Water quality monitoring in the MRG: The importance of long-term datasets for assessing river function and health

David J. Van Horn[1], Justin K. Reale[2], Cliff N. Dahm[1], Thomas P. Archdeacon[3], Ricardo González-Pinzón[4], Peter J. Regier[4], Matthew Segura[2], and Betsy M. Summers[4]

[1]Department of Biology, University of New Mexico, Albuquerque, New Mexico, USA
[2]U.S. Army Corps of Engineers, Albuquerque, New Mexico, USA
[3]U.S. Fish and Wildlife Service, Albuquerque, New Mexico, USA
[4]Department of Civil, Construction and Environmental Engineering, University of New Mexico, Albuquerque, New Mexico, USA

US Army Corps of Engineers®

THE UNIVERSITY of NEW MEXICO

Previous Water Quality Studies in the MRG

WATER-QUALITY ASSESSMENT OF THE RIO GRANDE VALLEY STUDY UNIT, COLORADO, NEW MEXICO, AND TEXAS--ANALYSIS OF SELECTED NUTRIENT, SUSPENDED-SEDIMENT, AND PESTICIDE DATA

By S.K. Anderholm, M.J. Radell, and S.F. Richey

WATER-QUALITY ASSESSMENT OF THE RIO GRANDE VALLEY, COLORADO, NEW MEXICO, AND TEXAS--
Summary and analysis of water-quality data for the basic-fixed-site network, 1993-95

By Denis F. Healy

Nutrient and organic carbon trends and patterns in the upper Rio Grande, 1975–1999

Howard D. Passell[a,*], Clifford N. Dahm[b], Edward J. Bedrick[c]

Science of the Total Environment

An International Journal for Scientific Research into the Environment and its Relationship with Humankind

NITROGEN SOURCES AND SINKS WITHIN THE MIDDLE RIO GRANDE, NEW MEXICO[1]

Gretchen P. Oelsner, Paul D. Brooks, and James F. Hogan[2]

JOURNAL OF THE AMERICAN WATER RESOURCES ASSOCIATION

AMERICAN WATER RESOURCES ASSOCIATION

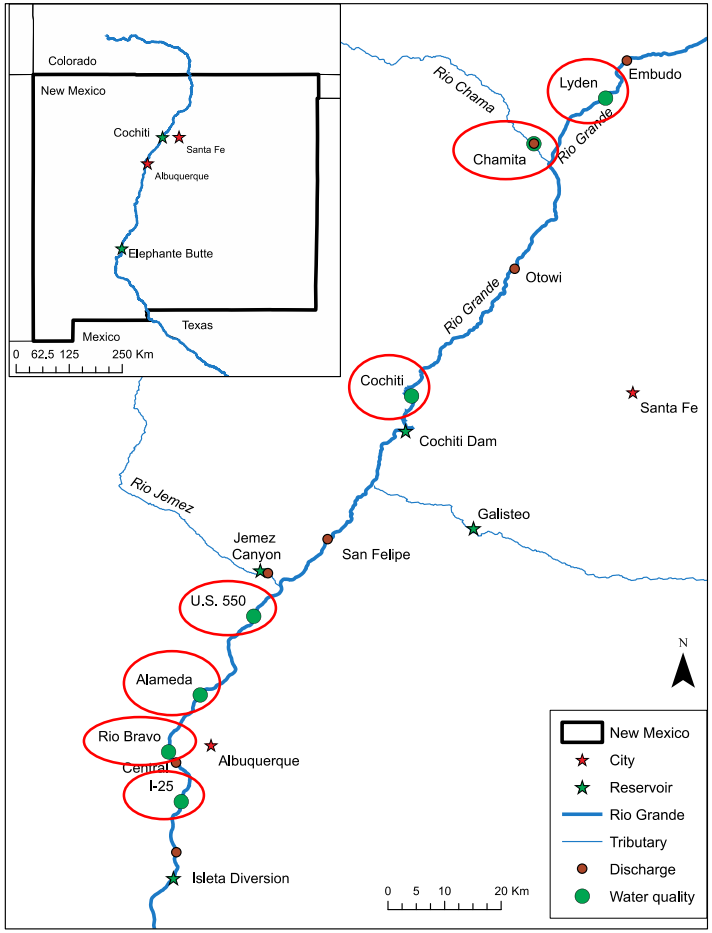
USACE - Continuous Water Quality Monitoring Network for the Middle Rio Grande

History: 2006 – Present

Goals: Assess temporal and spatial water quality trends in the Middle Rio Grande (MRG)

Methods: Continuous water quality collection in the Abq. reach of the MRG since 2006,three sites added above Cochiti Reservoir in 2012.

Study Sites


Colorado
New Mexico
Cochiti
Santa Fe
Albuquerque
Elephante Butte
Texas
Mexico
0 62.5 125 250 Km
Rio Chama
Lyden
Embudo
Chamita
Rio Grande
Otowi
Rio Grande
Cochiti
Santa Fe
Cochiti Dam
Rio Jemez
Galisteo
Jemez Canyon
San Felipe
U.S. 550
N
Alameda
Rio Bravo
Albuquerque
Central
I-25
Isleta Diversion
0 5 10 20 Km
New Mexico
City
Reservoir
Rio Grande
Tributary
Discharge
Water quality

Study Sites

Study Sites

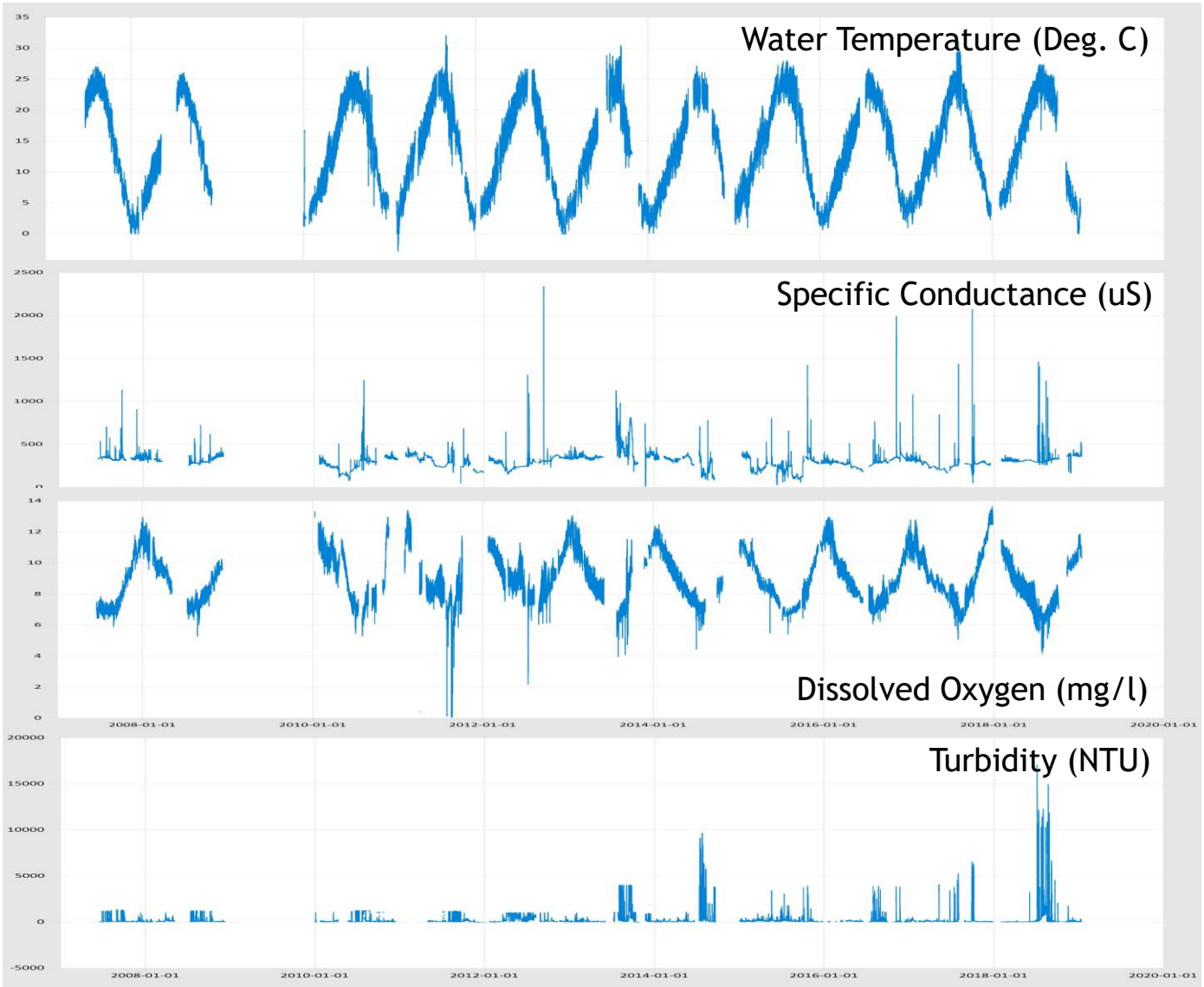
Cochiti

Buckman

Study Sites

Study Sites

Data – Bernalillo 550



Stormwater

Drought

Disturbance Impacts

Wildfire

Flooding

Temperature pH

Refugia

Baseline Conditions

Turbidity Salinity

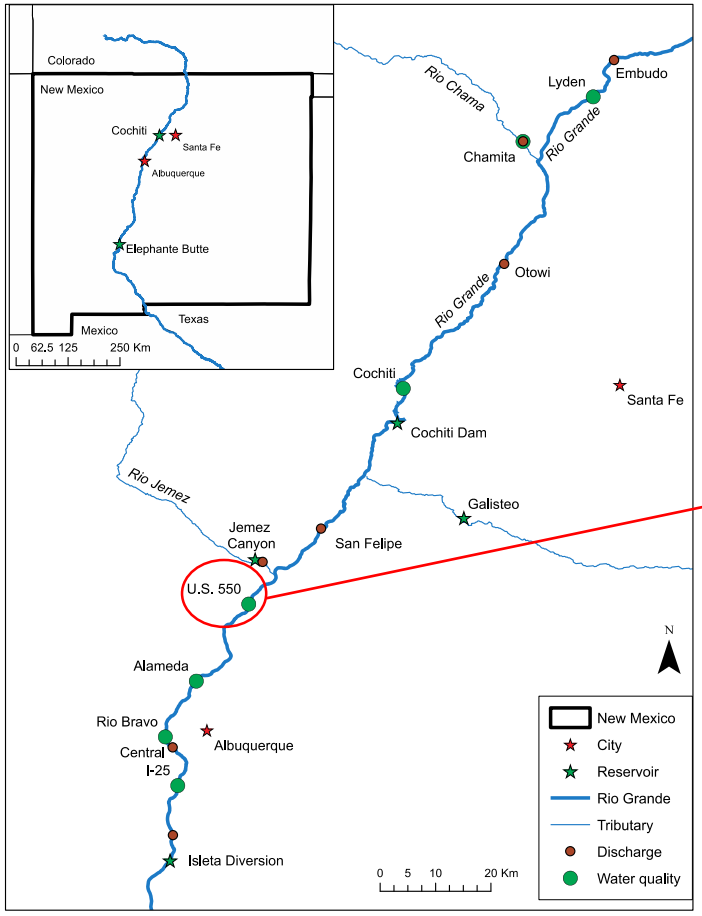
Primary Productivity

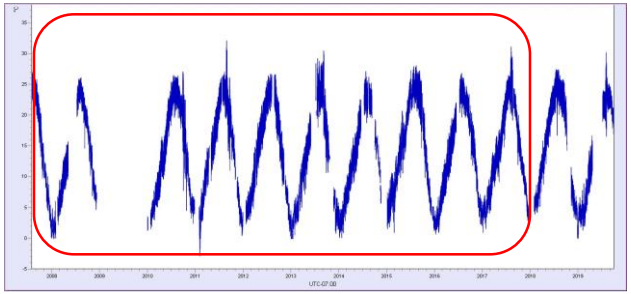
Dissolved Oxygen

Ecosystem Respiration

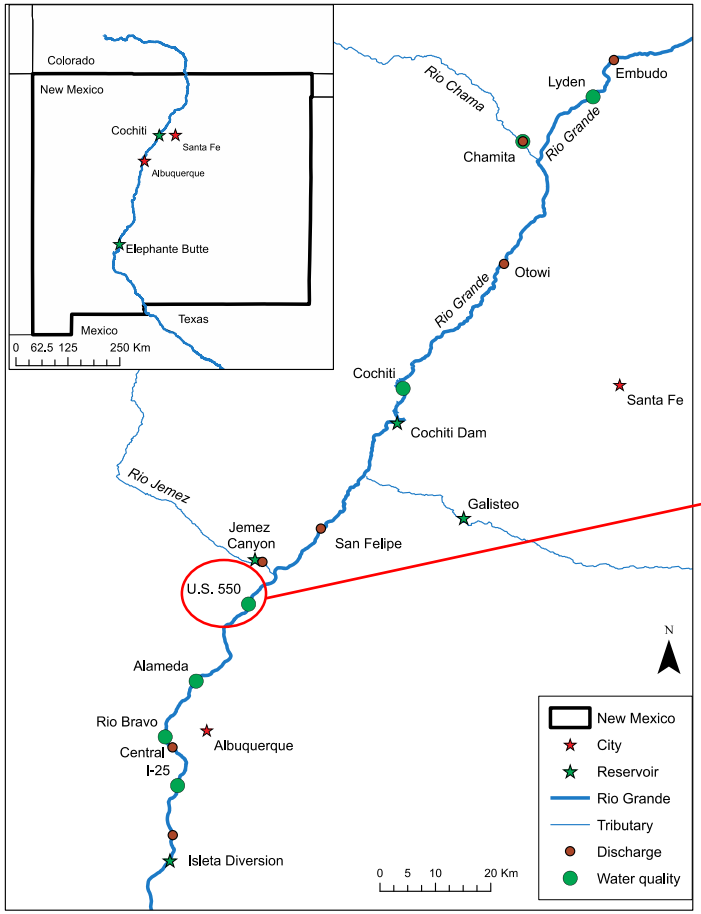
Baseline Study Example

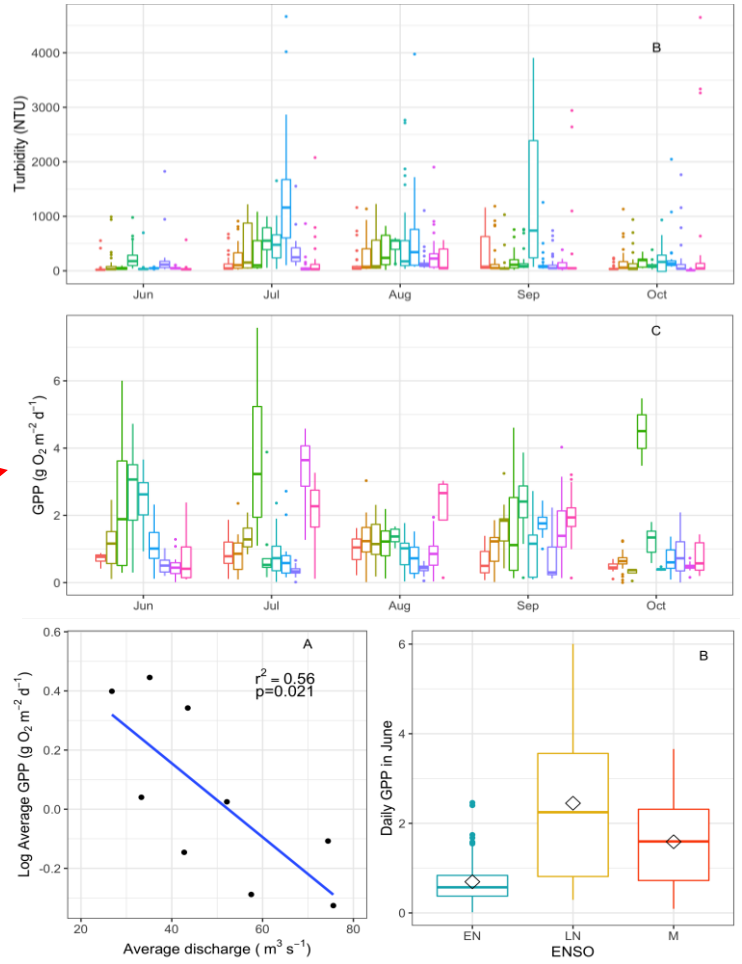
Baseline Studies – Stream Metabolism



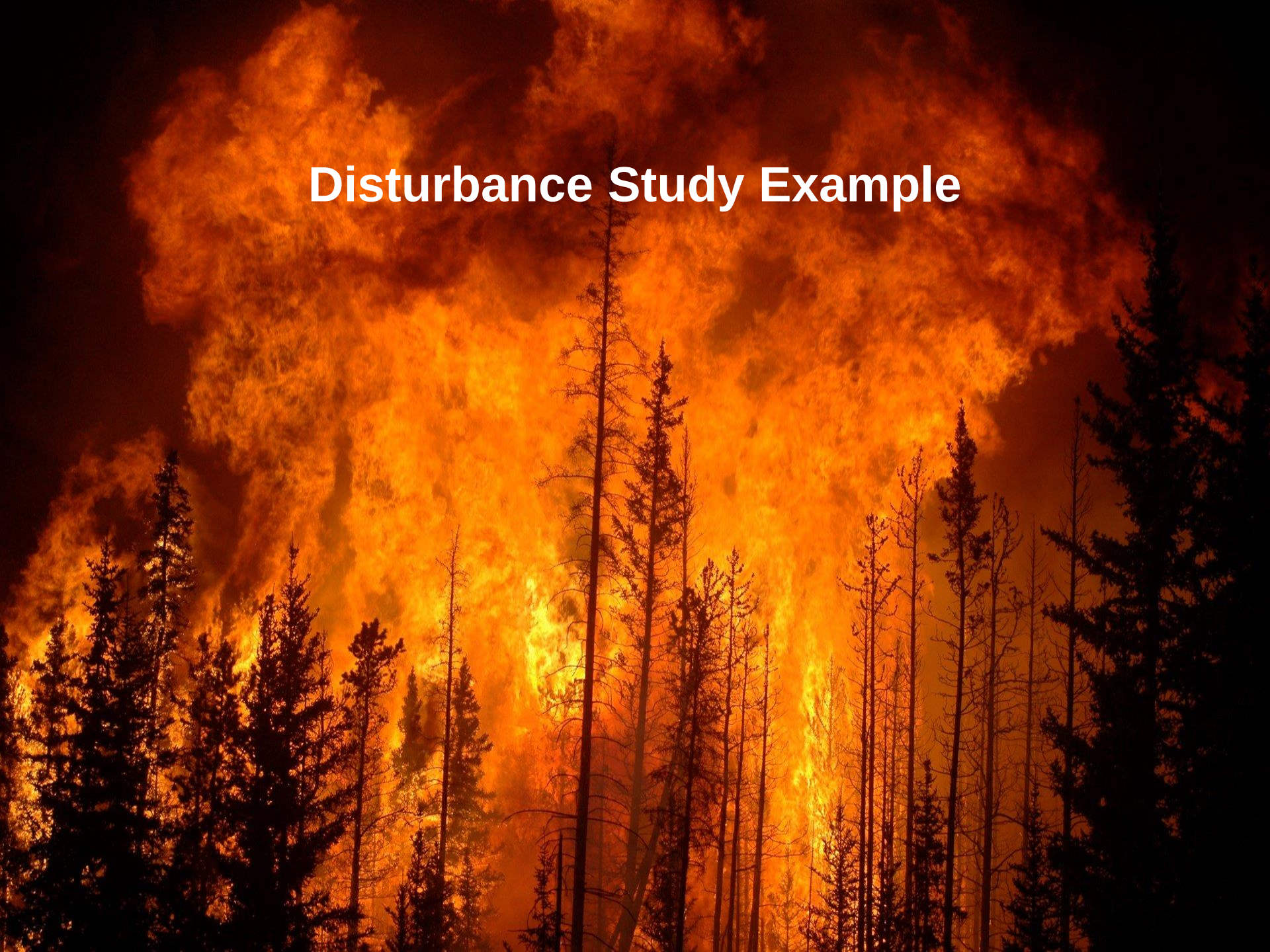


Baseline Studies – Stream Metabolism

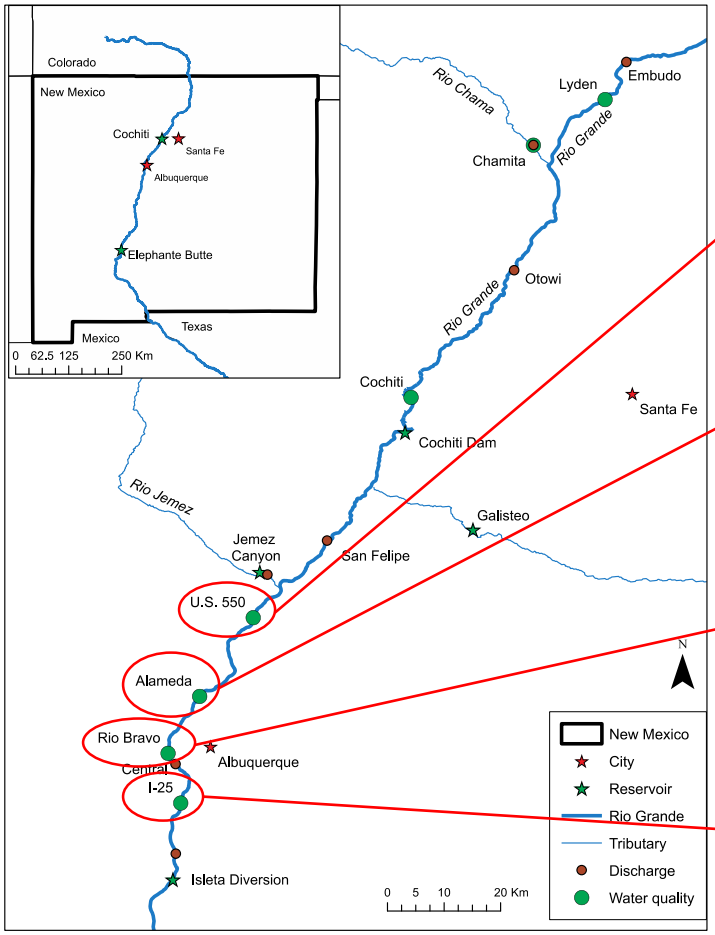


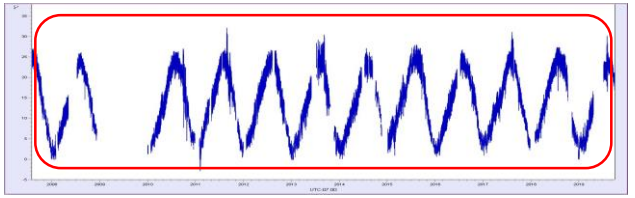


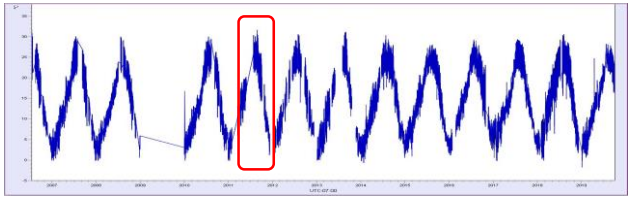
Summers 2019

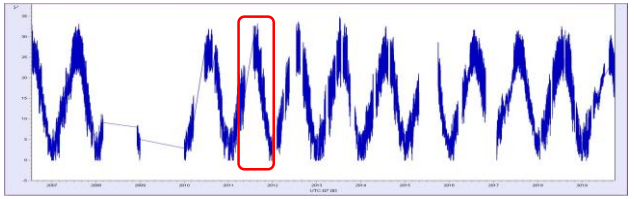

Disturbance Study Example

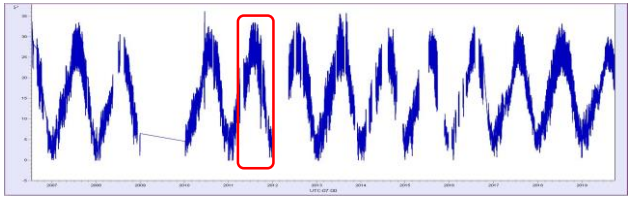
Disturbance Studies – Wildfire



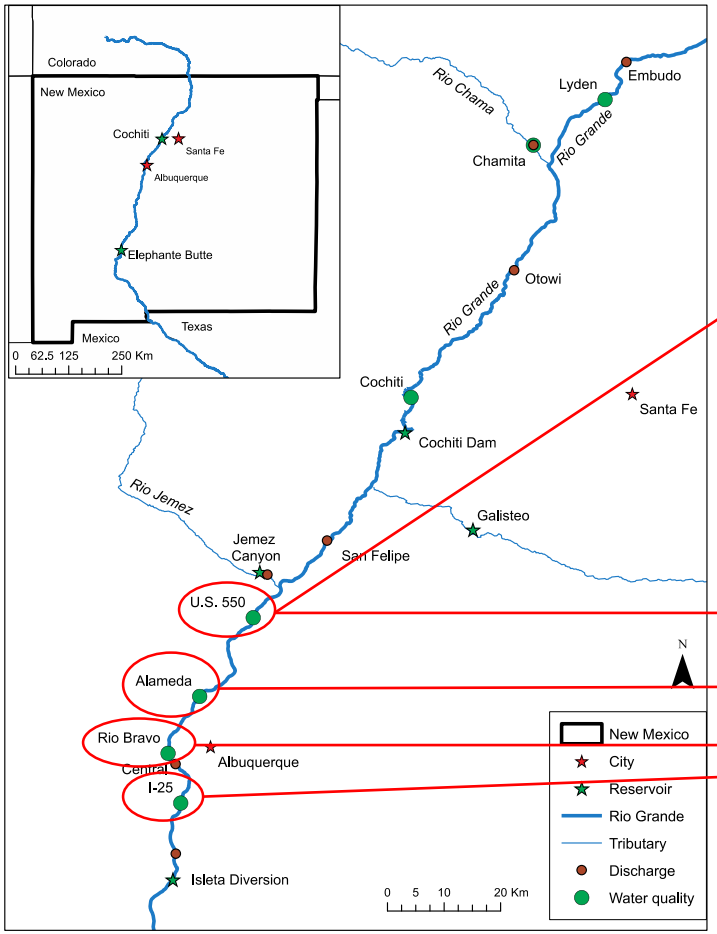


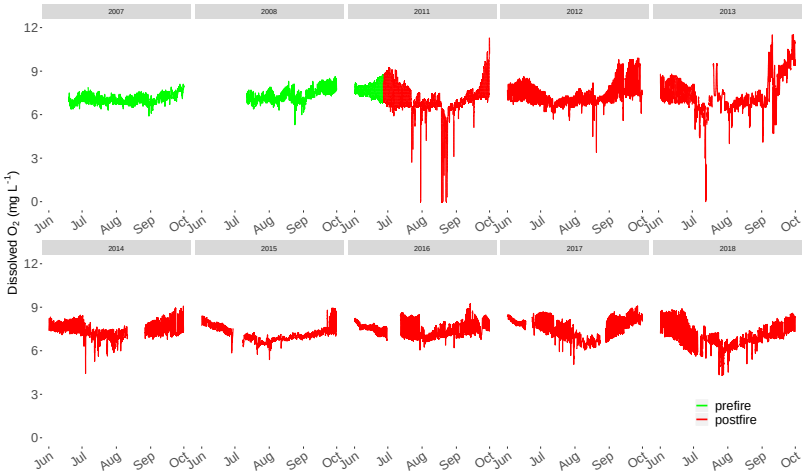


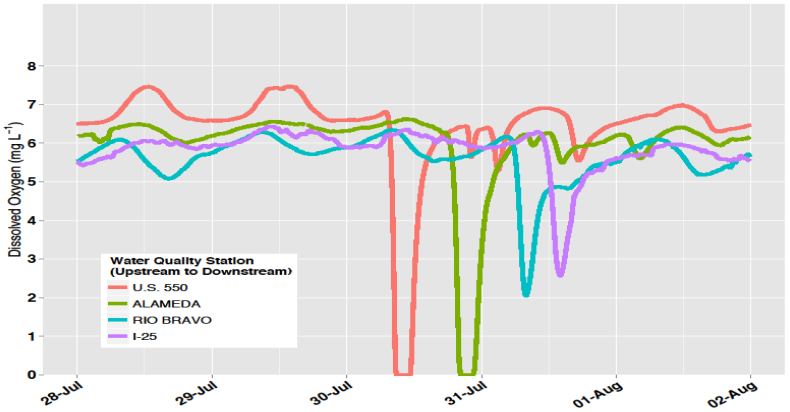




Disturbance Studies – Wildfire







Dahm et al. 2015, Reale et al. 2015, Reale et al. In Revision

Baseline Studies

Thermal Regime and Reproductive Phenology

Reale, J.K., Segura, M.V., Stomp. J. In preparation. High-frequency water temperature data collection within the inundated floodplain of the Middle Rio Grande during the 2019 snowmelt pulse. Submitted to MRGESCP.

Reale, J.K. 2014. Continuous water temperature monitoring on the Middle Rio Grande during the 2014 snowmelt pulse. Submitted to MRGESCP.

Valdez, R.A., Haggerty, G.M., Richard, K. and Klobucar, D., 2019. Managed spring runoff to improve nursery floodplain habitat for endangered Rio Grande silvery minnow. *Ecohydrology*, *12*(7), p.e2134.

Archdeacon, T.P., Diver, T.A., Betrand, N.G., Wilson, W.D., Knight, W., Uliabarri, M., Lusk, J., Reale, J.K. In preparation. Effects of stocking season on survival and reproduction of hatchery-reared Rio Grande Sivery Minnow. TBD.

Metabolic Regime

Summers, B., Van Horn, D.J., Reale, J.K., Gonzalez-Pinzón, R., Bixby, R., Stone, M.C. In preparation. Seasonal and interannual variability in stream metabolism along an aridland river. TBD.

Summers, B., Van Horn, D.J., Reale, J.K., Gonzalez-Pinzón, R., Bixby, R., Stone, M.C. In preparation. The impacts of large-scale climate patterns and localized disturbance events on whole stream metabolism in an aridland river. TBD.

Refugia

Van Horn, D.J., Reale, J.K., Archdeacon T.P. Submitted. Water quality in three potential aquatic refugia in an arid-land river: Assessing suitability to sustain populations of an endangered fish species. Inland Waters.

Disturbance Studies

Wildfire

Dahm, C. N., Candelaria-Ley, R., Reale, C. S., Reale, J. K., and Van Horn, D. J. 2015. Extreme water quality degradation following a catastrophic forest fire. Freshwater Biology. 60: 2584-2599.

Reale, J. K., Van Horn, D. J., Condon, K.E., and Dahm, C. N. 2015. The effects of catastrophic wildfire on water quality along the river continuum. Freshwater Science. 34:1426-1442

Reale, J.K., Van Horn, D.J., Archdeacon T.P., Gonzales, E.J, Dudley, R.K., Turner, T.F., Dahm, C.N. In revision. Effects of a catastrophic wildfire on downstream fish assemblages in an aridland river. Hydrobiologia.

Stormwater

Regier, P., Gonzalez-Pinzón, R., Reale, J.K., Van Horn, D., Khandelwal, A., Nichols, J. Submitted. Impacts of urban stormwater runoff on downstream water quality in the Rio Grande. Science of the Total Environment.

Flooding

Reale, J.K., Van Horn, D.J., Archdeacon T.P., Gonzales, E.J, Dudley, R.K., Turner, T.F., Dahm, C.N. In revision. Effects of a catastrophic wildfire on downstream fish assemblages in an aridland river. Hydrobiologia.

Summers, B., Van Horn, D.J., Reale, J.K., Gonzalez-Pinzón, R., Bixby, R., Stone, M.C. In preparation. The impacts of large-scale climate patterns and localized disturbance events on whole stream metabolism in an aridland river. TBD.

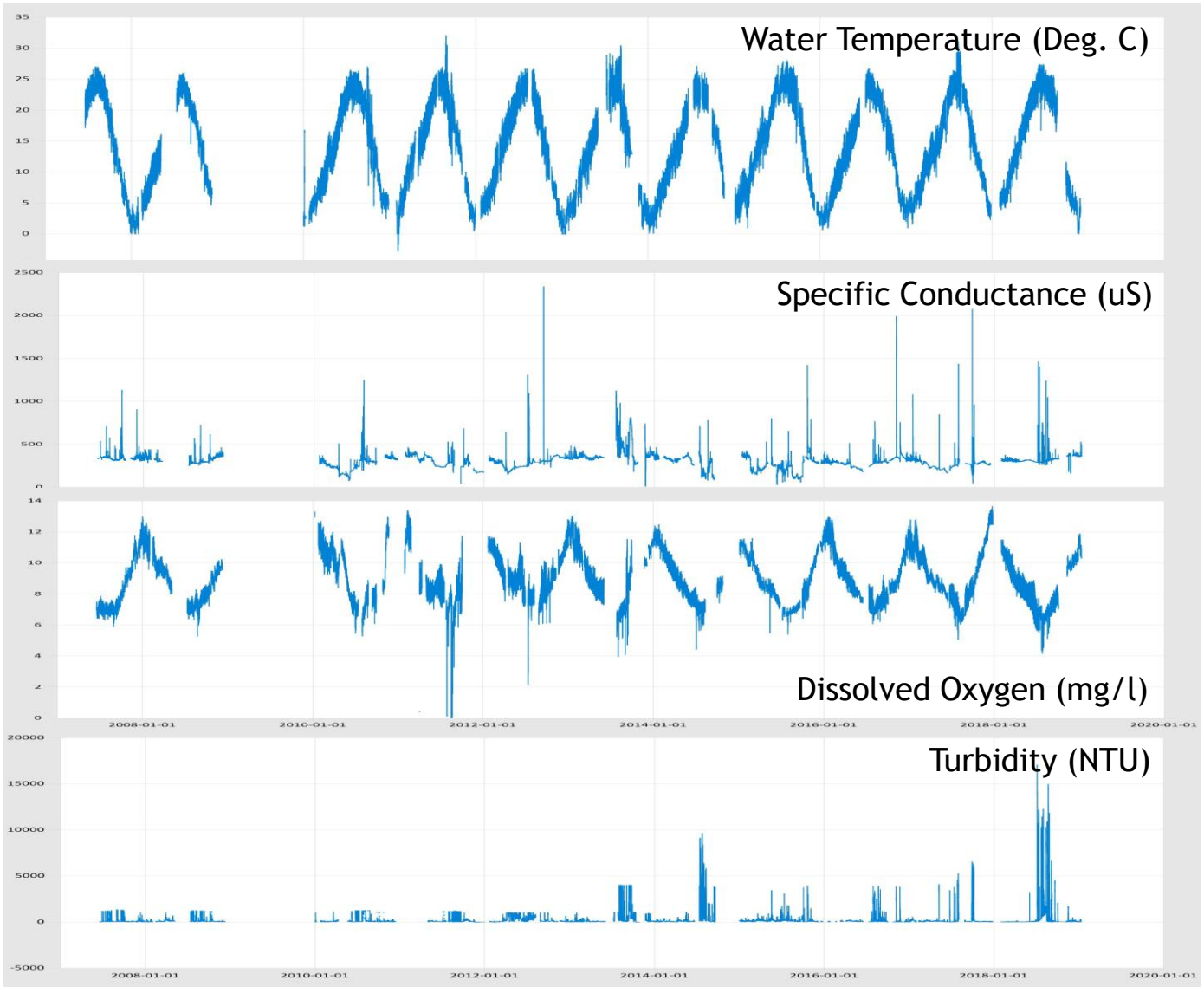
Drought

Van Horn, D.J., Reale, J.K., Archdeacon T.P. Submitted. Water quality in three potential aquatic refugia in an arid-land river: Assessing suitability to sustain populations of an endangered fish species. Inland Waters.

Conclusions

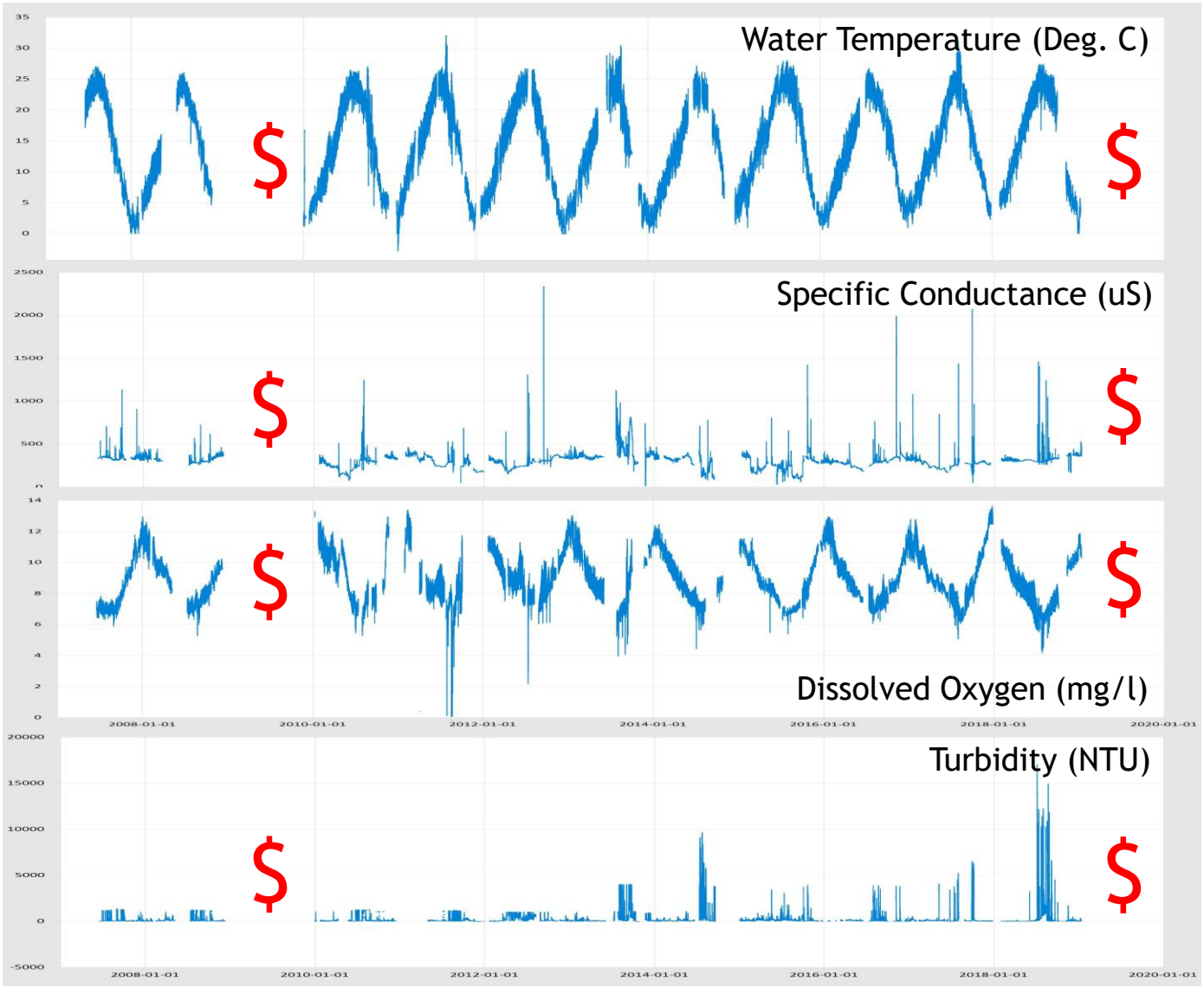
- WQ data are fundamental for understanding the local conditions and stressors
- The MRG is a dynamic system, with wide spatial and temporal variation
- Near-continuous data allows us to document the impacts from episodic events and spatial/temporal variation
- Additional data is needed to document future disturbances and long-term change, and to interpret fish abundance/health/reproductive data

Data – Bernalillo 550

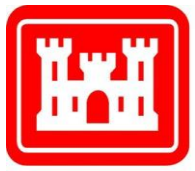


Data Gaps

Data Gaps


Water Temperature (Deg. C)
$
$
Specific Conductance (uS)
$
$
Dissolved Oxygen (mg/l)
$
$
Turbidity (NTU)
$
$
2008-01-01
2010-01-01
2012-01-01
2014-01-01
2016-01-01
2018-01-01
2020-01-01

Acknowledgements



US Army Corps of Engineers®

New Mexico EPSCoR

THE UNIVERSITY of NEW MEXICO

Acknowledgements

Amy Louise – USACE
Chelsea Reale – USACE
Nabil Shafike – USACE
Curtis McFadden – USACE
Bruno Quirici – USACE

Cynthia G. Abeyta – USFWS
Joel D. Lusk – USFWS

Jerry Lovato – AMAFCA
Patrick Chavez – AMAFCA

David Gensler – MRGCD
Mat Martinez – MRGCD

Ruben Lucero – IP
Cody Walker – IP
Ramona Montoya – IP

Roxanne Candelaria-Ley – UNM
Alex Clark – UNM
Grady Ball – UNM
Lydia Zeglin – UNM
Becky Bixby – UNM
Mariah Zuni – UNM/IP

Aashish Sanjay – UNM
Justin Nichols - UNM