

Selection of Stream Insect Larvae for Indicating Anthropogenic Impact

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This study examined the total mercury concentrations, [Hg], and $\delta^{15}\text{N}$ values in macro-invertebrates collected from 35 stream sites in Rhode Island, USA, to determine the organism groups most suitable for use as indicators of anthropogenic impact. Site selection was designed to cover a wide geographical range and to encompass relatively pristine locations in the western part of the state and others from more highly developed and populated areas near the city of Providence. Sites were sampled on an irregular basis over a two-year time period. Samples were collected by dip and kick nets and consisted largely of insect larvae. The distributions of larval insects varied among sites. The most common larval organism groups, found at 30 and 28 sites, respectively, were: hellgrammites, a group that is a combination of dobsonflies and fishflies, and darner dragonflies. The larvae of both of these groups are engulfer-predators. Across sites, relationships between [Hg] and $\delta^{15}\text{N}$ varied among the organism groups. Engulfer-predators showed significant negative relationships between [Hg] and $\delta^{15}\text{N}$ values, except for skimmer dragonflies, which did not show a significant relationship. The $\delta^{15}\text{N}$ value of organisms has been found to reflect the level of nitrogen nutrients in fresh water sites which often results from human wastewater inputs. Therefore, the negative relationships shown for most of the engulfer-predators may reflect anthropogenic impacts across sites. However, pH varies among sites and explains 31% of the variance in [Hg] for hellgrammites. When pH was combined with the $\delta^{15}\text{N}$ data for this organism group in a stepwise regression, 43% of the variance in [Hg] was explained. Overall, the frequency of occurrence and the strength of the relationship between [Hg] and $\delta^{15}\text{N}$ for hellgrammites appear to support their potential use as an indicator of the magnitude of Hg contamination and anthropogenic impact in streams. At sites where hellgrammites are not found, darner dragonflies could be substituted because the relationships between [Hg] and $\delta^{15}\text{N}$ were not significantly different between these two groups.