Baseline conditions of the
UPPER LEHIGH
Delaware River Watershed Initiative

Indices of Biological Integrity: An index of biological integrity (IBI) is a collection of metrics which describe the structure and function of an ecosystem based on its biota. Metric values are converted to scores and yield a total IBI score. These scores can be translated into easily-interpreted regional quality classifications.

<table>
<thead>
<tr>
<th>Rating</th>
<th>Daniels Fish IBI</th>
<th>PADEP Macro-invertebrate IBI</th>
<th>Algae MMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
<td>0 – 35</td>
<td>0 – 45</td>
<td>0 – 3.33</td>
</tr>
<tr>
<td>Fair</td>
<td>35.1 – 46</td>
<td>45.1 – 74</td>
<td>3.34 – 6.66</td>
</tr>
<tr>
<td>Good</td>
<td>46.1 – 60</td>
<td>74.1 – 100</td>
<td>6.67 – 10</td>
</tr>
</tbody>
</table>

Notable Fish & Significance to IBI

**Longnose Dace (Rhinichthys cataractae)**
Insectivore, intermediate tolerance to non-specific stressors

**Margined Madtom (Noturus insignis)**
Insectivore, intermediate tolerance to non-specific stressors

**Common Shiner (Luxilus cornutus)**
Generalist feeder, intermediate tolerance to non-specific stressors

Average Daniels Fish IBI Score: 39.44 (Fair)

Notable Algae & Significance to IBI

**Achnanthidium minutissimum**
Nutrient sensitive, grazer and scour resistant

**Achnanthidium rivulare**
Nutrient tolerant, neutral pH optimum, grazer and scour resistant

**Cocconeis placentula**
Moderate nutrient tolerance, grazer and scour resistant

Average Algae MMI Score: 7.55 (Good)

Notable Macroinvertebrates & Significance to IBI

**Riffle beetles: Promoresia**
Require fast-flowing waters, pollution sensitive, scrapers

**Microcaddisflies: Stactobiella**
Somewhat pollution sensitive, scrapers

**Black flies: Simuliidae**
Those present here are pollution sensitive, collector-filterers

Average Macroinvertebrate IBI Score: 78.60 (Good)

Multiple Indicators: Data collection includes chemical parameters as well as biota. Water chemistry alone can either over exaggerate or fail to detect changes from brief pollution events, but biota provide information on year-round water and habitat quality. Different biota respond differently to stressors. Analyzing data on multiple groups of biota tells a more complete story of ecosystem structure and function in relation to landscape variables and human activities.

Circle icons represent 2013-2014 DRWI sampling sites. Number of ANS/Stroud WRC sites = 13; Cluster Group sites = 32.

THE ACADEMY OF NATURAL SCIENCES
DREXEL UNIVERSITY
July 2016
Cluster Organization


Strategy: Prevent degradation of existing water quality conditions through preservation of forested and wetland areas, with emphasis on enhancing connectivity of protected lands; promote conservation and stewardship at the municipal and county levels; restoration of degraded stream corridors through dam removal.

Monitoring Objectives: Characterization of the Lehigh’s sub-drainages; comparing conditions above and below the region of acid mine drainage inputs; assessing effectiveness of land preservation as a means of water quality protection.

Habitat Assessment

In-stream habitat assessments are a composite of variables including flow type descriptions, particle size classifications and embeddedness estimations. These features interact to influence biotic communities. Reaches sampled in the Upper Lehigh cluster had similar amounts of riffle (35%), glide (34%; fast-flowing but not as choppy as riffle) and pool (28%; still or backflow) flow types. Flow type is often reflected in both substrate particle size and how embedded particles are. Particle size and embeddedness then, in turn, partially determine the area of habitat available for fish, macroinvertebrates, and algae within a reach. In the Upper Lehigh cluster, the dominant particle sizes were cobble (38%) and small boulders (22%). The coarse gravel, cobbles, and boulders present were about 42% embedded (covered in fine sediment; high percentages can indicate erosion of upstream land). Overall this cluster was given a habitat grade of suboptimal.

Summary of Water Chemistry Parameters

There were 33 seasonal sampling events performed by the Academy of Natural Sciences and Stroud Water Research Center at 13 sites from 2013 to 2014. All samples at all sites met nitrate criteria for cold water fisheries (<3.1 mg/L nitrate). Also, all samples were below 0.05 mg/L soluble reactive phosphorus (SRP) – a widely-referenced maximum for suitability for aquatic life. Some of the highest SRP concentrations in the cluster were from Bear Creek, which drains an area that is heavily forested (80%) but has pockets of development (7.2%). Total suspended solids (TSS) should be below 25 mg/L to support cold water fisheries. All samples at all sites achieved levels of chloride considered safe for aquatic life under chronic exposure (<230 mg/L, EPA), but Rucks Run (RR3) produced the highest concentration of chloride (69.4 mg/L). Chloride can be related to urban land use via road salts and wastewater treatment plants. The site is downstream of a major highway, and forested areas that are undergoing development. Ammonia concentration and its effects on freshwater communities is highly variable; upper limits of concentrations suitable for aquatic life can range from 0.07 to 2.0 mg/L total ammonia (EPA) depending on temperature, pH and species. All sampling events in this cluster met the total ammonia criterion, with concentrations below 0.07 mg/L. Weathering is the main source of calcium (from limestone), magnesium (from igneous rocks that include biotite and pyroxene), and potassium (from igneous and silicate rocks including feldspar) in freshwater streams. Their concentrations vary depending on rainfall and pollution as well as local geology, with ion concentrations in igneous geographies roughly half those of sedimentary landscapes. Downstream this variation becomes less notable than in headwaters, and ion concentrations increase overall (Allan and Castillo, 2007).

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