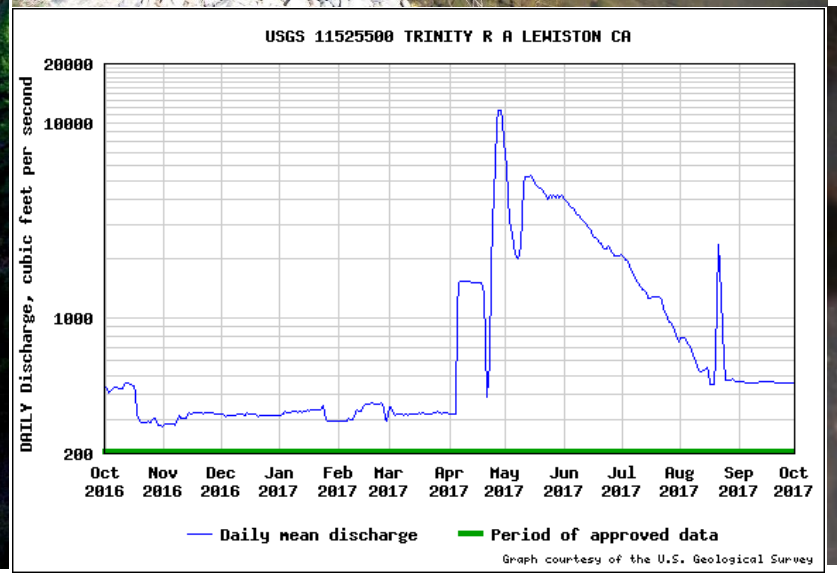
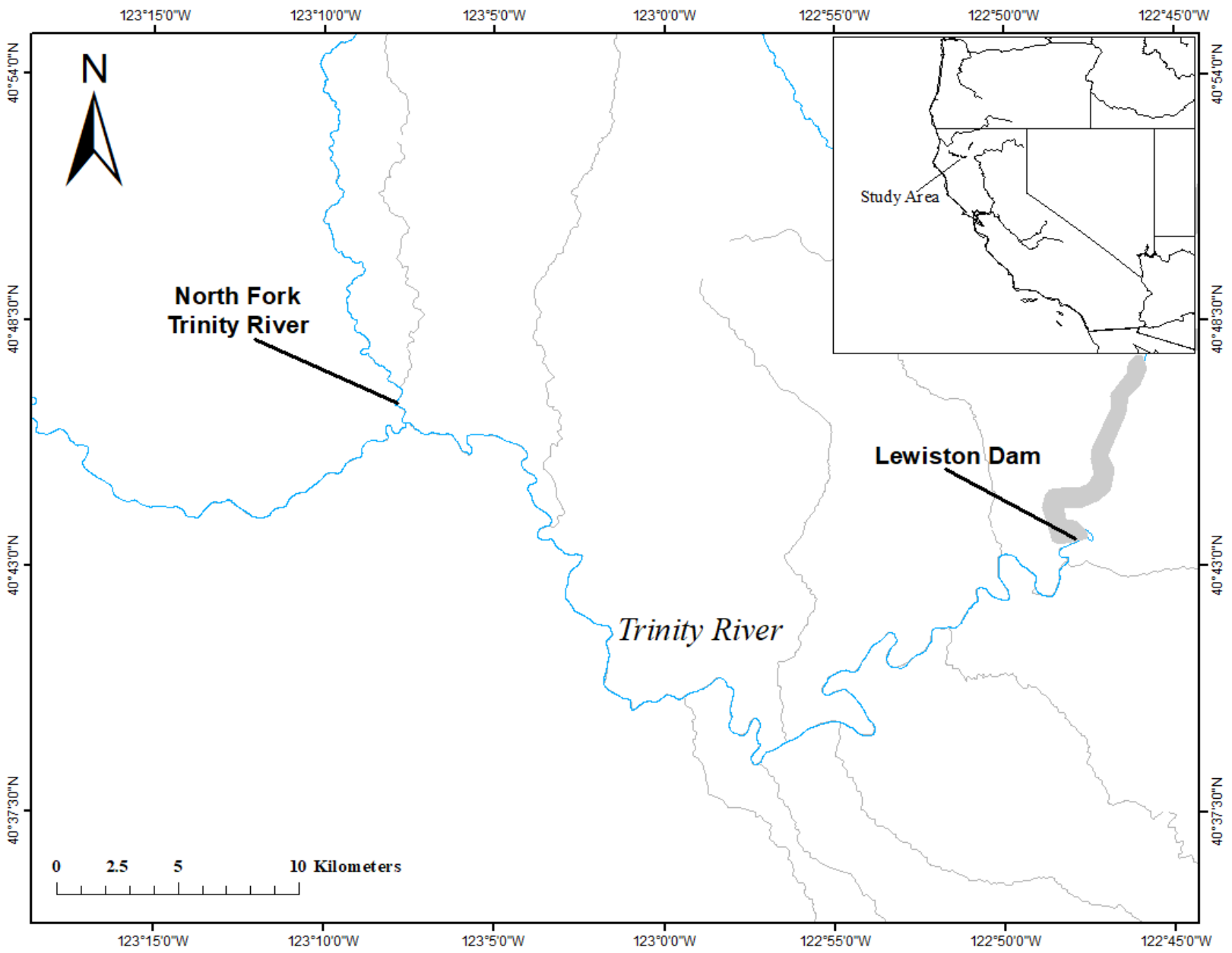
Streamflow and Salmonid Rearing Habitat at TRRP Rehabilitation Sites



Josh Boyce, Damon Goodman, Nicholas Som (USFWS) • Aaron Martin, Kyle Hopkins (YTFD) • Justin Alvarez (HVTFD)

Forty mile Restoration Reach



Altering and restoring the Trinity River

Trinity River Restoration Program (TRRP)

1999: TRFES (science based foundation of TRRP) ⟶ juvenile salmonid rearing habitat

2000: ROD (U.S. DOI decision establishing TRRP) ⟶ adaptive management (effectiveness monitoring)

-64 km "restoration reach"

-sediment augmentation

-WY-specific flow management

-mechanical channel rehabilitation

Trinity River Flow Evaluation Study*

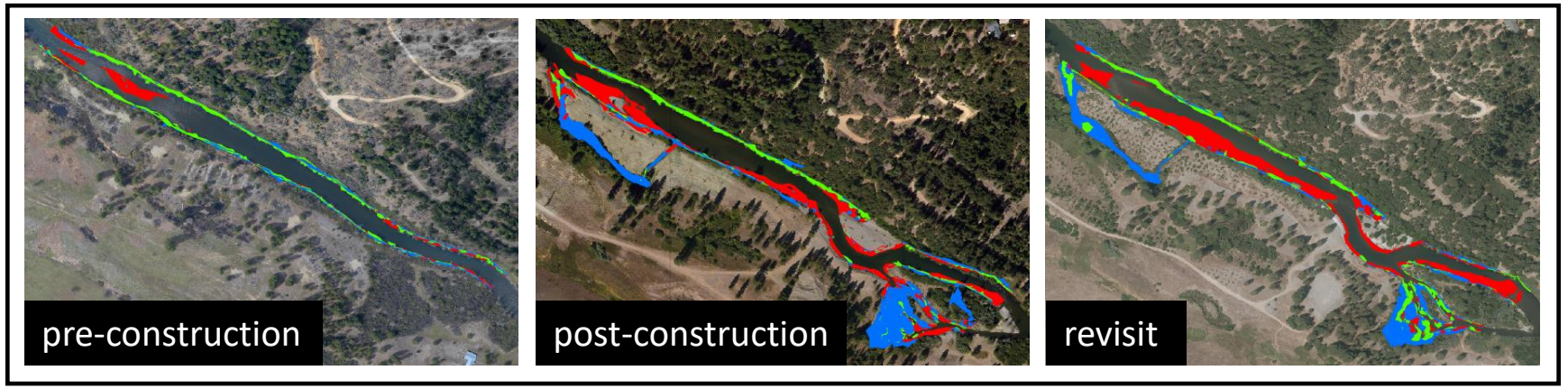
2005: first rehabilitation site completed

Chinook Salmon (Sprin-Run/Fall-Run)	38,600 (not available)	12,550 (1,550/11,000)	67%
Coho Salmon	5,000	200	96%
Steelhead	10,000	4,700	53%

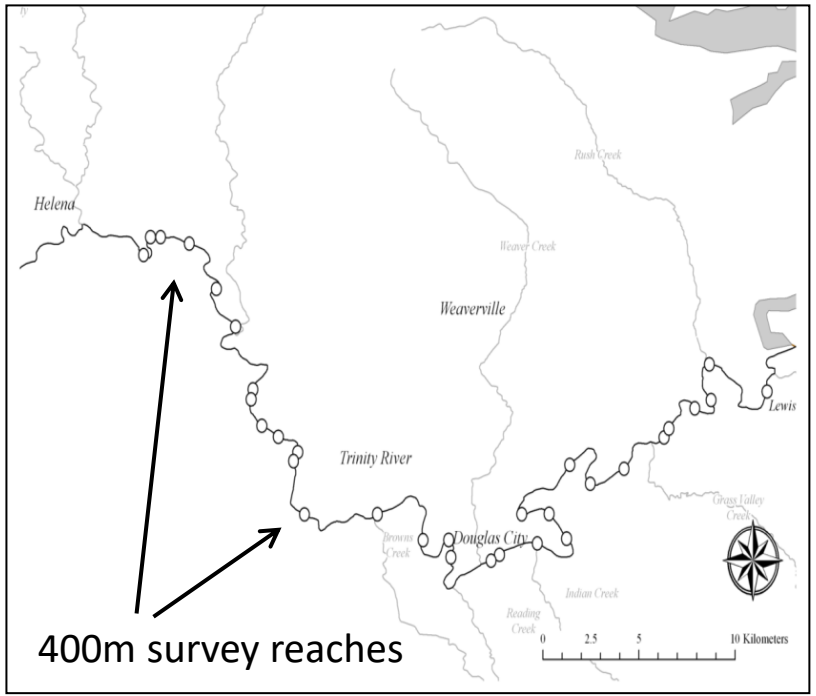
*USFWS and Hoopa Valley Tribe. 1999. Trinity River Flow Evaluation Final Report. U.S. Fish and Wildlife Service, Arcata Fish and Wildlife Office, Arcata, CA and Hoopa, CA.

Effectiveness Monitoring: multiple scales and methods

Site Evaluation



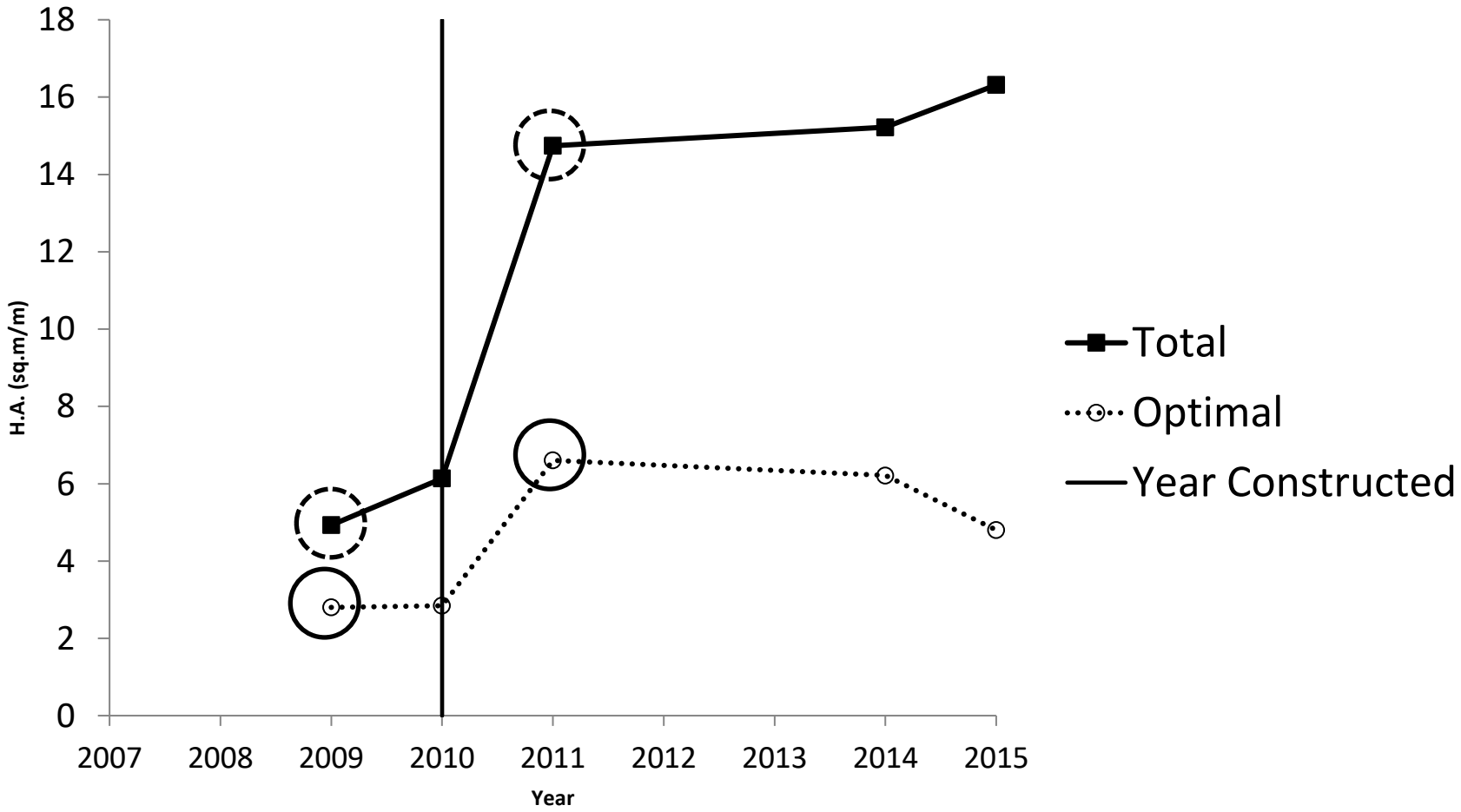
Systemic Evaluation



Mapping Rearing Habitat

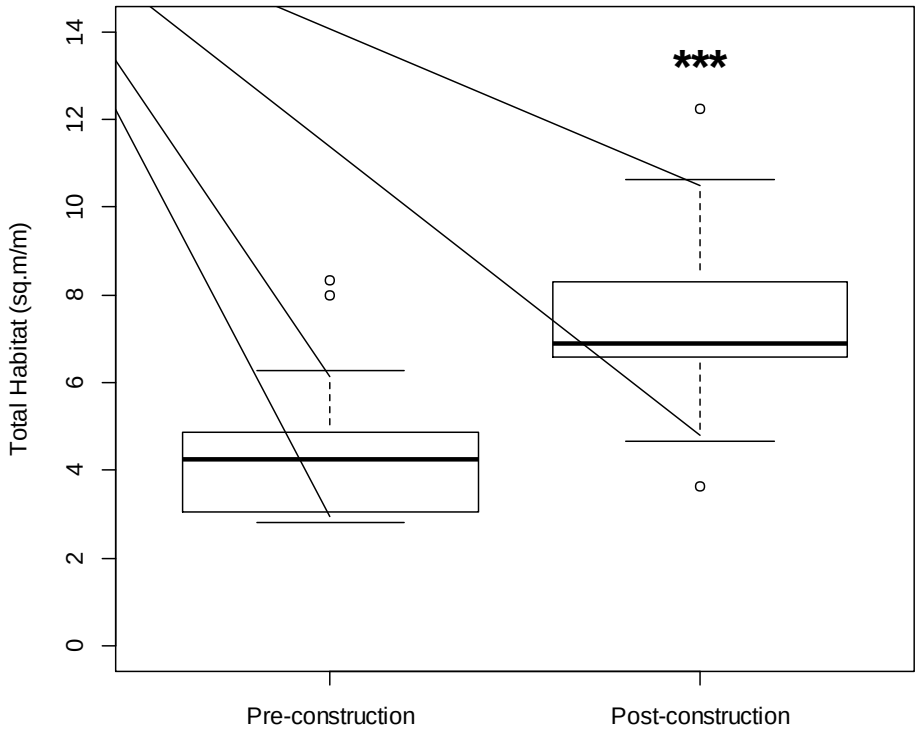
Developmenta		Criteria
Fry (<50 mm		epth and Velocity >0 to 0.6 m No DV) 0 to 0.12 m/s
Cover (C)		Suitable habitat
Presmolt (>		>0 to 1 m
Outside Cover (No C)	D	0 to 0.24 m/s Unsuitable habitat 0 to 0.6 m

Single streamflow: 13 rehabilitation sites @ 450 cfs

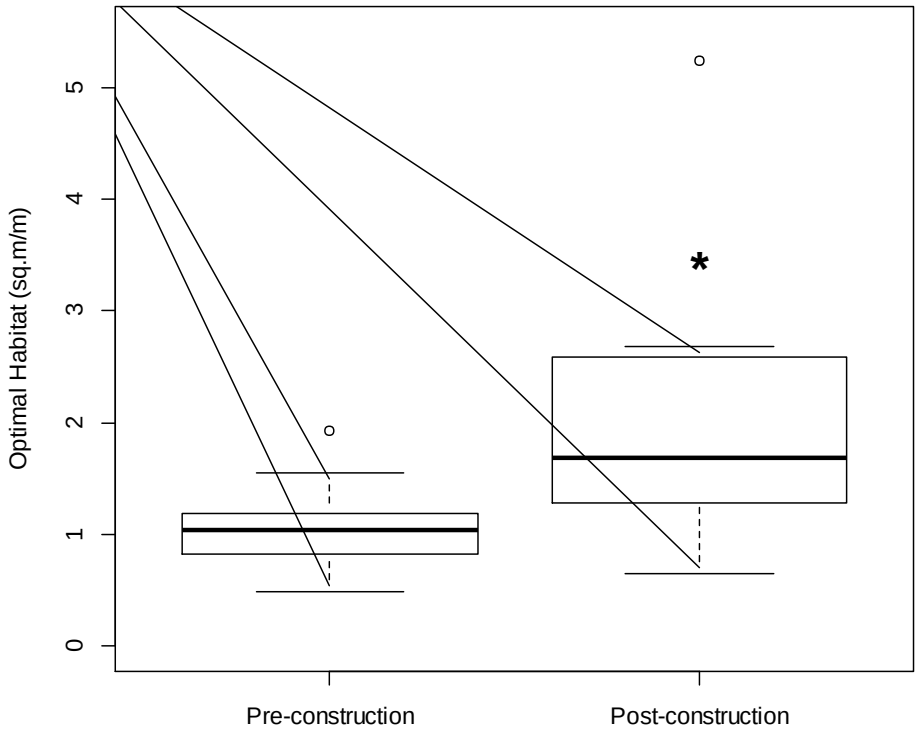


Channel rehabilitation increased habitat

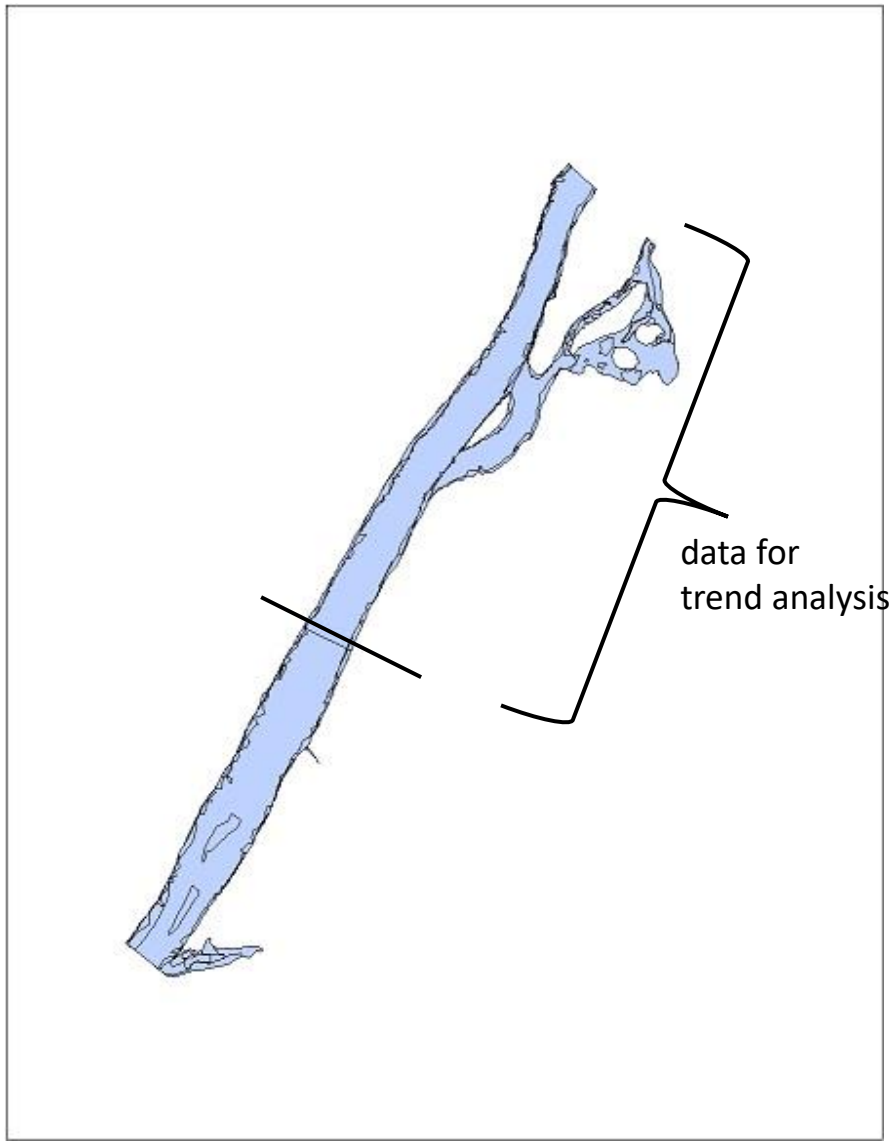
*** paired t test: p<0.001



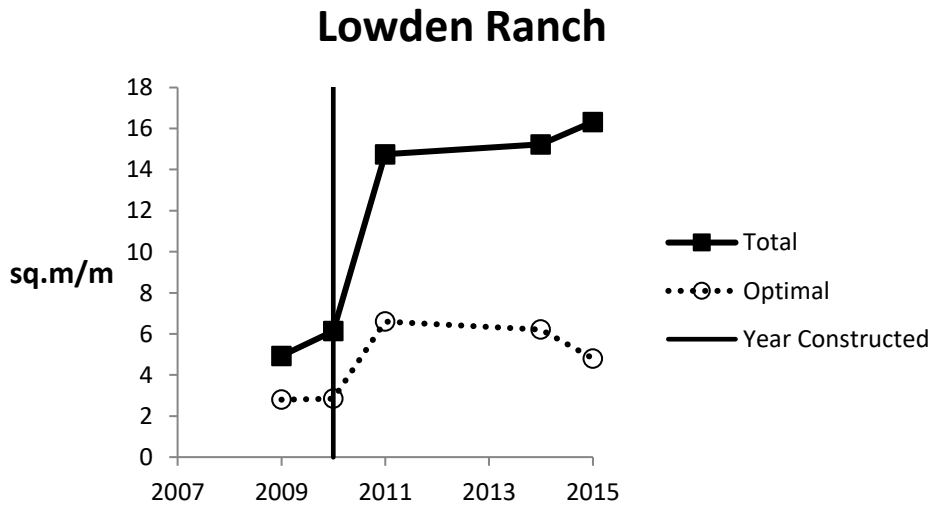
* paired t test: p<0.05



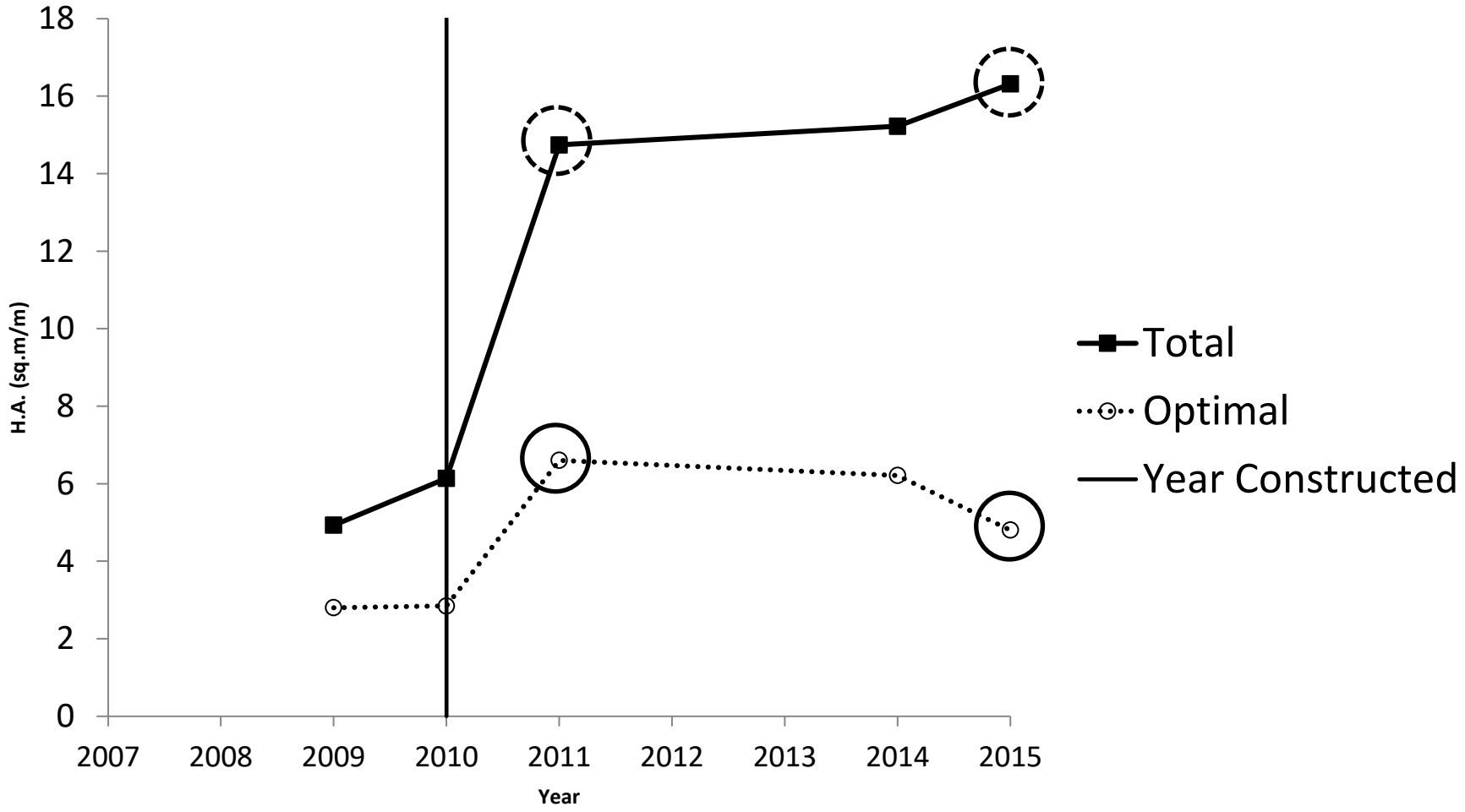
Summer base flow trend analysis: *sub-sampling protocol*



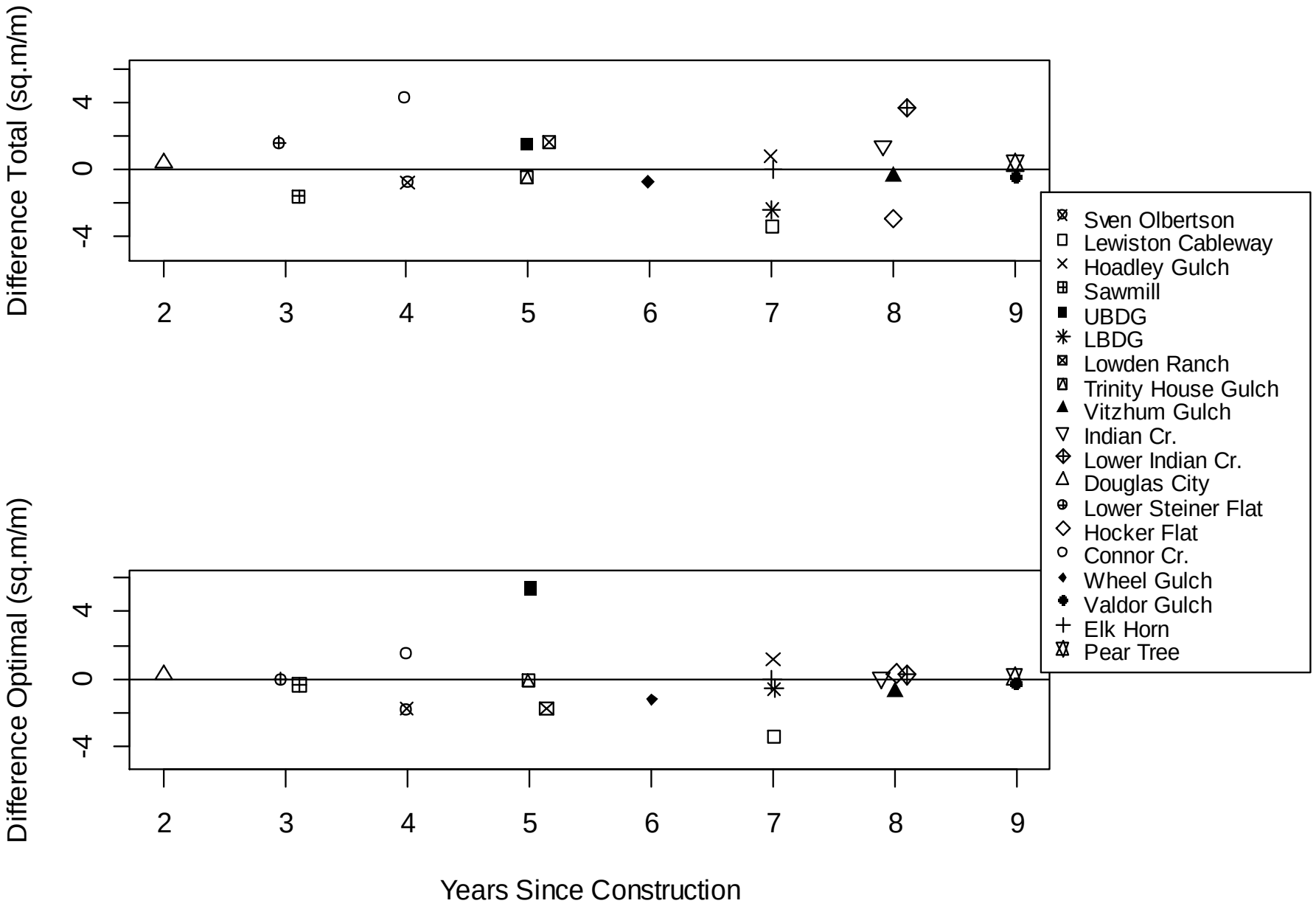
Site	Section	Length (m)	Constr Year	Survey Year	Year S.C.	Total Presmolt sq.m.	Total Presmolt sq.m/m	Optimal Presmolt sq.m.	Optimal Presmolt sq.m/m
Lowden	U	400	2010	2009	-1	1972	4.93	1121	2.80
Lowden				2010	0	2456	6.14	1139	2.85
Lowden				2011	1	5897	14.74	2642	6.61
Lowden				2014	4	6089	15.22	2486	6.21
Lowden				2015	5	6526	16.32	1921	4.80
Lowden	L	278.6		2009	-1	1977	7.10	296	1.06
Lowden				2011	1	3542	12.71	916	3.29
Lowden				2013	3	3737	13.41	1662	5.97



Single streamflow: 19 rehabilitation sites @ 450 cfs

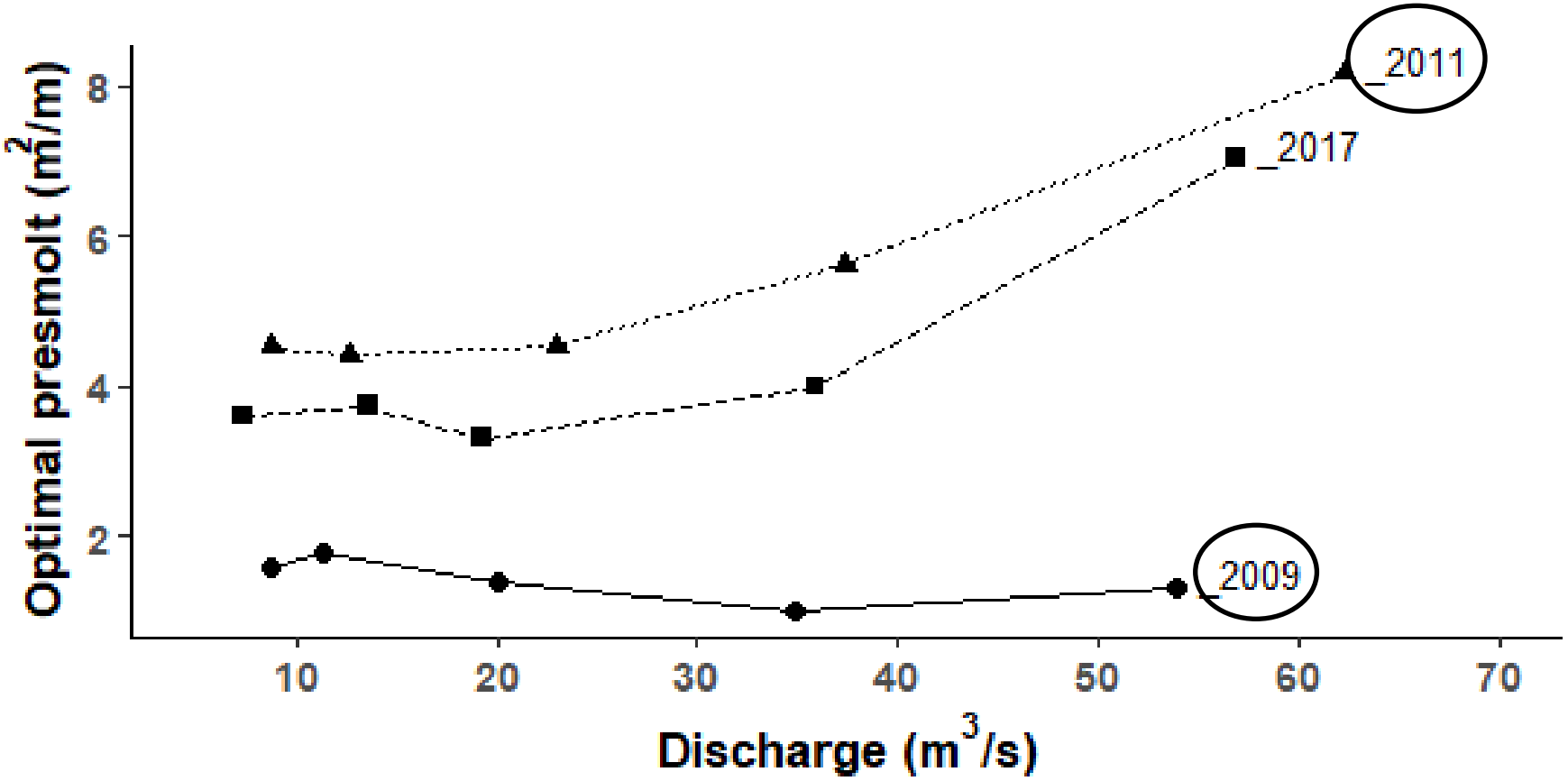


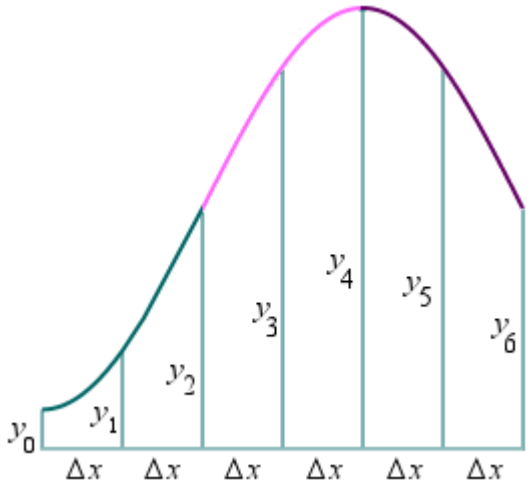
~ 50% of sites had more habitat at most recent survey



Multiple streamflows: six rehabilitation sites, 300-2,000 cfs

Site	Year of Construction	Survey Year									
		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Lewiston Cableway	2008	x	x							x	
Upper Bucktail DarkGulch	2008	x	x				x				
Lower Bucktail Dark Gulch	2008	x	x						x		x
Bucktail	2016								x		x
Lowden Ranch	2010		x		x						x
Reading Creek	2010		x		x						x
Hocker Flat	2005	x									x

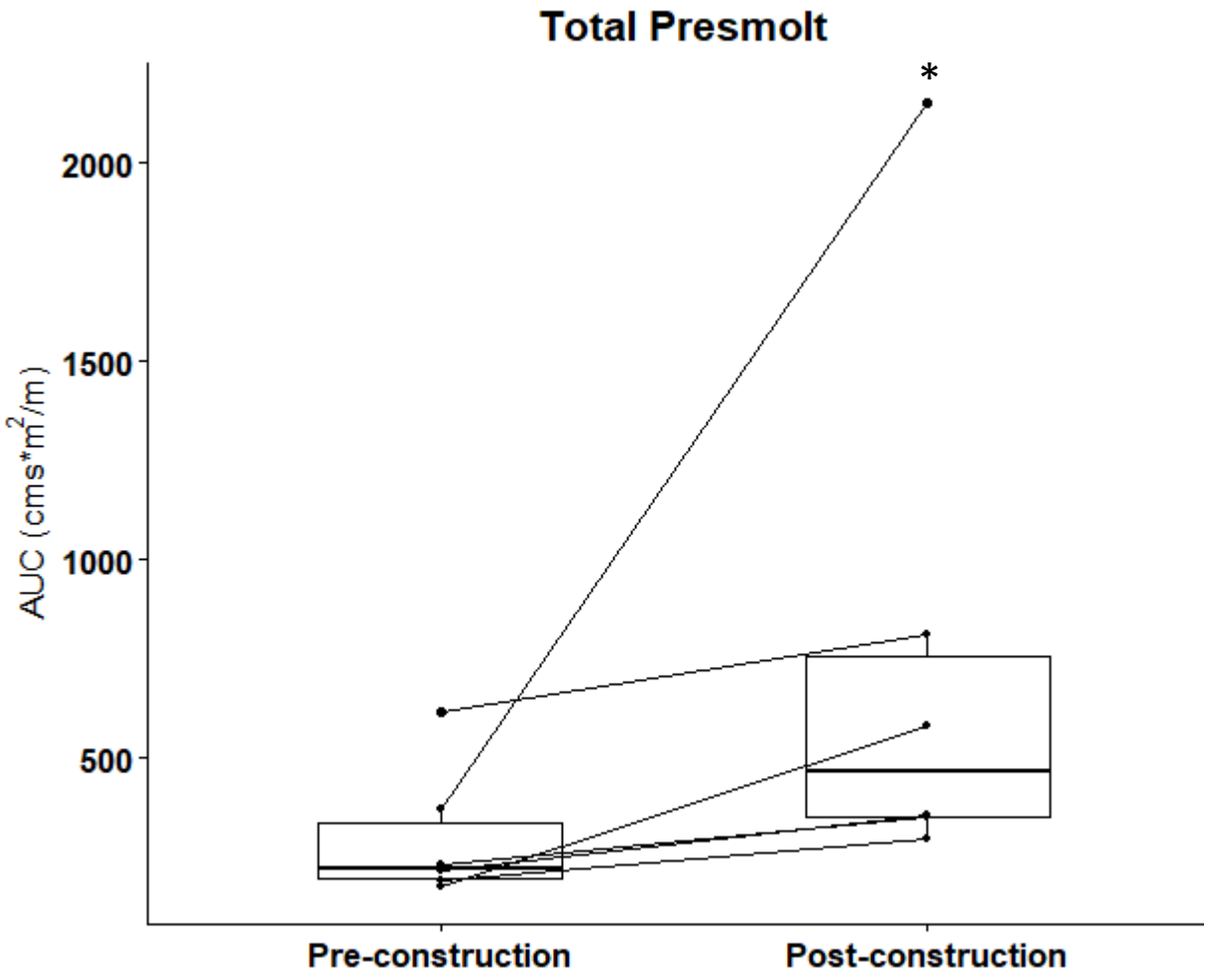

Optimal presmolt (m²/m)
8
6
4
2
10
20
30
40
50
60
70
Discharge (m³/s)
_2011
_2017
_2009

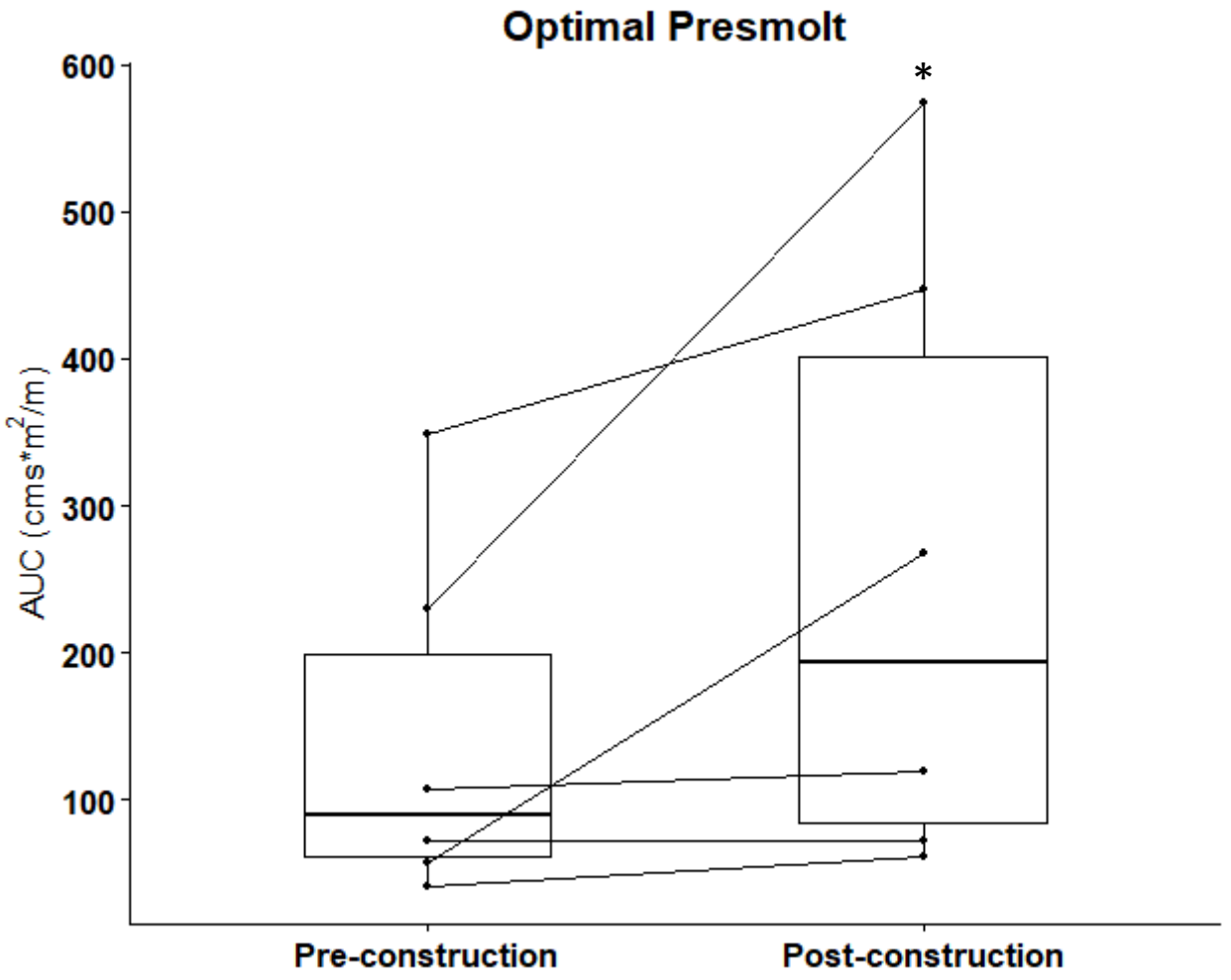

y_0
y_1
y_2
y_3
y_4
y_5
y_6
Δx
Δx
Δx
Δx
Δx
Δx

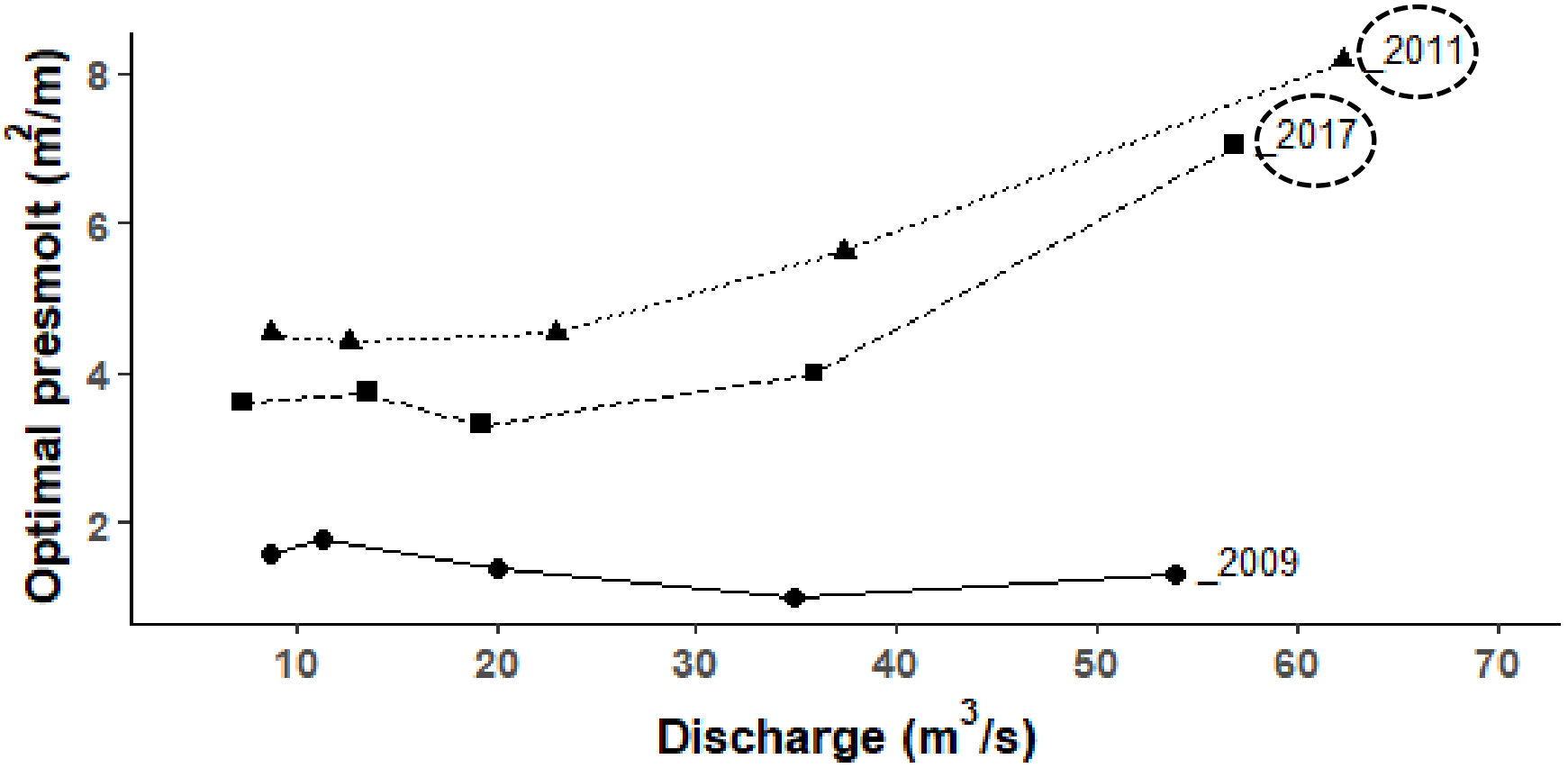
AUC (cms*m²/m)

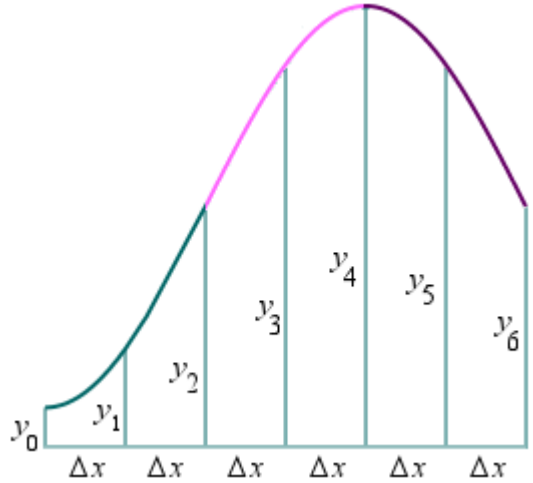
Channel rehabilitation increased AUC

* Wilcoxon signed rank test p<0.05



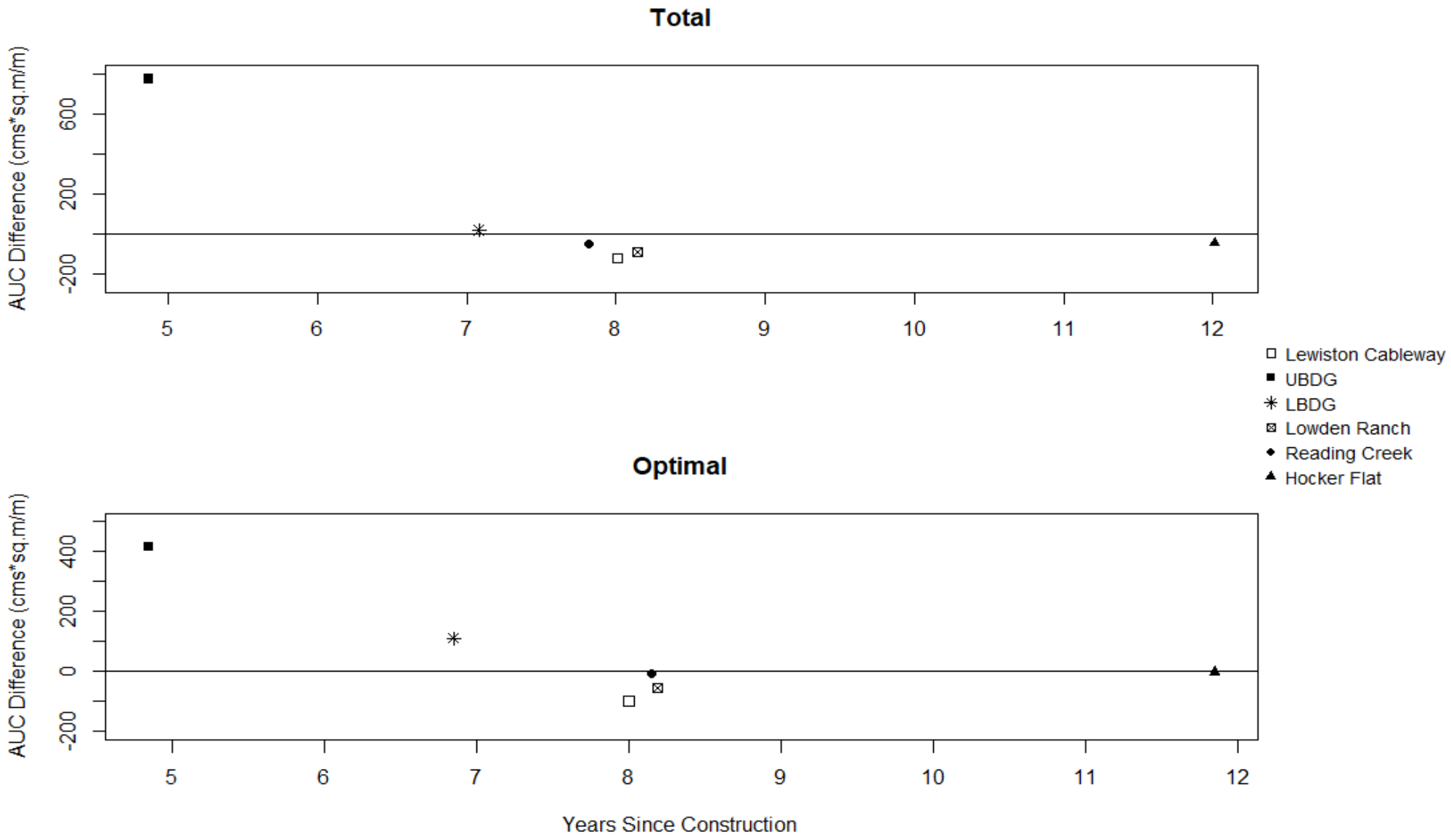



Optimal presmolt (m2/m)
8
6
4
2
10
20
30
40
50
60
70
Discharge (m3/s)
2011
2017
2009

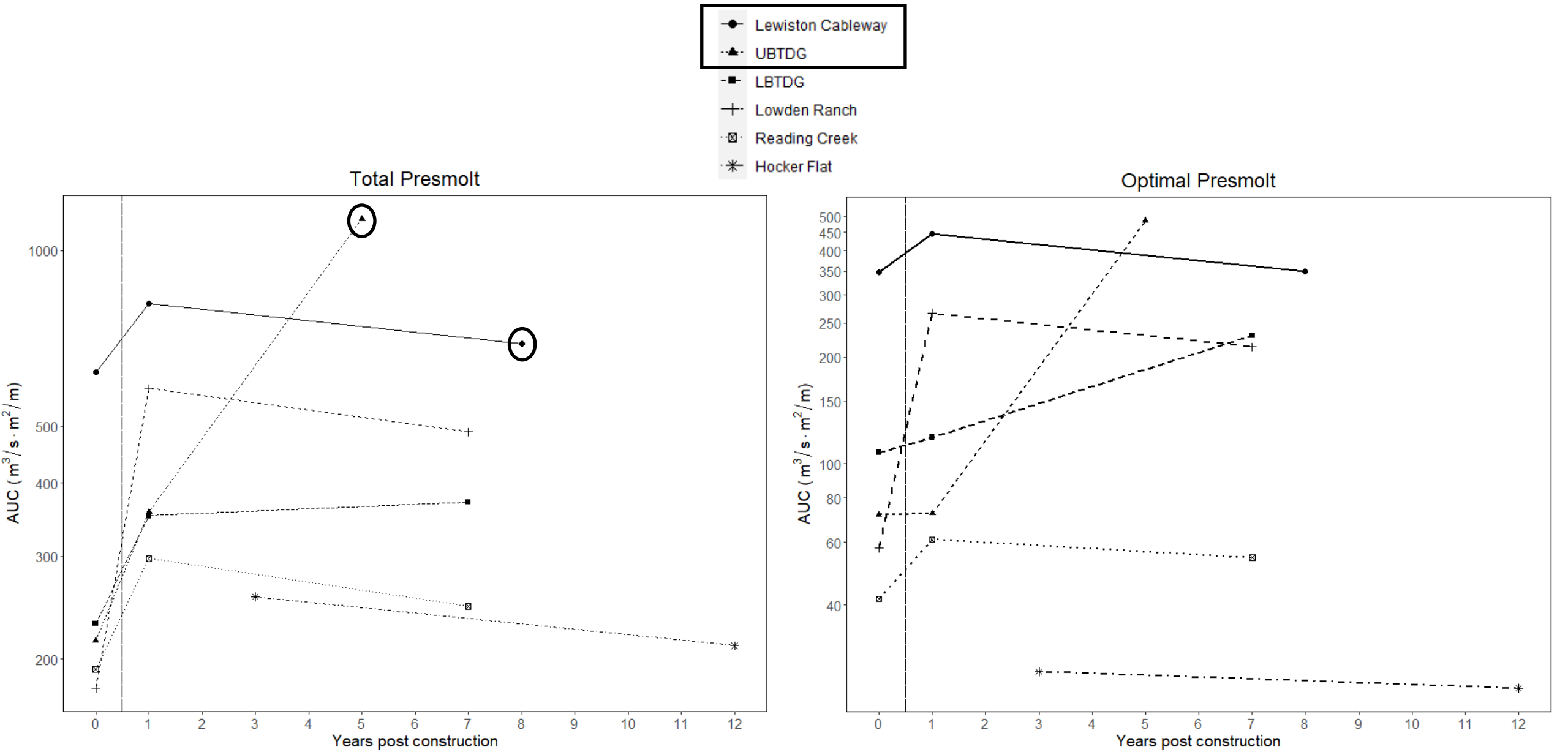

y0
y1
y2
y3
y4
y5
y6
Δx
Δx
Δx
Δx
Δx
Δx

AUC (cms*sq.m/m)

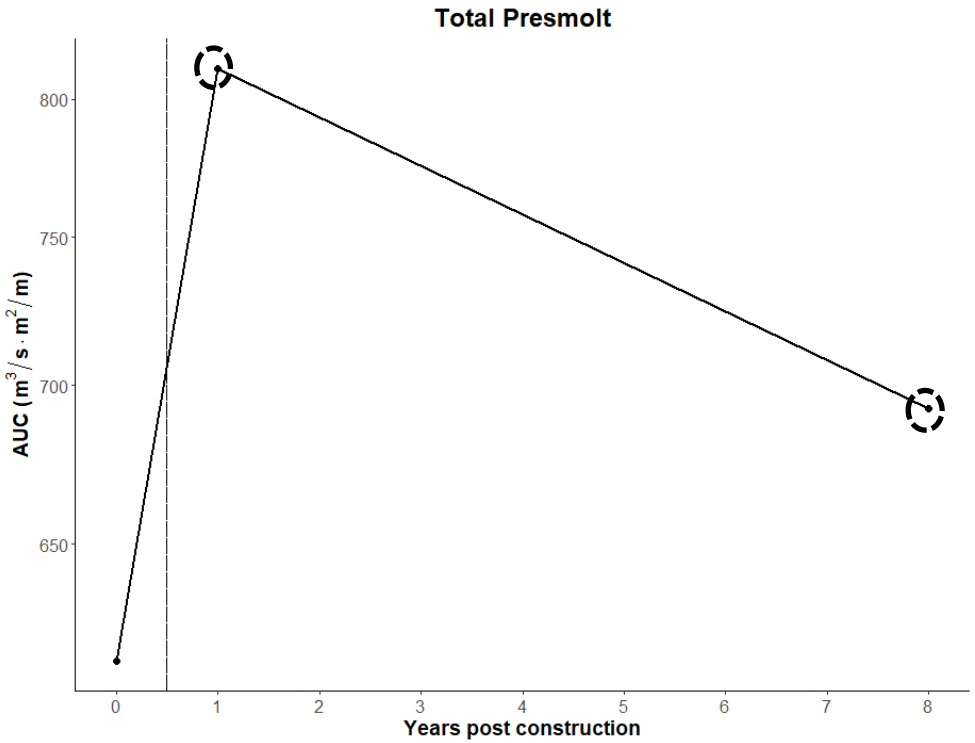
2 of 6 sites had more habitat at most recent survey



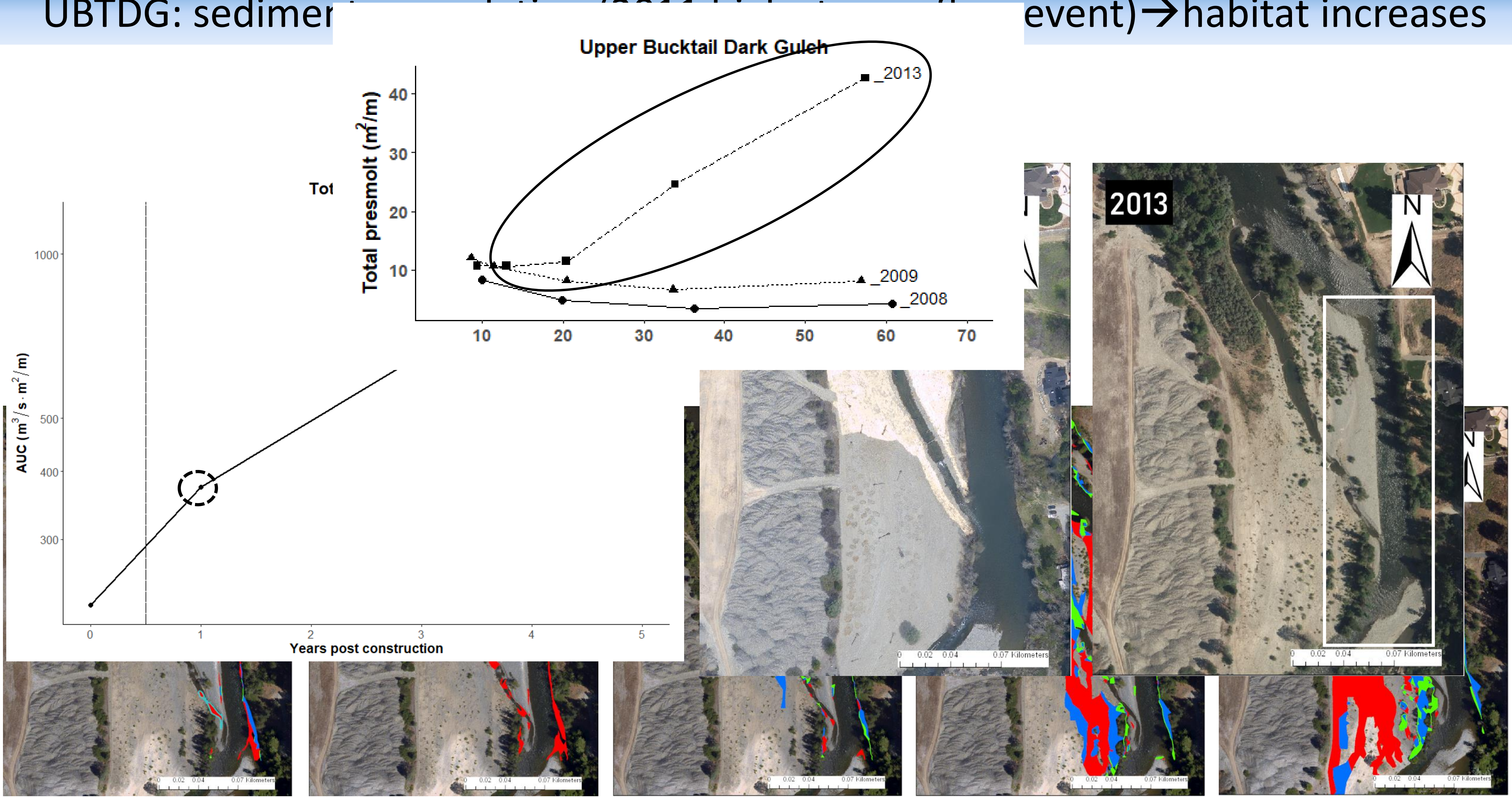
Trends in AUC over time



Cableway: 80% reduction in surface area of three point bars



UBTDG: sedimen event)→habitat increases



Conclusions

1) Construction matters → Increased habitat availability (both trend analyses)

2) Construction benefits not sustained at some sites

less habitat (post-construction to most recent)

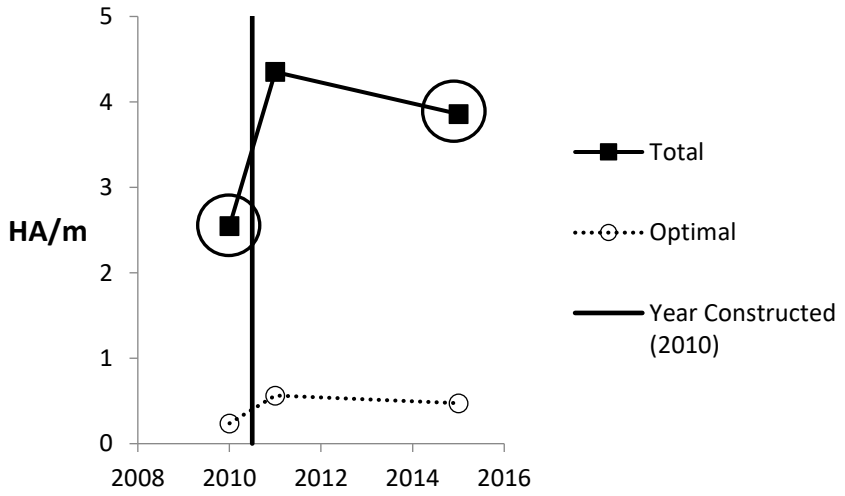
10 of 19 sites: single flow

4 of 6 sites: multiple flows

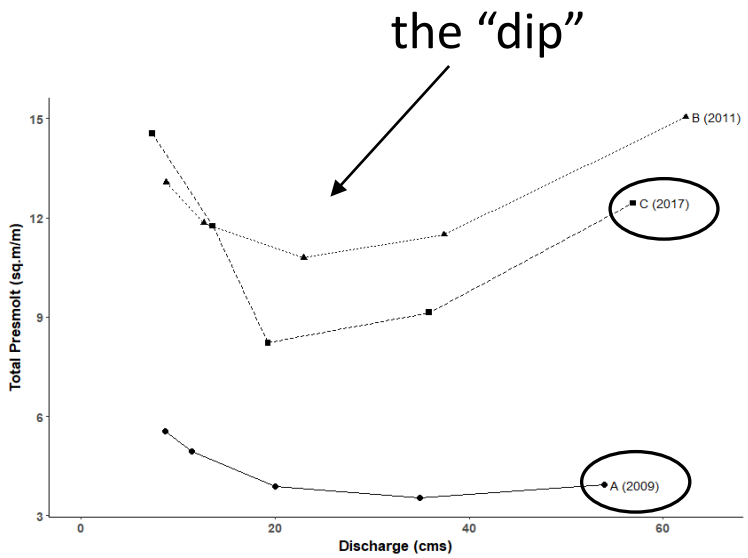
3) Another revisit to assess continued trends?

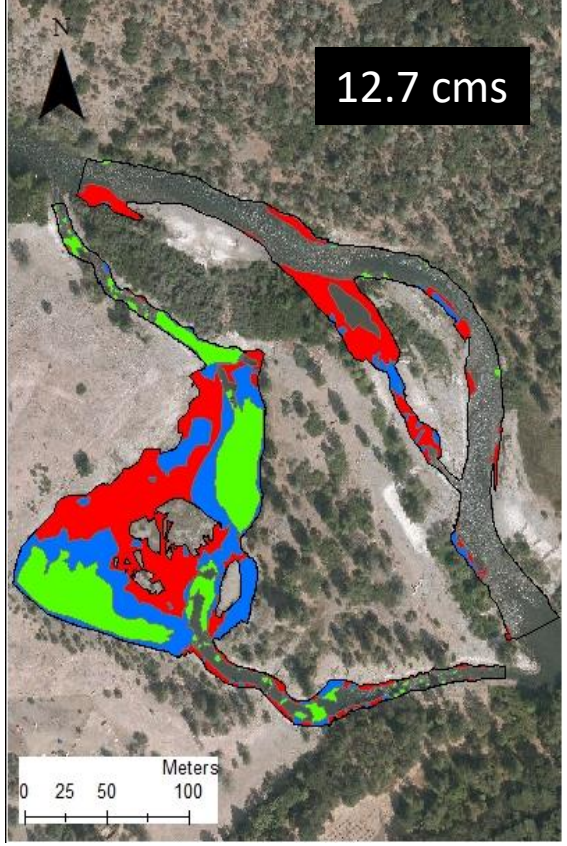
Upshot: currently more habitat than at pre-construction

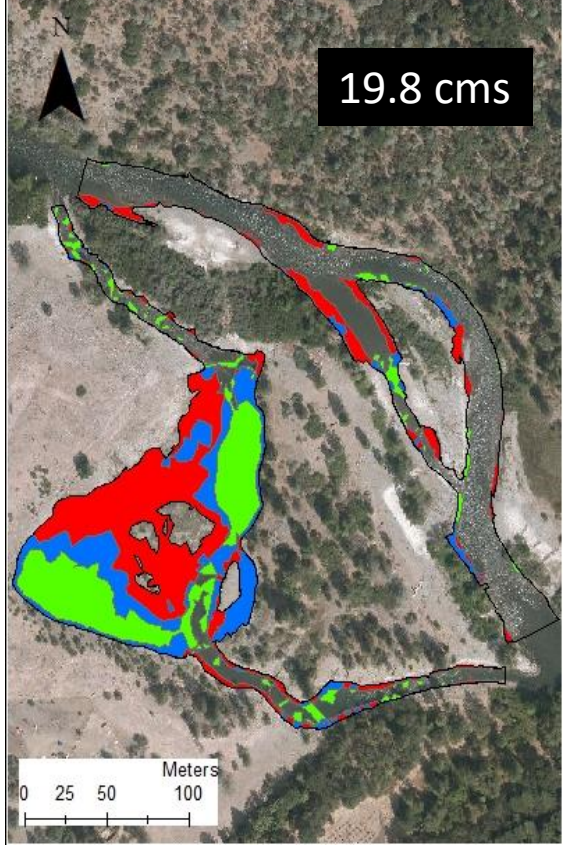
6 of 7 sites (single flow)

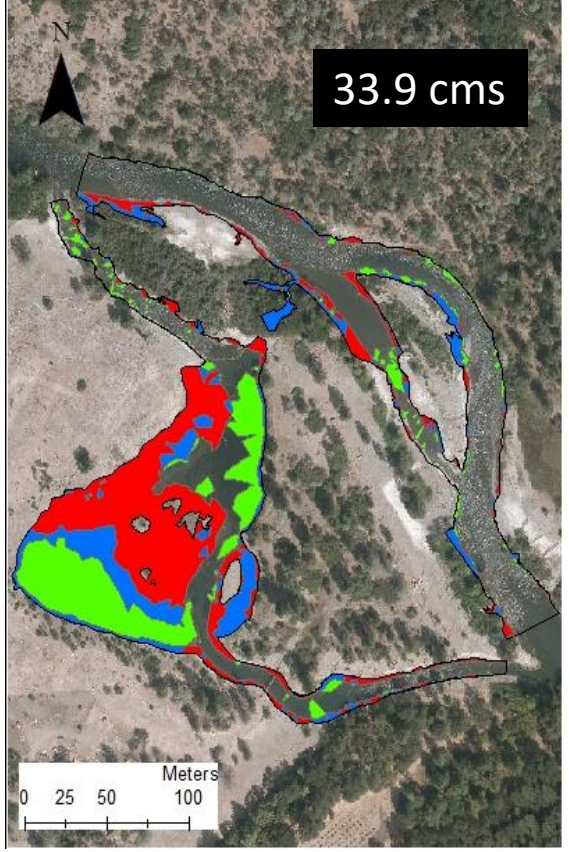


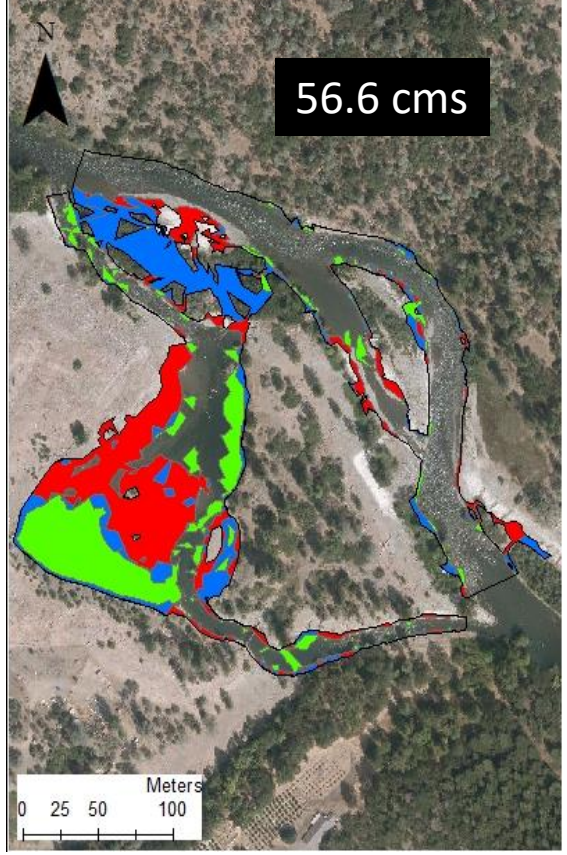
5 of 5 sites (multiple flows)

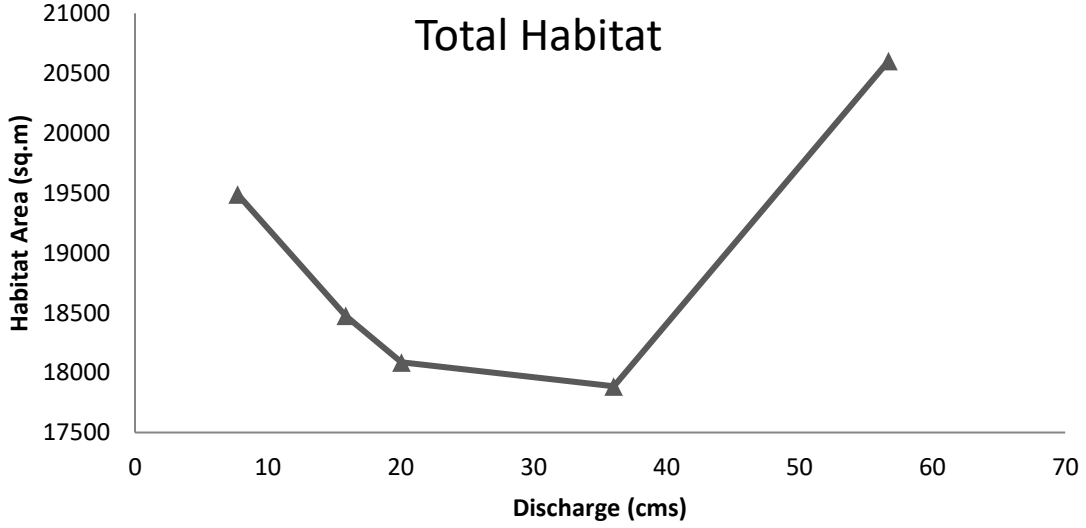



N
12.7 cms
Meters
0 25 50 100

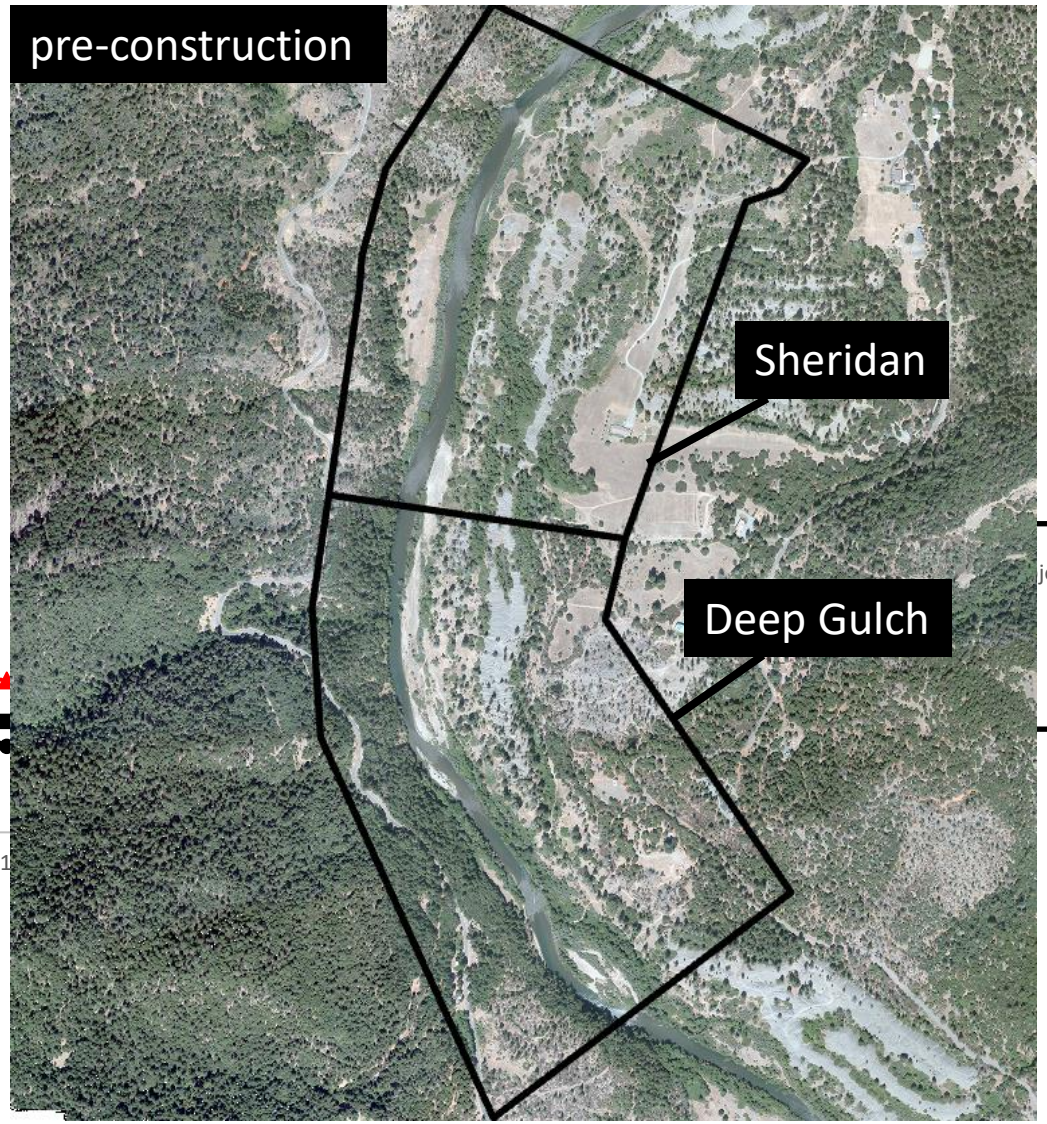

N
19.8 cms
Meters
0 25 50 100

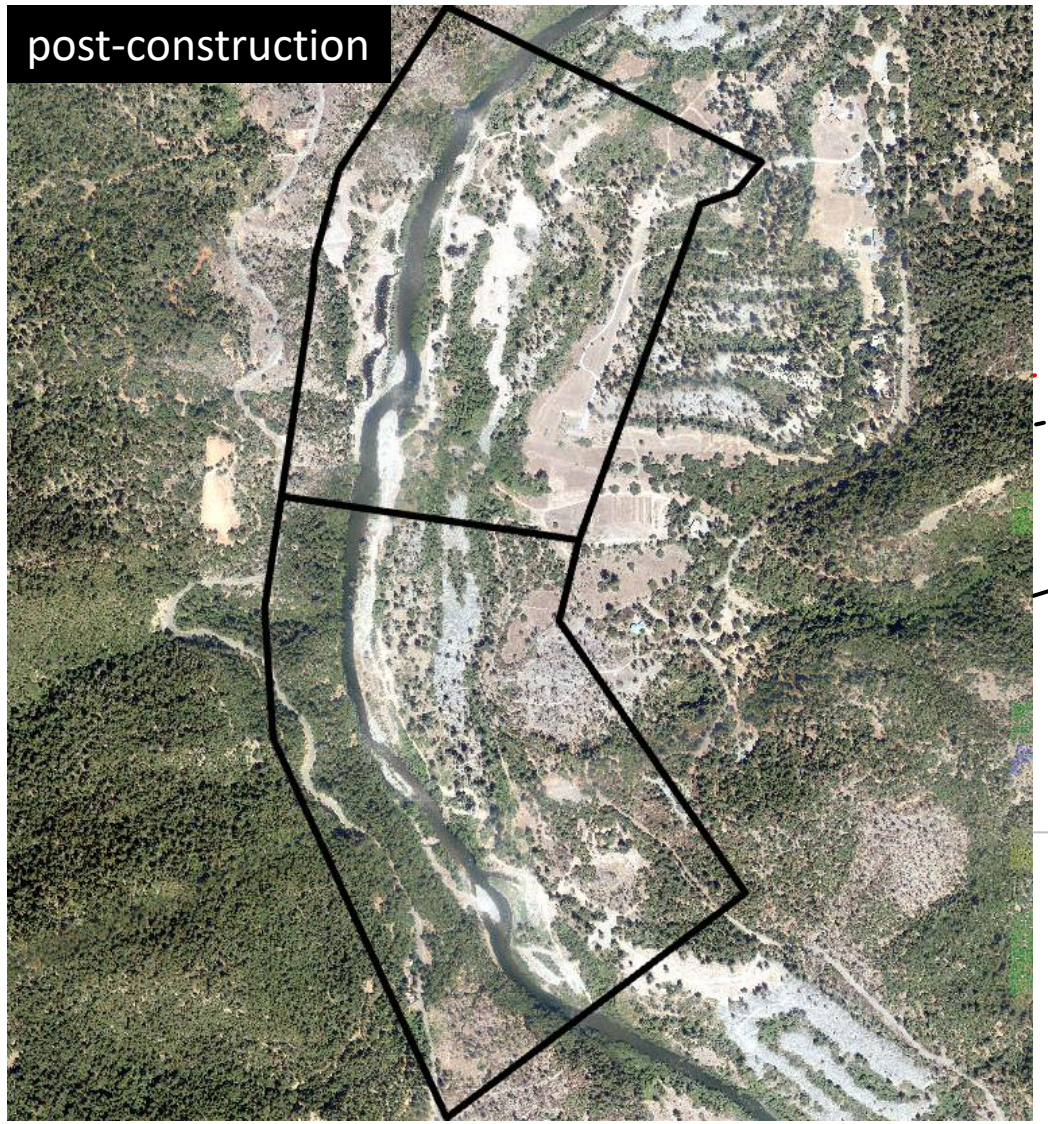

N
33.9 cms
Meters
0 25 50 100

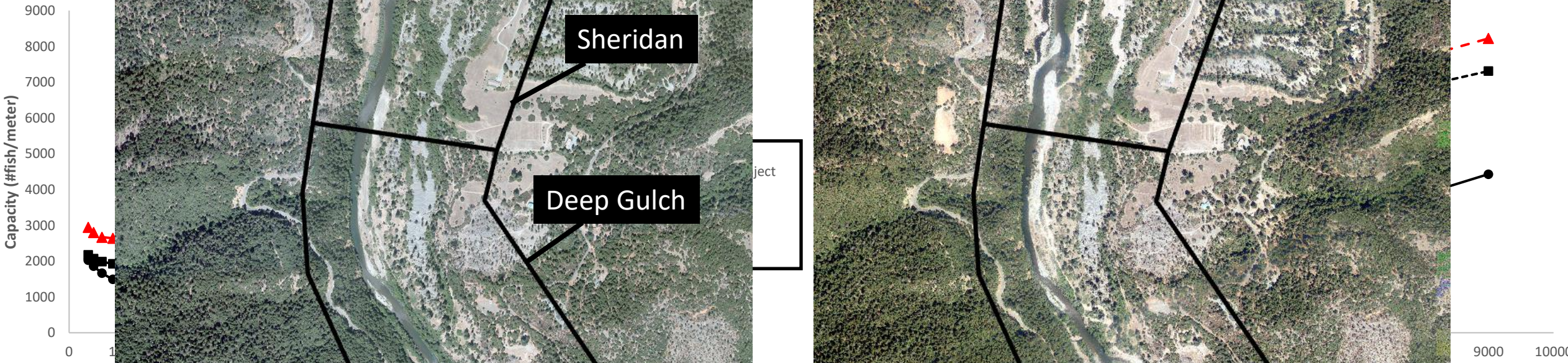

N
56.6 cms
Meters
0 25 50 100

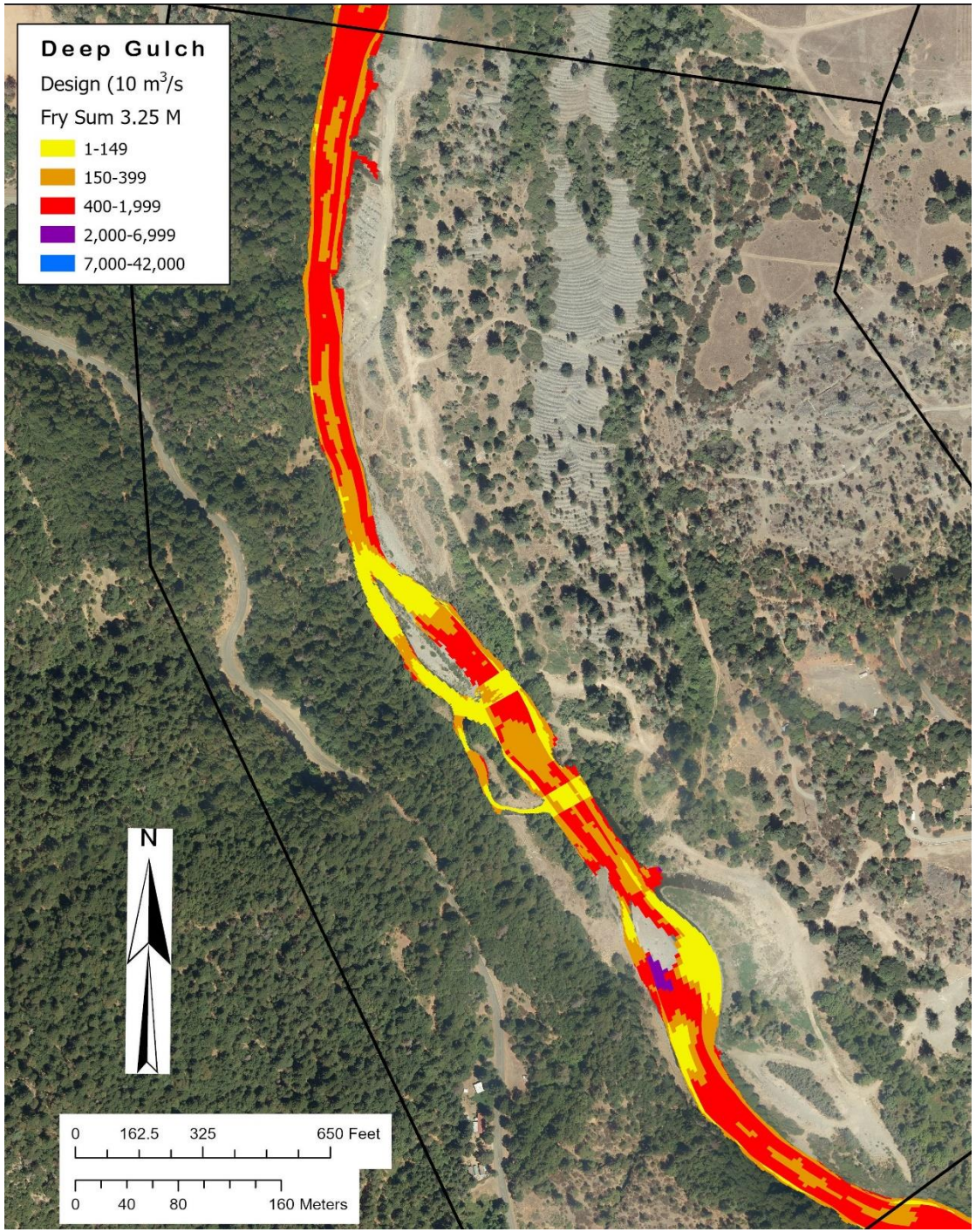

Total Habitat
Habitat Area (sq.m)
21000
20500
20000
19500
19000
18500
18000
17500
0
10
20
30
40
50
60
70
Discharge (cms)

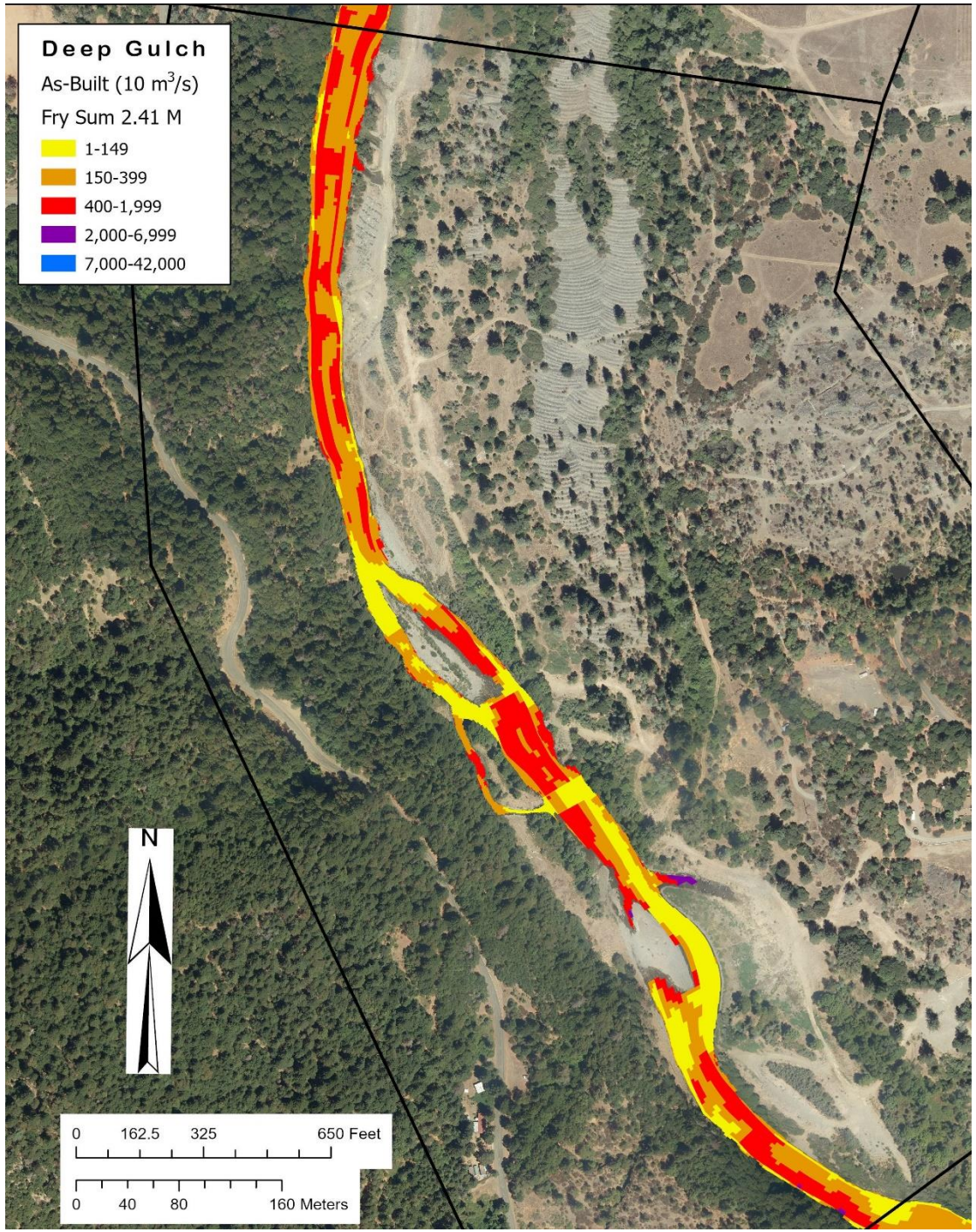
Current monitoring efforts: hydraulic modeling








Deep Gulch
Design (10 m3/s
Fry Sum 3.25 M
1-149
150-399
400-1,999
2,000-6,999
7,000-42,000
N
0 162.5 325 650 Feet
0 40 80 160 Meters


Deep Gulch
As-Built (10 m3/s)
Fry Sum 2.41 M
1-149
150-399
400-1,999
2,000-6,999
7,000-42,000
N
0 162.5 325 650 Feet
0 40 80 160 Meters

Thank You