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Session B2 - Assessing fish passage connectivity at the watershed scale: Truckee River case study

Item Type	event;event
Authors	Conyngnam, Jock
Download date	2026-04-10 15:15:03
Link to Item	https://hdl.handle.net/20.500.14394/24454

Assessing fish passage connectivity at the watershed scale: Truckee River case study

Jock Conyngham, Craig
Fischenich, and Kyle McKay

*National Conference on Engineering and
Ecohydrology for Fish Passage
Amherst, Massachusetts
June 5, 2012*



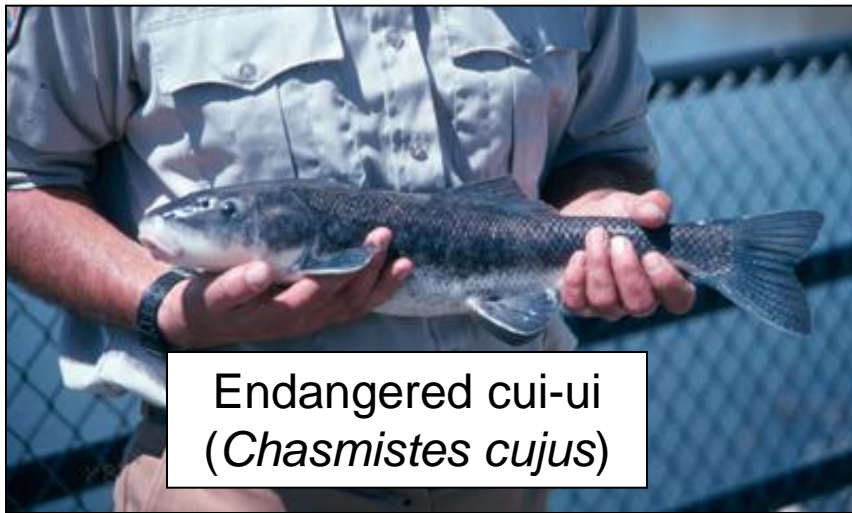
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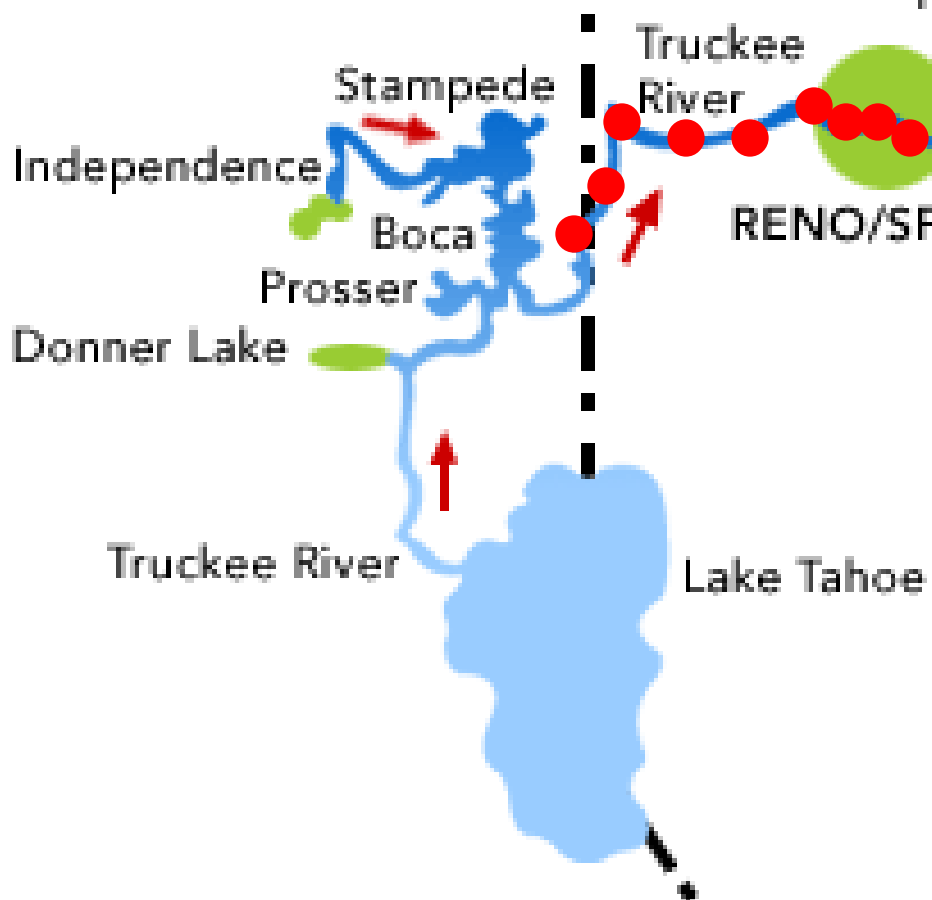
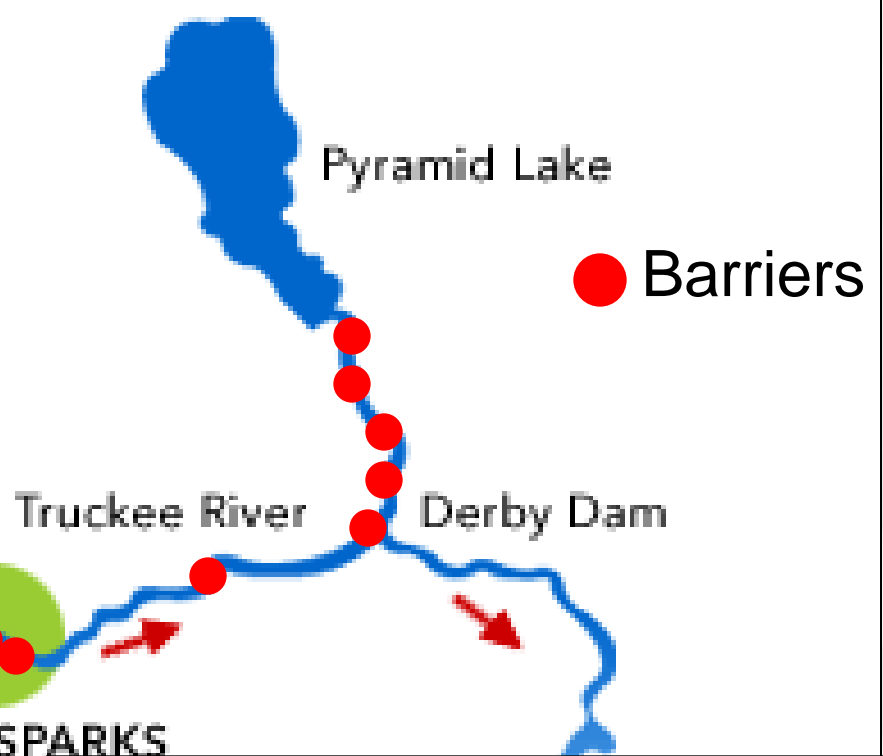


**Truckee River:
Movement Impediment
Inventory and Alternatives
Development, With
Assessment of Environmental
Benefit Dependencies**





Endangered cui-ui
(*Chasmistes cujus*)



Threatened Lahontan cutthroat trout
(*Oncorhynchus clarki henshawi*)

Structure	River mile (mi)	Diversion Discharge (% of river)	Structure Height (ft)
Pyramid Lake	0		
Marble Bluff	4	0.0	35
Numana	12.5	3.1	12
S-S	21.75	0.6	na
Fellnagle	27	0.6	4
Herman	31.5	1.9	2.4
Derby	39.5	25.8	15
Tracy PP	44	3.9	na
Cochran	66	0.8	na
Idlewild Ponds	66.5	0.3	na
Chalk Bluff	69.8	10.7	3
Orr	70	3.3	na
Lake	71.5	1.8	na
Last Chance	73	2.6	na
Washoe-Highlands	76	34.9	8 - 10
Verdi	80.5	40.6	13
Steamboat	83.5	7.0	10
Fleisch	86	44.0	14
Lake Tahoe	121.1		



Truckee River: Scoping the Problem

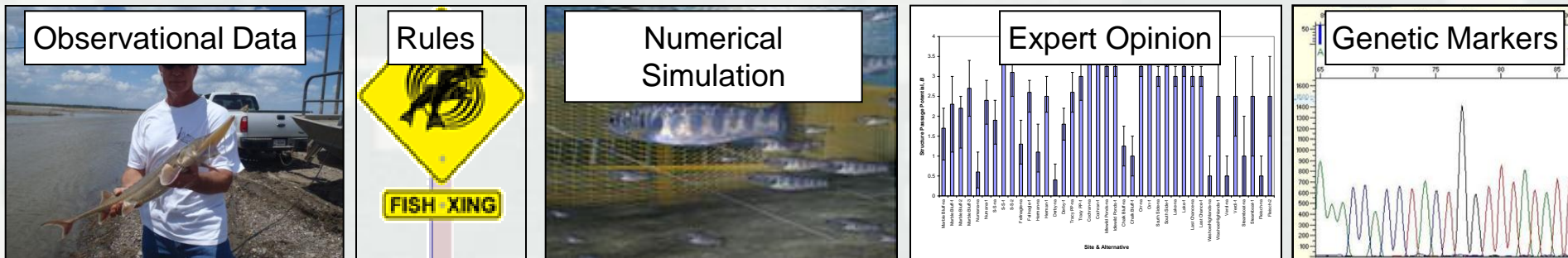


Enhancing and measuring fish passage

- What alternatives exist to improve bi-directional fish passage?



- How do we compare alternatives at a single barrier?



How do we evaluate cumulative effects of multiple barriers within a single watershed?



Fish passage alternatives

- Upstream:
 - ▶ Fish ladders
 - ▶ Pumps, lifts, locks
 - ▶ Trap-and-Truck
 - ▶ Bypass Channels
 - ▶ Partial or Full Removal
- Downstream
 - ▶ Physical barriers
 - ▶ Diversion screens
 - ▶ Behavioral guidance devices
 - ▶ Collection systems
 - ▶ Operational changes

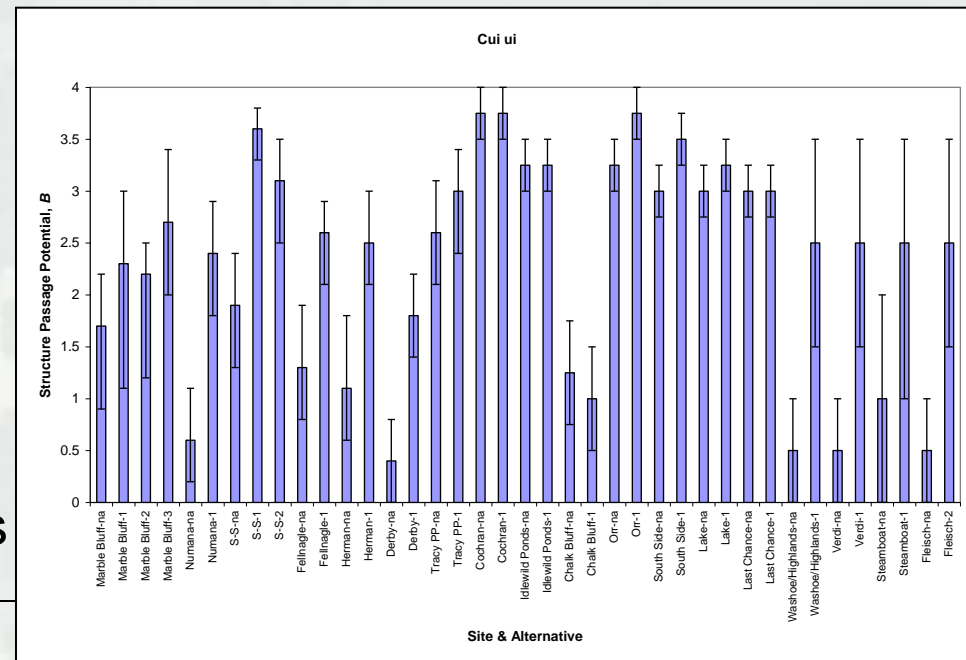
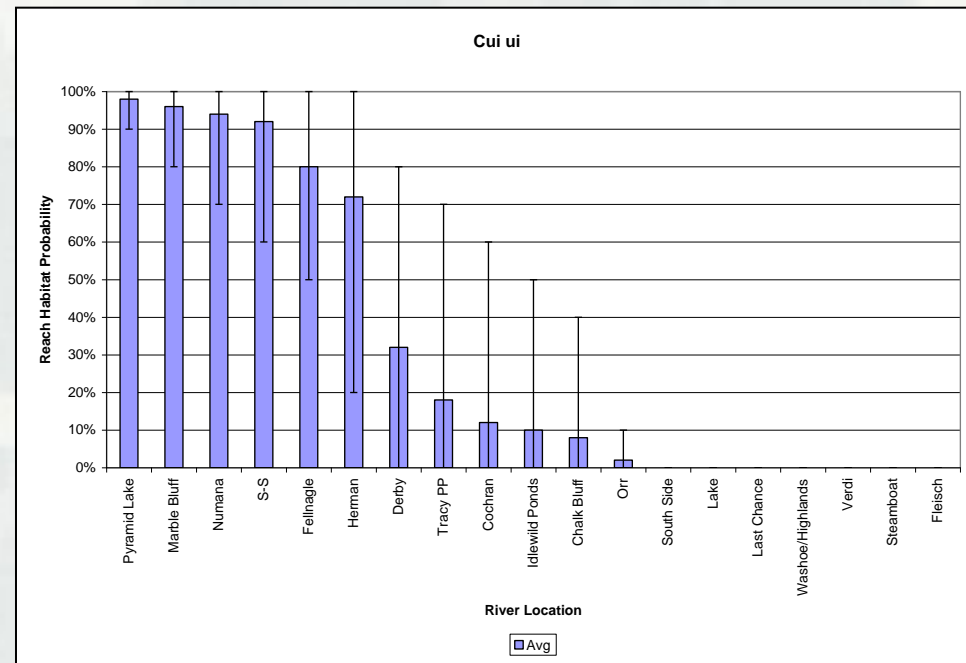


Expert elicitation of passage rates

- Why?
 - ▶ No available data
 - ▶ 3 months to develop a plan

- Who?
 - ▶ Local subject matter experts
 - ▶ Variety of technical capabilities

- How?
 - ▶ Blank surveys
 - ▶ Follow-up calls for error checking
 - ▶ Verification of results at meetings
 - ▶ Statistics assessment of results

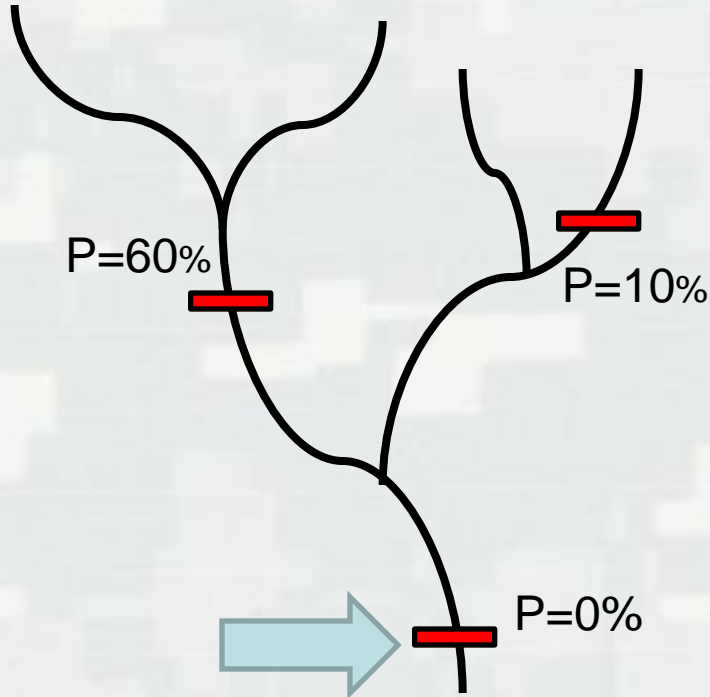


Truckee River: Analyzing multiple barriers and their interactive influences on movement

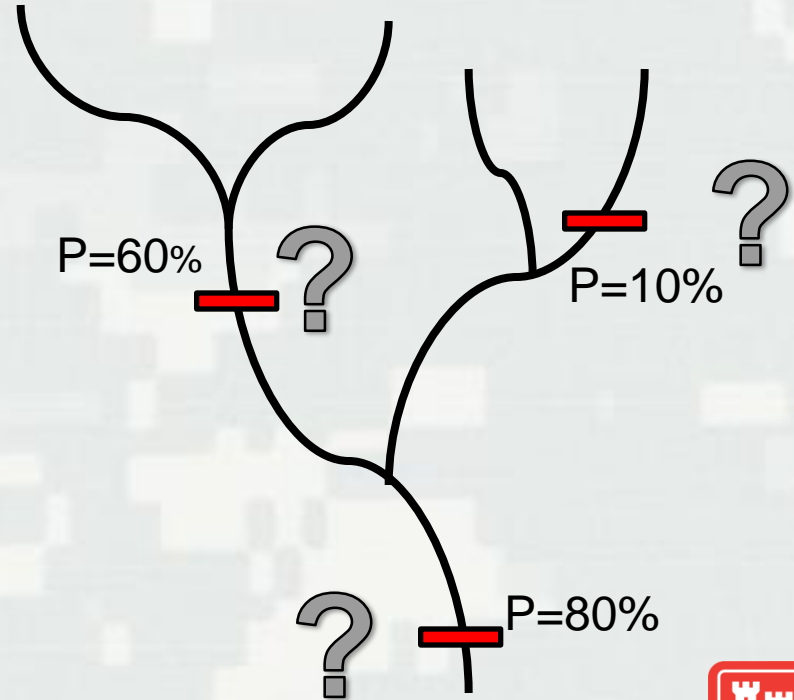


Why are multiple barriers challenging: dependencies, life histories, and basin morphologies?

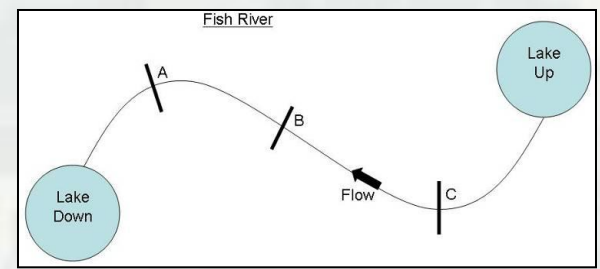
Scenario 1: Obvious Solution



Scenario 2: Not so obvious solution...



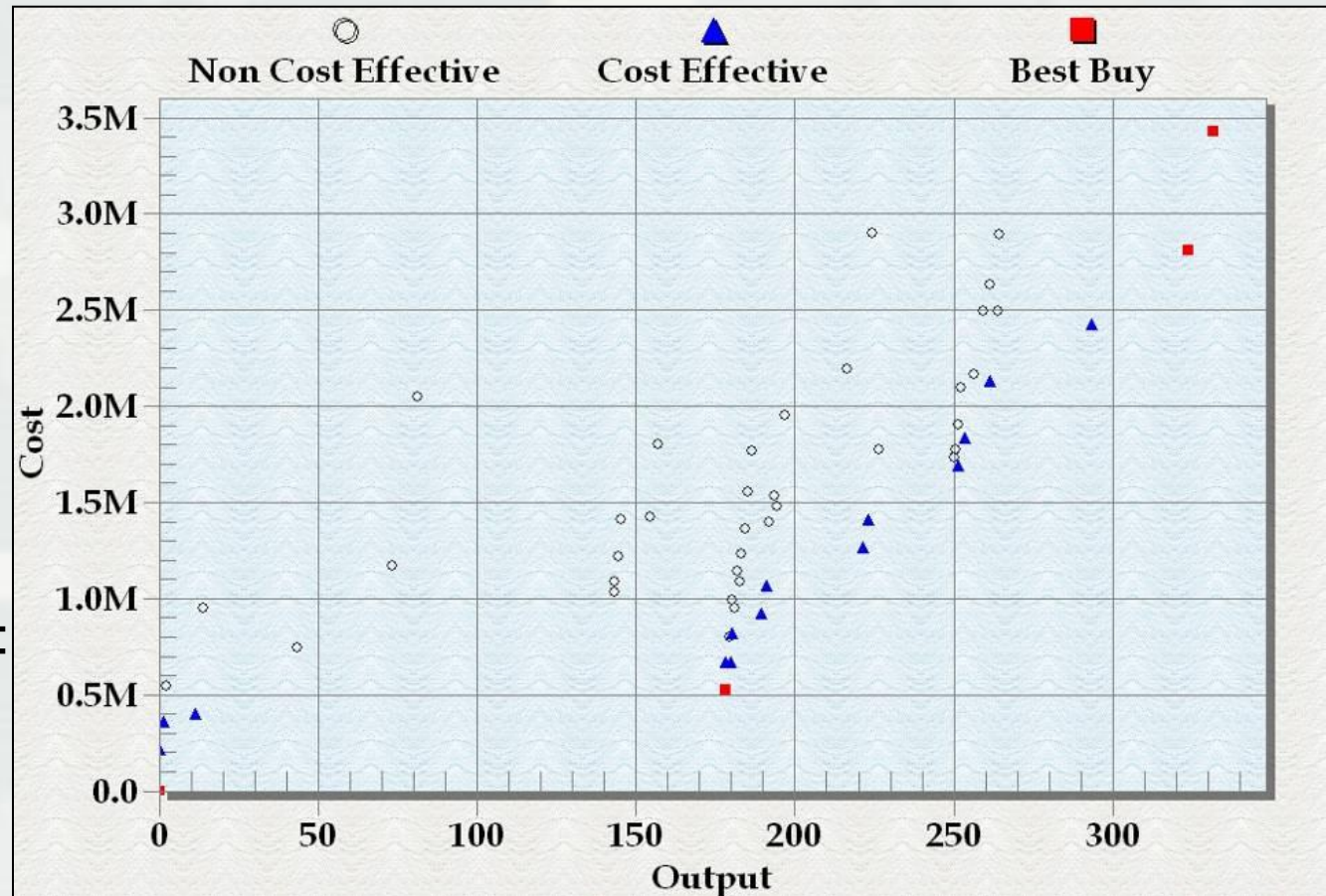
Developing a system-wide fish passage model



River Mile	Structure	Structure Passage Efficiency	Cumulative Efficiency	Upstream Habitat (mi)	"Benefit-miles"	Cumulative "Benefit-miles"
Scenario 1: Pre-Restoration						
0	Lake Down	100	100	5	5	5
5	A	80	80	5	4	9
10	B	50	40	5	2	11
15	C	50	20	5	1	12
20	Lake Up		20	0	0	12
Scenario 2: Improve Passage at B from 50% to 80%						
0	Lake Down	100	100	5	5	5
5	A	80	80	5	4	9
10	B	80	64	5	3.2	12.2
15	C	50	32	5	1.6	13.8
20	Lake Up		32	0	0	13.8
Scenario 3: Improve passage at C from 50% to 80%						
0	Lake Down	100	100	5	5	5
5	A	80	80	5	4	9
10	B	50	40	5	2	11
15	C	80	32	5	1.6	12.6
20	Lake Up		32	0	0	12.6

Truckee Application

- Dependency between actions
- Eight species
- Bi-Directional Passage (Up and Down separate)
- Other parameters:
 - ▶ Habitat quality
 - ▶ Mobility
 - ▶ LWD & sediment passage

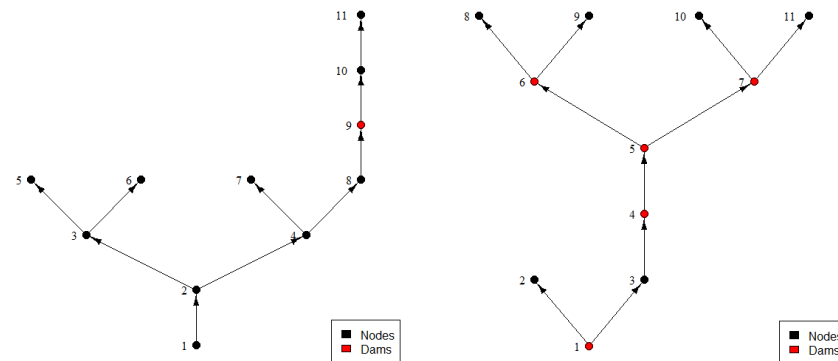
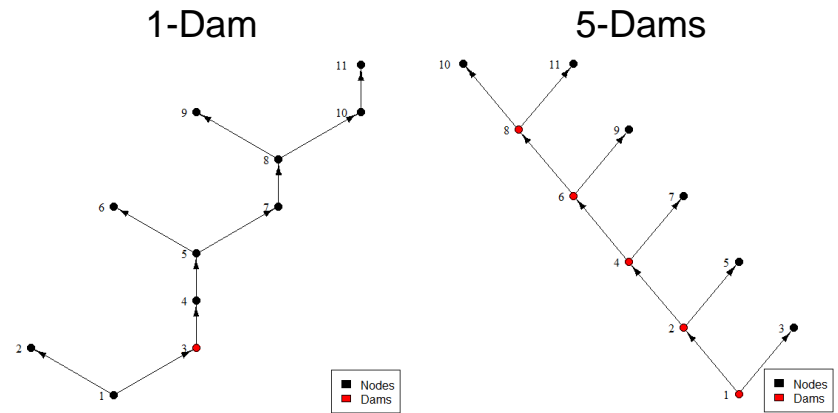


Some thoughts on the future of multi-barrier fish passage assessment



Ongoing Activities

- Expanding algorithm to dendritic (rather than linear) river networks
- Seeking to couple upstream and downstream passage benefits (suggestions are welcome!)
- Examining species-scale and guild-scale results in connectivity restoration benefits with random network configurations



Unanswered Questions

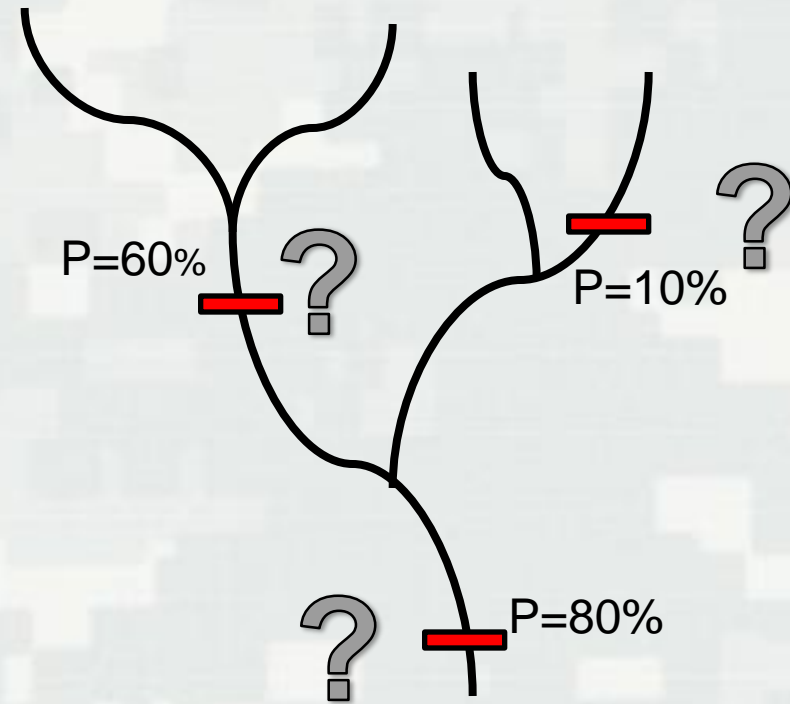
- Future work in the Truckee:
 - ▶ What is the influence of episodic passage rates on connectivity estimates?
 - ▶ How can the Truckee model best validated with monitoring data after construction? How should AM implications steer alternative selection?

- Fish passage modeling in general:
 - ▶ Can models be developed that are transportable to any basin morphology?
 - ▶ Can the models be applied to prioritize fish passage improvement at regional scales?
 - ▶ How can we parameterize passage rates on tight timelines with minimal data collection?
 - ▶ How do alternative approaches for watershed connectivity assessment compare (e.g., O'Hanley and Tomberlin 2005, Cote et al. 2009, Padgham and Webb 2010)?



Take-away Points

- Fish passage improvement is highly dependent upon actions at neighboring barriers.
- Although challenging, watershed-wide passage prioritization is feasible (even on short timelines)!
- Validity stems from accurate life history and specific habitat data.
- You don't get what you don't ask for and you can't substantiate.
- Future work is critical to adequately characterize this complex analytical problem.
 - ▶ We're actively working on this issue and need your help!



Questions and Feedback

USACE Ecosystem Management and Restoration Research Program

<http://el.erdc.usace.army.mil/emrrp/>

Truckee River Fish Passage Team Members

Kyle McKay	Craig Fischenich	Mike Channell	Leigh Skaggs
Dan Artho	Jerry Fuentes	James Lee	Mario Parker
Lisa Heki	David Potter	Jay Kidder	Matt Maples
Kim Tisdale	Gary Scoppettone	Bill Hauck	Jock Conyngham

Contact Information

Jock Conyngham

406-541-4845

Jock.N.Conyngham@usace.army.mil

