

Supplementary Materials

# Hydroclimatic Conditions, Wildfire, and Species Assemblages Influence Co-Occurrence of Bull Trout and Tailed Frogs in Northern Rocky Mountain Streams

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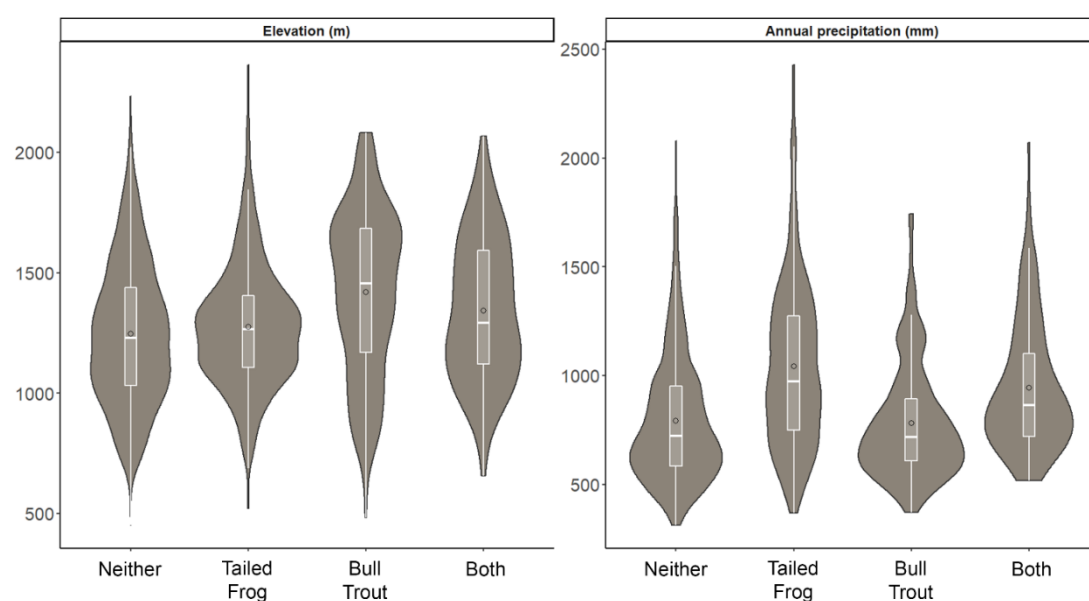
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**Table S1.** Habitat characteristics of sample sites included in the field methods comparison (i.e., evaluation of electrofishing versus day and night snorkeling). See Peterson et al. [47] and Thurow et al. [48] for additional details.

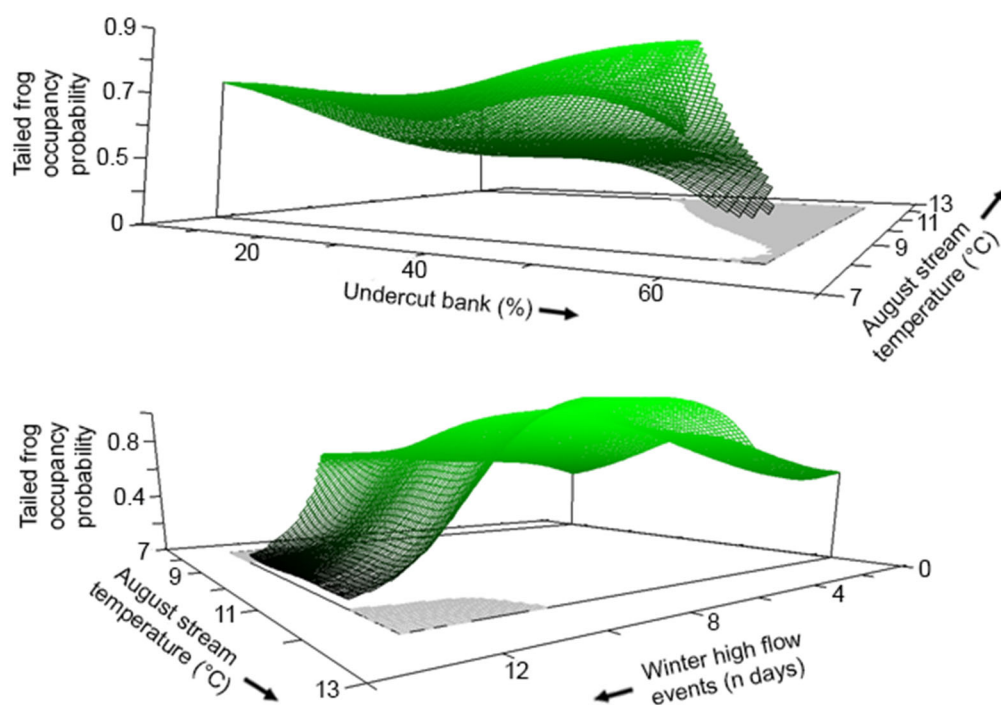
Variable	Mean	SD	Range
Site elevation (m)	1430	534	169 - 2450
Mean wetted width (m)	4.70	1.80	1.9 - 10.5
Mean cross-sectional area (m <sup>2</sup> )	0.81	0.51	0.1 - 2.5
Map reach gradient (%)	4.49	2.48	0.4 - 11.8
Wood density (no./m <sup>2</sup> )	0.05	0.05	0 - 0.3
% pools composition	10.94	10.65	0 - 50.5
Undercut banks (%)	11.00	15.59	0 - 93.4
Water temperature (°C)	9.90	2.76	3.0 - 16.8
Day visibility (m)	2.67	0.98	0.5 - 7.8
Substrate (percent of substrate composition)			
Fines	14.82	11.96	0 - 67
Gravel	25.24	13.29	0 - 64
Cobble	28.60	10.59	4 - 59
Rubble	31.14	18.30	0 - 78

**Table S2.** Detection rates of Rocky Mountain tailed frog tadpoles and adults using three survey methods in 106 survey reaches in 1<sup>st</sup> to 3<sup>rd</sup> order streams in the northern Rocky Mountains. Surveys of each site were always conducted in the same order: day snorkeling, followed by night snorkeling, followed by multi-pass electrofishing. There are 8 possible combinations of detections for each life stage using the 3 methods (detection vs non-detection x 3 methods). For example, in the top row, no tadpoles were detected using any method in 30.2% of 106 sites surveyed whereas no adults were detected using any method in 60.4% of 106 sites. .

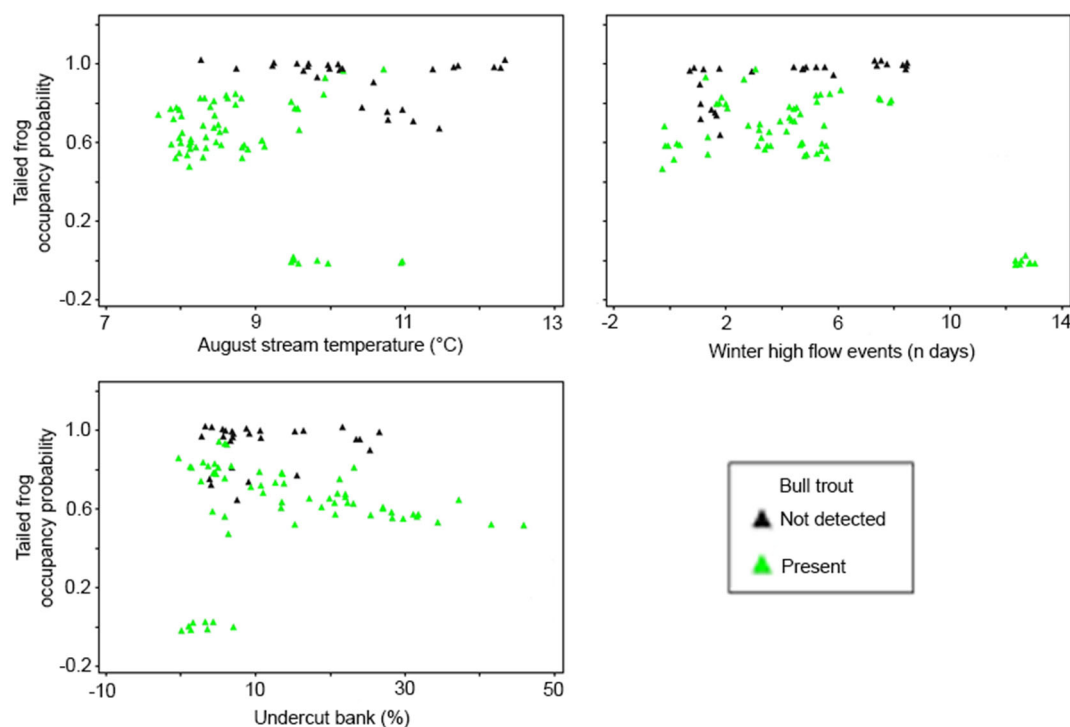
Tailed frog detection using:			Percentage of 106 sites with corresponding detection pattern across methods	
Day Snorkeling	Night Snorkeling	Electrofishing	Tadpoles	Adults
Not Detected	Not Detected	Not Detected	30.2%	60.4%
Detected	Detected	Detected	16.0%	0.9%
Not Detected	Detected	Detected	32.1%	1.9%
Not Detected	Not Detected	Detected	10.4%	25.5%
Not Detected	Detected	Not Detected	4.7%	1.9%
Detected	Not Detected	Detected	3.8%	4.7%
Detected	Detected	Not Detected	2.8%	2.8%
Detected	Not Detected	Not Detected	0.0%	1.9%



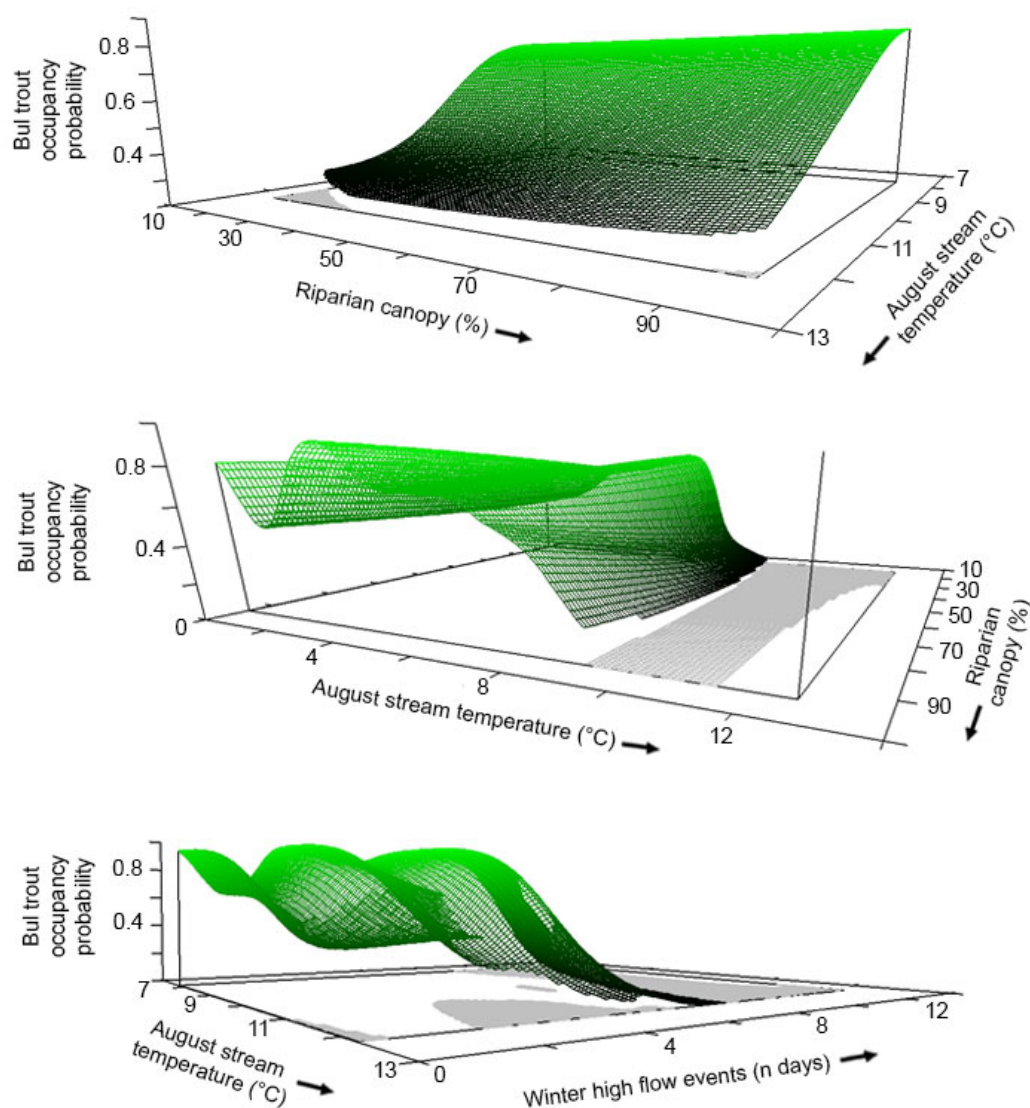
**Figure S1.** Distribution of elevation and precipitation across each of four species occupancy categories: Sites where neither tailed frogs nor bull trout were detected ( $n = 1,684$  Neither sites), sites occupied by tailed Figure 664. Tailed Frog only sites); sites occupied by bull trout but not tailed frogs ( $n = 331$  Bull Trout only sites), and sites occupied by both tailed frogs and bull trout ( $n = 150$  Both sites). The violin plots show a smoothed frequency distribution of all sites across each variable (density plot width), as well as the median (white line), mean (circle), 25<sup>th</sup> and 75<sup>th</sup> percentiles (ends of box), and minimum and maximum (white lines depicting  $1.5 \times$  the inter-quartile range).



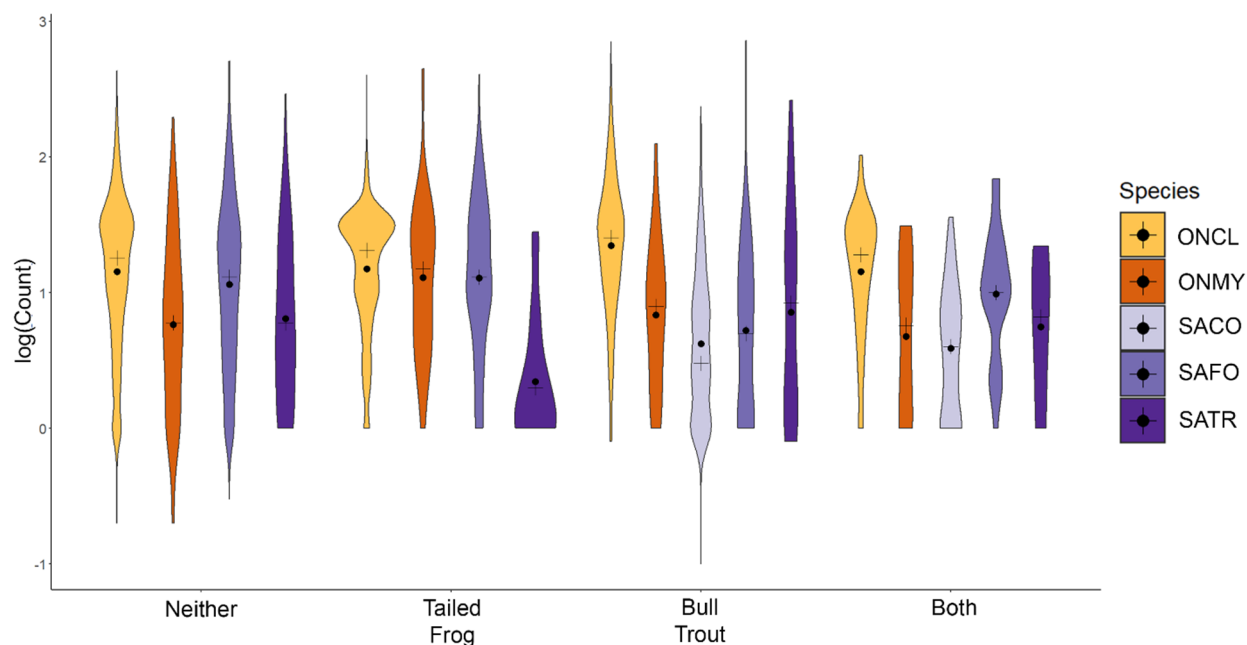
**Figure S2.** NPMR modeled relationships between tailed frog tadpole occupancy rate and important predictor variables using 96 study sites where both field-measured and GIS-derived variables were available within the ranges of the Rocky Mountain tailed frog and bull trout. Predictor variables shown are (a) August stream temperature (°C) and percent undercut bank; and (b) August stream temperature (°C) and winter high flow events (i.e., the number of winter days when stream flows are in >95 percentile of the flow of record). Gray shading in each panel indicates regions of predictor space with insufficient data for predictions to be made.



**Figure S3.** Bivariate plots of NPMR modeled relationships between tailed frog tadpole occupancy rate and important predictor variables using 96 study sites where both field-measured and GIS-derived variables were available within the ranges of the Rocky Mountain tailed frog and bull trout. Black symbols are sites where bull trout were not detected and green symbols are sites where bull trout were present. Predictor variables shown are (a) August stream temperature (°C), (b) winter high flow events (i.e., the number of winter days when stream flows are in >95 percentile of the flow of record), and (c) percent undercut bank.



**Figure S4.** NPMR modeled relationships between bull trout occupancy and important predictor variables using 96 study sites where both field-measured and GIS-derived variables were available within the ranges of the Rocky Mountain tailed frog and bull trout. Predictor variables shown are (a) Riparian canopy cover and August stream temperature (°C), (b) winter high flow events (i.e., the number of winter days when stream flows are in >95 percentile of the flow of record) and Riparian canopy cover, and (c) August stream temperature (°C) and winter high flow events. Gray shading in each panel indicates regions of predictor space with insufficient data for predictions to be made.



**Figure S5.** Distribution of fish species abundance from electrofishing surveys across each of four species occupancy categories: Sites where neither tailed frogs nor bull trout were detected ( $n = 1,684$  Neither sites), Scheme 664. Tailed Frog only sites); sites occupied by bull trout but not tailed frogs ( $n = 331$  Bull Trout only sites), and sites occupied by both tailed frogs and bull trout ( $n = 150$  Both sites). Fish species are westslope cutthroat trout (ONCL; *Oncorhynchus clarkia lewisii*); rainbow trout (ONMY; *Oncorhynchus mykiss*); bull trout (SACO; *Salvelinus confluentus*), brook trout (SAFO; *Salvelinus fontinalis*); and brown trout (SATR; *Salmo trutta*). In these violin plots, the points are the mean and the crosshairs are the median.