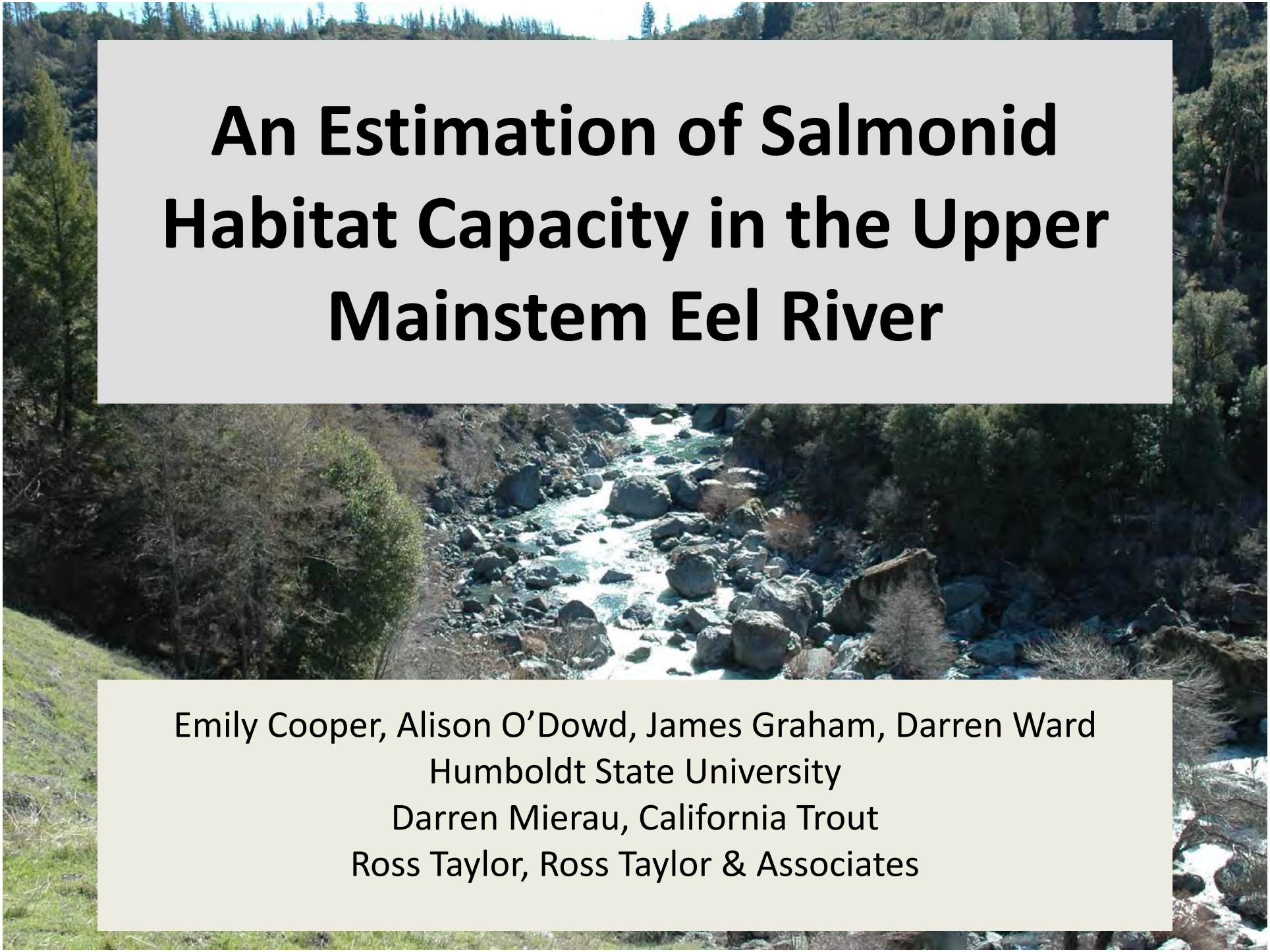
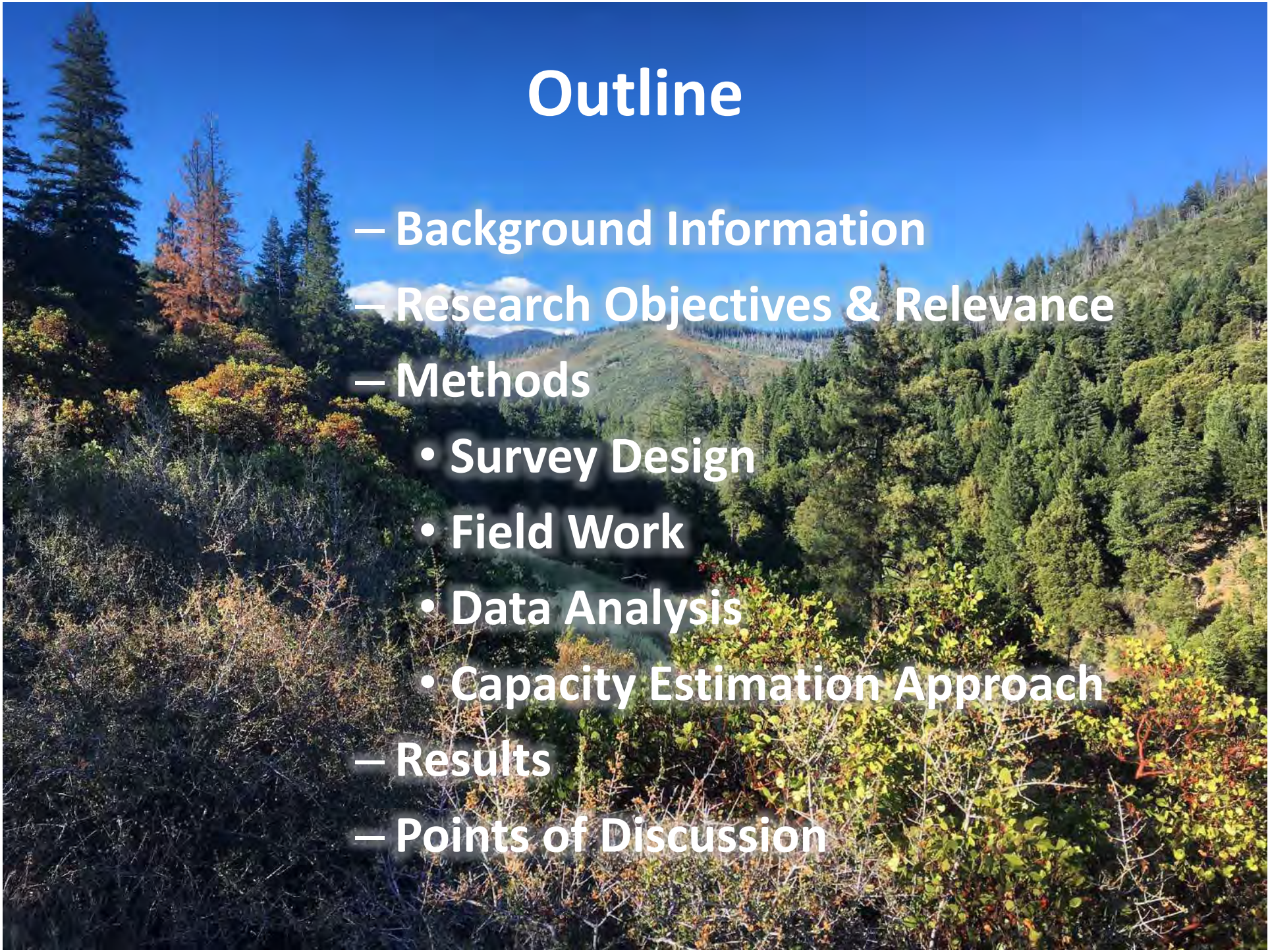
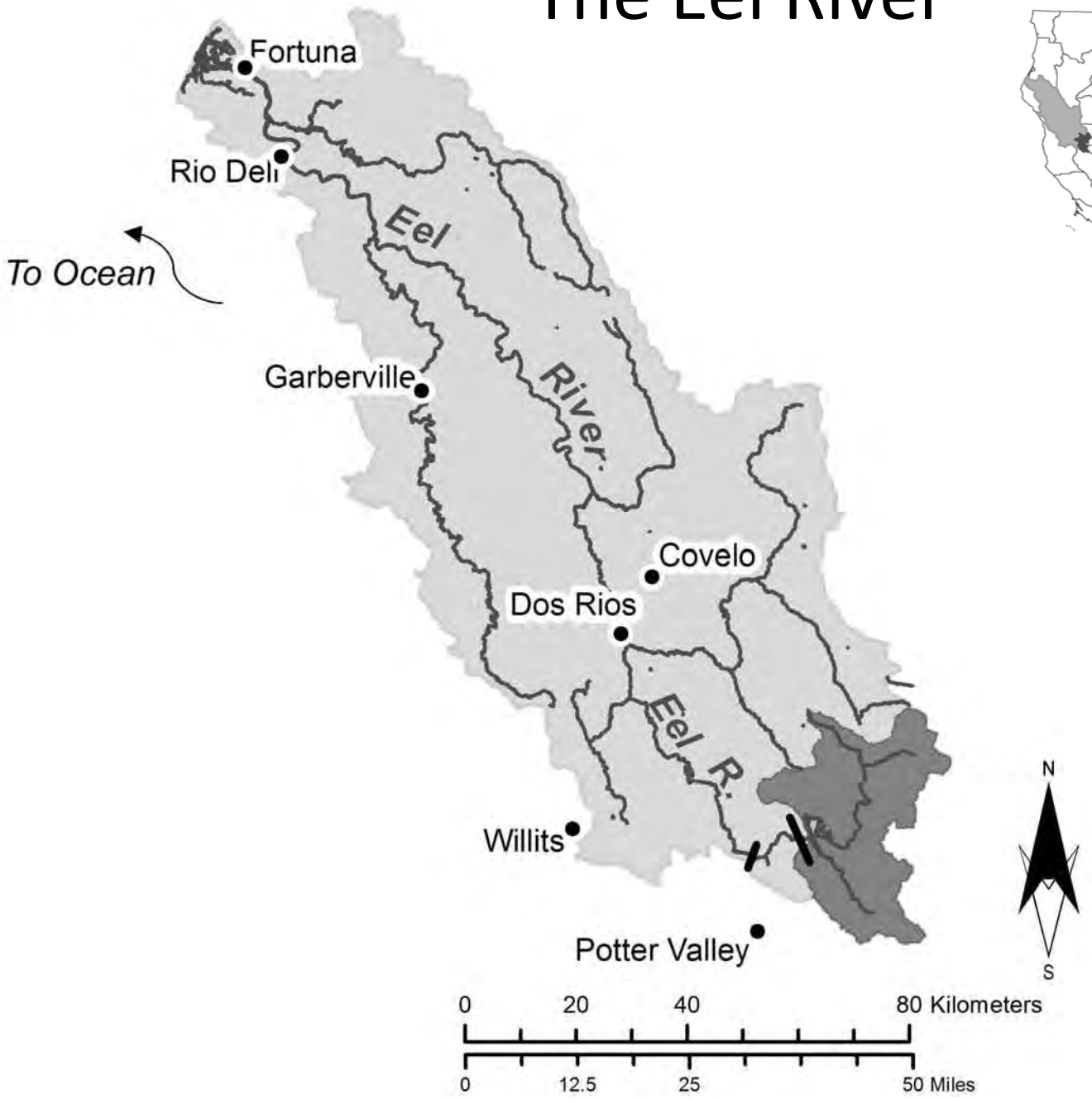


An Estimation of Salmonid Habitat Capacity in the Upper Mainstem Eel River

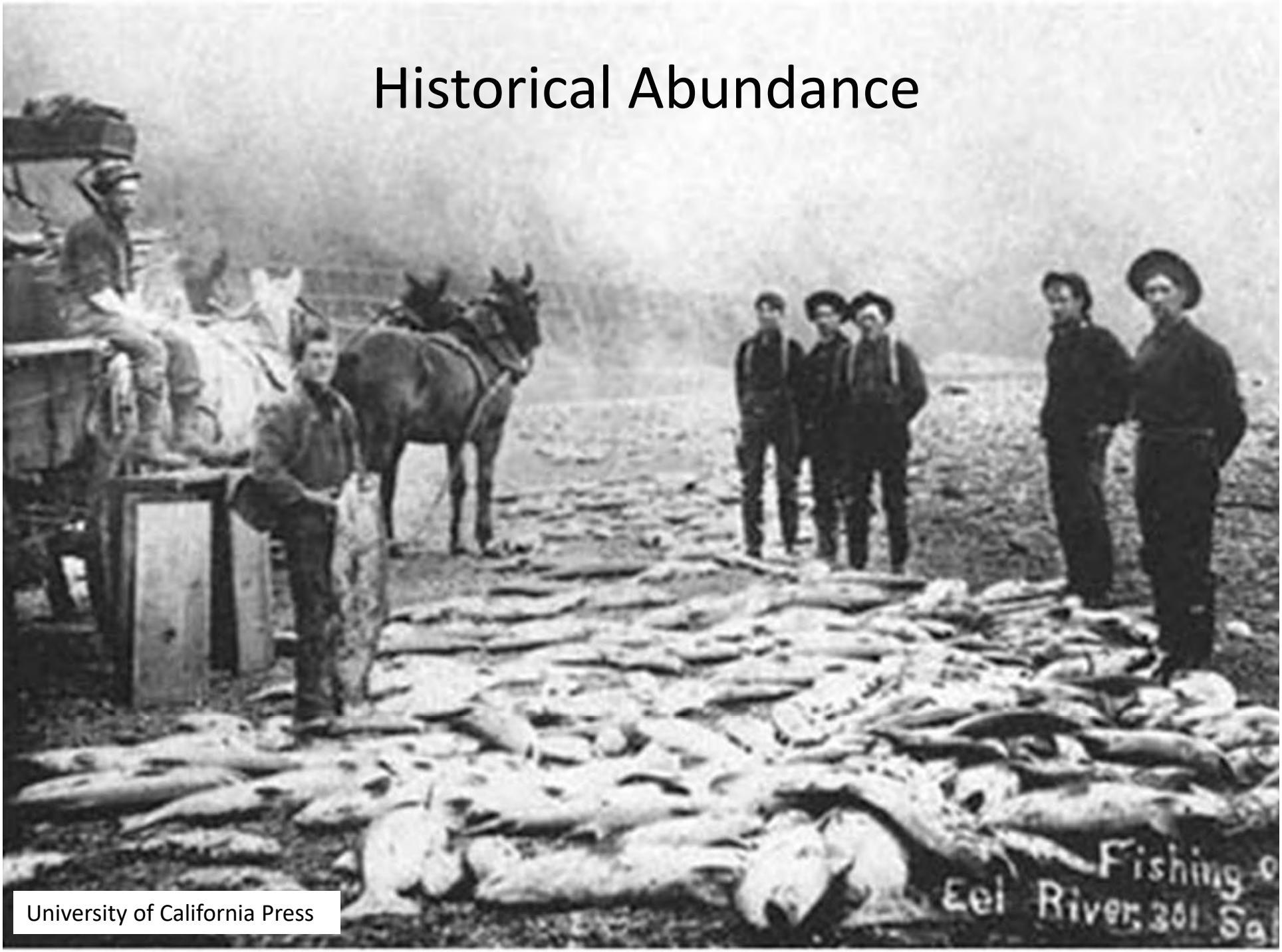
Emily Cooper, Alison O'Dowd, James Graham, Darren Ward
Humboldt State University
Darren Mierau, California Trout
Ross Taylor, Ross Taylor & Associates


Outline
– Background Information
– Research Objectives & Relevance
– Methods
• Survey Design
• Field Work
• Data Analysis
• Capacity Estimation Approach
– Results
– Points of Discussion

The Eel River

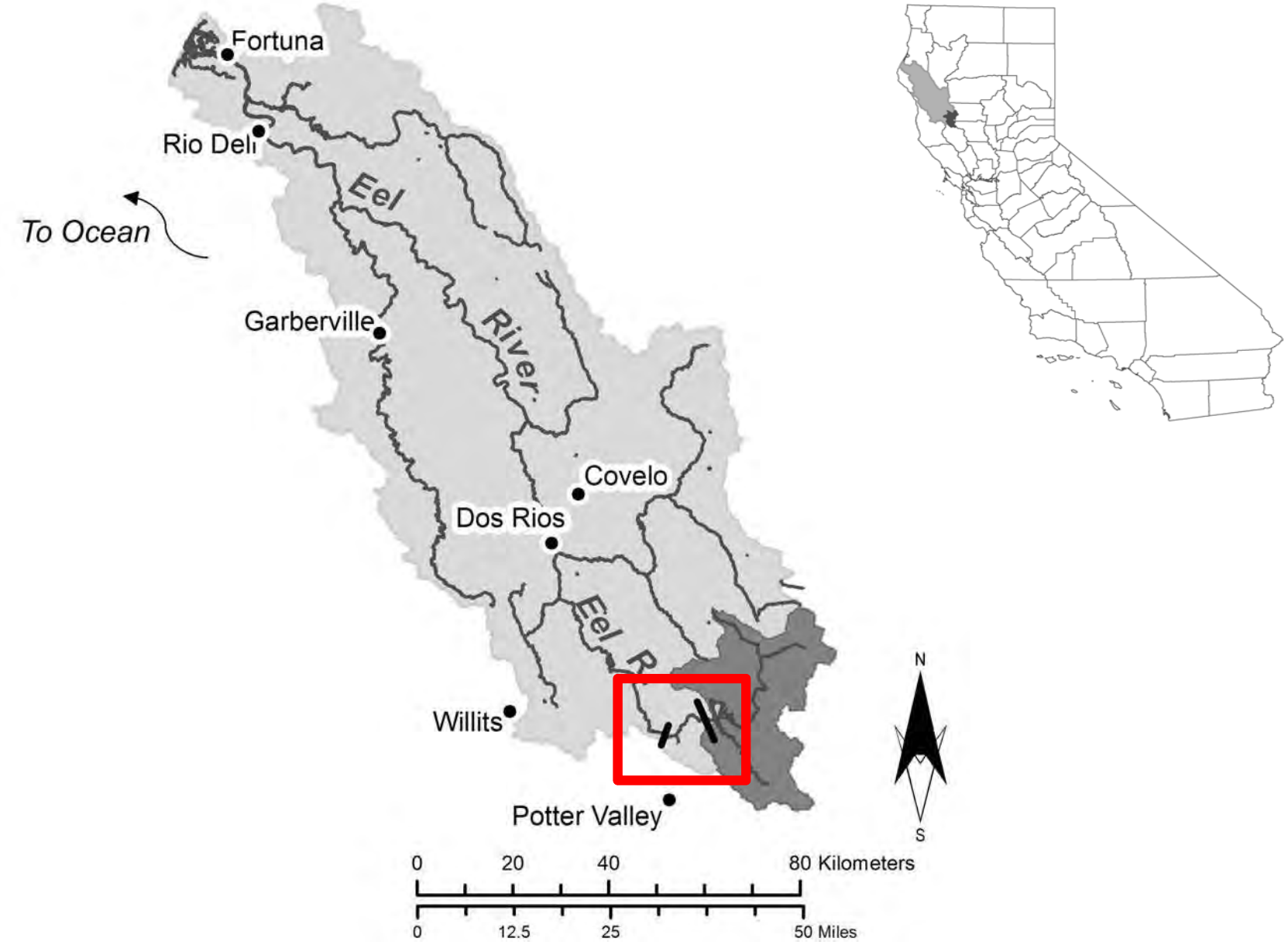


Historical Abundance



University of California Press

Potter Valley Project



Cape Horn & Scott Dam

FOER, 2016

Kovner, 2016

Research Objectives

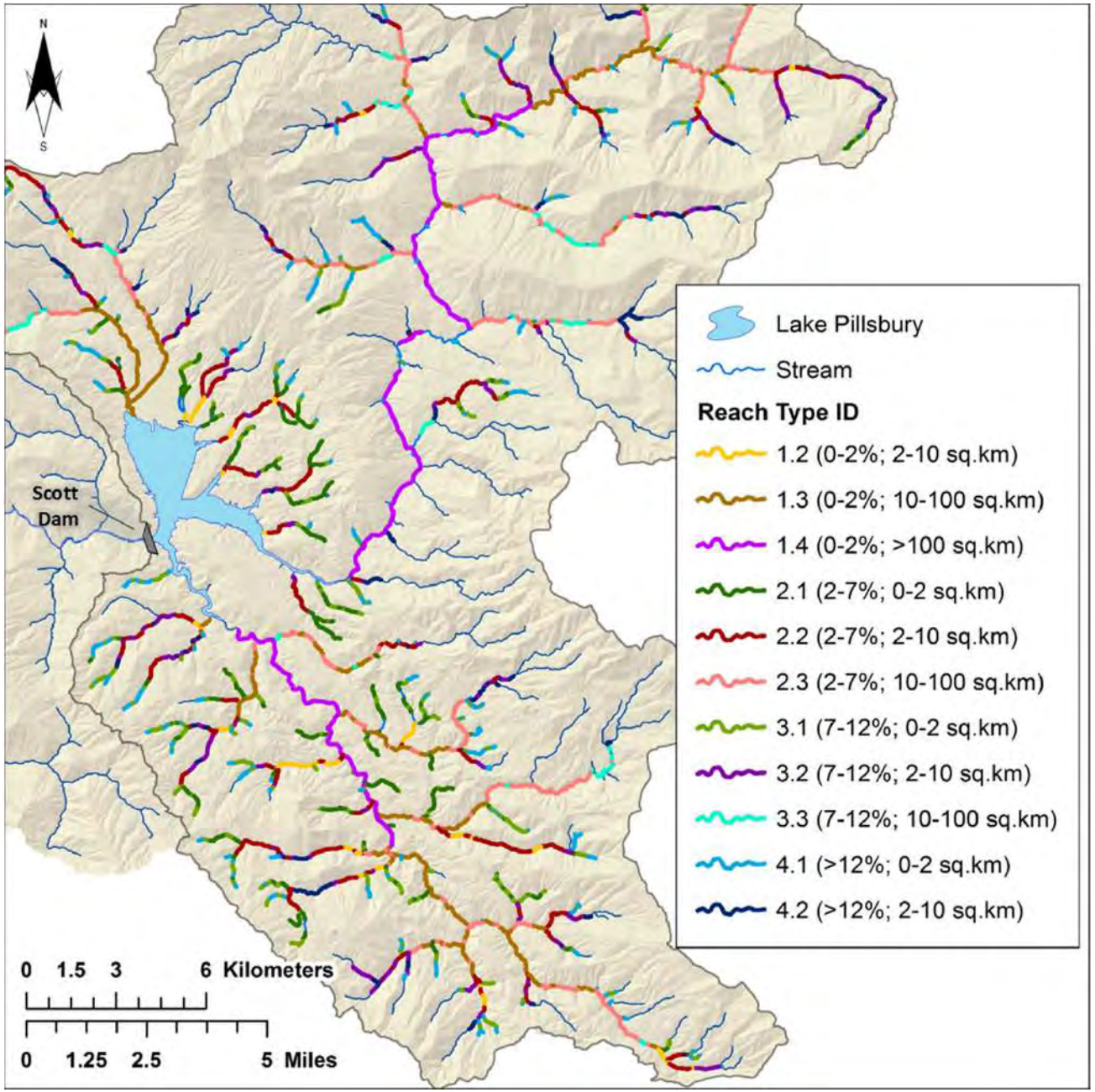
In the upper mainstem Eel River upstream of Scott Dam:

1) Quantify and characterize anadromous salmonid spawning and rearing habitat

2) Estimate population capacity for Chinook salmon and steelhead trout if the Potter Valley Project were either modified or removed.

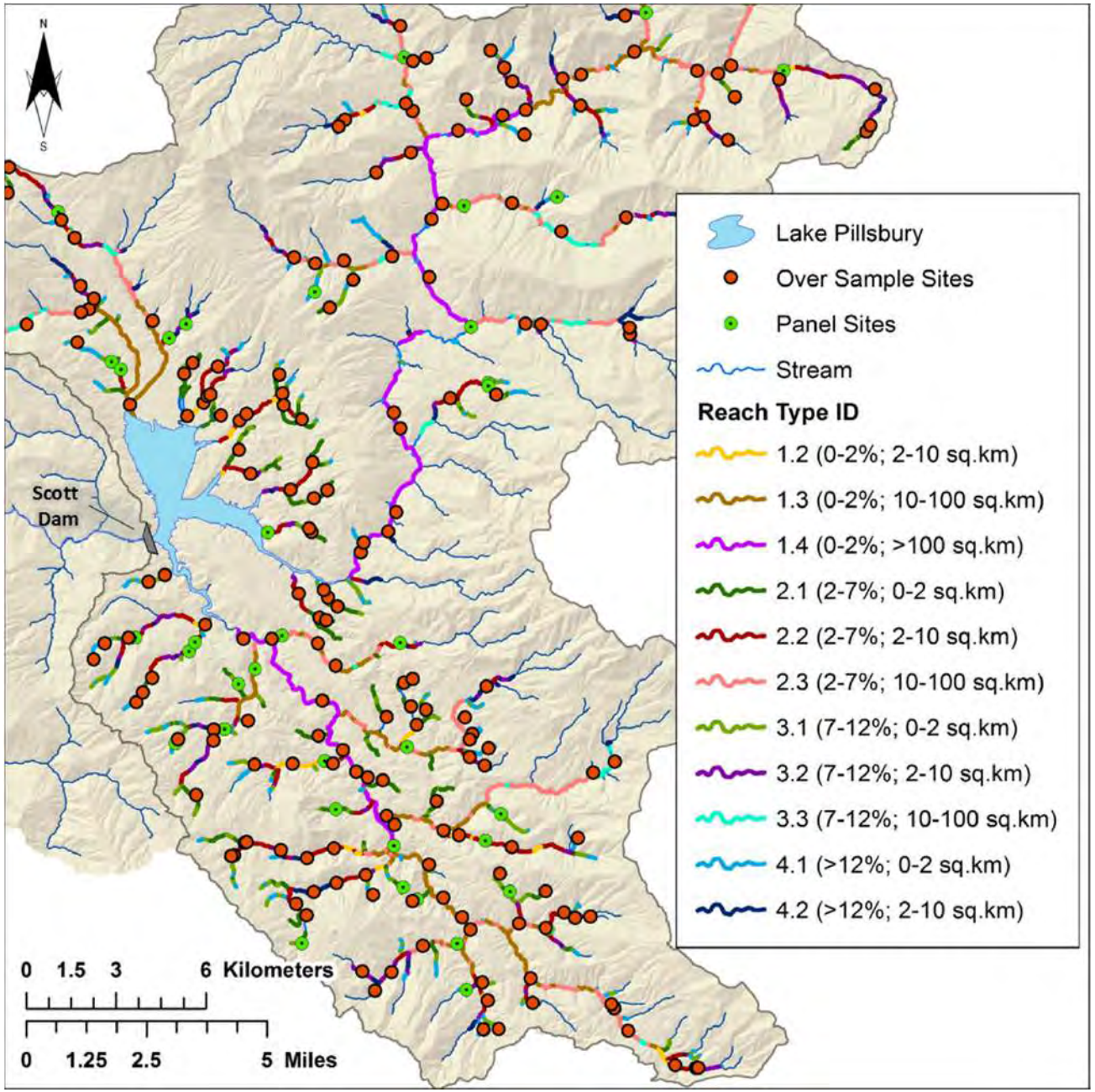
Survey Design

- Stratified "Reach Types"



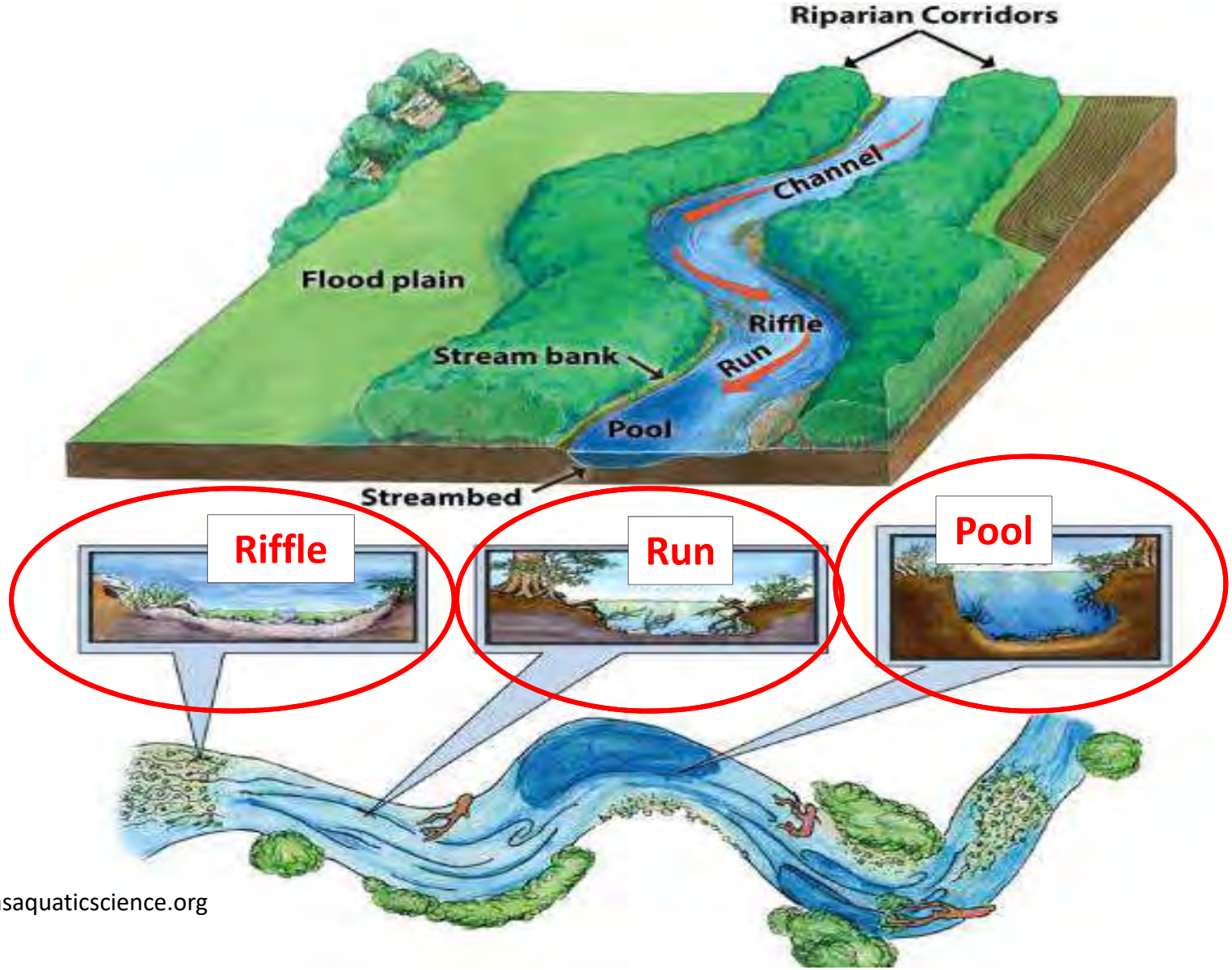
Survey Design

- Stratified "Reach Types"
- GRTS



Habitat Assessment: Field Methods

CDFW *California Salmonid Stream Habitat Restoration Manual, Part III*



Texasaquaticscience.org

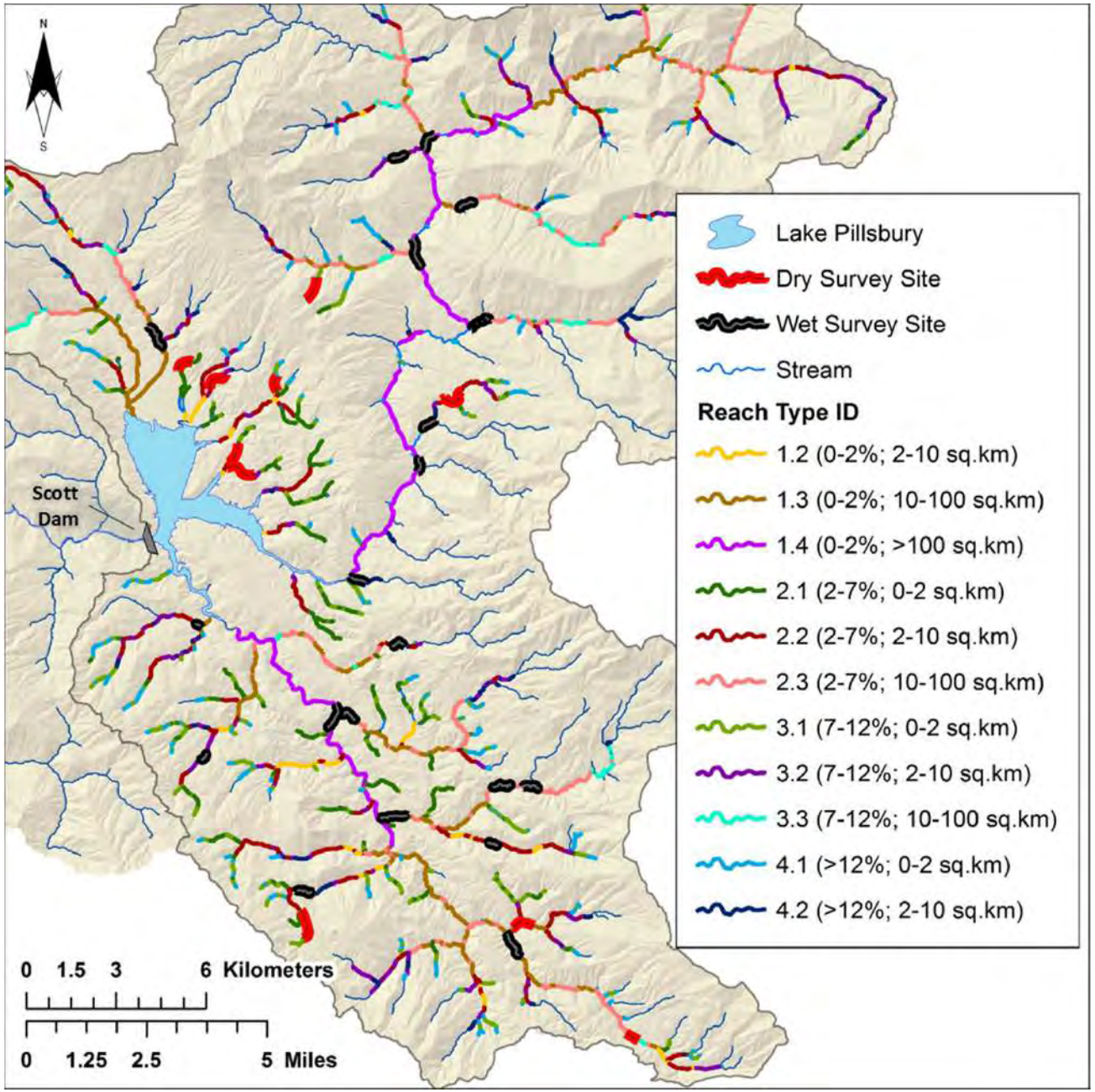
Habitat Assessment: Field Methods

- Unit-scale measurements:
  - Wetted surface area
  - Depth
  - Instream Cover
  - Canopy Cover

- Reach-scale measurements:
  - Discharge (CFS)
  - Substrate Composition
  - Embeddedness (fine substrate)
  - Water Quality
    - Temperature, pH, Turbidity

Survey Design

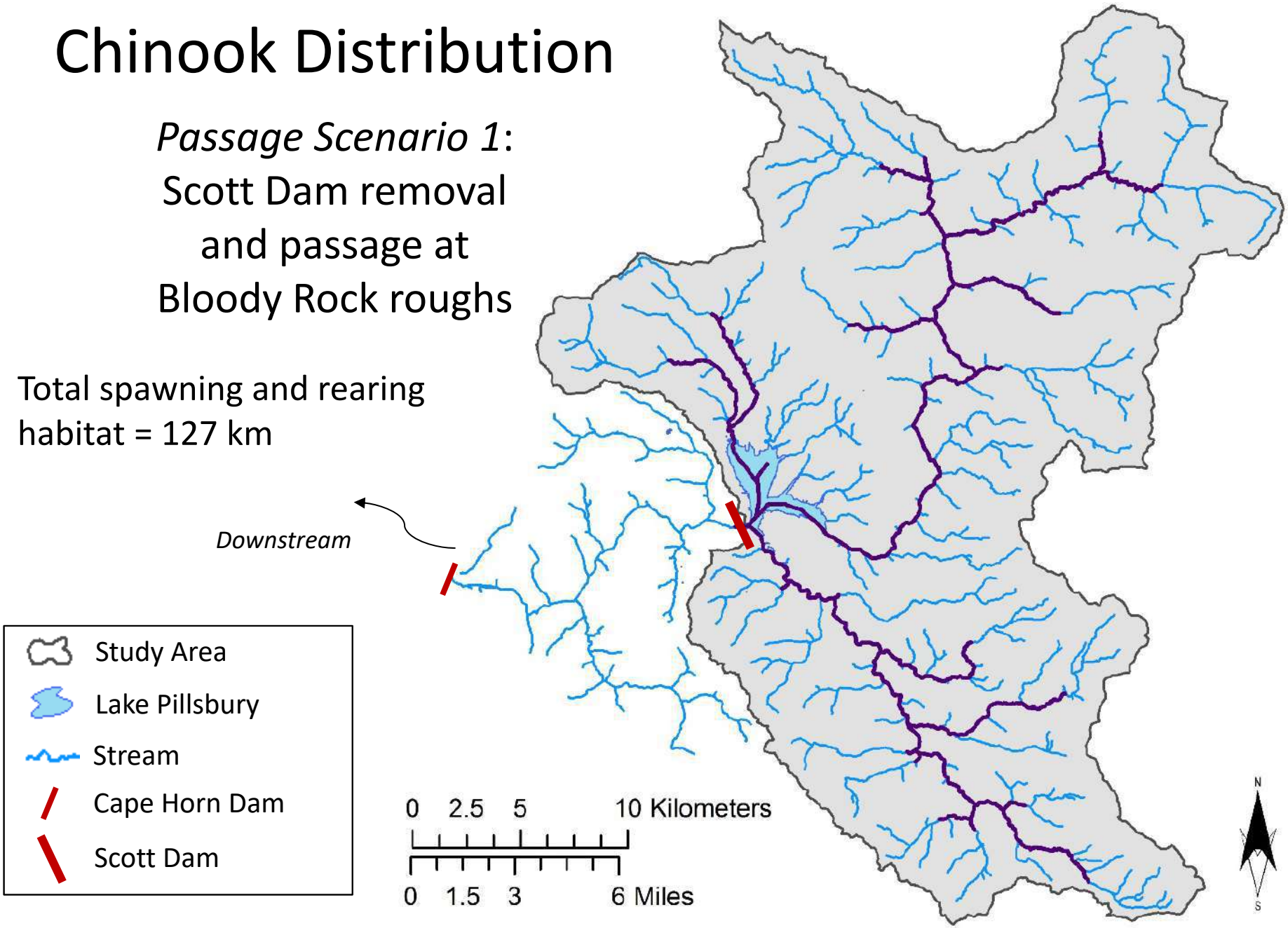
- Stratified "Reach Types"
- Wet & Dry Habitat Surveyed



Chinook Distribution

Passage Scenario 1:
Scott Dam removal
and passage at
Bloody Rock roughs

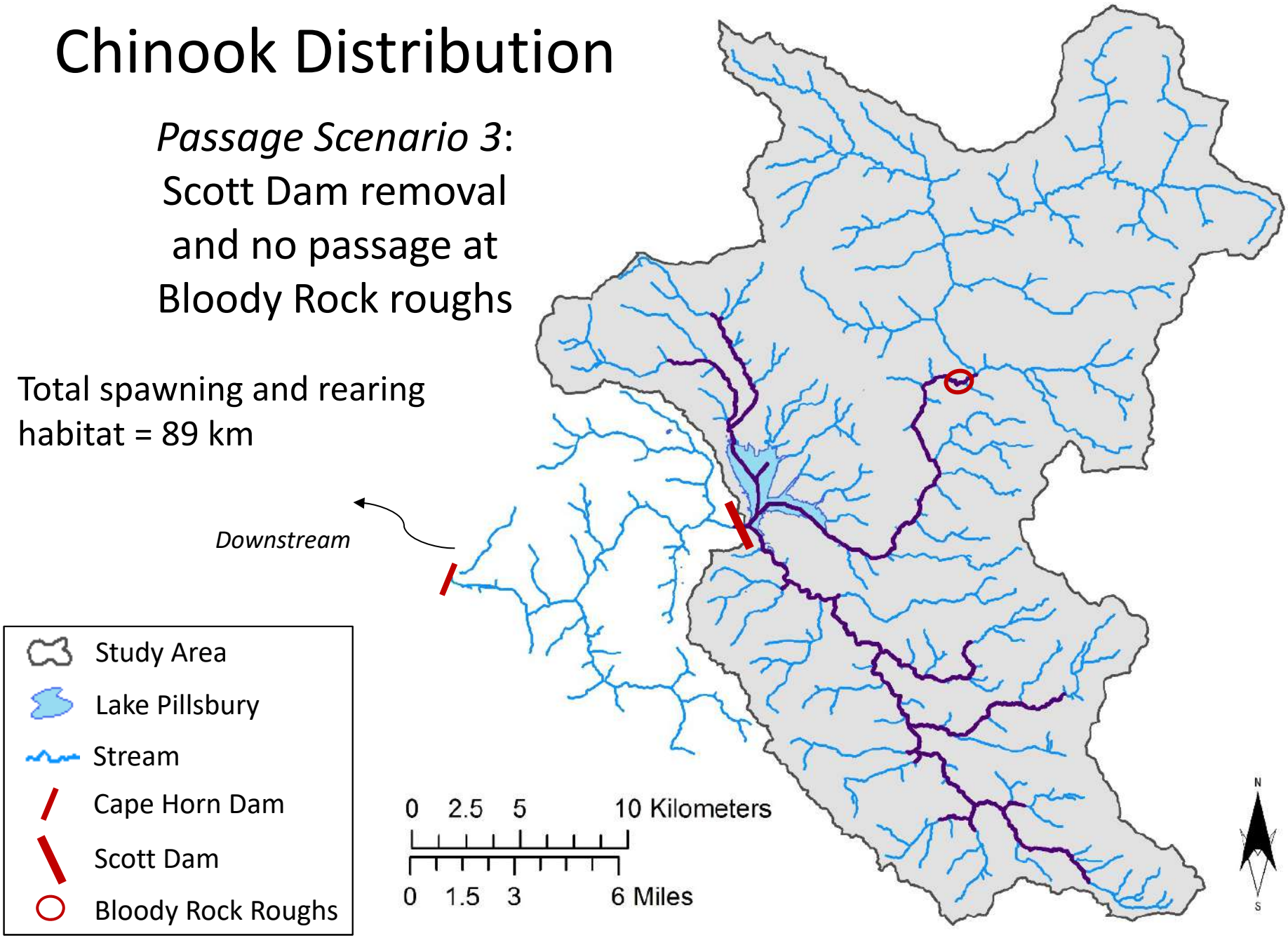
Total spawning and rearing habitat = 127 km



Chinook Distribution

Passage Scenario 3:
Scott Dam removal
and no passage at
Bloody Rock roughs

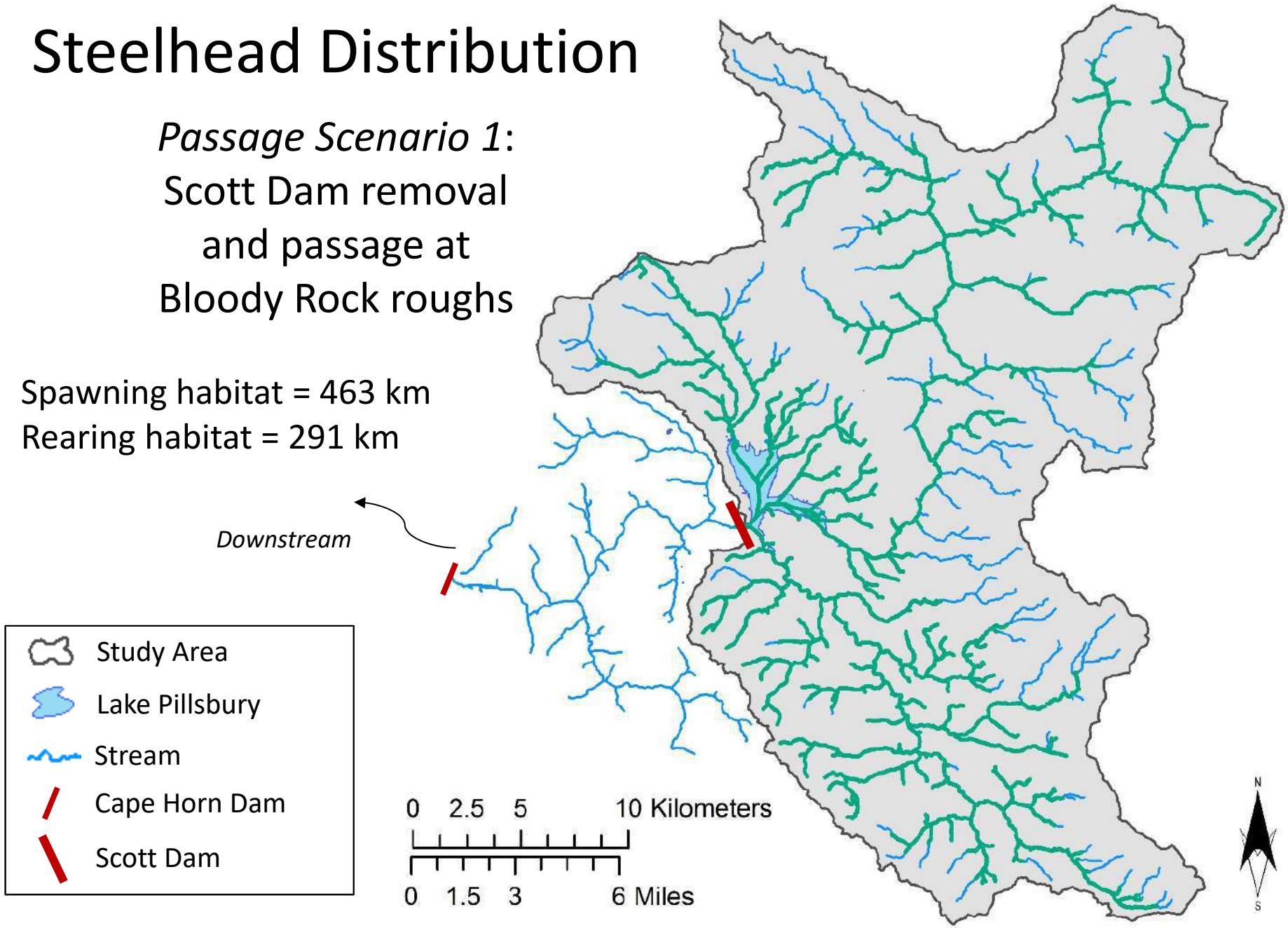
Total spawning and rearing habitat = 89 km



Steelhead Distribution

Passage Scenario 1:
Scott Dam removal
and passage at
Bloody Rock roughs

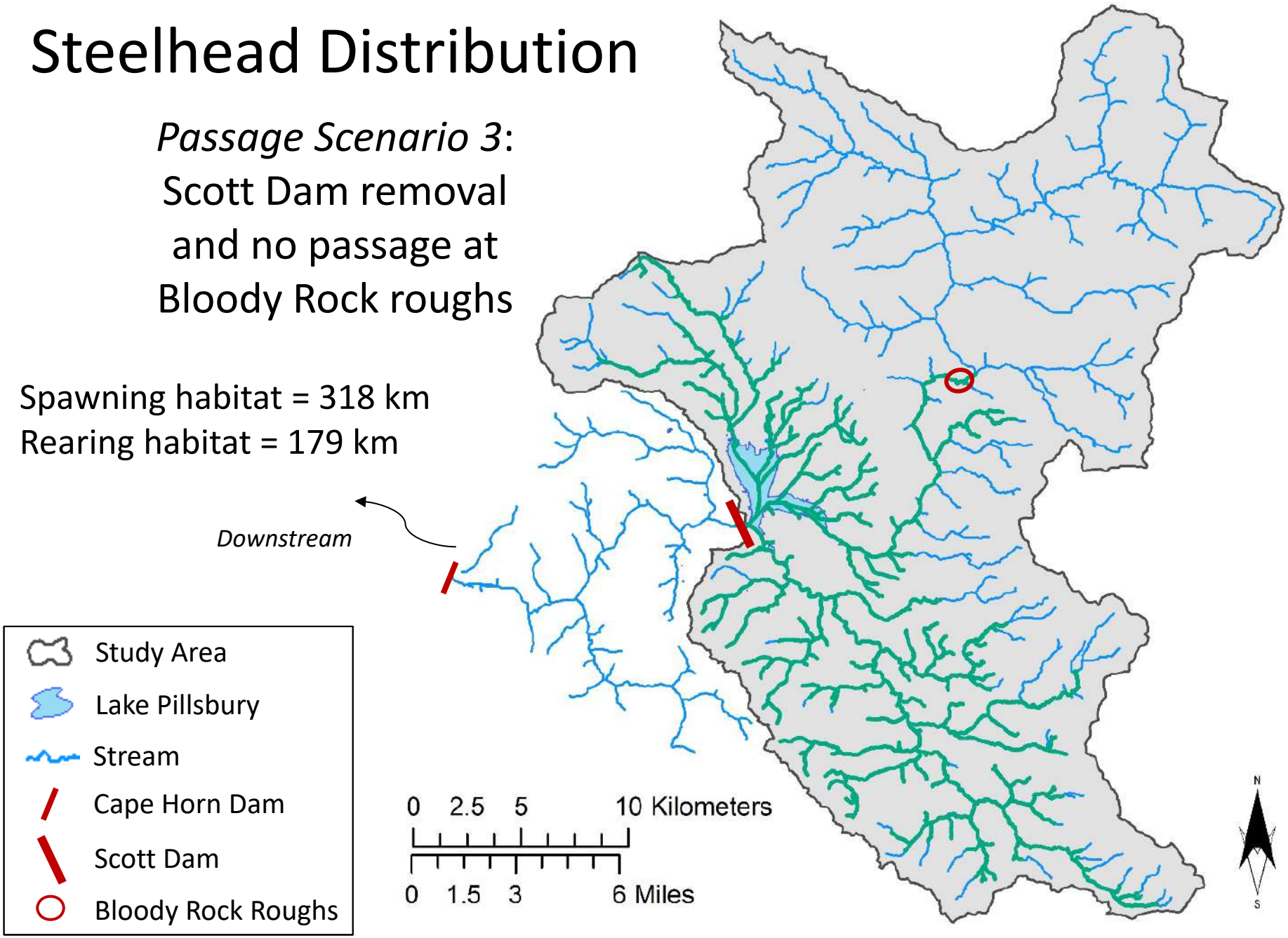
Spawning habitat = 463 km
Rearing habitat = 291 km



Steelhead Distribution

Passage Scenario 3:
Scott Dam removal
and no passage at
Bloody Rock roughs

Spawning habitat = 318 km
Rearing habitat = 179 km



Bloody Rock Roughs Barrier Assessment

2/20/2016 at ~400 cfs

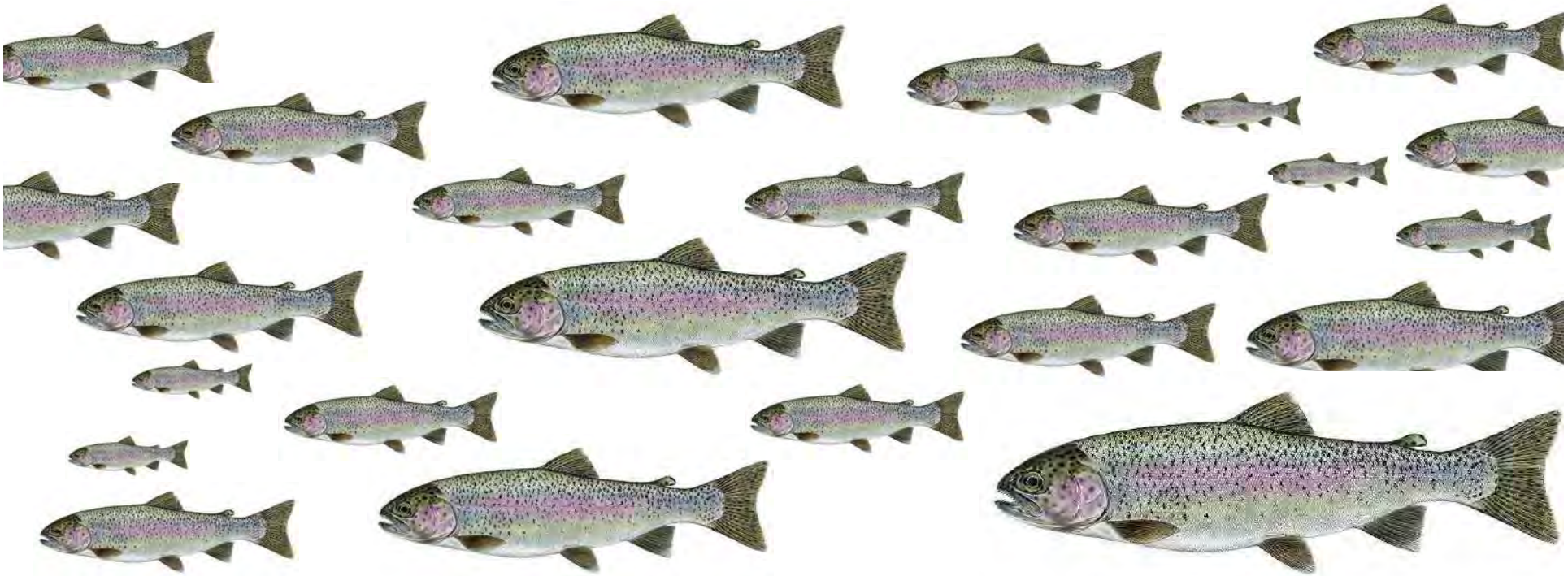
Bloody Rock Roughs Barrier Assessment

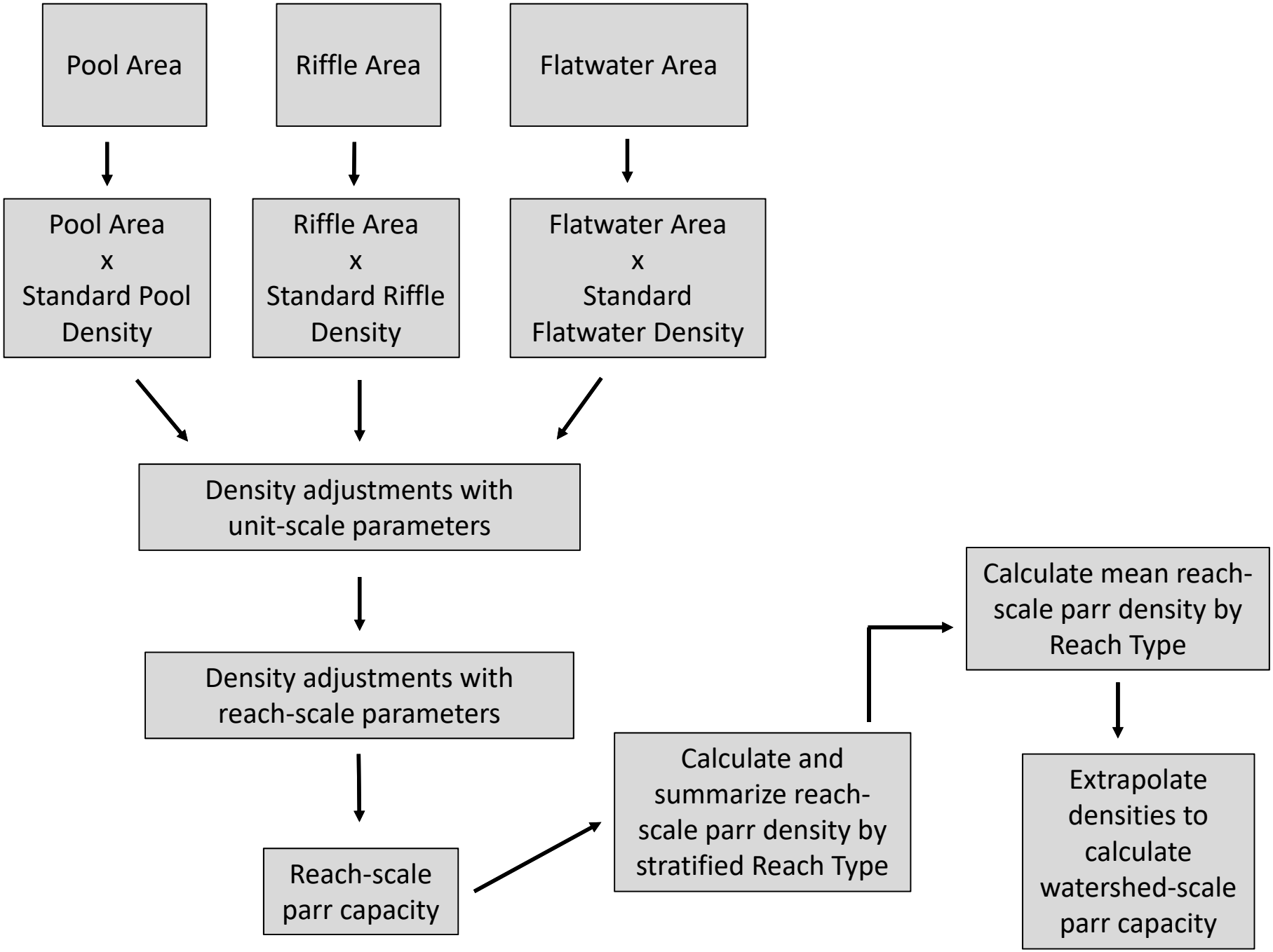
5/17/2016 at ~58 cfs

Modeling Habitat Capacity: 1) Unit Characteristic Method

(Cramer & Ackerman, 2009; Cramer 2012)

- Measures capacity by identifying life stage most limiting to production
- Relates habitat conditions to fish densities
- Validation: predicted capacity ± 35% of observed capacity

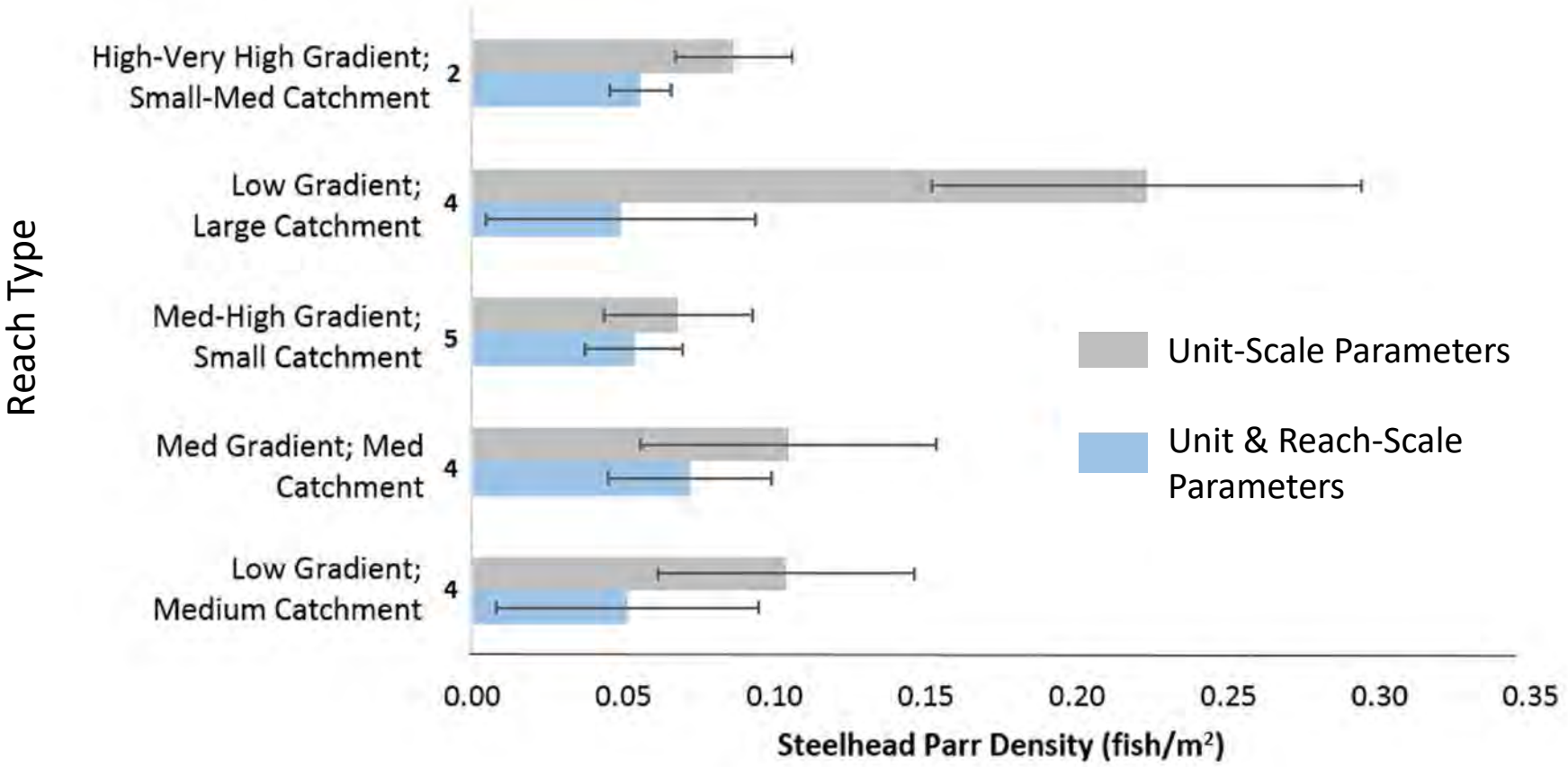



Pool Area
Riffle Area
Flatwater Area
Pool Area x Standard Pool Density
Riffle Area x Standard Riffle Density
Flatwater Area x Standard Flatwater Density
Density adjustments with unit-scale parameters
Density adjustments with reach-scale parameters
Reach-scale parr capacity
Calculate and summarize reach-scale parr density by stratified Reach Type
Calculate mean reach-scale parr density by Reach Type
Extrapolate densities to calculate watershed-scale parr capacity

Steelhead UCM Parr Capacity

Passage Scenario 1: Dam removal and passage at Bloody Rock roughs

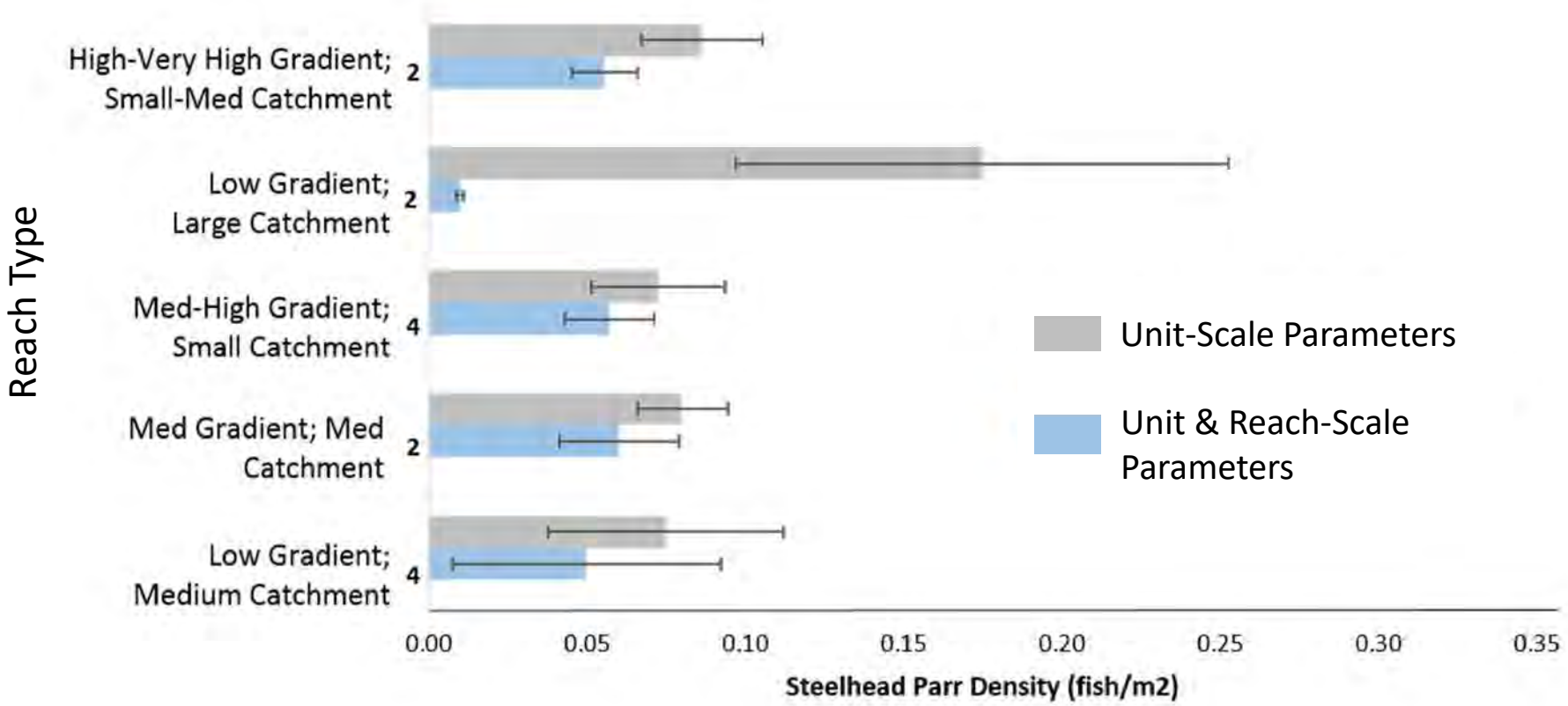
Watershed Scale Capacity = 57,374 Parr (SD 32,081)



Steelhead UCM Parr Capacity

Passage Scenario 3: Dam removal and no passage at Bloody Rock roughs

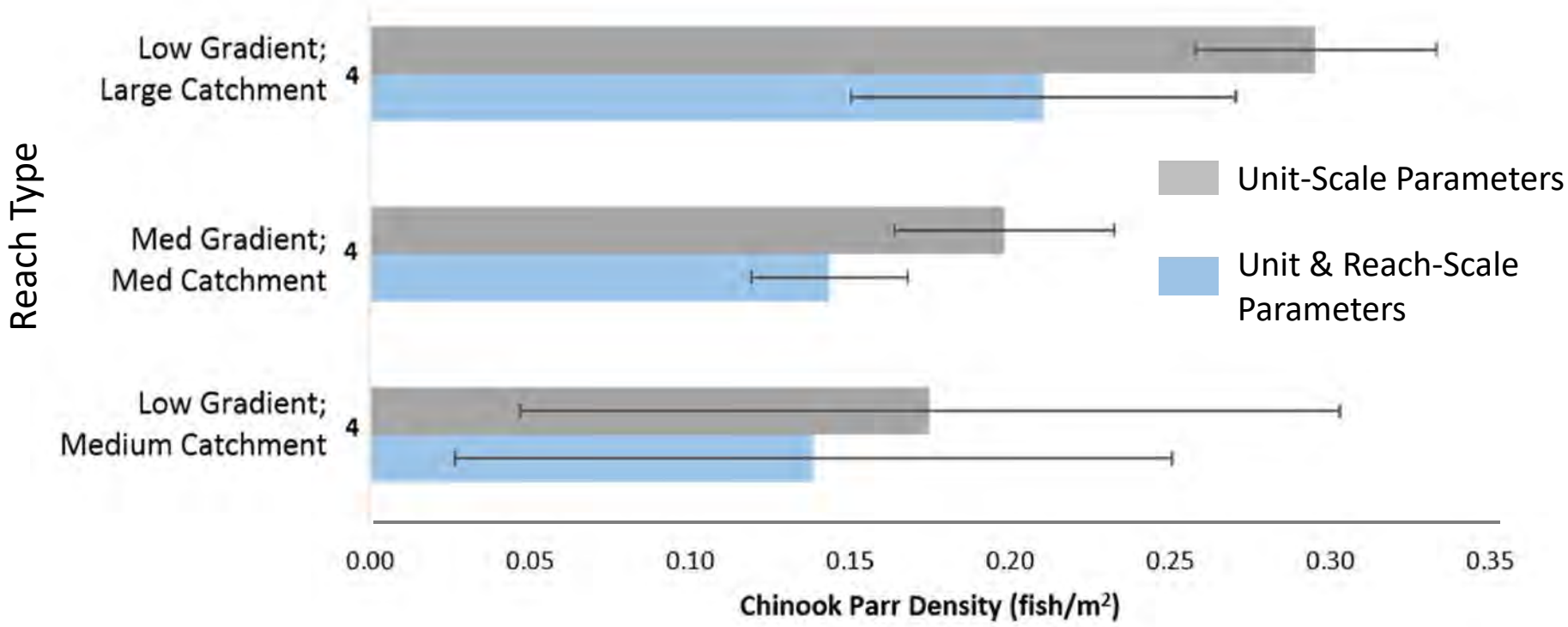
Watershed Scale Capacity = 27,848 Parr (SD 9,982)



Chinook UCM Parr Capacity

Passage Scenario 1: Dam removal and passage at Bloody Rock roughs

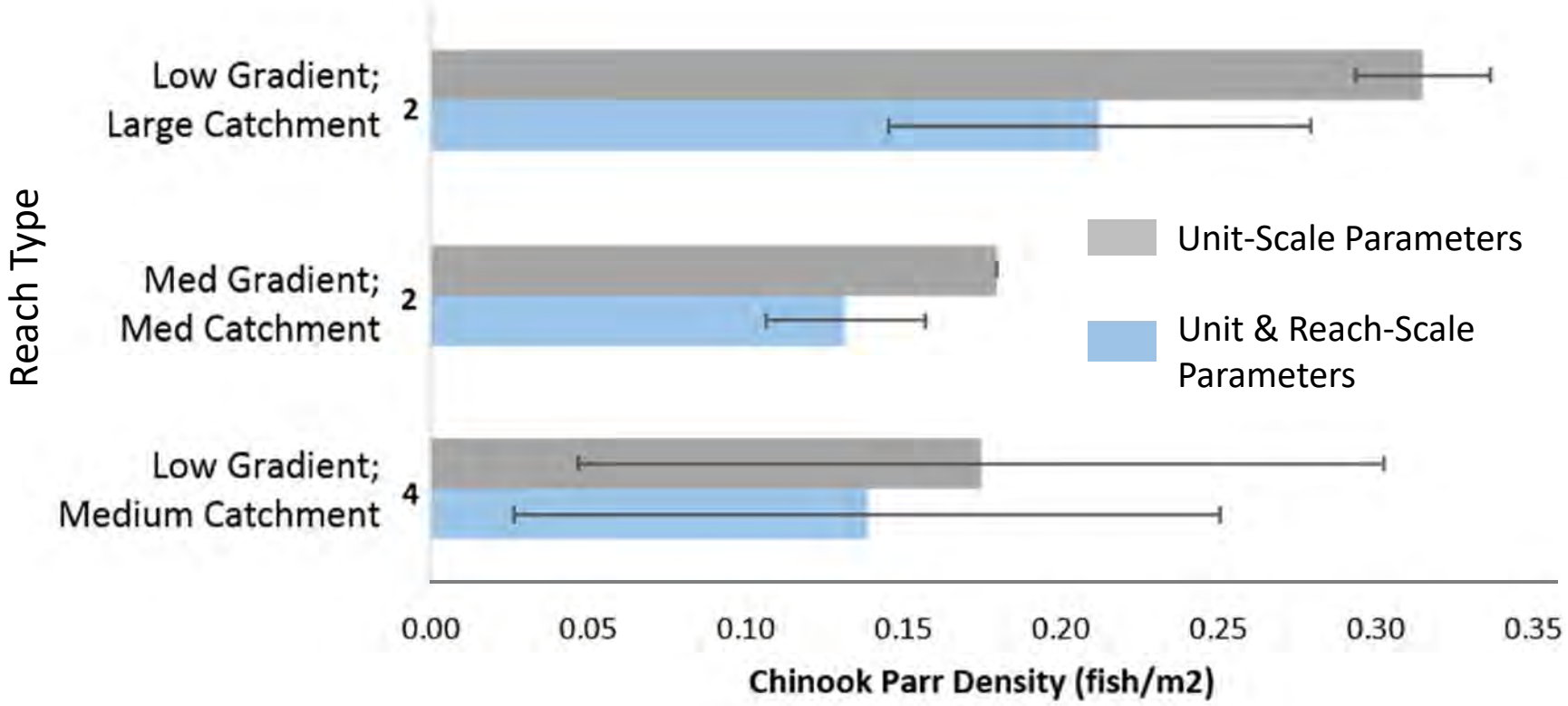
Watershed Scale Capacity = 201,426 Parr (SD 67,550)



Chinook UCM Parr Capacity

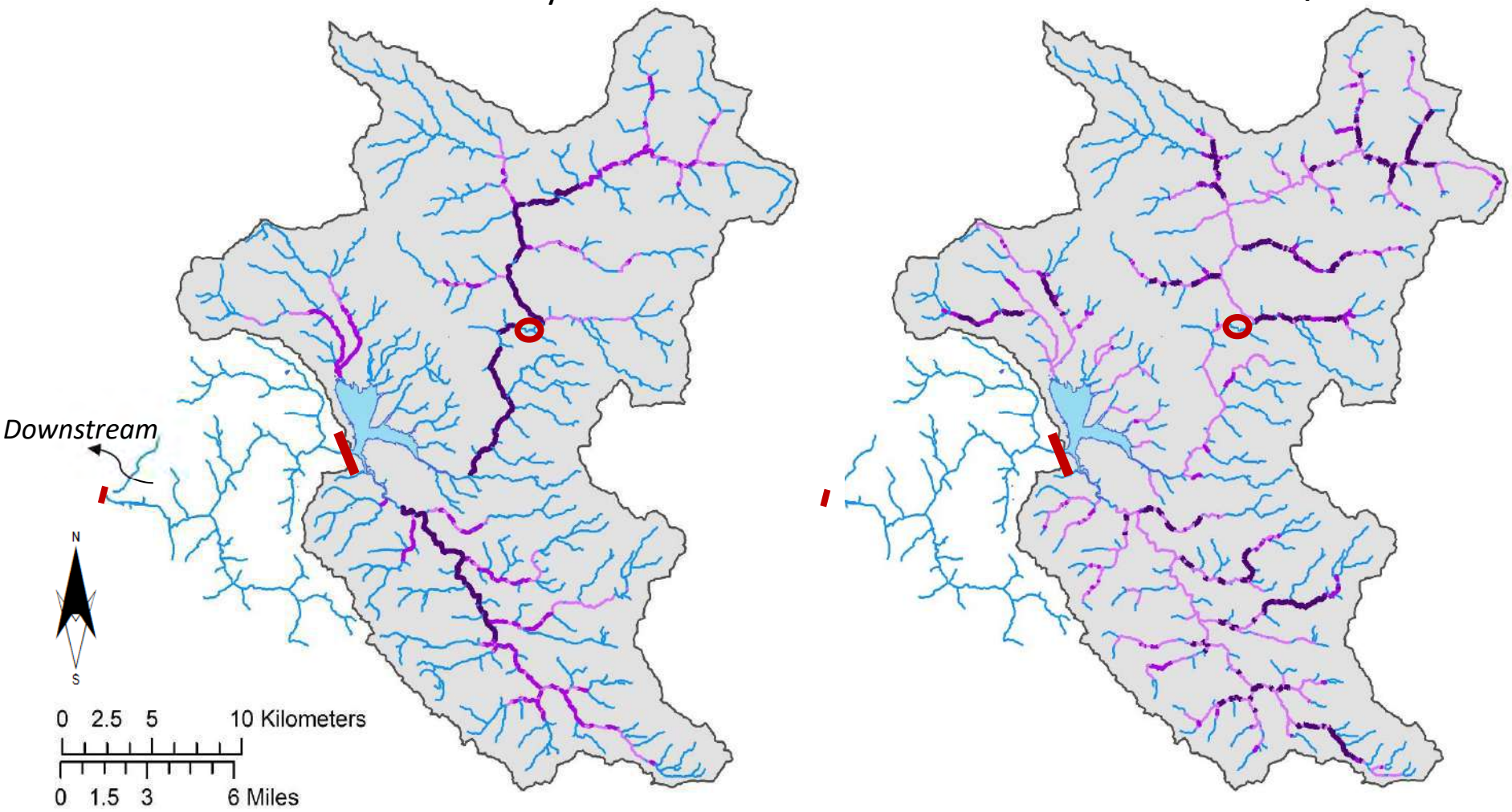
Passage Scenario 3: Dam removal and no passage at Bloody Rock roughs

Watershed Scale Capacity = 65,200 Parr (SD 18,901)



Chinook Parr Density

Steelhead Parr Density



Cape Horn Dam

Scott Dam

Bloody Rock Roughs

Study Area

Lake Pillsbury

Stream

Chinook UCM Density

0.13

0.14

0.21

Steelhead UCM Density

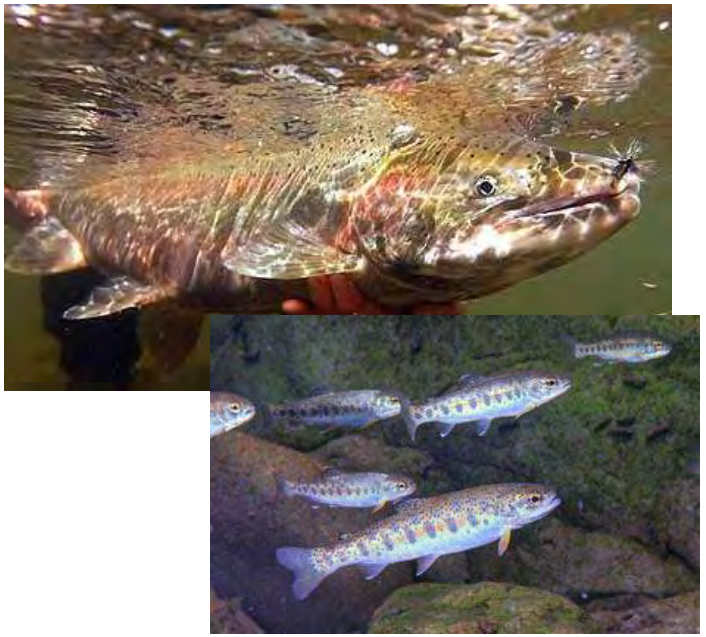
0.05

0.06

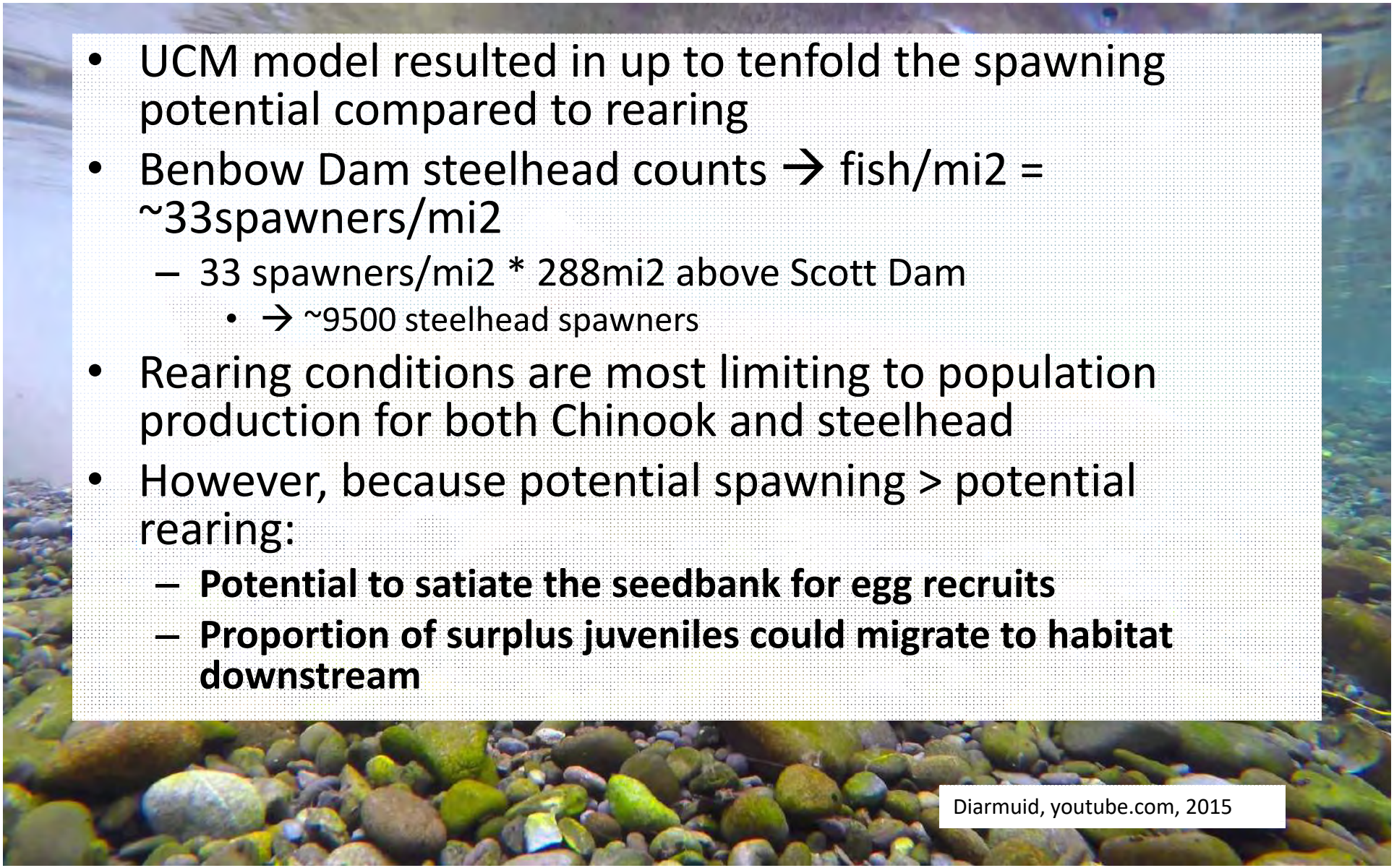
0.07

Parr Estimates → Number of Spawners

- Conversions with subsequent life stage specific survival rates
- Highly variable , many sources of uncertainty, low confidence
- Past abundance estimates (CDFG, 1979; VTN, 1982; NMFS, 2016) :
  - 1,500 – 6,120 steelhead spawners
  - 1,250 – 2,300 Chinook spawners
- This research:
  - 1,044 – 2,088 steelhead spawners
  - 4,593 Chinook spawners

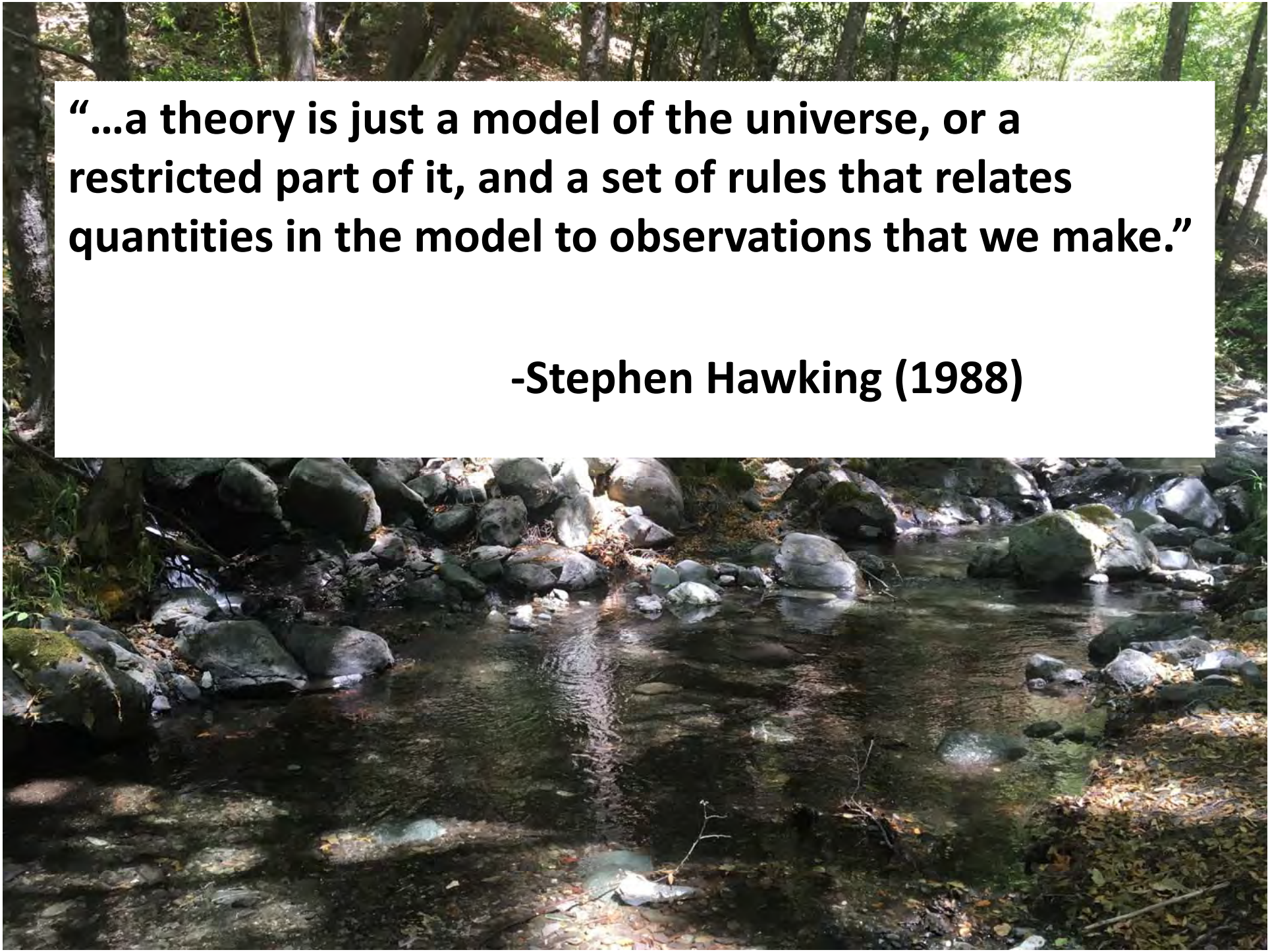


Spawner Capacity



- UCM model resulted in up to tenfold the spawning potential compared to rearing
- Benbow Dam steelhead counts → fish/mi2 = ~33spawners/mi2
  - 33 spawners/mi2 * 288mi2 above Scott Dam
    - → ~9500 steelhead spawners
- Rearing conditions are most limiting to population production for both Chinook and steelhead
- However, because potential spawning > potential rearing:
  - **Potential to satiate the seedbank for egg recruits**
  - **Proportion of surplus juveniles could migrate to habitat downstream**

Diarmuid, youtube.com, 2015



"…a theory is just a model of the universe, or a restricted part of it, and a set of rules that relates quantities in the model to observations that we make."

-Stephen Hawking (1988)

Conclusions

- The UCM identified rearing conditions most limiting to potential population production
- The UCM also identified of high quality rearing streams which were mapped
- Ample spawning habitat was quantified
- Potentially higher increase in salmonid production than what is suggested by modeling parr capacity in streams above Scott Dam
- It's important to understand potential downstream effects from dam removal and how that may contribute to spawning and rearing potential

Acknowledgements

- Dr. Alison O'Dowd, Thesis Advisor
- Dr. Jim Graham & Dr. Darren Ward, Thesis Committee Members
- *Funding from:*
  - California Trout
  - Council on Ocean Affairs, Science, & Technology (COAST)
  - Water Resources & Policy Initiatives
  - Research, Scholarship, & Creative Activities Program (RSCA), HSU
- *Support & Collaboration from:*
  - Mendocino National Forest Service
  - Ross Taylor & Associates
  - Josh Fuller & David White, National Marine Fisheries Service
  - California Department of Fish & Wildlife
  - Native Fish Society
  - Friends of Eel River
  - Cramer Fish Sciences
  - Field Crew: Erik Daniels, Ariel Dasher, Erik Kenas, Mason Price

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Water Resources & Policy Initiatives

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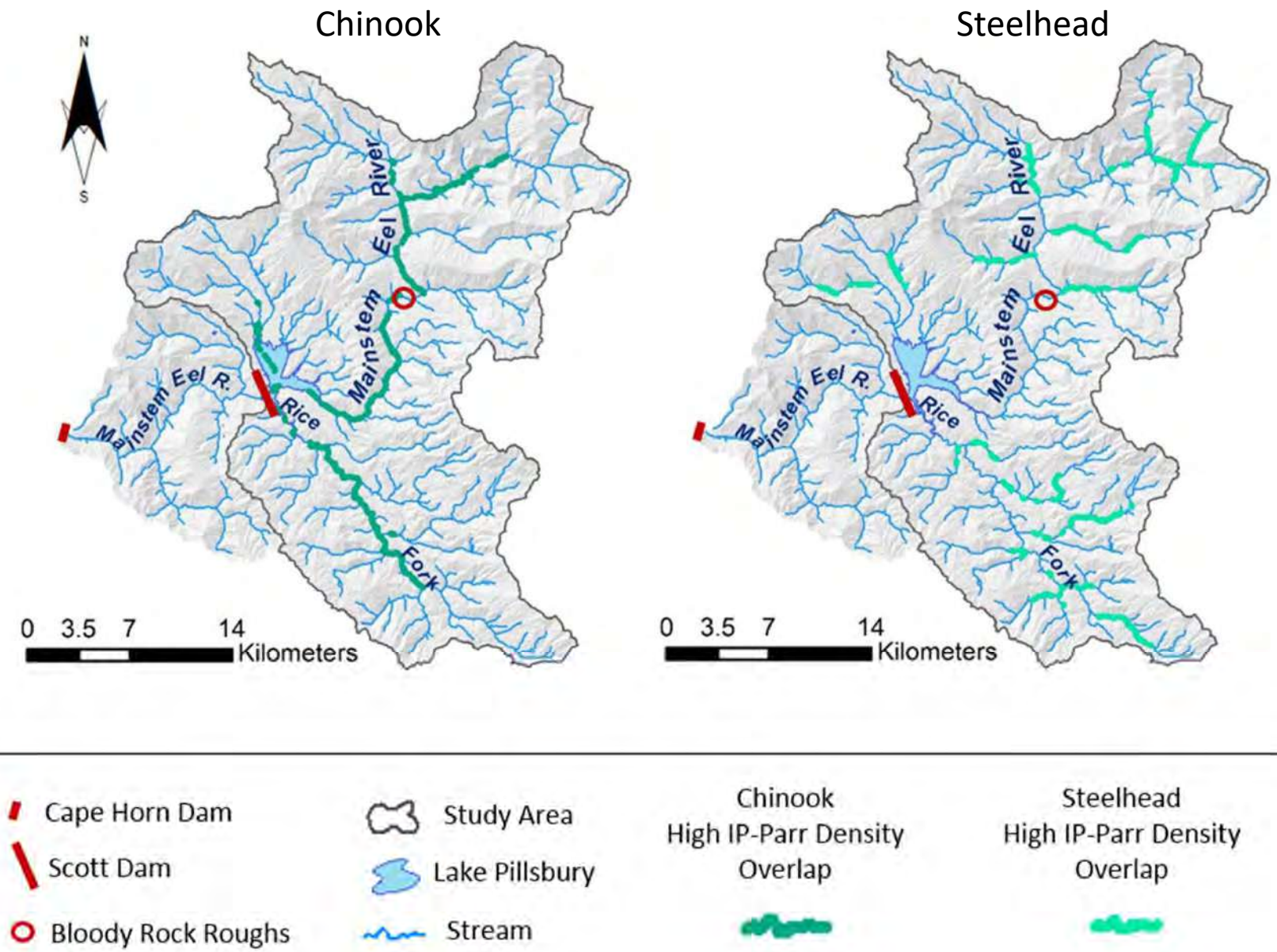
High Intrinsic Potential + High Potential Density



Quick Facts

- Scott Dam: 162 River mi from Pacific Ocean
- Scott Dam: 138’ high; 805’ wide; 86,000 acre ft capacity
- 12 river mi between Scott Dam and Cape Horn Dam
- Cape Horn Dam: 96’ high; 515’ wide
- Study site drainage area: 288 mi^2
- Elevation range of study site: 1,818’ – 7,057’