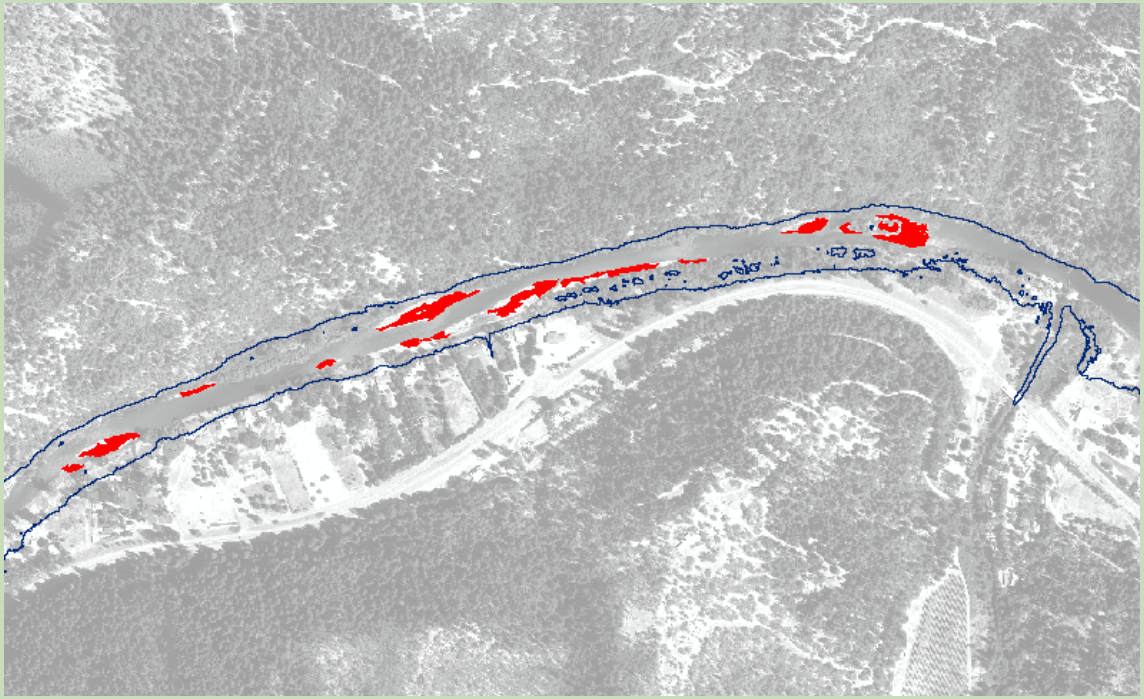
Upper Trinity River Coarse Sediment Storage Synthesis



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November 10, 2021

Background and Objectives

- NEED: consider actual coarse sediment storage to better relate to physical process and habitat objectives.
- OBJECTIVES:
  1. Develop a field-based active gravel bar area map of the 64 km management segment.
  2. Relate existing active bar frequency and area with forcing mechanisms (forced meanders, bedrock obstructions, large wood, etc.).
  3. Evaluate existing active bar frequency and area as an index of contemporary coarse sediment storage, and use results to inform potential coarse sediment storage as a function of geomorphic, hydraulic, and/or biological variables.
  4. Re-evaluate potential coarse sediment augmentation sites and volumes upstream of Indian Creek to inform development of long-term coarse sediment management plan and River Corridor Management Map.
  5. Evaluate relationship between active bar area and fish habitat.

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Field Methods

- GPS mapping performed in summer 2014 from Lewiston Dam to NF Trinity River, entire reach independently field-verified.
- 450 cfs water edge
- “Mobile” boundary on landward side based on set criteria
- Assignment of formative feature
- For large wood, number of pieces and XS area tabulated
- Ground photos taken of every bar
- Mapped bars within the 2,000 cfs channel
- Metric: Active bar area (m^2) per 1000m length of channel (e.g., density)

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Gravel bar mapping results

- Spatial gravel distribution
  - Longitudinally
  - Cumulative
  - Unit area
- Variables used for exploring bar area relationships:
  - 311 cms (11,000 cfs) channel width
  - 311 cms (11,000 cfs) shear stress by 200 m panel
  - Bar formative feature
  - Large wood (number of pieces and large wood XS area per bar)
  - 1998 – 2010 gravel augmentation volume
  - SRH-2D fry/presmolt habitat at 200 m and 1,000 m, and subreach segments, various overlap
  - Mapped redd distribution
  - Channel complexity
  - FYLF egg mass habitat

Initial 2015 analysis

Revised 2018-19 analysis

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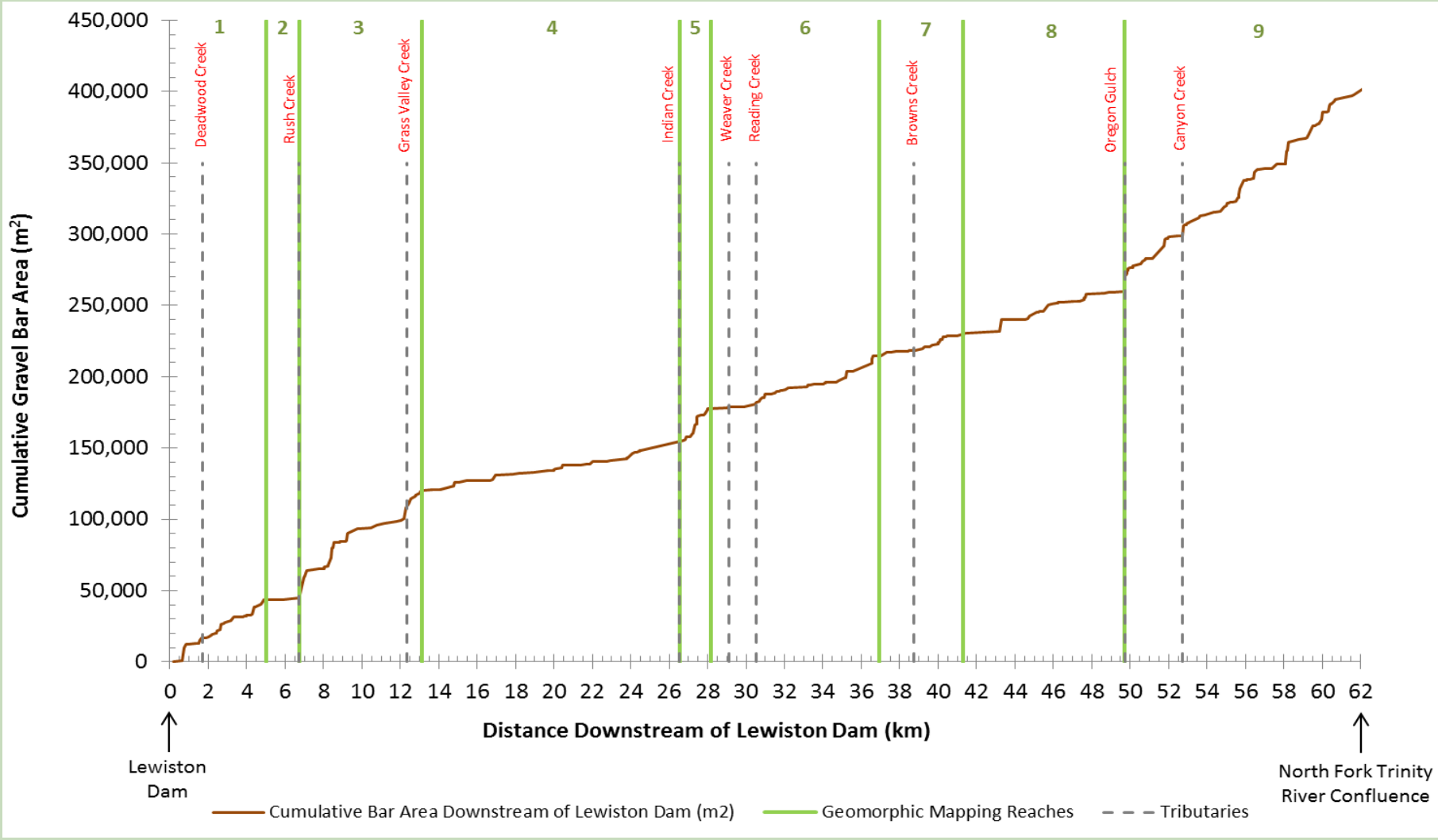
Results: cumulative longitudinal bar area



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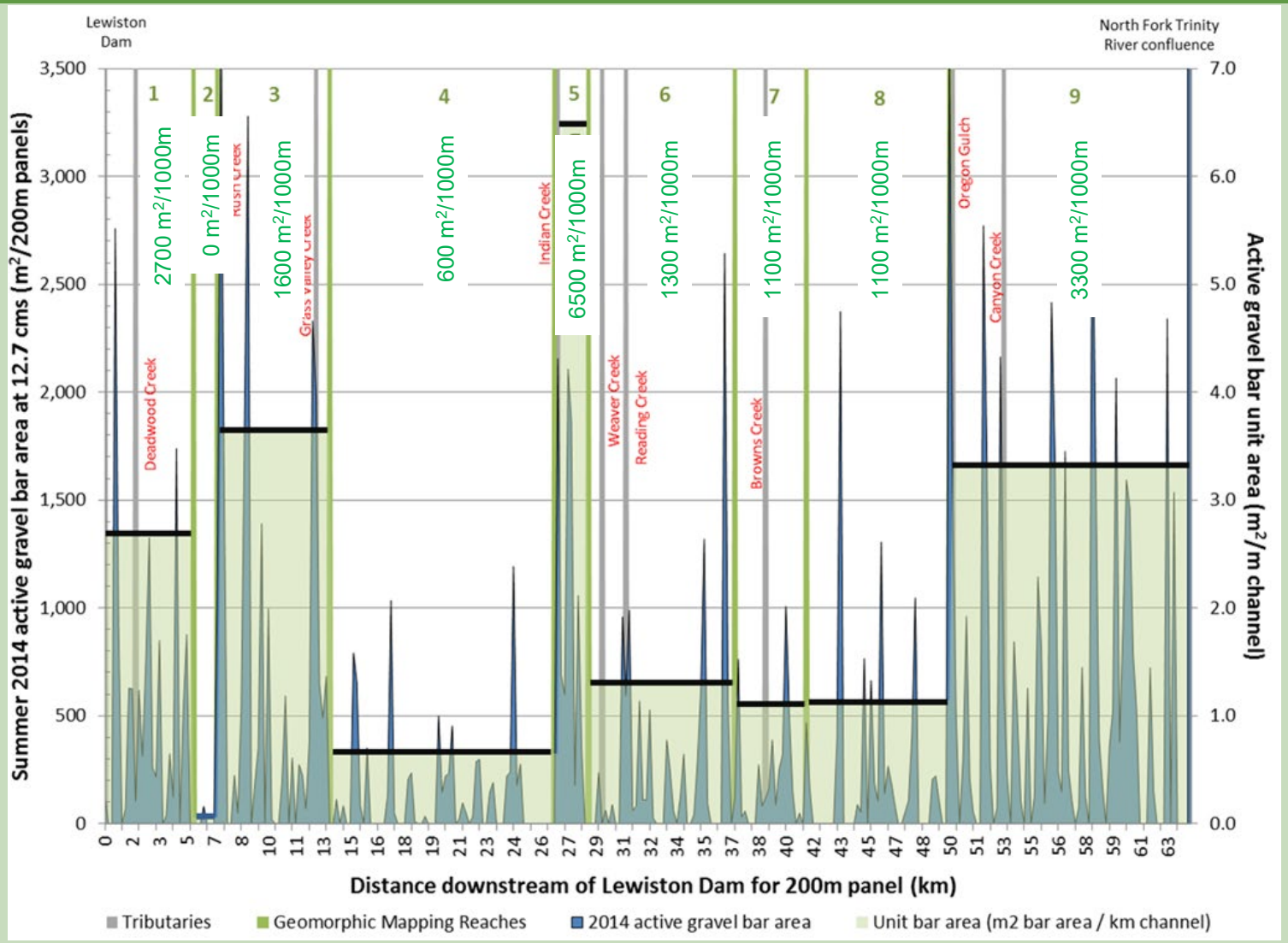
Results: Unit bar area by subreach



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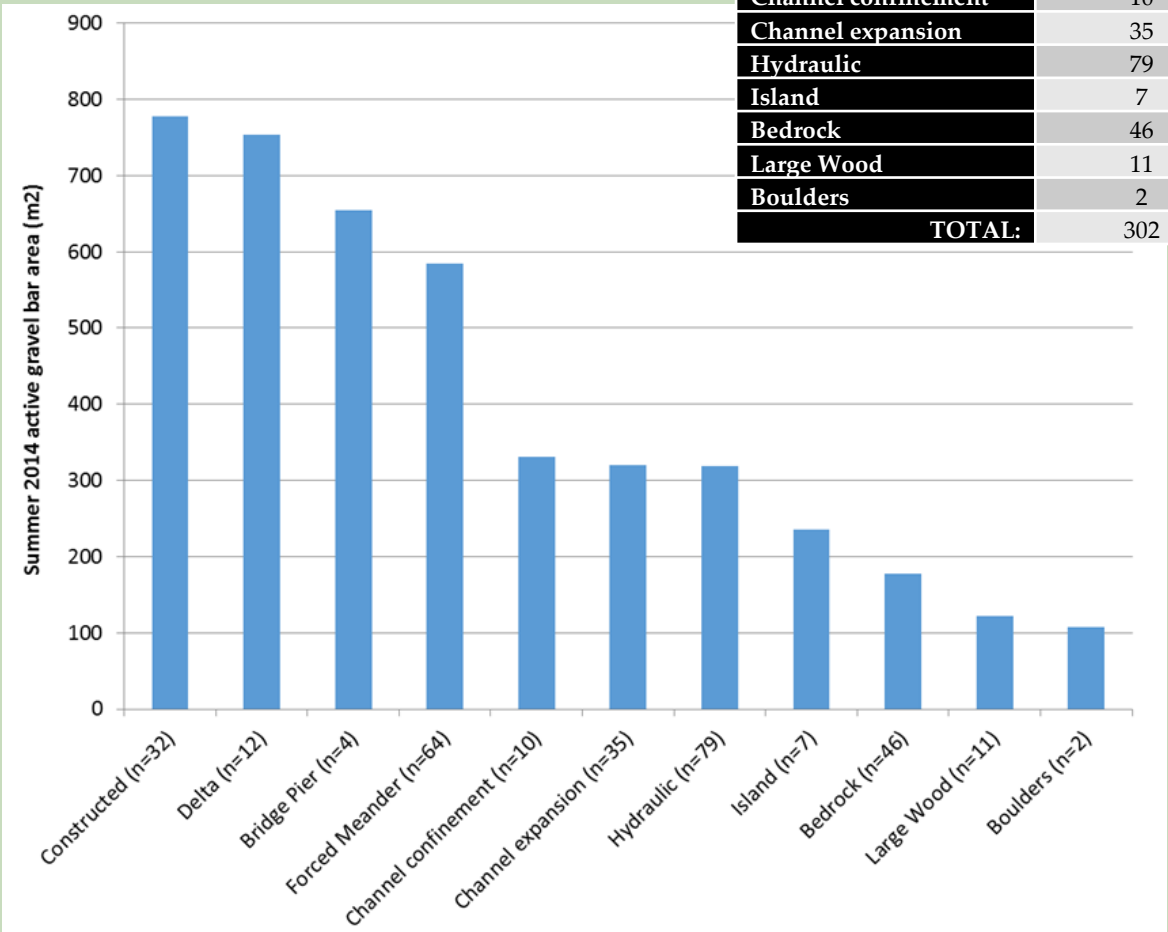
Results: Bar area as a function of formative feature

Formative feature type	Count	Maximum area (m^2)	Minimum area (m^2)	Average area (m^2)
Constructed	32	4,159	35	778
Delta	12	3,914	26	754
Bridge Pier	4	1,436	224	655
Forced Meander	64	3,408	3	584
Channel confinement	10	4,159	3	331
Channel expansion	35	1,503	32	320
Hydraulic	79	2,414	21	319
Island	7	2,514	6	235
Bedrock	46	999	18	178
Large Wood	11	762	3	122
Boulders	2	674	12	108
TOTAL:	302			



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Geomorphic results summary

- Spatial results show differences in gravel bar area (and inferred storage) between subreaches:
  - Subreaches 1, 3, and 9 have the highest active bar area.
  - Subreaches 1 and 3 are likely highest due to historic gravel augmentation; Subreach 9 likely highest due to Canyon Creek supply and residual effects of 1997 flood.
  - Subreaches 2 and 4 have the lowest active bar area.
  - Subreach 4 has had no gravel augmentation, and gravel supply from Grass Valley Creek has been largely eliminated since 1994.
  - Subreach 4 has ½ of the bar area density of Subreach 6 and 7 in a similar geomorphic setting➔ minimum future storage target?
  - Subreach 4 has 16% of the bar area density of Subreach 3➔an upper limit to future storage target?
- Bar area relationships show channel width, shear stress, and past gravel augmentation do not correlate well.
- Bar area relationships show large wood does correlate well, but only relatively few data points define the relationship.

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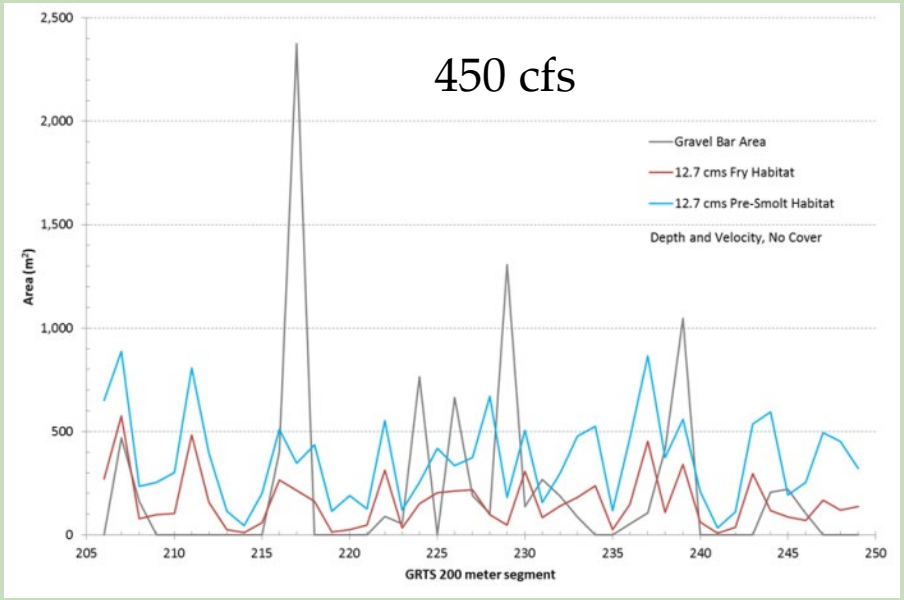
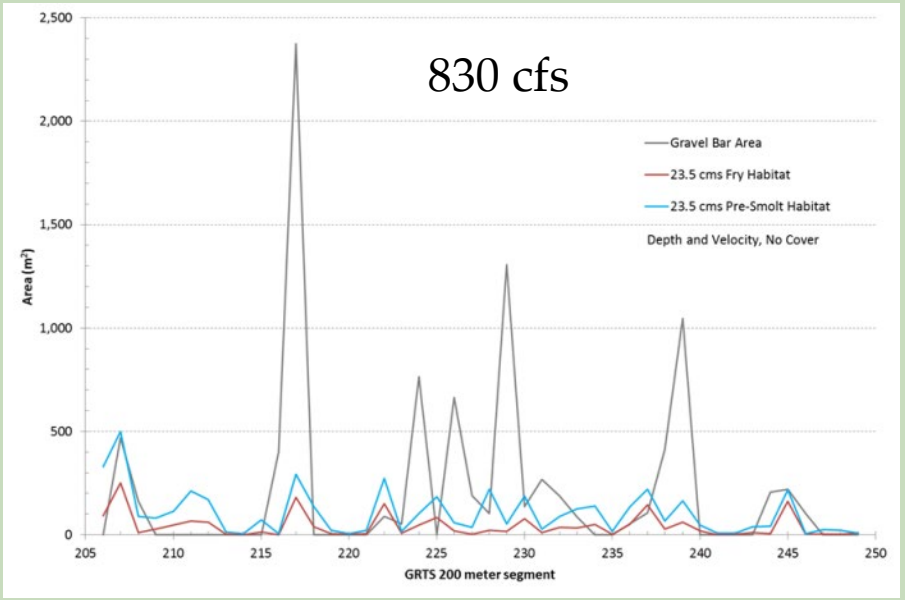
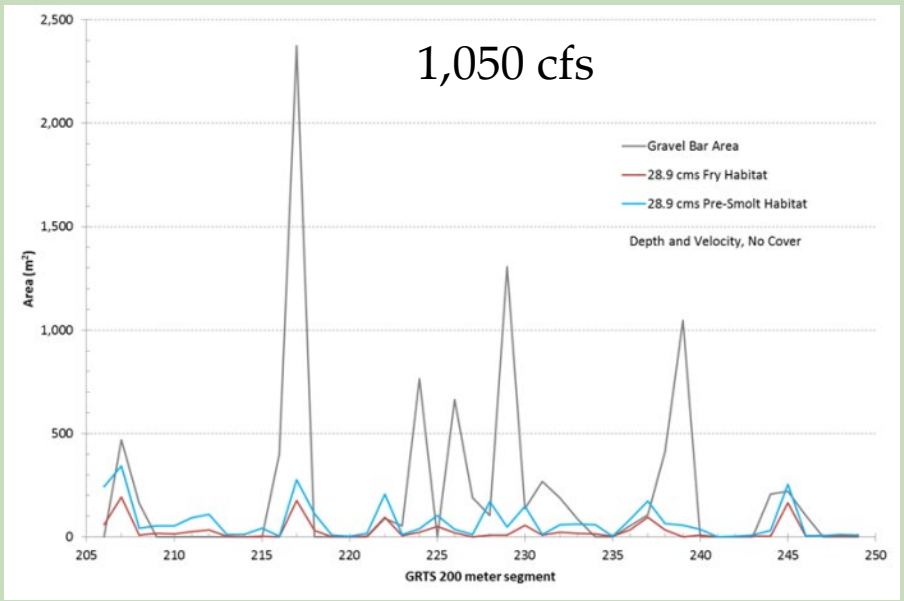
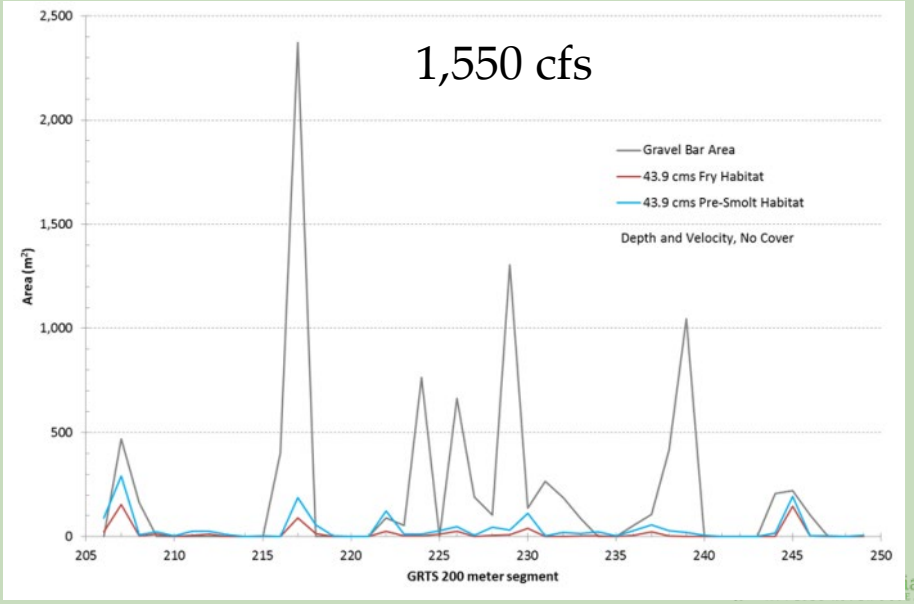
Initial 2015 plot shows relationships between bar area and fish habitat









2015 recommended next steps

- Acquire and evaluate full 2-D habitat model results for the entire reach
  - Additional validation?
  - Results for the short subreach show encouraging patterns but the analysis needs to be broadened to the entire reach.
  - **Refine relationships between habitat quantity and active bar area to inform desired future conditions**
- Supplement large wood analysis by implementing projects to test relationships
  - Incorporate specific large wood experiments into upcoming rehabilitation projects to help better understand and quantify the role of large wood to active bar area (number of pieces and upstream area) for use in design and DSS.

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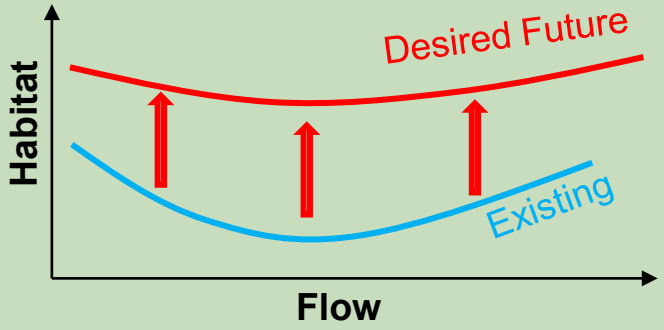
2018-19 Analysis Methods

- Evaluated relationships between fry and presmolt fish habitat to active bars
  - A range of analyses on fish habitat, complexity and Foothill Yellow-Legged Frog data
  - Analyzed local flows from 375 cfs – 2,000 cfs (dip in habitat curve)



- Key results from 2 analyses presented here:
  - Regression of active bar area to fry and presmolt habitat at the 1,000 m river sections (5 Consecutive GRTS Panels)
  - Regression of active bar area to fry and presmolt habitat at subreach level

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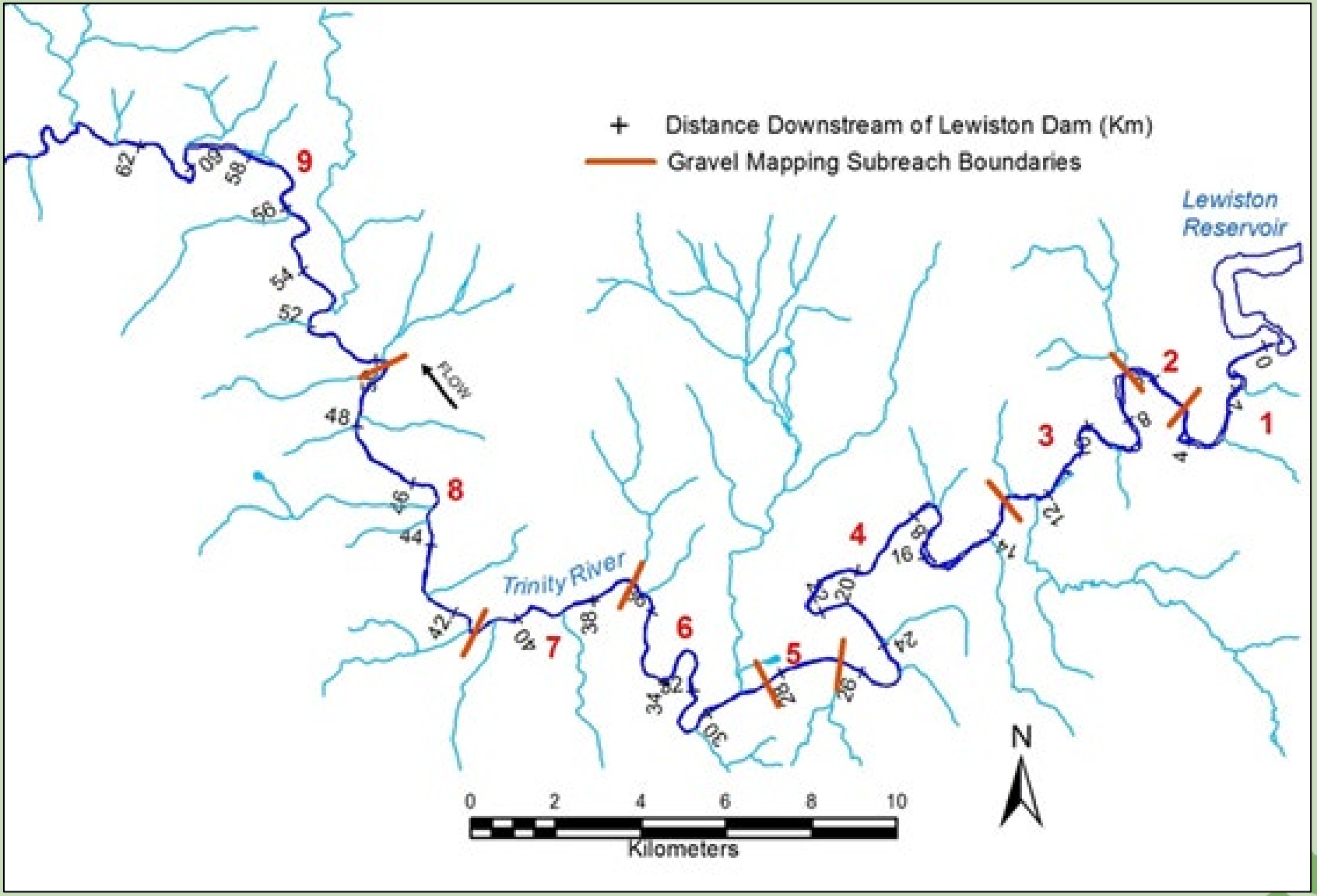
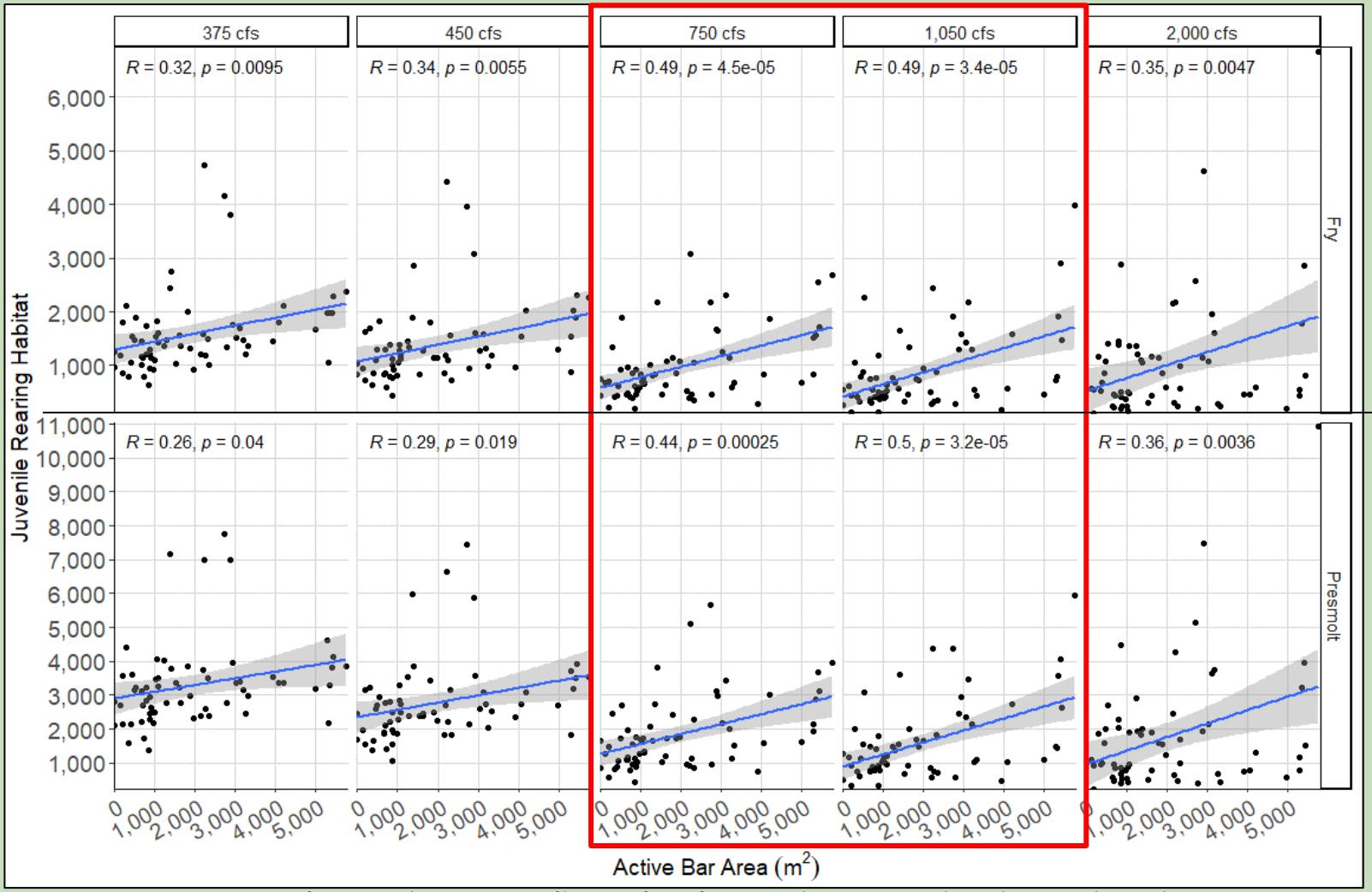
Spatial Scale of Analysis - Subreaches



Fish Habitat to Active Bar Area 1,000 m



Fry

Pre-Smolt

Linear regressions for each streamflow, for fry and presmolt Chinook Salmon. Strongest relationship denoted by the red box around 750 cfs-1,050 cfs. This is presumed to be the point at which inundation level on bars is maximizing habitat.

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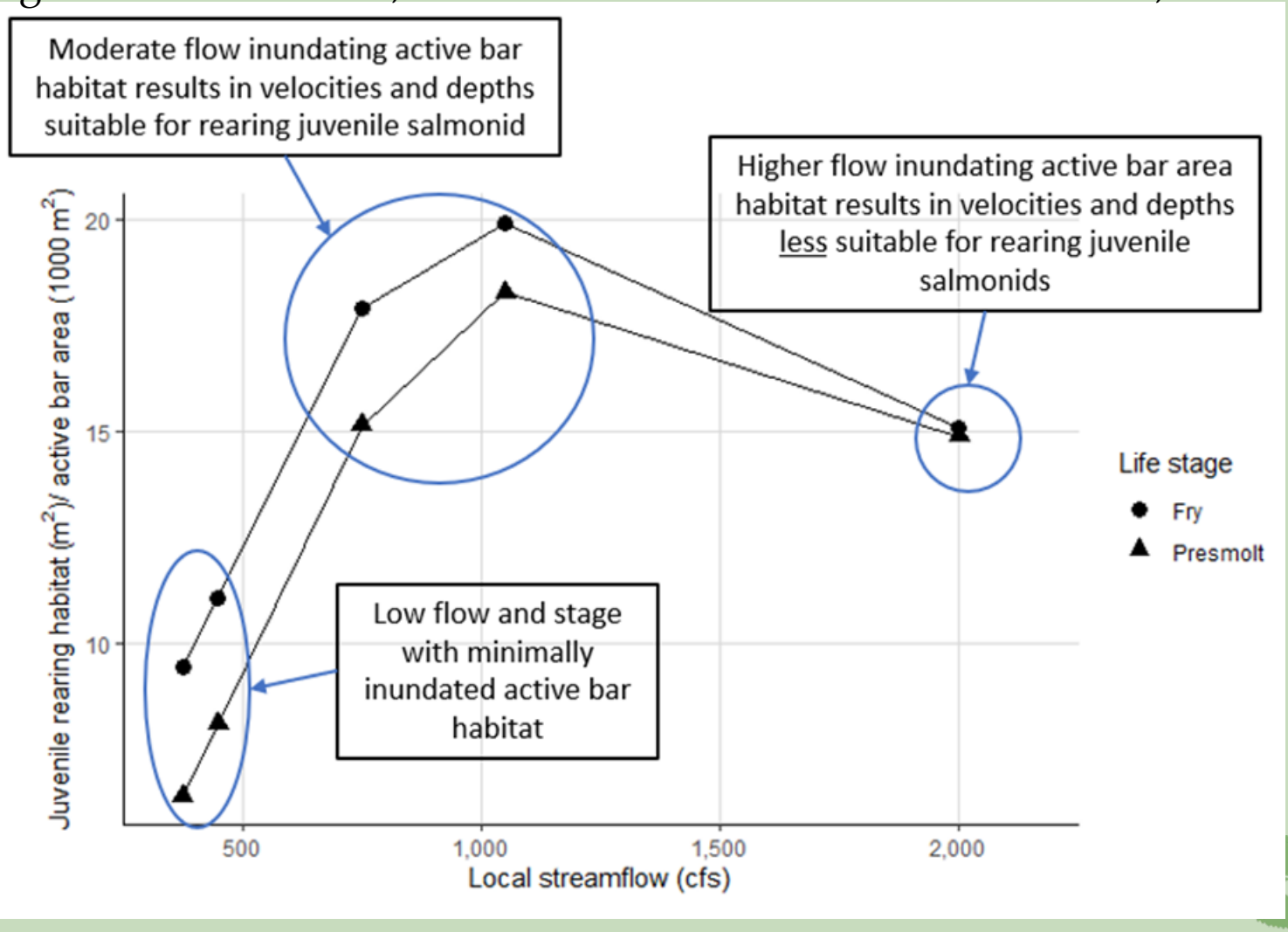
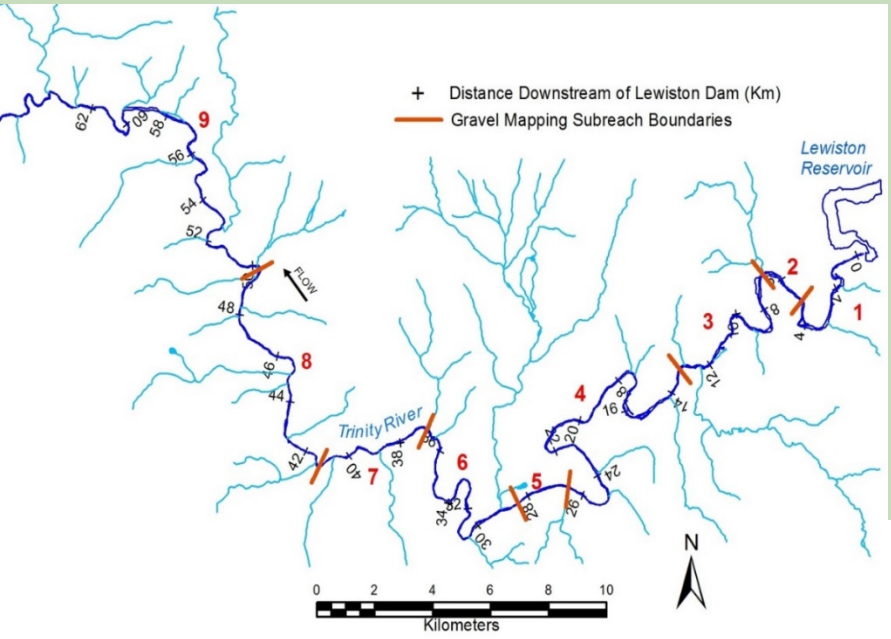
Slope of each regression as a function of streamflow

- The relationship between the rate of increase in fish habitat from active bar area changes with streamflow, and is maximized between 750 cfs and 1,050 cfs.



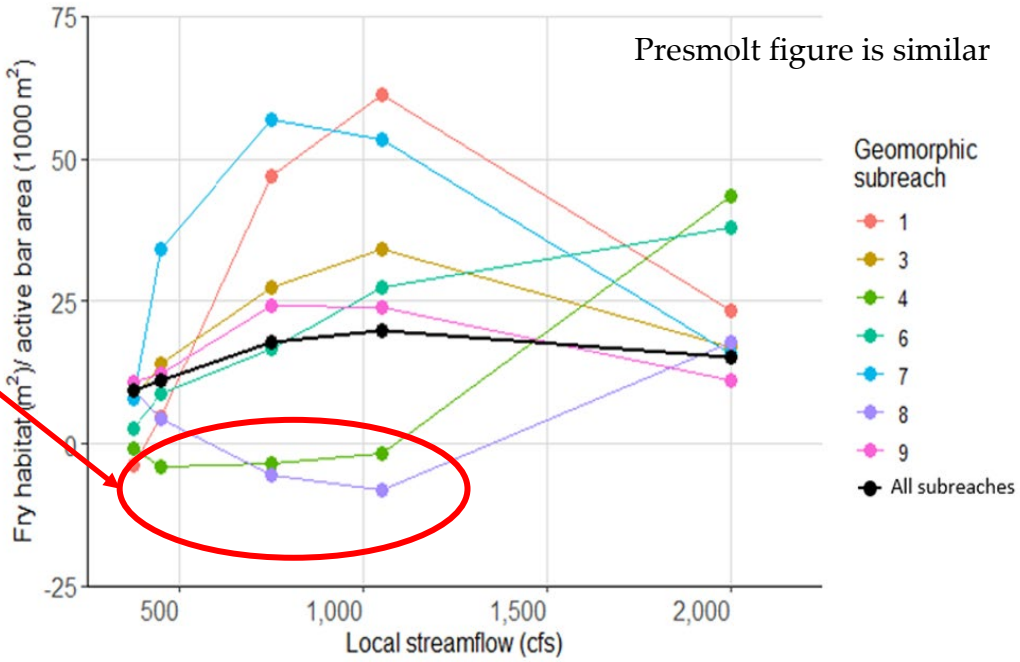
Subreach Scale Analysis Results



All subreaches except for Subreaches 4 and 8 have a positive relationship between habitat and active bar area

Why doesn't gravel result in higher fish habitat in subreaches 4 and 8?

- Bars are higher elevation (habitat density increases from 1,050 to 2,000 cfs)
- Requires gravel additions (very low density in Subreach 4)
- Other features driving fish habitat here?



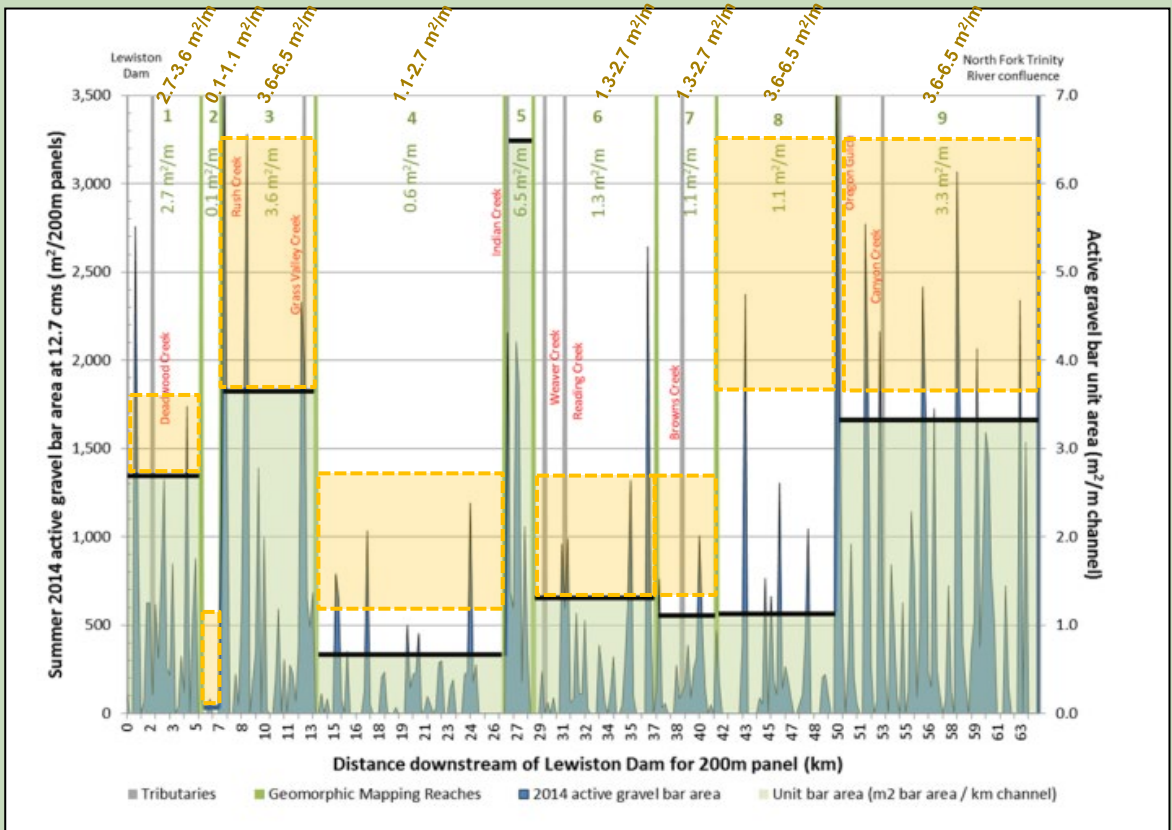
Summary of Results and Recommendations

1. Subreach 4 (GVC-Indian Creek) has lowest active bar density, much more potential
2. Subreaches 6-7 (Weaver creek-Browns Creek) has low active bar density, much more potential
3. Subreach 8 (below Dutch Creek) has largest potential for increased density, active restoration projects underway

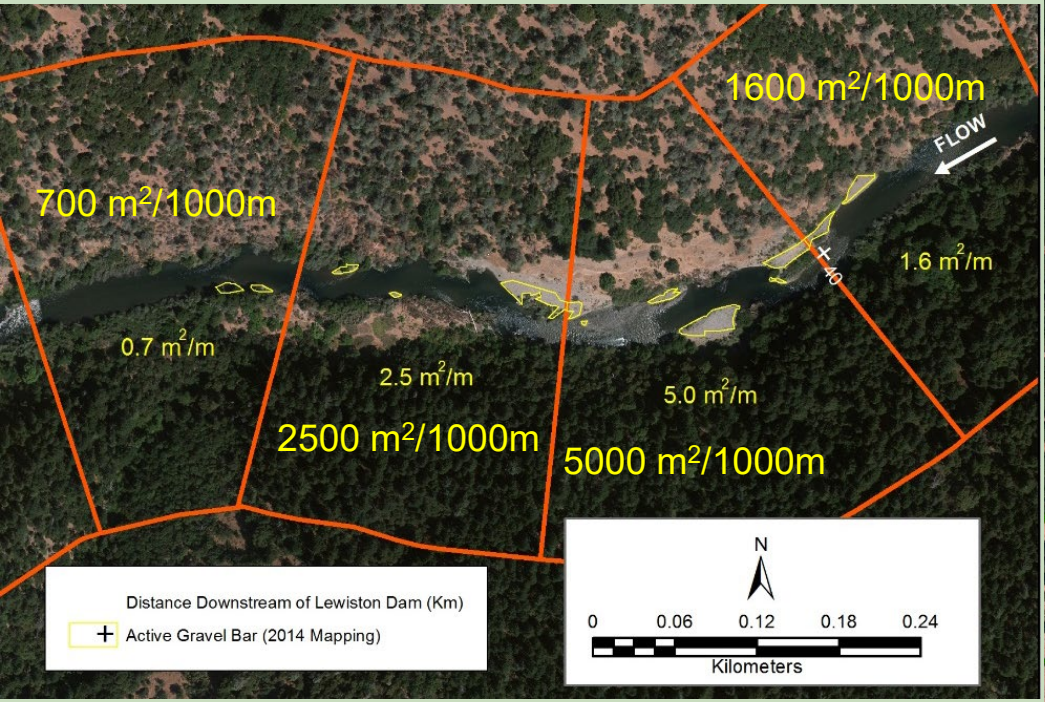
Geomorphic Subreach	Existing unit active bar area, m^2/1,000 m channel	Target future unit active bar area, m^2/1,000 m channel
1	2,700	2,700 – 3,600
2	100	100 – 1,100
3	3-600	3,600 – 6,500
4	600 ⇨	1,100 – 2,700
5	650	650
6	1,300 ⇨	1,300 – 2,700
7	1,100 ⇨	1,300 – 2,700
8	1,100 ⇨	3,600 – 6,500
9	3,300	3,600 – 6,500

How can we increase Active Bar Area for priority Subreaches

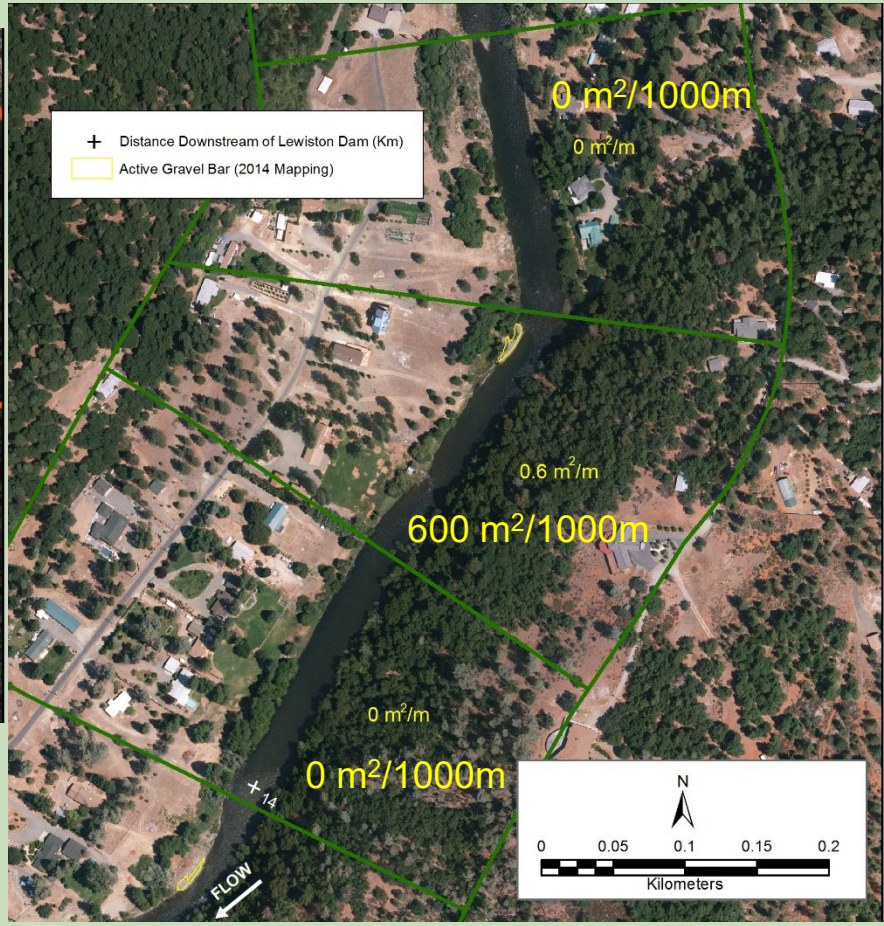
- Prioritize Subreaches 4, 6, and 7 – gravel augmentation and added roughness features to increase gravel retention (storage)
- Subreach 8 is undergoing substantial rehab projects that should show large increases in active bar area
- Add large wood to increase gravel storage (and active bar area) in less accessible sites



What do these recommendations look like in the field (i.e., reality check)?



Subreach 7 (Browns Canyon)



Subreach 4 (Poker Bar)

Potential targets:

- Reach 4: 600 ➔ 1100-2700 m²/1000m
- Reach 6-7: 1100 ➔ 1300-2700 m²/1000m
- Reach 8: 1100 ➔ 3600-6500 m²/1000m

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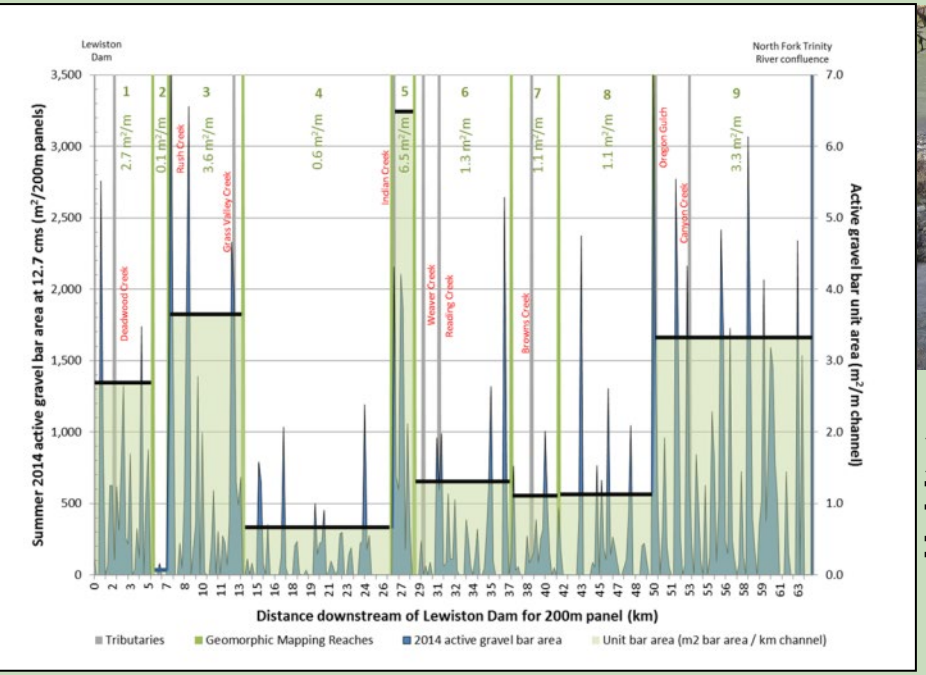
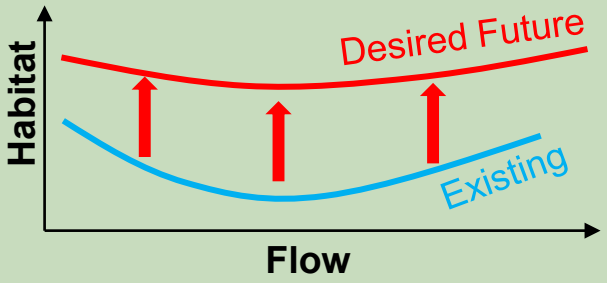
RECOMMENDED NEXT STEPS: Update Coarse Sediment Management Plan (CSMP)





- Revisit appropriate gravel storage targets for desirable geomorphic form and processes in each geomorphic subreach
- Continue to assess gravel storage targets to increase and maintain fry and pre-smolt rearing habitat (~$35k every 5 years)
- Use storage targets, constraints, opportunities, and logistics as a basis for updated long-term CSMP recommendations and River Corridor Management Map.

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Questions?