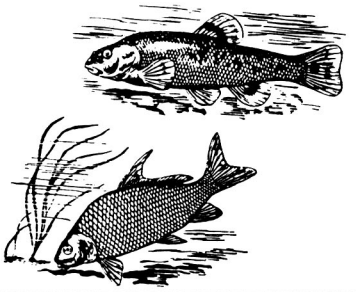
Environmental Indicator Profile Sheet



Indicator Profile No. 12

Fish Assemblage Analyses

Category: **Biological**

Tools Used to Measure Indicator:

- Index. of Biotic Integ., (IBI)
- Index. of Well Being, (I_{WB})
- Rapid Bio. Assess., (RBP)
- Species Extinct./Reduction.
- Presence of fish with disease, tumors, fin damage, etc.

Description:

Fish diversity, species richness, species pollutant tolerance, disease prevalence, and other metrics are used to evaluate the aquatic health of waterbodies as compared to a regional reference condition. This indicator, used by state and local governments, volunteer monitoring groups, and environmental organizations for measuring in-stream water resource quality, is widely regarded as one of the more reliable methods for assessing human-caused ecological impacts.

Fish are collected (usually by electrofishing or seining) and a biosurvey of the resident fish community is conducted. Stations for collection must be representative of the entire reach system in terms of habitat. Wherever possible, multiple habitats (i.e., riffle, run and pool) are sampled for each site.

Fish pathology, indicated by the presence of tumors, fin damage, parasite infestations, and discoloration, among other anomalies is also used in the designation of water body health.

Utility of Indicator to Assess Stormwater Impacts:

- Can characterize the existence and severity of degradation and help identify causes and sources of degradation.
- Can be used to evaluate the effectiveness of restoration programs and help prioritize sites for future evaluation.
- Can be used to help evaluate the effectiveness of BMP controls (both structural and non-structural).
- Can be used on both a regional and local level.
- Can help identify barriers to fish migration.
- Can be used to mobilize public support when popular species are impacted.

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

Advantages of Method:

- Because of a longer lifespan (3 to 4 years), fish exposed to years of impacts, provide a good assessment of long-term impacts.
- The fish assemblage represents a broad range of trophic levels and may be strongly influenced by lower trophic levels (i.e., algae, macroinvertebrates, etc.). Therefore, the fish assemblage provides an integrated view of the entire environmental system.
- Fish are relatively easy to collect and identify. The environmental requirements and life history of fish are fairly well documented.
- The general public is familiar with fishing for sport and food.
- Waterbody aquatic life uses are depicted in terms of fish.

Disadvantages of Method:

- Careful regional analysis is required to ensure that metrics and data are representative of ecoregion. This can require substantial calibration of metrics prior to application monitoring.
- Seasonal changes in fish populations and distribution are natural occurrences. Therefore, multiple sampling sessions are required to obtain representative results.
- Data collected after major flow events may not be representative of normal conditions.
- The relative health of a selected reference condition can skew the results of the system being evaluated.
- Monitoring must account for stream size and order as a factor in natural biological diversity and species density. Fish that spawn elsewhere may be impacted by degraded spawning grounds. Reduced richness in the study area may not be a true indicator of its water quality conditions.
- Lack of fish diversity can be due to confounding problems (poor habitat, low flow, channelization, fish barriers, fishing pressures, etc.), making impact source identification difficult.

Case Study: Schueler,T.R. 1994
The Importance of Imperviousness
Watershed Protection Techniques, Vol.1, No. 3 Fall 1994

Four streams in the Maryland Piedmont were monitored to identify the number of fish and number of sensitive fish present as related to watershed imperviousness. As the level of imperviousness increased the total number of fish species present decreased. For a watershed of less than 10% imperviousness, a total of 12 species were present (7 of which were sensitive). At a percent impervious between 10 and 12, two sensitive species (brown trout and sculpin) were no longer present. As the percent imperviousness rose to above 25, four more species were no longer identified. At 55% imperviousness only two, pollutant tolerant species existed.

This relatively simple study shows that as the intensity of development increases (as measured in terms of impervious area, the total number of fish species decreases. Those fish species which are the most sensitive are adversely affected in watersheds of relatively low impervious area.

Method References:

- Index of Biotic Integrity (IBI): Karr, J.R.; K.D. Fausch, P.L. Angermeier, P.R. Yant, and I.J. Schlosser., 1986. Assessing Biological Integrity in Running Waters: A Method and Its Rationale. *Special Publication 5. Illinois Natural History Survey*

- Index of Well Being (I_{wb}): Gammon, J.R. 1980. The use of community parameters derived for electrofishing catches of river fish as indicators of environmental quality,. In: *Seminar on Water Quality Management Tradeoffs.* Report No. EPA-905/9-80-009. U.S. EPA, Washington, D.C.

- Rapid Bioassessment Protocols (RBP): Plafkin, J.L.; M.T. Barbour, K.D. Porter, S.K. Gross, R.M. Hughes., 1989. *Rapid Bioassessment Protocols for use in Streams and Rivers Benthic Macroinvertebrates and Fish.* Report No. EPA/440/4-89/001. U.S. EPA, Office of Water

- Extinction/Reduction in Species: Klein, R.D. 1979. Urbanization and Stream Quality Impairment., In: *Water Resources Bulletin.* Vol. 15, No. 4, pp 948-963