



University of
Massachusetts
Amherst

Dam Removal I: Ecological and Geomorphic Adjustments to Dam Removal in an Upland Mesic Catchment

Item Type	event;event
Authors	Nislow, K. H.;Magilligan, F.;Doyle, H.;Kynard, B.;Damkot, P.;Dietrich, J.
Download date	2025-07-04 04:32:18
Link to Item	https://hdl.handle.net/20.500.14394/25238

Ecological and Geomorphic Adjustments to Dam Removal in an Upland Mesic Catchment



^{2,4,6}Nislow, K.H., ¹Magilligan, F., ³Doyle, H., ⁴Kynard, B., ^{4,6}Damkot, P. & ⁵Dietrich, J.

¹Department of Geography, Dartmouth College

²USDA Forest Service, Northern Research Station

³Department of Earth Sciences, Dartmouth College

⁴Department of Environmental Conservation, Umass-Amherst

⁵Department of Geography, Neukom Institute, Dartmouth College

⁶Northeast Climate Science Center

PERSPECTIVES

1 MAY 2015 • VOL 348 ISSUE 6234

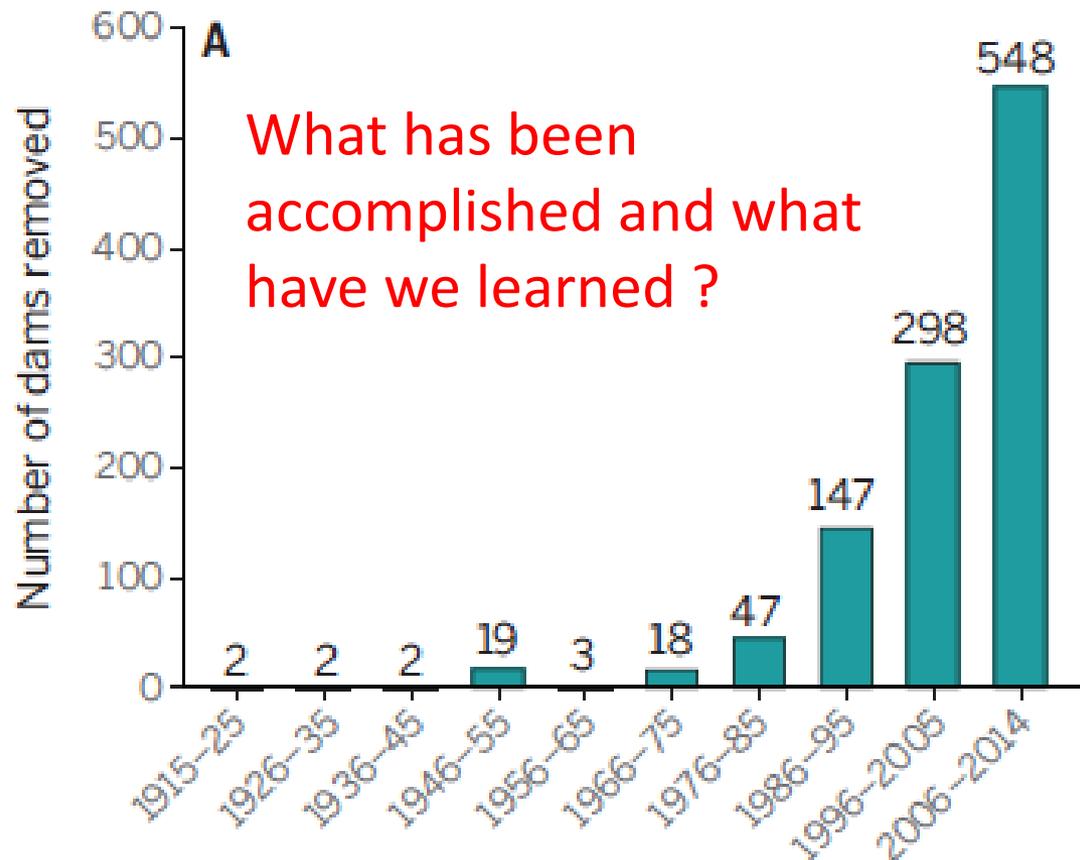
ECOLOGY

1000 dams down and counting

Dam removals are
reconnecting rivers in
the United States

By J. E. O'Connor,¹ J. J. Duda,²
G. E. Grant³

Dam removals in the United States



[Communities](#) → [Forest and Rangeland Ecosy...](#) → [FRESC Public Data](#) → [USGS Dam Removal Scienc...](#)

Bellmore et al. (2015). USGS Dam Removal Science Database. doi:10.5066/F7K935KT.

USGS Dam Removal Science Database

Of the 130 dam removals that have geomorphic or ecological assessment, **only 35** have combined geomorphic and ecological monitoring **with < 5** having ecological and geomorphic monitoring beyond the first year.



This database is the result of an extensive literature search aimed at identifying documents relevant to the emerging field of dam removal science. In total the database contains **179 citations** that contain empirical monitoring information associated with **130 different dam removals** across the United States and abroad. Data includes publications through 2014 and supplemented with the U.S. Army Corps of Engineers National Inventory of Dams database, U.S. Geological Survey National Water Information System and aerial photos to estimate locations when coordinates were not provided. Publications were located using the Web of Science, Google Scholar, and Clearinghouse for Dam Removal Information.

Monitoring

Management

Focus: How successful was the removal in achieving designed management (often ecological) goals?

Science

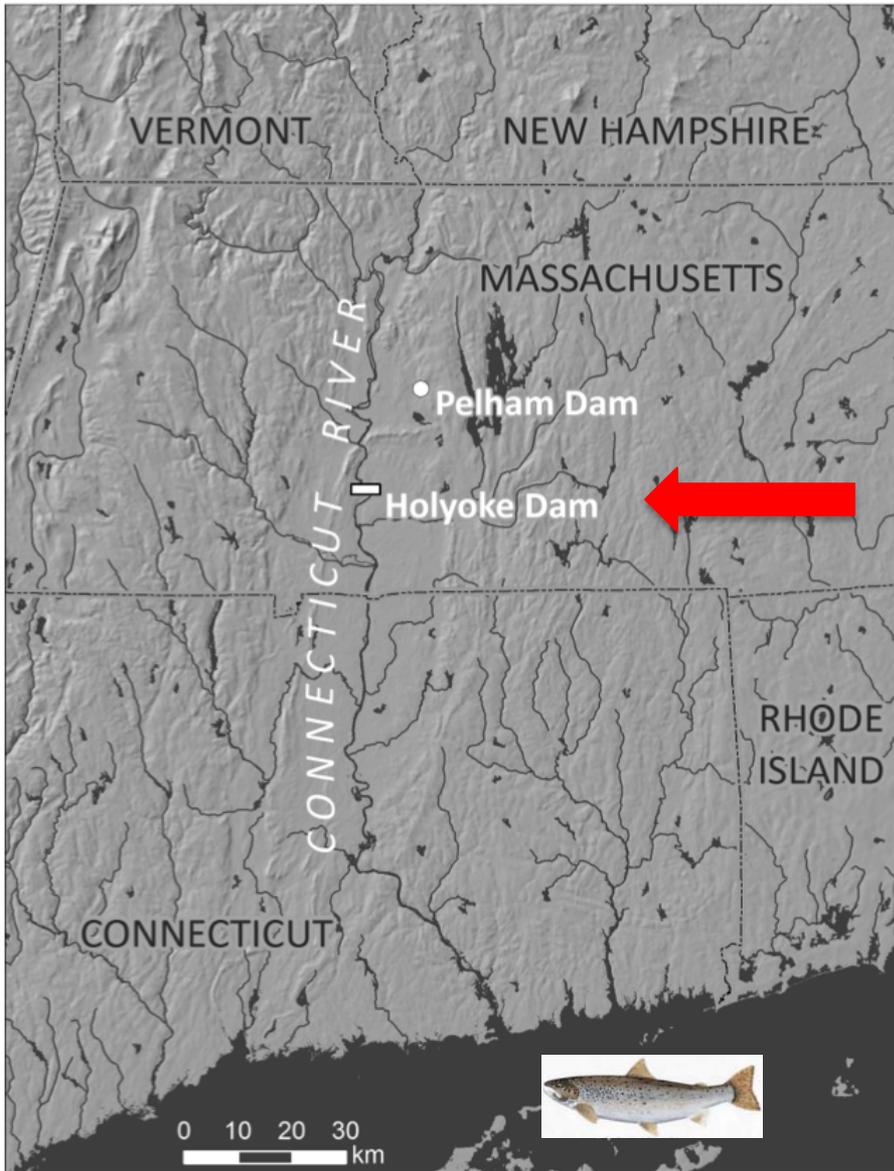
Focus: How do fluvial systems respond to the removal of a long-standing disturbance?

Metrics: fish passage; presence/absence of fish above former barrier; successful demographic shifts; improved spawning habitat; etc.?

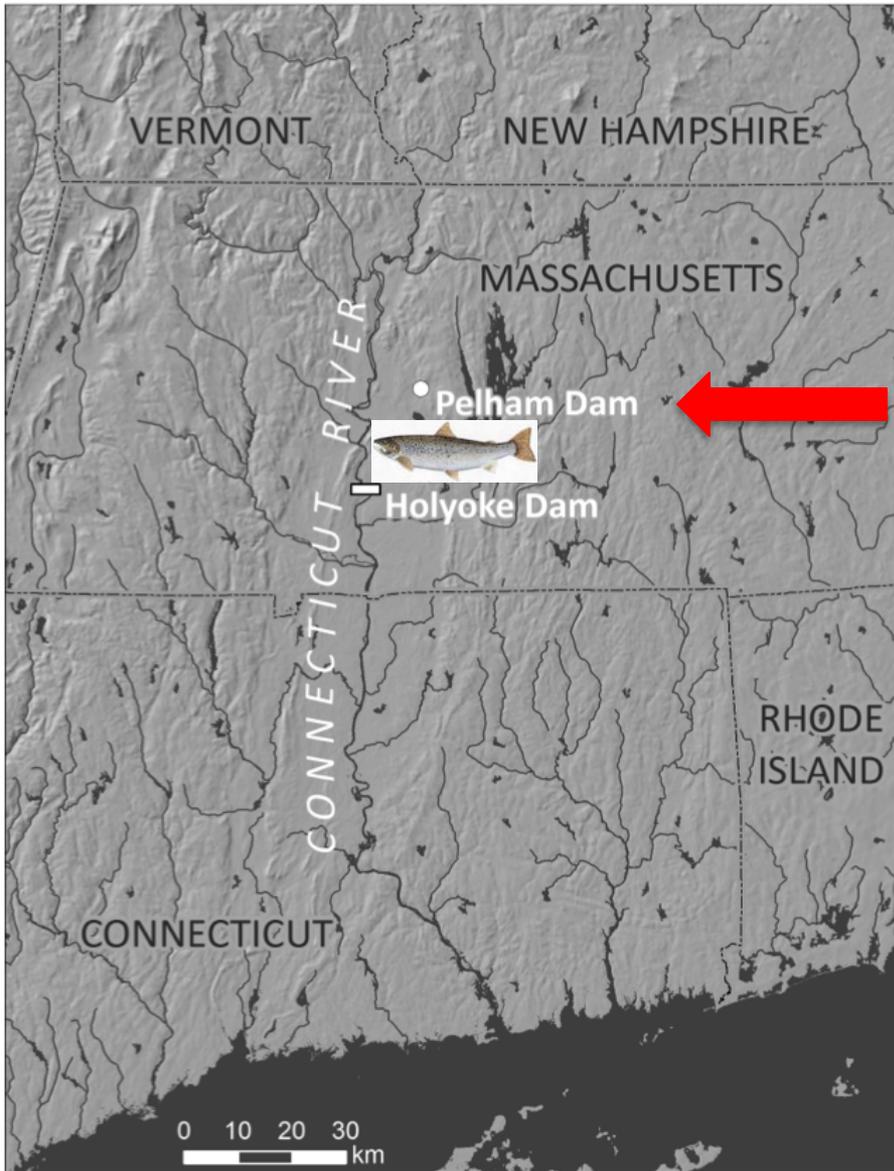
Questions: What processes, given the new boundary conditions, govern the rate, direction, and magnitude of geomorphic and ecological adjustments?



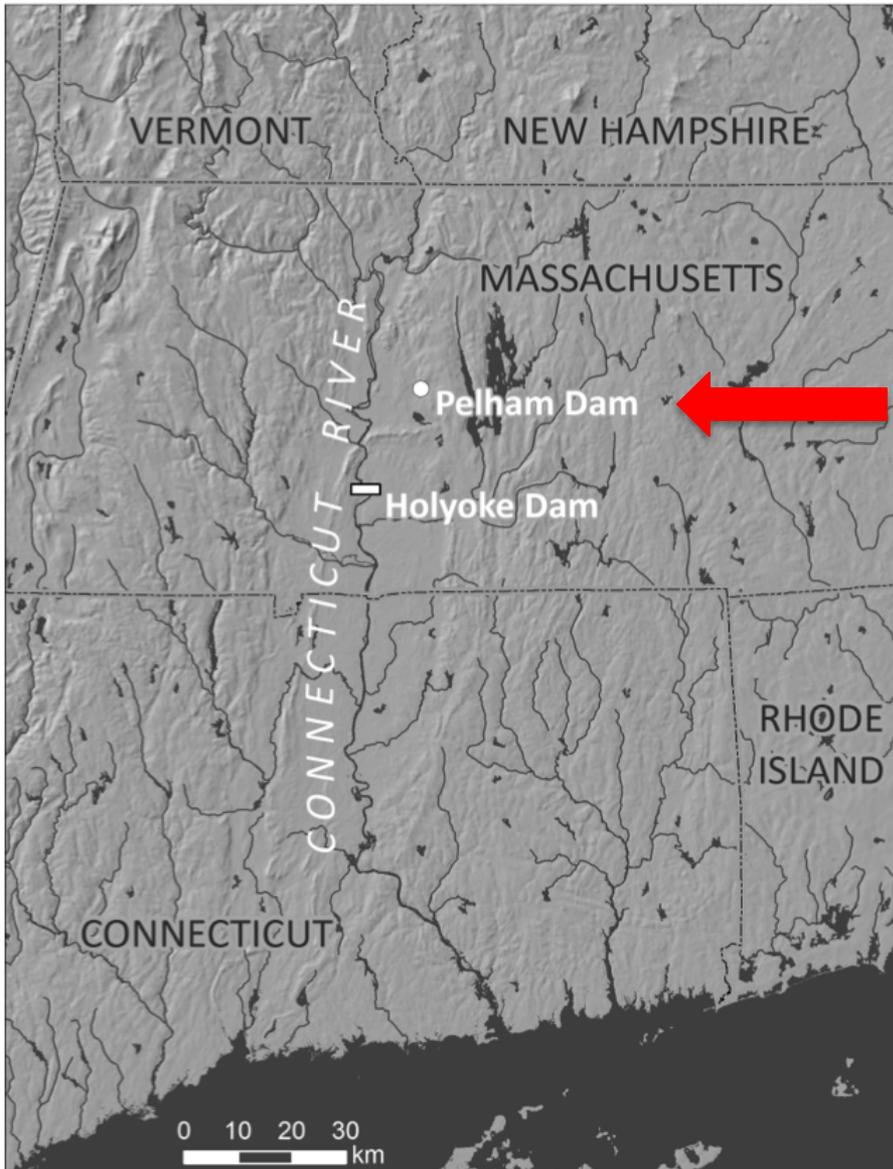
Pelham Dam (Amethyst Brook), MA



Pelham Dam (Amethyst Brook), MA



Pelham Dam (Amethyst Brook), MA



1. Ecological Impacts Associated with Dam Removal

- Evaluate the immediate and sustained changes in:
 - a) fish species richness & abundance above/below the dam site.
 - b) distribution of native anadromous Sea lamprey nest sites.

2. Geomorphic Adjustments Associated with Dam Removal

- Quantify changes in stream channel geometry and channel bed habitat/complexity (D_{50}) above and below dam.
- Determine whether channels downstream of former dam are in equilibrium with new reconnected sediment supply

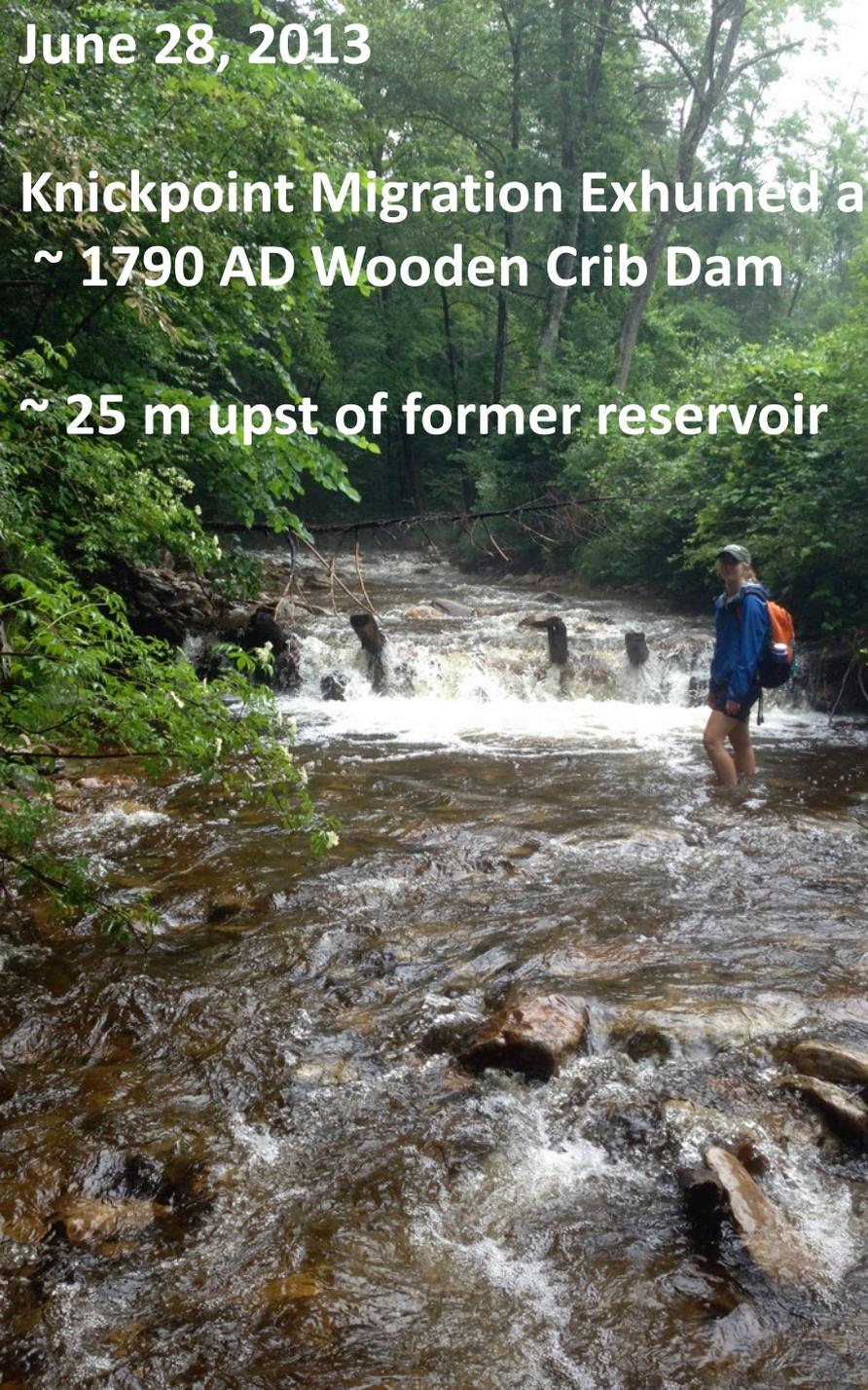


**November 2012
Bartlett Dam removed**

June 28, 2013

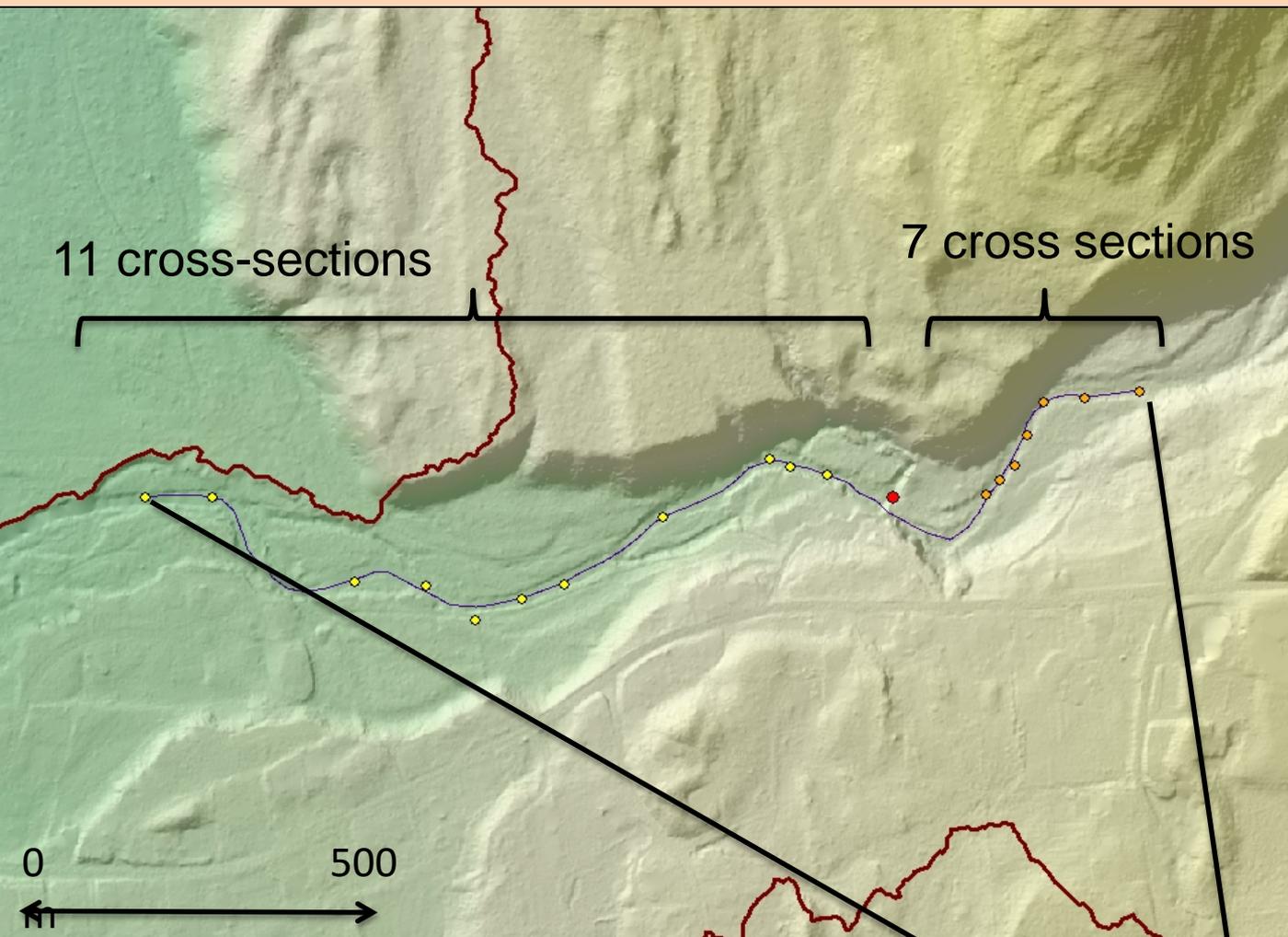
Knickpoint Migration Exhumed a
~ 1790 AD Wooden Crib Dam

~ 25 m upst of former reservoir





5 days later (July 1, 2013)
~ 20 yr RI flood
→ Same Q as Hurricane Sandy



Amethyst Bk.: (24 km²)

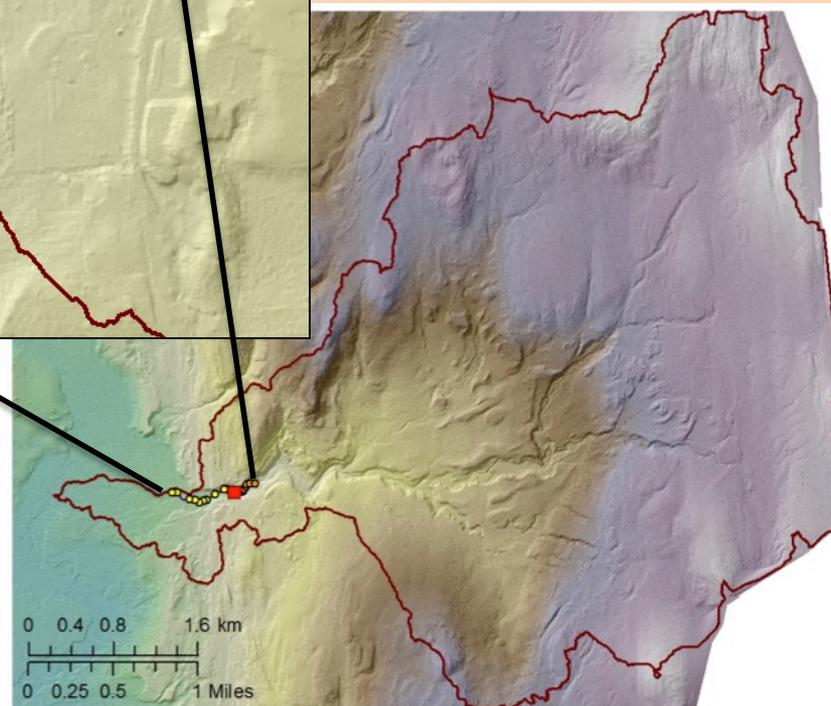
Slope = ~ 1%

Bartlett Dam Built: ~ 1820

" Removed: 2012

Crib Dam Built : <1760

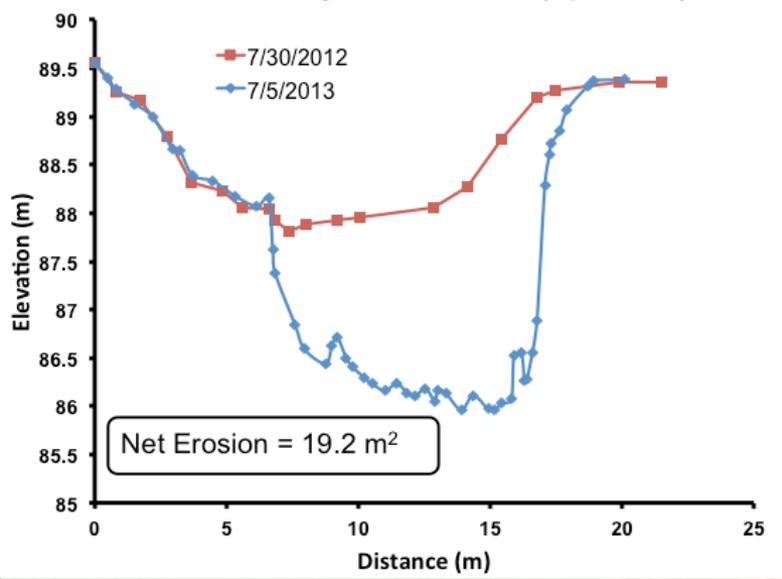
" Removed: 2016



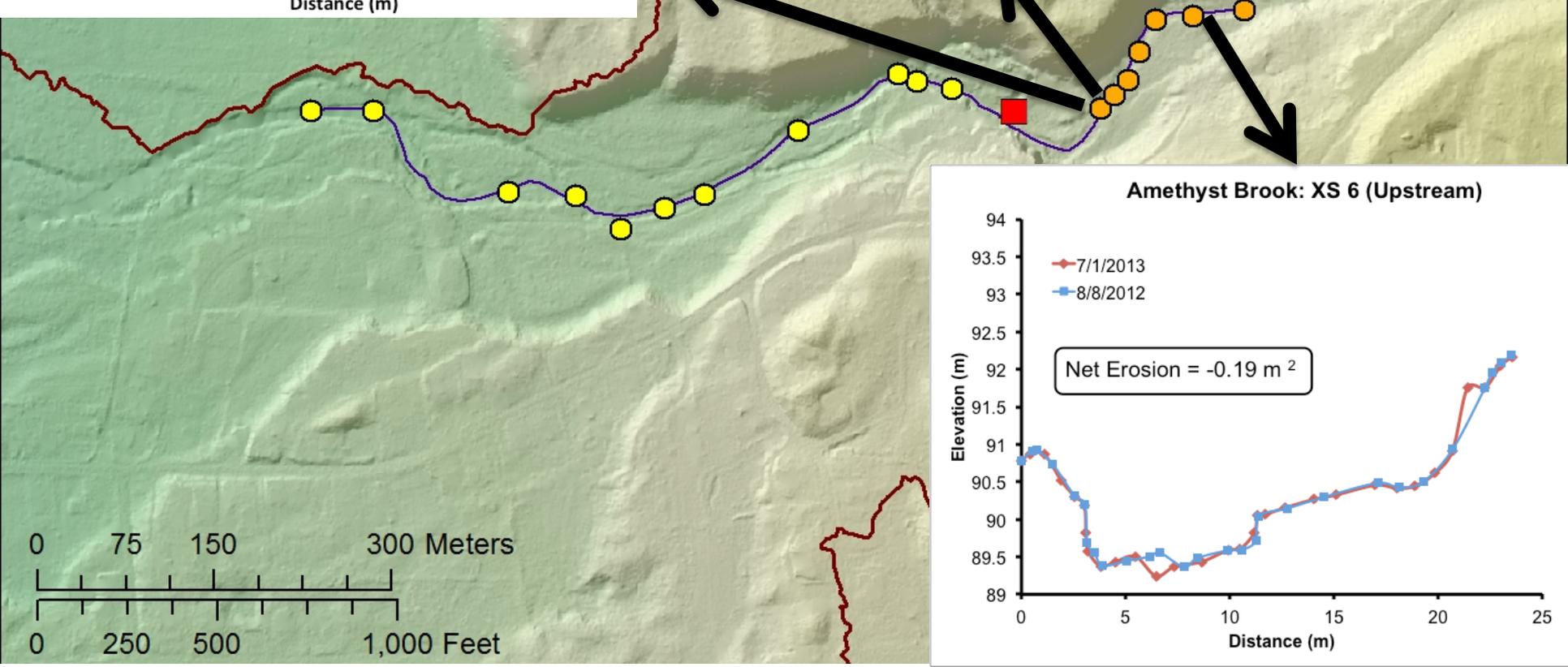
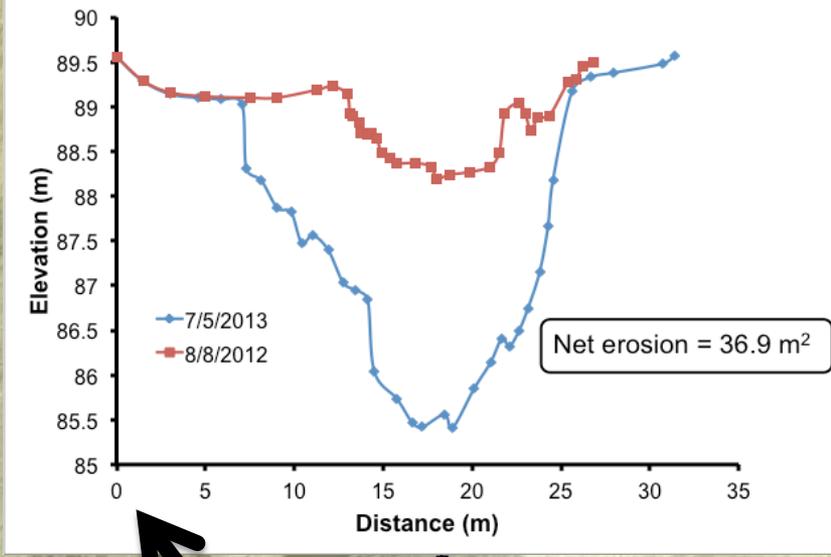
Methods:

- Annual Wolman Pebble Counts
- Annual Long Profile and Cross Section Surveying
- Electrofishing and Lamprey Redd Surveys

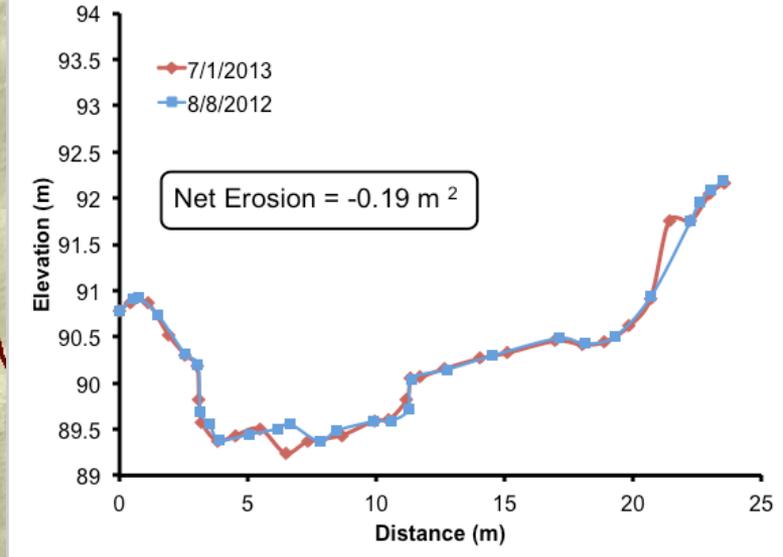
Amethyst Brook: XS 1 (Upstream)



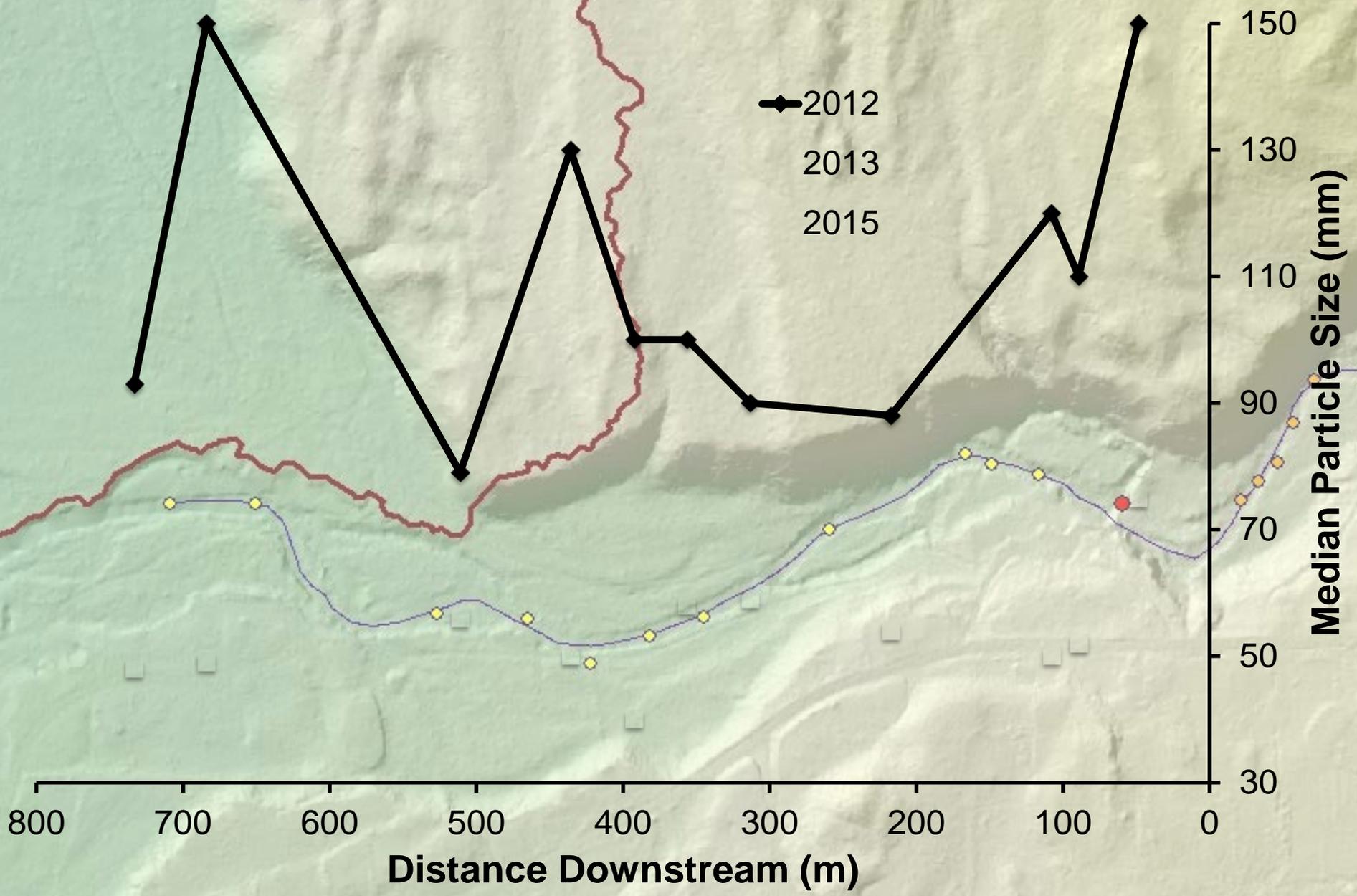
Amethyst Brook: XS 2 (Upstream)



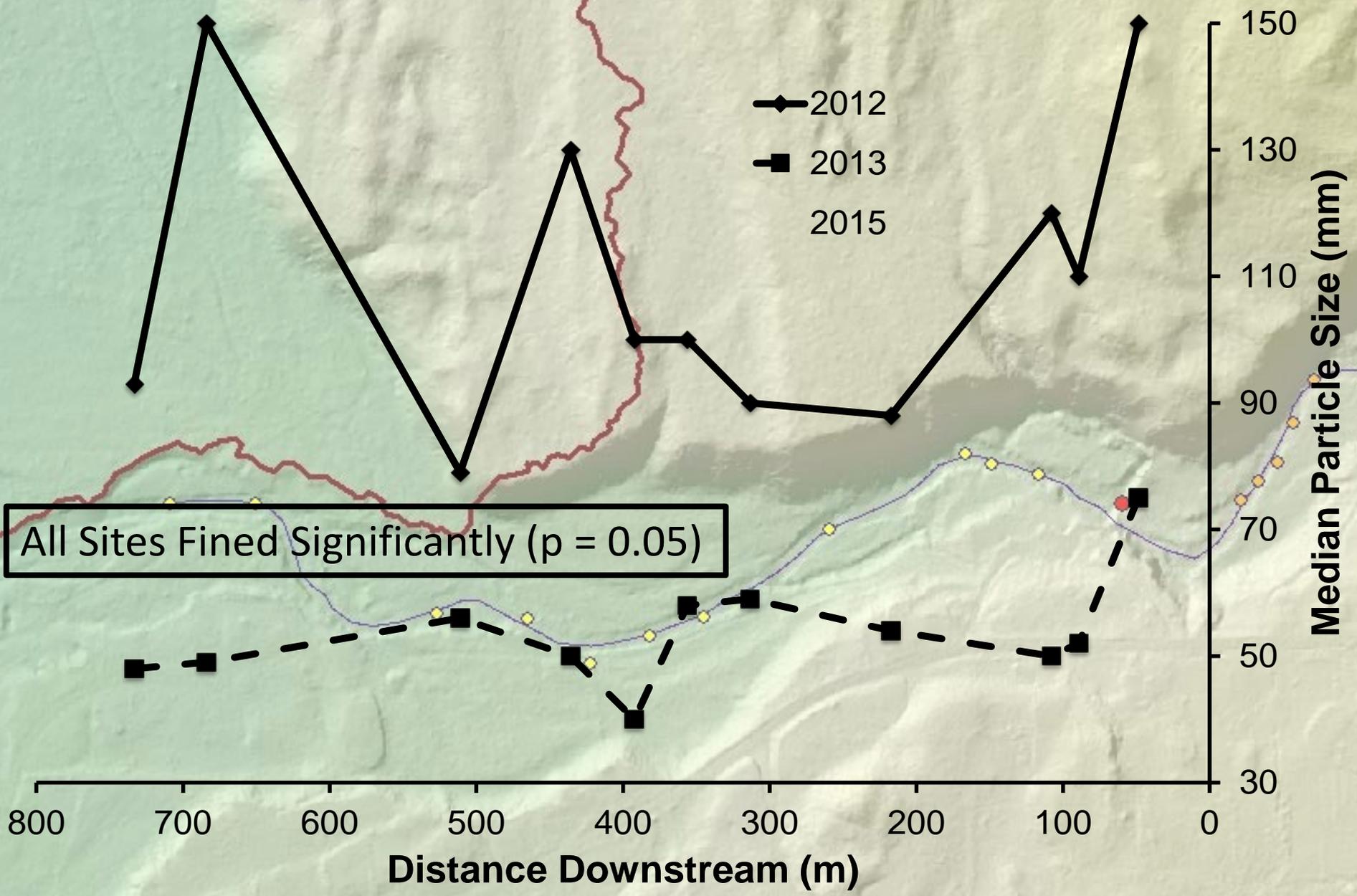
Amethyst Brook: XS 6 (Upstream)



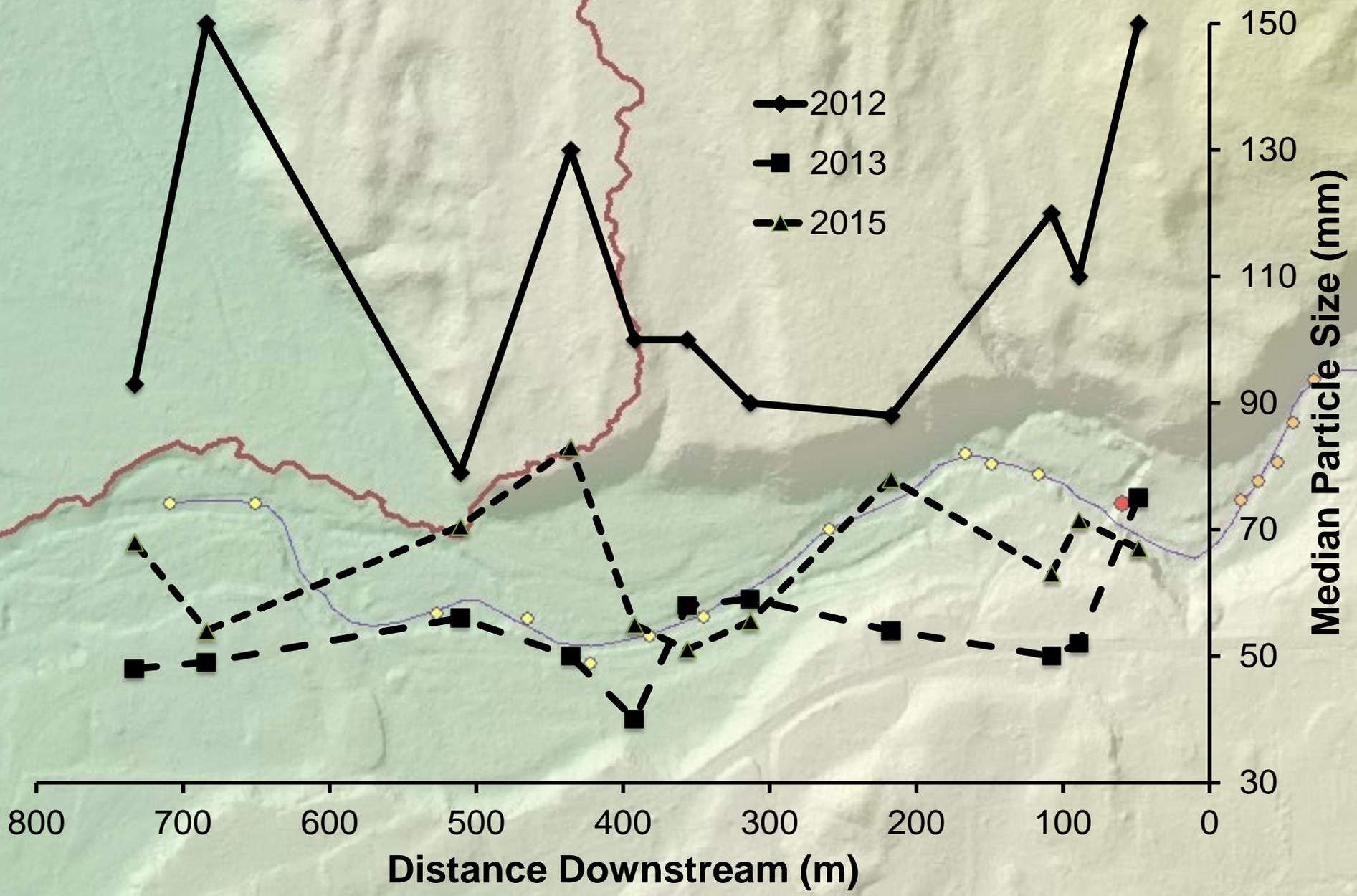
Downstream Changes in Median(D_{50}) Bed Particle Size



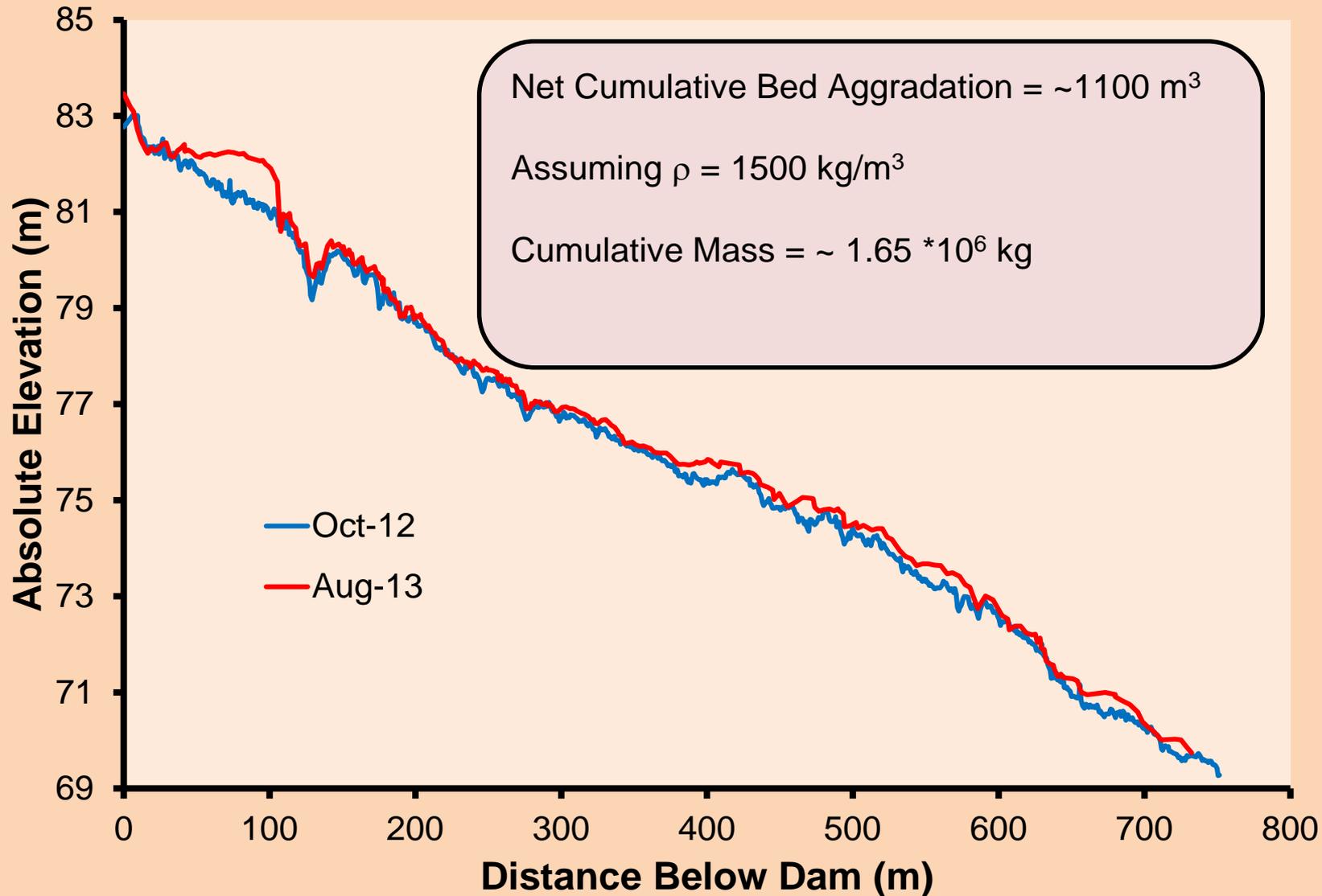
Downstream Changes in Median(D_{50}) Bed Particle Size



Downstream Changes in Median(D_{50}) Bed Particle Size



Channel Bed Elevation Change 2012-2013

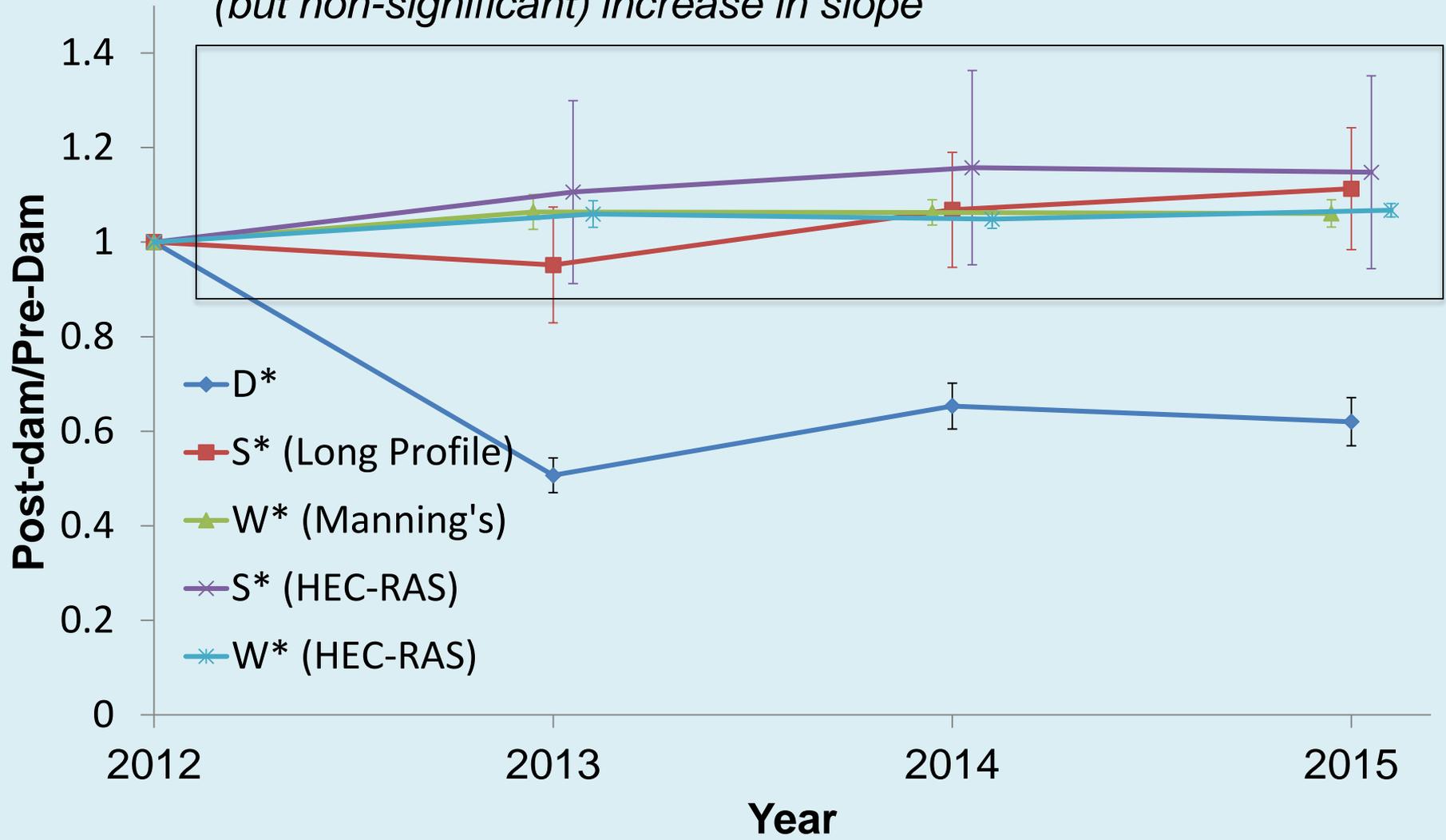


2012 - 2013: Average bed aggradation = $\sim 25 \text{ cm}$

2013 - 2015: No Appreciable Net Change

Time Series of Geomorphic Adjustments Following Dam Removal

Channel adjustments have been minimal other than a slight (but non-significant) increase in slope



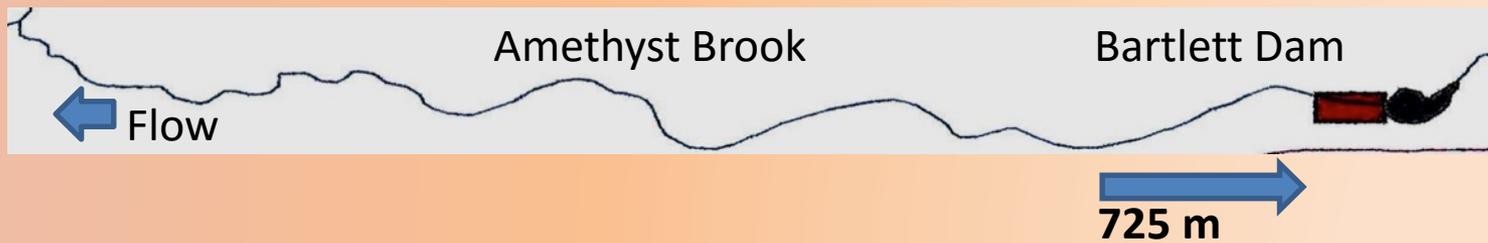
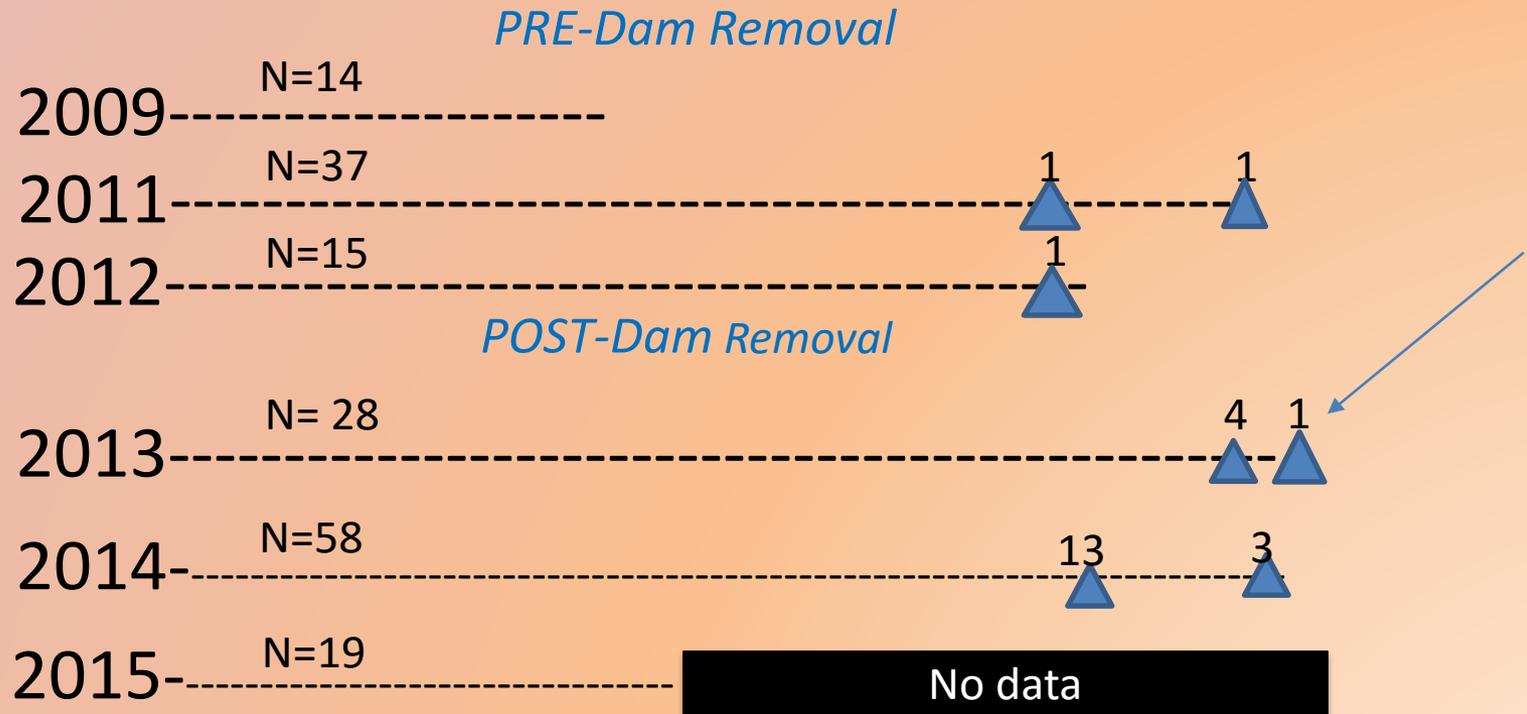
$D = D_{50}$; $S = \text{Slope}$; $W = \text{Width}$; * indicates ratio to pre-removal

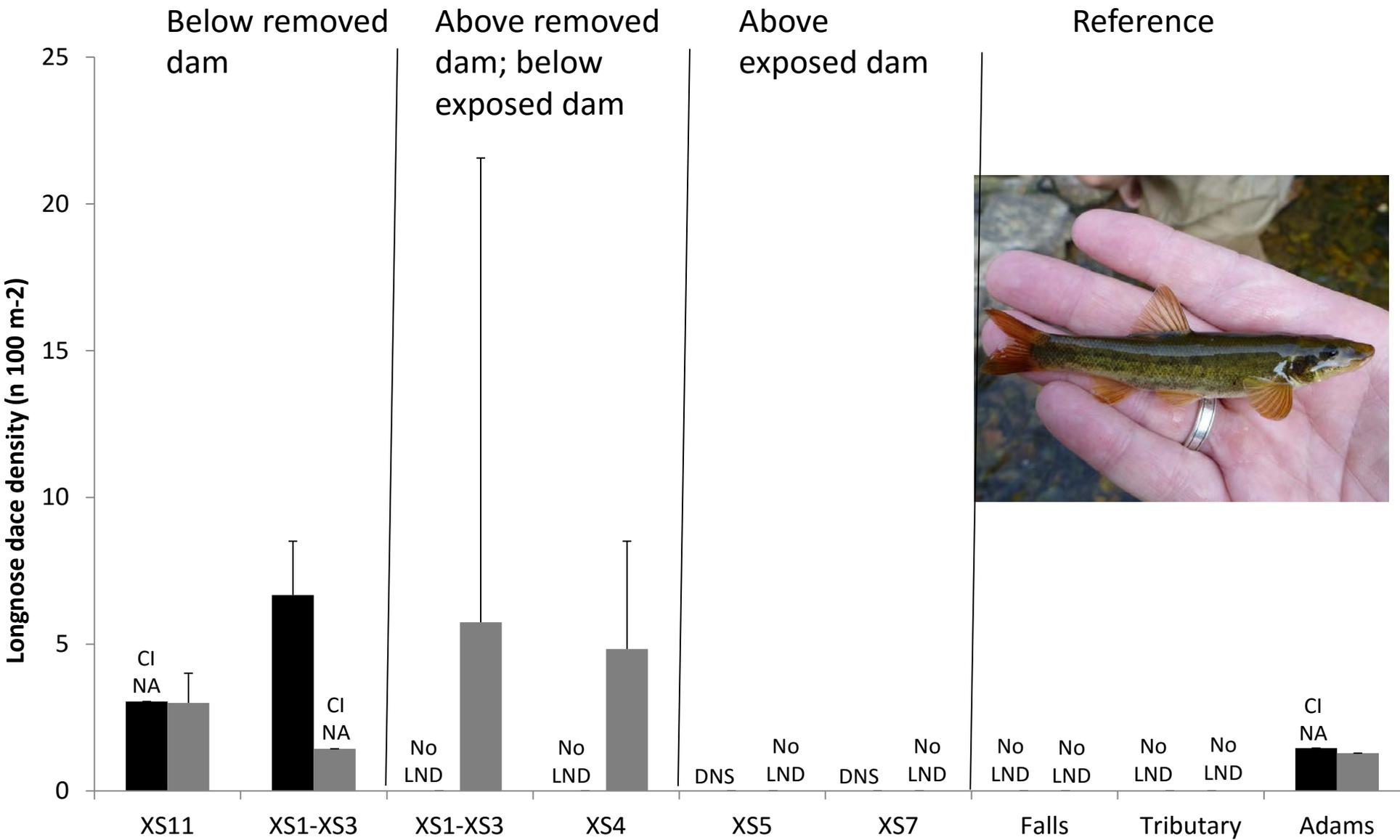
Ecological response to removal: impact of restored passage and re-connected sediment supply on lamprey and resident fish distribution, abundance and diversity

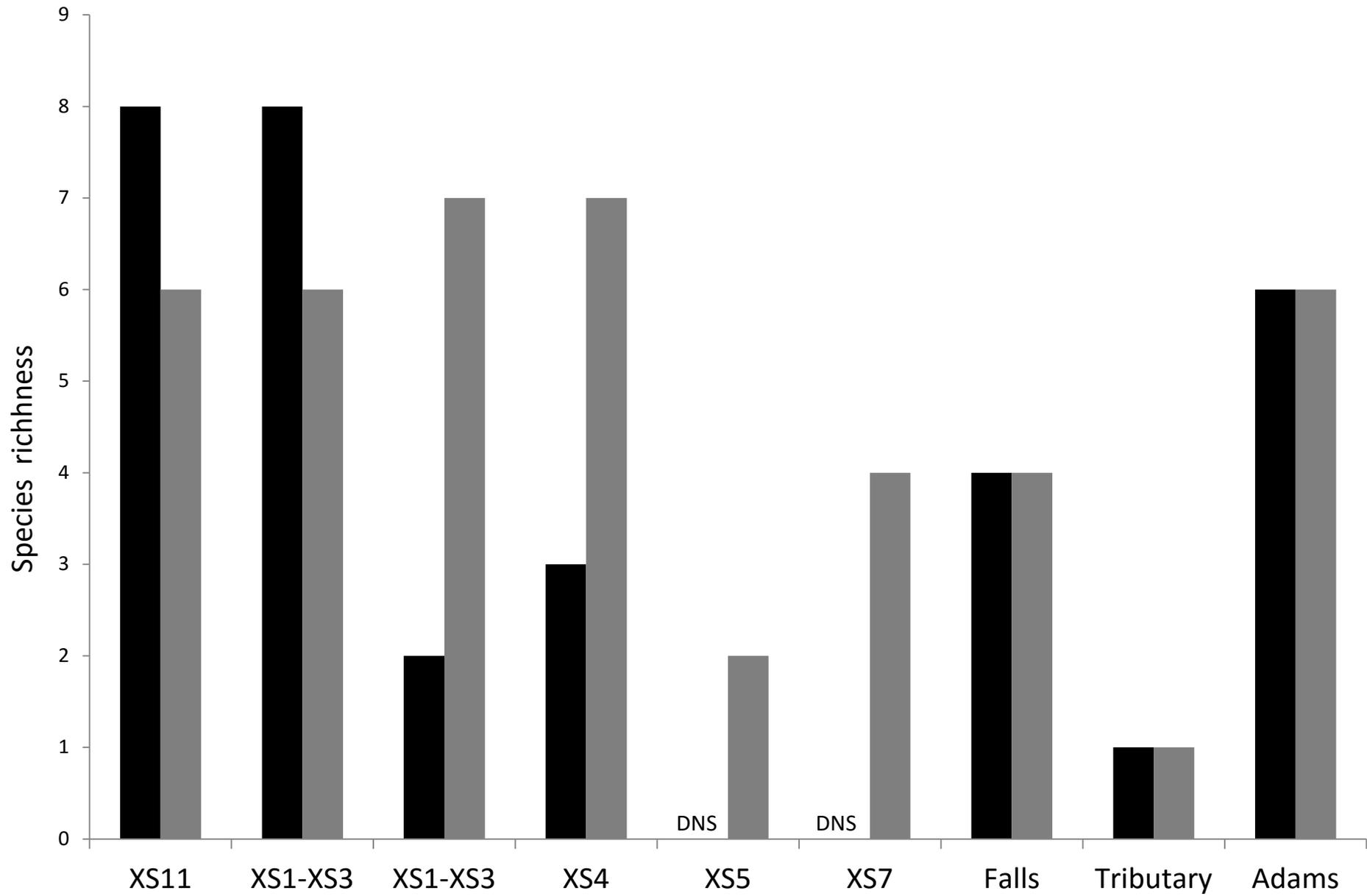


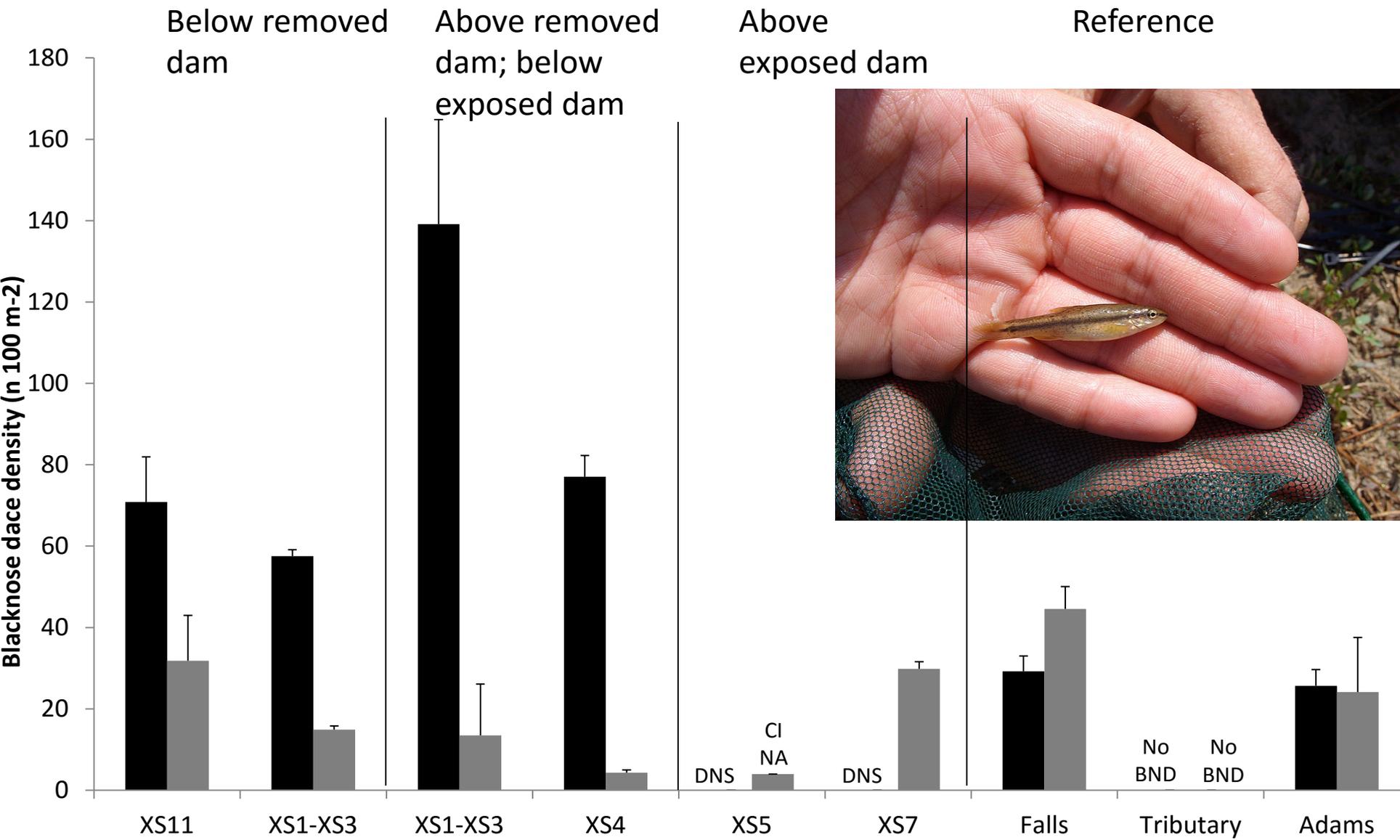
and location of sea lamprey spawning nests by Yr: pre- and post-dam removal

YEAR --- N= Total # nests ; ▲ = # nests within 725 m of dam











		2012	2013	2014	2015
Below Dam	T11	154	77	106	94
	T1-3	159	76	105	124
Above Dam Below Crib Dam	T1-3	144	43	125	368
	T4	206	17	46	93
Above Crib Dam	T5		10	34	121
	T7		93	73	73

CONCLUSION

Immediate response to dam removal:

- Bed aggradation & significant fining downstream of former dam; channel adjustment associated with dam removal/flood interaction in dam proximal sections
- Lamprey nests increase in #, especially in dam proximal locations, and spawning observed above the former dam
- Fish species richness increases upstream as species move above the dam
- In sections experiencing major channel adjustment, abundances of some species was reduced



CONCLUSION

“Long-term” response to dam removal:

- Bed coarsens slightly but still finer than pre-dam condition
- Lamprey nests increase in #, especially in dam proximal locations
- Species whose abundance was reduced in dam/flood impacted reaches recover
- Bed fining is dominant and persistent response relative to other channel changes
- Downstream bar formation expands



2012



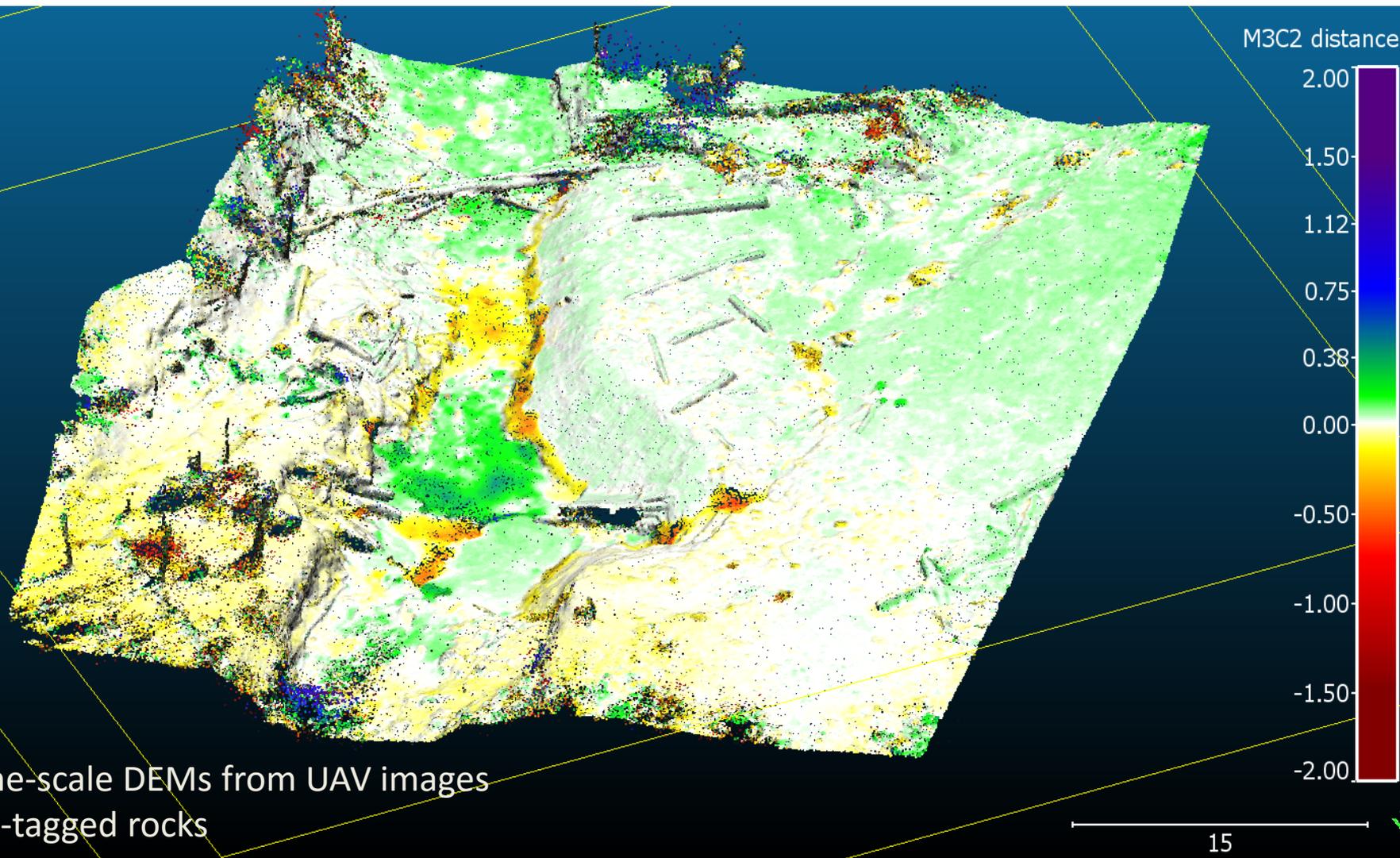


2014

Re-connected Supply of Fine Bed Material Has Led To Aggradation and Progressive (Alternate) Bar Formation



January 2016)
Crib Dam Removed



Fine-scale DEMs from UAV images
Pit-tagged rocks