

# Metric Refinement

In an effort to ensure sensitivity to common urban and agricultural stressors, the Northern Fish IBI metrics were re-evaluated using data from Round 1 (2000-2004). Metric refinements led to changes in scoring criteria, species lists, and the selection of a replacement metric (Table 1). Metric recalibration analysis mirrored those techniques used by Ohio EPA and Maryland Department of Natural Resources (Emery et al. 2003; Rankin and Yoder 1999; Roth et al. 2000). Each metric was examined individually to ensure sensitivity to urban and agricultural land uses, statistically significant separation between least impaired and most impaired sites, adequate scoring distribution, and correlation with habitat scoring. Linear regression models were used to assess drainage correlation and the need for scoring modification.

**Table 1. Refined Fish IBI Metrics.**

Metric	Recalibration Results
1. Total Number of Fish Species	Revised Maximum Species Richness Scoring Lines
2. Number of Benthic Insectivorous Species	Eliminated white sucker & bullheads
3. Number of Trout and/or Sunfish Species	Eliminated green sunfish & bluegill
4. Number of Intolerant Species	No refinement needed
5. Proportion of Tolerant Individuals	Replacement metric for Proportion White Suckers
6. Proportion of Generalists	Revised species list
7. Proportion of Insectivorous Cyprinids	No refinement necessary
8. Proportion of Piscivores	Removed size limits
8. Proportion of Trout	No refinement necessary
9. Number of Individuals in Sample	Removed Tolerant Species
10. Proportion of DELT Anomalies	No refinement at this time

Using surrounding watershed land use/land cover and site habitat scores from Round 1, a subset of sites were divided into least impaired and most impaired. The following criteria were used to classify sites: least impaired < 35% combined urban/agricultural land use and habitat score  $\geq$  160; most impaired > 65% urban land use. A total of 32 sites (17 least impaired; 15 most impaired) were analyzed using analysis of covariance (ANCOVA) and Mann-Whitney nonparametric U-test (Table 2).

In addition, each metric was analyzed for classification efficiency to ensure minimal overlap between least impaired and most impaired sites (Table 2). The classification efficiency was calculated as the proportion of least impaired sites with individual metric scores greater than or equal to 3 and the proportion of most impaired sites with individual metric scores less than 3

(Roth et al. 2000). Metric classification efficiencies ranged from 59 to 91 percent for Round 1 data and 54 to 90 percent using an independent dataset from USEPA. The mean classification efficiency for refined metrics was 66 percent compared to the 56 percent efficiency using previous metrics.

**Table 2. Results of metric analysis and classification efficiency for impaired vs. non-impaired sites.**

<b>Fish IBI Metrics</b>	<b>ANCOVA (<i>p</i>-value)</b>	<b>Mann-Whitney (<i>p</i>-value)</b>	<b>Round 1 Classification Efficiency (%)</b>	<b>Independent Data Classification Efficiency (%)</b>
<b>Species Richness &amp; Composition</b>				
1. Number of Species	0.042	--	59%	73%
2. Number of Benthic Insectivorous Species	<0.001	--	69%	78%
3. Number of Trout and/or Sunfish Species	0.036	--	59%	54%
4. Number of Intolerant Species	<0.001	--	91%	90%
5. Proportion of Tolerant Species	--	0.021	75%	73%
<b>Trophic Composition</b>				
6. Proportion of Generalists	--	<0.001	75%	70%
7. Proportion of Insectivorous Cyprinids	--	0.004	72%	73%
8. OR	--	0.007	63%	76%
Proportion of Piscivores	--	0.61		
<b>Fish Abundance &amp; Condition</b>				
9. Number of Fish	--	0.14	59%	66%
10. Proportion of Fish with anomalies	N/A	N/A	N/A	N/A