



Key EPA Internet-Based Tools for Watershed Management

In-Depth Level Course Tutorial

Section Seven: Biological Resources

Full document available at

<http://www.epa.gov/owow/watershed/wacademy/epatools/>

**Assessment and Watershed Protection Division
Office of Wetlands, Oceans and Watersheds
U.S. Environmental Protection Agency**

7. Biological Resources

Biological data are used to support waterbody biological assessments. As an indicator of water resource (stream or watershed) health, biological or ecological integrity is very often highly visible. A stream with surviving and reproducing aquatic organisms is an indication of pollution-free waters and a healthy aquatic ecosystem. Remember that biological communities often show a delayed response to pollutants or stressors due to bioaccumulation, and these organisms often provide a better measure of waterbody condition than a more rapidly changing water chemistry measurement or a toxicity test.

Those who work with biological data often rely on **biological indicators** to assess waterbody health and ecological conditions. Indicators might be actual groups or types of biological resources being monitored to come up with a measurement or an *index* of the ecological condition of the waterbody.

EPA offers Internet-available resources on using biological indicators to measure a waterbody's condition. If a **biological sampling and assessments** program is beginning and information on the use of **benthic macroinvertebrate communities** and **fish samples** to assess watershed health is needed, EPA can help.

7.1 Go to the [Biological Indicators for Watershed Health](#) page.

The screenshot shows the EPA website page for "Biological Indicators of Watershed Health". The left sidebar contains a navigation menu with the following items: "Biological Indicators of Watershed Health Home", "Biological Integrity Indicator Species", "Key Concepts" (indicated by a red arrow), "Publications", "Aquatic Biodiversity", "Statistical Primer", and "Coral Biocriteria". The main content area includes a search bar, a description of biological indicators, and a list of key indicator criteria. On the right, there are two boxes: "View special modules of this collection" and "EPA bioassessment Web sites".

7.2 Click [Key Concepts](#) on the left-hand sidebar.

The Key Concepts page has links to detailed information on setting up a step-by-step process to use biological data in water quality assessments. For example, the sampling effort must be designed first. Information regarding the ecoregion context, finding a biological metric that is appropriate to show water quality changes, and more is available.

- 7.3 Click [Statistical Primer](#) on the left-hand side. These links present an overview of working with data statistics.
- 7.4 For an overview of technical documentation determining the level of sampling necessary to answer specific questions, click [Statistical Power Analysis](#).
- 7.5 Click the browser's **Back** button until you see within the left-hand sidebar a link to [Biological Indicators of Watershed Health](#).
- 7.6 On the right-hand side within the top box, click [Photo Library](#). This contains high-quality photographs that you may use in publications and for government and not-for-profit Web sites.
- 7.7 Click [Invertebrates](#).
- 7.8 Click [Caddisflies](#).
- 7.9 Scroll to the bottom of the page and click the [caddisflies](#) link in the last paragraph.

On the right-hand side list, notice that caddisflies are categorized as a **moderately pollution tolerant** species.

What are two benthic macroinvertebrate species that might be found in a very high quality stream?

- 7.10 Click the **Back** button and then click [caddisfly families](#) in the same paragraph used in step 7.09.

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Biological Indicators of Watershed Health

Recent Additions | Contact Us | Print Version Search:

EPA Home > Biological Indicators of Watershed Health > Indicator Species > Invertebrates as Indicators > Caddisflies

Caddisfly Families

We are fortunate to have a set of Caddisfly family pages to assist with the identification of caddisflies. These pages were developed by Larry Abele of the New York State Department of Environmental Conservation, [Stream Biomonitoring Unit](#). Larry started his effort on caddisfly identification on the NYDEC Stream Biomonitoring Unit's Web site [Representatives of Caddisfly Families \(Trichoptera\)](#). He agreed to post his work here to ensure its use and to allow him to pursue additional efforts for the Stream Biomonitoring Unit. We look forward to seeing more of his photographs and outstanding efforts soon.

Anataniidae	Beraeidae	Brachycentridae	Calamoceratidae
Dipseudopsidae	Glossosomatidae	Goeridae	Helicopsychidae
Hydropsychidae	Hydroptilidae	Lepidostomatidae	Leptoceridae
Limnephilidae	Molannidae	Odontoceridae	Philopotamidae
Phryganeidae	Polycentropodidae	Psychomyiidae	Rhyacophillidae
Sericostomatidae	Uenoidae		

For more pictures, see our photo library on [caddisflies](#).

7.11 Click any caddisfly family link to learn more.

CADDIS

Not to be confused with the caddisfly, CADDIS is an online software application. It stands for Causal Analysis/Diagnosis Decision Information System.

Background on CADDIS

Thousands of waterbodies in the United States are listed by states as biologically impaired because there may have been fish kills or poor biological samples. For many of these, the cause of the impairment is also reported as *unknown*. Before an appropriate management action can be formulated, the *cause* of the biological impairment must be determined. The mechanisms, symptoms and stressor-response relationships for different stressors must be researched to analyze the causes. This information is then used to draw the appropriate conclusions.

CADDIS is designed to step you through that decision-making process to establish the sources and causes of adverse effects on the biological community using available watershed and stressor data and information.

7.12 Click the top left-hand sidebar on the link called [Biological Integrity](#).

7.13 Now scroll down to the bottom paragraph and click [Causal Analysis/Diagnosis Decision Information System](#).

A Web application is launched that takes the concepts in the book *Stressor Identification Guidance Document* (EPA 2000) and provides them in an interactive way using links and sequential steps.

- 7.14 Click the [Step-by-Step Guide](#).
- 7.15 Click the [Summary Tables of Types of Evidence](#) on the left-hand sidebar under step 5, or in the Quick Links at the bottom of the page.

If there are numerous sites or instances where data supports a conclusion of co-occurrence of stressor and adverse biological response, a case can be built that that stressor is a probable cause of an adverse biological response. The next step might be management actions to reduce the stressor in the waterbody. One of the types of data used to determine whether a stressor is a cause of the biological impairment is **Spatial/Temporal Co-occurrence** data.

- 7.16 Click [Spatial/Temporal Co-occurrence](#) in the first table.

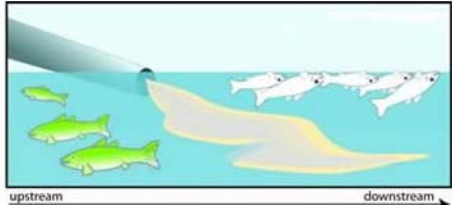
3.2.1. Spatial/Temporal Co-Occurrence

Links to Types of Evidence that Use Data from the Case
[Click to Expand/Collapse]

Back to Evaluate Data from the Case:
In-Depth Look

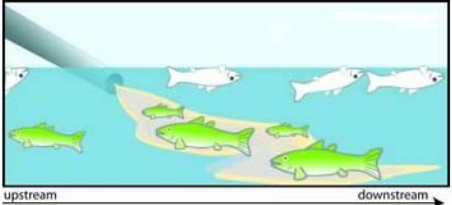
Concept

The biological effect must be observed where and when the cause is observed, and must not be observed where and when the cause is absent.



upstream → downstream

Figure 3-1a. Spatial/Temporal Co-occurrence with Upstream/Downstream Comparisons, Supports. The impairment (dead fish) occurs downstream of the source of the causal agent (effluent) but not upstream.
([General explanation of symbols](#))



upstream → downstream

Figure 3-1b. Spatial/Temporal Co-occurrence with Upstream/Downstream Comparisons, Refutes. The impairment (dead fish) occurs both upstream and downstream of the source of the causal agent (effluent).

The biological effect must be observed where and when the cause is observed and must not be observed where and when the cause is absent.

The picture on the left shows fish kills when there is effluent from a pipe coming into the stream – supports. The picture on the right shows fish kills even upstream of the pipe effluent coming into the stream – does not support.

- 7.17 Click [Additional illustrations](#).

Write down one case where data on a particular stressor will not support the spatial/temporal co-occurrence concept:

7.18 Close the popup window.

Notice that there are examples and example analyses to show how this concept is applied. The example here is from Little Scioto River, Ohio.

7.19 Scroll down the page and click the [Little Scioto River, OH, USA](#) example analysis worksheet. Notice that sediment is one of the candidate causes.

7.20 Scroll down to the bottom of the page.

Does the data support the case that sediment could be a candidate cause of the biological impairment? _____