

New Jersey Fish Index of Biotic Integrity



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What is a Fish Index of Biotic Integrity?



- Using fish assemblages to assess the overall health of a stream ecosystem
- A scoring system based on multiple attributes (metrics) of a fish assemblage
- Individual metrics are summed and overall score used to determine health of a water body
- Metrics selected based on how well they indicate anthropogenic stressors

Why Use Fish as Biological Monitors?



- Fish are long-lived and are therefore good indicators of long-term disturbances
- Fish assemblages generally consist of a number of trophic levels
- Fish are at the top of the food chain in aquatic environments and are consumed by humans
- Fish are easy to collect and identify
- Fish account for nearly half the endangered vertebrates of the U.S.

Validity of the Index of Biotic Integrity

Karr et al. 1986

Criterion 1. *The measure must be biological.*

Criterion 2. *The measure must be interpretable at several trophic levels or provide a connection to other organisms not directly involved in the monitoring.*

Criterion 3. *The measure must be sensitive to the environmental conditions being monitored.*

Criterion 4. *The response range of the measure must be suitable for the intended application.*

Criterion 5. *The measure must be reproducible and precise within defined and acceptable limits for data collected over space and time.*

Criterion 6. *Variability of the measure must be low.*

Methods

Backpack Electrofishing



Barge Electrofishing



North vs. South



Northern Streams

- High gradient
- Cobble/boulder
- Riffle/run/pool
- More diverse

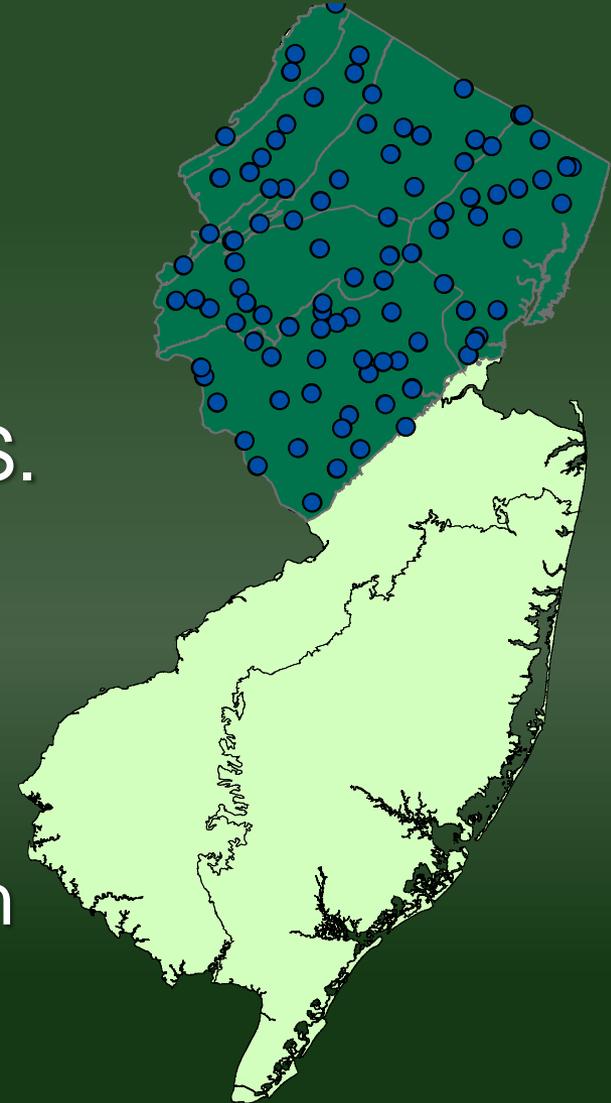
Southern Streams

- Low gradient
- Sand/gravel
- Run/pool
- Lower diversity

Northern Fish IBI



- Northern Fish IBI developed by U.S. EPA Region 2
- BFBM initiated monitoring in 2000
- 98 site network consisting of fixed, random, sentinel sites
- 26-32 sites per year, 5 year rotation
- Index period – June through Mid-October
- Currently in 3rd round of monitoring



Northern Fish IBI Metrics

SPECIES RICHNESS AND COMPOSITION

1. Species Richness
2. Number Benthic Insectivorous Species
3. Number Trout/Sunfish Species
4. Number Intolerant Species
5. Proportion of Tolerant Species

TROPHIC COMPOSITION

6. Proportion of Generalist Species
7. Proportion of Insectivorous Cyprinids
8. Proportion of Trout or Piscivores

FISH ABUNDANCE AND CONDITION

9. Total Abundance
10. Proportion of DELT Anomalies

Healthy Fish Community



Brook Trout



Smallmouth Bass



Swallowtail Shiner



Fallfish



Margined Madtom



Cutlips Minnow



Slimy Sculpin

Impaired Fish Community



Mummichog



Banded Killifish



Green Sunfish

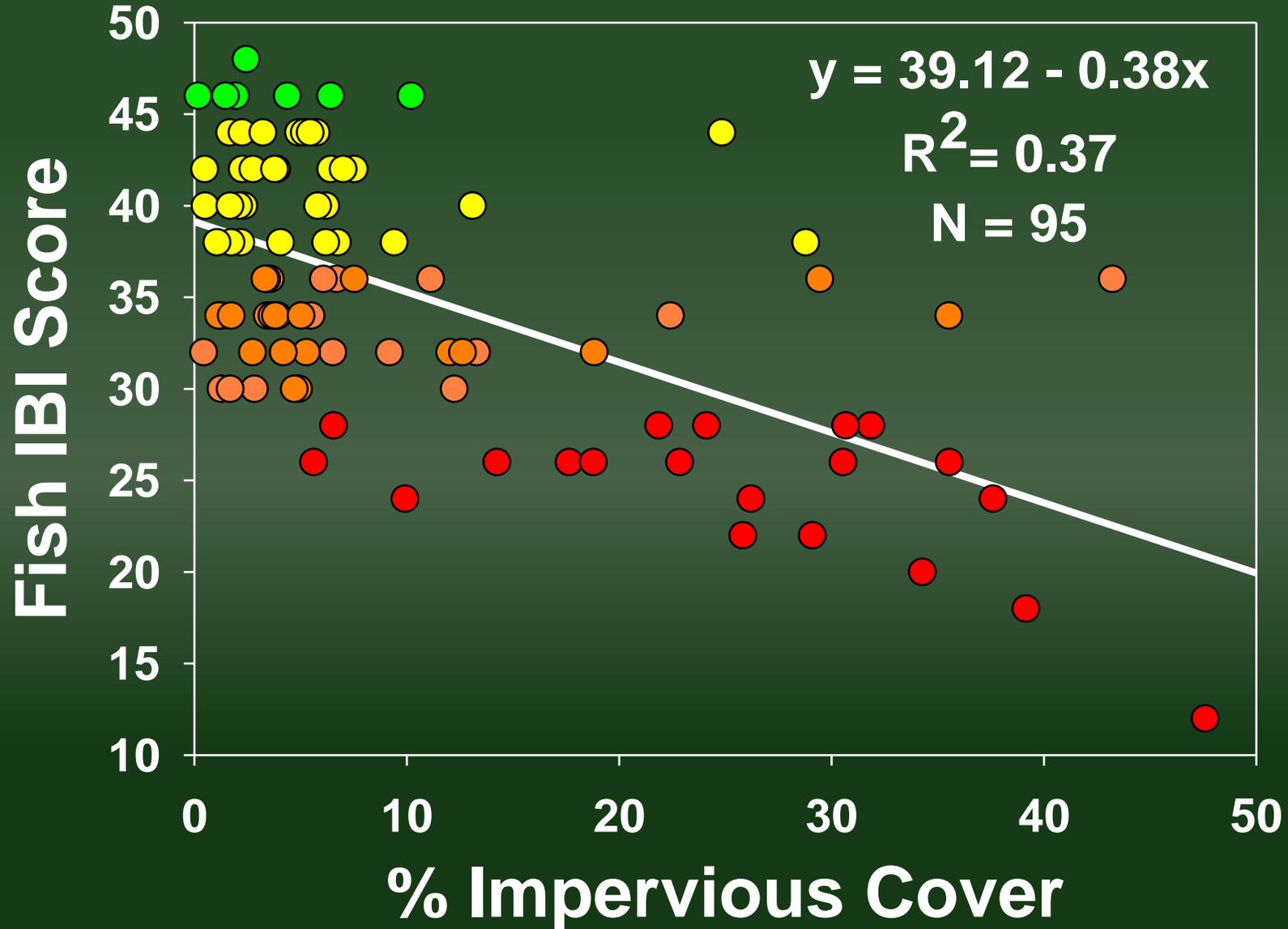


White Sucker



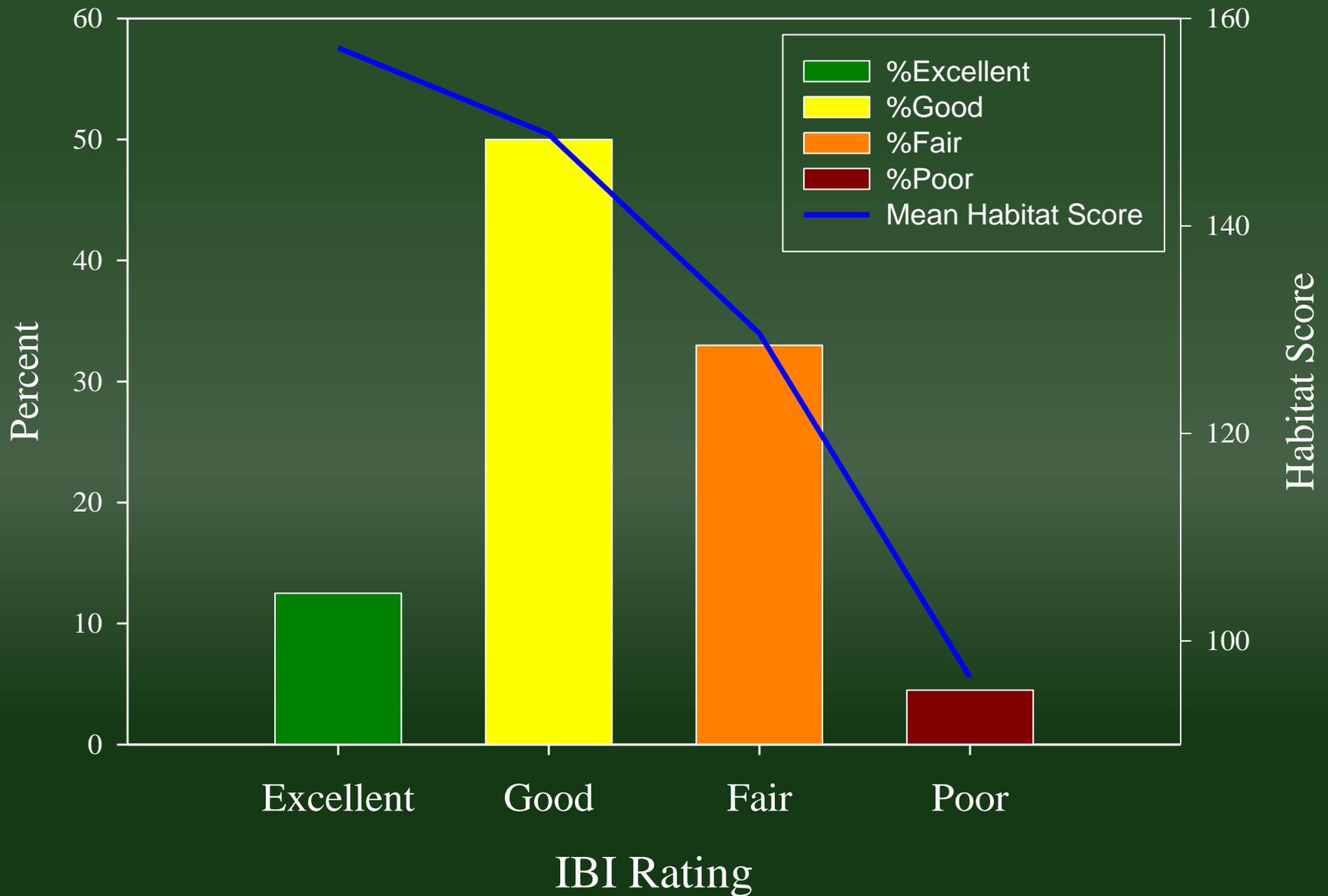
Common Carp

Northern Fish IBI Round 2 Results

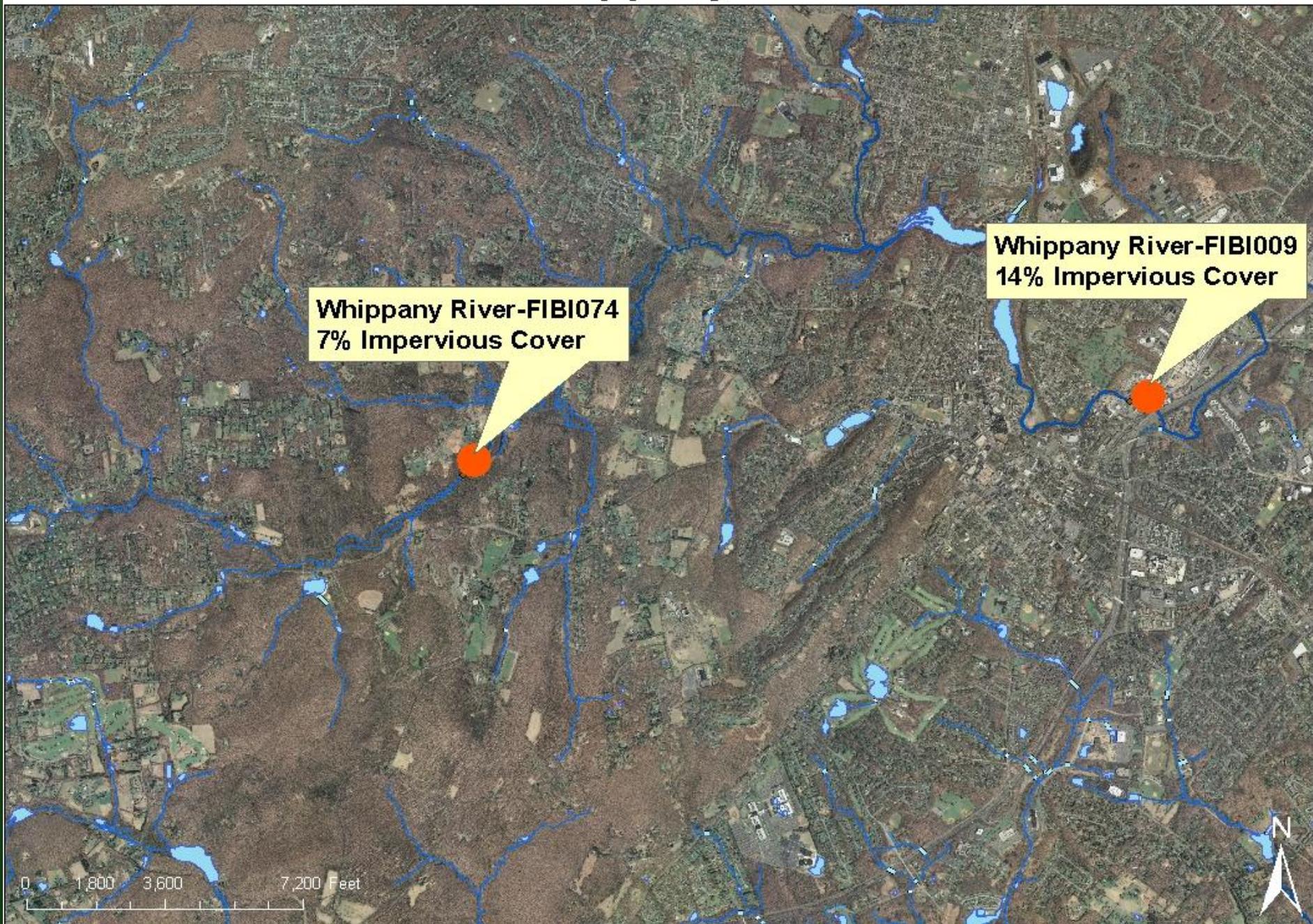


2011/2012 Fish IBI Results

N = 48



Whippany River



Northern IBI Case Study

FIBI074 Whippany River

- 63% Forest/Wetland
- 33% Urban
- 7% Impervious Cover
- 8.4 Miles² Drainage
- Habitat score = 153
- IBI score = 42 Good



Results

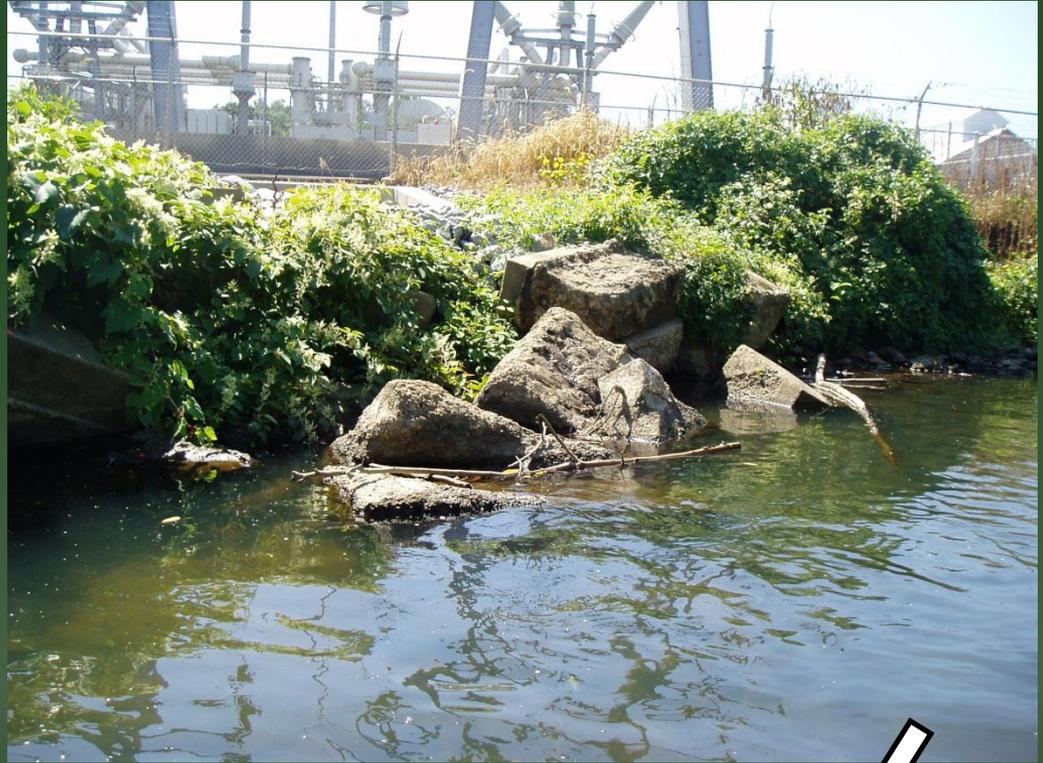
- 14 Species
- 3 Benthic Insectivore Species
- 3 Intolerant Species
- 7% Tolerant Species
- Wild Brown Trout incl. YOY
- Abundant American Brook Lamprey



Northern IBI Case Study

FIBI009 Whippany River

- 48% Forest/Wetland
- 48% Urban
- 14% Impervious Cover
- 28.1 Miles² Drainage
- Habitat score = 127
- IBI score = 26 Poor

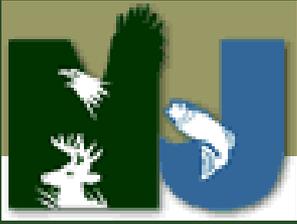


Results

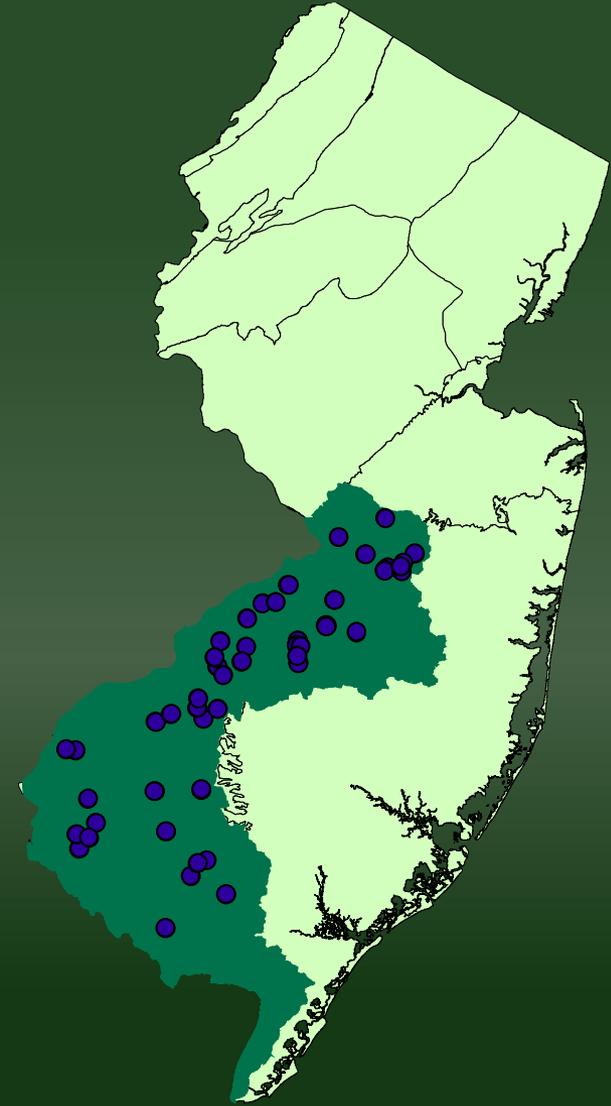
- 10 Species
- 1 Benthic Insectivore Species
- 0 Intolerant Species
- 29% Tolerant Species
- No Trout or American Brook Lamprey



Southern Fish IBI



- Pilot project to develop a fish IBI started by NJ Fish & Wildlife in 2000
- BFBM initiated redevelopment in 2008
- Scoring criteria and validation finalized spring 2012
- 43 site network consisting of fixed, random, sentinel sites



Southern IBI Metrics

Richness & Composition

1. Native Species Richness
2. Benthic Species Richness
3. Intolerant Species Richness
4. Proportional Abundance Tolerant Species

Trophic Composition

5. Proportional Abundance Insectivores
6. Proportional Abundance Piscivores

Fish Abundance & Condition

7. Abundance minus Tolerant Species
8. DELT Anomalies

Healthy Fish Community



Southern IBI Development



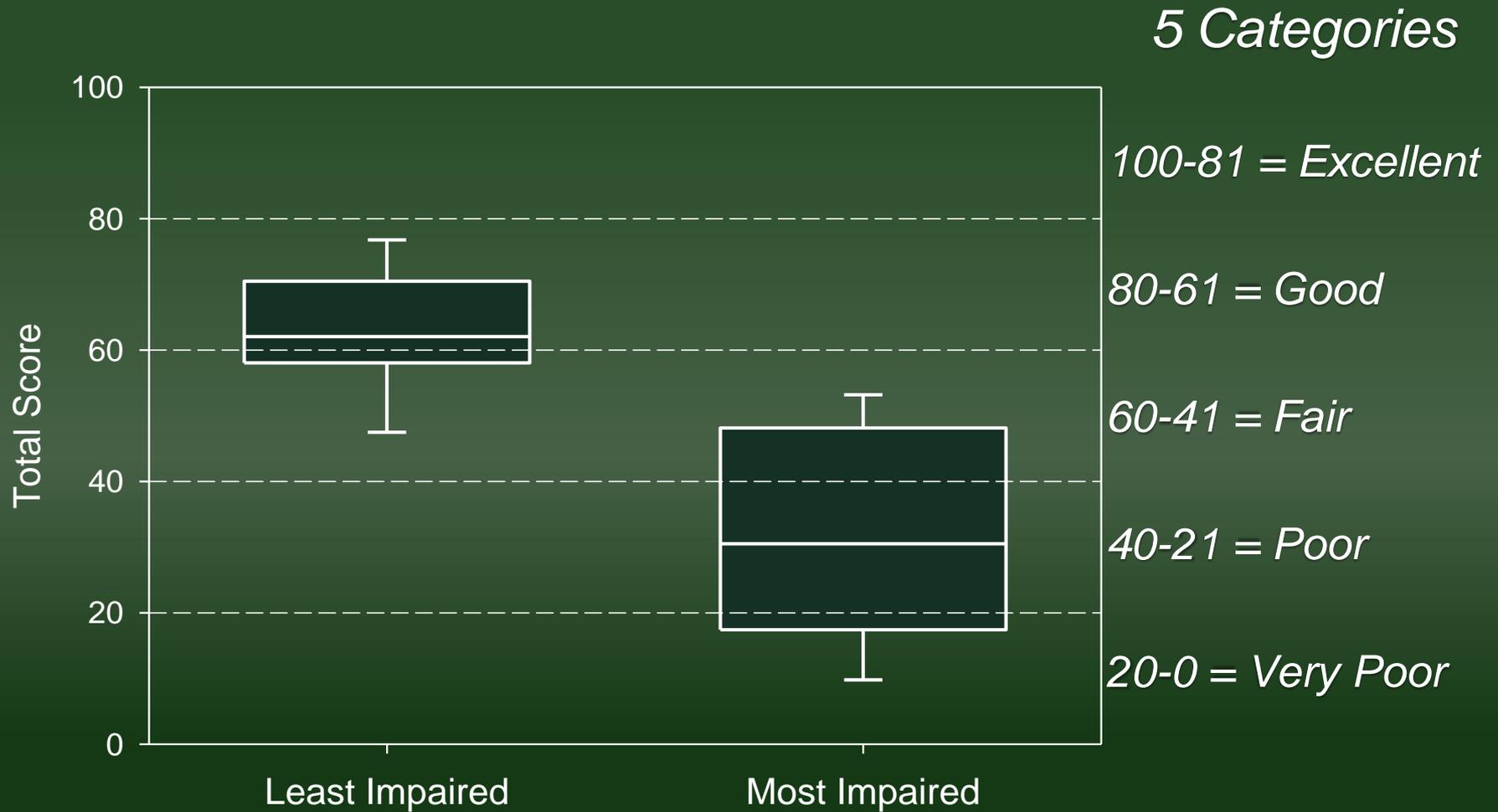
- Used Maryland, Virginia, North Carolina, South Carolina, and Georgia Programs as models for developing NJ Inner Coastal Plain Fish IBI
- All of these states have similar fish species to NJ
- Maryland has an established Coastal Plain Fish IBI and has completed recalibration
- Results present to MD DNR, EPA Regions 2 and 3, Versar Inc, and NJ Fish IBI Workgroup

Steps



- Researched historical fish distributions within Inner Coastal Plain
- Identified and sampled “least impacted” and “most impacted” sites within Inner Coastal Plain
- Researched applicability of Coastal Plain Fish IBI’s from other states
- Used Maryland DNR Coastal Plain Fish IBI as a template for data analysis and metric development
- Tested Coastal Plain metrics, Northern NJ IBI metrics, and Karr’s original fish metrics

Rating Categories



Southern IBI Case Study

FIBI213 Ivanhoe Brook

- 66% Forest/Wetland
- 13% Urban
- 3.5% Impervious Cover
- 3.6 Miles² Drainage
- Habitat score = 134
- IBI score = 77 Good

Results

- 14 Native Species
- 4 Benthic Species
- 2 Intolerant Species
- 20% Tolerant Species
- 51% Insectivore Species
- 4% Top Predator Species
- 132 Fish
- 0% External Deformities



Southern IBI Case Study

FIBI201 NB Pennsauken Creek

- 31% Forest/Wetland
- 60% Urban
- 19% Impervious Cover
- 4.0 Miles² Drainage
- Habitat score = 98
- IBI score = 36 Poor



Results

- 8 Native Species
- 1 Benthic Species
- 0 Intolerant Species
- 56% Tolerant Species
- 5% Insectivore Species
- 1.5% Top Predator Species
- 88 Fish
- 0% External Deformities



Fish IBI Network

- 141 Site Network
- Regional sampling – 2013 Northeast
- 81 Fixed sites – every 5 years
- 50 Probabilistic sites – 10 sites/year
- 10 Sentinel sites – 5 site/year
- Atlantic drainage streams will be evaluated during Atlantic Coastal Plain Monitoring
- If S. IBI is applicable to Atlantic drainage streams, 9 additional fixed sites will be added in this region



**Any
Questions?**

