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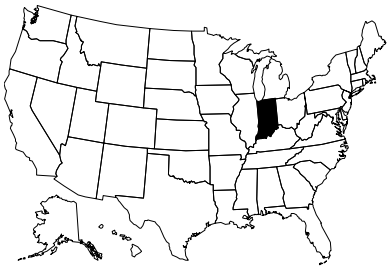

Contact Information

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Program Description

The Biological Studies Section (BSS) of IDEM's Office of Water Quality conducts studies of fish and macroinvertebrate communities, as well as stream habitats. These data are used to help develop biological criteria to which all other streams can be compared in order to identify impaired streams or watersheds. BSS also conducts fish tissue and sediment sampling to monitor sources of toxic and bioconcentrating substances too low to be detected in other environmental media. Fish tissue data serve as the basis for fish consumption advisories issued to protect the health of people who consume fish caught in Indiana waters. Fish tissue data are also useful for wildlife health risk assessments for fish-eating birds and mammals, and for providing the information needed to develop models for assessing changes in the quality of Indiana ecosystems.

The BSS is responsible for determining the biological integrity of aquatic communities of Indiana streams and lakes. This is accomplished through a variety of field and laboratory studies that involve several different forms of aquatic life. These data are used to determine compliance with the existing narrative biological criteria in Indiana's current water quality standards, to determine the use attainability, and to make correlations to physical and/or chemical impairments which may exist.

The BSS participates in the review of requests for site-specific water quality criteria for waters influenced by NPDES discharges. In the course of its various monitoring and assessment field activities, the staff finds point and nonpoint source-related problems, which are then referred to the appropriate IDEM programs. The Section also cooperates in the monitoring and assessment of the Ohio River in conjunction with the Ohio River Valley Water Sanitation Commission (ORSANCO), and other state and federal agencies.

Lake and reservoir assessments prior to 1989 were conducted by the State and have since been contracted to Indiana University, School of Public and Environmental Affairs. From 1990 through 1995, the State in conjunction with USEPA - Region 5, conducted a statewide ecoregion-based fish community study. Indiana has historically collected macroinvertebrate community samples at a network of fixed stations. In addition the State has been conducting macroinvertebrate community assessments at wadeable stream sites since 1990. Since 1996 the biological assessments for fish and invertebrate community assessments have been conducted using probabilistic sampling on a rotational watershed basis as per Indiana's *Surface Water Quality Monitoring Strategy*. In 2000 the State participated in a study to determine if fish and macroinvertebrate indices could be developed for lakes and reservoirs. Conclusions are still pending.

Documentation and Further Information

Indiana 2001 - 2005 Surface Water Quality Monitoring Strategy:
http://www.in.gov/idem/water/assessbr/016surfwaterqualmonstrat.pdf

Indiana 303(d) List of Impaired Waterbodies, information and links:
http://www.in.gov/idem/water/planbr/wqs/303d.html

Indiana Water Quality 305(b) Report, general information: http://www.IN.gov/idem/water/planbr/wqs/quality.html

Indiana Water Quality Standards: http://www.state.in.us/legislative/iac/title327.html

IDEM Office of Water Quality's Assessment Branch - Biological Studies Section homepage, with numerous links to relevant fact sheets and reports: http://www.in.gov/idem/water/assessbr/biostud/index.html

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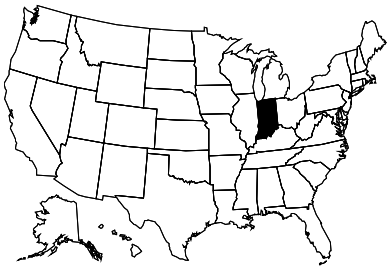

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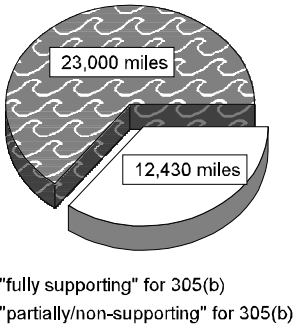
Programmatic Elements

Uses of bioassessment within overall water quality program	✓	problem identification (screening)
	✓	nonpoint source assessments
	✓	monitoring the effectiveness of BMPs
	✓	ALU determinations/ambient monitoring
	UD	promulgated into state water quality standards as biocriteria
	✓	support of antidegradation
	✓	evaluation of discharge permit conditions
	✓	TMDL assessment and monitoring
		other:
Applicable monitoring designs	✓	targeted (i.e., sites selected for specific purpose) *(specific river basins or watersheds and comprehensive use throughout jurisdiction)*
	✓	fixed station (i.e., water quality monitoring stations) *(specific river basins or watersheds and comprehensive use throughout jurisdiction)*
	✓	probabilistic by stream order/catchment area *(specific river basins or watersheds and comprehensive use throughout jurisdiction)*
	✓	probabilistic by ecoregion, or statewide *(specific river basins or watersheds and comprehensive use throughout jurisdiction)*
	✓	rotating basin *(specific river basins or watersheds and comprehensive use throughout jurisdiction)*
		other:

Stream Miles

Total miles *(determined using RF3 and the National Hydrography Database)*	**35,673**
Total perennial miles	21,094
Total miles assessed for biology	**35,430**
fully supporting for 305(b)	23,000
partially/non-supporting for 305(b)	12,430
listed for 303(d)	unknown
number of sites sampled *(on an annual basis)*	< 200
number of miles assessed per site	site specific

35,430 Miles Assessed for Biology



Aquatic Life Use (ALU) Designations and Decision-Making

ALU designation basis	Warm Water vs. Cold Water	
ALU designations in state water quality standards	Two designations: Well balanced warmwater aquatic community and Cold water put-and-take trout waters	
Narrative Biocriteria in WQS	under development - The narrative biocriteria in Indiana have only been proposed and are not formal. They are loosely defined by 327 IAC 2-1-3(a)(2), 327 IAC-2-1-9 (49); and for the Great Lakes waters 327 IAC 2-1.5-5(a)(2) and (3), and 327 IAC 2-1.5-2 (92). IDEM uses informal numeric procedures to support narrative biocriteria (see http://www.in.gov/IDEM/water/planbr/wqs/quality.html).	
Numeric Biocriteria in WQS	none	
Uses of bioassessment data in integrated assessments with other environmental data (e.g., toxicity testing and chemical specific criteria)	✓	assessment of aquatic resources
	✓	cause and effect determinations
		permitted discharges
	✓	monitoring (e.g., improvements after mitigation)
	✓	watershed based management
Uses of bioassessment/ biocriteria in making management decisions regarding restoration of aquatic resources to a designated ALU	Biological assessment data are used for 305(b)/303(d) purposes and was used for the FY 2000 Unified Watershed Assessment (updated 2001), which was used for the Watershed Restoration Action Strategies.	

Reference Site/Condition Development*

Number of reference sites	**unknown**	
Reference site determinations		site-specific
		paired watersheds
	✓	regional (aggregate of sites)
	✓	professional judgment
		other:
Reference site criteria	Deviation from central tendencies on multimetric indices and the qualitative habitat evaluation index (QHEI) is also taken into consideration when evaluating impairment. Field chemistry is measured and probabilistic sites are sampled for broad chemical analysis.	
Characterization of reference sites within a regional context	✓	historical conditions**
	✓	least disturbed sites
	✓	gradient response
		professional judgment
	✓	other: IBI is calibrated on drainage area for headwater streams, wadeable rivers, large rivers and great rivers
Stream stratification within regional reference conditions	✓	ecoregions (or some aggregate)
		elevation
		stream type
	✓	multivariate grouping
		jurisdictional (i.e., statewide)
	✓	other: 8 digit USGS Hydrologic Unit Codes
Additional information	✓	reference sites linked to ALU *(in a statistical sense)*
		reference sites/condition referenced in water quality standards
	✓	some reference sites represent acceptable human-induced conditions *(it is understood that all sites have a human-induced condition)*

*IDEM uses a non-typical process for developing reference condition: reference condition is represented by a percentage of the total population of the sites sampled. The number of reference sites in Indiana is not available at this time.

**Reference condition is defined by a historical cross-section of sample sites representing the full gradient of ecological conditions as they existed during statewide or ecoregion specific investigation.

Field and Lab Methods

Assemblages assessed	✓	benthos *(<100 samples/year; single season, multiple sites - broad coverage)*
	✓	fish *(<100 samples/year; single season, multiple sites - broad coverage)*
	✓	periphyton *(<100 samples/year; solely through a pilot contract with USGS)*
	✓	other: phytoplankton and zooplankton *(<100 samples/year; single observation, limited sampling)*
Benthos		
sampling gear		multiplate, dipnet, and kick net (1 meter); 243-600 micron mesh
habitat selection		riffle/run (cobble) and artificial substrate in the absence of riffle/run
subsample size		100 count and proportional/volume
taxonomy		family
Fish		
sampling gear		backpack, boat, longline and pram unit (tote barge) electrofishers; and 1/8" mesh seine
habitat selection		multihabitat
sample processing		enumeration, length measurement, biomass - batch, and anomalies
subsample		none
taxonomy		species
Habitat assessments		visual based; performed with bioassessments
Quality assurance program elements		standard operating procedures, quality assurance plan, periodic meetings and training for biologists, sorting and taxonomic proficiency checks, specimen archival

Data Analysis and Interpretation

Data analysis tools and methods	✓	summary tables, illustrative graphs
	✓	parametric ANOVAs
	✓	multivariate analysis
	✓	biological metrics *(aggregate metrics into an index)*
	✓	disturbance gradients
		other:
Multimetric thresholds		
transforming metrics into unitless scores		cumulative distribution function
defining impairment in a multimetric index		cumulative distribution function and use various break points for impairments
Multivariate thresholds		
defining impairment in a multivariate index		significant departure from mean of reference population
Evaluation of performance characteristics	✓	repeat sampling *(watersheds are sampled on 5 yr rotational basis)*
	✓	precision *(Standard Error, 95% Confidence Interval and Relative Percent Difference)*
		sensitivity
		bias
	✓	accuracy *(10% field duplicates, 10% laboratory duplicates)*
Biological data		
Storage		Assessment Information Management System (AIMS), MS Access based utility, and some historical data still in paper files
Retrieval and analysis		Statistica and MINITAB for cluster analysis of large matrices