Monitoring fishery response to remediation and restoration in the Upper Clark Fork

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Purpose

- Evaluate program effectiveness
  - Document successes
  - Explain failures
- Recommend future direction
- Provide information to the public

In other words…

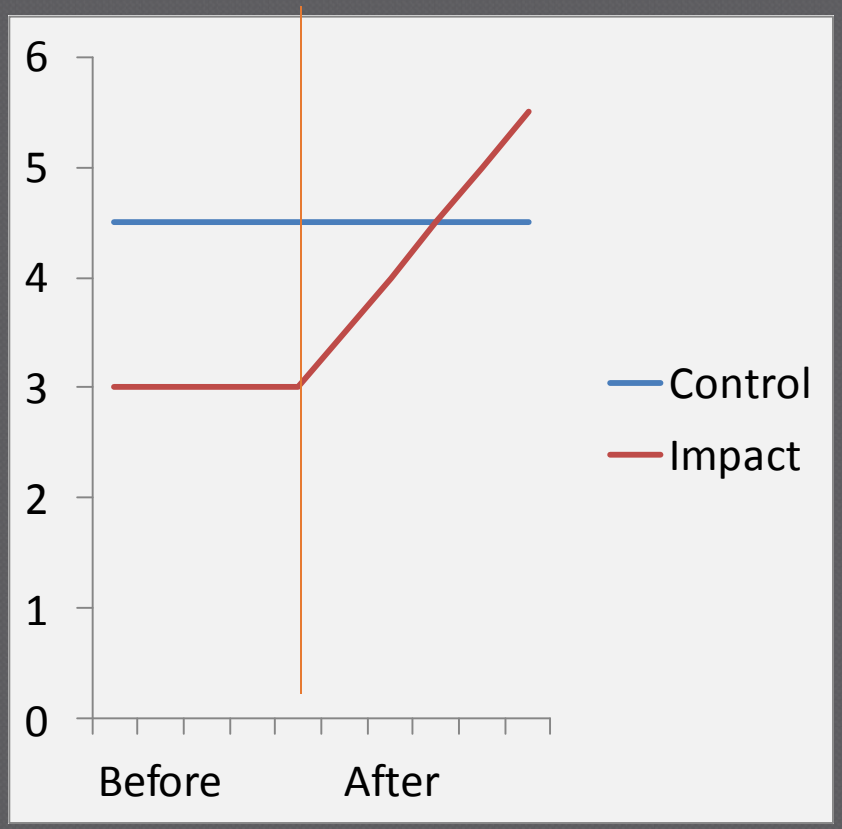
- It's cool!
  - Big – ecosystem level
  - Ambitious – lots of work
  - Making a difference
  - Making history
- …and a challenge

Spatial and temporal scales

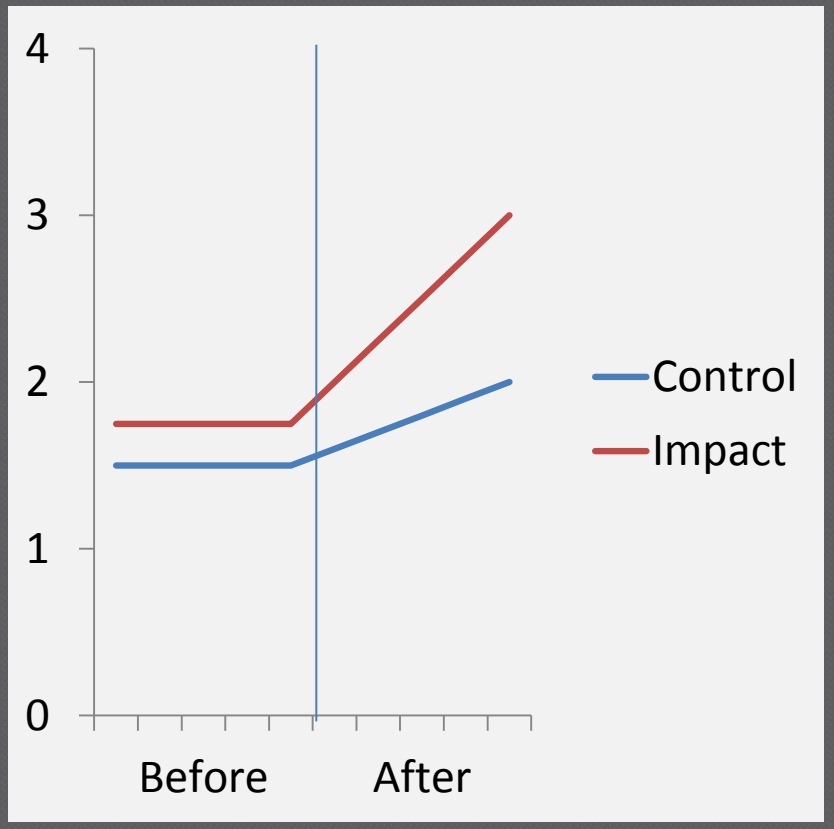
- Spatial
  - Project
  - Watershed
  - Basin
  - Biological (sub pops, species, communities, ecosystems)
  - Remediation and/or restoration effects
- Temporal
  - Immediate, years and decades
  - A mix
    - Culvert removed but generation(s) for fishery response

A couple, simple scenarios

BOTH CONSTANT, PROJECT INCREASE



BOTH INCREASE, PROJECT MORE SO



Ideal vs. real world

IDEAL

- Data is plentiful and precise
- Impact has defined time and space
- Response is solely affected by impact
- Controls are similar to impact in all aspects except event

REALITY

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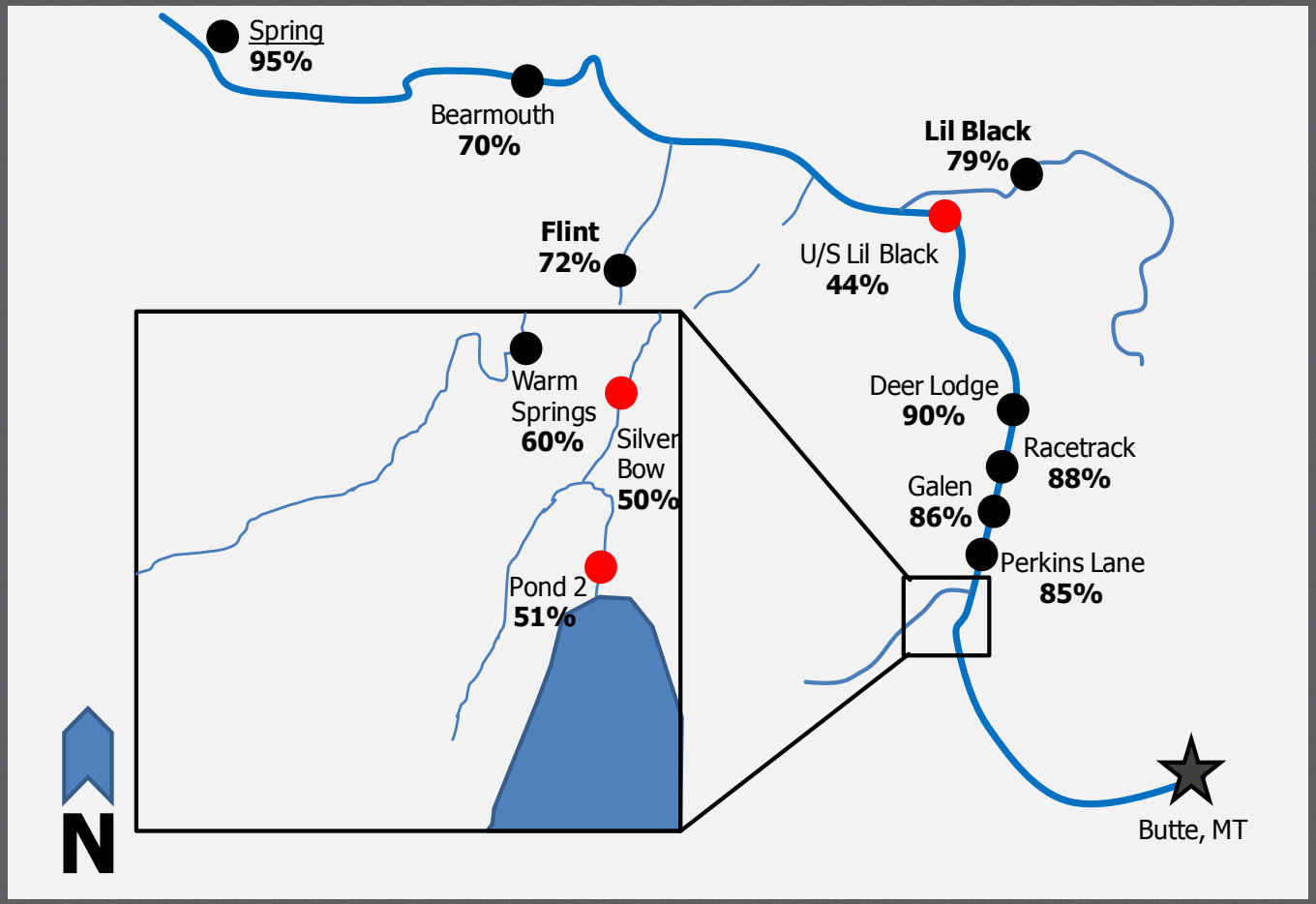
REALITY

- Data is limited and variable
- Impact happens over time and varies through space
- Response is affected by many factors (fish move)
- Controls have their own, unique issues

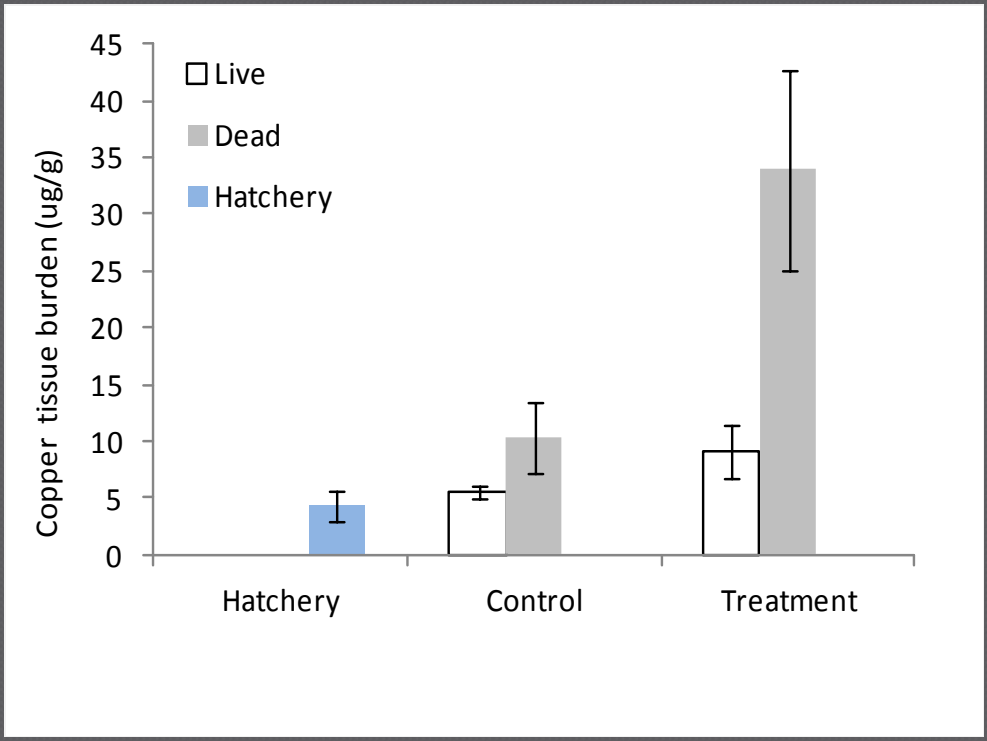
The "not so ideal but ending happily" caged fish story



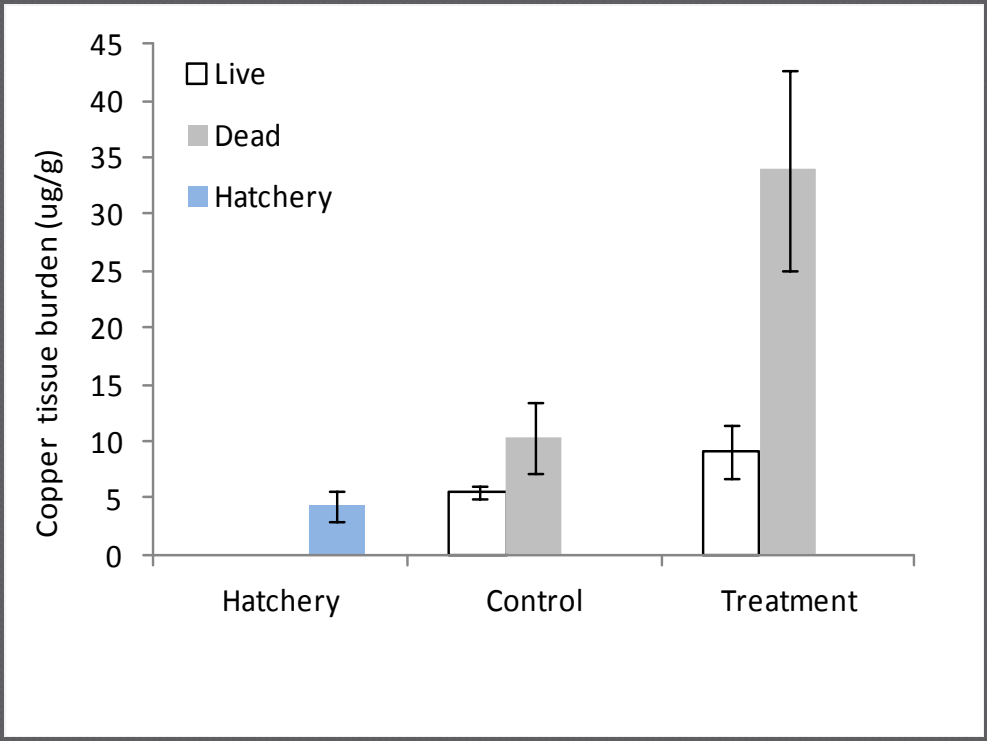
- Survival in tributaries (controls) was less than many mainstem (impacted) sites

- Tributaries have their own “issues”

- Mortality was more fish specific than site specific



- Metals burden provided a characterization we couldn't make with survival
  - we have a baseline to measure benefits of cleanup.



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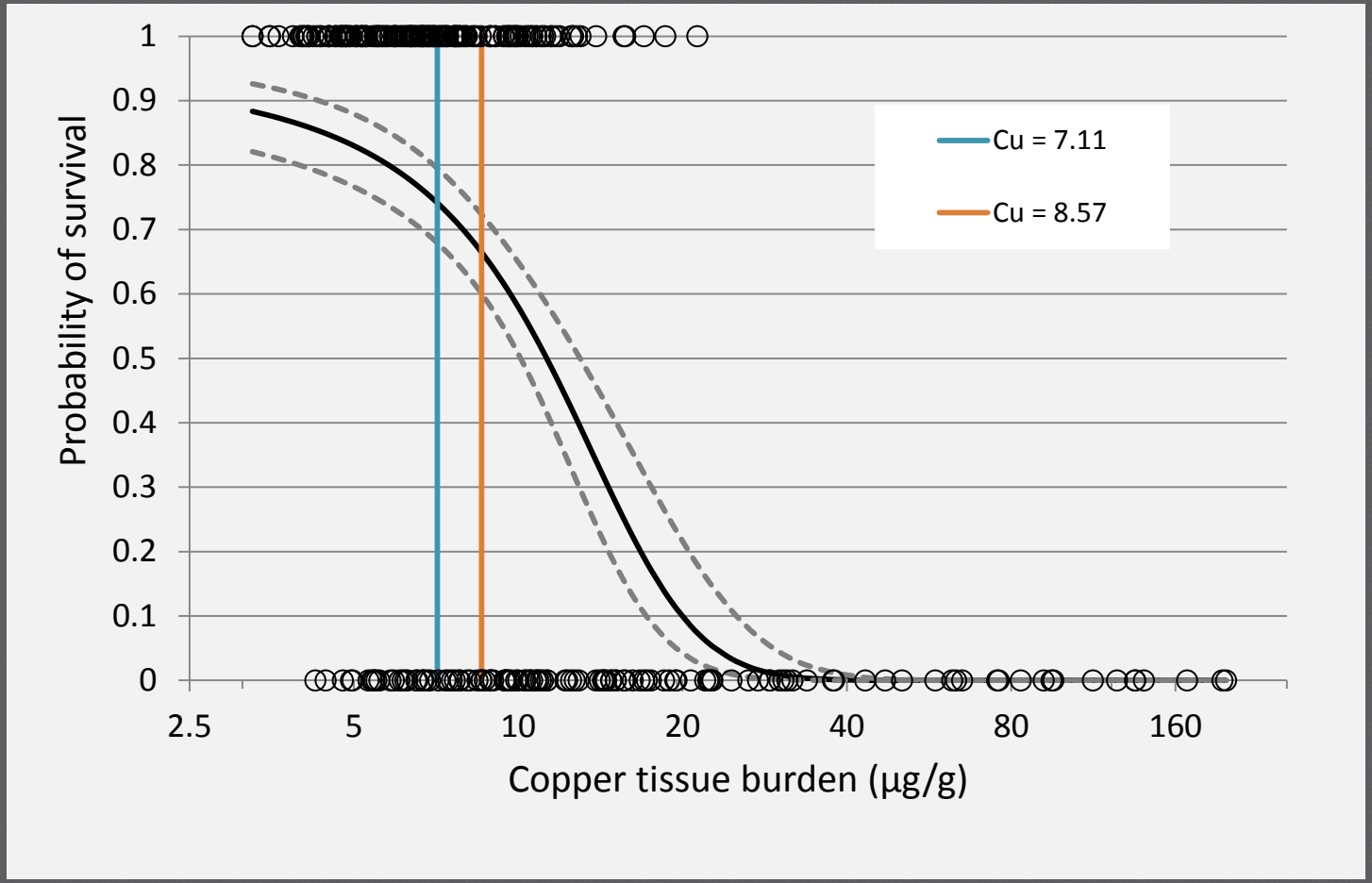
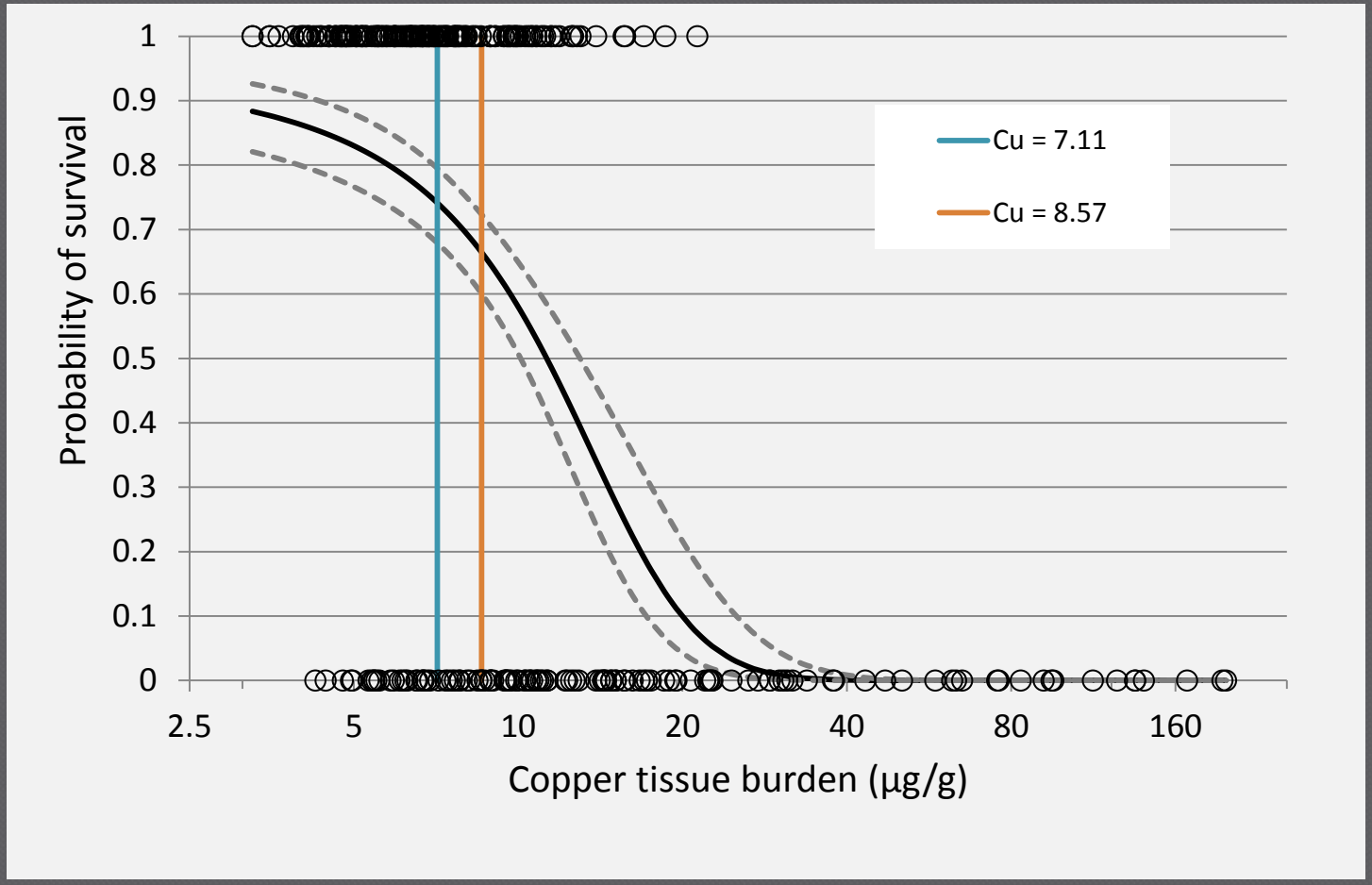
- Live vs. dead burdens suggested a predictor of survival
  – if so, a basin-specific relationship that links metals burden directly to young trout survival is possible


Probability of survival
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2.5
5
10
20
40
80
160
Copper tissue burden (µg/g)
Cu = 7.11
Cu = 8.57

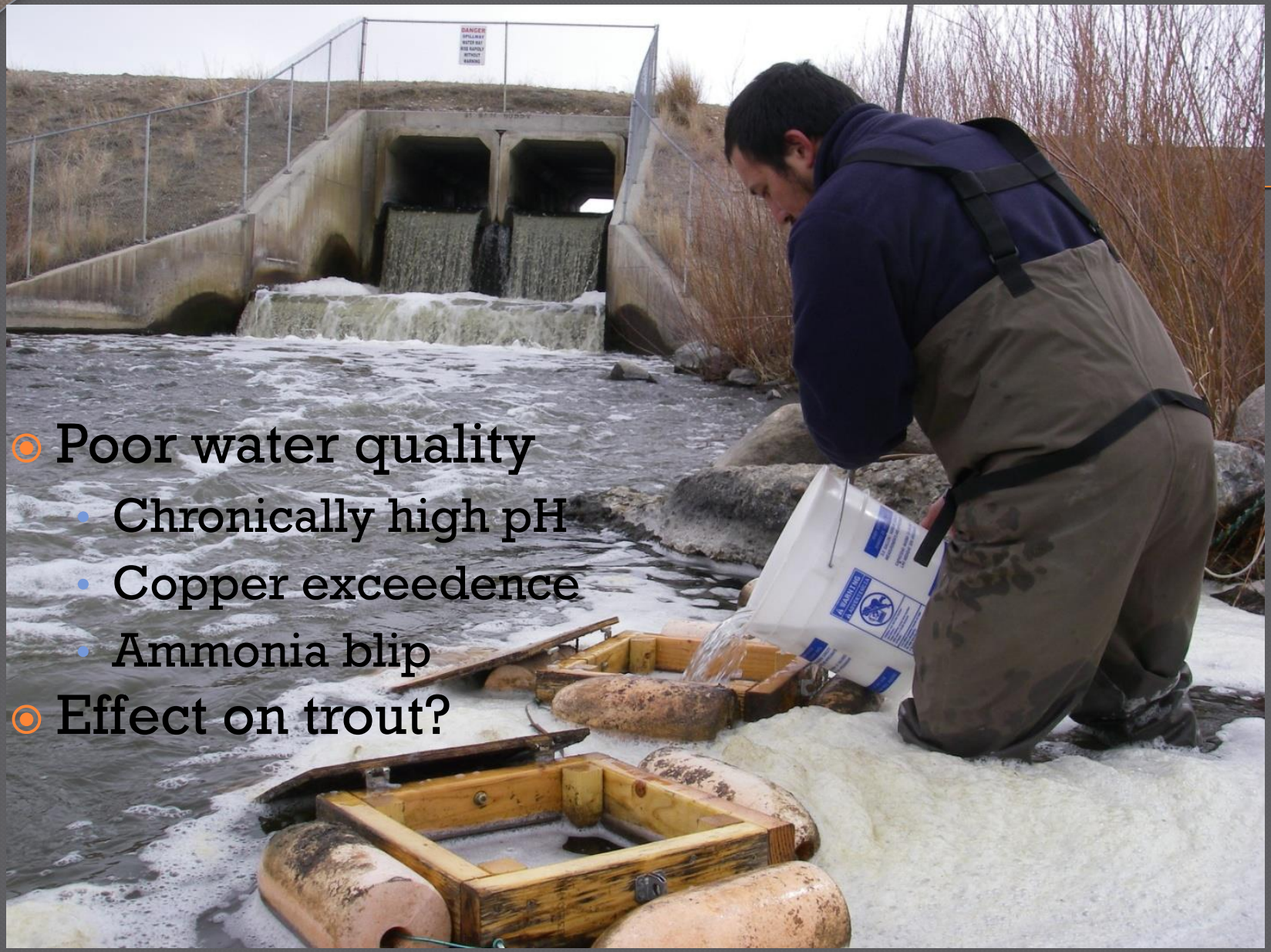


Model	Cu P-value	Zn P-value	McFadden R2	ROC	AIC
2.848 - 0.253*Cu	< 0.001		0.275	0.811	304.939
5.602 - 0.027*Zn		< 0.001	0.256	0.829	313.152
5.907 - 0.200*Cu - 0.018*Zn	< 0.001	< 0.001	0.36	0.863	271.979

- Temperature was not included in the model by the analysis

Caged fish results

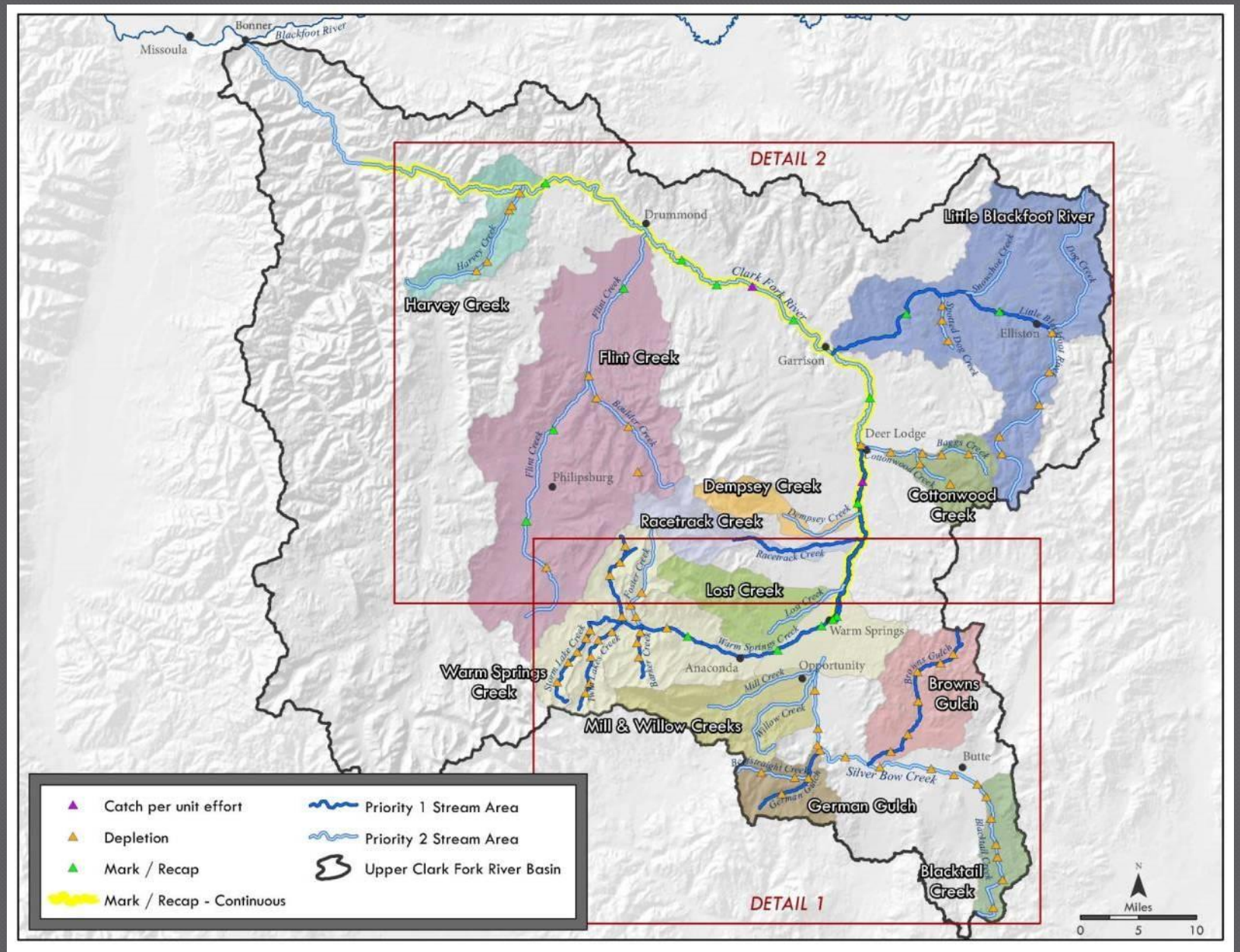
- Baseline metals burden data can be used to measure benefits of cleanup
- A site-specific model that links metals burden to survival of young trout (the Achilles heel of the Clark Fork)
- High water temperature was not influential in predicting survival of trout
  - May reduce burden needed to affect survival during summer



- Poor water quality
  - Chronically high pH
  - Copper exceedence
  - Ammonia blip
- Effect on trout?

Future monitoring: dealing with the less than ideal

- Start collecting data NOW!
  - Efficient, cost-effective sampling
- Strategic sampling
  - Priority Streams
  - Anticipate projects
  - Anticipate controlling for change
- Coordinate between disciplines and with project managers


DETAIL 2
DETAIL 1
Missoula
Bonner
Blackfoot River
Drummond
Clark Fork River
Garrison
Harvey Creek
Flint Creek
Little Blackfoot River
Elliston
Deer Lodge
Philipsburg
Dempsey Creek
Racetrack Creek
Cottonwood Creek
Lost Creek
Warm Springs
Warm Springs Creek
Anaconda
Opportunity
Mill & Willow Creeks
Browns Gulch
Butte
Silver Bow Creek
German Gulch
Blacktail Creek
Catch per unit effort
Depletion
Mark / Recap
Mark / Recap - Continuous
Priority 1 Stream Area
Priority 2 Stream Area
Upper Clark Fork River Basin
N
Miles
0
5
10

Program goals and monitoring response

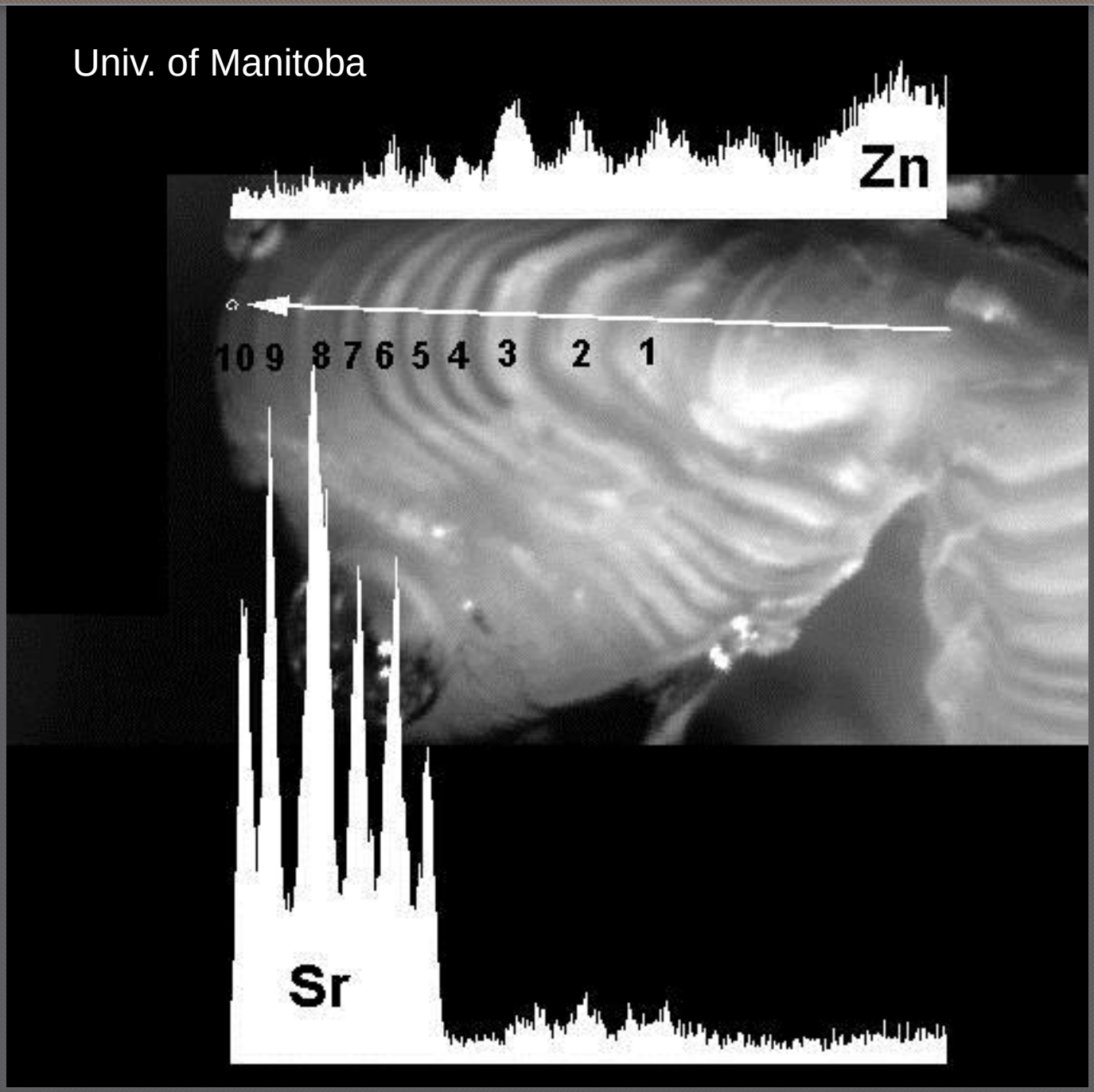
- Restore mainstem fisheries
  - Better survival, more natives
- Enhance tributary populations
  - Improve use of mainstem
  - Larger systems are fisheries, too
- Conserve remaining native trout populations
  - Get some use of mainstem
- Evaluate effects of construction
  - Fish abundance and survival

Primary Methods

- Population surveys (Electrofishing)
- Otolith microchemistry
  - Survival
  - Origin
- Caged fish
- Genetics and tagging
- Trapping


DEERE

Univ. of Manitoba




Genetics
and
Tagging


Oregon State Univ.

Conclusion

- Biological assessments can be messy, but yield good information
- Strategic sampling and early data collection helps
- Information sharing and coordination is essential
- Monitoring is necessary to maximize resource benefits and document this historical event

Acknowledgements

- DEQ: caged fish and mainstem fish pops
- NRD: trib prioritization
- FWP personnel
  - Nathan Cook
  - Brad Liermann
  - Jason Lindstrom
  - Trevor Selch
- DEQ, NRD & FWP: future monitoring