Stream Habitat Restoration Evaluations

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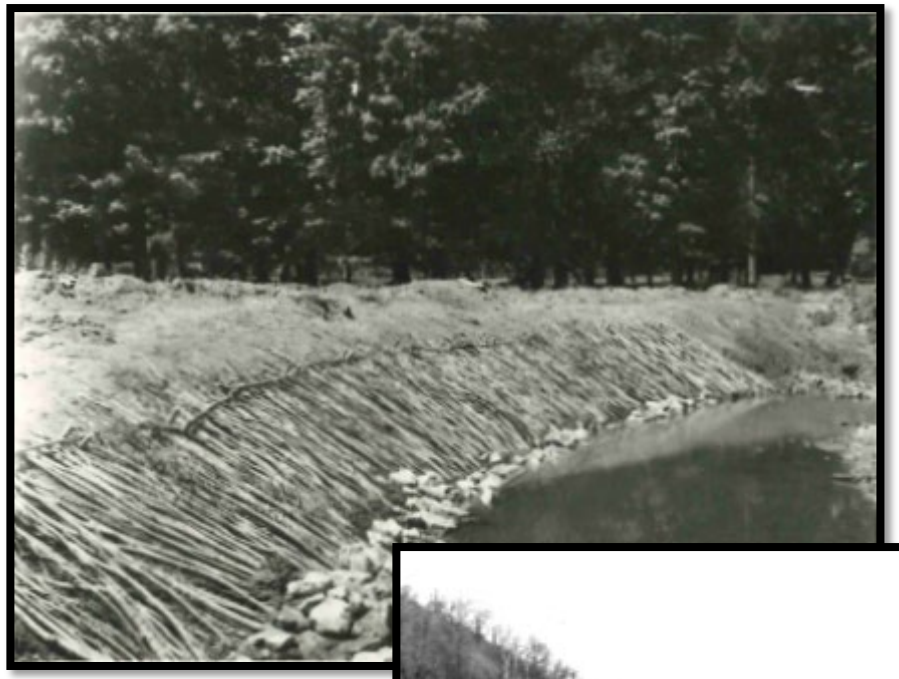
DEPARTMENT OF NATURAL RESOURCES

Outline

- Brief history (background & context)
- Key evaluation/research questions
  - Three broad areas
- Request for assistance



1940s, 1950s, 1960s: Flooding, bank erosion & siltation

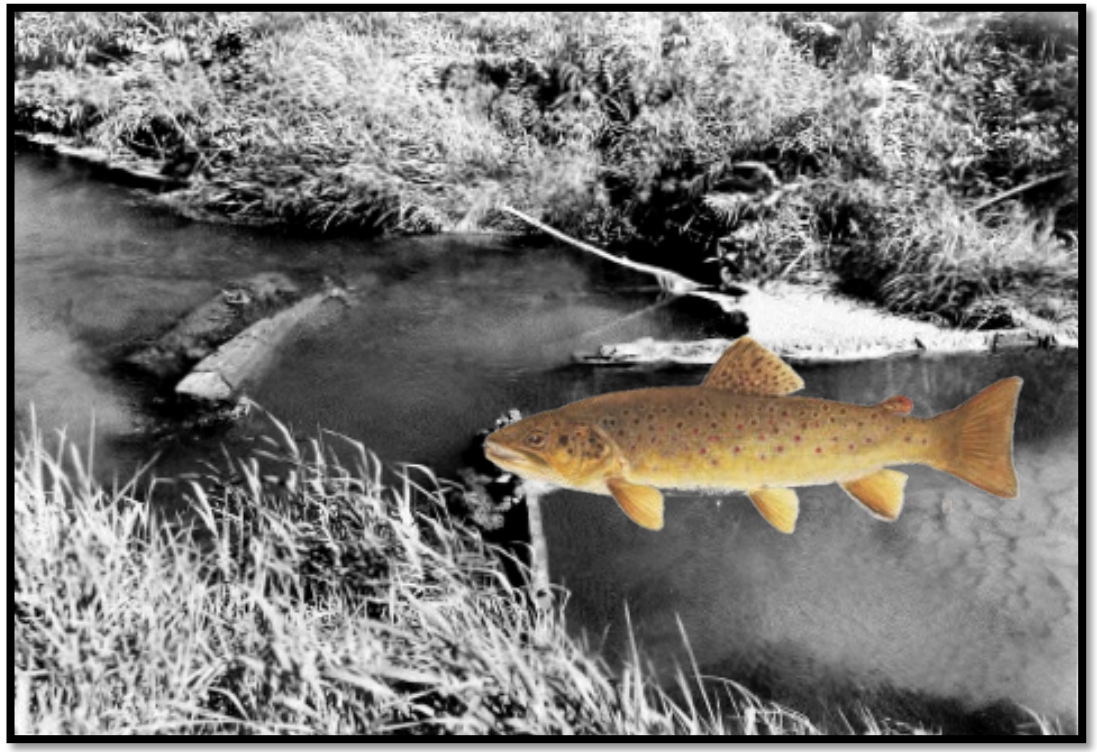
- Willow mats, revetments
- Some bank sloping
- Bank armoring – Riprap, sheet piling, old car bodies, etc.

1940s-1960s Techniques ≠ more fish

1960-1990s: INSTREAM cover (esp. adult cover) limiting

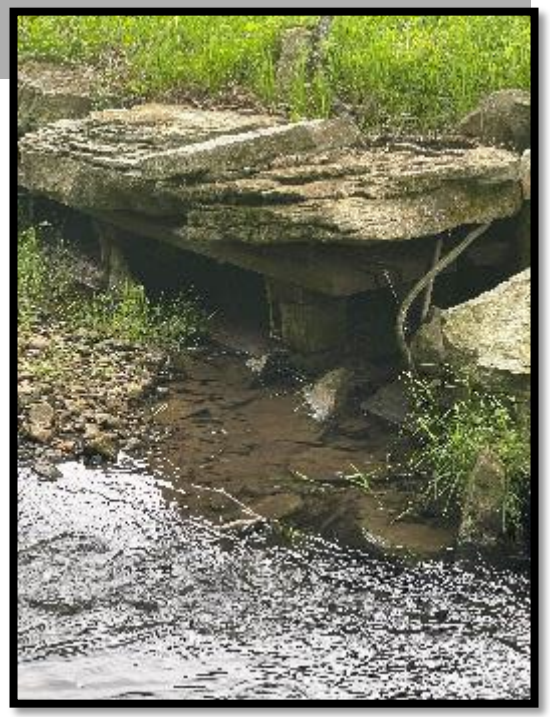
- Hewitt ramps, instream rocks, deflectors, overhead bank cover (cribs, LUNKERs)
- Some channel narrowing & deepening

- Some evaluations (mostly short term: 2-4 years, Brown Trout response)
- More adult Brown Trout



Why not just continue?

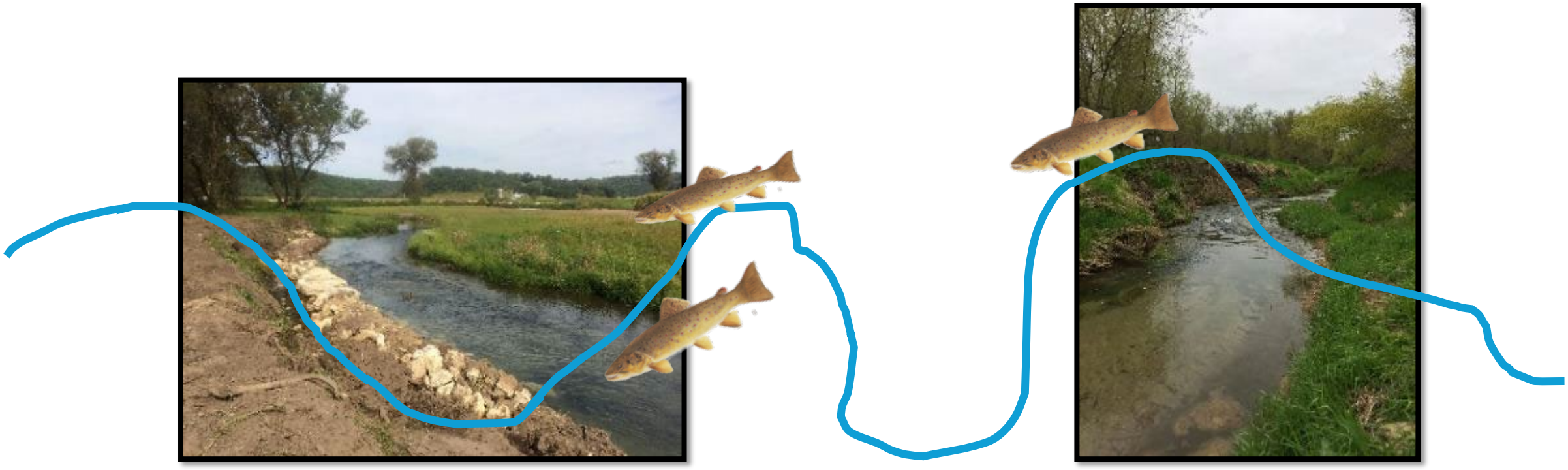
- Several observed issues, concerns, unknowns
  - ❖ Frequent & ongoing maintenance
    - ❖ Observed but rarely quantified (how long do projects last?)
  - ❖ Have benefits (fish habitat & abundance) stopped?
    - ➢ Short-term evaluations



Immediately after a project = many large Brown Trout

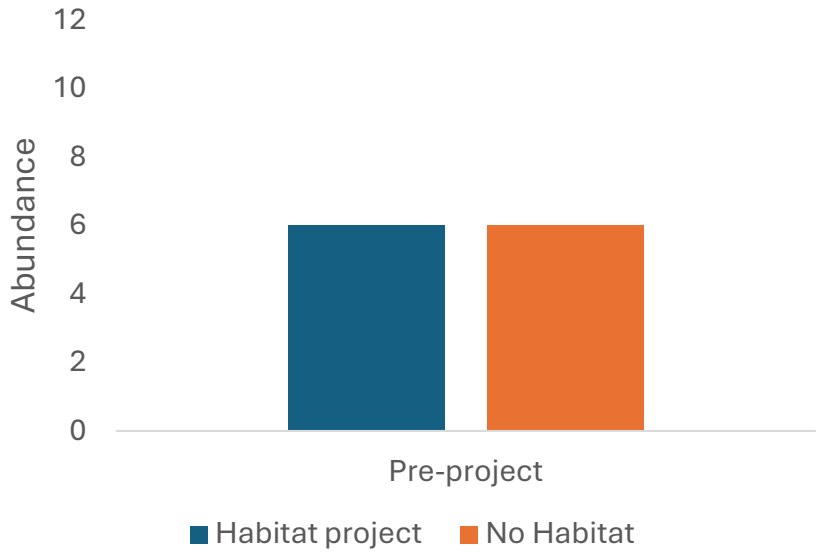
Where from?

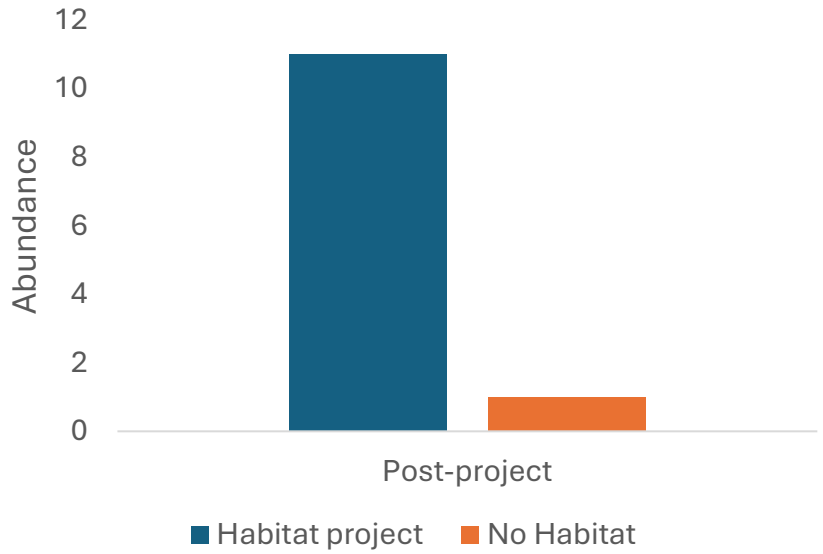
- Recruitment – take years
- Survival & growth – take 1-2 years
- Immigration?



Concern

- Increase production
  or
- Redistribution?





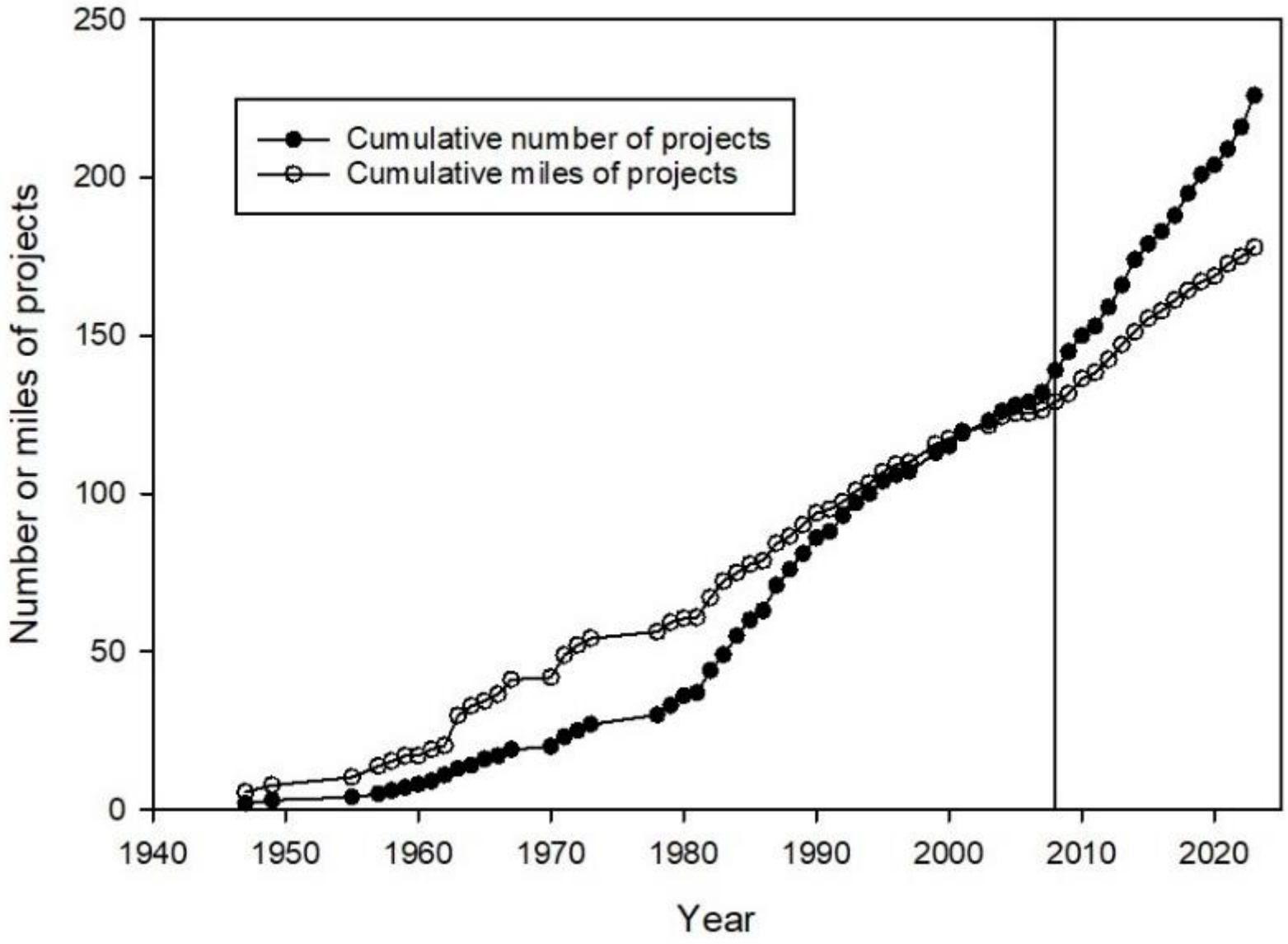
Why did so many older habitat projects need maintenance?

- Several constraints
  - Riparian widths too narrow
  - Equipment (by hand!)
  - Limited funding
  - Knowledge (geomorphology)

CLEAN WATER LAND & LEGACY AMENDMENT

Increased funding

- More projects
- Via more agencies, conservation groups & companies
- = greater variety of habitat project designs



BANK PROTECTION

More Rock	Less rock & more wood	Mostly wood

Bank sloping & floodplain creation:

various amounts







Key evaluation questions:

1. How long do stream projects last?

2. How long do project benefits last (fish habitat, fish populations):

3. Where do “new” fish come from?

1. How long do stream habitat projects last (survive)?

    a. Approach (survival analysis)

    b. What factors influence longevity?
        i. Intrinsic & extrinsic factors

    c. Define “failure/death”

    d. PRELIMINARY DATA (not complete yet)

    e. Compare costs

Approach-How long do projects last (medical analogy)

Diagnose problem

Treatment

33% survive for 10 years or mean years

Time to an event (e.g., death)

2nd treatment

66% survive

Diagnose problem

Treatment-project

How long does project survive

How long do projects last before they fail/die?

- Approach-compile project histories, model survival, test covariates (other factors)
  - What other factors might influence survival? SEVERAL!!
    - Extrinsic – land use (watershed, riparian), valley slope, etc.
    - Intrinsic-cost, rock amount, DESIGN**

How long do projects last before they fail?

- How do you define “failure/death” ≈ Maintenance
- But another issue……..

Preliminary Data

Survival Analysis

Survival times (suite of models available)

- Kaplan-Meier estimator:
- Minor maintenance is needed
- Complete Redo of the project area was completed.

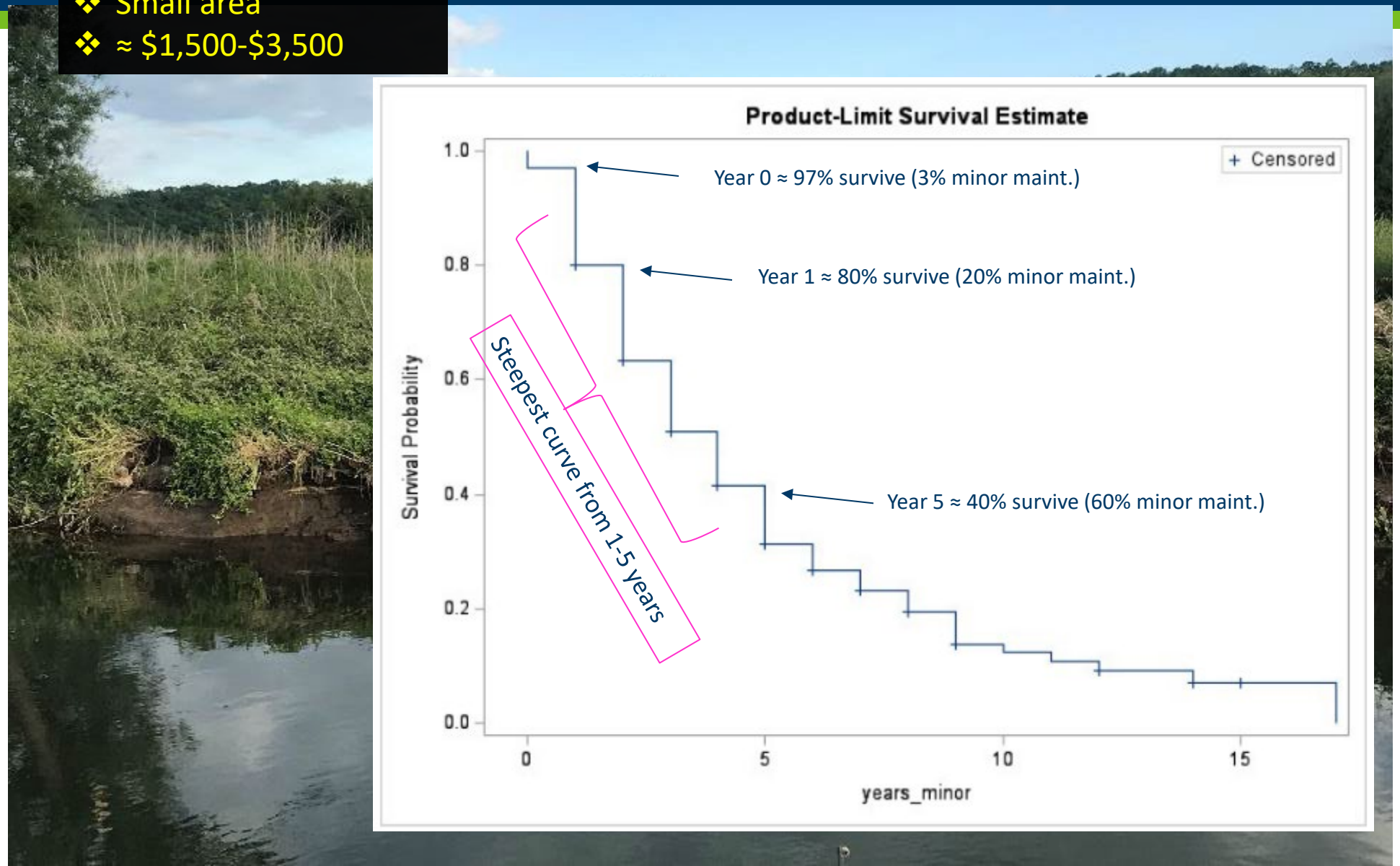
*Some preliminary grouping of project designs (e.g., amount of sloping/seeding, RR, overhead cover, wood cover)

- Design A
- Design B
- Design C
- Design D

Preliminary Data

Minor maintenance

- Remove flood debris
- Repair a bank or two
- Install channel block
- Small area
- ≈ $1,500-$3,500



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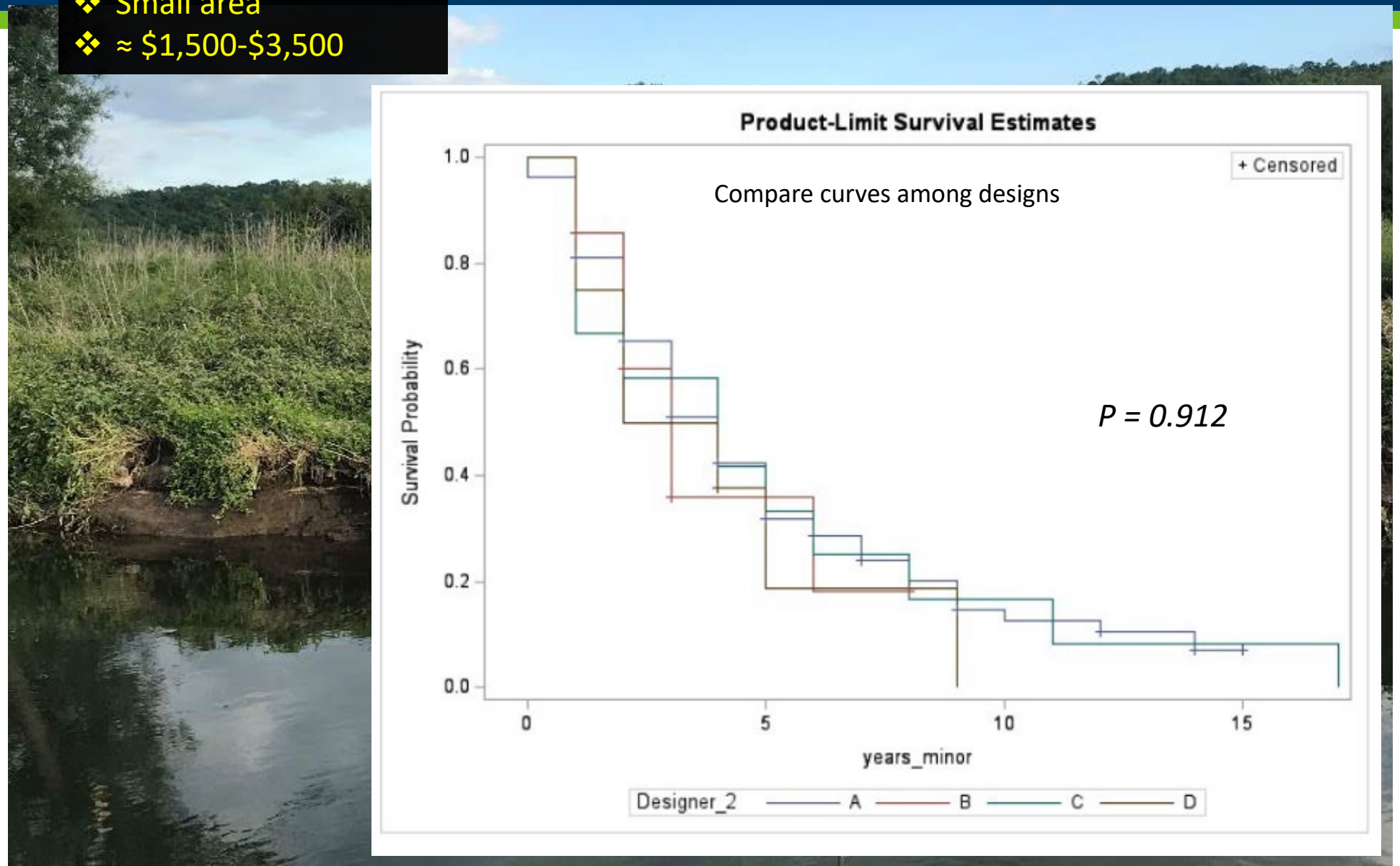
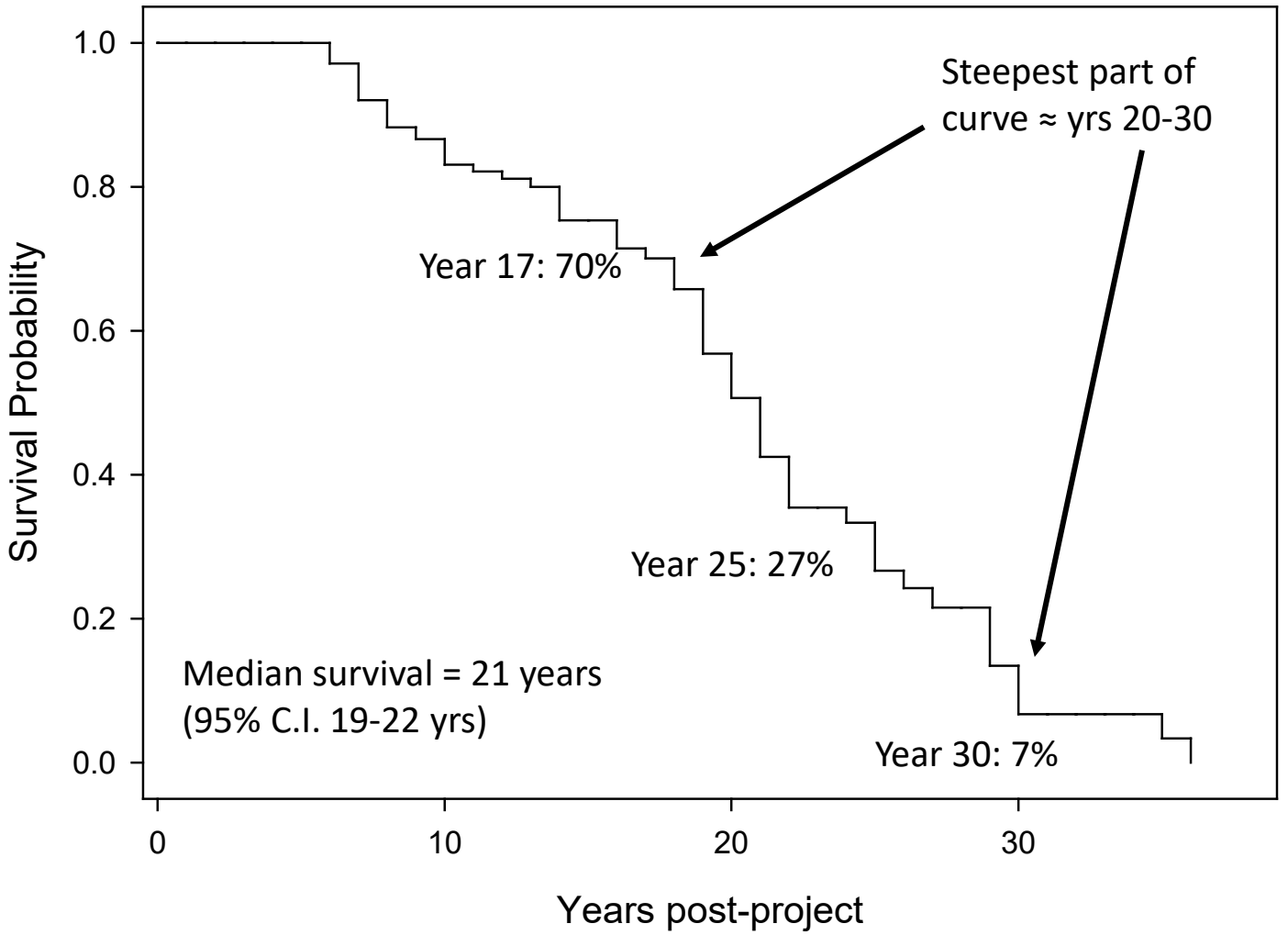
Preliminary Data Compare survival curves



Preliminary Data

Complete REDO



20-30 yrs ≈ lifespan
of these projects

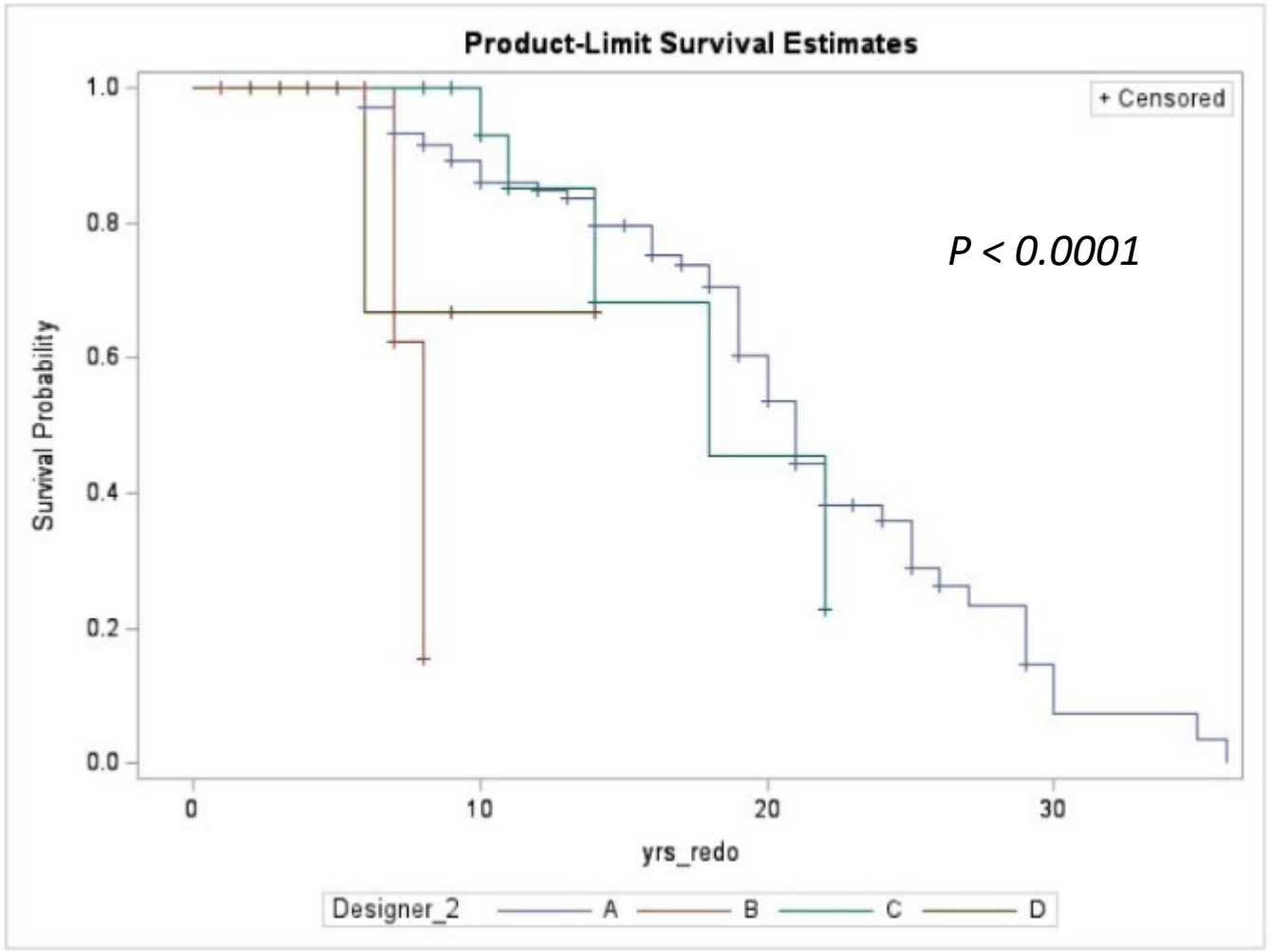
Preliminary Data

Complete REDO

Were there differences among designs?

Yes, but…….

*Not all data compiled yet and some newer projects not around long enough yet.



1. How long do stream habitat projects last (survive)?

    ….

    e. Compare costs – traditionally $/foot or $/mile

        a) Inflation adjusted (2020)

        b) Cost / mile / year

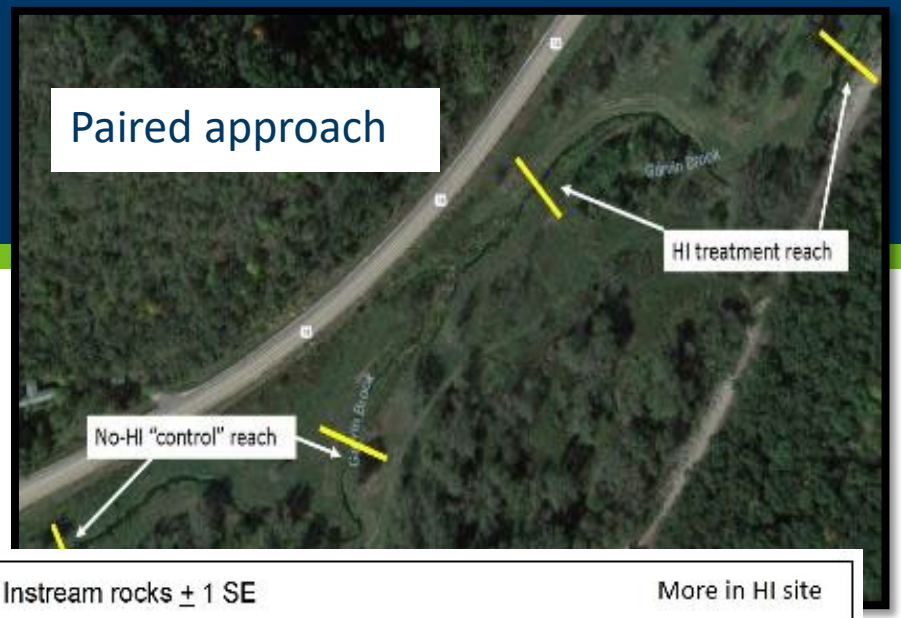
Year 1 $400k — Year 3 Minor-$3k — Year 15 Minor-$3k — Year 20 $20,300/mi/yr

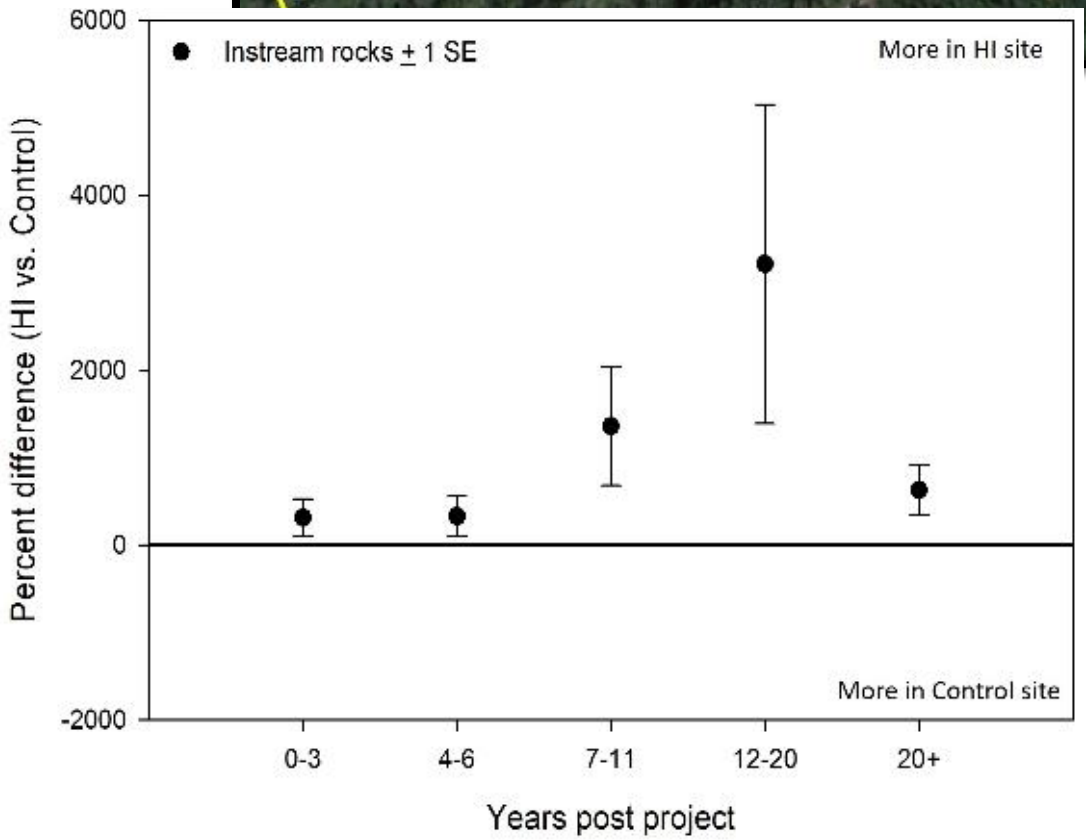
Year 1 $280k — Year 2 Minor-$4k — Year 8 Major-$45k — Year 11 Minor-$5.5k — Year 13 Minor-$4.5k — Year 17 Major-$65k — Year 18 Minor-$5k — Year 20 $20,450/mi/yr

2. How long do stream project benefits last?

Comparing project to control sites across years (1 pair=1 replicate)

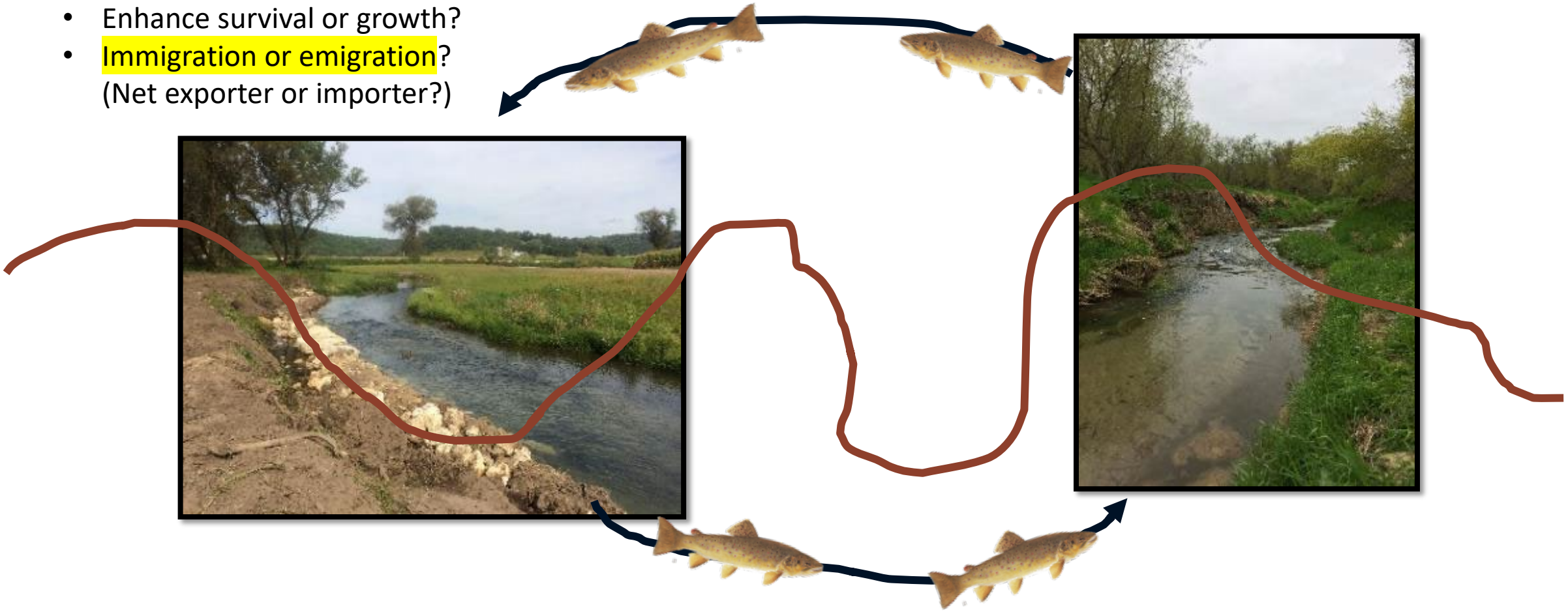
- Traditional trout abundance
- Fish habitat quality
- Fish community & biotic integrity





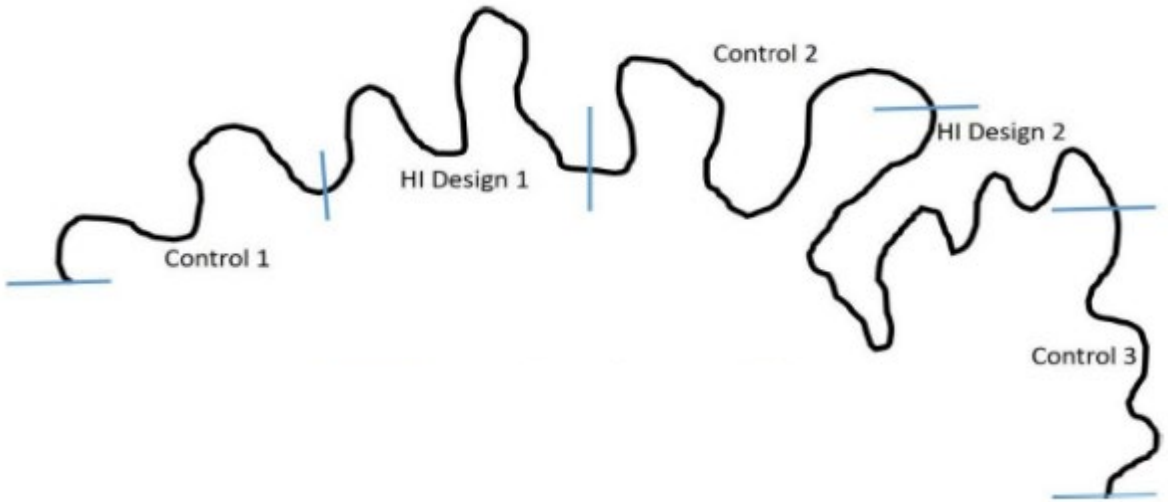
3. Where do new fish come from?

- How do stream habitat projects function at a whole stream scale?
- Does habitat project:
  - Improve recruitment?
  - Enhance survival or growth?
  - Immigration or emigration?
    (Net exporter or importer?)



3. Where do new fish come from?

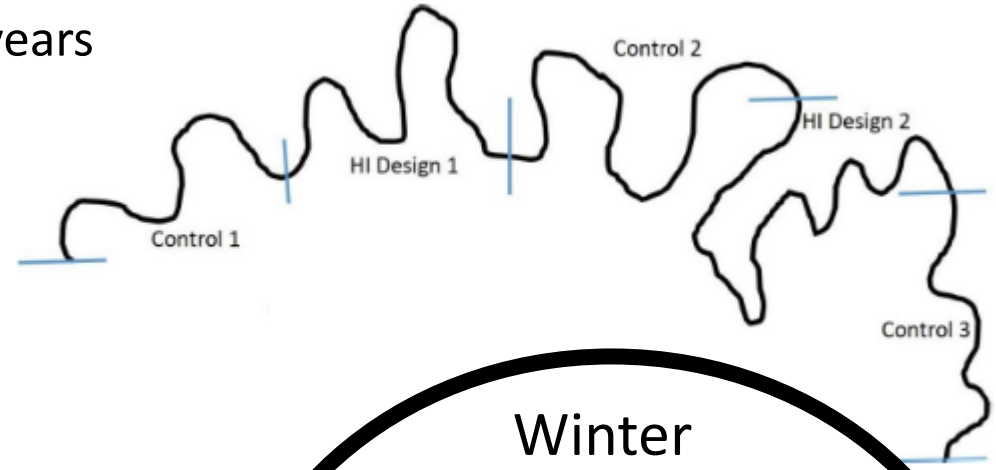
- Need a stream: 5 reaches = 3 Control + 2 for habitat projects (different designs)
- Sufficient length & riparian width

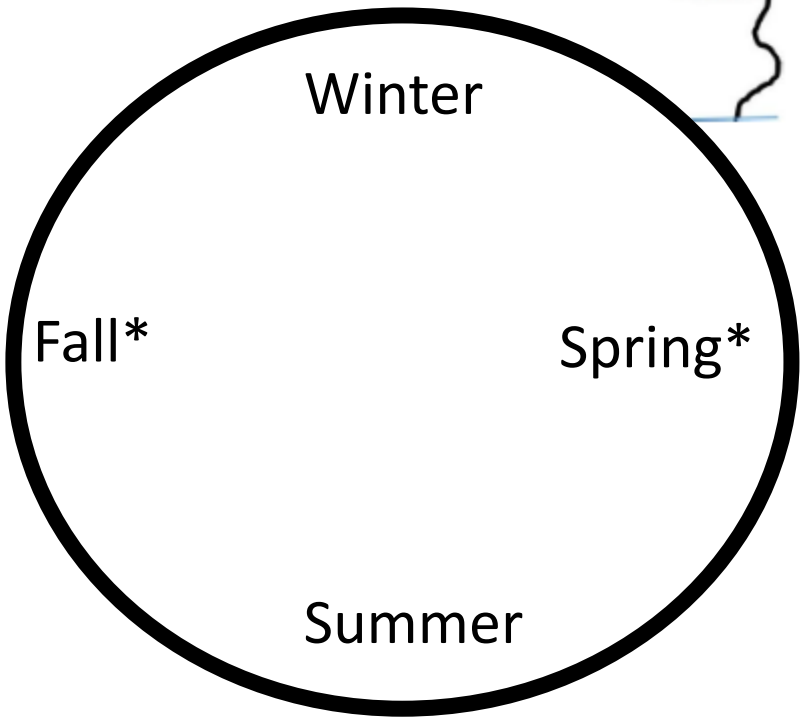


- Pre-project (Before)
  - ≈ 3 years = geomorphology; fish habitat; fish abundance, growth, survival, immigration & emigration
- Implement habitat projects
- Post-project (After)
  - ≥ 3 years = geomorphology; fish habitat; fish abundance, growth, survival, immigration/emigration

3. Where do new fish come from?

- Sampling fish spring and fall, whole study area, at least 7-8 years
  - (started in 2025)
- Population estimate (recruitment)
- PIT tag trout (new batch every year)
- Recaptured trout = survival and growth & some movement
  - What about movement other times?

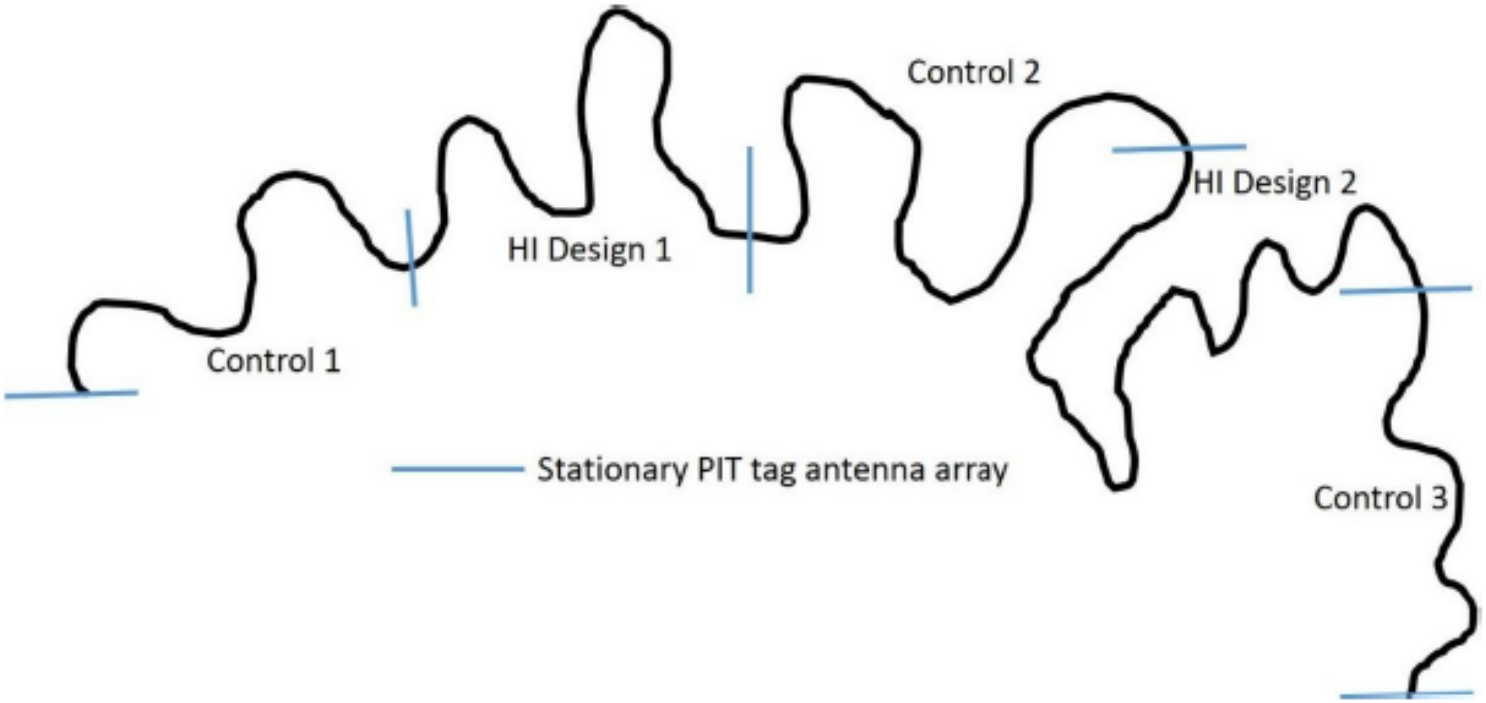




3. Where do new fish come from?

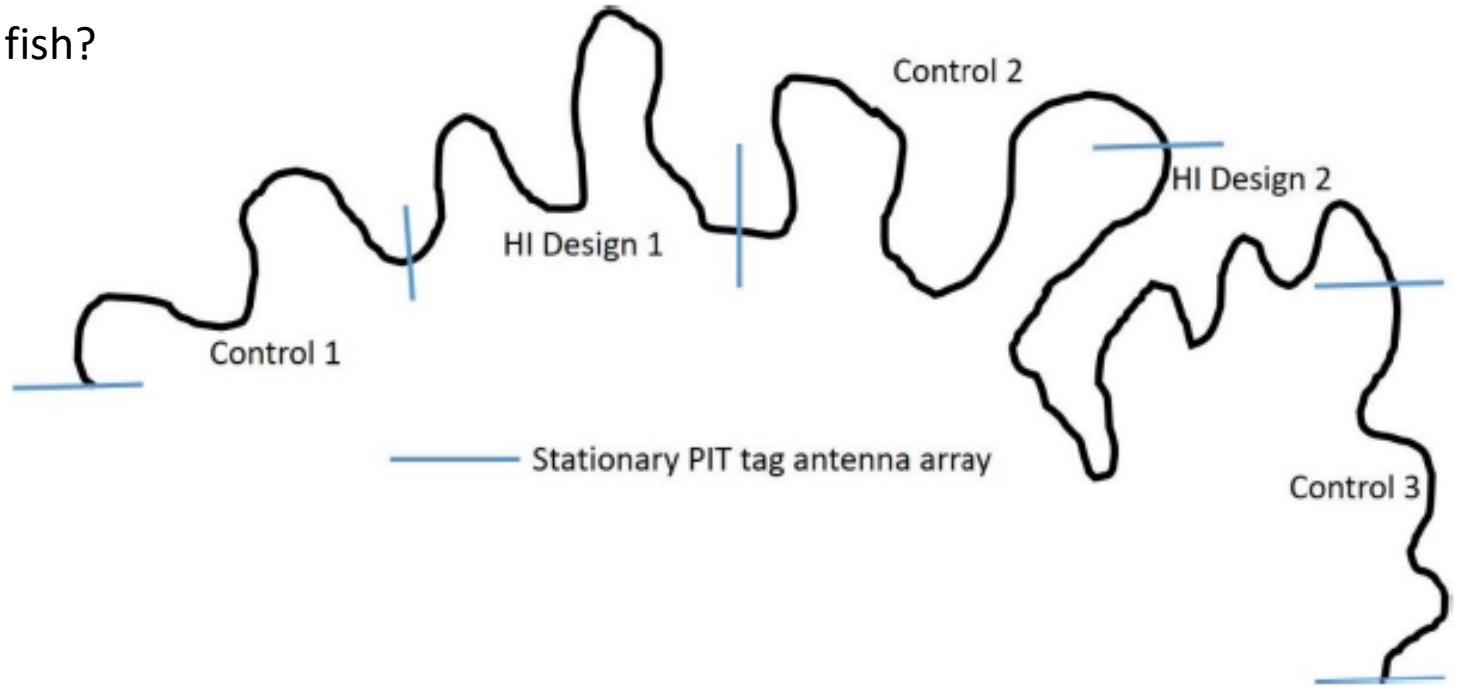
Near continuous movement-Antenna arrays

- Fish crosses: fish number, date, time



3. Other questions?

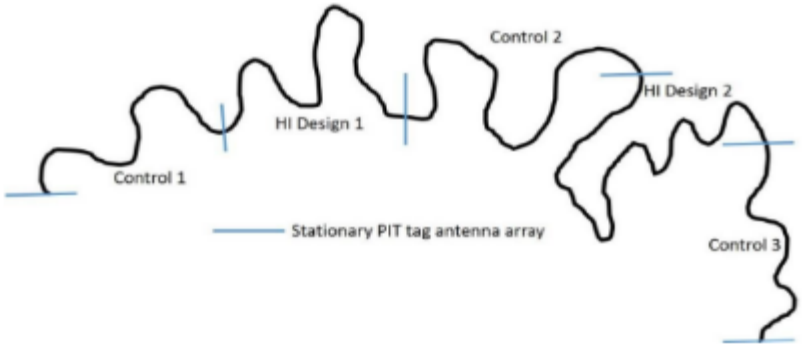
- For example,
  - How do habitat project designs influence sediment movement to the next downstream reach?
  - How does this sediment impact fish habitat (pool depths, spawning substrates)?
  - How do changes in fish habitat effect fish?



3. Where do new fish come from?

- Looking for help to fund the habitat projects
- Beaver Creek
- Project team includes
  - DNR-Fisheries (Research, Management, Habitat)
  - Trout Unlimited
  - DNR-EcoWaters staff
  - DNR-Wildlife
  - Winona State University
  - others

- Preliminary erosion est. range from 50-200 tons depending on site



Questions?