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Missouri Aquatic Biological Assessment

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A Brief History of Missouri Bioassessment

- The Clean Water Act
  - Fishable/Swimmable Language
  - Biological Integrity Language
- WQ Assessment in the Good Old Days
  - Chemical Analysis
  - Upstream/Downstream Studies
  - Use of a Quantitative Similarity Index

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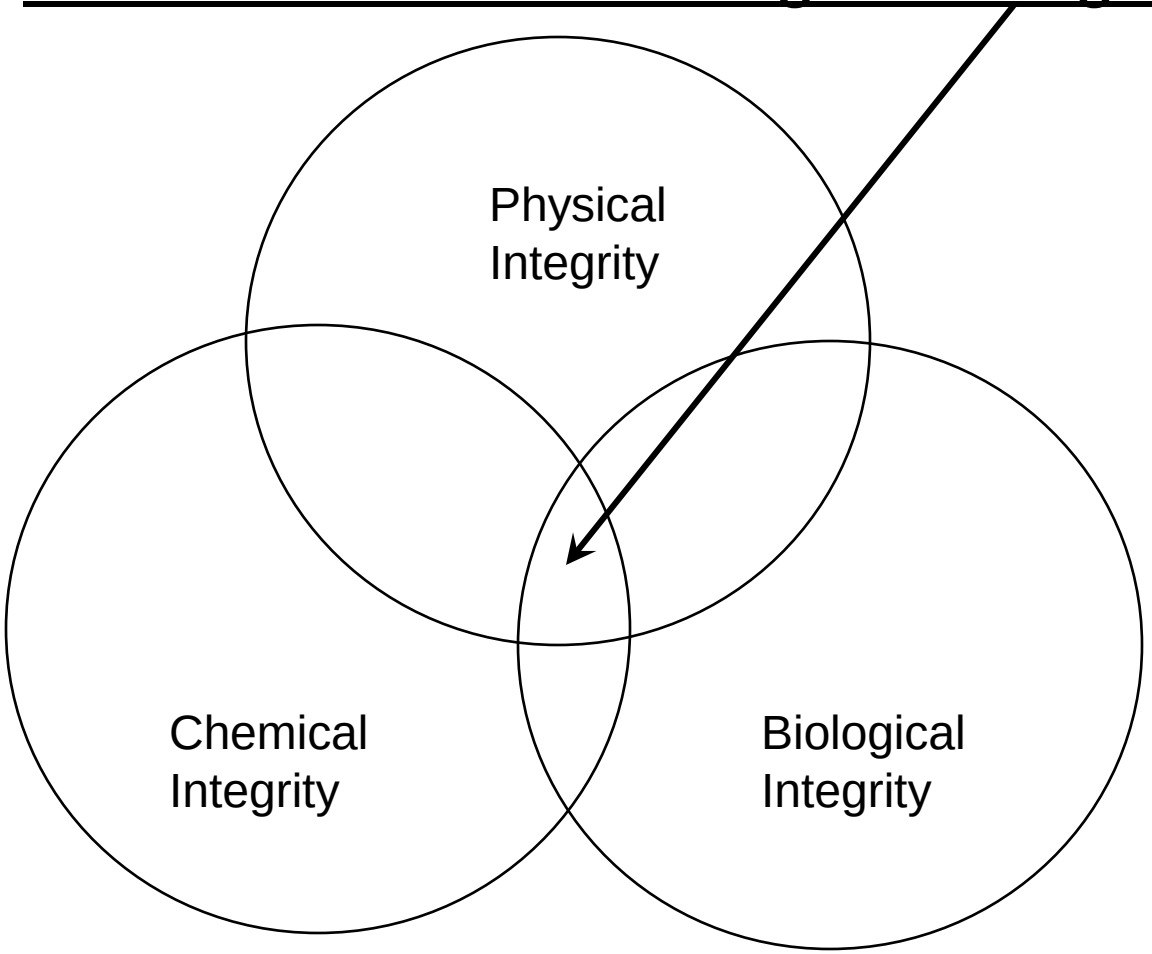
The Elements of Ecological Integrity



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A Brief History of Missouri Bioassessment

- American Canoe Association vs. EPA
  - 1998 Lawsuit resulted in a 2001 Consent Decree
  - Consent Decree
    - EPA required to comply with §303(d) of the CWA
    - Missouri created a new Water Quality Monitoring Program
    - Large staffing expansion at ESP and WPP in 1999

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The 1992 Project

- Multi-agency partnership
- Objectives
  - Define and Evaluate Aquatic Ecoregions
  - Establish Reference Streams
  - Sample Macroinvertebrate Communities at References
  - Analyze data
- Goal
  - Establish Numeric Criteria for Wadeable Streams

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Why Macroinvertebrates?

- Response to human disturbance
- Widely distributed
- Easy to collect
- Low on the food chain

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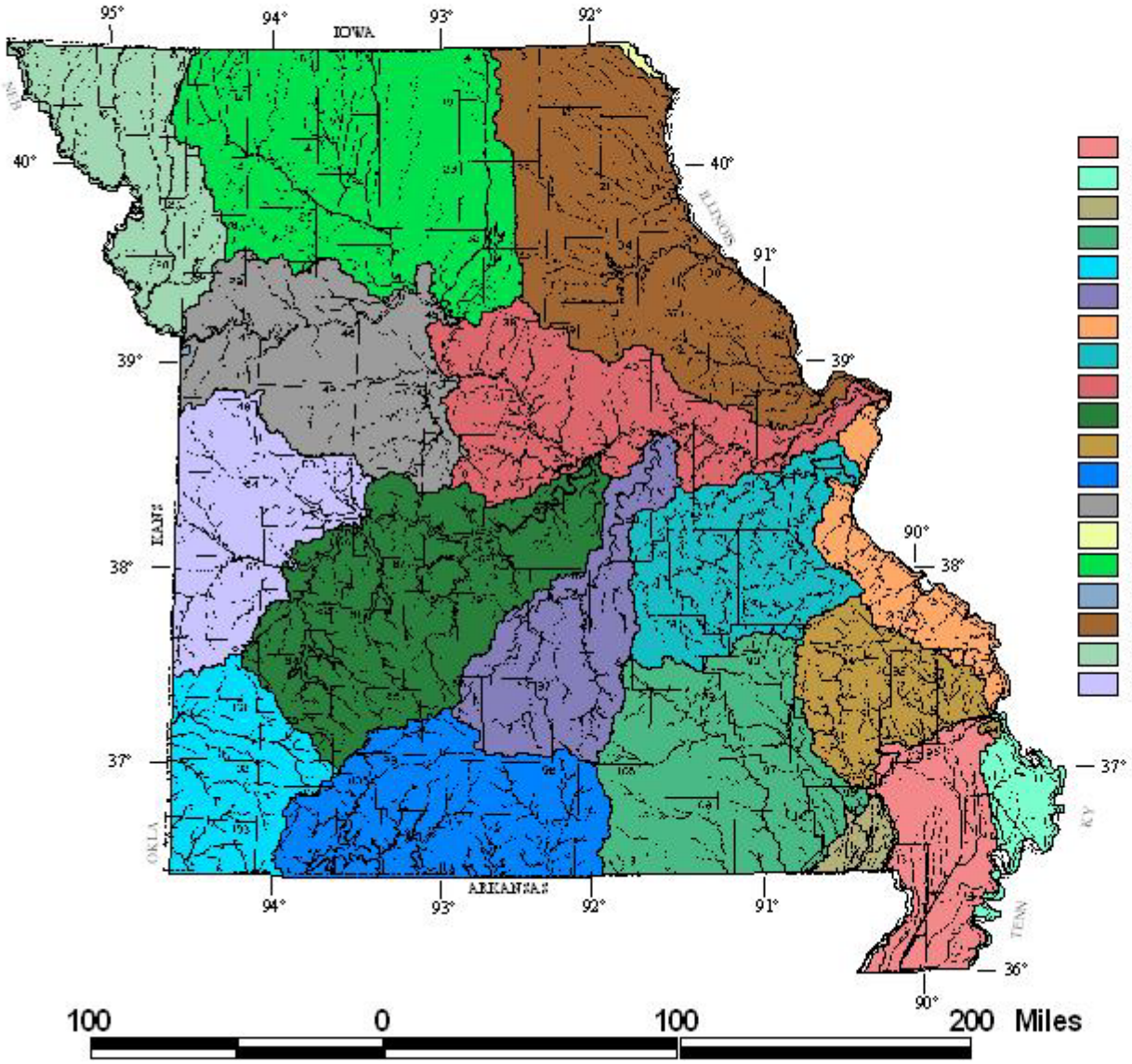
Aquatic Ecoregions of Missouri

Missouri Ecological Drainage Units (EDU)



Legend

- MS Alluvial Plain/Little Drainage
- MS Alluvial Plain/Lower MS / St. Johns Bayou
- MS Alluvial Plain/White / Black Drainages
- Ozark/ Current / Black Drainages
- Ozark/ Elk / Spring Drainages
- Ozark/ Gasconade Drainage
- Ozark/ MS Tribs btwn MO and OH Rivers
- Ozark/ Meramec Drainage
- Ozark/ Moreau / Loutre Drainages
- Ozark/ Osage Drainage
- Ozark/ Upper St. Francis / Castor Drainages
- Ozark/ White Drainage
- Plains/ MO Tribs btwn Blue and Lamine Drainages
- Plains/ Des Moines Drainage
- Plains/ Grand / Chariton Drainages
- Plains/ Kansas Drainage
- Plains/ MS Tribs btwn Des Moines and MO Rivers
- Plains/ MO Tribs btwn Nishnabotna and Platte Drainages
- Plains/ Osage Drainage

MoRAP map series 2001 - 001

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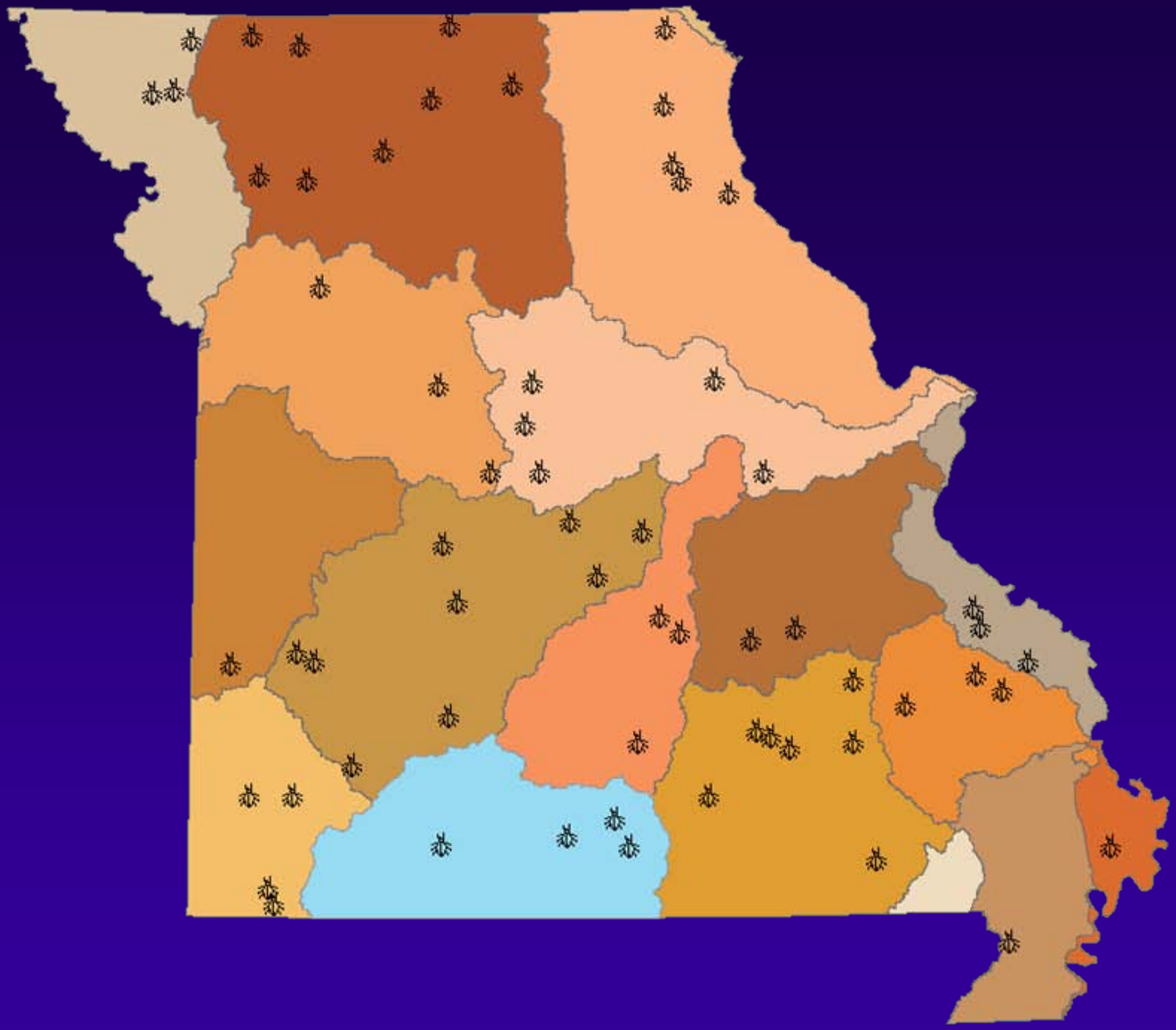
Reference Streams

- Perennial
- Wadeable
- Subjected to Six Step Selection Process
- Field Verified



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Macroinvertebrate Sampling

- Develop written protocols
- Sample two seasons per year (spring & fall)
- Multi-habitat sampling
- Physical habitat assessment
- Use multiple metrics and multivariate statistics to analyze results

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Semi-quantitative Macroinvertebrate Stream Bioassessment Procedure

- Stream size and sampling reach length
- Multi-habitat sampling
- Laboratory processing of samples
- Level of identification
- Data analysis

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Sampling Reach Length

- Determined by measuring 20x the stream width of the top of the lower bank
- Approximates two riffle / pool sequences or two glide / bend sequences

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Multi-habitat Sampling

Riffle / Run Prevalence

Glide / Pool Prevalence

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Laboratory Processing of Samples

Riffle/Run Prevalence

- Flowing Water Over Coarse Substrate - 600 organism subsample
- Non-flowing Water Over Depositional Substrate - 300 organism subsample
- Root Mat - 300 organism subsample

Total = 1200 organisms

*All habitats also have large/rare taxa removed at the end of subsampling

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Laboratory Processing of Samples

Glide/Pool Prevalence

- Non-flowing Water Over Depositional Substrate - 300 organism subsample
- Large Woody Debris - 300 organism subsample
- Root Mat - 300 organism subsample

Total = 900 organisms

*All habitats also have large/rare taxa removed at the end of subsampling

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Data Analysis

- Taxa Richness
- EPT Taxa
- Biotic Index
- Shannon Diversity Index

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Mayfly

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Stonefly

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Caddisfly

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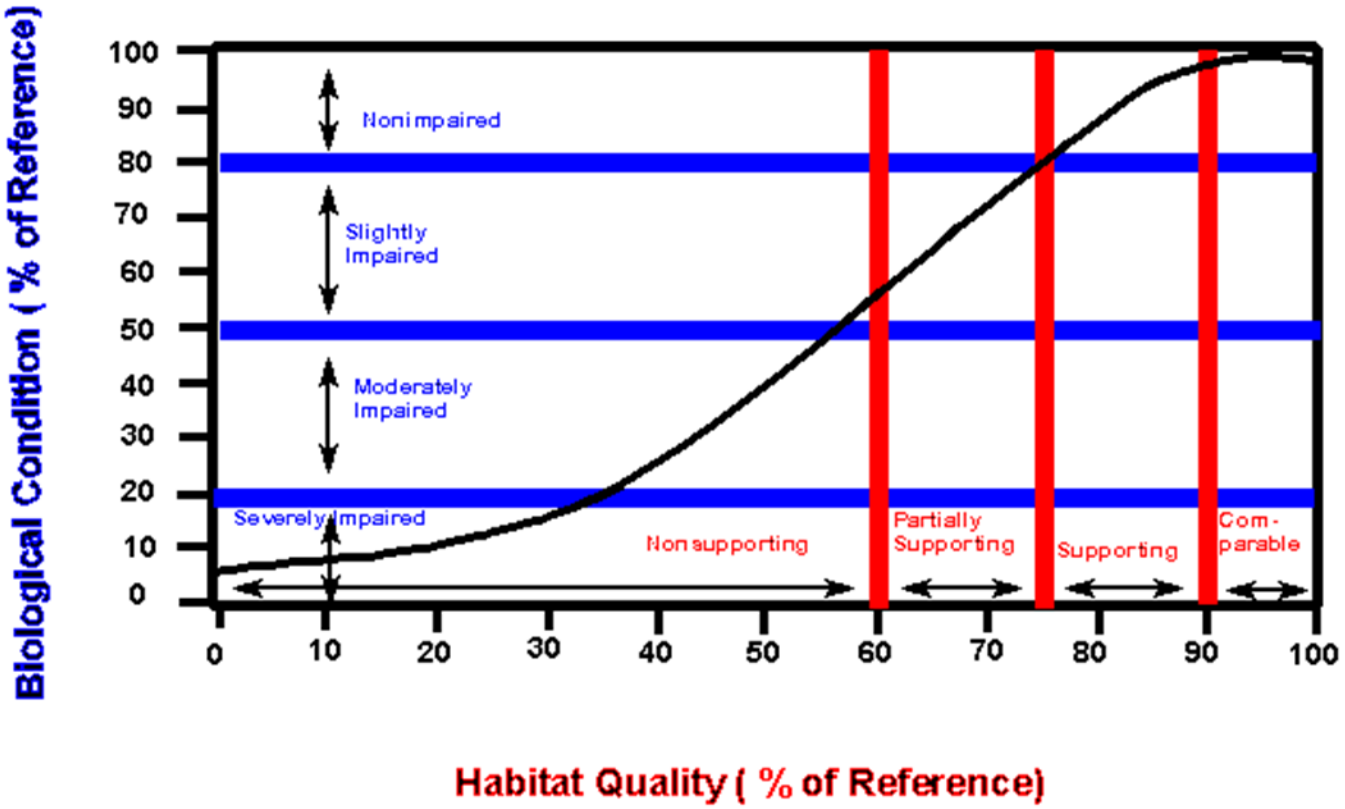
The Biological Condition Gradient



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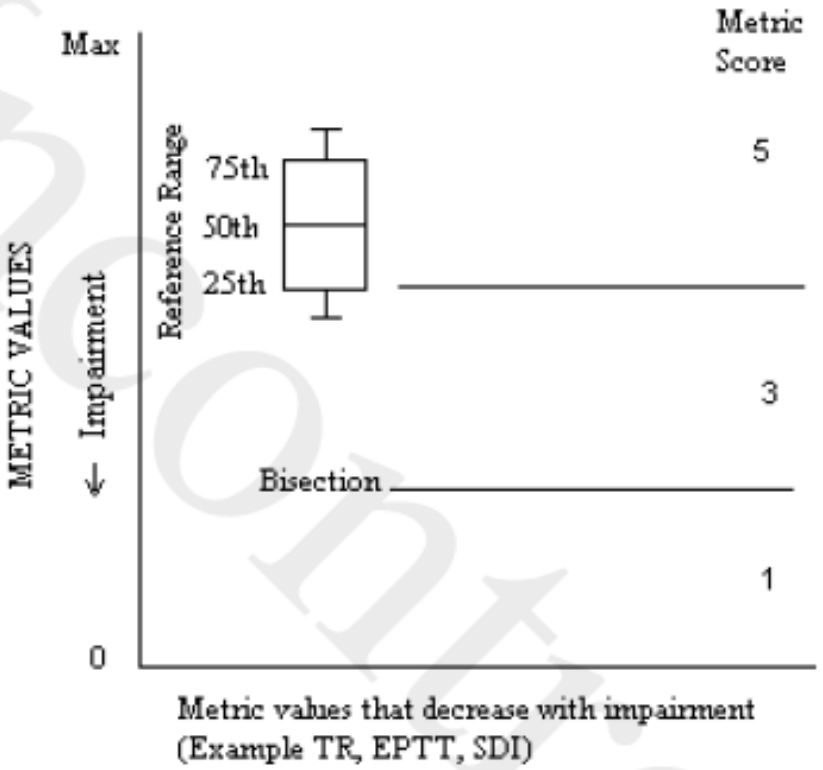
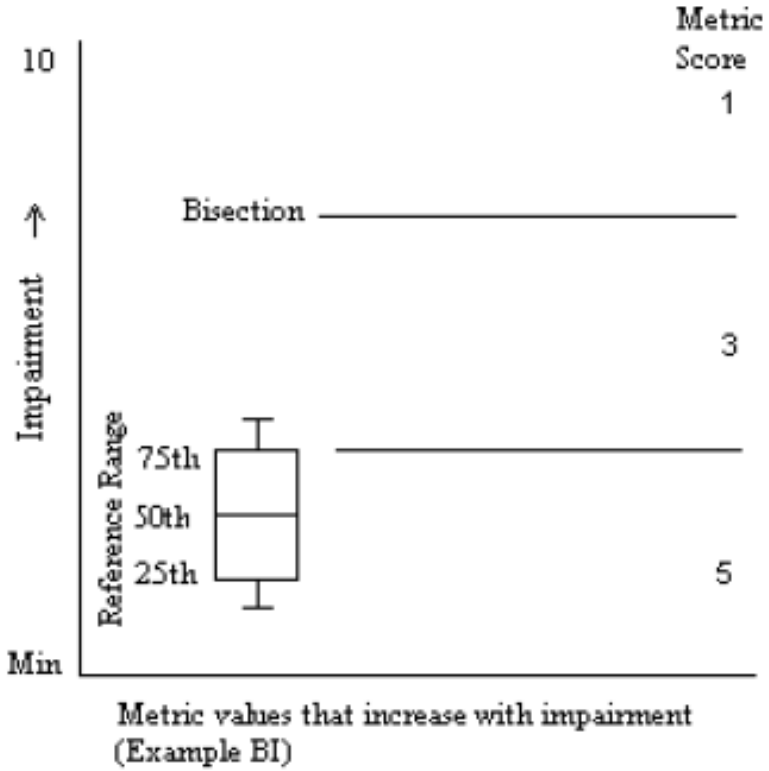
Metric Threshold Values



Metric values that decrease with impairment
(Example TR, EPTT, SDI)



Metric values that increase with impairment
(Example BI)

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Ozark/Moreau/Loutre EDU Criteria

Spring Criteria

	Score = 5	Score = 3	Score = 1
TR	>71	71-35	<35
EPTT	>17	17-9	<9
BI	<6.4	8.2-6.4	>8.2
SDI	>2.80	2.80-1.40	<1.40

Fall Criteria

	Score = 5	Score = 3	Score = 1
TR	>73	73-37	<37
EPTT	>15	15-7	<7
BI	<6.8	6.8-8.4	>8.4
SDI	>3.18	3.18-1.59	<1.59

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Data Analysis

Macroinvertebrate Stream Condition Index

- An aggregation of the four primary metrics
- MSCI Scores range from 4 to 20
- Based on comparison with the Reference Condition
- Assessment of supportability of aquatic life

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Macroinvertebrate Stream Condition Index

Rating	MSCI Score
Fully Biologically Supporting	16-20
Partially Biologically Supporting	10-14
Non-Biologically Supporting	4-8

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The Big Picture

- So, how do we fit in?
  - Contractors for our client programs (primarily the Water Protection Program)
  - Technical expertise for special projects
  - Interagency work groups

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Water Protection Program Projects

- 305(b) Report
- 303(d) List
- Listing Methodology Document
- 319 Group
- 401 Certification Group

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The 303(d) List

- Total Maximum Daily Load (TMDL)
- Petition to de-list
- Additional monitoring
- Site-specific criteria
- Lawsuits

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Use of the Macroinvertebrate Stream Condition Index

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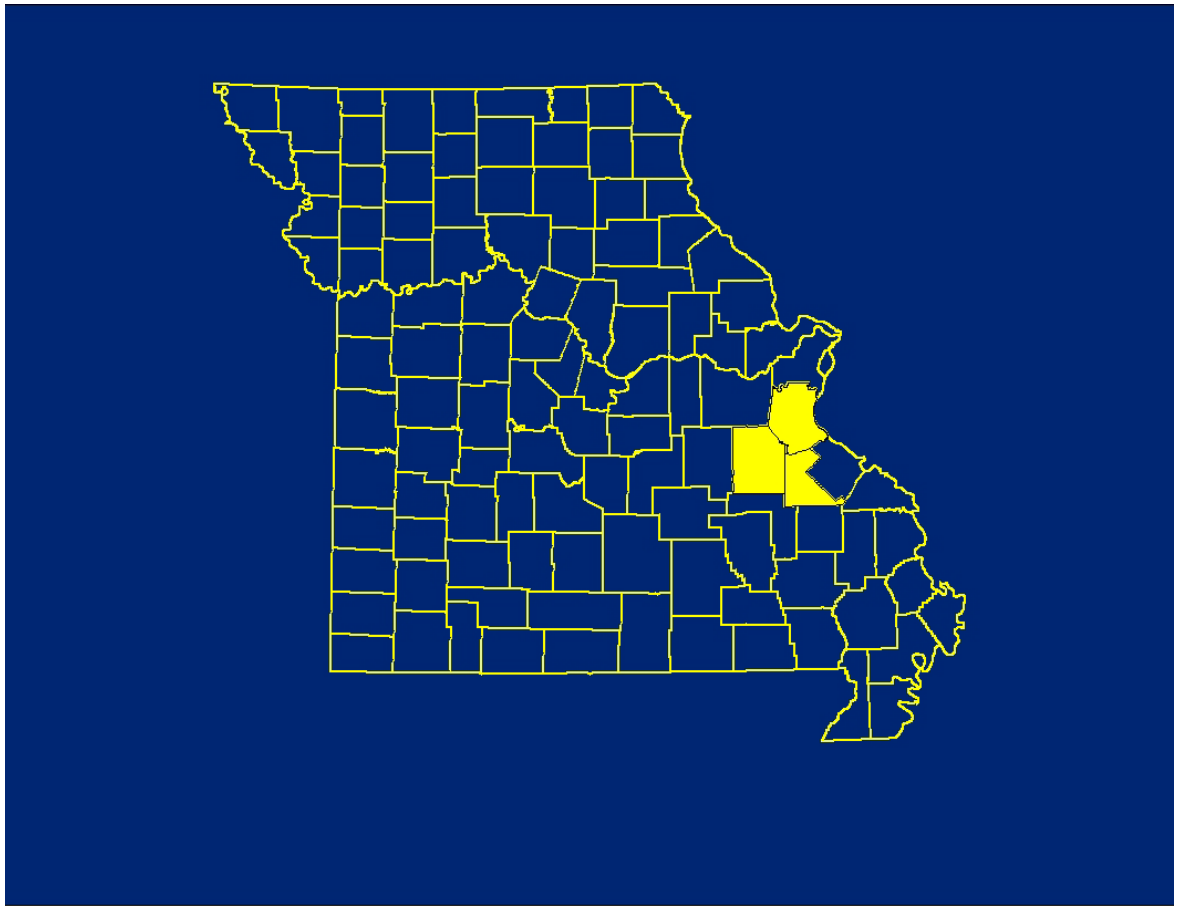
Mine-Affected Systems

Big River




D-S
NOW LEASING
RAIL ROAD CROSSING

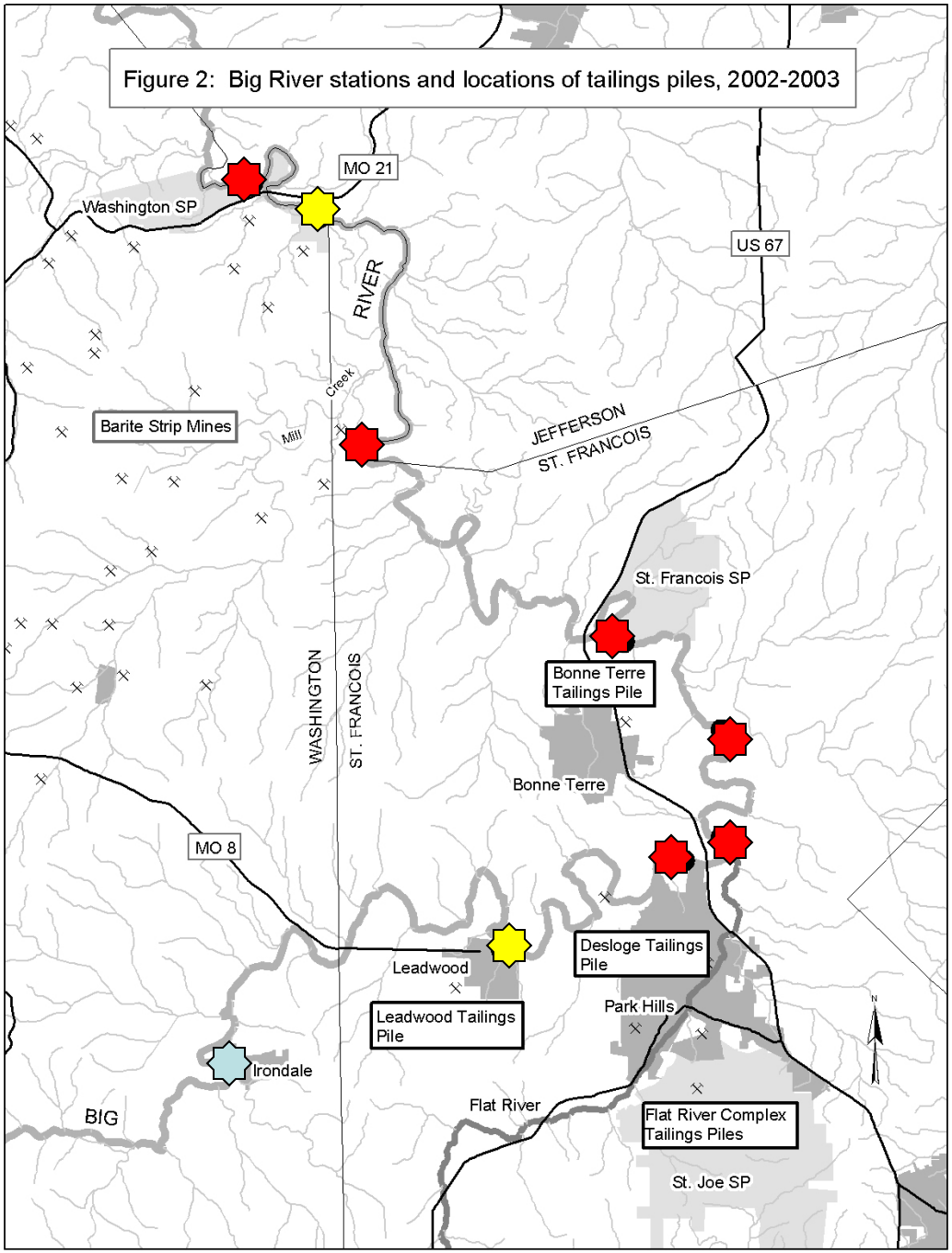


Figure 2: Big River stations and locations of tailings piles, 2002-2003
MO 21
Washington SP
US 67
RIVER
Creek
Barite Strip Mines
Mill
JEFFERSON
ST. FRANCOIS
St. Francois SP
Bonne Terre Tailings Pile
WASHINGTON
ST. FRANCOIS
Bonne Terre
MO 8
Desloge Tailings Pile
Leadwood
Leadwood Tailings Pile
Park Hills
Irondale
BIG
Flat River
Flat River Complex Tailings Piles
St. Joe SP
N

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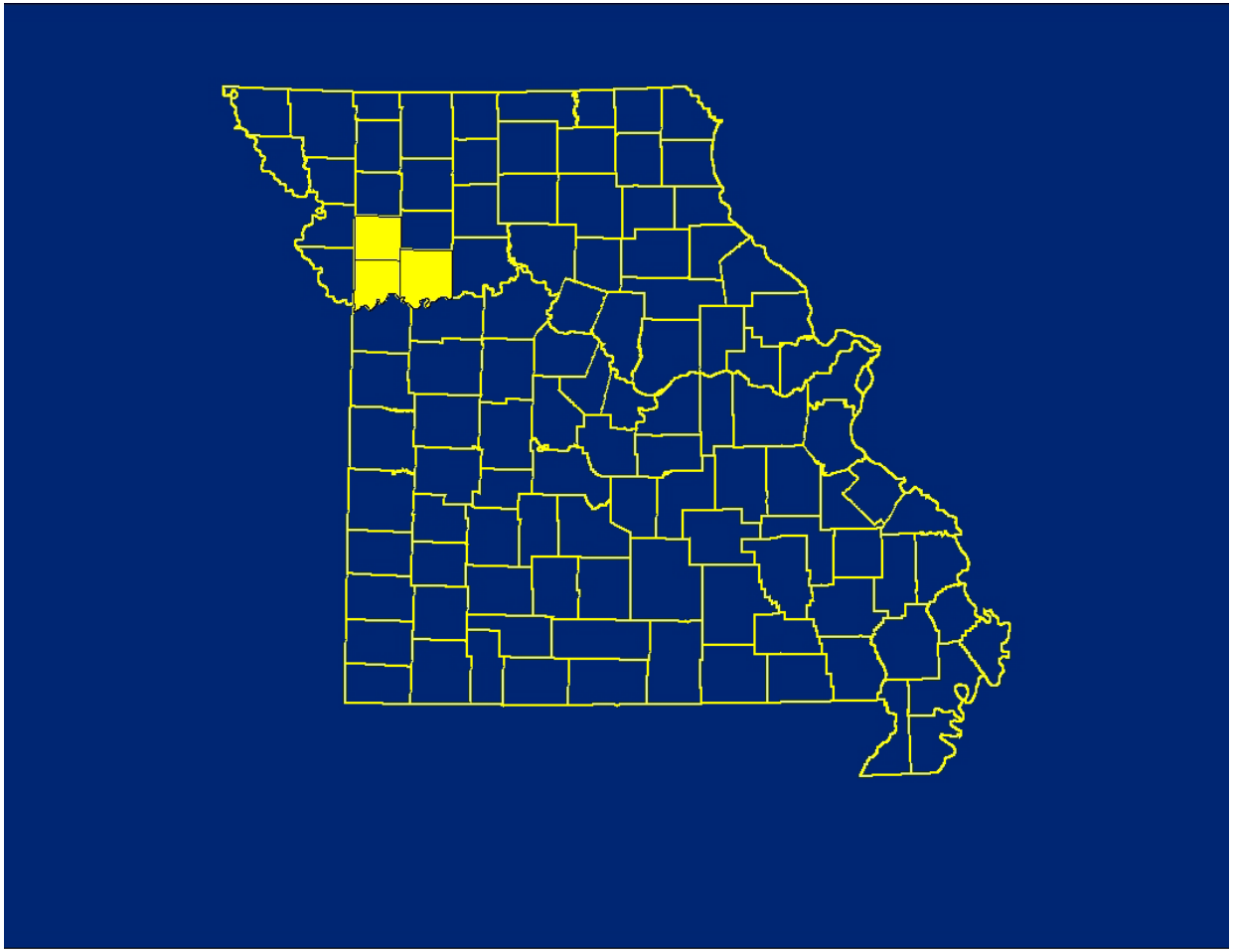
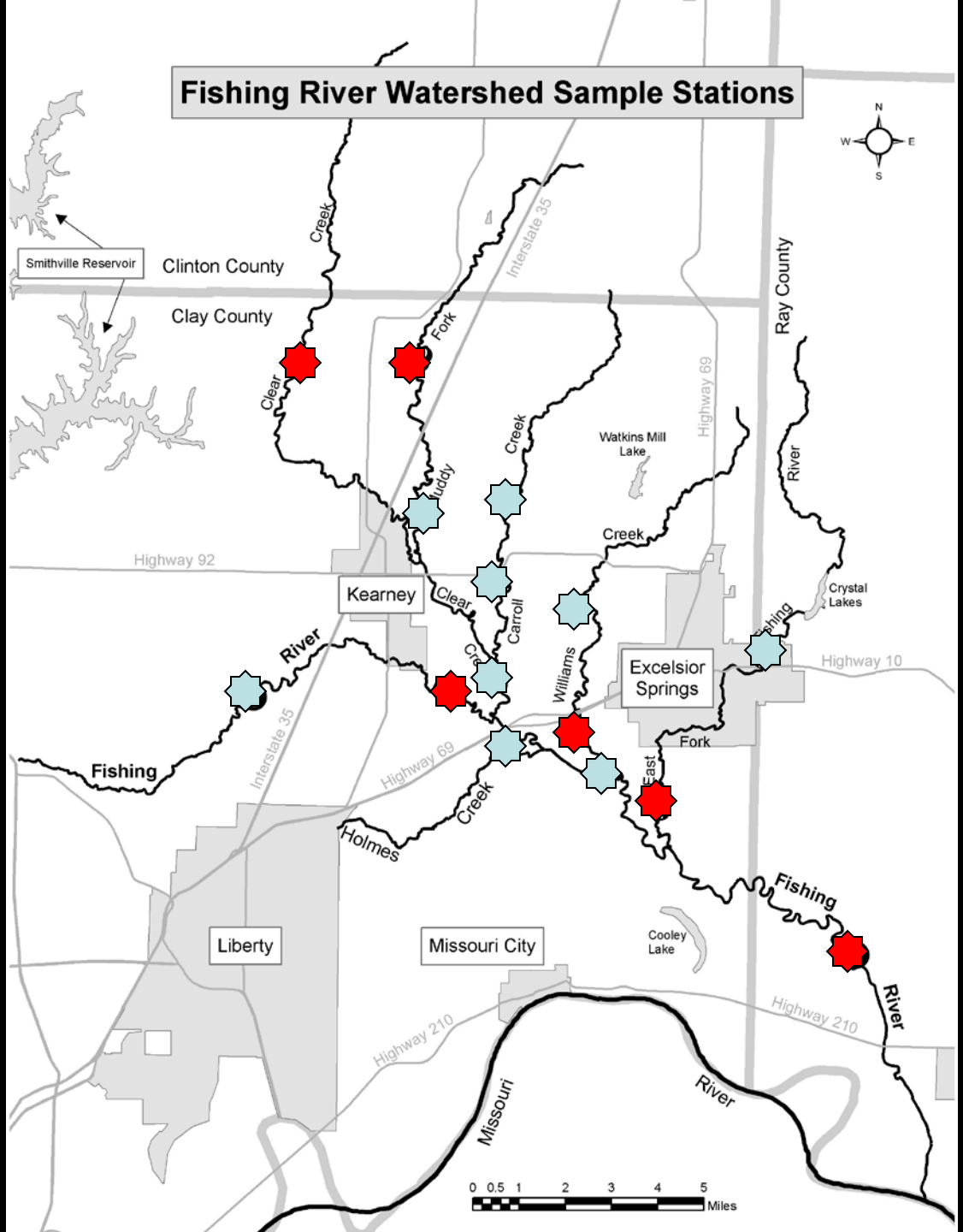
Urban Influence

Fishing River Watershed




Fishing River Watershed Sample Stations
N
W
E
S
Smithville Reservoir
Clinton County
Clay County
Ray County
Clear Creek
Fork
Interstate 35
Highway 69
Watkins Mill Lake
Creek
Buddy
Creek
River
Highway 92
Kearney
Clear
Carroll
Crystal Lakes
Fishing
River
Williams
Excelsior Springs
Highway 10
Fork
East
Fishing
Interstate 35
Highway 69
Creek
Holmes
Fishing
River
Liberty
Missouri City
Cooley Lake
Highway 210
Highway 210
Missouri
River
0 0.5 1 2 3 4 5
Miles

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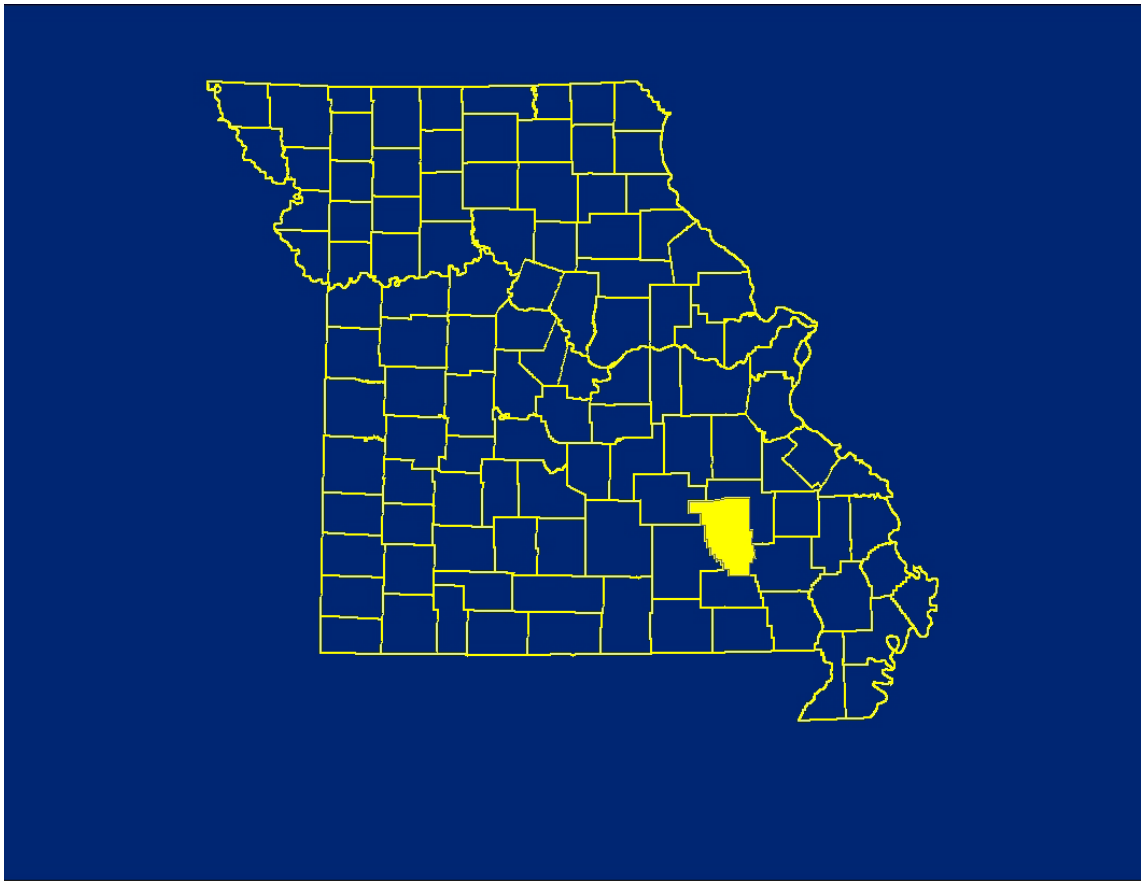
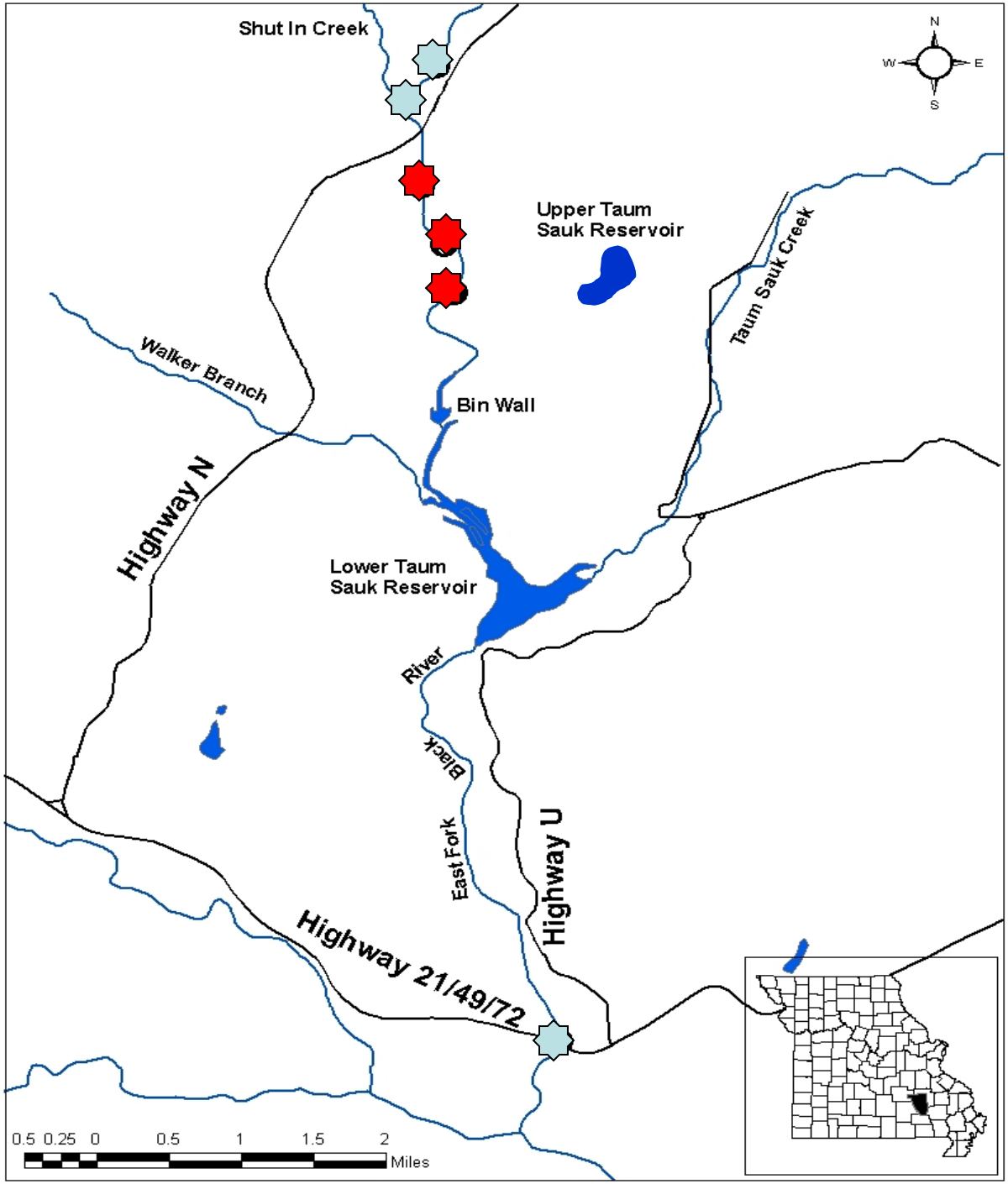
Catastrophic Events

East Fork Black River




Shut In Creek
N
W
E
S
Upper Taum
Sauk Reservoir
Taum Sauk Creek
Walker Branch
Bin Wall
Highway N
Lower Taum
Sauk Reservoir
River
Black
East Fork
Highway U
Highway 21/49/72
0.5 0.25 0 0.5 1 1.5 2
Miles

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Bonne Femme Creek Sampling

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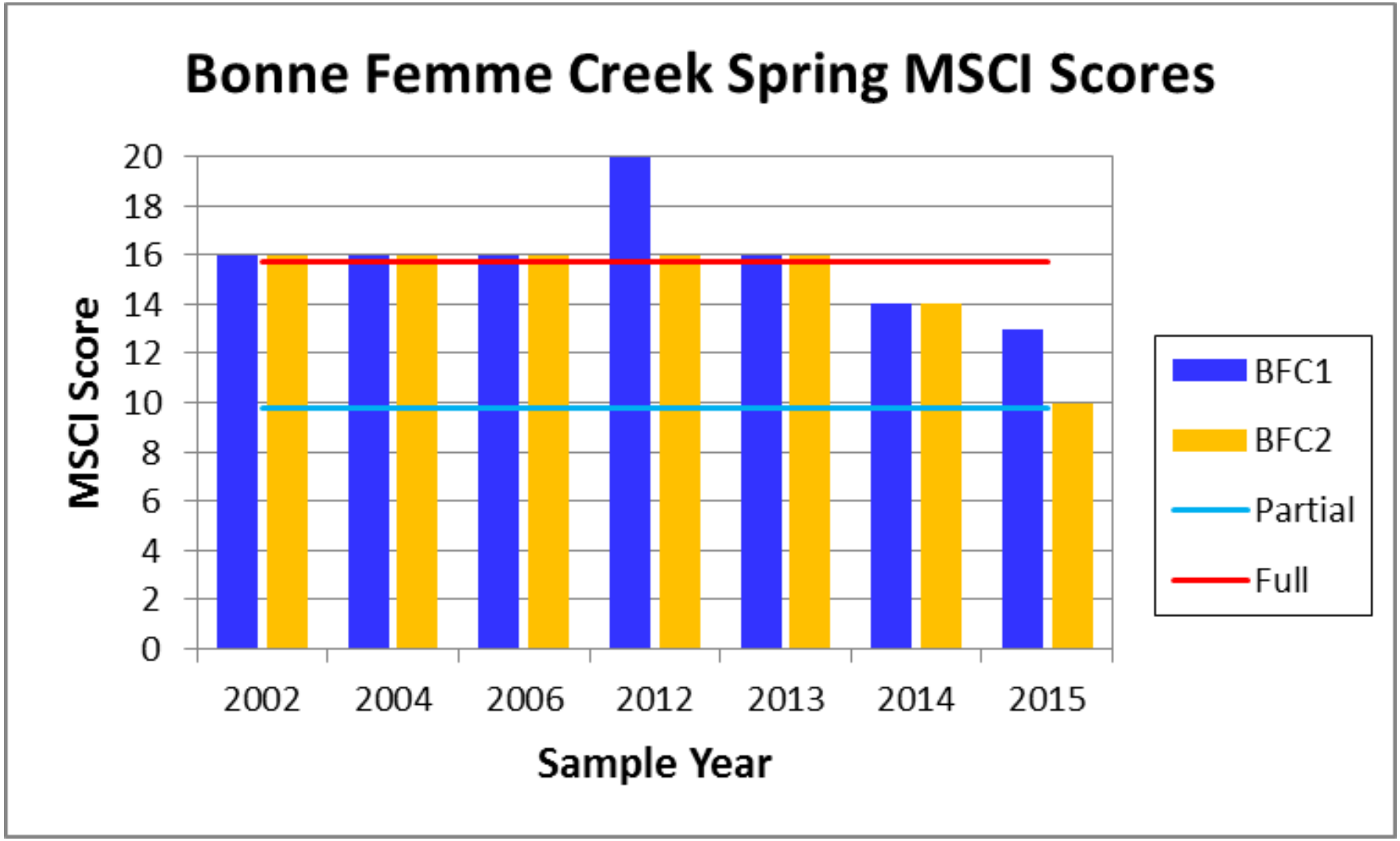

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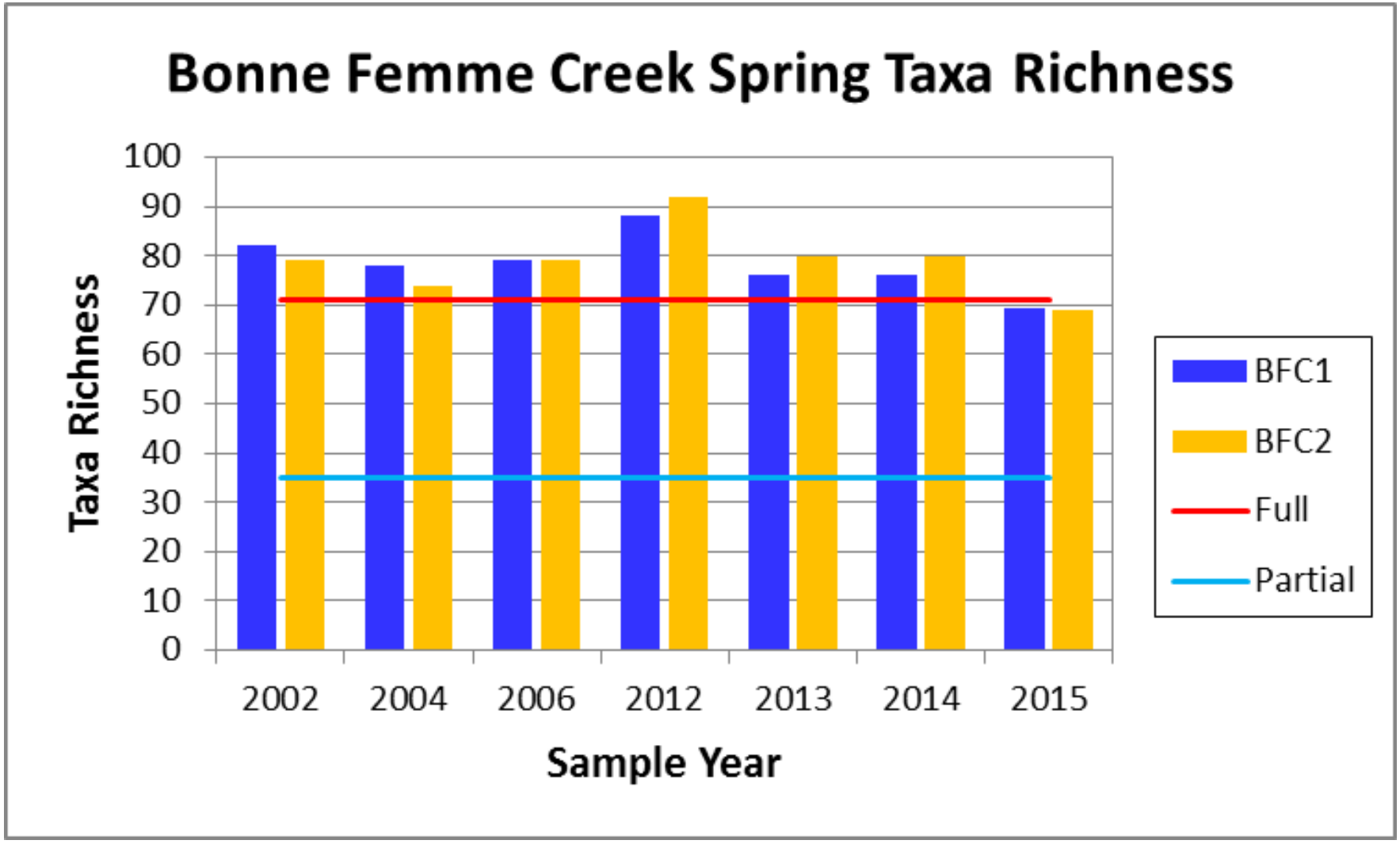

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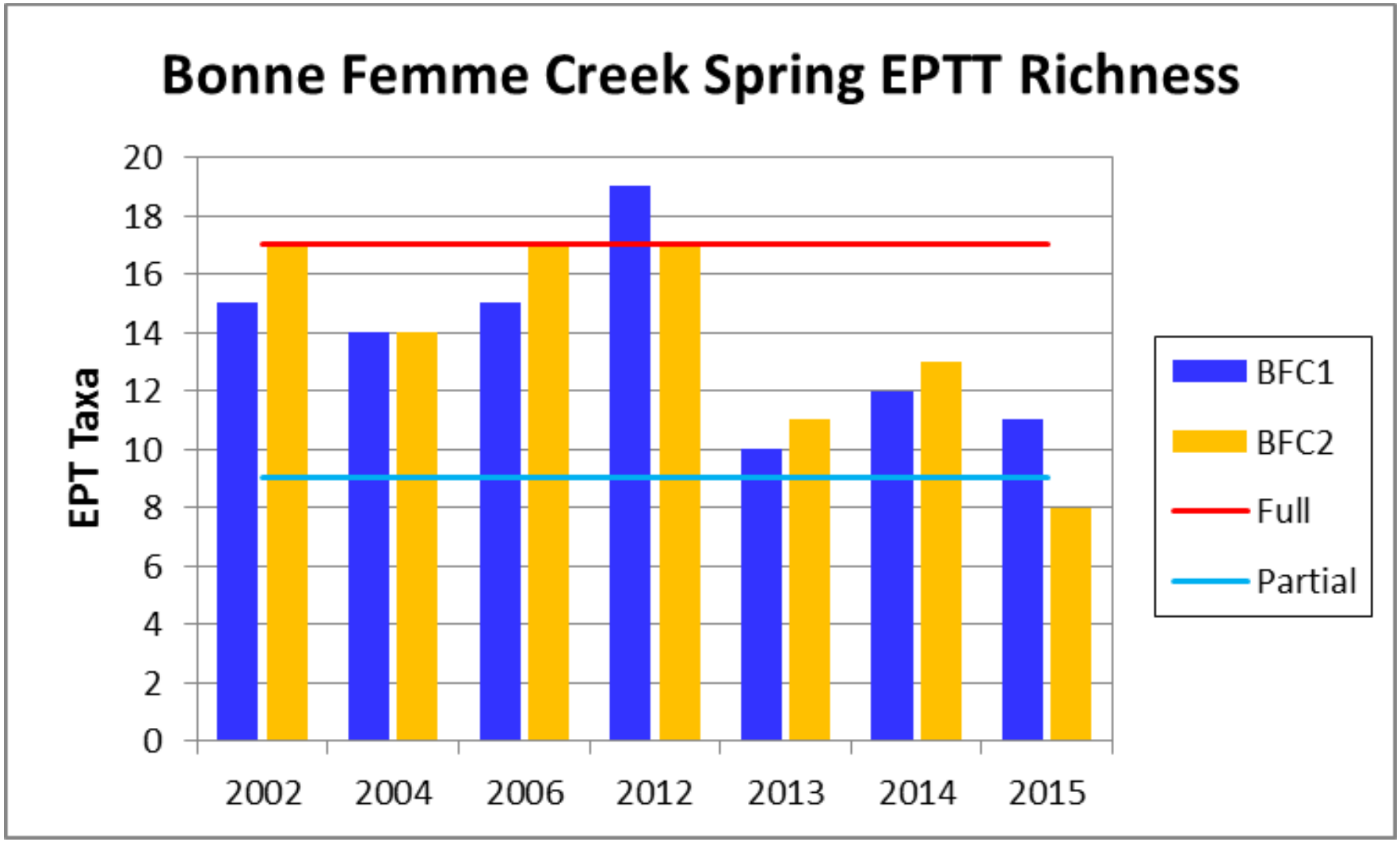

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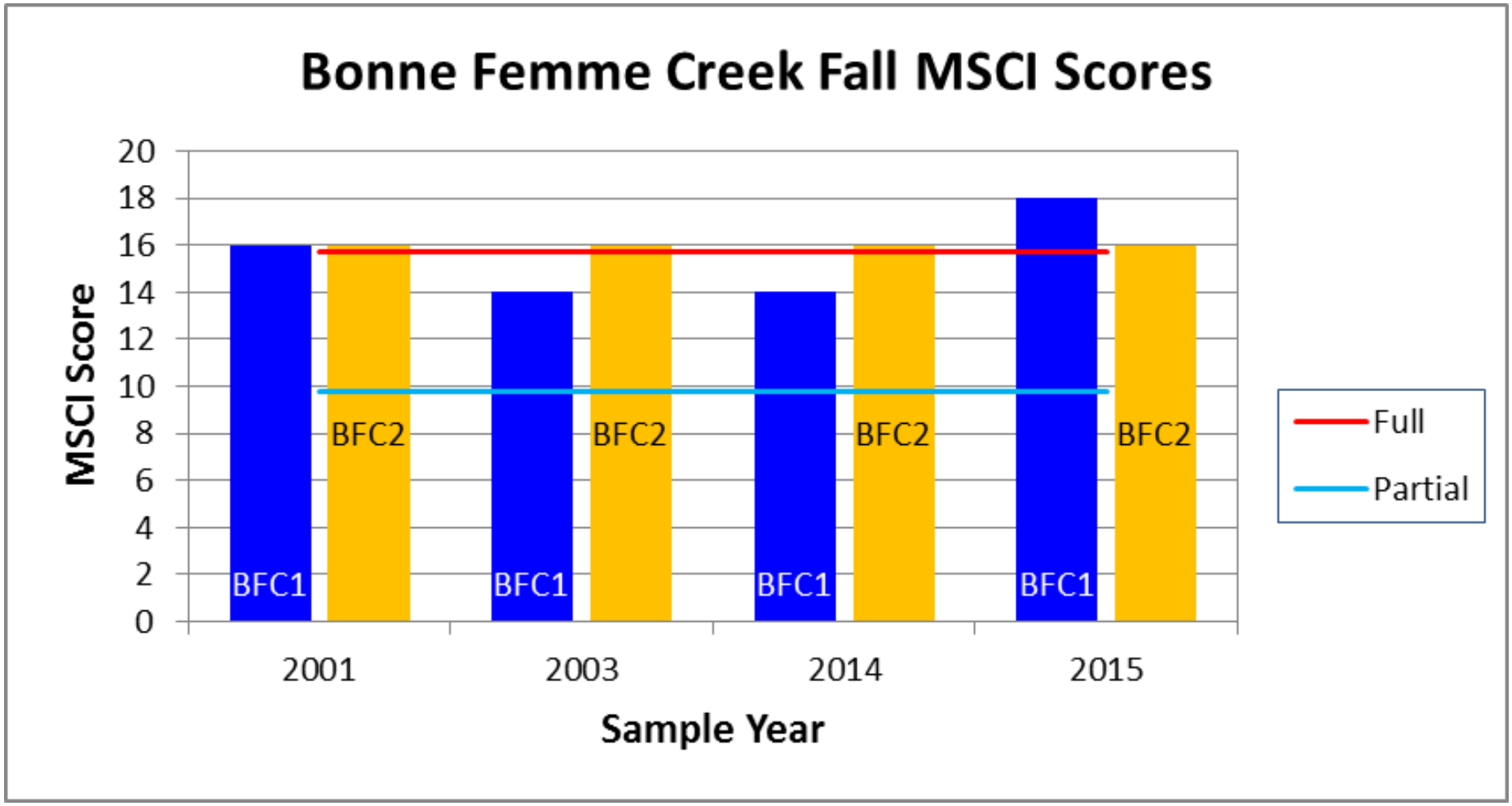

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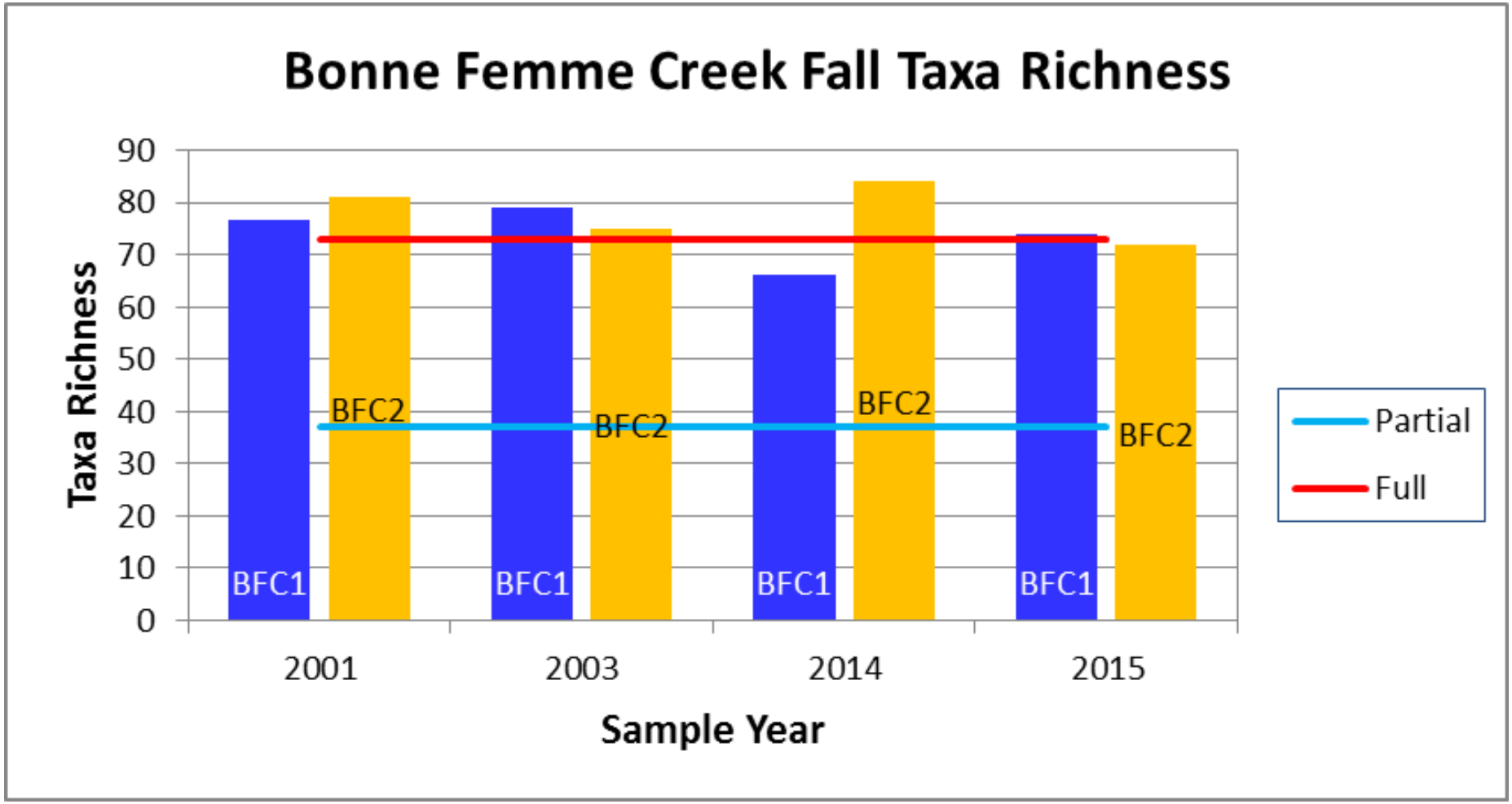

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