New Jersey's Fish IBI Programs

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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 averaged 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.

➢ NJ Fish IBI is a true quantitative index of biotic integrity

➢ Is a direct measure of aquatic life use and fishable/swimmable as elaborated in CWA

Northern Fish IBI
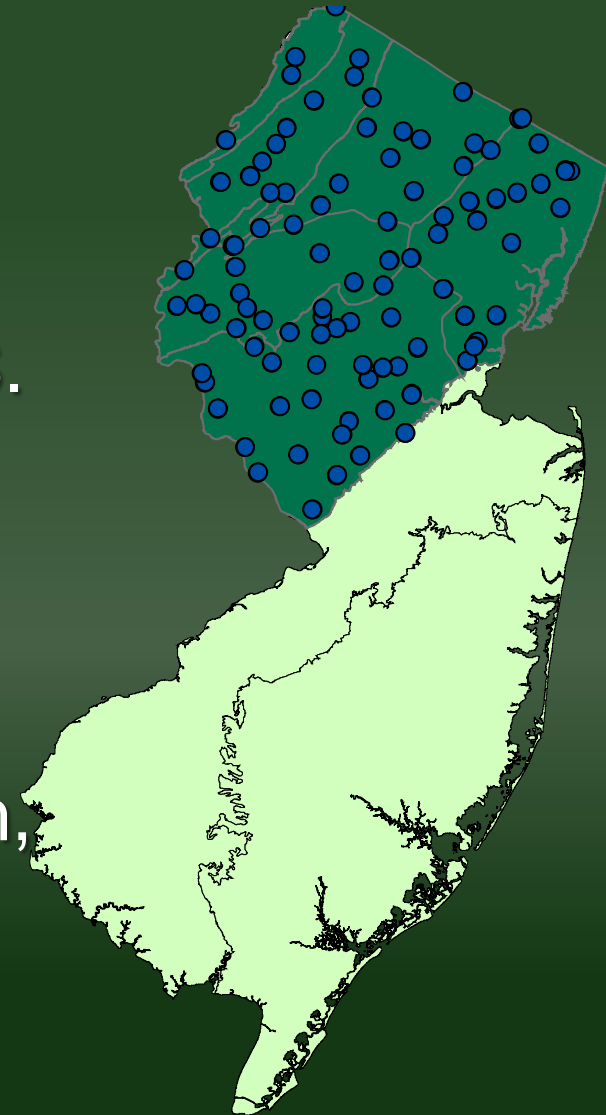
- ➢ Northern Fish IBI developed by U.S. EPA Region 2
- ➢ BFBM initiated monitoring in 2000
- ➢ BFBM completed metric refinement in 2005 & 2014
- ➢ Network consisting of fixed, random, sentinel sites
- ➢ Index period – June through Mid-October
- ➢ Currently in 4th round of monitoring

Southern Fish IBI
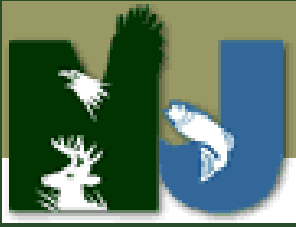
➢ Pilot project to develop a fish IBI started by NJ Fish & Wildlife in 2000

➢ BFBM initiated redevelopment in 2008

➢ Scoring criteria and validation finalized spring 2012

➢ Network consisting of fixed, random, sentinel sites

➢ Currently evaluating Outer Coastal Plain
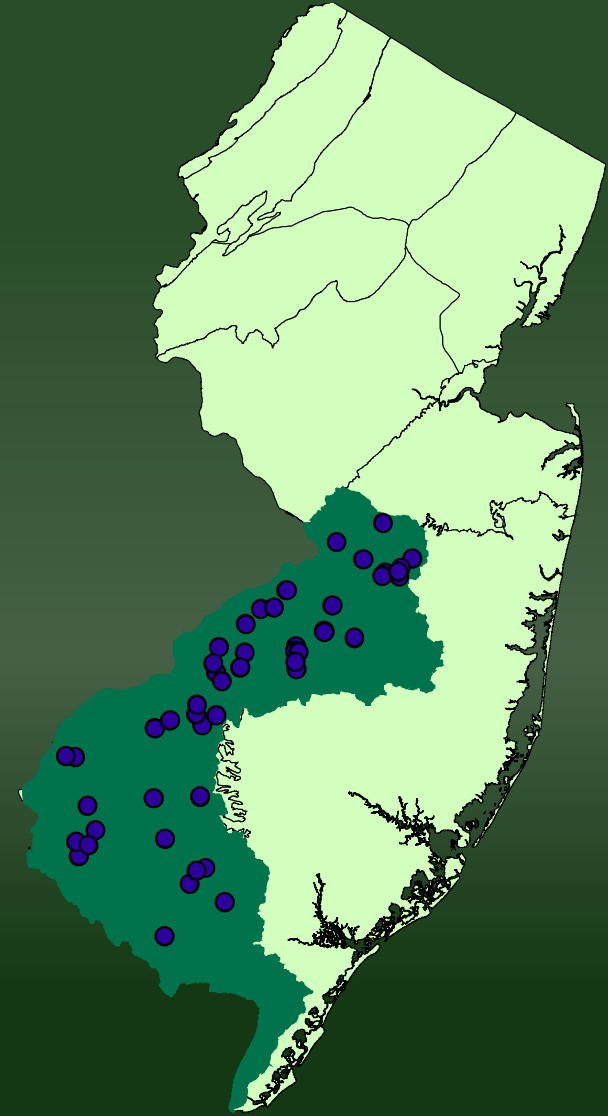
North vs. South

Northern Streams
- ➢ High gradient
- ➢ Cobble/boulder
- ➢ Riffle/run/pool
- ➢ More diverse

Southern Streams
- ➢ Low gradient
- ➢ Sand/gravel
- ➢ Run/pool
- ➢ Lower diversity

Methods

Backpack Electrofishing

Barge Electrofishing

Healthy Fish Community

Impaired Fish Community

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

Northern IBI Metrics

Development of new high-gradient indices of biotic integrity for wadeable rivers and streams in New Jersey

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Bureau of Freshwater and Biological Monitoring

The New Jersey Bureau of Freshwater and Biological Monitoring has been conducting Fish Index of Biotic Integrity (FIBI) monitoring on rivers and streams (>4-miles^2) in the Northern part of the state since 2000 using Karr's original IBI format with several regional modifications. The NJ Fish IBI serves several purposes including identifying waters with aquatic life use impairments 303(d), assessing the waters of the state 305(b), nominating quality streams for special anti-degradation protection, and tracking streams with natural trout reproduction. In an effort to increase the overall performance of the IBI and to assess smaller headwater streams (<4-miles^2), a new design and approach to metric development was evaluated on approximately 230 high gradient streams. This design, developed by Whittier and Hughes, has been implemented for numerous Western U.S. studies, as well as the Connecticut multi-metric indices (MMI). Analysis resulted in two distinct stream classes; a coldwater community (Headwaters IBI) consisting of brook trout, sensitive salamanders, and native crayfish and cool/warmwater fish communities (Northern FIBI). Over 140 metrics from ten ecological classes were tested for signal to noise (S/N), range, responsiveness, and redundancy. A total of eight metrics were selected for the Northern FIBI and six were selected for the Headwaters IBI.

Metric	Ecological Class	Signal/Noise	ANOVA F-Statistic	Discrimination Efficiency
%Richness Rheophilic Sp.	Stream Flow	12.5	99.5	100.0%
%Cold/Non-Tolerant Coolwater Sp.	Thermal	12.1	43.6	80.0%
%Richness Generalist Sp.	Trophic	6.49	56.2	88.0%
Tolerance Index	Tolerance	16.4	56.4	92.0%
%Richness Lithophilic Sp.	Reproduction	13.2	68.55	96.0%
%Cyprinidae Sp.	Composition	11.3	62.0	88.0%
%Top 3 Dominant Sp.	Composition	7.5	33.7	88.0%
%Richness Benthic Insectivore Sp.	Habitat	16.0	50.3	96.0%

Northern Fish IBI

Total Fish Fish IBI Score

Northern Fish IBI

$r^2 = 0.57$
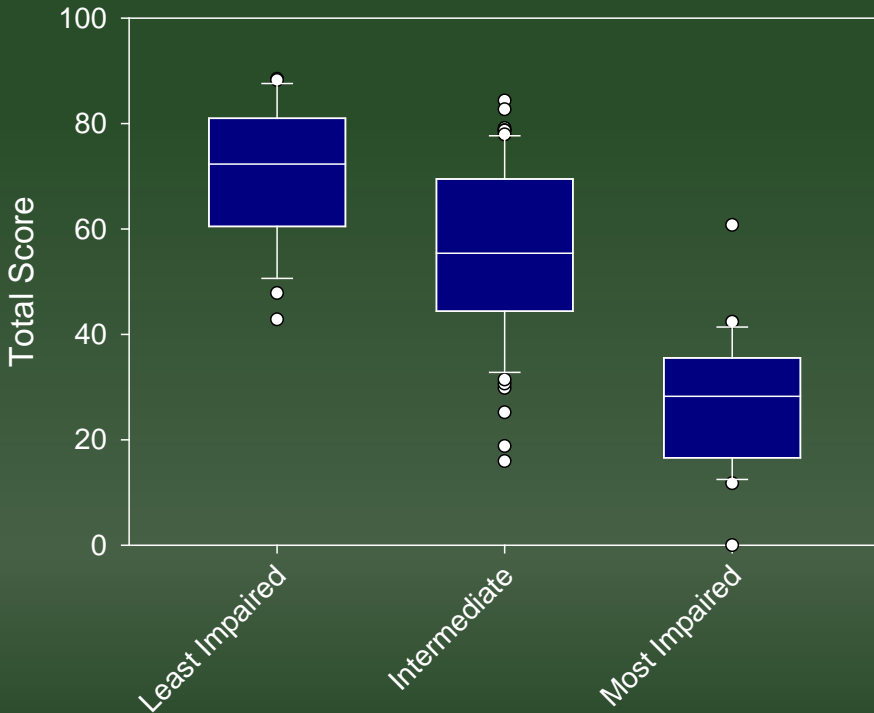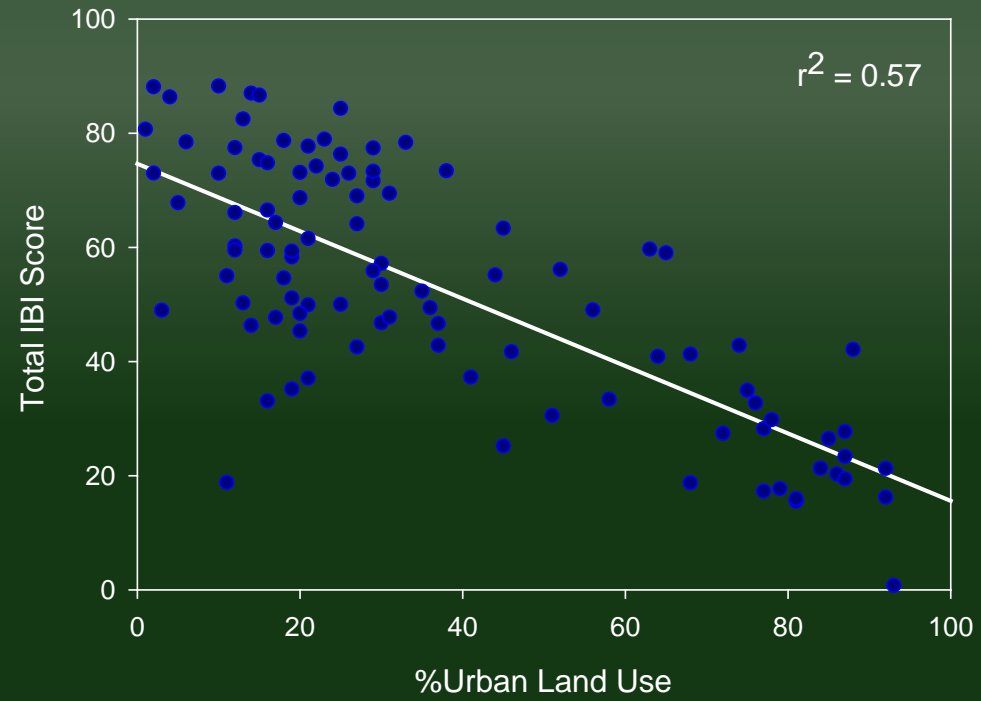
Why is Fish IBI Data Important?

➢ NJ Fish IBI is a true quantitative biotic index
➢ Assessment is conducted on 150-m reach
➢ Comprehensive assessment of 150-m reach which includes in situ water chemistry, nutrients, flow, visual habitat assessment, canopy cover/wetted width, etc.
➢ Fish are good indicators of long-term trends
➢ Provides information on trout production(TP) & Nontrout(NT) classifications
➢ Measure of aquatic life use and swimmable/fishable
➢ Public has a strong interest – FIBI webpage averaged 5,454 data downloads/month in 2014

Pros and Cons

Pros

- Quantitative assessment
- Operational costs almost zero
- No laboratory analysis
- Almost no laboratory identification
- Scores/ratings calculated same day
- Metric recalibrations are completed in-house

Cons

- Requires 4-6 field staff
- Is dependent on hourly staff
- Can only complete 35-40 sites/year (Quality vs Quantity)
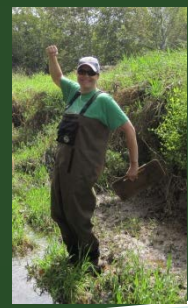
Fish IBI Network

➢ Regional sampling – 2015 Coastal

➢ 200 site network (FIBI & HIBI)

➢ Probabilistic, fixed, sentinel sites

➢ Atlantic drainage streams will be further evaluated in 2015 & 2016

➢ If S. IBI is applicable to Atlantic drainage streams, additional fixed sites will be added in this regi

FIBI048 - Buckhorn Creek
Harmony Township, Warren County
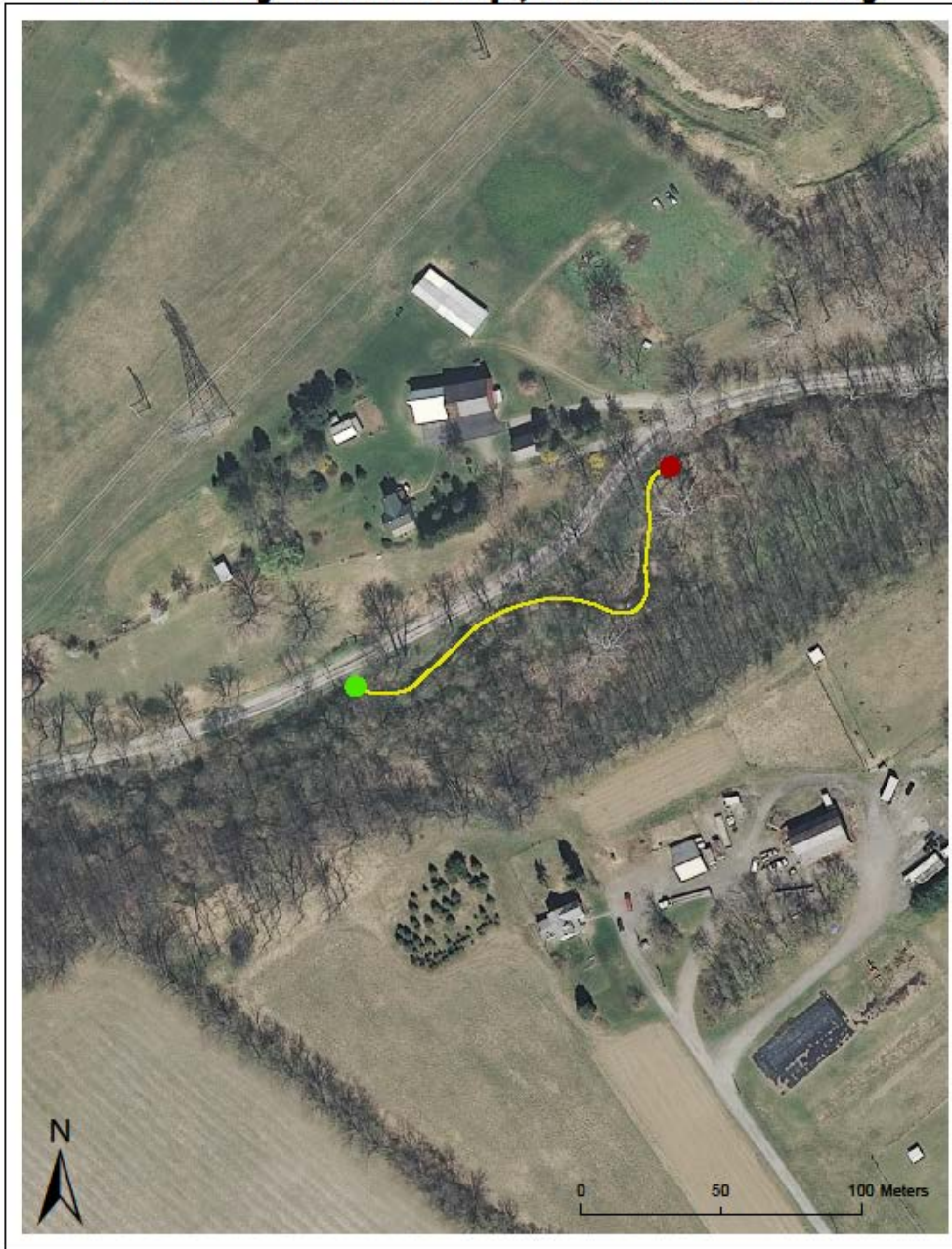
➢ FW2-TPC1
➢ FIBI sampling 2002, 2007, 2011, 2013, 2014

2007
FIBI Score – 70.8
Habitat Score 167
Water Temperature(7/17/2007) 20.7

2011
FIBI Score – 74.7
Habitat Score 160
Water Temperature(6/22/2011) 20.6

2013
FIBI Score – 77.3
Habitat Score 161
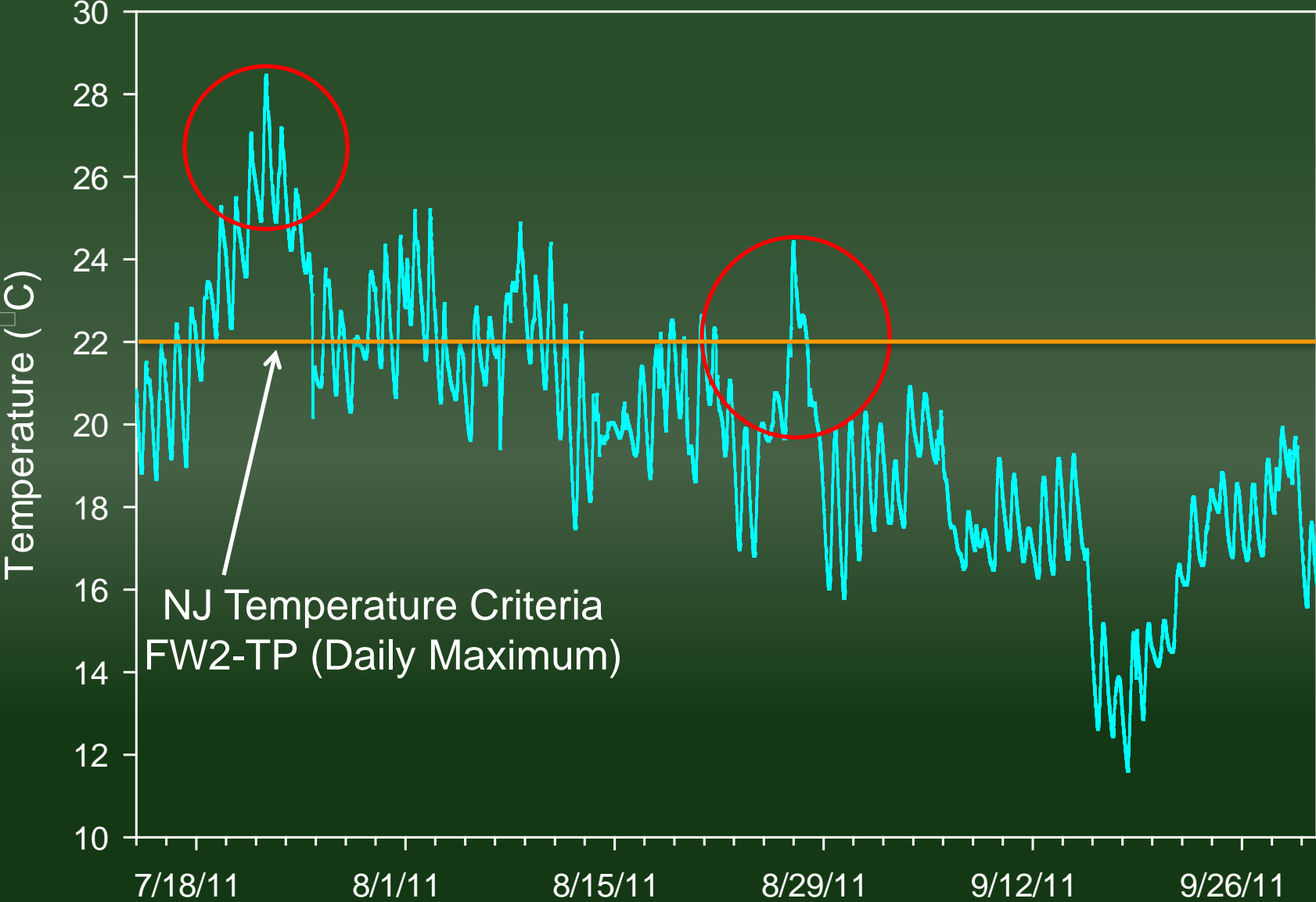*Water Temperature(6/27/2013) 19.8*

2014
FIBI Score – 73.1
Habitat Score 159
Water Temperature(6/26/2014) 19.7

Buckhorn Creek Temperature

NJ Temperature Criteria
FW2-TP (Daily Maximum)

Where	Category	Maximum Daily Temp °C	July Mean Temp °C	June-Aug Temp °C
MI,WI	Cold	< 20.7	< 17.5	< 17.0
CT	Cold	< 22.40	< 18.45	< 18.29
MI,WI	Cool	20.7-24.6	17.5-21.0	17.0-20.5
CT	Cool	22.40-26.30	18.45-22.30	18.29-21.70

FIBI048 – Buckhorn Creek

20 Wild Brown Trout – 60% YOY
3 Wild Rainbow Trout
174 Fallfish
3 Green Sunfish

4 Wild Brown Trout – Zero YOY
1 Wild Rainbow Trout
0 Fallfish
7 Green Sunfish

2007

2013

2011

2014

3 Wild Brown Trout – Zero YOY
1 Wild Rainbow Trout
1 Fallfish
30 Green Sunfish

4 Wild Brown Trout – Zero YOY
0 Wild Rainbow Trout
0 Fallfish
10 Green Sunfish