Effects of the Las Conchas Fire on Water Quality and Fish Assemblages in the Middle Rio Grande

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US Army Corps of Engineers

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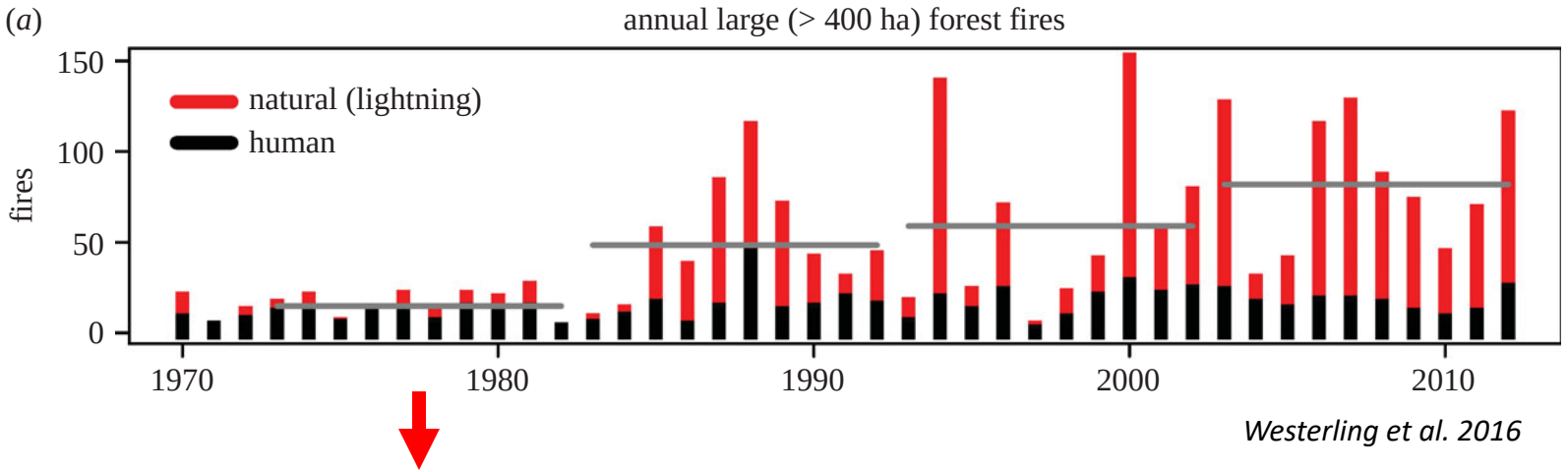
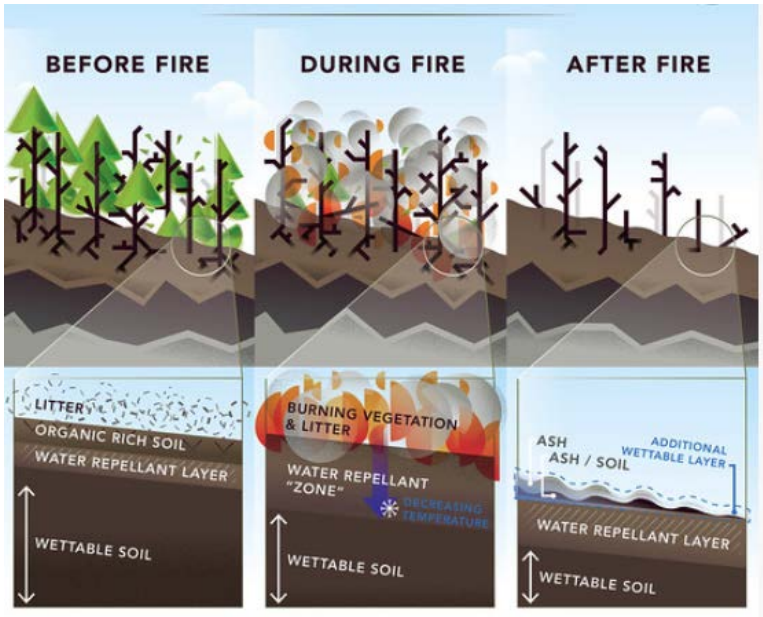
Wildfire Background



Westerling et al. 2016



The Las Conchas Fire and Impacts to Rio Grande Water Quality

Stormwater

Drought

Disturbance Impacts

Wildfire

Flooding

Temperature

pH

Refugia

Turbidity

Primary Productivity

Baseline Conditions

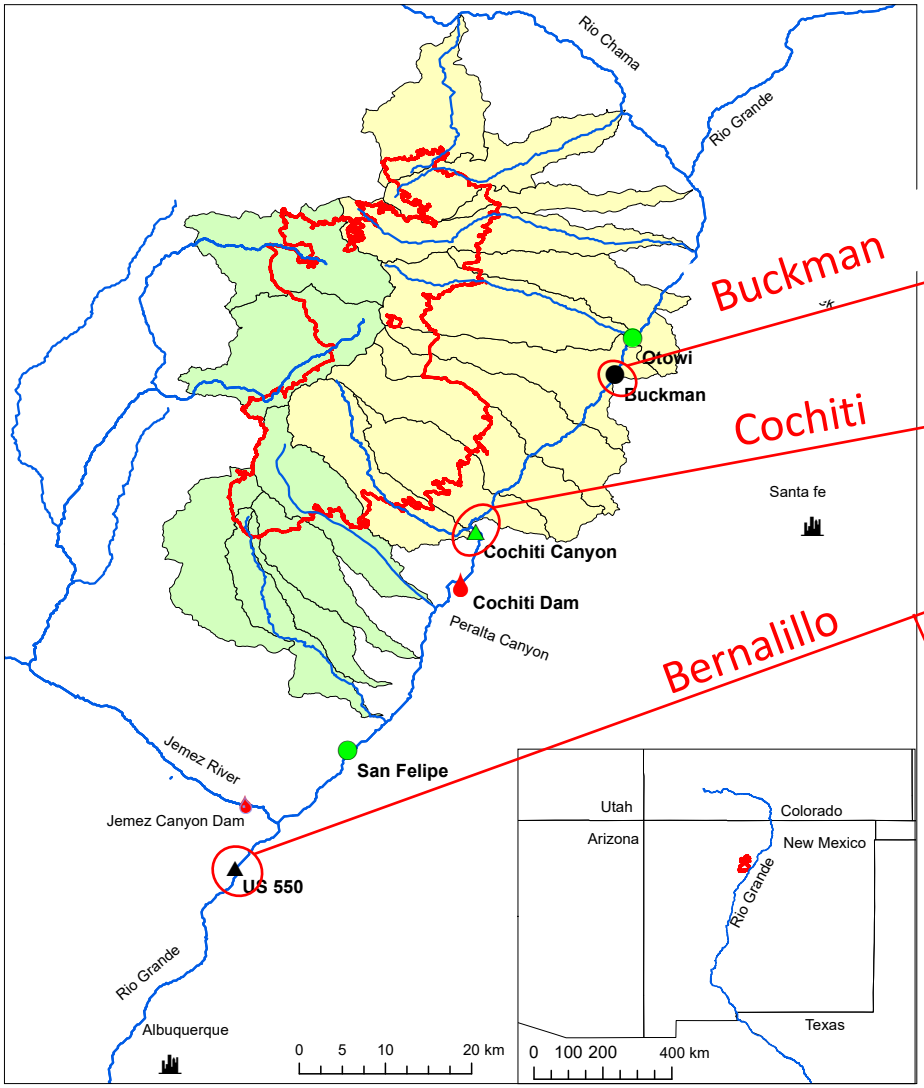
Salinity

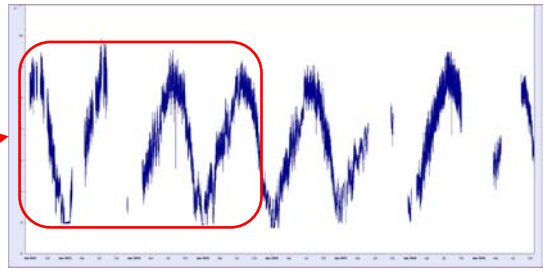
Ecosystem Respiration

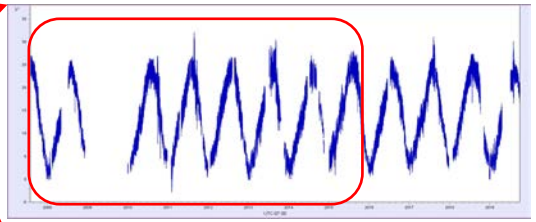
Dissolved Oxygen

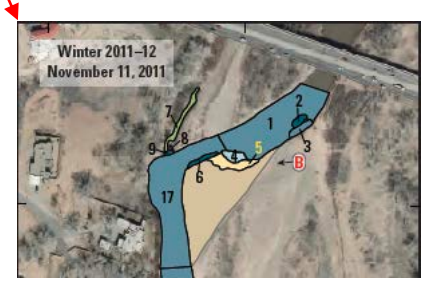
Fish Community

The Las Conchas Fire and MRG Monitoring Locations



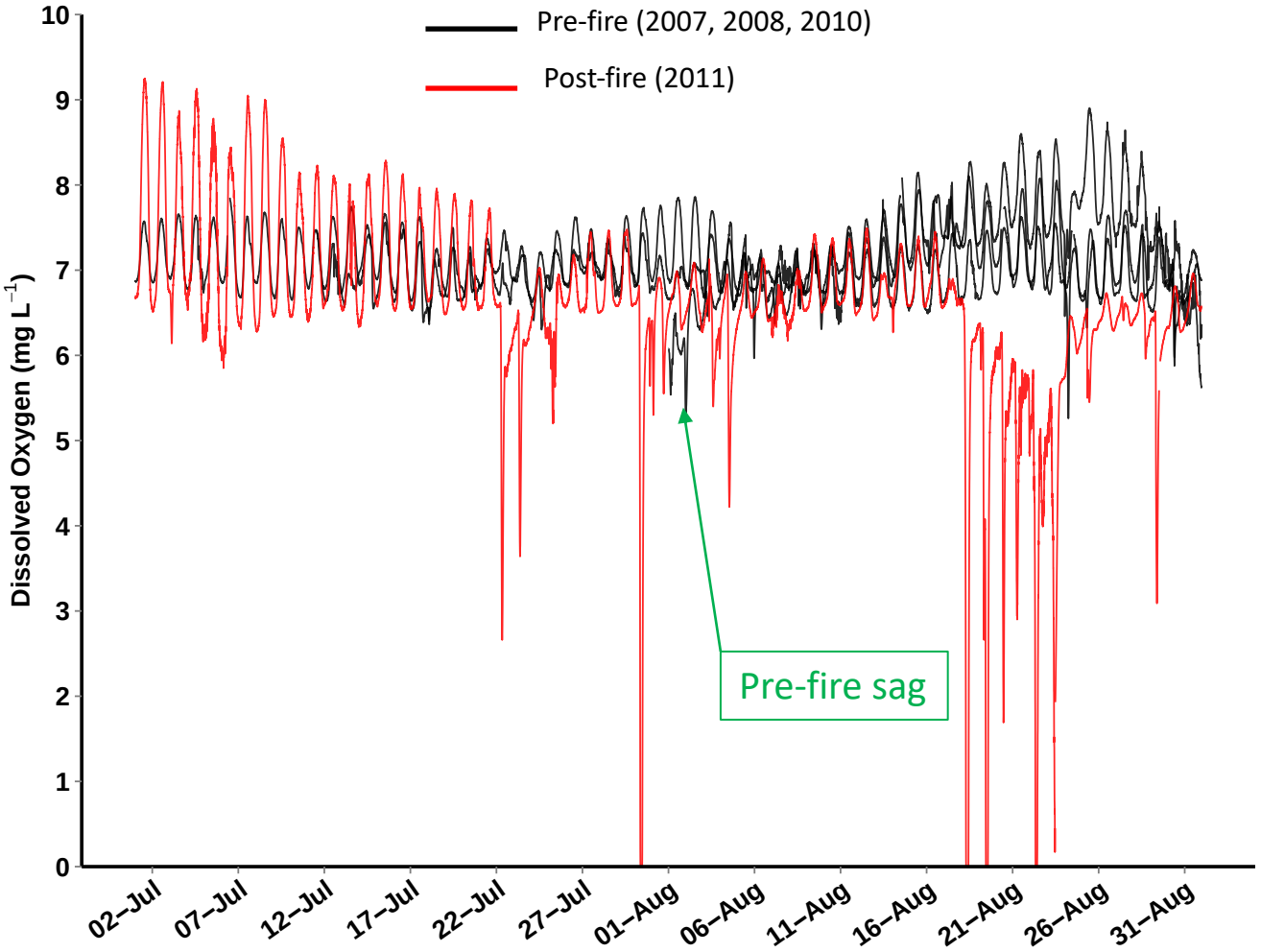






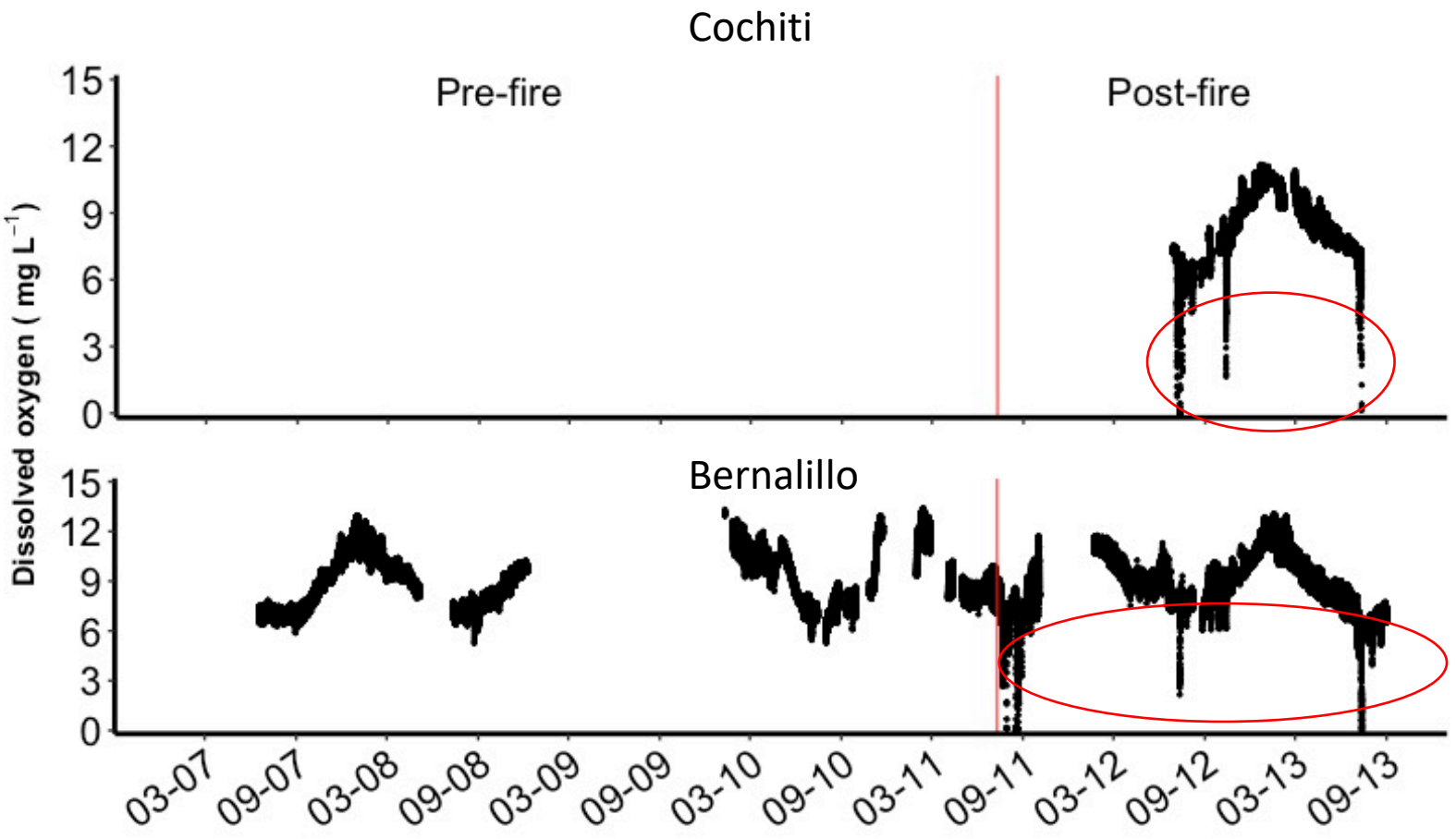
Dahm et al. 2015, Reale et al. 2015,
Reale et al. in revision, SWCA 2014, Dudley et al. 2019

Immediate Wildfire Impacts to Dissolved Oxygen at Bernalillo



Dahm et al. 2015

Multi-Year Wildfire Impacts to Dissolved Oxygen



Reale et al. in revision

Wildfire WQ Implications for MRG Biota

- Prior to the Las Conchas fire DO rarely declined below 6 mg/l upstream of Albuquerque.
- Immediately following the fire, numerous DO sags down to 0 mg/l.
- DO sags below 5 mg/l persisted through 2013 upstream and downstream of Cochiti Dam.
- No acute lethal concentration (NALC) for the RG Silvery Minnow is 4.4 mg/l.
- The 50% lethal concentration (LC_{50}) for DO for the RG Silvery Minnow is ~0.8 mg/l, and most of the mortality occurs within the first 3-8 hours.

Fish Assemblage Data Analysis

Negative binomial models were used to calculate total and species expected catch per unit effort [$\hat{E}(CPUE)$].

Total $\hat{E}(CPUE)$, species richness, and Simpson's diversity index were used as assemblage metrics.

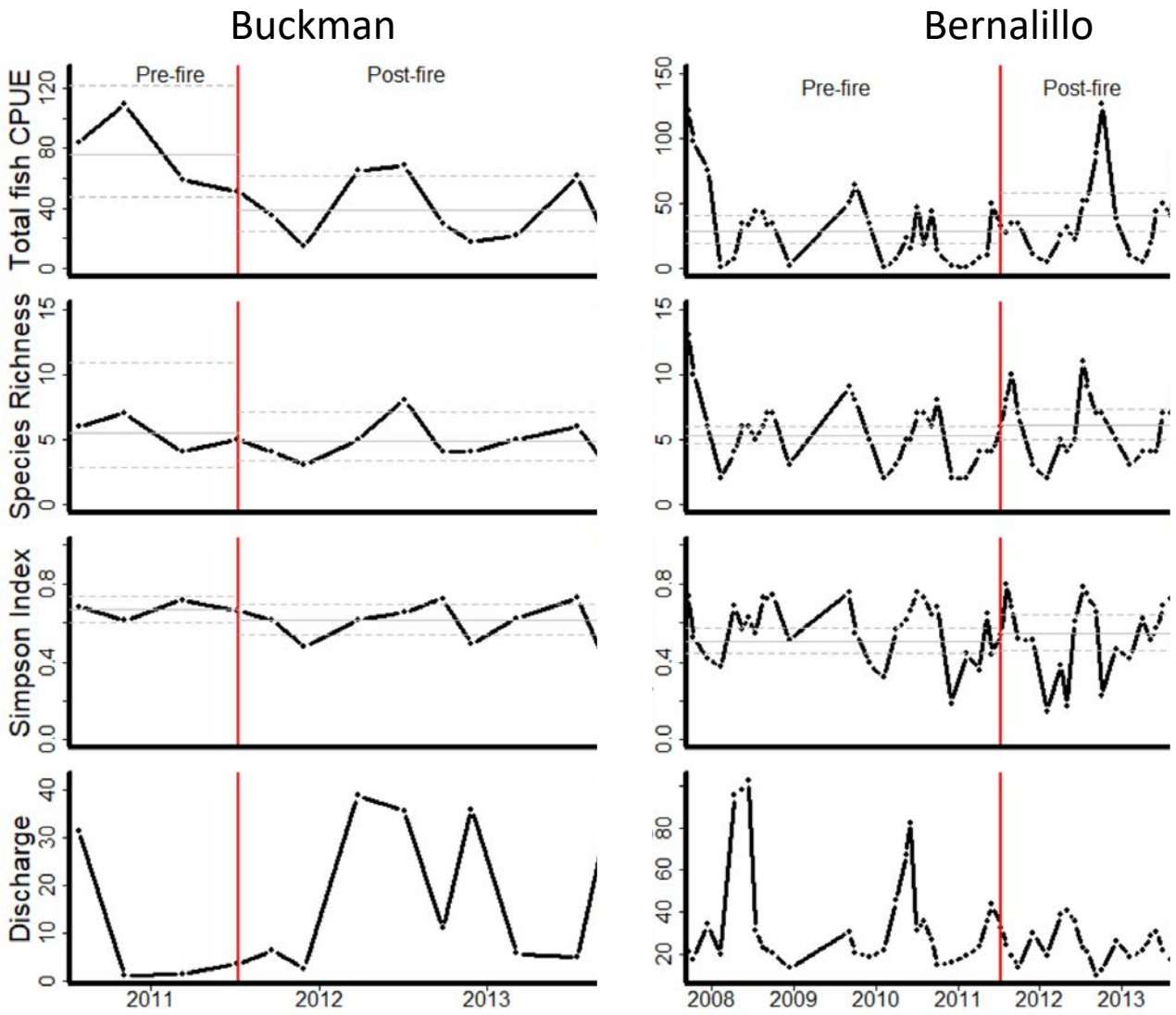
$\hat{E}(CPUE)$ of three native cyprinids (Fathead Minnow, Flathead Chub, and Longnose Dace) and one non-native catastomid (White Sucker) were used to evaluate species-specific responses.

Used generalized linear mixed models to predict the mean fish assemblage density and diversity during each period of interest.

Used generalized linear models to evaluate the relationships between fish assemblage density and diversity to variation in sampling effort, hydrologic conditions, seasonality, Las Conchas fire, and 2013 flood.

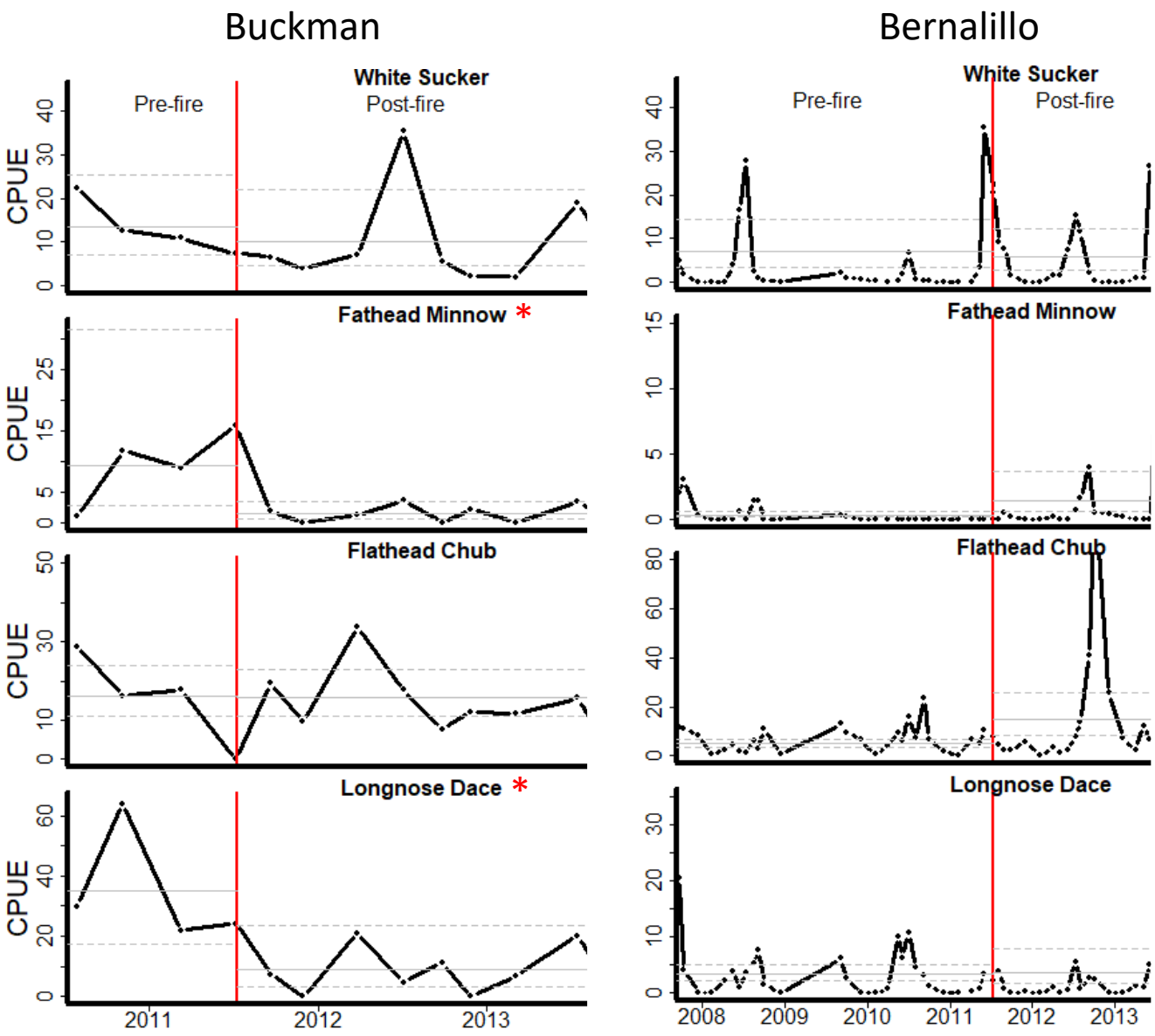
- Generated a subset of model combinations and ranked by AIC.
- Developed an average model (AIC=0.90).
- Reported significant parameter estimates from the average model (*).

Post-Fire Fish Assemblage Response



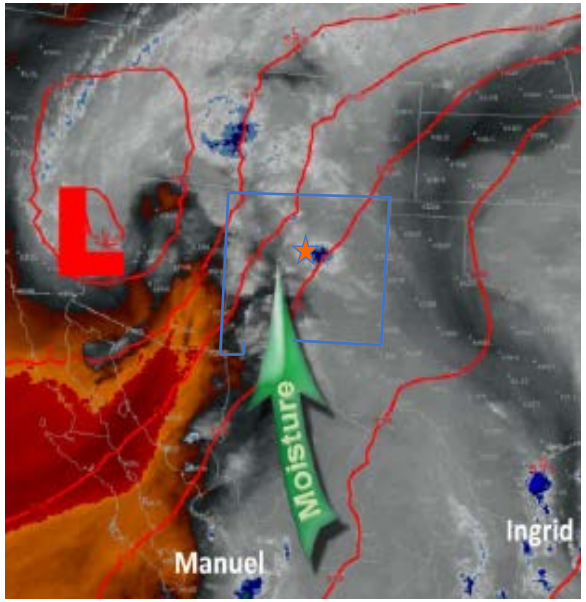
* = significant

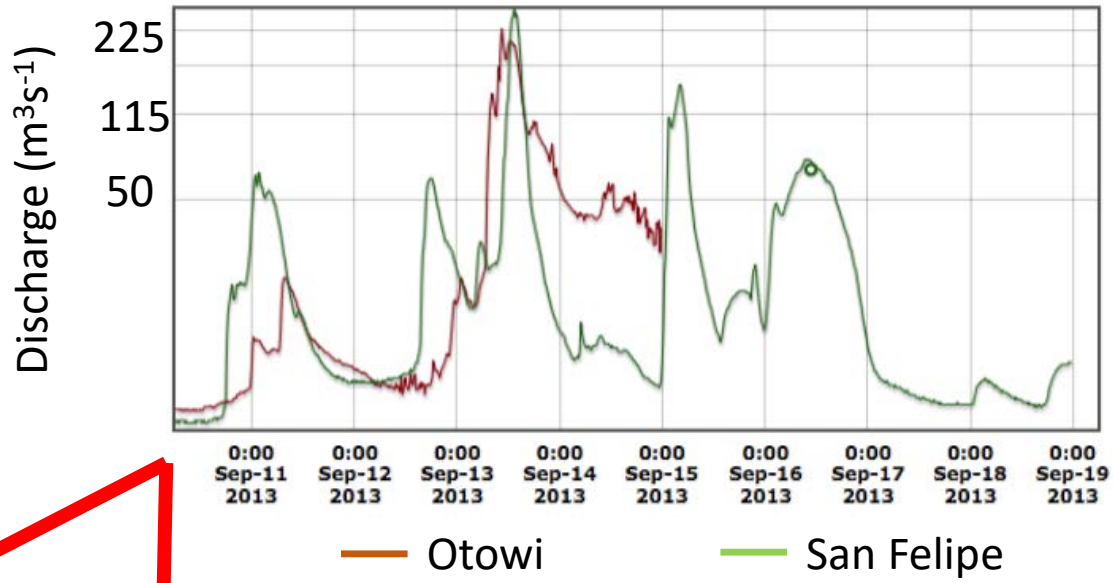
Post-Fire Species Response



* = significant

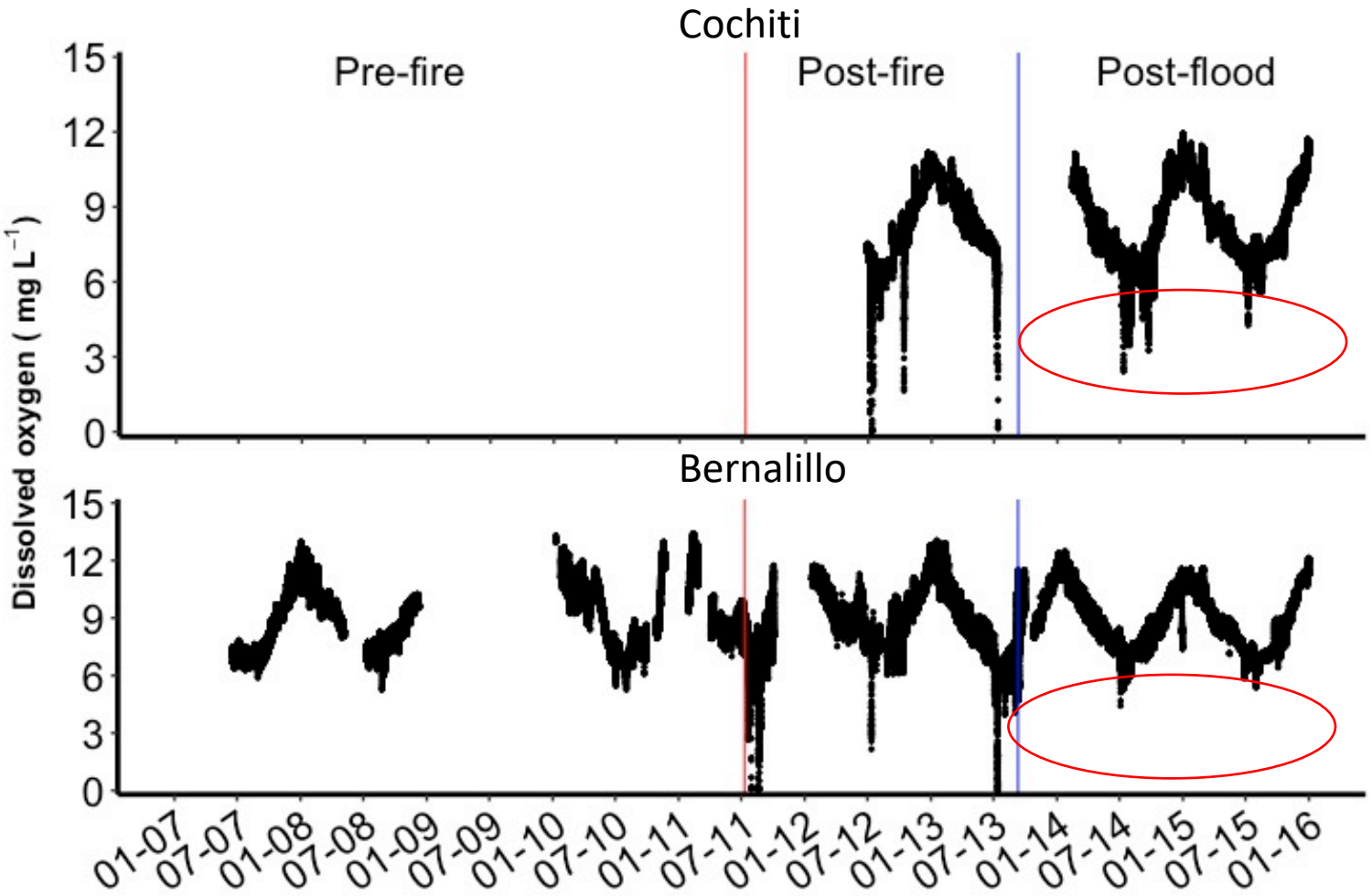
September 2013 Flood



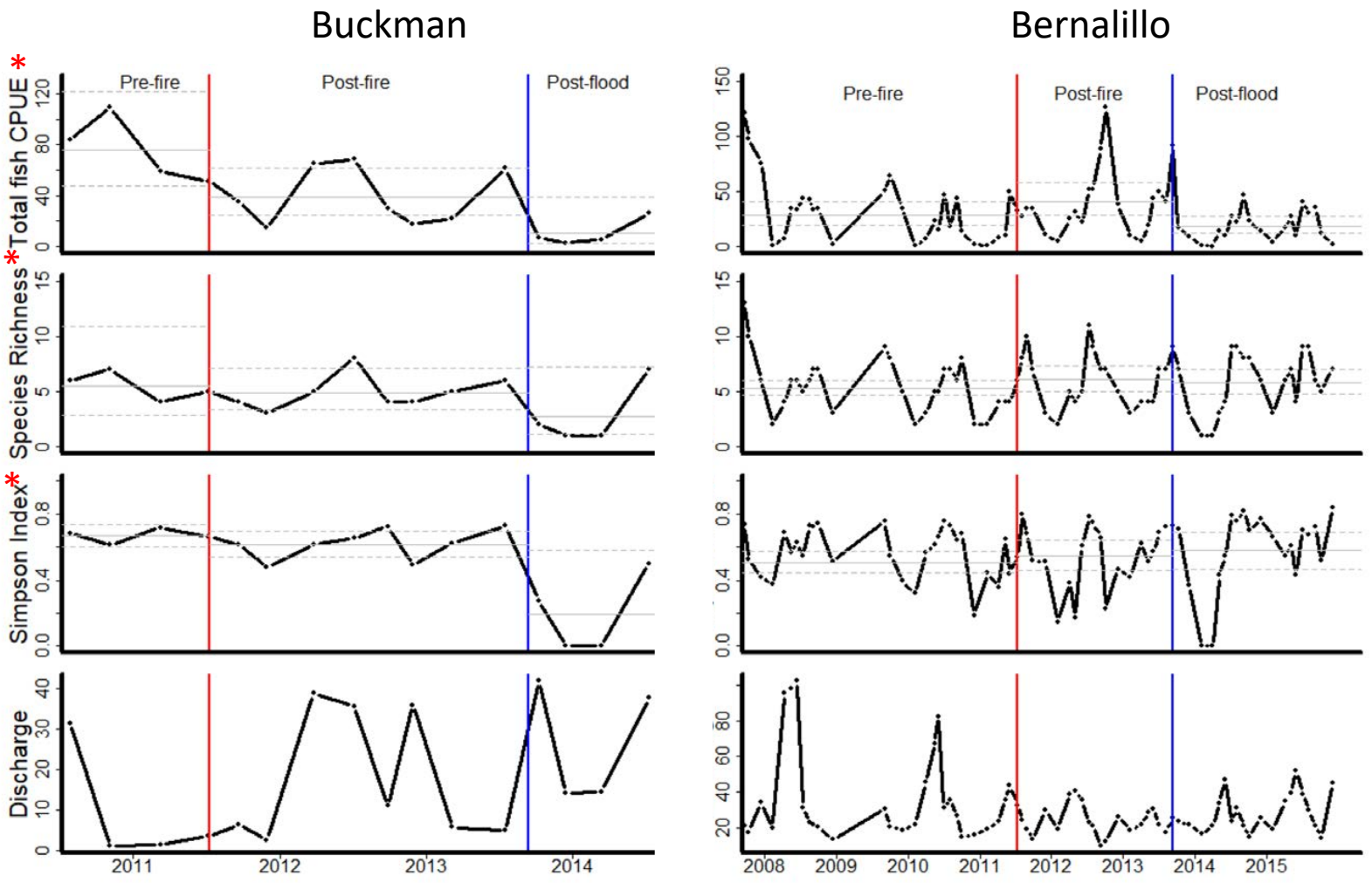


NOAA-NWS 2014, Pinson 2014, Walterscheid 2015, USGS 2013, Gochis et al. 2015; AuBuchon and Bui 2014

Post-Flood Dissolved Oxygen Conditions

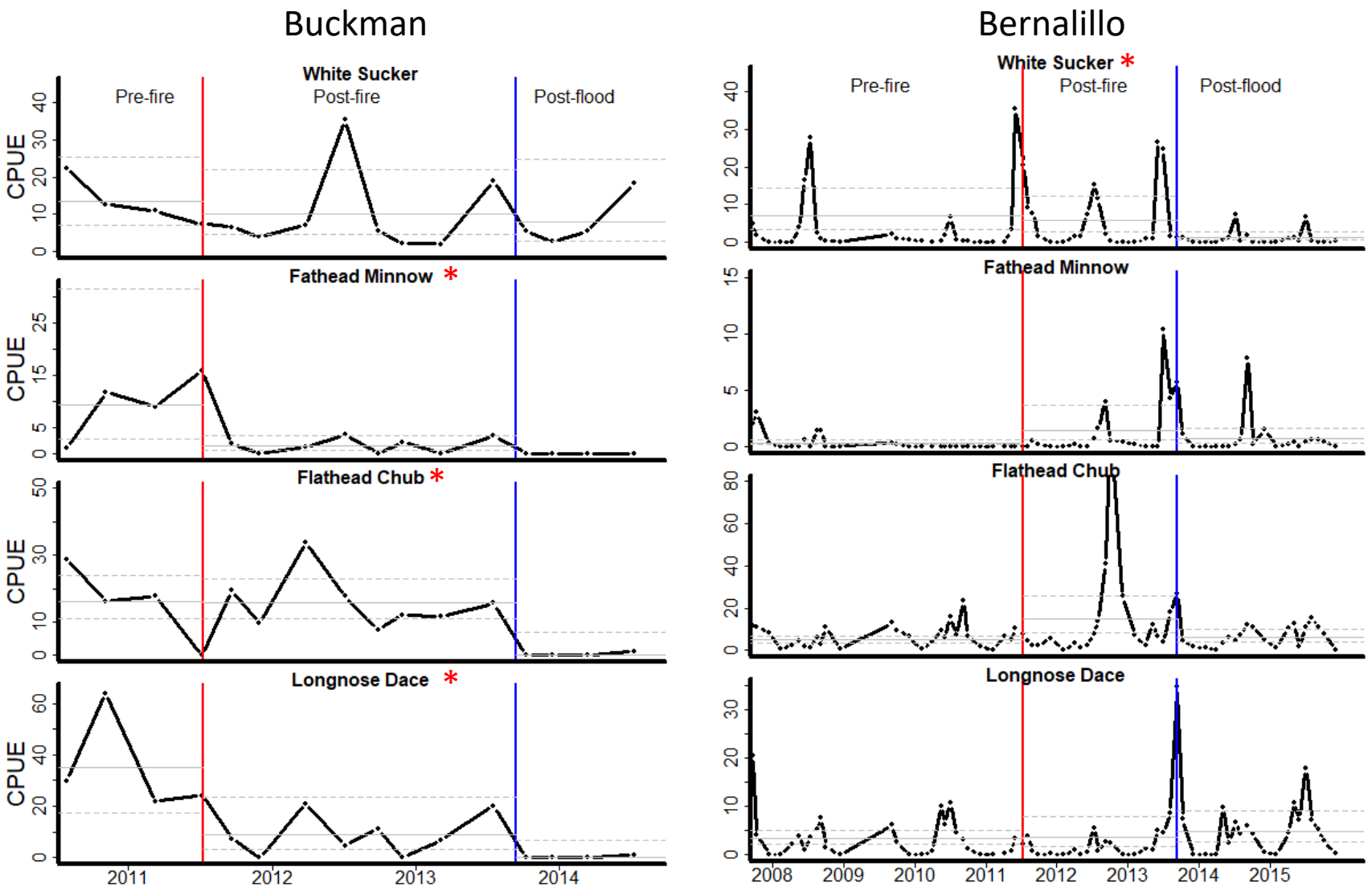


Post-Flood Assemblage Response



* = significant

Post-Flood Species Response



* = significant

Take Home Points: Fire and Flood Effects on MRG Fish Assemblages

- Despite the poor post-fire water quality conditions at both sites, assemblage density and diversity were unaffected, with the exception of Longnose Dace and Fathead Minnow at Buckman.
- Following the 2013 flood, total fish density, richness, diversity, and the density of native species including Longnose Dace, Fathead Minnow, and Flathead Chub were negatively impacted at Buckman.
- Measures of fish assemblage density and diversity did not change in response to the 2013 flood at Bernalillo.
- We attribute the variability in assemblage response to differences in proximity and extent of fire-impacted contributing watersheds, geomorphology, hydraulic complexity, and species-specific traits.

Acknowledgements

American Southwest
Ichthyological Researchers