica (Berl.), 10:123-153, 13 figs., 11 tables.

Гольд, З. Г. (Gol'd, Z. G.)

[36] -1976. Биологическая оценка качества вод малых рек Сора, Бюря (бассейн Енисея). [Biological estimation of water quality in small rivers Sora, Byura (Ensei Basin).] Биол. Науки (Biol. Nauki), 1976(3): 40-45, 2 figs., 3 tables.

Grassé, P.-P.

[37] -1976. L'appareil respiratoire, p. 93-204, figs. 61-141, IN: Grassé, P.-P., Traité de Zoologie, 8(4). Masson, Paris.

Gysels, H.

[38] -1975. Electrophoretical and histochemical investigations on some noxious Lepidoptera and on the impact of pesticides upon Ephemera danica, a water-dwelling, innocuous mayfly. Acta Zool. Path. Antverp., 62:129-141, 10 figs.

Harrison, A. D. & J. J. Rankin

[39] -1975. Forest litter and stream fauna on a tropical island, St. Vincent, West Indies. Verh. Int. Ver. Theor. Angew. Limnol., 19:1736-1745, 1 fig., 3 tables.

[40] -1976. Hydrobiological studies of Eastern Lesser Antillean Islands: II. St. Vincent: Freshwater fauna — its distribution, tropical river zonation and biogeography. Arch. Hydrobiol. / Suppl. 50:275-311, 10 tables.

Hart, D. S. & M. A. Brusven

[41] -1976. Comparison of benthic insect communities in six small Idaho batholith streams. Melanderia, 23:1-18, 7 figs., 7 tables.

Hoffman, J. A.

[42] -1976. Appareil circulatoire et circulation, p. 1-91, figs. 1-60, 5 tables, IN: Grassé, P.-P., Traité de Zoologie, 8(4). Masson, Paris.

Horridge, G. A.

[43] -1976. The ommatidium of the dorsal eye of Cloeon as a specialization for photoreisomerization. Proc. R. Soc. Lond., B, 193:17-29, plates 1-5 (figs. 2-6), figs. 1, 7-8 in text.

Horst, T. J.

[44] -1976. Population dynamics of the burrowing mayfly Hexagenia limbata. Ecology, 57:199-204, 3 figs., 3 tables.

Horst, T. J. & G. R. Marzolf

[45] -1975. Production ecology of burrowing mayflies in a Kansas reservoir. Verh. Int. Ver. Theor. Angew. Limnol., 19:3029-3038, 5 figs., 3 tables.

Howell, F. G. & J. B. Gentry

[46] -1974. Effect of thermal effluents from nuclear reactors on species diversity of aquatic insects, p. 562-571, 4 figs., 1 table, IN: Gibbons, J. W. & R. R. Scharitz [eds.], Thermal Ecology. AEC Symp. Ser. (CONF 730505), Natl. Tech. Inf. Serv., Springfield, Va. 670 p.

Hubbard, M. D.

[47] -1976. Nomenclatural notes in Baetidae (Ephemeroptera). J. Kans. Entomol. Soc., 49:193.

Hubbard, M. D. & W. L. Peters

[48] -1976. The number of genera and species of mayflies (Ephemeroptera). Entomol. News, 87:245, 1 table.

Hynes, J. D.

[49] -1975. Downstream drift of invertebrates in a river in southern Ghana. Freshw. Biol., 5:515-532, 8 figs., 1 table.

Illies, J.

[50] -1975. A new attempt to estimate production in running waters (Schlitz studies on productivity, No. 12). Verh. Int. Ver. Theor. Angew. Limnol., 19:1705-1711, 3 figs., 2 tables.

Ischinger, L. S. & T. F. Nalepa

[51] -1976. Water pollution: freshwater macroinvertebrates. J. Water Pollut. Control Fed., 48:1318-1335.

Itô, T.

[52] -1976. JIBP-PF Kenkiu Suieki ni okeru Teisei Doubutsu no Tokusei to Seisan. Characteristics and production of benthic animals in the study waters of the JIBP-PF. Bentosu Kenren Shi [Benthos Res. (Inf. Bull. Japan. Assoc. Benthology)], 11/12:1-12, 9 tables. (in Japanese)

Iversen, T. M.

[53] -1975. Disappearance of autumn shed beech leaves placed in bags in small streams. Verh. Int. Ver. Theor. Angew. Limnol., 19:1687-1692, 3 figs., 3 tables.

Jacob, U., S. Kauk & F. Klima

[54] -1975. Eine ephemeropterologische Überraschung — Ephemera glaucops Pictet bei Leipzig. Entomol. Nachr., 19:185-195, 8 figs.

Jacob, U. & W. Zimmermann

[55] -1976. II. Internationale Konferenz über Ephemeropteren 1975 in Kraków (VR Polen). Entomol. Nachr., 20:17-18.

Jónasson, P. M.

[56] -1975. Kaj Berg. Arch. Hydrobiol., 76:256-264, 1 photo.

Junk, W. J.

[57] -1975. The bottom fauna and its distribution in Bung Borapet, a reservoir in Central Thailand. Verh. Int. Ver. Theor. Angew. Limnol., 19:1935-1946, 5 figs., 5 tables.

Keffermüller, M. & R. Sowa

[58] -1975. Les espèces du groupe Centroptilum pulchrum Eaton (Ephemeroptera, Baetidae) en Pologne. Gatunki z grupy Centroptilum pulchrum Eaton (Ephemeroptera, Baetidae) w Polsce. Pol. Pismo Entomol., 45:479-486, 24 figs.

Kellogg, R. L. & R. V. Bulkley

[59] -1976. Seasonal concentrations of dieldrin in water, channel catfish, and catfish-food organisms, Des Moines River, Iowa — 1971-3. Pestic. Monit. J., 9:186-194, 6 figs., 5 tables.

Kemp, P. H., F. M. Chutter & D. J. Coetzee

[60] -1976. Water quality and abatement of pollution in Natal rivers. Part V. The rivers of Southern Natal. Natal Town & Reg. Plann. Rep., 13(5):i-ix + 1-100, 10 figs., 19 tables, appendix (44 tables).

Knowles, E. E., III & J. E. Hall

[61] -1976. Histopathology of an opecoelid trematode infection in mayfly naiads. J. Invertebr. Pathol., 27:351-362, 12 figs., 4 tables.

Krull, J. N. & R. L. Boyer

[62] -1976. Abundance and diversity of benthos during the spring waterfowl migration. Am. Midl. Nat., 95:459-462, 2 tables.

Lehmkuhl, D. M.

[63] -1976. Additions to the taxonomy, zoogeography, and biology of Analetris eximia (Acanthametropodinae: Silphlonuridae: Ephemeroptera). Can. Entomol., 108:199-207, 23 figs.

Lim, R. P. & J. I. Furtado

[64] -1975. Population changes in the aquatic fauna inhabiting the bladderwort, Utricularia flexuosa Vahl., in a tropical swamp, Tasek Bera, Malaysia. Verh. Int. Ver. Theor. Angew. Limnol., 19:1390-1397, 3 figs., 2 tables.

Luedtke, R. J. & M. A. Brusven

[65] -1976. Effects of sand sedimentation on colonization of stream insects. J. Fish. Res. Board Can., 33:1881-1886, 5 tables.

Luedtke, R. J., M. A. Brusven & F. J. Watts

[66] -1976. Benthic insect community changes in relation to in-stream alterations of a sediment-polluted stream. Melanderia, 23:21-39, 4 figs., 8 tables.

Macan, T. T.

[67] -1975. Structure of the community in the vegetation of a moorland fishpond. Verh. Int. Ver. Theor. Angew. Limnol., 19:2298-2304, 6 figs., 1 table.

Macan, T. T. & A. Kitching

[68] -1976. The colonization of squares of plastic suspended in midwater. Freshw. Biol., 6:33-40, 4 tables.

Maki, A. W., L. Geissel & H. E. Johnson

[69] -1975. Comparative toxicity of larval lampricide (TFM: 3-trifluoromethyl-4-nitrophenol) to selected benthic macroinvertebrates. J. Fish. Res. Board Can., 32:1455-1459, 2 tables.

Mancini, E. R., J. R. Gammon & P. H. Carlson

[70] -1976. Recent collections of Anepeorus simplex (Walsh) (Ephemeroptera: Heptageniidae) from the Wabash River, Indiana. Entomol. News, 87:237-238.

Manier, J.-F.

[71] -1973. L'ultrastructure de la trichospore de Genistella ramosa Léger et Gauthier, Trichomycète Harpellale parasite du rectum des larves de Baetis rhodani Pictet. C. R. Acad. Sci., Paris, D, 276:2159-2162, 1 fig., 2 plates.

de March, B. G. E.

[72] -1976. Spatial and temporal patterns in macrobenthic stream diversity. J. Fish. Res. Board Can., 33:1261-1270, 4 figs., 2 tables, appendix.

de March, B., J. F. Flannagan, M. Friesen, A. Furutani, R. D. Hamilton, S. G. Lawrence, S. L. Leonhard & B. E. Townsend

[73] -1975. A compilation of literature pertaining to the culture of aquatic invertebrates, algae and macrophytes, Vol. II. Fish. Mar. Serv. Res. Dev. Tech. Rep. (Can.), 576:i-ii + 1-32. (published in manuscript form) ["Ephemeroptera," p. 16-17.]

Mason, W. T., Jr., P. A. Lewis & P. L. Hudson

[74] -1975. The influence of sieve mesh size selectivity on benthic invertebrate indices of eutrophication. Verh. Int. Ver. Theor. Angew. Limnol., 19:1550-1561, 2 figs., 4 tables.

Mantoničkin, I. & Z. Pavletić

[75] -1975. Influence des ruisseaux d'alimentation sur la composition et la structure du bentos dans les lacs accumulateurs du karst yougoslave. Verh. Int. Ver. Theor. Angew. Limnol., 19:1907-1920, 3 figs., 4 tables.

McCafferty, W. P.

[76] -1976. A coordinate indexing system for ecosystematic data. Proc. Indiana Acad. Sci. (1975), 85:252-257, 3 figs., 1 table.

McCafferty, W. P. & G. F. Edmunds, Jr.

[77] -1976. Redefinition of the family Palingeniidae and its implications for the higher classification of Ephemeroptera. Ann. Entomol. Soc. Am., 69:486-490, 1 fig.

[78] -1976. The larvae of the Madagascar genus Cheirogenesia Demoulin (Ephemeroptera: Palingeniidae). Syst. Entomol., 1:189-194, 12 figs.

McClure, R. G. & K. W. Stewart

[79] -1976. Life cycle and production of the mayfly Choroterpes (Neochoroterpes) mexicanus Allen (Ephemeroptera: Leptophlebiidae). Ann. Entomol. Soc. Am., 69:134-144, 16 figs., 2 tables.

McConville, D. R.

[80] -1975. Comparison of artificial substrates in bottom fauna studies on a large river. J. Minn. Acad. Sci., 41:21-24, 1 fig., 3 tables.

McLachlan, A. J. & S. M. McLachlan

[81] -1975. The physical environment and bottom fauna of a bog lake. Arch. Hydrobiol., 76:198-217, 7 figs., 5 tables.

Moss, S. T. & R. W. Lichtwardt

[82] -1976. Development of trichospores and their appendages in Genistellospora homothallica and other Harpellales and fine-structural evidence for the sporangial nature of trichospores. Can. J. Bot., 54:2346-2364, 32 figs.

Neuherz, H.

[83] -1975. Die Landfauna der Lurgrotte (Teil I). Sitzungsber. Österr. Akad. Wiss., Math.-Naturwiss. Kl., 183:159-285, 10 figs., 12 tables, 3 maps.

Neveu, A. & M. Échaubard

[84] -1975. La dérive estivale des invertébrés aquatiques et terrestres dans un ruisseau du Massif-Central: la Couze Pavin. Ann. Hydrobiol., 6:1-26, 17 figs., 5 tables.

Okazawa, T.

[85] -1975. Aquatic insect survey of the River Kaunnai, with special reference to the rocky chute bed fauna. Kontyû, 43:497-512, 3 figs., 4 tables, appendix.

Osborne, J. A., M. P. Wanielista & Y. A. Yousef

[86] -1976. Benthic fauna species diversity in six central Florida lakes in summer. Hydrobiologia, 48:125-129, 1 fig., 2 tables.

Paterson, C. G. & J. R. Nursall

[87] -1975. The effects of domestic and industrial effluents on a large turbulent river. Water Res., 9:425-435, 6 figs., 8 tables.

Pearson, R. G. & N. V. Jones

[88] -1975. The effects of dredging operations on the benthic community of a chalk stream. Biol. Conserv., 8:273-278, 4 tables.

Prater, B. L. & M. A. Anderson

[89] -1976. A mass-rearing method for burrowing mayflies. AQC Newsl. (Anal. Qual. Control, U.S. Environ. Prot. Agency, Cincin.), 30:3-4.

Puthz, V.

[90] -1975. Eine neue Caenidengattung aus dem Amazonasgebiet (Insecta: Ephemeroptera: Caenidae). Amazoniana, 5:411-415, 7 figs.

Razet, P.

[91] -1976. Les organes excréteurs et l'excrétion, p. 517-635, figs. 306-381, 2 tables, IN: Grassé, P.-P., Traité de Zoologie, 8(4). Masson, Paris.

Richardson, M. Y. & D. C. Tarter

[92] -1976. Life histories of Stenonema vicarium (Walker) and S. tripunctatum (Banks) in a West Virginia stream (Ephemeroptera: Heptageniidae). Am. Midl. Nat., 95:1-9, 1 fig.

Rye, R. P. & E. L. King, Jr.

[93] -1976. Acute toxic effects of two lampricides to twenty-one freshwater invertebrates. Trans. Am. Fish. Soc., 105:322-326, 1 table.

Salonen, K., J. Sarvala, I. Hakala & M.-L. Viljanen

[94] -1976. The relation of energy and organic carbon in aquatic invertebrates. Limnol. & Oceanogr., 21:724-730, 2 figs., 2 tables.

Šapkarev, J. A.

[95] -1975. Composition and dynamics of the bottom animals in the littoral zone of Dojran Lake, Macedonia. Verh. Int. Ver. Theor. Angew. Limnol., 19:1339-1350, 11 figs., 4 tables.

Sarai, D. S.

[96] -1976. Total and fecal coliform bacteria in some aquatic and other insects. Environ. Entomol., 5:365-367, 1 table.

Scudder, G. G. E.

[97] -1975. An annotated checklist of the Ephemeroptera (Insecta) of British Columbia. Syesis, 8:311-315.

Синиченкова, Н. Д. (Sinitshenkova, N. D.)

[98] -1974. О некоторых раннемеловых поденках Забайкалья (Insecta, Ephemeroptera). [On some early Cretaceous mayflies from Transbaikal (Insecta, Ephemeroptera).] Бюл. Моск. О-ва, Инст. Прир., Отд. Геол. (Byul. Mosk. O-va, Inst. Prir., Otd. Geol.), 49:148.

[99] -1975. Личинки поденок семейства Hexagenitidae (Insecta, Ephemeroptera). [Mayfly larvae of the family Hexagenitidae (Insecta, Ephemeroptera).] Палеонтол. Ж. (Paleontol. Zh.), 1975(1):82-86, 1 fig., plate X (6 figs.).

Slack, K. V., J. W. Nauman & L. J. Tilley

[100] -1976. Evaluation of three collecting methods for a reconnaissance of stream benthic invertebrates. J. U.S. Geol. Surv., 4:491-495, 1 fig., 5 tables.

Sowa, R.

[101] -1975. Ekologia i biogeografia jętek (Ephemeroptera) wód płynących w polskiej części Karpat. 2. Cykle życiowe. Ecology and biogeography of mayflies (Ephemeroptera) of running waters in the Polish part of the Carpathians. 2. Life cycles. Acta Hydrobiol., 17:319-353, 9 figs., 1 table.

[102] -1975. What is Cloeon dipterum (Linnaeus, 1761)? The nomenclatural and morphological analysis of a group of the European species of Cloeon Leach (Ephemerida: Baetidae). Entomol. Scand., 6:215-223, 15 figs.

Stanford, J. A. & A. R. Gaufin

[103] -1975. Structure and function of the hyporheic communities in the Flathead and Tobacco Rivers, Montana. Verh. Int. Ver. Theor. Angew. Limnol., 19:1639-1640. [Abstr.]

Statzner, B.

[104] -1975. Zur Longitudinalzonierung eines zentralafrikanischen Fließgewässersystems unter besonderer Berücksichtigung der Köcherfliegen (Trichoptera, Insecta). Longitudinal zonation of a Central African running water system with particular reference to caddisflies (Trichoptera, Insecta). Arch. Hydrobiol., 76:153-180, 15 figs., 2 tables.

Svensson, B.

[105] -1976. The association between Epoicocladius ephemerae Kieffer (Diptera: Chironomidae) and Ephemera danica Müller (Ephemeroptera). Arch. Hydrobiol., 77:22-36, 6 figs., 2 tables.

Tarter, D. C.

[106] -1976. Limnology in West Virginia: A Lecture and Laboratory Manual. Marshall Univ. Bookstore, Huntington, W. Va. 249 p. ["Ephemeroptera (Mayflies)," p. 14-39, fig. 2, table 2]

Taylor, M. P.

[107] -1974. Biological monitoring in Wheeler Reservoir before operation of Browns Ferry Nuclear Plant, p. 399-413, 9 figs., 2 tables, IN: Gibbons, J. W. & R. R. Scharitz [eds.], Thermal Ecology. AEC Symp. Ser. (CONF 730505), Natl. Tech. Inf. Serv., Springfield, Va. 670 p.

Ulfstrand, S.

[108] -1975. Diversity and some other parameters of Ephemeroptera and Plecoptera communities in subarctic running waters. Arch. Hydrobiol., 76:499-520, 6 figs., 2 tables, 2 appendices.

Ward, J. V.

[109] -1975. Bottom fauna-substrate relationships in a northern Colorado trout stream: 1945 and 1974. Ecology, 56:1429-1434, 2 figs., 2 tables.

Wichard, W., P. T. P. Tsui & A. Maehler-v. Dewall

[110] -1975. Chloridzellen der Larven von Caenis diminuta Walker (Ephemeroptera, Caenidae) bei unterschiedlicher Salinität. Chloride cells of the larvae of Caenis diminuta Walker (Ephemeroptera, Caenidae) under different salinity. Int. Rev. Gesamten Hydrobiol., 60:705-709, 2 figs., 1 table.

Wiens, A. P., D. M. Rosenberg & K. W. Evans

[111] -1975. Symbiocladius equitans (Diptera: Chironomidae), an ectoparasite of Ephemeroptera in the Martin River, Northwest Territories, Canada. Entomol. Ger., 2(2):113-120, 2 figs., 2 tables.

Williams, D. D. & H. B. N. Hynes

[112] -1976. Stream habitat selection by aerially colonizing invertebrates. Can. J. Zool., 54:685-693, 4 figs., 2 tables.

[113] -1976. The recolonization mechanisms of stream benthos. Oikos, 27:265-272, 2 figs., 6 tables.

Winner, R. W., J. S. Van Dyke, N. Caris & M. P. Farrel

[114] -1975. Response of the macroinvertebrate fauna to a copper gradient in an experimentally-polluted stream. Verh. Int. Ver. Theor. Angew. Limnol., 19:2121-2127, 3 figs., 3 tables.

Wise, E. J.

[115] -1976. Studies on the Ephemeroptera of a Northumbrian river system: I. Serial distribution and relative abundance. Freshw. Biol., 6:363-372, 2 figs., 4 tables.

Zelinka, M.

[116] -1976. Mayflies (Ephemeroptera) in the drift of trout streams in the Beskydy Mountains. Acta Entomol. Bohemoslov., 73:94-101, 5 tables.

Ziemann, H.

[117] -1975. Über den Einfluß der Wasserstoffionenkonzentration und des Hydrogenkarbonatgehaltes auf die Ausbildung von Bergbachbiozönosen. On the influence of the hydrogen-ion concentration and the bacarbonate concentration on the structure of biocoenoses of mountain brooks. Int. Rev. Gesamten Hydrobiol., 60:523-555, 9 figs., 10 tables.

Зимбалевская, Л. Н. (Zimbalevskaya, L. N.)

[118] -1974. Некоторые черты структуры сообществ пресноводных фитофильных беспозвоночных. [Certain features of the structure of freshwater phytophilous invertebrate communities.] Гидробиол. Ж. (Gidrobiol. Zh.), 10:38-46, 2 figs., 3 tables.

Zimmerman, M. C., T. E. Wissing & R. P. Rutter

[119] -1975. Bioenergetics of the burrowing mayfly, Hexagenia limbata, in a pond ecosystem. Verh. Int. Ver. Theor. Angew. Limnol., 19:3039-3049, 3 figs., 6 tables.

Zimmermann, W.

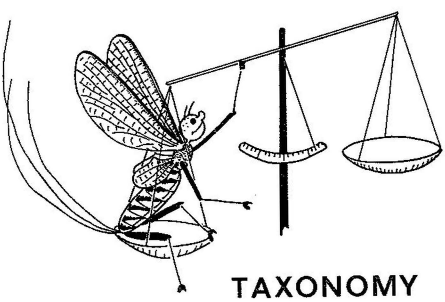
[120] -1975. Zum Erstnachweis von Arthroplea congener Bengtsson 1909 (Ephemeroptera, Heptageniidae, Arthropleinae) in der DDR. Entomol. Nachr., 19:54-59, 4 figs.

* * * * * * * * * * * * * * *

EATONIA INDEX

compiled by Janice G. Peters

The numbers in brackets refer to paper numbers listed in the Recent Ephemeroptera Literature. When a paper treats two or more topics, or when it easily could be treated in different ways, we give one abstract with cross references at the end of other significant sections.



TAXONOMY

Cloeon cognatum Stephens [species reinstated, removed from synonymy with Cloeon dipterum; = Cloeon dipterum of Eaton 1871 in part, NEC (Linnaeus); = C. dipterum var. 1 of Eaton 1885, NEC (Linnaeus); = C. dipterum of Pictet 1843-45, Macan 1949, 1970, Kimmins 1954, Grandi 1960, Landa 1969 in part, NEC (Linnaeus)[1]; = C. affinis (Rambur) syn. n.; = C. apicalis (Costa) syn. n.; = C. consobrinum Stephens syn. n.; = C. virgo Stephens syn. n.] Sowa (1975) [102] p. 216.

Cloeon consobrinum Stephens
a)- (removed from synonymy with Cloeon dipterum
b)- SEE Cloeon cognatum

Cloeon dipterum (Linnaeus) [= Cloeon dipterum variety 3 of Eaton 1885; = C. annulatum (Müller); = C. rufulum (Müller); = C. dipterum of authors[1]; Cloeon affinis (Rambur), C. apicalis (Costa), C. consobrinum Stephens, C. inscriptum Bengtsson, C. cognatum Stephens, C. virgo Stephens removed from synonymy] Sowa (1975) [102] p. 216.

Cloeon dipterum variety 1 of Eaton 1885, NEC (Linnaeus)
SEE Cloeon cognatum

Cloeon inscriptum Bengtsson
a)- (designation of lectotype) Brinck & Müller-Liebenau IN Sowa (1975) [102] p. 216.
b)- (species reinstated, removed from synonymy with Cloeon dipterum) Sowa (1975) [102] p. 217.

Cloeon virgo Stephens
a)- (removed from synonymy with Cloeon dipterum)
b)- SEE Cloeon cognatum

CAENIDAE

Genus Brasilocaenis gen. n. Puthz (1975) [90] p. 411.

Brasilocaenis irmleri sp. n. (male & female imagos, nymph; Amazonas, Brazil) Puthz (1975) [90] p. 412.

---

[1] In synonymies in the genus Cloeon Sowa [102] p. 216 treats only "the more important publications, above all...taxonomic..."

EPHEMERELLIDAE

Genus Hyrtanella gen. n. Allen & Edmunds (1976) [8] p. 133.

Hyrtanella christineae sp. n. (female imago, male & female nymphs; Sabah, Malaysia) Allen & Edmunds (1976) [8] p. 135.

EPHEMERIDAE

Ephemera lineata Eaton (= Ephemera lutea of Burmeister NEC Linnaeus) Jacob, Kauk & Klima (1975) [54] p. 186.

Ephemera lutea of Burmeister NEC Linnaeus
SEE Ephemera lineata

Ephemera paulae Grandi
SEE Ephemera zettana

Ephemera zettana Kimmins (= Ephemera paulae Grandi syn. n.) Jacob, Kauk & Klima (1975) [54] p. 188.

Genus Fontainica McCafferty
SEE Palingeniidae genus Cheirogenesia

Fontainica josettae McCafferty
SEE Palingeniidae, Cheirogenesia decaryi

EUTHYPLOCIIDAE

Euthyplocia bullocki Navas
SEE Siphlonuridae, Chaquihua bullocki

HEPTAGENIIDAE

Genus Paracinygmula gen. n. Bajkova (1975) [15] p. 54.

Paracinygmula zhilzovae sp. n. (nymph; Primor'ye, Far Eastern RSFSR, USSR) Bajkova (1975) [15] p. 56.

LEPTOPHLEBIIDAE

Genus Hermanella subgenus Hermanellopsis Demoulin
SEE genus Hermanellopsis

Genus Hermanellopsis Demoulin (status changed from subgenus to genus) Edmunds, Jensen & Berner (1976) Mayflies North & Cent. Am., p. 222.

PALINGENIIDAE, Palingeniinae

Genus Cheirogenesia Demoulin (nymph; = genus Fontainica McCafferty syn. n.) McCafferty & Edmunds (1976) [78] p. 190.

Cheirogenesia decaryi (Navas) (additional description of nymph; = Fontainica josettae McCafferty syn. n.) McCafferty & Edmunds (1976) [78] p. 193.

PALINGENIIDAE, Subfamily Pentageniinae McCafferty (status changed from family to subfamily) McCafferty & Edmunds (1976) [77] p. 488.

Family PENTAGENIIDAE McCafferty SEE Palingeniidae subfamily Pentageniinae

SIPHLONURIDAE, Acanthametropodinae

Analetris eximia Edmunds (male & female imagos; additional description of nymph) Lehmkuhl (1976) [63] p. 199.

SIPHLONURIDAE, Ameletopsinae

Chaquihua bullocki (Navas) (transferred from genus Euthyplocia) Edmunds, Jensen & Berner (1976) Mayflies North & Cent. Am., p. 281.

TRICORYTHIDAE

Leptohyphes murdochi Allen (spelling emended) Edmunds, Jensen & Berner (1976) Mayflies North & Cent. Am., p. 254.

Leptohyphes murdocki Allen SEE Leptohyphes murdochi

Tricorythodes fallax Traver SEE Tricorythodes minutus

Tricorythodes minutus Traver (= Tricorythodes fallax Traver syn. n.) Edmunds, Jensen & Berner (1976) Mayflies North & Cent. Am., p. 259.

FOSSIL EPHEMEROPTERA

HEXAGENITIDAE

Hexameropsis africana sp. n. (nymph; early Cretaceous; Algeria) Sinitshenkova (1975) [99] p. 86.

Hexameropsis selini Tshernova & Sinitshenkova (nymph) Sinitshenkova (1975) [99] p. 85.

OTHER TAXONOMY

Keys to adults and nymphs of species of Ametropus in North America. Allen & Edmunds (1976) [9].

Key to nymphs of genera and keys to nymphs of species of Baetisca in West Virginia, USA. Tarter (1976) [106].

Key differentiating nymphs of Cinygma, Cinygmula, and Paracinygmula. Bajkova (1975) [15].

Description and discussion of distinguishing characters of Ephemera glaucops, with comparative figures of male genitalia of middle European species of Ephemera. Jacob, Kauk & Klima (1975) [54].

Discussion of characters of Cloeon dipterum, C. cognatum, and C. inscriptum. C. pallidum Leach and 3 species of Curtis, 1834 (C. dimidiatum, C. marmoratum, C. obscurum), which have historically been assigned to C. dipterum, are provisionally synonymized with C. cognatum although identifications are obscure. Other potential synonyms are suggested. Sowa (1975) [102].

Discussion of European species of the Centroptilum pulchrum species group. The lectoallotype of C. stenopteryx (a male subimago) is redescribed. Keffermüller & Sowa (1975) [58].

Description of egg and first instar of Choroterpes mexicanus. McClure & Stewart (1976) [79].

Discussion of Hexagenitidae with additional description of nymphal abdomen and wing pads of Ephemeropsis trisetalis. Sinitshenkova (1975) [99]. (FOSSIL EPHEMEROPTERA)

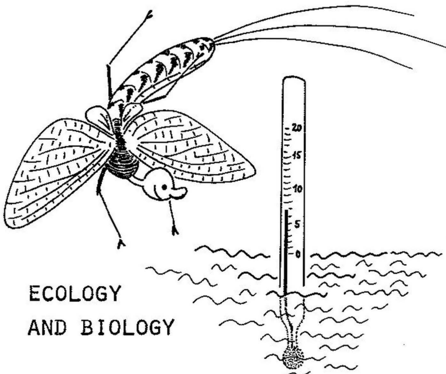
Report of new fossil genus of Siphlonuridae from early Cretaceous deposits in the Transbaikal region of USSR. Specimens of Epeoromimus and Mesoneta are reported from the same era. Sinitshenkova (1974) [98]. (FOSSIL EPHEMEROPTERA)

BIOGRAPHY

Biography and list of publications of Kaj Berg. Jónasson (1975) [56].

CLASSIFICATION AND PHYLOGENY

Discussion of phylogeny and relationships of Pentageniinae (Palingeniidae) to Palingeniinae and Ephemeridae, with general principles of higher classification of Ephemeroptera. McCafferty & Edmunds (1976) [77].



ECOLOGY AND BIOLOGY — life histories

Life cycle, instars, feeding, adult activity, fecundity, and production of Choroterpes mexicanus in a Texas river, USA. C. mexicanus was multivoltine. Statistical analyses indicated 16 instars in the overwinter generation and 19 instars in the 2 overlapping summer generations. Fecundity was lowest in late summer, and eggs developed in 13-15 days at about 25°C. Nymphs fed on detritus (90%) and algae, with some seasonal variations in food selection. Predation was also considered. McClure & Stewart (1976) [79].

Life cycles of Stenonema vicarium and S. tripunctatum in a West Virginia stream, USA. Both species were univoltine with peak emergence in May, and both fed principally on detritus (also some diatoms and filamentous algae). Sex ratio of S. vicarium was 75 males to 100 females, with females producing an average of 3528 eggs; for S. tripunctatum ratio was 52 to 100, with 2621 eggs. Richardson & Tarter (1976) [92].

Growth and population of nymphs of Ephemerella ignita in a small chalk stream, England-UK. Although nymphs were present all year, rapid growth and highest populations occurred from April to May. Maximum density on submerged Ranunculus penicillatus was 11,400 nymphs/m^2. From 2 methods, peak densities in May in the stream section studied were 1498 and 753 nymphs/m^2. Results are compared with data on E. ignita from other regions. Bass (1976) [18].

Life cycles of 21 species from the Beskid Mountains and Raba River, Poland. Most species exhibited some overwinter growth and a univoltine (Rhithrogena hybrida, R. ferruginea, R. germanica, R. semicolorata, Habroleptoides modesta) or polyvoltine (Baetis alpinus, B. lutheri, B. vardarensis, B. muticus, B. rhodani) life cycle. Those with egg diapause in winter included the univoltine Rhithrogena diaphana, Oligoneuriella rhenana, and Baetis melanonyx and the polyvoltine Ephemerella ignita, Baetis fuscatus, and Caenis pseudorivulorum. Growth of Rhithrogena loyolaea usually required more than one year. Other categories are a univoltine heterogeneous growth pattern (Ecdyonurus dispar, E. subalpinus, Rhithrogena iridina iridina), a univoltine pattern with summer egg diapause (Ameletus inopinatus), and an ovoviviparous polyvoltine pattern. Life cycles of other species from the area (total 54) are also categorized and the type of life cycle as related to type and altitude of stream is discussed. Sowa (1975) [101].

ALSO SEE: Horst & Marzolf [45], Horst [44] life cycle of Hexagenia limbata in a Kansas reservoir; Zimmerman et al. [119] seasonal changes in size classes of nymphs of H. limbata in an Ohio pond; Armitage [10] life cycle data on Baetis rhodani, B. scambus, Caenis rivulorum, and Ephemerella ignita in an English river; Svensson [105] note on 2 and 3 year cohorts in life cycle of Ephemera danica in a Swedish stream; Illies [50] data indicating 3 generations/yr in Baetis vernus in small German stream.

ECOLOGY AND BIOLOGY — adult activity

Seasonal and hourly emergence patterns of 14 species of mayflies from the Bigoray River, Canada. Ameletus oregonensis, Siphloplecton basale, and Leptophlebia cupida emerged in early season, Paraleptophlebia debilis in late season, and other species more toward the middle of the 21 week emergence season. Data are compared with emergence seasons from other North American regions. Total emergence rate was 348 mayflies/m^2/yr. Boerger & Clifford (1975) [21].

Temperature studies of 2 lakes in Wales-UK and experimental studies on temperature and emergence in Nemoura avicularis and Leptophlebia vespertina. Nymphs of L. vespertina collected in winter and kept at 11°C in darkness emerged 6 weeks before natural populations, while a second group of nymphs held at 6°C for 4 months over summer did not emerge until temperature was raised: temperature, not photoperiod, influenced emergence. Effects of high temperatures on nymphs were also studied. Brittain (1976) [23].

ALSO SEE: Horst & Marzolf [45], Horst [44] emergence biomass and fecundity of Hexagenia limbata in a Kansas reservoir; Richardson & Tarter [92] fecundity of Stenonema vicarium and S. tripunctatum; McClure & Stewart [79] seasonal and daily emergence patterns, swarm behavior, sex ratio (1:1), and fecundity of Choroterpes mexicanus; Neveu & Échaubard [84] surface drift in a French stream showing imago and subimago activity of Baetis sp. in morning, beginning at about 12°C; Zimmermann [120] notes on emergence process in Arthroplea congener; Alimov [2] emergence season of Ephemera vulgata in Lake Krugloe, USSR; Junk [57] notes on mass emergence of Eatonigenia sp. in Bung Borapet, Thailand, often after rain.

ECOLOGY AND BIOLOGY — nymphal activity

Comparison of colonization by aquatic fauna of flat or pleated plastic sheets and artificial vegetation substrate in middle of small pond, England-UK. Among Ephemeroptera, Leptophlebia spp. preferred artificial vegetation while Cloeon simile and C. dipterum were more abundant on the plastic, results which correspond with their natural habits of seeking shelter (Leptophlebia) or rapid swimming in more open areas (Cloeon). Macan & Kitching (1976) [68].

Daily drift patterns in 1972, 1973, and 1974 in the Couze Pavin, a river in France. For Baetis sp., Ephemerella ignita, Nemouridae, and Simuliidae, nymphal drift was greatest at night; both high water and moonlight suppressed drift. Composition of benthic fauna differed from drift fauna, but drift density and diversity increased with increase in benthic density and diversity. Neveu & Échaubard (1975) [84].

Drift of Ephemeroptera in 2 trout streams of Beskydy Mountains, Czechoslovakia. Most species in benthos were present in drift, with Baetis rhodani (and other Baetis spp.) and Rhithrogena semicolorata most abundant. Drift density averaged .54 and .33 nymphs/m^3 water. Peak activity shifted from early evening in cold months to late night or early morning in warm months. Drift density increased with floods and then declined rapidly, although total drift was higher under flood conditions. Drift was much less in stream section without trout than when trout were present. Zelinka (1976) [116].

Drift studies on a small stream in Ghana. Ephemeroptera were dominant group in drift, with Austrocaenis and Centroptilum abundant and night-active. Moonlight apparently suppressed drift, but no correlation was found between drift and flow, nor drift and benthos—C. medium was more abundant in drift, C. flavum in benthos. A distinction was made between background and true drift, with discussion. Hynes (1975) [49].

ALSO SEE: Bournaud & Thibault [22] review and discussion of research on drift, with suggestion for use of "drift intensity" (number, weight or volume of animals flowing through a m^2 section/hr) as a comparable indicator of drift activity; Adamus & Gaufin [1] review listing of North American invertebrates reported in drift, with diel cycles noted; Lehmkuhl [63] nymphal behavior and habitat selection of Analetris eximia; Luedtke & Brusven [65] return-to-substrate rates, drift, and behavioral notes on Ephemerella grandis and other insects; Luedtke et al. [66] notes on habitat preferences of insect species in Idaho streams; Armitage [10] habitat preferences of dominant species of invertebrates in an English river, with only Ecdyonurus dispar (among Ephemeroptera) showing no site preference; Bass [18] habitat selection of E. ignita in an English chalk stream; Zimmermann [120] biological notes on Arthroplea congener and habitat selection in a German pond, especially young nymphs' preference for aquatic plants (Ranunculus); Junk [57] substrate preferences of Eatonigenia sp. in a reservoir in Thailand; Chutter [28] day-time drift in a Natal river.

ECOLOGY AND BIOLOGY — communities and trophic relationships

Experiments on recolonization in a river in Ontario, Canada. Especially designed traps limited recolonization to one direction of entry. After 28 days, total recolonization was computed from the following components: drift 41.4%, upstream migration 18.2%, vertical migration up through substrate 19.1%, and aerial sources 28.2%. For Ephemeroptera, recolonization occurred principally by drift (67.9%) and upstream migration (21.4%), but other groups of organisms favored other directions of recolonization. Williams & Hynes (1976) [113].

Relationship of sediment size to distribution of aquatic invertebrates in Rat River, Manitoba, Canada, as studied by mutual information analysis. Certain faunal assemblages were characteristic of silt habitats — including mayflies Ephemera simulans, Baetisca sp., Stenonema nepotellum in early season; Ephoron album, Caenis sp. in mid season; and Stenonema nepotellum, Heptagenia maculipennis, Hexagenia limbata, Paraleptophlebia mollis in late season (Ephemera simulans moved to more sandy substrate over summer). A distinct faunal assemblage also occurred on boulders. Assemblages on other substrates were characterized by seasonal changes, although they could be better associated with substrate size in early season than in late season. Certain species only occurred at one time, and temporal succession of related species was evident. de March (1976) [72].

Model of population dynamics of Hexagenia limbata in a Kansas reservoir, USA. The population was density dependent in the nymphal stages, but not in the adult or egg stages. Carrying capacity of the reservoir was estimated at 320 nymphs/m^2 with a more rapid instantaneous growth rate in Hexagenia nymphal populations as abundance decreased. Horst (1976) [44].

Energy budgets of Hexagenia limbata from an Ohio pond, USA. Nymphs turned over gut content about 5 times/day, fed under conditions of light or darkness, and apparently selected food of high caloric content. Energy budgets, calculated for different size classes, different zones of pond, and different months, showed a high net growth efficiency (average 68%). Zimmerman, Wissing & Rutter (1975) [119].

Comparison between Plecoptera and Ephemeroptera communities in River Vindelälven and tributaries, Swedish Lapland. Generally, biomass was higher in smaller streams. For mayflies: populations were larger (with seasonal variation), individuals were smaller, and members of a species showed a greater range of sizes. Although mean diversities of mayfly and stonefly communities were similar, diversity of mayflies was correlated with abundance, that of stoneflies with number of species. This result is attributed to differences in trophic levels, intraspecific competition, and reproductive strategies of the 2 orders. Ulfstrand (1975) [108].

Relationship of weight of organic carbon to energy values in 18 species of aquatic invertebrates, including Leptophlebia vespertina, Centroptilum luteolum, and Heptagenia fuscogrisea. Ash, carbon, and nitrogen levels and the energy to carbon ratios are given for each species. Salonen, Sarvala, Hakala & Vilganen (1976) [94].

Role of allochothonous (from drifting leaf litter) and autochothonous (periphyton) materials as nutrition sources for invertebrates of a small, shaded stream, Germany-DBR. Calculations on calories available from each of these sources and calculations of biomass, production, and calorie values of dominant invertebrate species (including Leptophlebia marginata, Centroptilum luteolum, Baetis rhodani, Rhithrogena picteti) demonstrated the importance of allochothonous material as a food sources. Caspers (1975) [26].

Ranking of dominant species of invertebrate communities of plants in Dnieper lakes and reservoirs, Ukrainian SSR, USSR, by total oxygen consumption of a species (Q) rather than biomass. Ranking is correlated with trophic level and method of feeding to demonstrate alteration of dominant invertebrates by feeding category as well as size. Abundance, biomass, and Q values for Cloeon dipterum are included. Zimbalevskaya (1974) [118].

ALSO SEE: McClure & Stewart [79] predation on and seasonal changes in feeding habits of Choroterpes mexicanus; Richardson & Tarter [92] feeding of Stenonema vicarium and S. tripunctatum; Macan & Kitching [68] colonization of artificial habitats in midwater in an English pond; Alimov & Finogenova [4] communities and energy balance in lakes Krivoe and Krugloe, USSR; Alimov & Finogenova [5] communities and energy balance in lakes Zelenetsko and Akulkino, USSR.

FAUNAL STUDIES — geographical

Checklist of Ephemeroptera species of British Columbia, Canada. Fourteen species are reported from the province for the first time. Scudder (1975) [97].

Distribution records for species of Ametropus in North America. Allen & Edmunds (1976) [9].

New record of Anepeorus simplex from Wabash River, Indiana, USA. Mancini, Gammon & Carlson (1976) [70].

Checklist and distribution of species of aquatic fauna in West Virginia, USA. Tarter (1976) [106].

First record of Arthroplea congener from Germany-DDR. Zimmermann (1975) [120].

Distribution of Ephemera glaucops and its rediscovery and verification from Germany-DDR. Jacob, Kauk & Klima (1975) [54].

Faunal list, including 7 species of Ephemeroptera, or Lur Grotto, Austria. Distribution of fauna in caves, geology, and zoogeographic relationships are considered. Neuherz (1975) [83].

Species of Ephemeroptera from Lakes Zelenetskoe and Akulkino, northern USSR. Finogenova (1975) [34].

ALSO SEE: Hart & Brusven [41] aquatic insect species of 6 small tributaries and Silver Creek, Idaho, USA; Ward [109] macroinvertebrate species of North St. Vrain River, Colorado, USA, 1945 and 1975; Harrison & Rankin [39][40] invertebrate species of stony habitat [39] and of all freshwater habitats [40] on St. Vincent, West Indies; Wise [115] Ephemeroptera species of River Coquet and tributaries, northeastern England-UK; Ulfstrand [108] Ephemeroptera and Plecoptera species of River Vindelälven and tributaries, Sweden; Échaubard & Neveu [33] list of invertebrate species of Couze Pavin, a small trout stream in France; Flössner [35] invertebrate species of the middle Saale River, Germany-DDR; Sapkarev [95] species list of invertebrates from 4 habitats in Kojran Lake, Yugoslavia; Mantoničkin & Pavletić [75] comparison between species of algae and invertebrates from 2 reservoirs and their feeder streams, Croatia, Yugoslavia; Okazawa [85] aquatic insect species of Kaunnai River, Hokkaido, Japan; Kemp et al. [60] invertebrate species lists from different habitats in small rivers of southern Natal, South Africa.

GENERAL

Report on the 2nd International Conference on Ephemeroptera, Cracow, 1975.
a)- Jacob & Zimmermann (1976) [55].
b)- Arvy, Peters & Sowa (1976) [11].

Note on current number of families, genera, and species in the Ephemeroptera. Hubbard & Peters (1976) [48].

Insect communities in 6 tributaries and stream of batholith region of Idaho, USA. Standing crop declined between 1973 and 1974 because of high spring runoff and bedrock scouring, accompanied by changes in relative dominance of Ephemeroptera and Plecoptera. Cluster analysis showed greatest difference between the main stream and tributaries. Clusters among tributaries varied seasonally (showing effect of physical and faunal differences), and similarity between clusters was greatest in late summer. Hart & Brusven (1976) [41].

Experiments on movement of insects across an unusual accumulation of sand (from mining) in an Idaho stream, USA. Only Centroptilum sp. A and Chironomidae colonized the sand. Representation of species in drift did not change above, at, or below sand bar, indicating insects could cross by drift. Certain species colonized rock-filled samplers in the sand. Laboratory studies on return-to-substrate rates indicated active choice of substrate. Only Dicosmoecus moved upstream through sand; instability of sand substrate apparently restricted upstream movement. Luedtke & Brusven (1976) [65].

Effects of in-stream alterations to increase fine sediment transport on benthic communities in an Idaho stream, USA. Gabion-wing deflectors (which narrowed the stream channel) and removal of debris jams were most effective methods of moving sediment, and also resulted in an overall increase in insects (but a change in community structure). Log-drop structures (small barriers to create pools) resulted in slight reduction of total benthos. No changes were evident for channel diversion. Initial construction of all structures reduced insect populations for a time. Luedtke, Brusven & Watts (1976) [66].

Examination of ecological theory in describing insect community zonation in a mountain river, Colorado, USA. There was no evidence of faunal change at vegetation zones. Trout distribution affected total abundance of insects, but not community structure. Seven-22% of insects had ranges limited by competition, including 2 species of Rhithrogena. The ranges of remaining species were best described by a gradient model rather than by biocoenoses. An index of faunal replacement is proposed (vertical distance or altitude in metres to 50% faunal replacement). Allan (1975) [7].

Comparison of macroinvertebrate fauna on different substrates in a river in Colorado, USA, between 1945 and 1974. Many taxa were found in only one of the study years, but some of the differences could be explained by different temperature patterns in these years. In 1974, percentage composition of Ephemeroptera was higher on sand and gravel and lower on rubble and bedrock than in 1945. Overall, the community changed very little. Ward (1975) [109].

Effects of localized channel modification on 6 coldwater trout streams, Pennsylvania, USA. There were few differences between natural and channelized sections in number, standing crop, density, or diversity of benthic fauna (Ephemerella, Stenonema and Baetis among dominant forms). Trout populations were reduced in channelized sections. Duvel, Volkmar, Specht & Johnson (1976) [32].

Limnological data and zonation of streams of St. Vincent, West Indies. Zones were characterized by altitude, forest cover, and fauna of stony runs. Among Ephemeroptera, Terpides jessiae was restricted to mountain torrent zone with forest cover, Baetidae occurred from this zone downstream through open forest zones, Leptohyphes sp. was more widely distributed and most common in the lower valley zones, zones with fine vegetable detritus. Harrison & Rankin (1975) [39].

Description, distribution, and zonation of freshwater habitats on St. Vincent, West Indies, with associated fauna. Among Ephemeroptera, Leptohyphes sp. was a dominant element in stony runs at all altitudes, Baetis sp. A was widely distributed, Terpides jessiae was restricted to higher zones, Tricorythodes was most common in moss and fern vegetation, and Caenis was found in marshes and estuarine pools. The upper zones of tropical island rivers which contain a warm-adapted true montane fauna could best be characterized as a "pseudorhithron." Biogeographical relationships of the fauna are discussed. Harrison & Rankin (1976) [40].

Effects of drag-line dredging on bottom fauna of a stream in England-UK. Dredging caused an increase in activity as measured by drift, upstream movement, and colonization of artificial substrates. Dredging reduced numbers of invertebrates present for a short time, but recovery was evident after 5 months. Pearson & Jones (1975) [88].

Comparison of aquatic fauna below Cow Green Reservoir, England-UK, before and after impoundment. Both kick samples and artificial substrates were used to study benthos. After impoundment, Ameletus inopinatus disappeared and Leptophlebia sp. appeared in the community; otherwise, community structure of Ephemeroptera did not change but there were some apparent changes in relative abundance of species. In general the fauna was rich, a finding attributed to regulated flow, increased growth of moss and algae, and enrichment from the reservoir. Armitage (1976) [10].

Distribution of species of Ephemeroptera in River Coquet and tributaries, northeastern England-UK. Although 3 topographical areas were defined, dominant species showed continuous distribution along the river. Rarer species exhibited discontinuous distribution — for example Heptagenia lateralis in hill region, H. sulphurea in coastal plain. Certain tributaries had distinct faunas. Factors which appeared to influence distribution included vegetation cover and temperature. Also, sediment deposition from sand and gravel extraction operations reduced numbers of mayflies at one station. Wise (1976) [115].

Annual fluctuations in biomass over 5 years in a small stream, Germany-DBR, as estimated from emerging adults. Productivity of the 10 most abundant organisms was studied in detail to explain fluctuations. An increase in emergence of Baetis vernus and B. rhodani (1.566 gm organic dry weight/m^2/1972) followed a drought which had reduced numbers of predators; predation in 1973 depleted Baetis populations (.260 gm/m^2/yr). Illies (1975) [50].

Effects of pH and bicarbonate concentrations on distribution of diatoms, Ephemeroptera, Plecoptera, and Trichoptera in 2 small mountain streams, Germany-DDR. A pH of 6 seemed to be a minimum level for many aquatic insects studied, including Ephemerella ignita, Ecdyonurus venosus, Epeorus assimilis, and Rhithrogena semicolorata. Current and temperature were also important. It may be possible to use the halobiont indices of diatoms to characterize biocoenoses of other groups. Ziemann (1975) [117].

Production and biomass along middle reaches of the Saale River, Germany-DDR, with dominant members of each community. Ephemeroptera (taken together) were found only at one of the cleaner water stations, representing there in dry weight a biomass of .5 gm/m^2 and production of 2 gm/m^2 and 10 kcal/m^2. Similar figures are given for total fauna at each station and for dominant species. Flössner (1976) [35].

Comparison of production of benthic animals in lakes and rivers studied in Japan under the IBP program. Yearly production was lower in the Yurappu River (51.2-155.1 gm wet weight/m^2) than in the Yoshino River, and invertebrates in the Yurappu were more abundant in drift but less abundant in benthos. While Stenopsyche griseipennis was usually the most abundant insect in the Yurappu, Epeorus latifolium and Ephemerella sp. nax were also common, with Epeorus more important than Stenopsyche in certain months. Itō (1976) [52].

Longitudinal distribution of aquatic insect species of Kaunnai River, Hokkaido, Japan. Common Ephemeroptera in biotopes included Baetis sp. 3 upstream (above timberline); many species in midstream with Baetis sp. A and Baetiella sp. A always dominant; Ephemerella trispina, Baetiella sp. B, Epeorus uenoi, and Rhithrogena japonica downstream. Cinygma sp. was one of the more widely distributed or eurytopic species. In mid-stream region is a "rocky-chute," a steep area of smooth, slab-like rock plates and a somewhat more limited fauna which was studied in detail. Okazawa (1975) [85].

Physico-chemical and biological (and bacteriological) description of small streams of southern Natal, South Africa. Six microhabitats or biotas were distinguished: stones in- or out-of-current, marginal or aquatic vegetation, sediments, cascades-waterfalls. Streams were clustered according to 2 measures of similarity in fauna composition, resulting in descriptions of zoogeographic zones. Within zones, factors most affecting community composition were biotopes, stream stability, and temperature. Many species of Ephemeroptera played dominant roles in different communities, for example Baetis (Acentrella) monticola in certain stones-in-current biotopes and B. (Acentrella) sp. 1 in cascade-waterfall biotope. Kemp, Chutter & Coetzee (1976) [60].

ALSO SEE: Boerger & Clifford [21] quantitative emergence (348 mayflies/m^2/yr) of Ephemeroptera in a Canadian river; McClure & Stewart [79] production (average 5.1, 15.4, 247.9 mg/m^2 dry weight for 3 annual generations), turnover ratio (annual average 5.42) and standing crop (880 individuals/m^2) of Choroterpes mexicanus in a Texas river; Bass [18] biomass of Ephemerella ignita on Ranunculus in an English stream.

HYDROBIOLOGY — still waters

Production of Hexagenia limbata nymphs in a Kansas reservoir, USA, over 4 years. Fluctuations ranged from 926.67 mg/m^2 in 1969-70 to 384.54 mg/m^2 in 1971-72, standing crop from 172.05-110.32 mg/m^2, and turnover ratios from 3.48-5.38. Production for the entire reservoir (1972-73) was estimated at 28.647 kg. Results are compared with another reservoir where production was higher and turnover ratio lower. Horst & Marzolf (1975) [45].

Study of phytoplankton, zooplankton, and benthos of an Alabama reservoir, USA, before operation of a nuclear generating plant. Among benthos, the distribution and seasonal changes in population abundance of Hexagenia bilineata are given for 4 years. Taylor (1974) [107].

Comparison between algae, plants, and invertebrates of 2 reservoirs (impounded for hydroelectricity) and their feeder streams, Croatia, Yugoslavia. For Ephemeroptera and other groups, there were more species in common between the shallow reservoir and its feeder stream than the larger system. This was attributed to slower current of the stream and greater wave action of the lake. Mantoničkin & Pavletić (1975) [75].

Secondary production and energy balance in Lakes Krivoe and Krugloe, northern USSR. Subjects included are species composition of each biocoenosis (Gammarus lacustris-Ephemera vulgata from 0.5-4 m depth includes Caenis macrura; E. vulgata-Sphaerium suecicum at depths of 4-7 m; and others), growth rates, and respiration. Data is presented for major species of each biocoenosis on biomass (B), production (P), P/B ratio, food consumption, assimilation, metabolism, and efficiency of utilization of food for growth. Alimov & Finogenova (1975) [4].

Standing crop, biomass, and emergence of Ephemera vulgata in Lake Krugloe, 1968-69, and in Lake Krivoe, northern USSR. Caenis macrura was also present. Alimov (1975) [2].

Comparison between community composition, biomass, and seasonal patterns of production in Lakes Krivoe and Krugloe, northern USSR, 1968-69. Alimov & Finogenova (1975) [3].

Secondary production and energy balance in Lake Zelenetskoe, northern USSR. Of 4 biocoenoses, Ephemeroptera were restricted to that of Anitella obscurata-Smittia septentrionalis (species of Baetis, Siphlonurus, and Ameletus) and are treated as a group in calculations of oxygen consumption, growth, biomass (B), production (P), P/B ratio, food consumption, assimilation, metabolism, and efficiency of utilization of food for growth. Data are included on Lake Akulkino. Alimov & Finogenova (1975) [5].

Abundance and seasonal population changes of invertebrate fauna associated with floating mats of Utricularia flexuosa and associated periphyton and detritus in a Malaysian swamp. Ephemeroptera (Cloeon sp. and Caenis sp.) represented 10.4% of the total standing crop. Mean standing crop was 21,957 individuals/m^2; populations were highest in August. Lim & Furtado (1975) [64].

Distribution of bottom fauna in Bung Borapet, a reservoir in Thailand. Eatonigenia sp., a major component of fauna, was found near outflow and in central regions at depths of 1.5-5 m, but rarely in other regions. Povilla cambodiensis was common in wood. Biomass and characteristics of the fauna are compared with those of other tropical lakes. Junk (1975) [57].

ALSO SEE: Horst [44] 4-yr data on standing crop of Hexagenia limbata in a Kansas reservoir; Zimbalevskaya [118] abundance and biomass of Cloeon dipterum in vegetation of Kremenchug Reservoir and a flood plain lake, USSR.

METHODS

Comparison of 5 artificial substrate samplers with Ponar grab, Upper Mississippi River, Minnesota, USA. Largest number of taxa was collected by concrete-block, Hester-Dendy, and barbecue-basket samplers, while barbecue baskets filled with wood and rock collected the greatest number of organisms. Ephemeroptera would best be collected with a combination of Hester-Dendy and barbecue-basket samplers. Other combinations of samplers are suggested for other groups. McConville (1975) [80].

Tests on potential use of day-time drift samples in monitoring water quality in South Africa. Tests concerned location of net, net pore size, and sample time. Day-time drift densities seemed unaffected by flow and were less variable than Surber samples. Mean numbers/m^3 of baetids in drift were 2-12, of caenids 6-10. Chutter (1975) [28].

Comparison of water quality of 3 rivers in Scotland, England and Wales, UK, by the Trent biotic index, Graham's biotic index, Chandler's score system, community diversity index, and Kothe's species deficit. Although it requires some modification, Chandler's score system was most sensitive to changes in water quality, and the diversity index was also valuable. Advantages and disadvantages of each index are discussed and the effects of sampling different habitats on resulting index scores are demonstrated. A general discussion on indices accompanies the article. Balloch, Davies & Jones (1976) [16].

Comparison of effects of sieve size and habitat collected on eutrophic classification of 4 Ohio rivers and a South Dakota reservoir, USA, as determined by following indices: Species Richness, Community Diversity, Trophic Condition, and Empirical Biotic. The .595 and .420 mm (mesh opening) sieves gave similar classifications in the river survey, but significant differences occurred between the .595 and .25 mm sieves in reservoir silt and mud. Precision of eutrophic classification increases with smaller sieve sizes. Mason, Lewis & Hudson (1975) [74].

Method for mass rearing nymphs of Hexagenia bilineata and H. limbata. Prater & Anderson (1976) [89].

Method for indexing ecosystematic data on Ephemeroptera. System can be used with file cards or with electronic data processing. McCafferty (1976) [76].

ALSO SEE: Winner et al. [114] comparison of 4 indices in evaluating copper stress on stream fauna, suggesting that unmanipulated indices (such as number of species) were more sensitive in detecting changes in community structure than were other diversity indices.

MINOR REFERENCES

(referring only to incidental data on Ephemeroptera, not to the entire paper)

Experiments demonstrating importance of current and food availability on choice and success of invertebrate colonization of artificial streams by air or over land, Ontario, Canada. Caenis sp. and young Baetidae were occasionally found in the experimental streams. Williams & Hynes (1976) [112].

Effects of domestic and industrial sewage effluent on North Saskatchewan River below Edmonton, Alberta, Canada. Among bottom fauna, Ephemeroptera component was small and restricted to less-polluted north bank of river. Paterson & Nursall (1975) [87].

Comparison of 3 methods (dip net, picking rocks, day drift) in surveying stream fauna. All Ephemeroptera were collected by dip net. Slack, Nauman & Tilley (1976) [100].

Report of Plecoptera, Chironomidae, Coleoptera, and Ephemeroptera at depths of up to 4.2 m in flood plain gravel of 2 Montana rivers, USA. Stanford & Gaufin (1975) [103].

Summary report comparing benthic macroinvertebrate fauna of 2 tributaries of Sandusky River, Ohio, USA. Caenis was abundant in one of the streams. Bankieris & Barker (1976) [17].

Benthos abundance (including Caenis) in 5 ponds, New York, USA, as potential food for migrating waterfowl. Krull & Boyer (1976) [62].

Effects of thermal discharge on fauna of a Virginia river, USA, with comparison between fauna collected by substrate sampler and bottom samples. More species and individuals of Ephemeroptera were found in the artificial substrate samplers. Dahlberg & Conyers (1974) [31].

Comparison of water quality and invertebrate fauna diversity in 6 oligotrophic lakes in Florida, USA. Hexagenia munda orlando occurred in all but the smallest lake. Osborne, Wanielista & Yousef (1976) [86].

Comparison of insects attracted to a blended (mercury-fluorescent) and a black-light trap, Finland. Numbers of Ephemeroptera adults collected were a little greater at the black-light trap. Blomberg, Itämies & Kuusela (1976) [20].

Experimental decomposition and disappearance of leaf discs (Fagus silvatica) from bags in 3 Danish streams. Ephemeroptera represented 1.3-14.8% of the total invertebrate fauna collected from the bags. The role of invertebrates in the decomposition rate of leaves varies between different streams. Iversen (1975) [53].

Generalizations, after 20 years' study, on community structure of a small pond, England-UK. Cloeon spp. and Leptophlebia spp. were among primary consumers. Macan (1975) [67].

Bottom fauna and its distribution in a small, peat-bog lake, England-UK. Leptophlebia vespertina was present in the exposed and sheltered shore sections. McLachlan & McLachlan (1975) [81].

Productivity of algae on stones in Lake Zelenetskoe, northern USSR. Siphlonurus sp. was found among associated invertebrates. Alimov & Nikulina (1974) [6].

Invertebrate fauna of 4 habitats (stony, fine sand, mud-sand with vegetation, mud-detritus) in the littoral zone of the eutrophic Lake Dojran, Macedonia, Yugoslavia. Caenis macrura was found in all habitats. Šapkarev (1975) [95].

Longitudinal zonation of a stream in Zaïre. Ephemeroptera were represented in fauna, which changed in composition in relation to substratum and terrestrial vegetation. Statzner (1975) [104].

MORPHOLOGY AND PHYSIOLOGY

Aerodynamic characteristics of Ephemera vulgata flight, particularly the formation of the vortex behind the wings and the effect of vortex on wing pleating and flight stability. Brodsky & Ivanov (1975) [24].

Anatomy and ultrastructure of the dorsal part of the compound eye of Cloeon sp. male imagos. Functional importance of structures, especially the clear zone, is discussed. Horridge (1976) [43].

Ultrastructure of muscles of femora, coxae, thorax, abdominal segments, and abdominal gills of nymphs of Ephemera danica. Differences between E. danica and other mayfly species in myofilament arrangement and thick filament length of muscles is discussed in relation to muscle function. Carnevali & Saita (1975) [25].

Coniform chloride cell structure of Caenis diminuta nymphs from 2 localities in Florida, USA. Nymphs from brackish water had significantly fewer chloride cells than those from fresh water. Wichard, Tsui & Maehler-v. Dewall (1975) [110].

Hemolymph patterns of mature and young nymphs of Ephemera danica taken from natural waters and after 24-hr experimental treatment with 3 insecticides, a nematicide, and 2 detergents (formulas given). Most nymphs died, and electropherograms showed changes in hemolymph patterns after exposure to pollutants. Staining indicated groups of enzymes most affected — particularly esterases, cholinesterase, and amylases. Histological sections of Cloeon dipterum killed by the nematicide showed precipitate in suboesophageal ganglion. Lepidoptera were also studied. Gysels (1975) [38].

ALSO SEE: Zimmerman et al. [119] respiration rates for 4 size classes of Hexagenia limbata, ranging from .76-.41 mg O_2/gm wet weight/hr and decreasing with growth.

PARASITES AND SYMBIOTIC ASSOCIATES

Report of coliform bacteria in selected species of insects from Missouri, USA. Nymphs of Isonychia sp. and Stenonema sp. both carried coliform bacteria; in Isonychia the total count was higher and 13% of these were fecal coliforms. Fecal coliforms were not found in Stenonema sp. Sarai (1976) [96].

Ultrastructure of trichospore of the Trichomycetes (Harpellales) Genistella ramosa from rectum of Baetis rhodani nymphs. Manier (1973) [71].

Development and ultrastructure of trichospores of 5 species of Trichomycetes (Harpellales), including Zygopolaris ephemeridarum from hindgut of Ephemerella inermis. Moss & Lichtwardt (1976) [82].

New records of mayfly parasites from the Cracow region of Poland. The protozoans Telomyxa glugeiformis and Spiriopsis adipophila were found in nymphs of Ephemera danica; S. adipophila was found in Ephemerella ignita. Unidentified gregarines, Microsporida, trematode cysts, gordiacid larvae and larvae of the nematode Cystidicoloides were found in these hosts or in Baetis rhodani and B. muticus. Ecdyonurus starmachi was rarely parasitized. Arvy & Sowa (1976) [13].

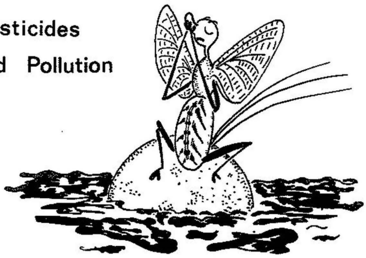
Experimental study of cercaria penetration and encystment of trematode Allopodocotyle lepomis (Opecoelidae) in Litobrancha recurvata. Host defense reaction included repair of entry wound, hemocyte accumulation, encapsulation, and melanin deposition in many cases. Host reaction was greater in mayflies with only a few parasites. Knowles & Hall (1976) [61].

Association between chironomid Epoicocladius ephemerae and Ephemera danica in small stream in Sweden. From laboratory experiments and field samples, young larvae actively seek hosts E. danica and E. vulgata by apparent chemical stimuli. Two and 3-year cohorts in mayfly population assured host availability to 1+ and 2 yr generations of E. ephemerae. During emergence season of E. danica, the chironomid pupated on the mayfly; later in summer, it pupated elsewhere. Data on instars, infestation rates, attachment sites on host, and distribution of E. ephemerae are included. Svensson (1976) [105].

Report of the chironomid Symbiocladius equitans on nymphs of Heptagenia maculipennis, H. flavescens ? (possibly), and Rhithrogena in a river of Northwest Terr., Canada. Infestation rate varied from 5-45% on Heptagenia and 25-65% on Rhithrogena. Life cycle, seasonal change in host selection, and quantitative estimates of infestation rates for S. equitans are discussed. Wiens, Rosenberg & Evans (1975) [111].

ALSO SEE: Arvy & Peters [12] list of mayfly species reported as hosts of other organisms.

Pesticides and Pollution



[Abbreviation: ppb = parts per billion (10^9).]

Dieldrin concentrations in water, catfish (Ictalurus), and aquatic invertebrates in Iowa, USA. Concentrations varied seasonally and were highest in June-July following application of aldrin to cropland. In 1971, concentrations in Potamanthus increased from 40 to about 100 ppb from May to June. Some data are given for Isonychia, Ephoron, and Heptageniidae. Kellogg & Bulkley (1976) [59].

Effects of experimental addition of copper [$Cu(II)SO_4$] at 120 ppb for 2½ years on macroinvertebrates of a small stream, Ohio, USA. Among most sensitive organisms were mayflies Baetis sp. and Stenonema interpunctatum: they were absent from site of injection downstream through reduced copper levels of 66 ppb. Community composition of fauna was similar further downstream (23 ppb) to that above the point of injection (9 ppb) although recovery was not complete, a conclusion based on a variety of indices. Winner, Van Dyke, Caris & Farrell (1975) [114].

Effects of cooling water discharge from a fossil-fuel electricity generating plant on fish and invertebrates in an Indiana river, USA. Ephemeroptera genera Stenonema, Baetis, Caenis, and Tricorythodes were found upstream from the cooling water intake, but they were rare near the discharge canal when temperatures were 31-39°C. Recovery was evident 1500 feet downstream from the discharge canal. Benda & Proffitt (1974) [19].

Effects of thermal discharge from nuclear reactor cooling water in South Carolina streams, USA. Thermal effluent stream was also subjected to sudden water releases and increased flow, increased turbidity, an enlarged floodplain, and loss of forest canopy. The post-thermal stream had received no effluent for 5 years. A natural stream showed a large number of species (for Ephemeroptera - 9) and high diversity, the thermal stream low diversity (one mayfly species) and the post-thermal stream an intermediate level of diversity (4 mayfly species). Estimates of evenness were also highest in natural stream. No aquatic insects were collected in hotter waters of thermal stream; some were found in backwaters and along floodplain bank. Howell & Gentry (1974) [46].

Water quality of the Couze Pavin, a small trout stream in France, subjected to pollution from dairy waste and city sewage. Species of Ephemeroptera were abundant only above pollution, with some recovery evident 10 km downstream from sewage discharge point. In this situation, where oxygen levels were always high, diversity indices gave the best indication of water quality. Échaubard & Neveu (1975) [33].

Evaluation of water quality of 2 small streams in the Yenesei Basin, USSR, based on species of phytoplankton, zooplankton, and benthos. Epeorus assimilis was present only at the station with highest water quality, while Ephemerella ignita was more widely distributed. Gol'd (1976) [36].

ALSO SEE: Mason et al. [74] water quality in Ohio Basin and a South Dakota reservoir by 4 indices, with the assignment of pollutional rank indicator numbers to Hexagenia sp. (5), Tricorythodes sp. (6), and Caenis sp. (6-7); Balloch et al. [16] water quality of 3 rivers in Scotland, England, and Wales affected by sewage, paper mill or dairy effluent or ferruginous water (ferric hydroxide precipitation);

Flössner [35] remarks on water quality of middle Saale River, Germany; Gysels [38] effects of selected pesticides and detergents on hemolymph of Ephemera danica and Cloeon dipterum; Chutter [28] potential use of day-time drift samplers in water quality studies; Kemp et al. [60] water quality of Natal streams, as measured by 2 biotic indices (Chutter and Brand et al.) and 5-day biochemical oxygen demand.

REVIEWS

Summary discussion of stream order continuum (order defined by stream width) and stream characteristics in relation to production levels and relative importance of functional categories of aquatic organisms. Cummins (1976) [30].

Comparison between energy sources, processing of energy (functional units), and ratio of photosynthesis to respiration in still and running freshwater systems. Cummins (1975) [29].

Review and discussion of literature to 1970 on drift, including methods, different types of drift, and factors affecting drift. Emphasis is put on standardization of techniques and experimentation, and suggestions are presented for standardization of terminology and quantitative expressions of drift data. Bournaud & Thibault (1973) [22].

List of species of aquatic animals in North America — principally invertebrates — which have been reported to drift, with discussion. Adamus & Gaufin (1976) [1].

List of mayfly species reported as hosts of parasites, commensals, or other associated organisms. Arvy & Peters (1976) [12].

Review article on insect circulatory system and hemolymph. Hoffman (1976) [42].

Review article on insect respiration and tracheal system. Grassé (1976) [37].

Review article on insect muscles and their structure. Auber (1976) [14].

Review article on insect excretion and the excretory system. Razet (1976) [91].

References to literature pertaining to culture of aquatic invertebrates, including Ephemeroptera. de March et al. (1975) [73].

Review of papers dealing with water pollution and freshwater macroinvertebrates in 1975. Ischinger & Nalepa (1976) [51].

TOXICITY

[Abbreviations: LC50 = lethal concentration in mg/l which killed 50% of test animals in 96 hours, unless other units or times are specified; ppm = parts per million (10^6).]

Toxicity of hexavalent chromates and their effect on respiration of a flowing-water and a quiet-water aquatic insect. Ecdyonurus was less resistant to chromates than Sympetrum. Critical level for Ecdyonurus was between .05 and .10 ppm chromate, above which death was rapid and below which decreases in chromate concentration did not greatly increase survival. Respiration rates decreased in presence of chromates. Other factors considered were density of exposed population and mechanism of chromate action. Chaisemartin (1975) [27].

Toxicity of TFM (formula given), used to control sea lampreys, to 35 species of aquatic invertebrates in continuous flow tests. Among Ephemeroptera, Hexagenia bilineata, Baetis sp., and Cloeon sp. were most sensitive (LC50s of 3.4, 4.4, and 7.2 respectively); Isonychia bicolor, Stenonema frontale, and S. luteolum were somewhat sensitive (LC50s of 12.3, 12.4, and 18.3); and LC50s for Tricorythodes sp., Baetisca obesa, and Paraleptophlebia sp. were 27, 29.2, and 32.4. Young nymphs of Ephemerella cornuta were more sensitive to TFM (LC50 = 24) than mature nymphs (LC50 = 45.6). LC50s after 24 hours are also given. Sublethal effects were noted for many test organisms. Maki, Geissel & Johnson (1975) [69].

Toxicity of Bayer 73 (or Bayluscide) and TFM-2B (98% TFM and 2% Bayer 73) to 21 species of freshwater invertebrates in static water tests. Formulas are given. For Ephemeroptera nymphs, LC50s after 24 hours were 6.9 Bayer 73 and 4.0 TFM-2B for Hexagenia sp. and 2.27 Bayer 73 and 30.5 TFM-2B for Stenonema sp. Generally, TFM-2B was less toxic to test organisms and target sea lampreys (Pteromyzon marinus). Rye & King (1976) [93].

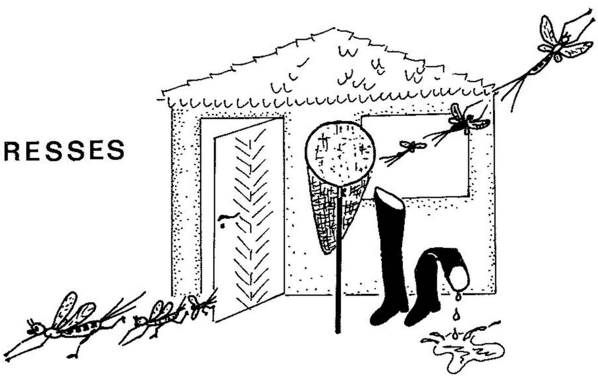
ALSO SEE: Brittain [23] temperature tolerances and time necessary to kill 50% of Leptophlebia vespertina nymphal population at 20°C (159 days), at 25°C (37 days), and at 32°C (4 days).

ZOOGEOGRAPHY

SEE: Lehmkuhl [63] relationships of mayfly fauna between Colorado and Saskatchewan river systems and possible dispersal routes; Harrison & Rankin [40] biogeographical relationships of freshwater fauna of Caribbean islands, with detailed list of affinities for fauna from St. Vincent.

* * * * * * * * * * * * * * *

ADDRESSES



New addresses of Ephemeropterists and all obtainable addresses of authors listed in the Recent Ephemeroptera Literature are included. Address changes are typed in capital letters.

P. R. Adamus
Department of Biology
University of Utah
Salt Lake City, Utah 84112, USA

A. F. Alimov
Zoological Institute,
Academy of Sciences USSR
Universitetskaya nab. 1
Leningrad "B 164," USSR

А. Ф. Алимов
Зоол. Инст., АН СССР
Ленинград В 164, СССР

J. D. Allan
Department of Zoology
University of Maryland
College Park, Maryland 20742, USA

R. K. Allen
Department of Zoology
California State University at L.A.
5151 State College Drive
Los Angeles, California 90032, USA

P. D. Armitage
Moor House (N.C.C.), Garrigill
Alston, Cumberland CA9 3HG
England

L. Arvy
Laboratoire d'Histoenzymologie
Faculté de Médecine
45, rue des Saints-Pères
75006 Paris, France

O. Ya. Bajkova
Amur Division, Pacific Ocean
Institute Fishery & Oceanography
680038 Khabarovsk, USSR

О. Я. Байкова
Амурское Отделение, Тихоокеан.
Научно-Исслед. Инст. Рыб.
Хоз. и Океаногр.
680038 Хабаровск, СССР

D. Balloch
Applied Hydrobiology Section
Department of Biological Sciences
University of Aston in Birmingham
Gosta Green, Birmingham, England

G. Bankieris
Department of Biological Sciences
Bowling Green State University
Bowling Green, Ohio 43403, USA

J. A. BARKER
3204 Tanya Drive
Wilmington, Delaware 19803, USA

J. A. B. Bass
Freshwater Biological Association
River Laboratory, East Stoke
Wareham, Dorset BH20 6BB, England

R. S. Benda
Department of Biology
Aquinas College
Grand Rapids, Michigan 49506, USA

L. Berner
Department of Zoology
University of Florida
Gainesville, Florida 32611, USA

O. Blomberg
Department of Zoology
University of Oulu, Kasarmintie 8
SF-90100 Oulu 10, Finland

H. Boerger
Department of Zoology
University of Alberta
Edmonton, Alberta T6G 2E1, Canada

M. Bournaud
Biologie animale et Zoologie
Université Lyon - I
43, Bd. du 11-Novembre
69621 Villeurbanne, France

J. E. Brittain
Zoologisk Museum
Universitetet i Oslo, Sars Gate
Oslo 5, Norway

A. K. Brodsky
Department of Entomology
Leningrad State University
Leningrad "B-164," USSR

А. К. Бродский
Кафедра Энтомологии
Ленинградского Государственного Университета
Ленинград В-164, СССР

M. A. Brusven
Department of Entomology
College of Agriculture
University of Idaho
Moscow, Idaho 83843, USA

C. Carnevali
Istituto di Zoologia
Via Celoria, 10
20133 Milano, Italy

P. H. CARLSON
Department of Entomology & Economic Zoology
Clemson University
Clemson, South Carolina 29631, USA

N. Caspers
Institut für Landwirtschaftliche Zoologie & Bienenkunde, Universität
D-5300 Bonn, Melbweg 42, Germany (DBR)

C. Chaisemartin
Laboratoire de Biologie animale
U.E.R. des Sciences
Limoges, France

F. M. CHUTTER
N.I.W.R., P. O. Box 395
Pretoria 0001, South Africa

H. F. Clifford
Department of Zoology
University of Alberta
Edmonton, Alberta T6G 2E1, Canada

K. W. Cummins
W. K. Kellogg Biological Station
of Michigan State University
3700 Gull Lake Drive
Hickory Corners, Michigan 49060, USA

M. D. Dahlberg
Virginia Inst. Scientific Research
6300 River Road
Richmond, Virginia 23229, USA

W. A. Duvel, Jr.
Michael Baker, Jr., Inc.
Box 280
Beaver, Pennsylvania 15009, USA

M. Échaubard
Laboratoire de Zoologie, Biologie et
Écologie animale, I.N.A.
16, rue Claude Bernard
75005 Paris, France

K. W. Evans
City of Edmonton, Parks &
Recreation Dept., C N Tower
Edmonton, Alberta T5J OKl, Canada

G. F. Edmunds, Jr.
Department of Biology
University of Utah
Salt Lake City, Utah 84112, USA

N. P. Finogenova
Zoological Institute
Academy of Sciences USSR
Universitetskaya nab. 1
Leningrad "B 164," USSR
Н. П. Финогенова
Зоол. Инст., АН СССР
Ленинград В 164, СССР

J. F. Flannagan
Fisheries Research Board of Canada
Freshwater Institute
Winnipeg, Manitoba R3T 2N6, Canada

H. Gysels
Instituut voor Dierkunde
Rijksuniversiteit Gent
K. L. Ledeganckstraat 35
B-9000 Gent, Belgium

J. E. Hall
Department of Microbiology
Medical Center
West Virginia University
Morgantown, West Virginia 26506, USA

A. D. Harrison
Department of Biology
University of Waterloo
Waterloo, Ontario N2L 3G1, Canada

D. S. Hart
Department of Entomology
University of Idaho
Moscow, Idaho 83843, USA

G. A. Horridge
Department of Neurobiology
Australian National University
Box 475
Canberra, A.C.T. 2601, Australia

T. Horst
Stone & Webster Engineering Corp.,
Environmental Engineering Division
P. O. Box 2325
Boston, Massachusetts 02107, USA

F. G. Howell
Savannah River Ecology Laboratory
Aiken, South Carolina 29801, USA

M. D. Hubbard
University P. O. Box 111
Florida A & M University
Tallahassee, Florida 32307, USA

P. L. Hudson
Southeast Reservoir Investigations
P. O. Box 429
Clemson, South Carolina 29631, USA

J. D. Hynes
Ministry of Natural Resources
Chatsworth Fish Hatchery, R.R. 2
Chatsworth, Ontario NOH IGO, Canada

J. Illies
Limnologische Flussstation des
Max-Planck-Inst. Limnologie
6407 Schlitz, Postfach 260
Germany (DBR)

L. S. Ischinger
Office of Biological Services
U.S. Fish & Wildlife Service
Fort Collins, Colorado, USA

T. Itô
Biological Institute, Fac. Sci.
Ehime University
Matsuyama 790, Japan

U. Jacob
Sektion Biowissenschaften der
Karl-Marx-Universität
Zellbiologie und Regulation
701 Leipzig, Talstrasse 33
Germany (DDR)

S. L. Jensen
Department of Life Sciences
Southwest Missouri State College
Springfield, Missouri 65802, USA

P. M. Jónasson
Kobenhavns Universitets
Ferskvands-Biologiske Laboratorium
Helsingørsgade 51
DK-3400 Hillerød, Denmark

W. J. Junk
Max-Planck-Institut für Limnologie
232 Plön, Postfach 165, Germany (DBR)

M. Keffermüller
Universitet im. Adama Mickiewicza
Instytut Biologii, Zakł. Zool. Syst.
61-701 Poznán, ul. Fredry 10
Poland

R. L. Kellogg
Iowa Cooperative Fishery Res. Unit
Iowa State University
Ames, Iowa 50011, USA

E. E. KNOWLES, III
Department of Biology
Essex Community College
Baltimore County, Maryland 21237
USA (for reprints, write J. E. Hall)

J. N. Krull
Department of Biology
Central Michigan University
Mt. Pleasant, Michigan 48859, USA

R. J. LUEDTKE
Fisheries Bioassay Laboratory
Department of Chemistry
Montana State University
Bozeman, Montana 59715, USA

D. M. Lehmkuhl
Department of Biology
University of Saskatchewan
Saskatoon, Saskatchewan S7N OWO
Canada

P. A. Lewis
Biological Methods Branch
Environmental Monitoring & Support
Laboratory
EPA, Natl. Environ. Res. Center
Cincinnati, Ohio 45268, USA

R. W. Lichtwardt
Department of Botany
University of Kansas
Lawrence, Kansas 66045, USA

T. T. Macan
Freshwater Biological Association
The Ferry House, Far Sawrey
Ambleside, Cumbria LA22 OLP, England

E. R. Mancini
Water Resources Laboratory
University of Louisville
Louisville, Kentucky 40208, USA

J.-F. Manier
Laboratoire de Zoologie I
Univ. Sci. Tech. Languedoc
34060 Montpellier, France

B. G. E. de March
Department of Environment
Fisheries and Marine Service
Freshwater Institute
Winnipeg, Manitoba R3T 2N6, Canada

W. T. Mason, Jr.
Interstate Comm., Potomac River Basin
814 East West Towers
4350 East West Highway
Bethesda, Maryland 20014, USA

W. P. McCafferty
Entomology Hall, Dept. of Entomology
Purdue University
West Lafayette, Indiana 47907, USA

R. G. McClure
Connors State College
Warner, Oklahoma 74469, USA

D. R. McConville
Biology Department
St. Mary's College
Winona, Minnesota 55987, USA

A. J. McLachlan
Zoology Department
University of Newcastle upon Tyne
Newcastle upon Tyne NE1 7RU, England

J. E. Mokry
Research Unit on Vector Pathology
Memorial University of Newfoundland
St. John's, Newfoundland A1C 5S7
Canada

S. T. Moss
Department of Biological Sciences
Portsmouth Polytechnic
King Henry I Street
Portsmouth PO1 2DY, England

B. NAGELL
Research Laboratory
Environmental Protection Board
Fack
S-171 21 Solna, Sweden

H. Neuherz
Zoologisches Institut der Universität
Lehrkanzel für Morphologie u. Ökologie
A-8010 Graz, Austria

A. Neveu
Laboratoire d'Écologie des Invertébrés
Station d'Hydrobiologie, I.N.R.A.
B.P. 79
64200 Biarritz, France

R. L. NEWELL
Stearns-Roger, Inc.
Environmental Sciences Division
700 South Ash, P. O. Box 5888
Denver, Colorado 80217, USA

T. Okazawa
Zoological Institute, Fac. Sci.
Hokkaido University
Sapporo, Hokkaido 060, Japan

J. A. Osborne
Department of Biological Sciences
Florida Technological University
Orlando, Florida 32816, USA

C. G. PATERSON
Biology Department
Mount Allison University
Sackville, New Brunswick, Canada

Z. Pavletić
University of Zagreb
41000 Zagreb, Yugoslavia

R. G. PEARSON
Zoology Department, James Cook
University of North Queensland
Queensland 4811, Australia

B. L. PRATER
Department of Biology
Heidelberg College
Tiffin, Ohio 44883, USA

V. Puthz
Limnologische Flussstation d.
Max-Planck-Institut f. Limnologie
6407 Schlitz, Postfach 102
Germany (DBR)

M. Y. Richardson
Department of Biological Sciences
Marshall University
Huntington, West Virginia 25701, USA

D. Rosenberg
Environment Canada, Fisheries &
Marine Service, Freshwater Inst.
501 University Crescent
Winnipeg, Manitoba R3T 2N6, Canada

R. P. Rutter
Ichthyological Associates, Inc.
Fricks Lock Road, R. D. #1
Pottstown, Pennsylvania 19464, USA

R. P. Rye, Jr.
Conservation Education Center
Route 1, Box 138 C
Guthrie Center, Iowa 50115, USA

A. Saita
Istituto di Zoologia dell'Universita
Via Celoria, 10
20133 Milano, Italy

K. Salonen
Lammi Biological Station
University of Helsinki
SF-16900 Lammi, Finland

J. A. Šapkarev
Zooloski Zabod
Prirodno-Matematički Fak.
Skopje, Yugoslavia

D. S. Sarai
Environmental Sciences Division
Water & Wastewater Technical School
Neosho, Missouri 64850, USA

K. SCHMIDT
Zoologisches Inst. d. Universität (T.H.)
75 Karlsruhe 1, Kornblumenstraße 13
Germany (DBR)

G. G. E. Scudder
Department of Zoology
University of British Columbia
Vancouver, British Columbia, Canada

N. D. Sinitshenkova
Paleontological Institute of the
USSR Academy of Sciences
Leninsky prospect 33
Moscow 117071, USSR
Н. Д. Синиченкова
Палеонтол. Инст. АН СССР
Ленинский проспект, 33
Москва 117071, СССР

R. Sowa
Uniwersytet Jagielloński
Zakład Hydrobiologii, Inst. Zool.
30-063 Kraków, ul. Oleandry 2
Poland

J. Stanford
Department of Biological Sciences
North Texas State University
Denton, Texas 76203, USA

B. Statzner
Zoologisches Inst. d. Universität
D-23 Kiel, Hegewischstr. 3
Germany (DBR)

K. W. Stewart
Department of Biology
North Texas State University
Denton, Texas 76203, USA

B. Svensson
Ecology Bldg., University of Lund
Helgonavägen 5
S-223 62 Lund, Sweden

D. Tarter
Department of Biological Sciences
Marshall University
Huntington, West Virginia 25701, USA

M. P. Taylor
Division of Environmental Planning
Tennessee Valley Authority
Muscle Shoals, Alabama 35660, USA

M. Thibault
Laboratoire de Zoologie, E.N.S.A.
65, rue de St. Brieuc
35043 Rennes Cedex, France

P. T. P. Tsui
Aquatic Environments Limited
5508-8 Ave. S.E.
Calgary, Alberta T2A 3P6, Canada

S. Ulfstrand
Department of Animal Ecology
University of Lund
S-223 62 Lund, Sweden

J. V. Ward
Department of Zoology #E 328
Colorado State University
Fort Collins, Colorado 80521, USA

W. Wichard
Institut für Cytologie und Mikromorphologie d. Universität Bonn
D-53 Bonn, Ulrich Haberland Str. 61a
Germany (DBR)

A. P. Wiens
Environment Canada, Fish. & Mar. Service, Freshwater Institute
501 University Crescent
Winnipeg, Manitoba R3T 2N6, Canada

D. D. WILLIAMS
Department of the Environment
Pacific Biological Station
Nanaimo, British Columbia V9R 5K6
Canada

R. W. Winner
Department Zoology & Physiology
Miami University
Oxford, Ohio 45056, USA

E. J. WISE
Department of Zoology
University College
Belfield, Stillorgan Road
Dublin, Ireland

T. E. Wissing
Department of Zoology
Miami University
Oxford, Ohio 45056, USA

M. Zelinka
Hydrobiologická Laboratoř Pro Výzkum Tekoucích Vod
Přírod. Fak. Univ. J. E. Purkyně
61137 Brno, Kotlářská 2
Czechoslovakia

H. Ziemann
DDR-50 Erfurt, Schillerstr. 46
Germany (DDR)

L. N. Zimbalevskaya
Institute of Hydrobiology
Ukrainian Academy of Sciences
Kiev, Ukrainian SSR, USSR

M. C. Zimmerman
Department of Zoology
Miami University
Oxford, Ohio 45056, USA

W. Zimmermann
Museum der Stadt Gotha
58 Gotha, Parkallee 15
Germany (DDR)

Florida A & M University
March 31, 1977