

RESEARCH NOTE

URBAN DRAINAGE AQUATIC INVERTEBRATE SIGNATURE SPECIES IN ALLEGHENY COUNTY, PENNSYLVANIA: *GAMMARUS MINUS* (CRUSTACEA, AMPHIPODA), AND *BAETIS FLAVISTRIGA* (INSECTA, EPHEMEROPTERA)¹

MICHAEL KORYAK*, LINDA J. STAFFORD* and JAN L. SYKORA**

*U.S. Army Corps of Engineers, 1000 Liberty Avenue, Pittsburgh, PA 15222

**University of Pittsburgh, Pittsburgh, PA 15260

Invertebrate bioassessments of urban/suburban streams within Allegheny County, Pennsylvania, were conducted during the spring of 2001 at 35 stations on 33 different streams. The purpose of this study was to support the Three Rivers-Second Nature (3R-2N) initiative. The general goals of the 3R-2N initiative are to generate interest in protecting/restoring the urban streams of Allegheny County, Pennsylvania. The assessments will be used to characterize and rank the water quality and health of the ecosystem of these streams.

Chemically, the streams tended to be alkaline and mineralized. The mean values for pH, alkalinity, acidity, and conductivity were 7.8, 131 mg/l as CaCO₃, 9 mg/l as CaCO₃, and 1215 uhm/cm, respectively. Calcium concentrations averaged 109 mg/l, and sodium 100 mg/l. The concentrations of ammonia and of metals, iron and aluminum in particular, were elevated at a number of stations. These parameters indicate widespread influences of alkaline mill slag leachates, salt runoff from highway deicing, and sewage contamination, and, at some locations, acid mine drainage from bituminous coal mines. Biological condition scores were developed from the invertebrate data based on modified Ohio EPA protocols (Ohio Environmental Protection Agency, 1988). All of the 35 stream stations examined were impaired to various degrees, 42.8% seriously impaired, 37.2% moderately impaired, and 20% slightly impaired.

A total of 18,883 aquatic invertebrates representing 67 different taxa were collected, 27.9% of which were pollution tolerant AC organisms (Annelida and Chironomidae) and 19.1% of which were intolerant EPT organisms (Ephemeroptera, Plecoptera, and Trichoptera). Among the EPT organisms, Baetidae

mayflies leap out as a potential local urban stream indicator taxon. Baetidae were found in 48% of the stations sampled. They represented 45.5% of EPT organisms and 8.7% of all organisms collected. An even more dominant local urban drainage signature taxon was *Gammarus* sp. *Gammarus* sp. were present in 80% of the samples. *Gammarus* sp. ranged from 0 to 100% of the aquatic invertebrate community at the various stations, and were 35.5% of all organisms collected at the urban/suburban stations. Reference specimens were identified as *Baetis flavistriga* and *Gammarus minus* (Kovalcik, 2002 personal communication).

Implications of the demonstrated tolerance of these two organisms to the stresses of urban/suburban drainage would include a re-evaluation of their use in development of Hilsenhoff species-level Biotic Index (BI) and Family Biotic Index (FBI) values (Hilsenhoff, 1988), as well as use of FBI metrics in the development of Rapid Biological Assessment (RBA) comparative condition scores (Plafkin et al., 1989). Tolerance values are used for the calculation of these indices. Tolerance values range from 0 for very intolerant organisms to 10 for very tolerant organisms. Most of these values were derived by Hilsenhoff from more than 53 Wisconsin streams. Relative to organic pollution in these streams, Hilsenhoff considered Baetidae and Gammaridae to be relatively sensitive and assigned them both a tolerance value of 4. Bode et al. (1996) and Barbour et al. (1999) questioned this sensitivity for *Baetis* sp. and both assigned *Baetis* sp. a tolerance value of 6. Bode et al. (1996), nonetheless, still assigned *Baetis flavistriga* a value of 4. In the case of local urban streams suffering from multiple insults, we believe that higher values for both Baetidae and Gammaridae would be appropriate.

In the case of RBAs, where identification to the species level would not be convenient and family or genus level identification is most appropriate, the tolerance of these organisms for urban drainage might best

¹Submitted for publication 27 June 2002; accepted 25 October 2002.

be accounted for by introducing new metrics. Two recommended urban stream metrics are 1) % EPT organisms exclusive of Baetidae, and 2) % non-crustacean organisms.

LITERATURE CITED

- Barbour, M. T., Gerritsen, J., Snyder, B. D., Stribling, J. B. 1999. Rapid Assessment Protocols For Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish, Second Edition. EPA 841-B-99-002. U. S. Environmental Protection Agency, Office of Water, Washington, DC.
- Bode, R. W., Novak, M. A., and Abele, L. E. 1996. Quality Assurance Work Plan for Biological Stream Monitoring in New York State. NYS Department of Environmental Conservation, Albany, NY.
- Hilsenhoff, W. L. 1988. Rapid Field Assessment of Organic Pollution with a Family-level Biotic Index: Journal of the North American Benthological Society, Vol. 7, pp. 65-68.
- Ohio Environmental Protection Agency. 1988. Biological Criteria for the Protection of Aquatic Life: Volume II. Users Manual for Biological Field Assessment of Ohio Surface Waters. Ohio Environmental Protection Agency, Ecological Assessment Section, Division of Water Quality, Columbus, Ohio.
- Plafkin, J. L., Barbour, M. T., Porter, K. D., Gross, S. K., and Hughes, R. M. 1989. Rapid Bioassessment Protocols for use in Streams and Rivers: Benthic Macroinvertebrates and Fish. U.S. Environmental Protection Agency. EPA 440/4-89/001.