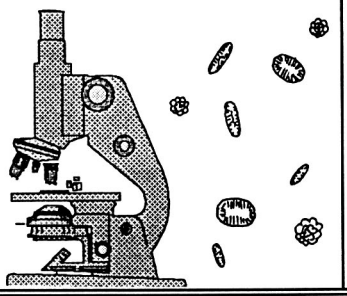
Environmental Indicator Profile Sheet



Indicator Profile No. 16

Other Biological Indicators

Biological Indicators

Tools Used to Measure Indicator:

- Phytoplankton Indices
- Zooplankton Indices
- Diatoms community measurments
- Periphyton Indices

Description:

There are several additional biological monitoring methods that have been used to assess water quality. Examples of some of these include surveys of: plankton (phytoplankton, zoophankton, periphyton, diatoms) Bryozoans, algal microfossils, amphibians and bacteria. Some of these are more commonly used than others and some have been used for direct assessment of urban stormwater runoff while others are for different water quality evaluations (such as wastewater effluent monitoring, water treatment plant monitoring, CSOs, etc.). This profile is targeted primarily at the utility of plankton surveys as a biological indicator. Bryozoans are technically considered macro-invertebrates, algal microfossils are part of sediments and bacteria are addressed separately under the Human Health Criteria indicator profile.

Utility of Indicator to Assess Stormwater Impacts:

- Plankton can be used to assess water quality through changes in community structure, patterns of distribution and relative proportions of sensitive and insensitive species.
- Plankton can be used to evaluate thermal pollution, presence of toxic pollutants, nutrients and excessive sedimentation.

Advantages of Method:

- Valuable as a continuous monitoring tool because the nature of the cell structure allows for continuous integration of stresses that effect growth and reproduction. Good for assessing short term impacts.
- Phytoplankton (free floating algae) have distinct species which flourish in eutrophic conditions and distinct species which are indicitive of clean water. This is particularily useful in estuaries and freshwater lakes.
- Periphyton (attached forms of algae) are traditionally used in lotic systems as an indicator of water quality.
- Diatoms and other single-celled microscopic plants provide a quantifiable measure of water quality degradation over a wide geographic area.

Indicator Useful for Assessing:

* Aquatic Integrity of:	
Lakes	●
Streams	◖
Estuaries	●
* Land Use Impacts	◖
* Stormwater Mgmt Programs	◖
* Whole Watershed Quality	○
* Industrial Sites	◖
* Municipal Programs	◖

Key:	
Very Useful	●
Mod. Useful	◖
Not Useful	○

Indicator Advantages

* Geographic Range	●
* Baseline Control	◖
* Reliable	○
* Accuracy	◖
* Low cost	◖
* Repeatable	●
* All Watershed Scale	◖
* Familiar to Practitioners	○
* Easy to use & Low training	○

Key	
Very Advantageous	●
Mod. Advantageous	◖
Not Advantageous	○

Cost

See Table 3.3C

Disadvantages of Method:

- May have limitations due to transient nature and variable distribution of species, and the influence of large storm events (washout).
- Requires fairly sophisicated sampling and laboratory work to quantify analysis and report results. Some methods and indices may over-simplify the ecological conditions by evaluating only species composition rather than community structure and dynamics.
- Short lifespans of organisms are not particularly suited for long term monitoring studies.
- Indicator populations are often highly seasonal in nature.
- Few stormwater managers have training or experience in interpreting sample data.

Case Study: Morgan, M.D., 1987

Impact of Nutrient Enrichment and Alkalinization on Periphyton Communities in the New Jersey Pine Barrens.

Hydrobiologia, Vol. 144, No. 3, p 233-241

Periphyton was used to evaluate impacts associated with urban residential and agricultural land uses in the New Jersey Pine Barrens. Communities of periphyton in three developed streams were compared with those of three undeveloped streams. 53 periphyton species were encountered in a sampling period of one year. Species richness was significantly greater in the disturbed streams. Species composition also varied between the two conditions. Elevated pH and nitrates in the disturbed conditions contributed to the effects of species composition.

Method References:

- Phytoplankton and Zooplankton: Gast, H.F.; R.E.M. Suykerbuyk, R.M.M. Roijackers, 1990. Urban Storm Water Discharges: Effects Upon Plankton Communities., In: *Water Science Tech.*, Vol. 22, No. 10/11, pp. 155-162.

- Diatoms: Maples, R.S., 1987. Diatoms as Indicators of Water Quality in Three Bayous of the Calcasieu River/Lake Complex., In: *Ecosystem Analysis of the Calcasieu River/Lake Complex*. Report No. DOE/EP/31111-1 Vol. 2.

- Periphyton: Falter, C.M.; J. Kann, M. Beckwith, 1988. Attached Benthic Algae (periphyton) in the littoral of Lake Pend Oreille, Idaho. *8th Annual International Symposium on Lake and Watershed Management, 1988.*