Assessment of the Fish Assemblage and Habitat Quality in the Red River of the North

Aaron Larsen
North Dakota Dept. of Health
Division of Water Quality
918 E Divide Ave
Bismarck, ND 58501

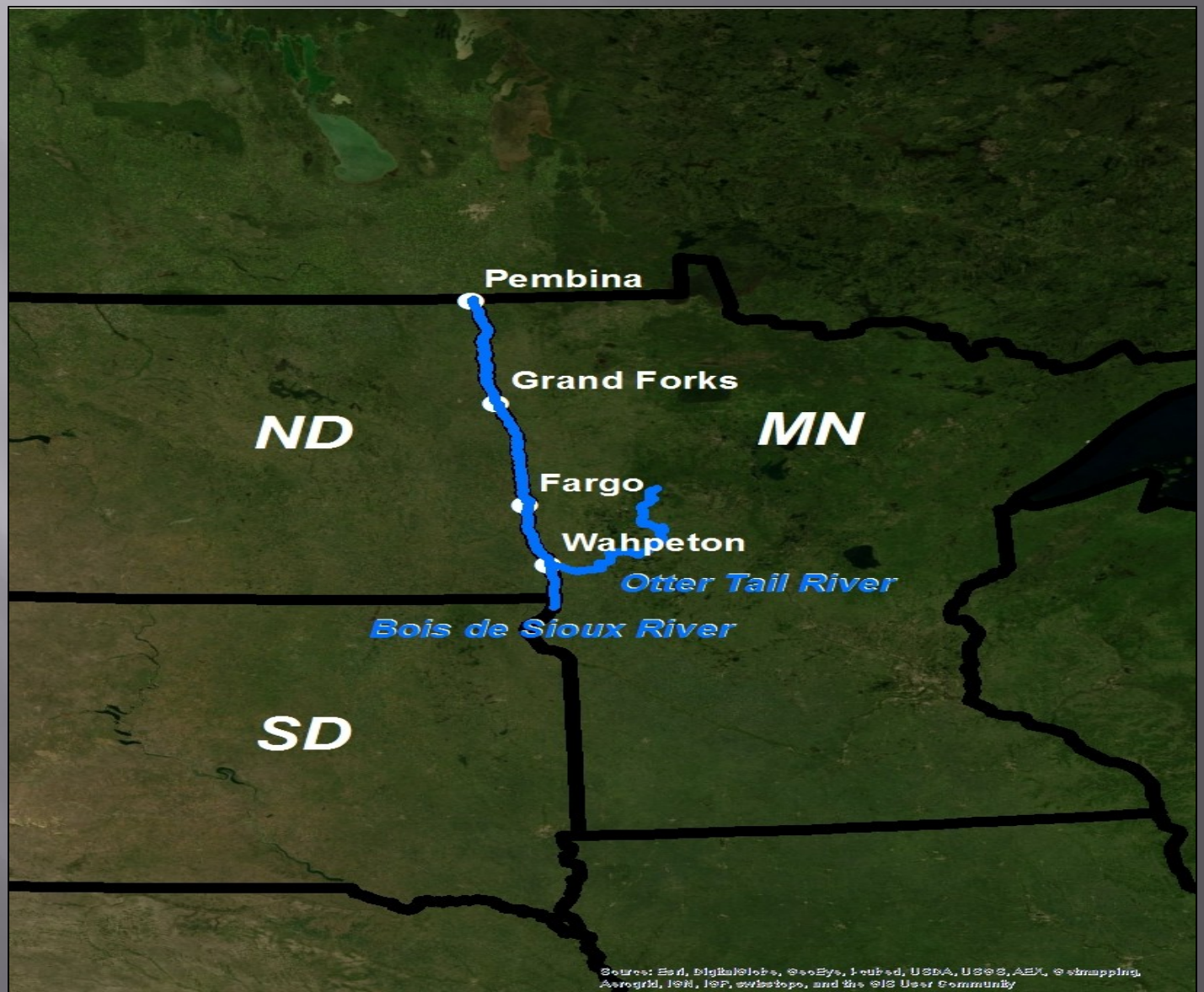
Chris O. Yoder
Research Director
Midwest Biodiversity Institute
PO Box 21561
Columbus, OH 43221

NORTH DAKOTA
DEPARTMENT *of* HEALTH

Outline

- Study Area
- Background
- Objectives
- Study Design
- Methods
- Results
- Conclusions

Study Area


Pembina
Grand Forks
ND
MN
Fargo
Wahpeton
Otter Tail River
Bois de Sioux River
SD
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Background

- Concept developed following a 2005 Red River Ecosystem Assessment Workshop
- Originally planned sampling for 2009
  - River conditions precluded sampling
- Focused first on fish and habitat – also collected macroinvertebrate and water quality samples
- 54 sites visited from Aug. 18 – Sep 1, 2010

Objectives

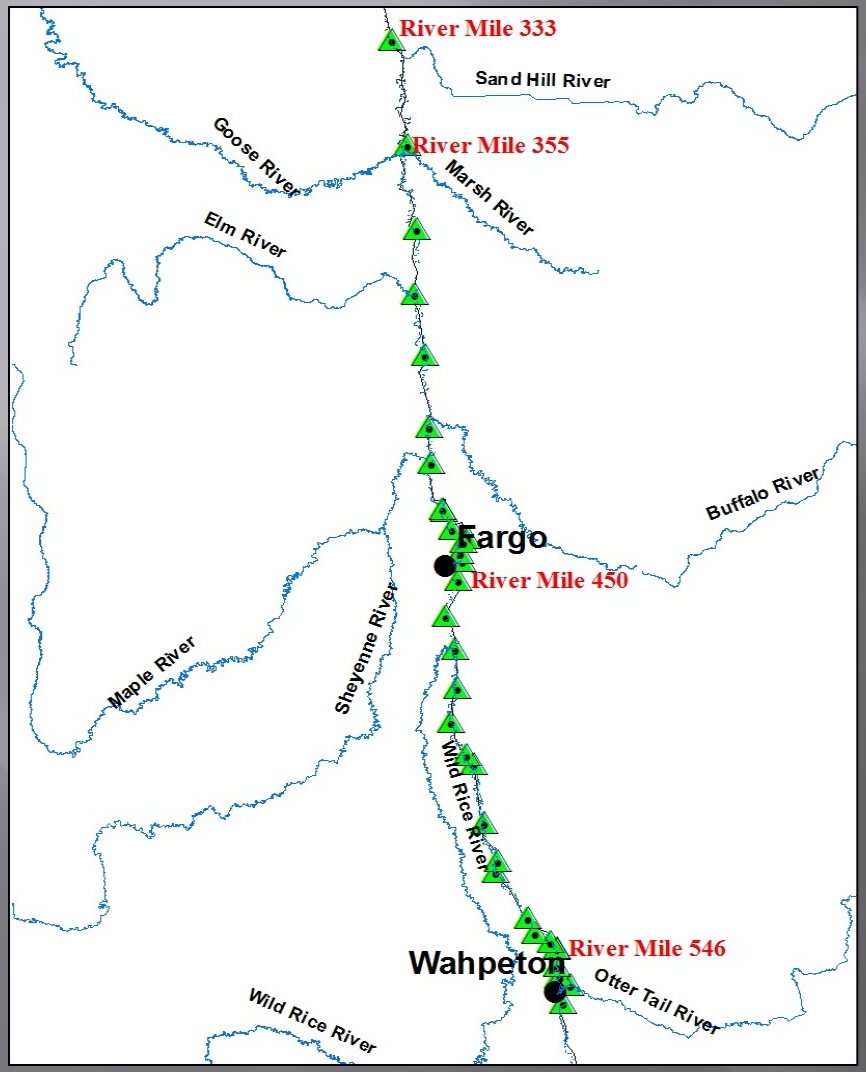
- Can the fish community effectively be sampled on the Red River?
- Develop Biocriteria for Red River
- Evaluate longitudinal trends of Red River
  - Upstream to downstream

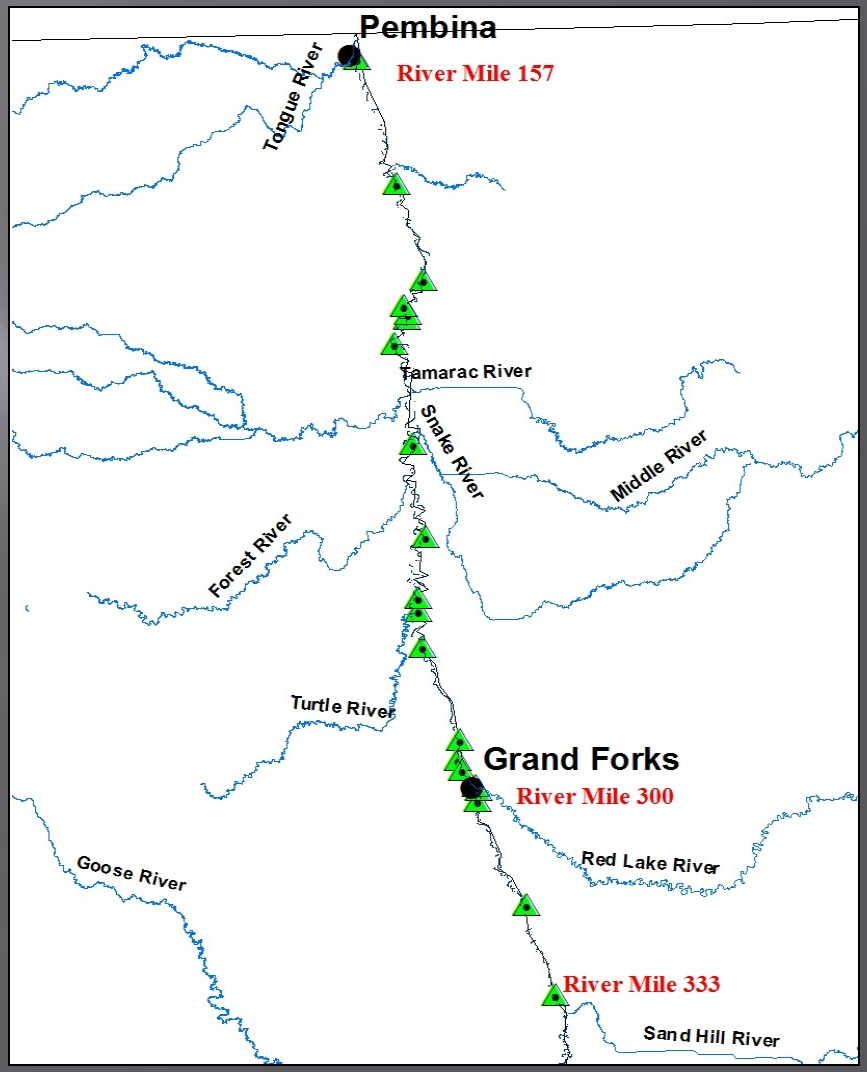
Study Design

Intensive Pollution Survey Design

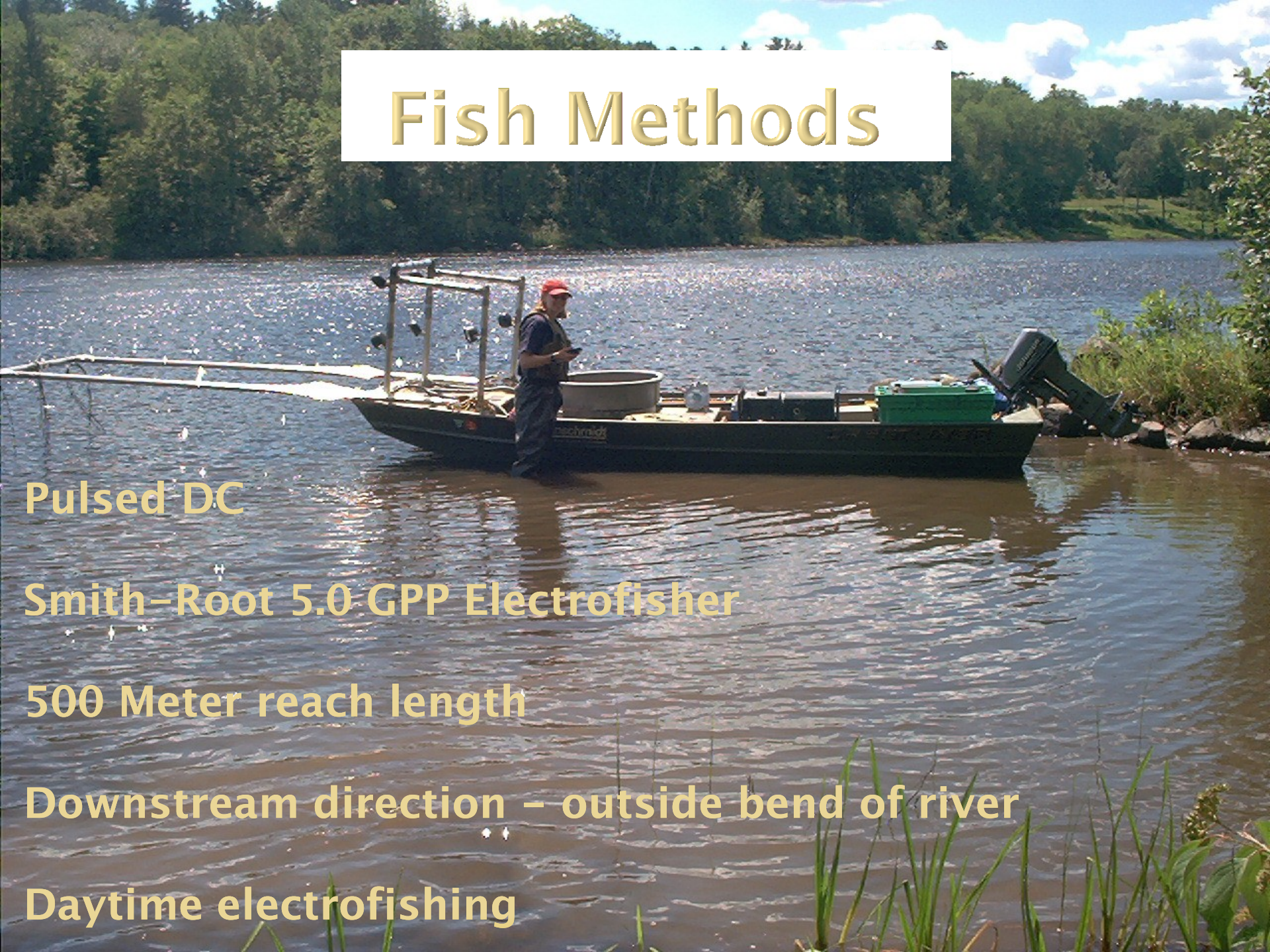
- Inventory of potential stressors
  - Wastewater treatment
  - Industrial discharges
  - Dams
  - Intermittent sources

Sampling Locations





Fish Methods



Pulsed DC

Smith-Root 5.0 GPP Electrofisher

500 Meter reach length

Downstream direction – outside bend of river

Daytime electrofishing

Habitat – (QHEI)

OhioEPA **Qualitative Habitat Evaluation Index and Use Assessment Field Sheet** QHEI Score: ☐

Stream & Location: _____ RM: _ _ _._ Date: _ _/_ _/_ _

Scorers Full Name & Affiliation: _____

River Code: _ _ _ - _ _ _ - _ _ _ STORET #: _ _ _ _ _ _ _ Lat./Long.: (NAD 83 - decimal °) _ _ _ . _ _ _ _ _ /8_ . _ _ _ _ Office verified location ☐

1] SUBSTRATE Check *ONLY* **Two** substrate *TYPE BOXES*; estimate % or note every type present

Check ONE (*Or 2 & average*)

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐☐ BLDR /SLABS [10]	____	____	☐☐ HARDPAN [4]	____	____
☐☐ BOULDER [9]	____	____	☐☐ DETRITUS [3]	____	____
☐☐ COBBLE [8]	____	____	☐☐ MUCK [2]	____	____
☐☐ GRAVEL [7]	____	____	☐☐ SILT [2]	____	____
☐☐ SAND [6]	____	____	☐☐ ARTIFICIAL [0]	____	____
☐☐ BEDROCK [5]	____	____	(Score natural substrates; ignore sludge from point-sources)		

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☐ 3 or less [0]

ORIGIN	EMBEDDEDNESS	QUALITY
☐ LIMESTONE [1]	SILT	☐ HEAVY [-2]
☐ TILLS [1]		☐ MODERATE [-1]
☐ WETLANDS [0]		☐ NORMAL [0]
☐ HARDPAN [0]		☐ FREE [1]
☐ SANDSTONE [0]		☐ EXTENSIVE [-2]
☐ RIP/RAP [0]		☐ MODERATE [-1]
☐ LACUSTURINE [0]		☐ NORMAL [0]
☐ SHALE [-1]		☐ NONE [1]
☐ COAL FINES [-2]		

Substrate ☐ Maximum 20

Comments

2] INSTREAM COVER Indicate presence 0 to 3: **0**-Absent; **1**-Very small amounts or if more common of marginal quality; **2**-Moderate amounts, but not of highest quality or in small amounts of highest quality; **3**-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

____ UNDERCUT BANKS [1]	____ POOLS > 70cm [2]	____ OXBOWS, BACKWATERS [1]
____ OVERHANGING VEGETATION [1]	____ ROOTWADS [1]	____ AQUATIC MACROPHYTES [1]
____ SHALLOWS (IN SLOW WATER) [1]	____ BOULDERS [1]	____ LOGS OR WOODY DEBRIS [1]
____ ROOTMATS [1]		

AMOUNT Check ONE (*Or 2 & average*)
☐ EXTENSIVE >75% [11]
☐ MODERATE 25-75% [7]
☐ SPARSE 5-<25% [3]
☐ NEARLY ABSENT <5% [1]

Cover Maximum 20 ☐

Comments

3] CHANNEL MORPHOLOGY Check ONE in each category (*Or 2 & average*)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☐ NONE [6]	☐ HIGH [3]
☐ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☐ MODERATE [2]
☐ LOW [2]	☐ FAIR [3]	☐ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Channel Maximum 20 ☐

Comments

4] BANK EROSION AND RIPARIAN ZONE Check **ONE** in each category for *EACH BANK* (*Or 2 per bank & average*)

River right looking downstream

L	R	EROSION	L	R	RIPARIAN WIDTH	L	R	FLOOD PLAIN QUALITY	L	R	
☐	☐	NONE / LITTLE [3]	☐	☐	WIDE > 50m [4]	☐	☐	FOREST, SWAMP [3]	☐	☐	CONSERVATION TILLAGE [1]
☐	☐	MODERATE [2]	☐	☐	MODERATE 10-50m [3]	☐	☐	SHRUB OR OLD FIELD [2]	☐	☐	URBAN OR INDUSTRIAL [0]
☐	☐	HEAVY / SEVERE [1]	☐	☐	NARROW 5-10m [2]	☐	☐	RESIDENTIAL, PARK, NEW FIELD [1]	☐	☐	MINING / CONSTRUCTION [0]
			☐	☐	VERY NARROW < 5m [1]	☐	☐	FENCED PASTURE [1]			
			☐	☐	NONE [0]	☐	☐	OPEN PASTURE, ROWCROP [0]			

Indicate predominant land use(s) past 100m riparian.

Riparian Maximum 10 ☐

Comments

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH Check **ONE** (*ONLY!*)
☐ > 1m [6]
☐ 0.7-<1m [4]
☐ 0.4-<0.7m [2]
☐ 0.2-<0.4m [1]
☐ < 0.2m [0]

CHANNEL WIDTH Check ONE (*Or 2 & average*)
☐ POOL WIDTH > RIFFLE WIDTH [2]
☐ POOL WIDTH = RIFFLE WIDTH [1]
☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY Check ALL that apply
☐ TORRENTIAL [-1]
☐ VERY FAST [1]
☐ FAST [1]
☐ MODERATE [1]
☐ SLOW [1]
☐ INTERSTITIAL [-1]
☐ INTERMITTENT [-2]
☐ EDDIES [1]
Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Pool / Current Maximum 12 ☐

Comments

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (*Or 2 & average*). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☐ BEST AREAS > 10cm [2]	☐ MAXIMUM > 50cm [2]	☐ STABLE (e.g., Cobble, Boulder) [2]	☐ NONE [2]
☐ BEST AREAS 5-10cm [1]	☐ MAXIMUM < 50cm [1]	☐ MOD. STABLE (e.g., Large Gravel) [1]	☐ LOW [1]
☐ BEST AREAS < 5cm [metric=0]		☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☐ MODERATE [0] ☐ EXTENSIVE [-1]

Riffle / Run Maximum 8 ☐

Comments

6] GRADIENT (ft/mi)
DRAINAGE AREA (mi²)
☐ VERY LOW - LOW [2-4]
☐ MODERATE [6-10]
☐ HIGH - VERY HIGH [10-6]

%POOL: ☐ %GLIDE: ☐
%RUN: ☐ %RIFFLE: ☐

Gradient Maximum 10 ☐

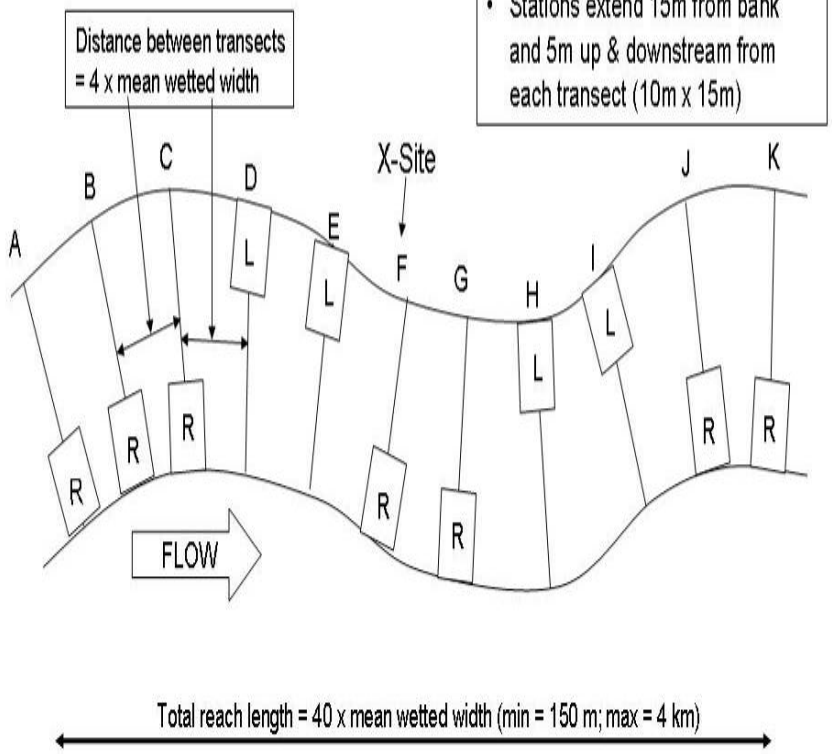
EPA 4520 06/16/06

Macroinvertebrate Methods

- ✓ Upstream endpoint is "Transect A"
- ✓ Downstream endpoint is "Transect K"

Sampling Stations

- L = left; R = right
- 1st station (at transect A) determined randomly; subsequent stations assigned systematically
- Stations extend 15m from bank and 5m up & downstream from each transect (10m x 15m)



*Adapted from 2009 NRSA field manual

In Situ Measurements

- Temperature
- Dissolved Oxygen
- pH
- Conductivity

Water Quality

Logistics

Results - Fish

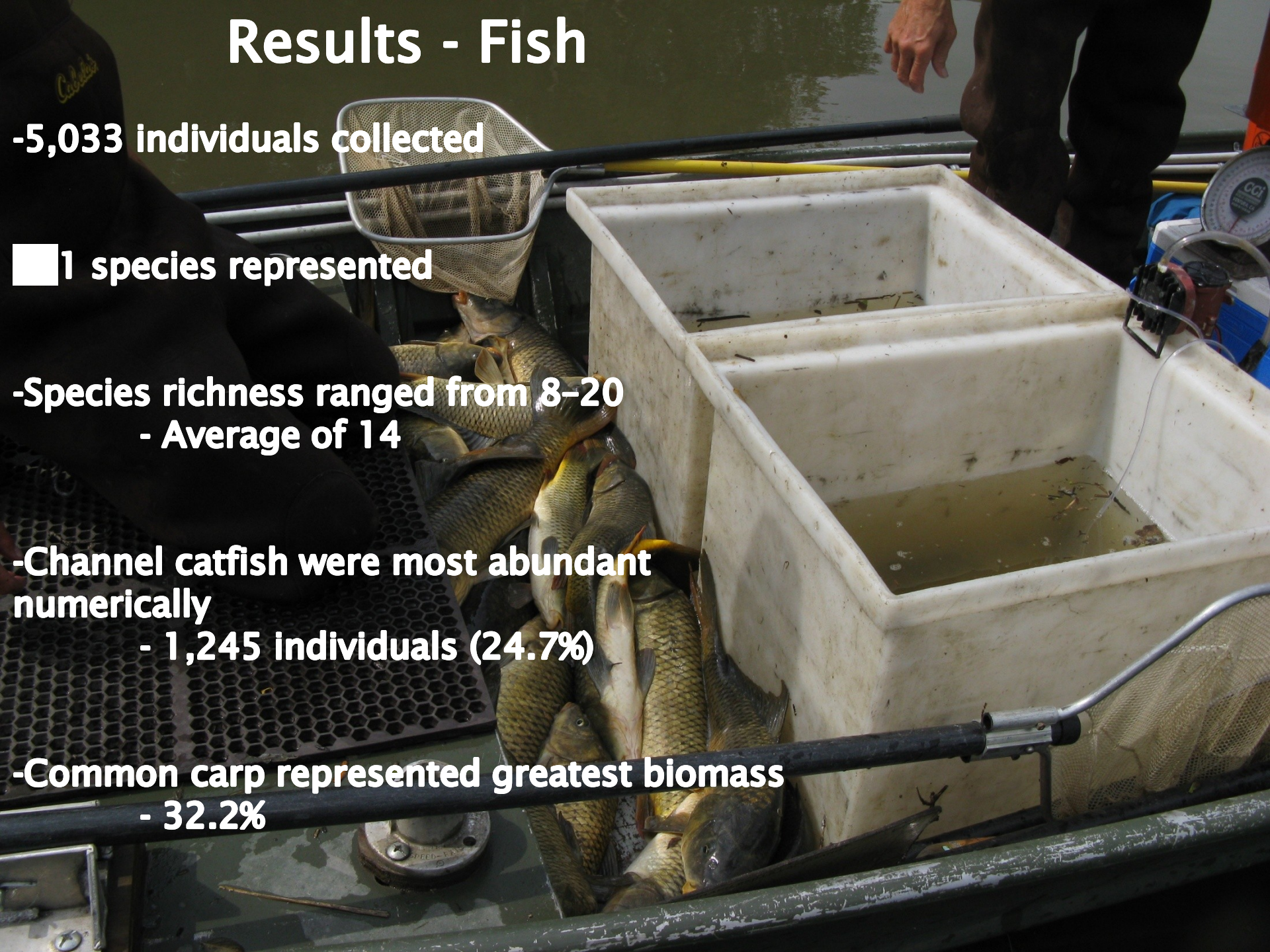
-5,033 individuals collected

-41 species represented

-Species richness ranged from 8–20
- Average of 14

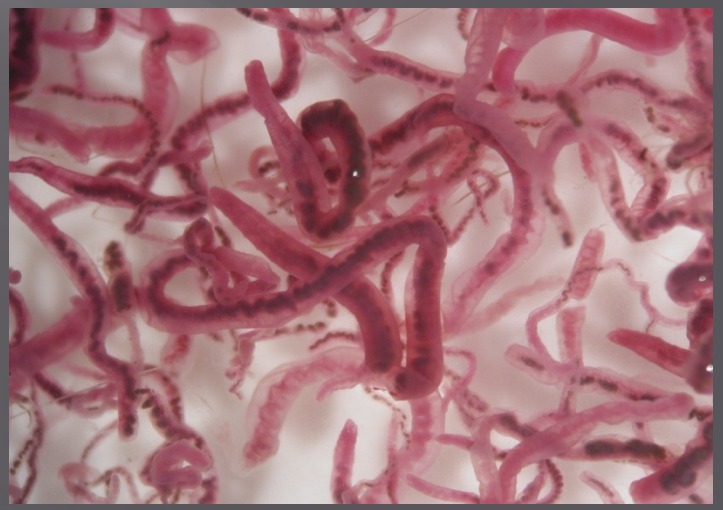
-Channel catfish were most abundant numerically
- 1,245 individuals (24.7%)

-Common carp represented greatest biomass
- 32.2%



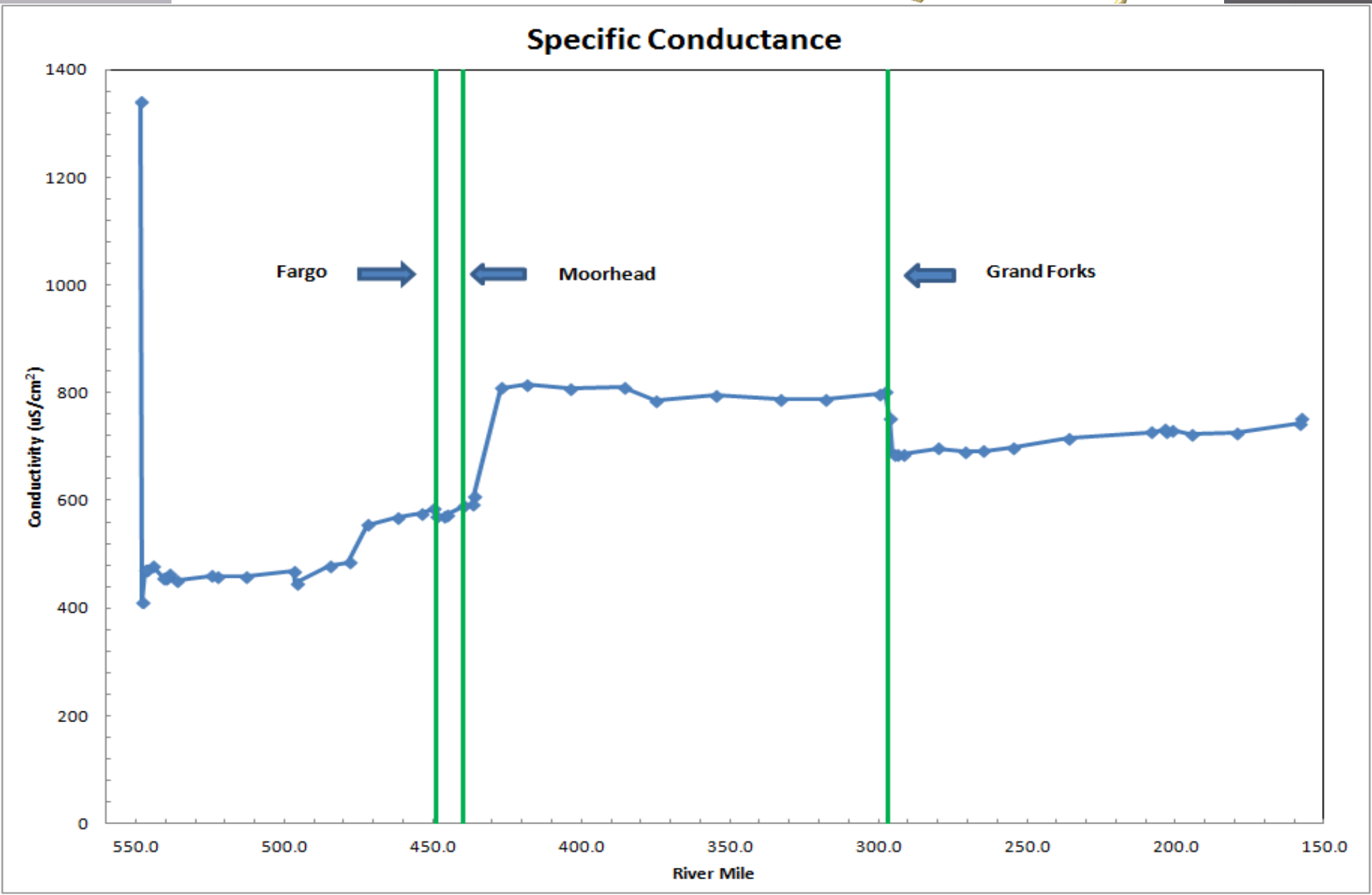
Results – Macroinvertebrates

- Total taxa ranged from 7 – 40
  - Average of 23
- Most abundant taxa
  - Chironomidae (32%)
  - Oligochaeta (16%)

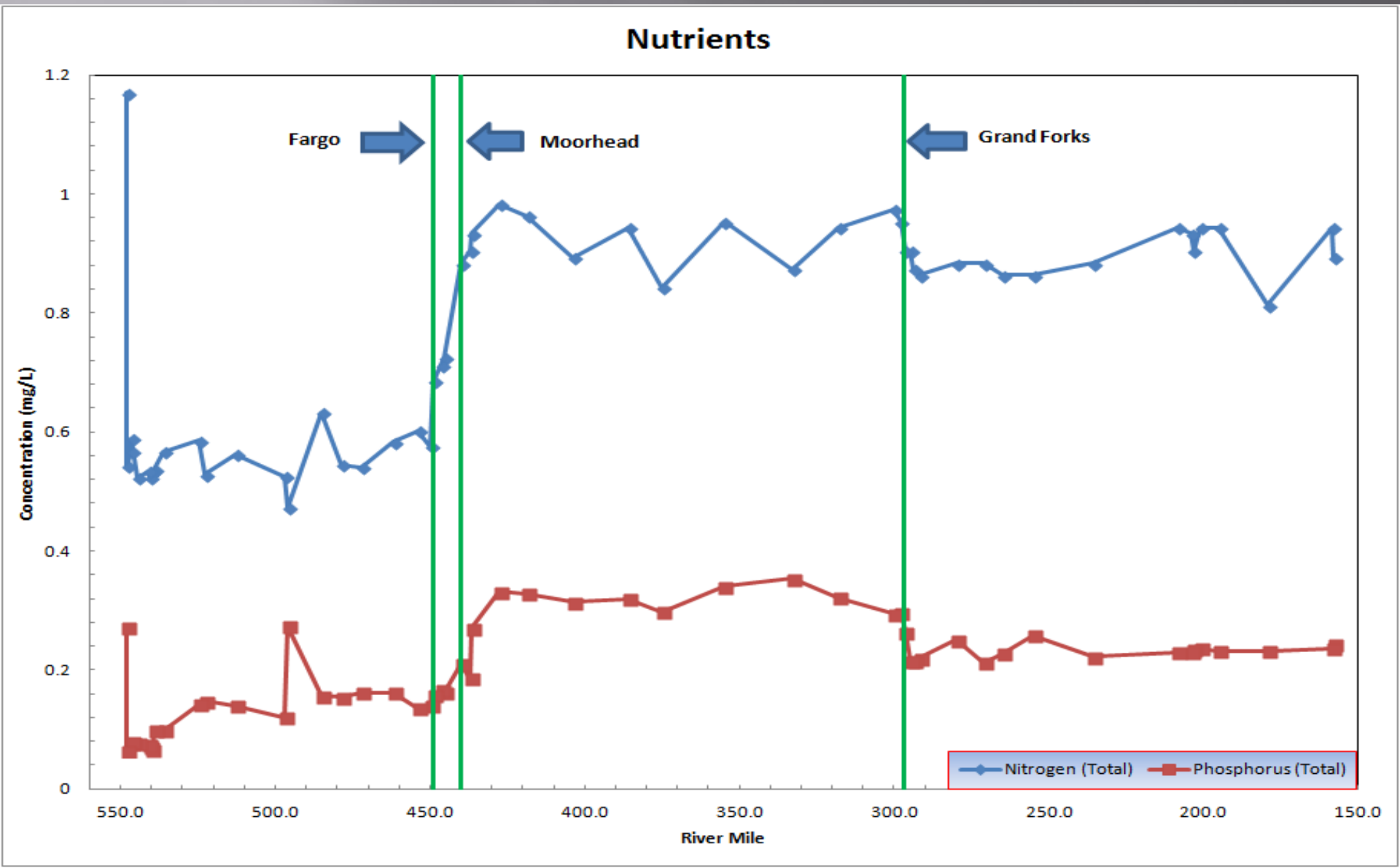


Red River
8/27/2010 RM 318.0
UST. Thompson Rd. bridge
2010WA1-33

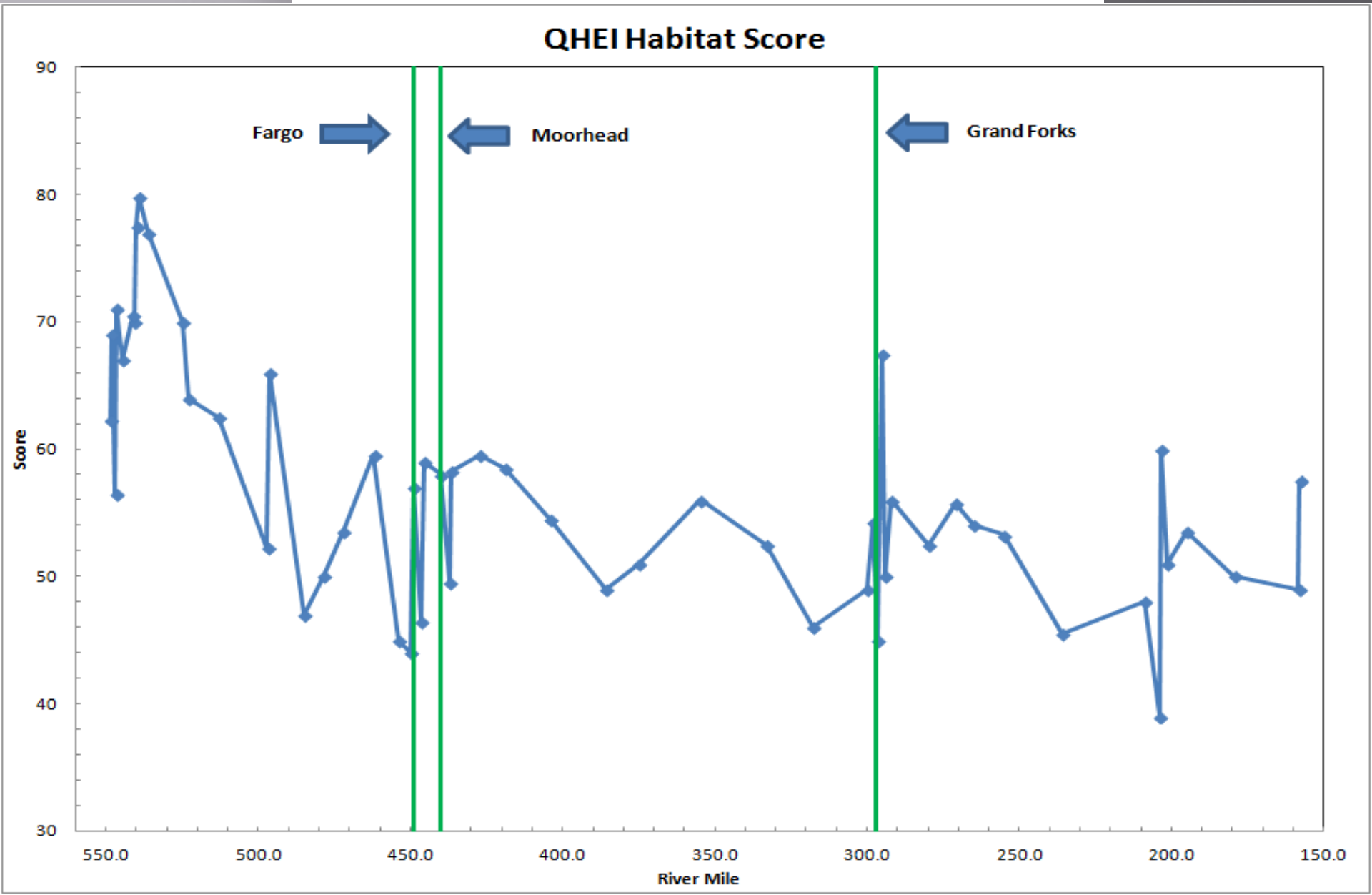
Results – Water Quality



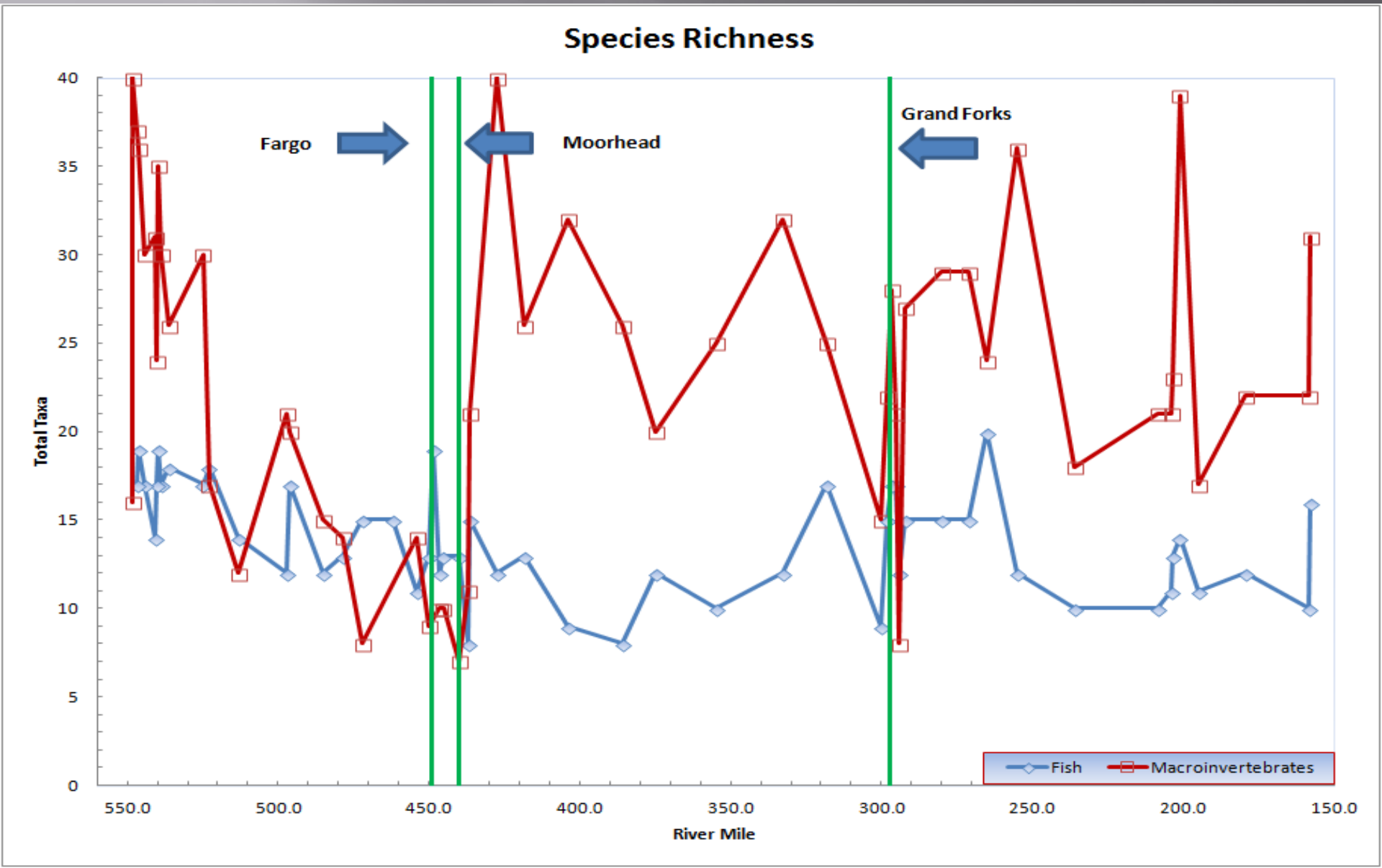
Results – Water Quality



Results – Habitat



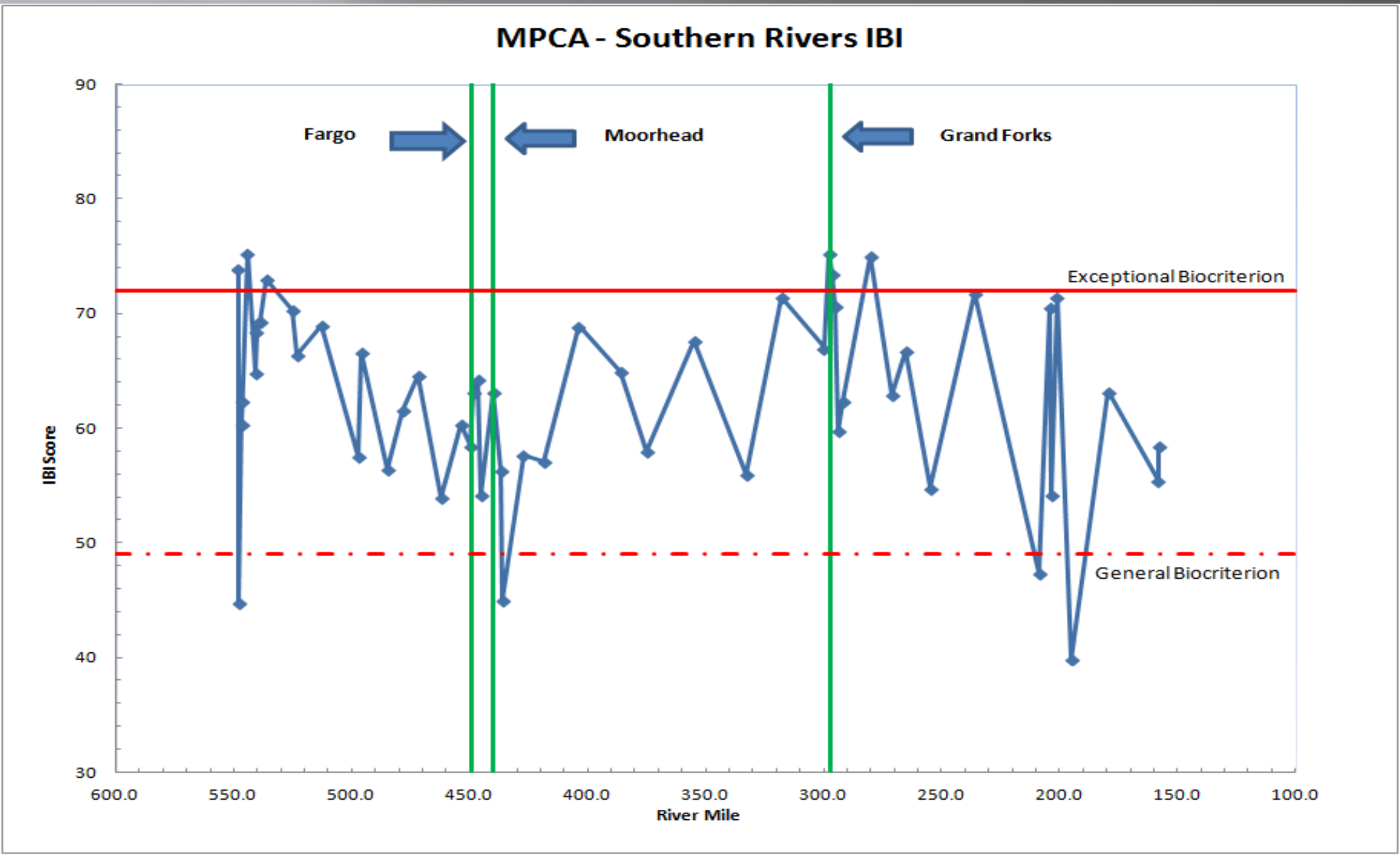
Results – Fish and Macroinvertebrates



Data Analysis

- Minnesota Pollution Control Agency (MPCA) has developed a Southern Rivers Index of Biotic Integrity (IBI) which includes the Red River of the North

Results – Use Attainment



Conclusions & Next Steps

- Fish community was successfully sampled
- Habitat attributes a key component for fish community
- Most sites meet general use criteria
- Further macroinvertebrate and chemical analysis to be completed in near future
- Identify potential stressors

Acknowledgements

- Midwest Biodiversity Institue
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QUESTIONS?