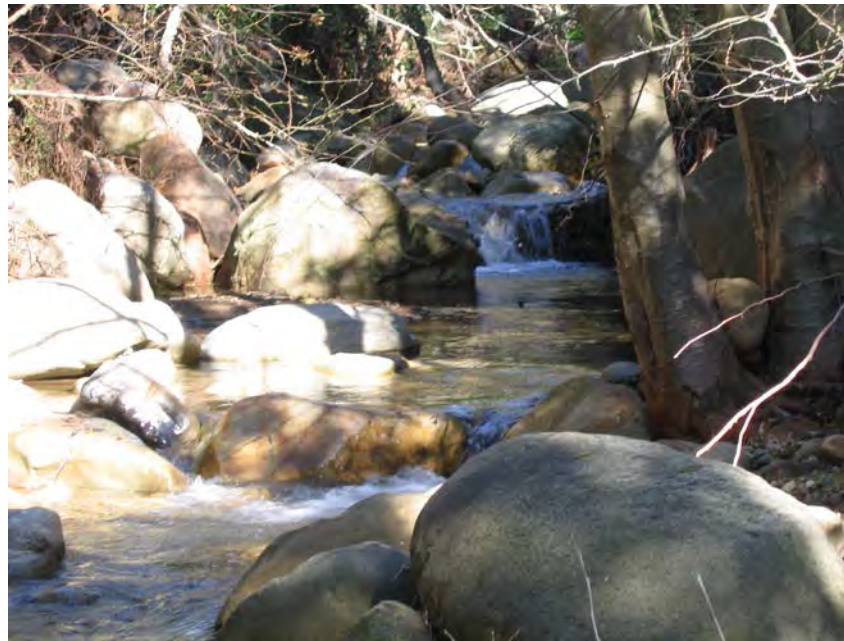


SOUTHERN STEELHEAD HABITAT: IT'S ALL ABOUT WATER AND BOULDERS:IMPLICATIONS FOR RESTORATION



Edward Keller and Garret Bean

Department of Earth Science

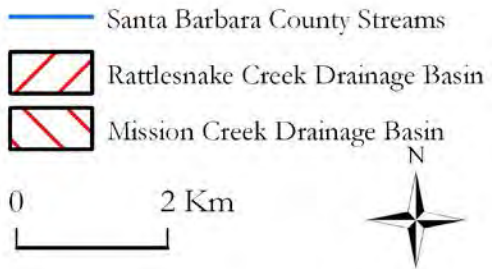
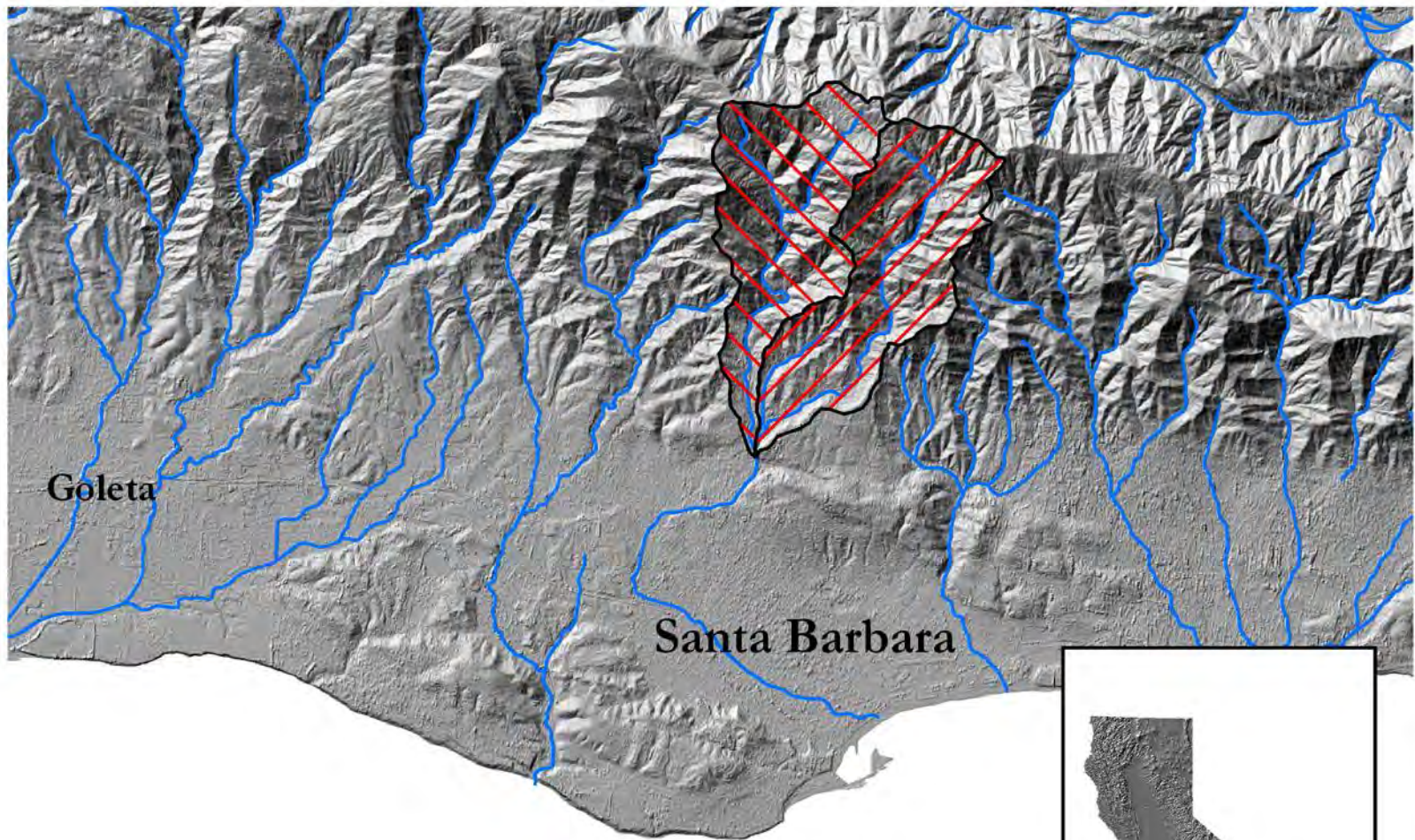
University of California, Santa Barbara

SRC March 21,2014

Linkages between Geology and Geomorphology to Endangered Southern Steelhead Trout

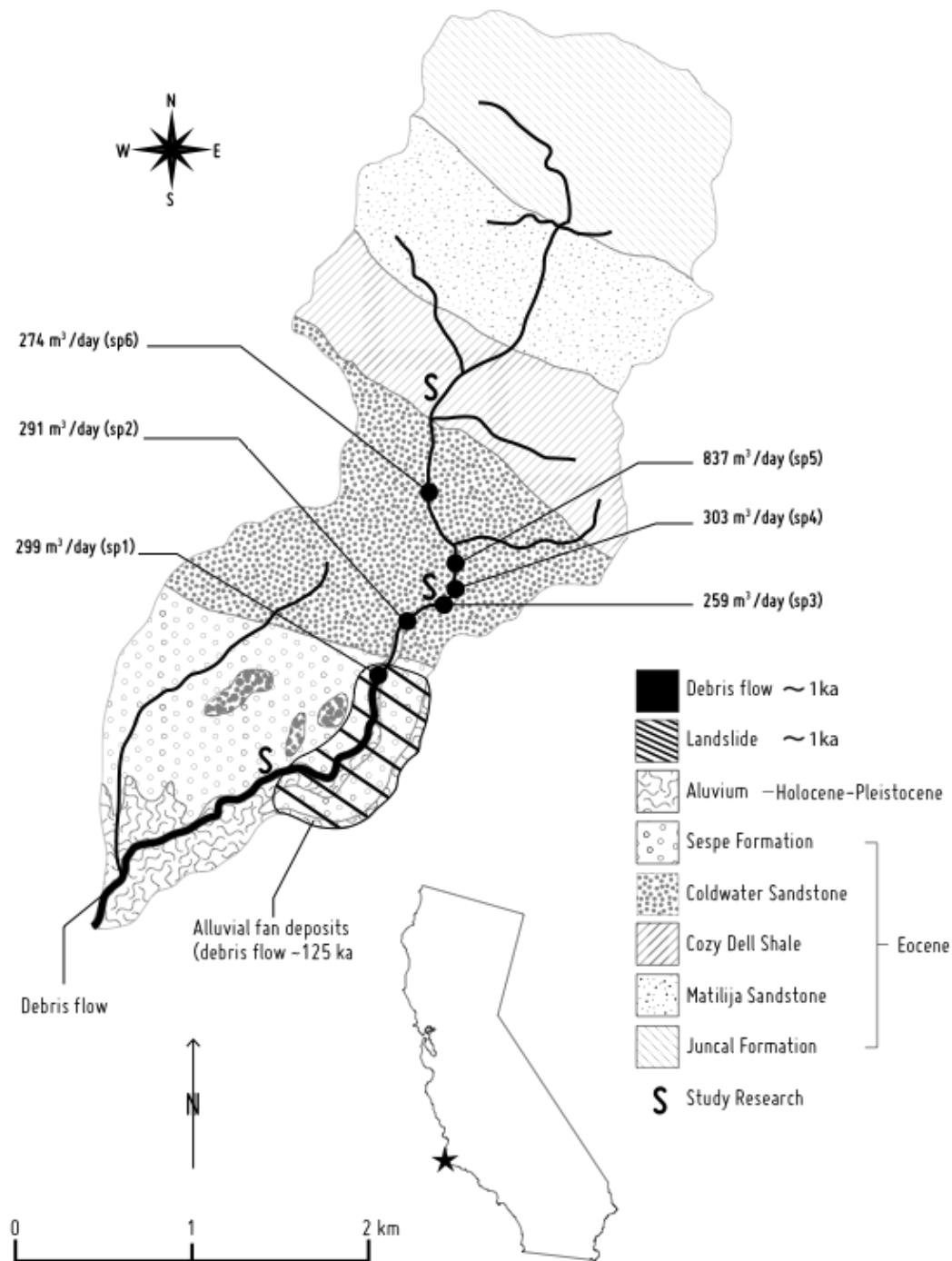


- Channel morphology and low flow habitat play a critical role in spawning and rearing of endangered steelhead trout
- Steelhead recovery are controlled by several limiting factors
 - 1) Available pool habitat
 - 2) Low flow water supply

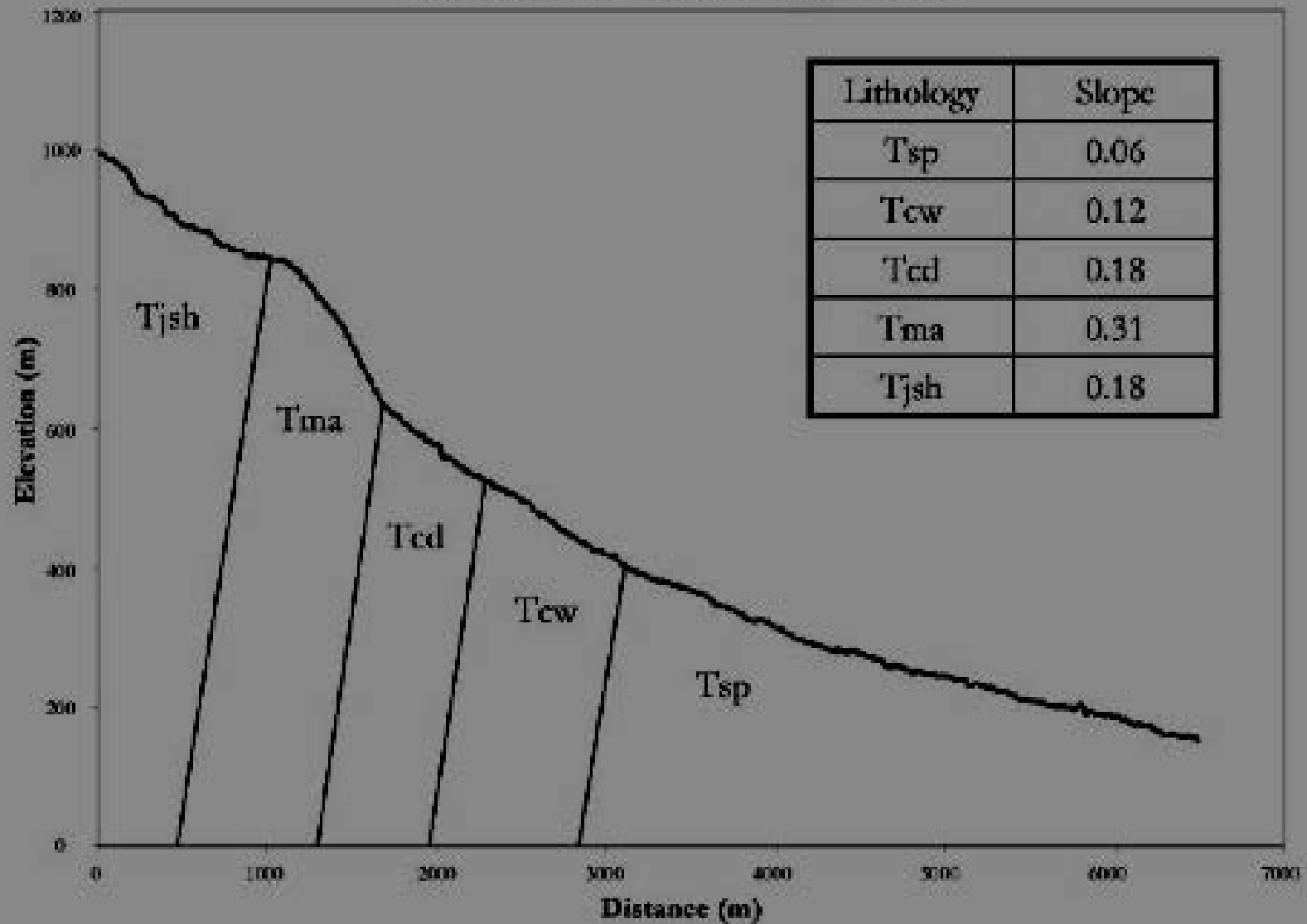


Rattlesnake Canyon





Rattlesnake Creek Long Profile



Types of pools

Step-pool

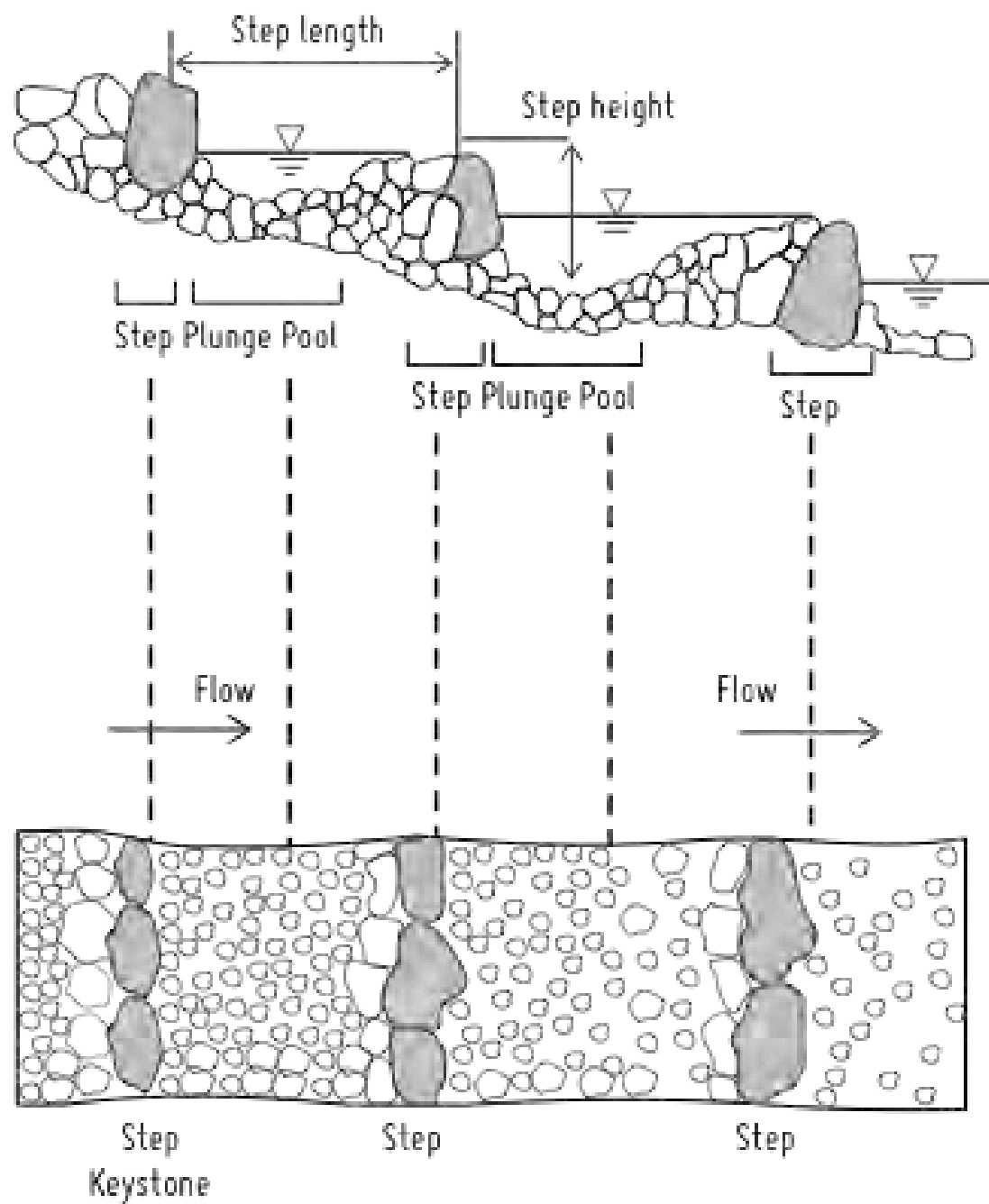
Forced pool

Forced step-pool

Combinations

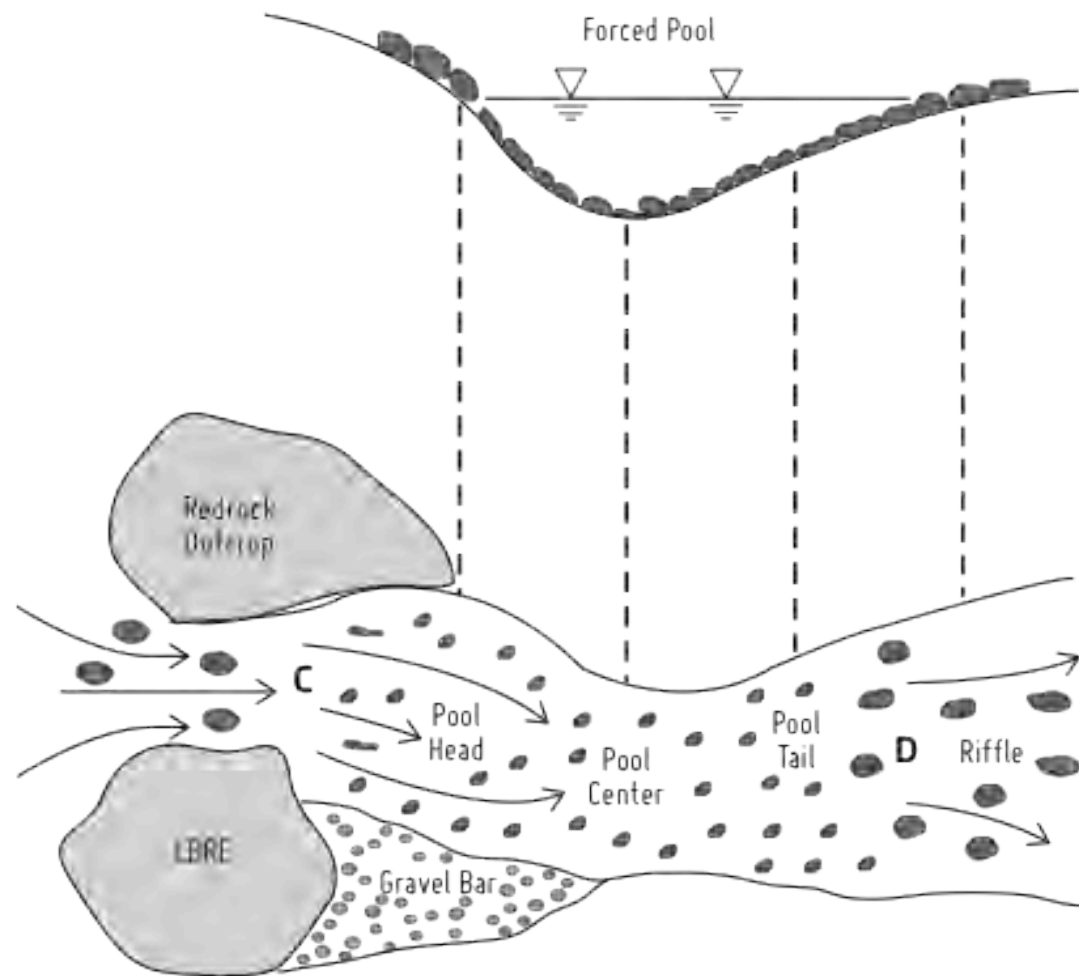


Step-pool: plunge pool





Forced pool: convergence of flow

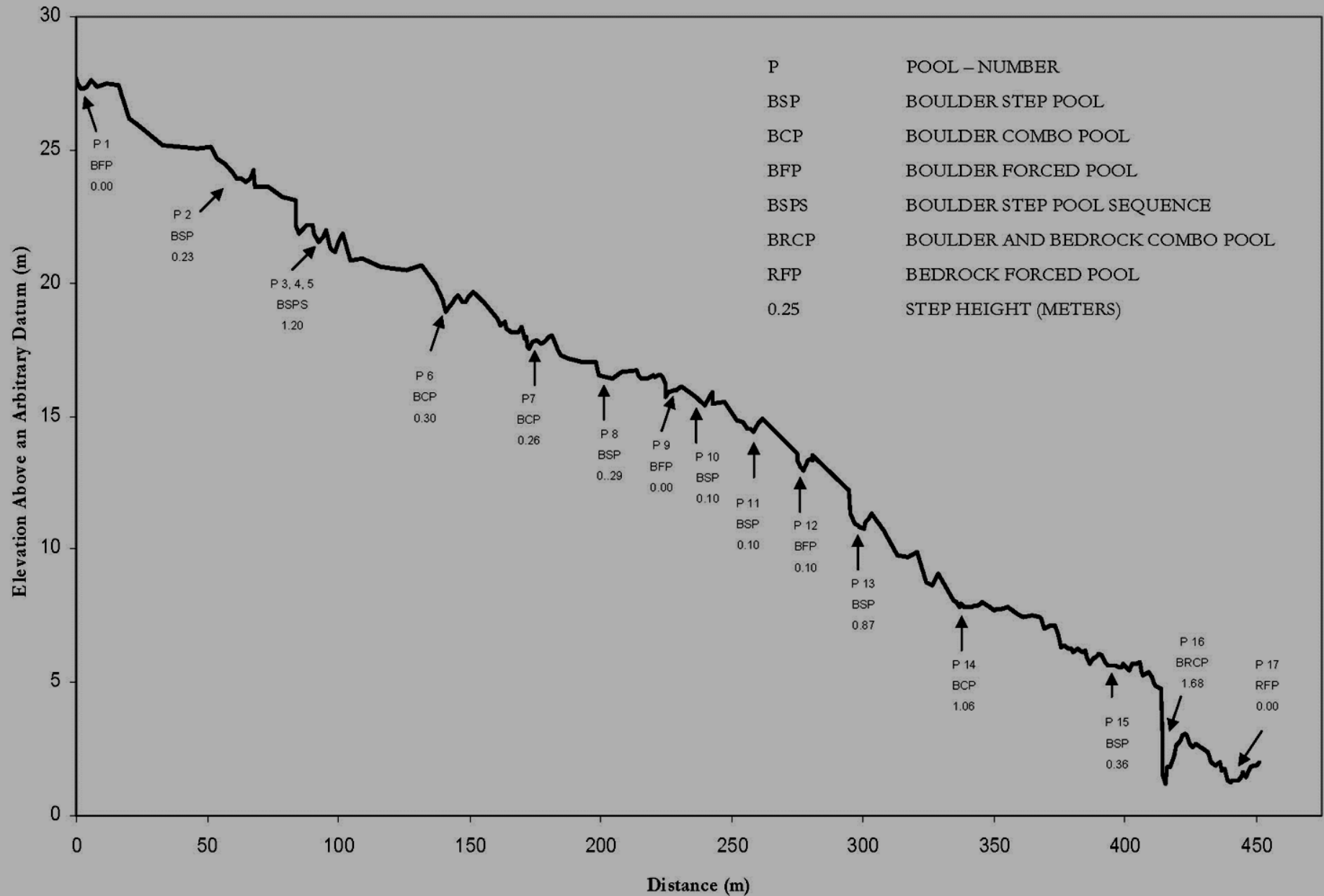


C: Convergent flow

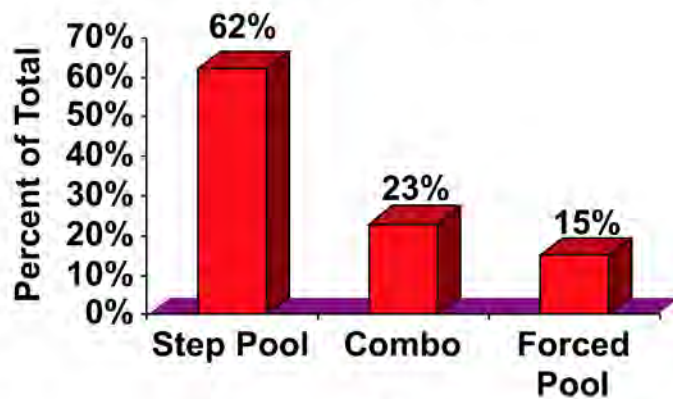
D: Divergent flow

●: Bed material

Geomorphology of Sespe Formation Study Reach, Rattlesnake Creek, Santa Barbara, California

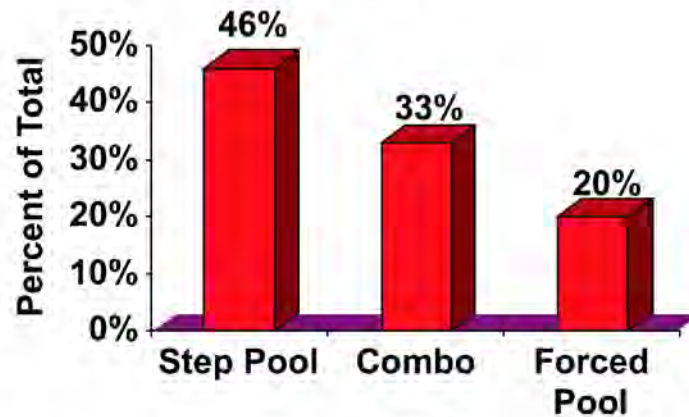


Pools In Study Area



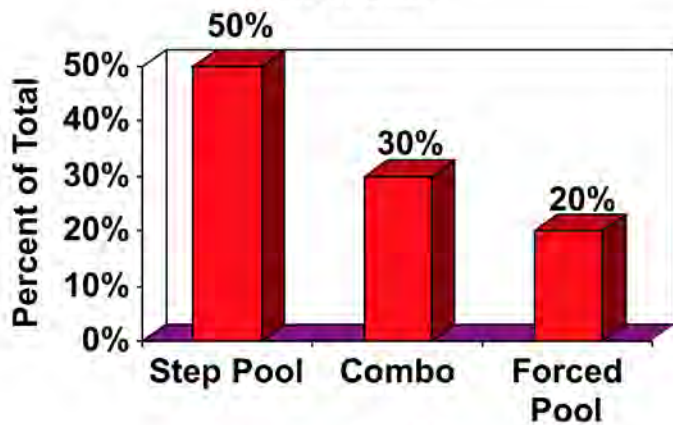
n = 47

Sespe



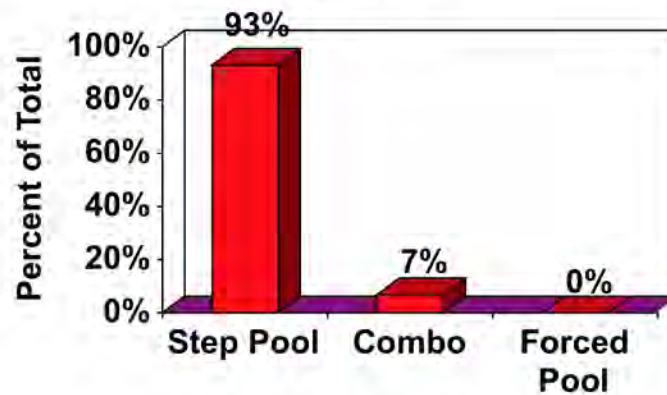
n = 15

Coldwater



n = 17

Cozy Dell



n = 15

Pool Dimensions and Spacing

	Length (m)	Depth (m)	Width (m)	Spacing (cw)	
MEAN	8.73	0.6	4.83	3.63	Sespe
ST DEV	2.8	0.39	1.59	1.97	
MEAN	8.04	0.64	4	3.85	Coldwater
ST DEV	2.24	0.22	0.9	1.72	
MEAN	7.51	0.7	3.76	2.15	Cozy Dell
ST DEV	1.79	.21	.76	1.54	

Statistical Analysis

- ANOVA

No significant differences between rock type and pool length, depth, and width

There is a significant difference between rock type and pool spacing

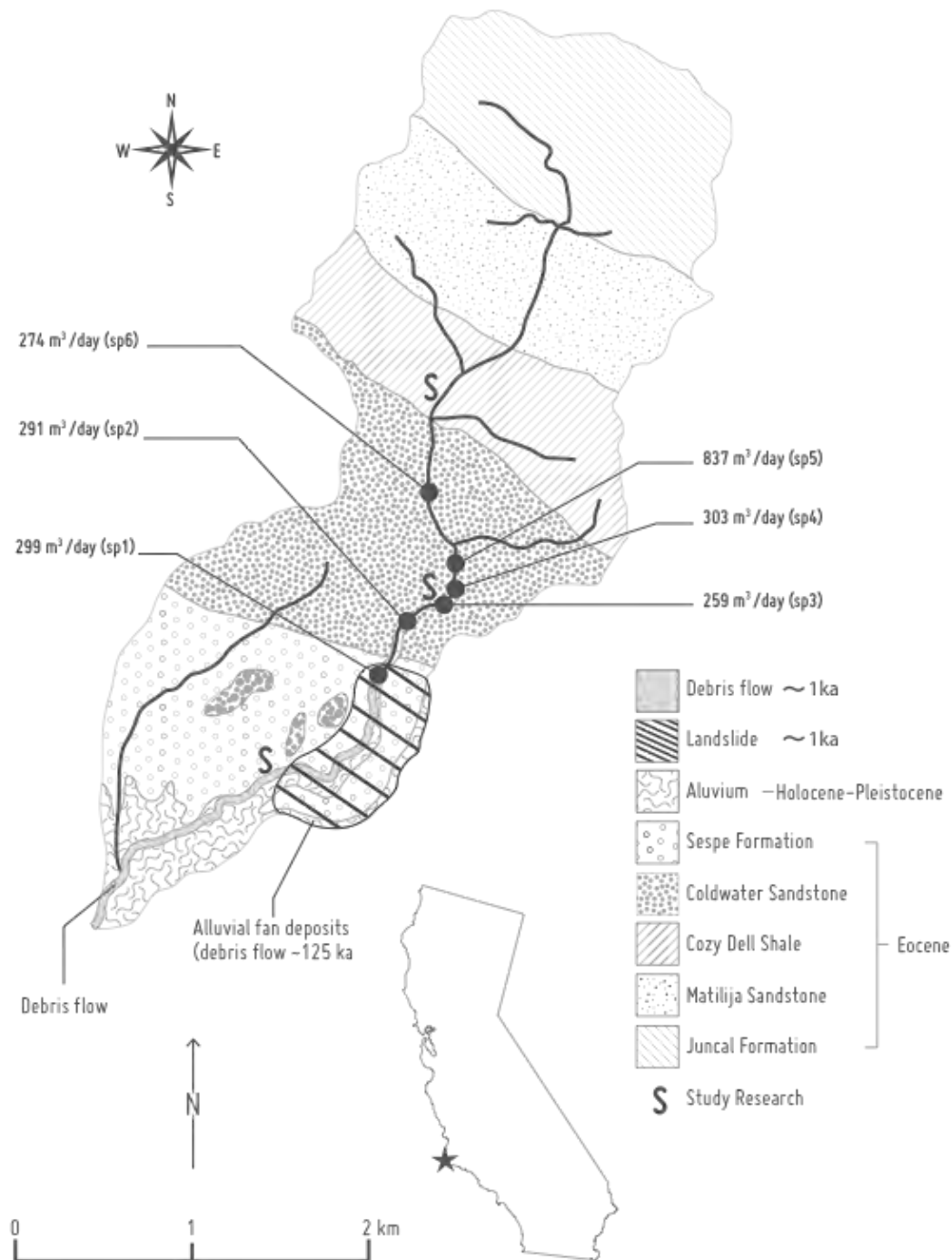
- Paired T-test

Significant difference between pool spacing for Coldwater Sandstone and Cozy Dell Shale

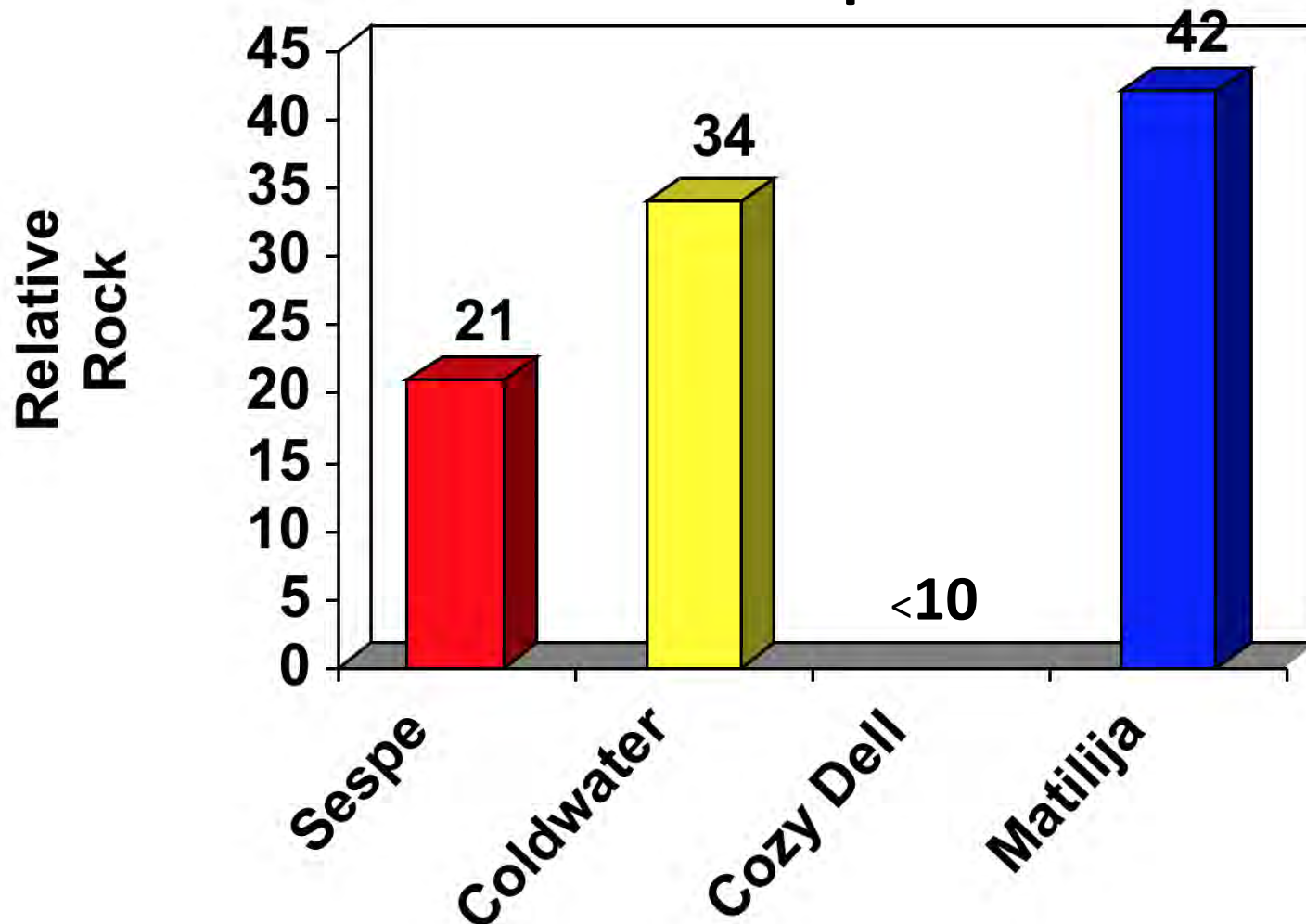
No other significant differences

Hydrogeologic influence on low-flow habitat

Detailed Field Mapping
Measurement of Spring flow
Fracture Density and Type



Rock Competence





Cozy Dell Shale

Fracture Density



Coldwater Sandstone

Rock Strength - Pools and Riffles

- No significant difference in rock competence between pools and the upstream channel
- No conclusive data for Cozy Dell Shale reach





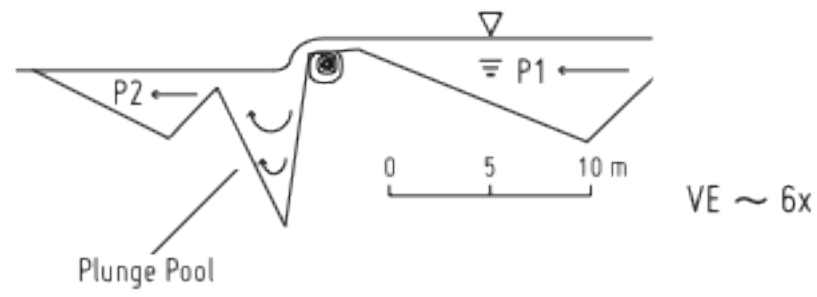
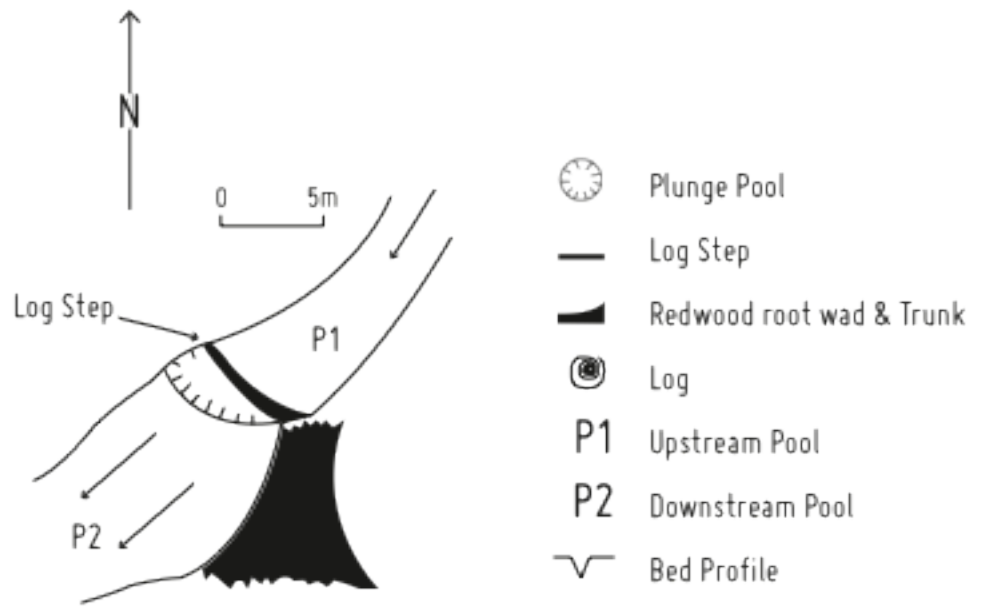
Implications for channel restoration

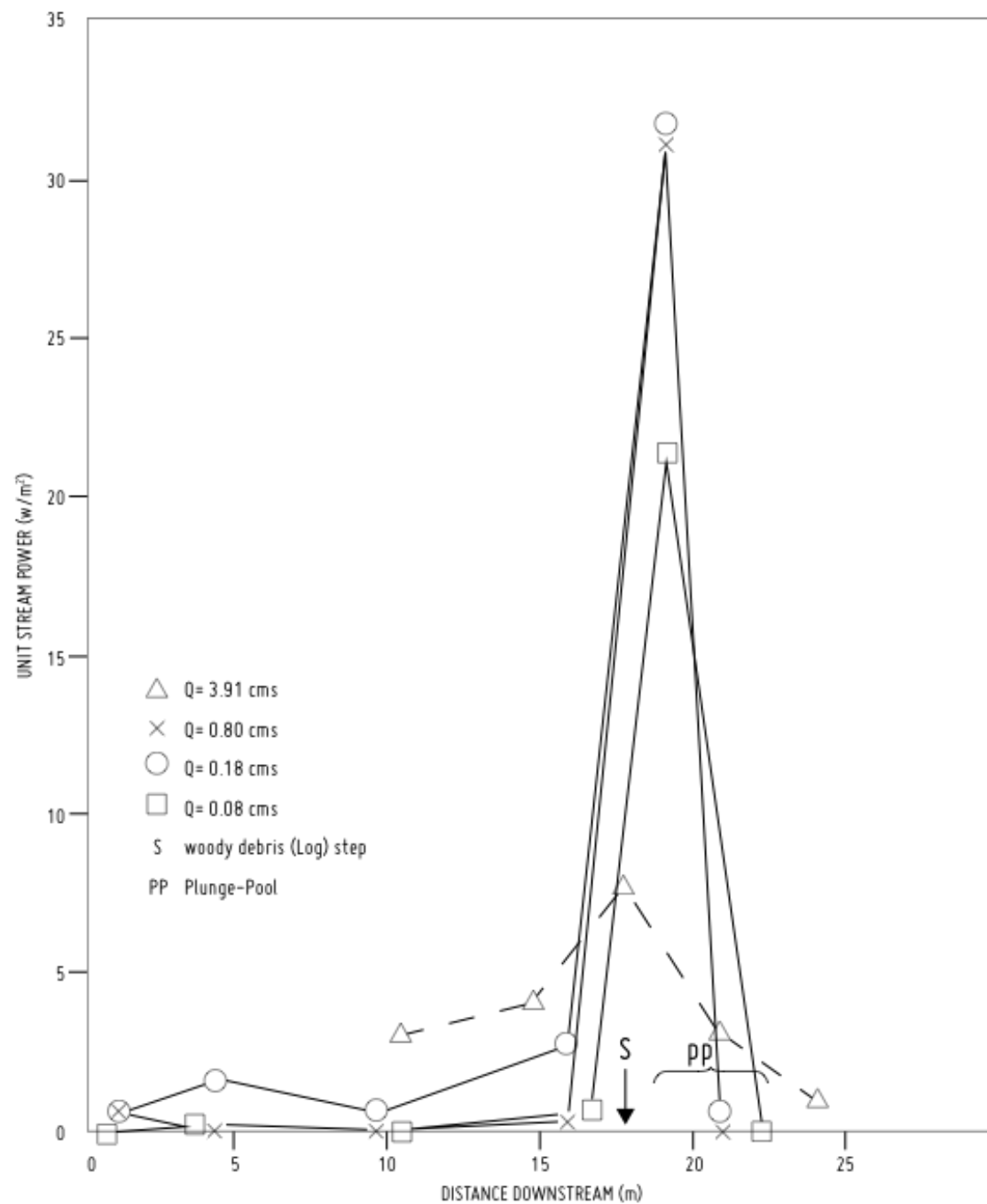


Get slope right

Do the hydrology to size
material for pool
framework







Summary

- Large Boulder Roughness Elements in Rattlesnake Cr. (composed hard sandstone) control channel slope as well as pool formation and morphology
- Bedrock type in Rattlesnake Cr. does not significantly affect the channel morphology
- Step-pools are the dominant pool type and in Rattlesnake Cr., and stable pool framework is composed of large Coldwater and Matilija Sandstone boulders
- Hydrogeology (spring flow) is important (critical in some years) in providing low-flow habitat
- Step-pools recover much sooner following disturbance than do forced pools
- Forced pools provide high quality fish habitat

Keep Our Streams Alive



Mark Capelli NOAA