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Editorial

Insects in Aquatic Ecosystems: Diversity, Function and Applications

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Estimates of total diversity within the Class Insecta have ranged from 5.5 to 30 million insect species on Earth [1,2], with only approximately 1 million described species known to science [3]. Among all insects, aquatic insect diversity accounts for approximately 10% of this estimated total, with roughly 100,000 species possessing at least one aquatic stage in their development, as well as inhabiting a myriad of aquatic systems, including phytotelmata, lentic and lotic freshwater (ponds, lakes, streams and rivers), salt marshes, and marine water [2–4]. With life histories that span both terrestrial and aquatic ecosystems, such taxonomic diversity might explain why aquatic insects are cosmopolitan in their distribution, being found on every continent except Antarctica. This is why in the last 30 years, they have been so helpful in their ecosystem service applications, being a global standard used to better understand their role in evaluating water quality, trophic ecology, impacts on human and animal health, how invasive species affect ecosystem functioning, and their role in potentially forecasting the effects of climate change worldwide.

Of the known aquatic insect orders, five are almost exclusively aquatic, being represented by approximately 27,000 species [5]. To more fully understand aquatic insect diversity, numerous semi-comprehensive treatments of aquatic insect systematics and taxonomic keys were initiated throughout the early and middle portions of the 20th century [6–10]. However, it was not until the late 20th century when the edited volumes of "An Introduction to the Aquatic Insects of North America" [11], which began in 1978, and a lineage that spans five editions and nearly fifty years, have research scientists, regional and federal managers, non-profit organizations, fly anglers and teachers at all levels worldwide been able to expand our comprehension of such diversity.

Dr. Kenneth W. Cummins, founding co-editor of this treatise and for whom this issue is dedicated, understood the importance of aquatic insect identification and its intimate connection with aquatic insect systematics, evolution, ecology, life histories and functional feeding group relationships. Therefore, this comprehensive treatment has allowed aquatic ecologists and their graduate students to follow in his footsteps to further develop our knowledge of aquatic insect diversity. Cummins feared that our need for traditional insect taxonomic methods of collecting and identifying aquatic insects would be replaced by squashing and DNA bar-coding them, but the fact is that both traditional and more modern and developing methodologies can work in concert to monitor and track their diversity as aquatic systems worldwide become impacted by both natural and anthropogenic influences. Such impacts, e.g., how aquatic insects adjust to changing climates, wetland destruction and artificial mitigation, and food web structures in unique habitats, are included in this issue of *Diversity* dedicated to Dr. Kenneth W. Cummins, a true legend in the field of aquatic entomology and ecology.

Check for updates

Received: 16 October 2026
Accepted: 16 October 2026
Published: 20 October 2026

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Author Contributions: All authors managed this editorial, wrote the manuscript and contributed to the revision. All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest: The authors declare no conflicts of interest.

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