

Abstract

Areas with diverse habitats tend to harbor a greater number of species. Given the great diversity of habitats in Oklahoma, one would expect the state to be above average with respect to species diversity. With the many lakes and streams in Oklahoma, this expectation would be extended to the aquatic fauna, too, including mayflies. Studies on mayflies in eastern Oklahoma support this view. My goals are to develop (1) a list of species for the state and (2) an identification manual for nymphs and adults. To achieve these goals, assistance with collecting is needed.

Introduction

Oklahoma exhibits incredible environmental variation. For example, average annual precipitation in southeastern Oklahoma is nearly four times that in the panhandle and elevation increases 17-fold from the southeast to the northwest (Web Atlas of Oklahoma, 2005). The state also has 27 geomorphic provinces (Johnson, 2006) and 12 ecoregions (Fig. 1; Oklahoma Forestry Services, 2007).

Throughout Oklahoma there are approximately 390,000 lakes and ponds (OWRB, 2016a) and 167,600 stream miles (OWRB, 2016b). Given this tremendous environmental variation and the many aquatic habitats in Oklahoma, one would expect a highly diverse aquatic fauna in the state.

Mayflies (Ephemeroptera) are an order of aquatic insects that are ubiquitous in these freshwater habitats, yet no comprehensive study of these insects has been conducted for Oklahoma. Currently, there is no single key to identify mayfly nymphs and adults to species for the state, and publications needed to identify species are widely scattered in the scientific literature.

My goals are to develop (1) a list of species for the state and (2) an identification manual for nymphs and adults.

Biology of Mayflies

Female mayflies lay their eggs in freshwater, which can be a large habitat such as a lake or river or something very small such as a spring, pond, or even a puddle. Nymphs (Fig. 2) hatch from these eggs. The length of this stage varies from three weeks to more than two years and depends on the species and temperature during development (Brittain and Sartori, 2003).

Once mature, the nymphs leave the water as winged subimagos, which soon molt to the imago stage (Fig. 3). Males form mating swarms, usually at dusk. A female enters the swarm, attracts a male, and the two mate on the wing. Females then lay their eggs to complete the life cycle.

Importance of Mayflies

Only the nymphs feed, primarily on detritus (organic debris from other organisms) although some species feed on algae and diatoms and a few are predaceous. Mayflies, then, occupy an important position in the food chain by converting detritus into their own tissues, which are then fed upon by over 200 different predators (Grant, 2001).

Most of the life cycle of a mayfly is spent as an egg and nymph in the water and thus makes them important indicators of water quality and environmental change (e.g., acidification, temperature, flow, chemical contamination) (Brittain and Sartori, 2003).

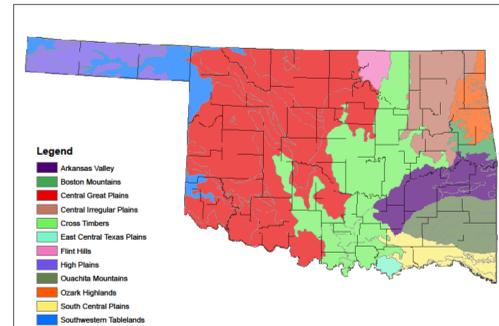


Fig.1. There are 12 level III ecoregions in Oklahoma. (Oklahoma Forestry Services, 2007)



Fig. 2. Mayfly nymphs. This is the aquatic, immature stage of the life cycle.



Fig. 3. Mayfly adults. This is the terrestrial stage of the life cycle.

Mayfly Diversity in Oklahoma

A number of authors (see list in McCafferty et al., 1997) have identified mayflies from Oklahoma, but their focus was not on the state's fauna. Other studies have examined the macroinvertebrate community of aquatic habitats in Oklahoma (see references cited in Bass, 1994) but many of these studies were conducted in the same geographic area of the state in habitats that did not contain a very diverse mayfly community.

To date, a total of 92 species in 13 families have been collected in Oklahoma. Most of these species were collected in just two studies in eastern Oklahoma: McCafferty et al. (1997) collected 40 species of mayflies in Spring Creek in northeastern Oklahoma and Baumgardner and Kennedy (2000) collected 56 species from the Kiamichi River watershed in the southeastern part of the state. These two studies provide evidence for a very diverse mayfly community in Oklahoma.

Challenges and Solutions

Oklahoma is not the largest state in the Union (20th) but its 181,048 sq. km. provide a challenge to sample its myriad lakes and streams. In addition, many mayflies are seasonal and so more than one collection is necessary per site each year.

Assistance with collecting specimens is my primary need. This could be solved a number of ways:

- utilize specimens stored in museums and research collections
- collaborate with other field biologists from different regions of the state
- incorporating collecting into field biology courses at colleges and universities
- developing science exercises, that involve collecting, for middle and high school science teachers to use in their courses and
- recruiting citizen scientists.

These suggestions would allow for more intensive collecting in a smaller area throughout the year.

This is a long-term study that has many opportunities for participation. If you would like to be involved with this study or offer suggestions, please contact me at peter.grant@swosu.edu or (580) 774-3054.

Acknowledgements

Funding for this study was provided by the SWOSU College of Arts and Sciences, Department of Biological Sciences and the Office of Sponsored Programs. Biology students, particularly Andrew Nelson, Anna Nelson and Amber Rymer, have assisted in field work.

References Cited

- Bass, D. 1994. Community structure and distribution patterns of aquatic macroinvertebrates in a tall grass prairie stream ecosystem. *Proc. Okla. Acad. Sci.* 74:3-10.
- Baumgardner, D. E. and J. H. Kennedy. 2000. Mayflies (Insecta: Ephemeroptera) of the Kiamichi River watershed, Oklahoma. *J. Kans. Entomol. Soc.* 72:297-305.
- Brittain, J. E. and M. Sartori. 2003. Ephemeroptera, pages 373-380. In, Resh, V. H. and R. T. Cardé (eds.). *Encyclopedia of Insects*, Academic Press.
- Grant, P. M. 2001. Mayflies as food. Pages 107-124. In, Dominguez, E. (ed.). *Trends in research in Ephemeroptera and Plecoptera*. Kluwer Academic/Plenum Publishers.
- Johnson, K. S. 2006. Geomorphic provinces, pages 4-5. In, C. R. Goins, and D. Goble, Eds. *Historical Atlas of Oklahoma*, University of Oklahoma Press.
- McCafferty, W. P., R. K. Heth and R. D. Waltz. 1997. The Ephemeroptera of Spring Creek, Oklahoma, with remarks on notable records. *Entomol. News* 108:193-200.
- Oklahoma Forestry Services. 2007. The ecoregions of Oklahoma. <http://www.forestry.ok.gov/ecoregions-of-oklahoma>
- Oklahoma Water Resources Board. 2016a. Lakes of Oklahoma. <http://www.owrb.ok.gov/news/publications/lok/lok.php>
- Oklahoma Water Resources Board. 2016b. Water facts. <https://www.owrb.ok.gov/util/waterfact.php>
- Web Atlas of Oklahoma. 2005. <http://www.okatlas.org/okatlas/cover.htm>.

Photos: <http://www.freshwater-science.org>, <http://insectimages.org/index.cfm>, <http://bioimages.org.uk/>