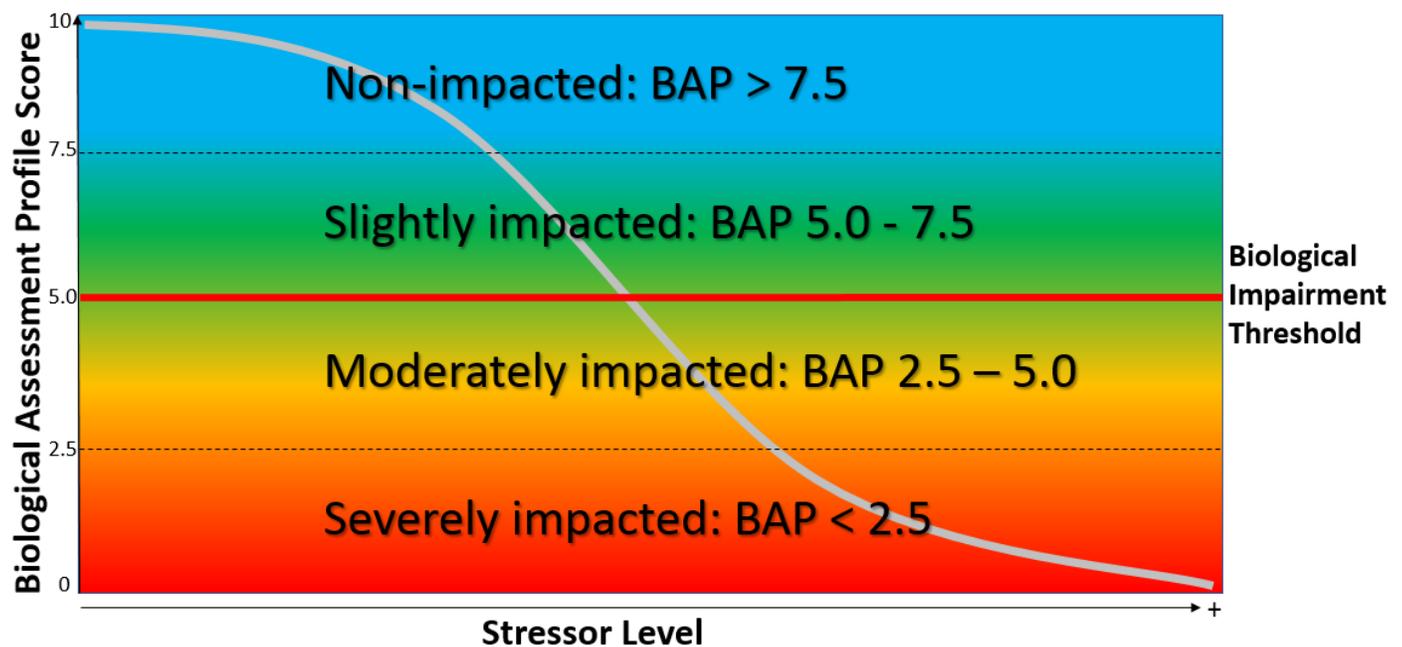


# Fact Sheet on Assessment of Water Quality Impact in Streams and Rivers

The assessment of stream and river water quality uses a four-tiered system of impact categorization based on the macroinvertebrate community. Macroinvertebrates provide an accurate means of water quality assessment by integrating the overall effects of multiple stressors to the community. Level of impact is assessed by first evaluating individual community metrics on a common 10-scale and the averaging them to yield a determination known as the Biological Assessment Profile (BAP) score. A BAP score of 5 or better is indicative of non or slightly impacted conditions and a value below 5 indicates moderate or severely impacted conditions and suggests biological impairment. The figure below illustrates as stressor levels increase, BAP scores decrease.



Various combinations of individual metrics are used to calculate the BAP score and are dependent upon the type of surface water and the method of sample collection. These metrics include: species richness, EPT richness, Hilsenhoff's biotic index, percent model affinity, nutrient biotic index, species diversity, and non-Chironomidae and Oligochaeta richness (See Glossary). Because metrics measure different aspects of the macroinvertebrate community, they do not necessarily form a consensus. A summary of impact categories is included below but for detailed information on New York State's biological monitoring program, including collection and assessment methods, see Standard Operating Procedure: Biological Monitoring of Surface Waters in New York State SOP #208-16, available for download from DEC's website. Glossary available on page 6.

## Non-Impacted Category (BAP $\geq 7.5$ )

Metrics reflect very good water quality. The biological community is diverse, and virtually unaffected by human disturbance. Water quality should not be limiting to fish, shellfish, and wildlife propagation or survival. This level of water quality includes both pristine habitats and those receiving discharges which minimally alter the biota.

### Riffle Habitats:

- Species Richness is  $\geq 26$
- Hilsenhoff Biotic Index is  $\leq 4.5$
- EPT (Ephemeroptera, Plecoptera and Trichoptera) Richness is  $\geq 15$
- Percent Model Affinity is  $\geq 64$
- Nutrient Biotic Index is  $\leq 5.0$

### Multiplate Samples from Navigable Waters:

- Species Richness is  $\geq 21$
- Hilsenhoff Biotic Index is  $\leq 7.0$
- EPT (Ephemeroptera, Plecoptera and Trichoptera) Richness is  $\geq 5$
- Species Diversity is  $\geq 3.0$

### Multiplate Samples from Non-Navigable Waters

- Species Richness is  $\geq 26$
- Hilsenhoff Biotic Index is  $\leq 4.5$
- EPT (Ephemeroptera, Plecoptera and Trichoptera) Richness is  $\geq 10$
- Species Diversity is  $\geq 4.0$

### Low Gradient Streams:

- Species Richness is  $\geq 21$
- Hilsenhoff Biotic Index is  $\leq 5.5$
- EPT (Ephemeroptera, Plecoptera and Trichoptera) Richness is  $\geq 5$
- Non-Chironomidae and Oligochaeta Richness is  $\geq 10$

## Slightly-Impacted Category

Metrics reflect good water quality. The biological community is slightly, but significantly altered from the pristine state. Water quality is usually not limiting to fish, shellfish, and wildlife survival, but may be limiting to fish propagation, especially sensitive coldwater fish taxa.

### Riffle Habitats:

- Species Richness is 18 - 25
- Hilsenhoff Biotic Index is 4.4 - 6.5
- EPT (Ephemeroptera, Plecoptera and Trichoptera) Richness is 10 - 14
- Percent Model Affinity is 49 - 63
- Nutrient Biotic Index is 5.1 – 6.0

### Multiplate Samples from Navigable Waters:

- Species Richness is 16 - 20
- Hilsenhoff Biotic Index is 7.1 – 8.0
- EPT (Ephemeroptera, Plecoptera and Trichoptera) Richness is 3 - 4
- Species Diversity is 2.5 – 2.9

### Multiplate Samples from Non-Navigable Waters

- Species Richness is 18 - 25
- Hilsenhoff Biotic Index is 4.6 – 6.5
- EPT (Ephemeroptera, Plecoptera and Trichoptera) Richness is 5 - 9
- Species Diversity is 3.9 – 3.0

### Low Gradient Streams:

- Species Richness is 16 - 20
- Hilsenhoff Biotic Index is 5.6 – 7.0
- EPT (Ephemeroptera, Plecoptera and Trichoptera) Richness is 3 - 4
- Non-Chironomidae and Oligochaeta Richness is 5 - 9

## Moderately Impacted Category

Metrics reflect poor water quality. The biological community is altered to a large degree from the pristine state. Water quality often is limiting to fish, shellfish, and wildlife propagation, but usually not to survival.

### Riffle Habitats:

- Species Richness is 10 - 17
- Hilsenhoff Biotic Index is 6.4 – 8.5
- EPT (Ephemeroptera, Plecoptera and Trichoptera) Richness is 5 - 9
- Percent Model Affinity is 34 - 48
- Nutrient Biotic Index is 6.1 – 7.0

### Multiplate Samples from Navigable Waters:

- Species Richness is 11 - 15
- Hilsenhoff Biotic Index is 8.1 – 9.0
- EPT (Ephemeroptera, Plecoptera and Trichoptera) Richness is 1 - 3
- Species Diversity is 2.0 – 2.4

### Multiplate Samples from Non-Navigable Waters

- Species Richness is 10 - 17
- Hilsenhoff Biotic Index is 6.6 – 8.0
- EPT (Ephemeroptera, Plecoptera and Trichoptera) Richness is 1 - 4
- Species Diversity is 2.0 – 2.9

### Low Gradient Streams:

- Species Richness is 11 - 15
- Hilsenhoff Biotic Index is 7.1 – 8.5
- EPT (Ephemeroptera, Plecoptera and Trichoptera) Richness is 1 - 2
- Non-Chironomidae and Oligochaeta Richness is 1 - 4

## Severely Impacted Category

Metrics reflect very poor water quality. The biological community is limited to a few tolerant species. The dominant species are almost all tolerant. Often 1-2 species are very abundant. Water quality is often limiting to both fish, shellfish, and wildlife propagation and survival.

### Riffle Habitats:

- Species Richness is  $\leq 10$
- Hilsenhoff Biotic Index is  $\geq 8.5$
- EPT (Ephemeroptera, Plecoptera and Trichoptera) Richness is  $\leq 5$
- Percent Model Affinity is  $\leq 34$
- Nutrient Biotic Index is  $\geq 7.0$

### Multiplate Samples from Navigable Waters:

- Species Richness is  $\leq 11$
- Hilsenhoff Biotic Index is  $\geq 9.0$
- EPT (Ephemeroptera, Plecoptera and Trichoptera) Richness is  $\leq 1$
- Species Diversity is  $\leq 2.0$

### Multiplate Samples from Non-Navigable Waters

- Species Richness is  $\leq 10$
- Hilsenhoff Biotic Index is  $\geq 8.0$
- EPT (Ephemeroptera, Plecoptera and Trichoptera) Richness is  $\leq 1$
- Species Diversity is  $\leq 2.0$

### Low Gradient Streams:

- Species Richness is  $\leq 11$
- Hilsenhoff Biotic Index is  $\geq 8.5$
- EPT (Ephemeroptera, Plecoptera and Trichoptera) Richness is  $\leq 1$
- Non-Chironomidae and Oligochaeta Richness is  $\leq 1$

# Glossary

**Assessment:** Diagnosis or evaluation of water quality

**Biological Assessment Profile (BAP):** a multimetric index of biological integrity used in NYS to translate macroinvertebrate community data into numerical water quality score between 0 (poor) and 10 (very high).

**Hilsenhoff's Biotic Index:** A measure of the condition of a biological community representing the degree of environmental disturbance on that community. Biotic indices are often used to determine the impact of water pollution on aquatic life based on various characteristics of the community present.

**Community:** Group of populations of organisms interacting in a habitat

**Discharge:** Stream and river discharge is a measure of the volume of water passing a specific location over a specified unit of time. Discharge is therefore the product of stream velocity times stream depth times stream width.

**EPT richness:** Number of taxa of mayflies (Ephemeroptera), stoneflies (Plecoptera), and caddisflies (Trichoptera) in a sample or subsample

**Impact:** Change in the physical, chemical or biological condition of a waterbody

**Impairment:** Detrimental effect caused by an impact

**Index (pl. 'indices'):** Number, metric or parameter derived from sample data used as a measure of water quality

**Macroinvertebrate:** Larger-than-microscopic invertebrate animal that lives at least part of its life in aquatic habitats

**Metric:** an attribute of a biological community that is sensitive to changes in water quality

**Multiplate:** Multiple-plate sampler, a type of artificial substrate sampler of aquatic macroinvertebrates

**Non-Chironomidae and Oligochaeta:** number of taxa in the sample excluding those in the Chironomidae family and Oligochaeta subclass

**Nutrient Biotic Index:** A measure of the macroinvertebrate community response to phosphorus developed specifically for use in NYS streams and rivers.

**Organism:** Living individual

**Percent Model Affinity:** Is a measure of similarity to a model non-impacted benthic macroinvertebrate community based on percent abundance in 7 major groups. This measure is described in detail in Novak, M.A. and R.W. Bode. 1992. Percent model affinity, a new measure of macroinvertebrate community composition. J. North American Benthological Society 11(1):80-85.

**Pristine:** Condition with the same physical, chemical, and biological characteristics as found in habitats free of measurable effects of human activity.

**Riffle:** Wadeable stretch of stream, usually with a rubble bottom and sufficient current to break the water surface by the flow; rapids

**Species richness:** Number of macroinvertebrate taxa in a sample or subsample

**Species Diversity:** Shannon diversity index, a metric accounting for both abundance and evenness of species present

**Tolerant:** Ability to survive poor water quality