HABITAT RESTORATION IN THE MIDDLE RIO GRANDE

Role of the New Mexico Interstate Stream Commission

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Office of the State Engineer

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Interstate Stream Commission

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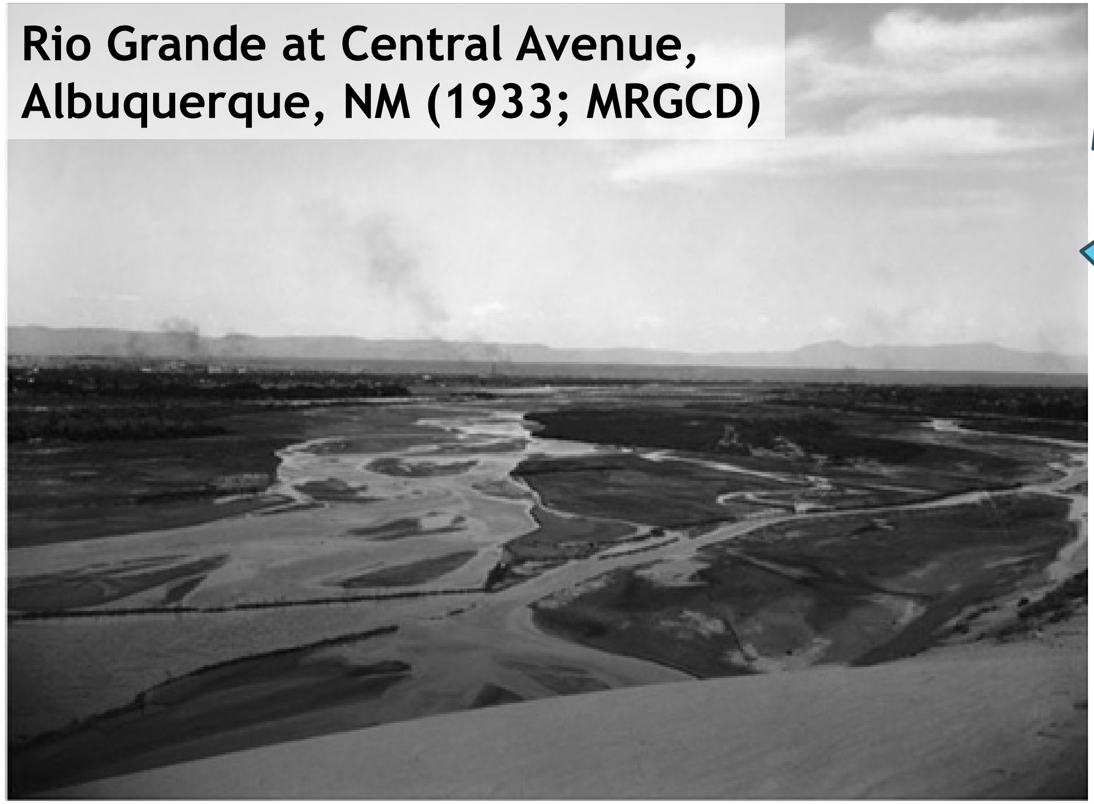
MRG was Historically a Floodplain River

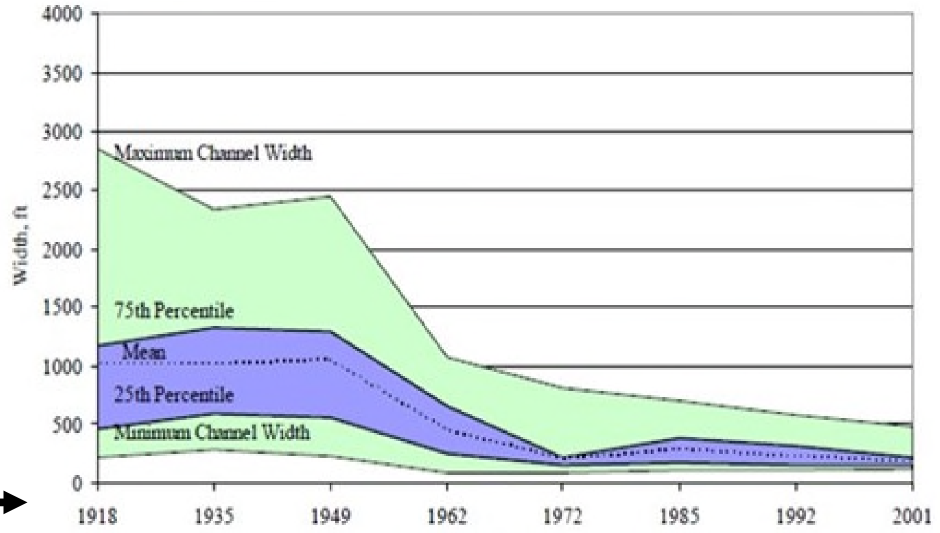


- MRG flooded laterally with snow-melt runoff
- Inundated nearby communities like the City of Albuquerque

- Extensive water use, threats of floods and a desire to gain more control of river flows
- Prompted construction of hundreds of miles of levees 1930-50 that confined river channel
- Effectively delinked the river from its historic floodplain

Kellner Jetty Jacks

- Under the Middle Rio Grande Project, 100,000+ steel jetty jacks were installed in 1950-60 to protect the levees and trap sediment and debris
- Further narrowed channel, causing downcutting, floodplain disconnection
- **Maximum channel width decreased ~82% from 1918 to 2001** (Holmquist-Johnson 2004)



Genesis of Habitat Restoration

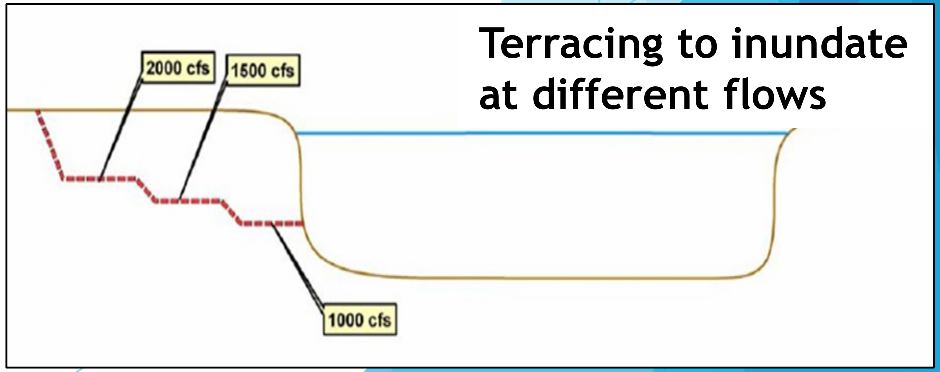
- 2003 BO: '*…conduct habitat/ecosystem restoration projects in the MRG to increase backwaters and oxbows, widen the river channel, and/or lower river banks…*'
- 2004 Habitat Restoration Subcommittee: Habitat Restoration Plan
- 2016 BO: large-scale habitat restoration and conservation storage of water for release to inundate these habitats

NDC 1ch, bankline terrace and sculpture

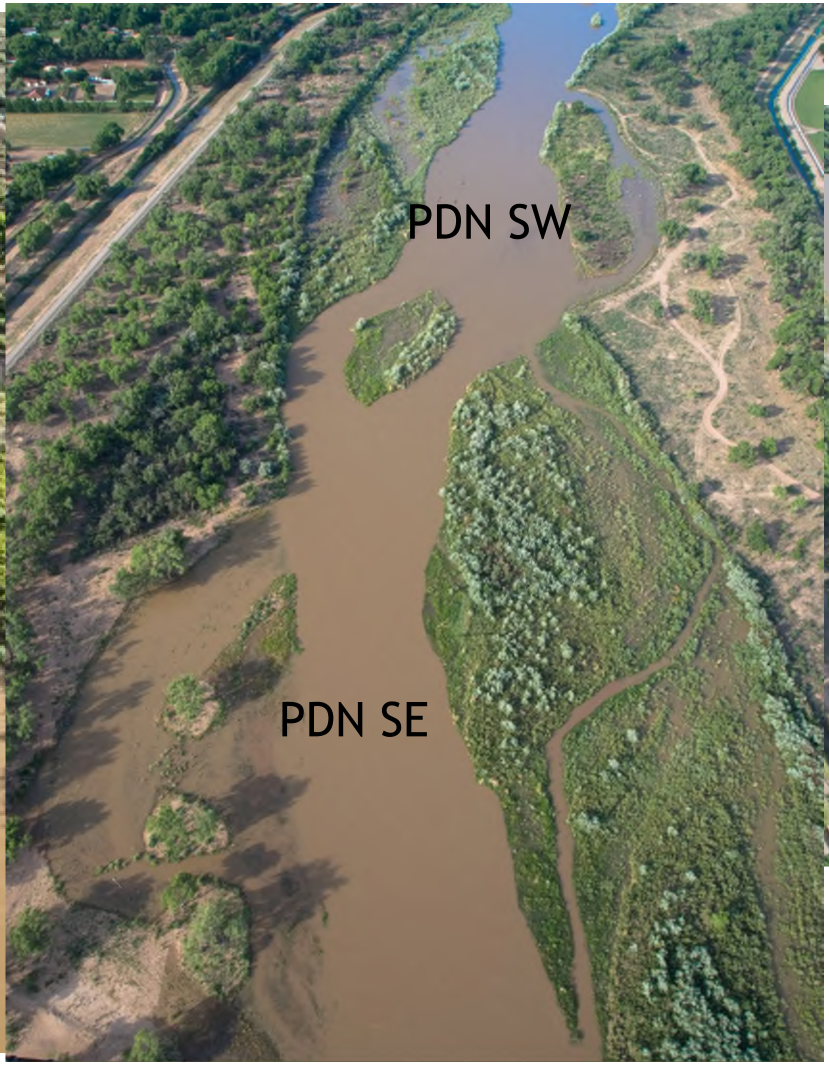
NDC-5i embayment after construction

Middle Rio Grande Habitat Restoration

- Habitat restoration began after 2003 BO
- Ten Program partners constructed ~300 sites totaling ~1,600 ha (each 0.4-5 ha).
- Sites were designed to establish diverse habitats at a range of flows—500-3,500 cfs.



Inundated Restoration Sites 2016 Modified Spring Flow



Aerial photos courtesy of Todd Caplan and Ondrea Hummel

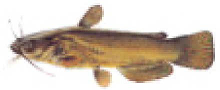
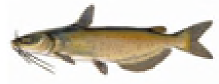
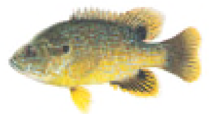
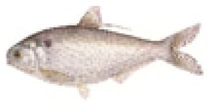
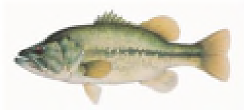
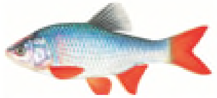
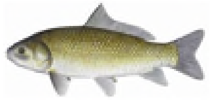
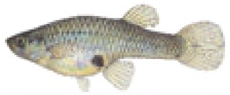
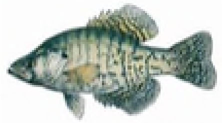
Inundated Restoration Sites (2016)

NMISC Significant Findings
In Coordination with SWCA, Tetra Tech, GSA

1. 55% of all MRG fish species were found in floodplains (2016, 2017, 2019)
2. RGSM move to and enter riverside floodplains with spring runoff
3. RGSM spawn in and near floodplains in spring
4. Time of residence is uncertain, but appear to use floodplains extensively
5. Runoff and hatching time should occur synchronously
6. RGSM larvae stay in floodplains 20-40 days (leave by juvenile stage)
7. RGSM larvae are most abundant fish species in floodplains
8. RGSM larvae use shallow, warm, low-velocity habitat with little cover
9. RGSM larvae stay near green “bathtub ring”

Finding:

1. 55% of all MRG fish species were found in floodplains

Species	Found in Floodplains	
black bullhead		
blue catfish		
bluegill	✦	
channel catfish		
common carp	✦	
fathead minnow	✦	
flathead catfish		
flathead chub	✦	
green sunfish		
gizzard shad		
largemouth bass		
longnose dace	✦	
red shiner	✦	
Rio Grande silvery minnow	✦	
river carpsucker	✦	
smallmouth buffalo	✦	
western mosquitofish	✦	
white crappie		
white sucker	✦	
yellow bullhead		
yellow perch		

✦ Found in Floodplains

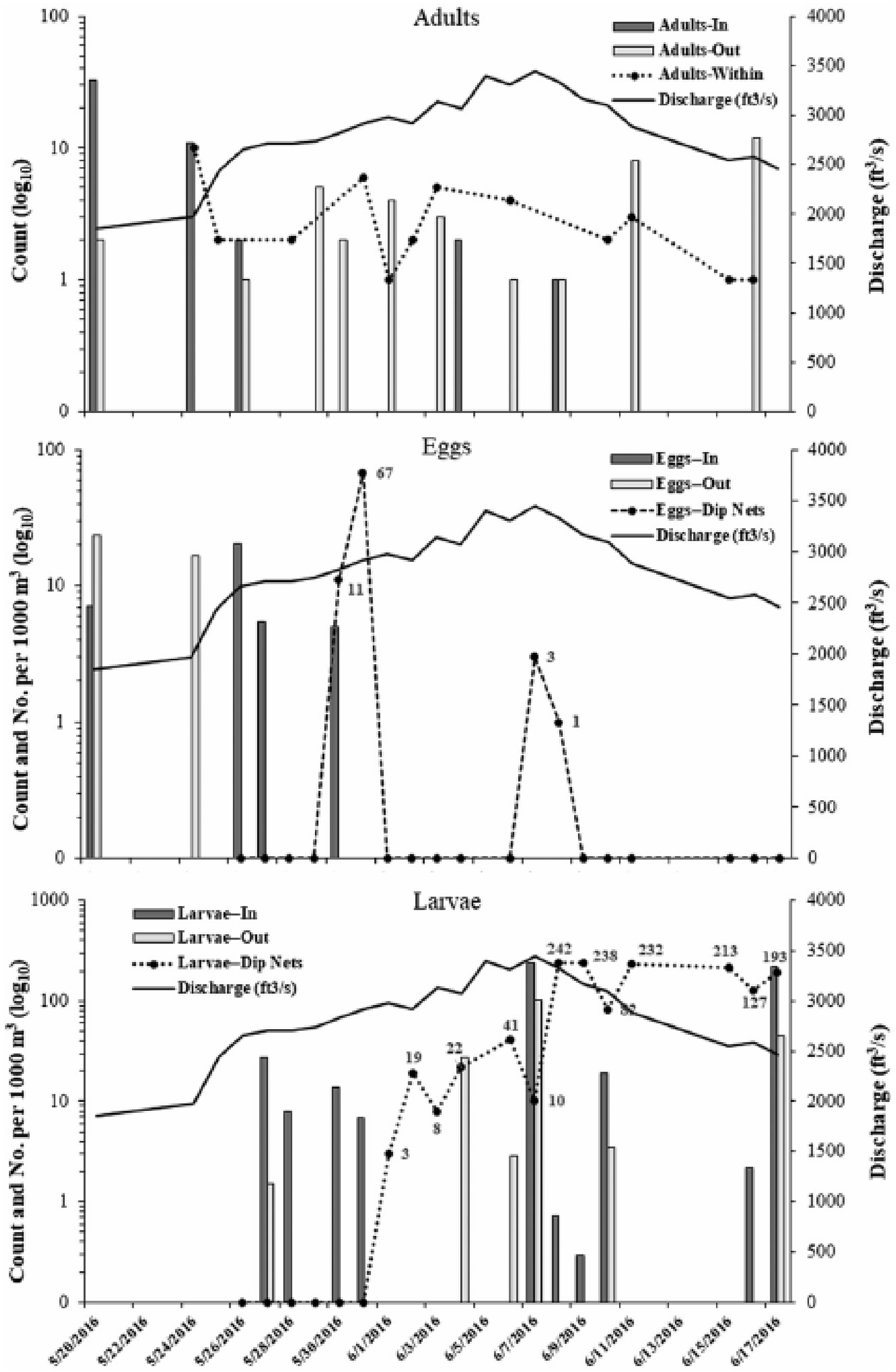
Finding:

2. RGSM move to and enter riverside floodplains with spring runoff
3. RGSM spawn in and near floodplains in spring

- Extensive use of constructed and natural sites when flows are sufficient to inundate (Gonzales and Hatch 2009).
- RGSM moved onto and from HR sites (Gonzales et al. 2012); 1st or 2nd most common species (Gonzales et al. 2014).
- 2008: of 9,545 RGSM, 108 females expressed eggs (Gonzales et al. 2013).
- 2009: of 2,057, 48-55% of females were gravid (Gonzales et al. 2013).
- Spawning in floodplains indicated by occurrence of eggs and abundance of RGSM adults (Gonzales and Porter 2011).

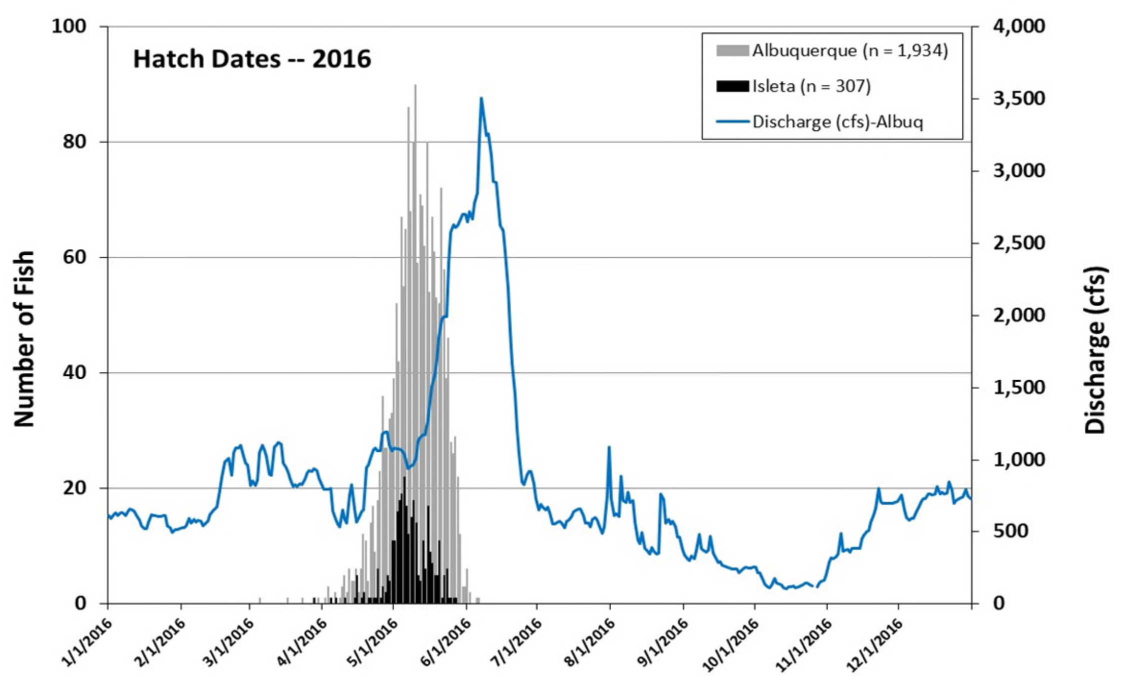
Finding:

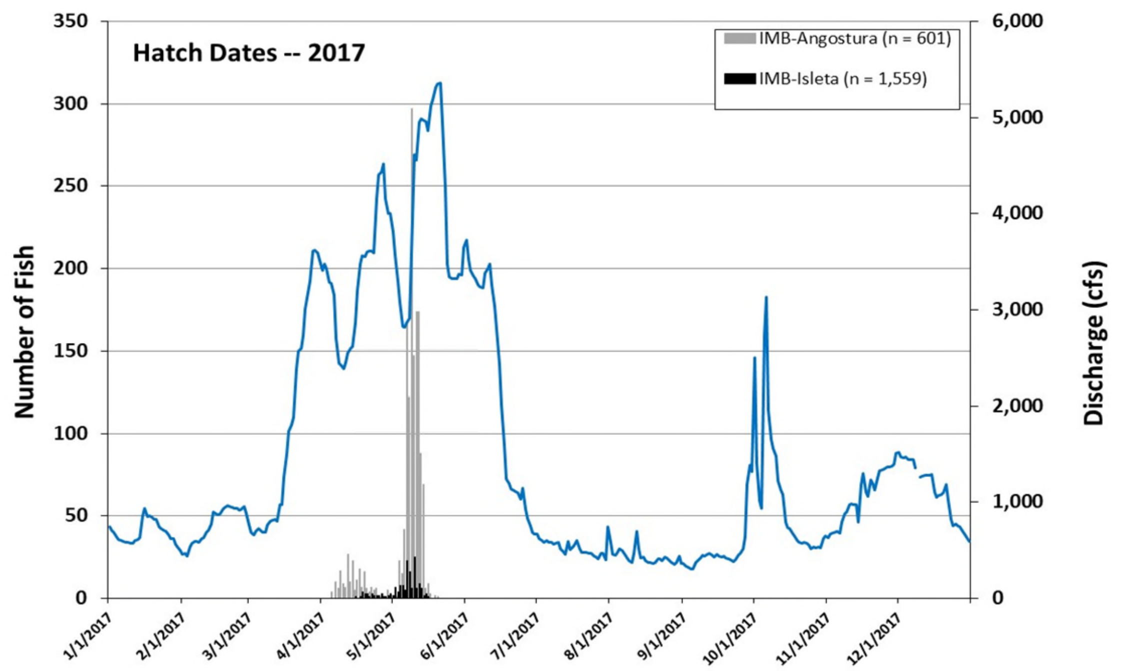
4. Time of residence is uncertain, but appear to use floodplains extensively



Findings:

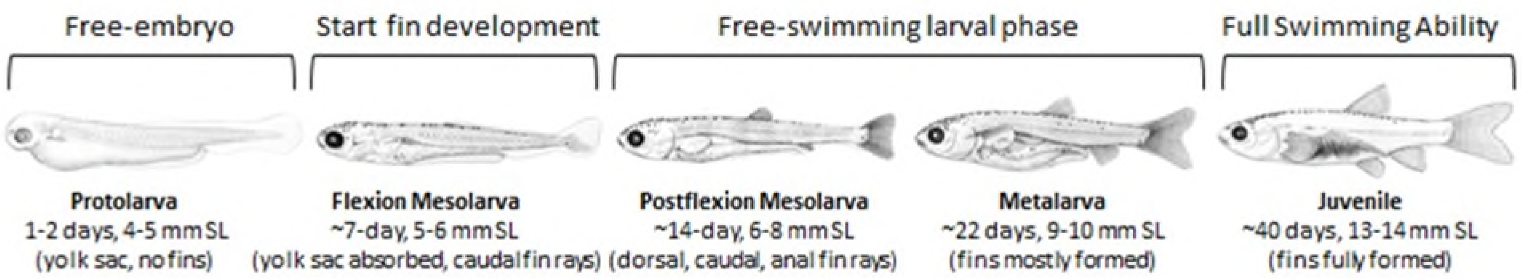
5. Runoff and hatching time should occur synchronously

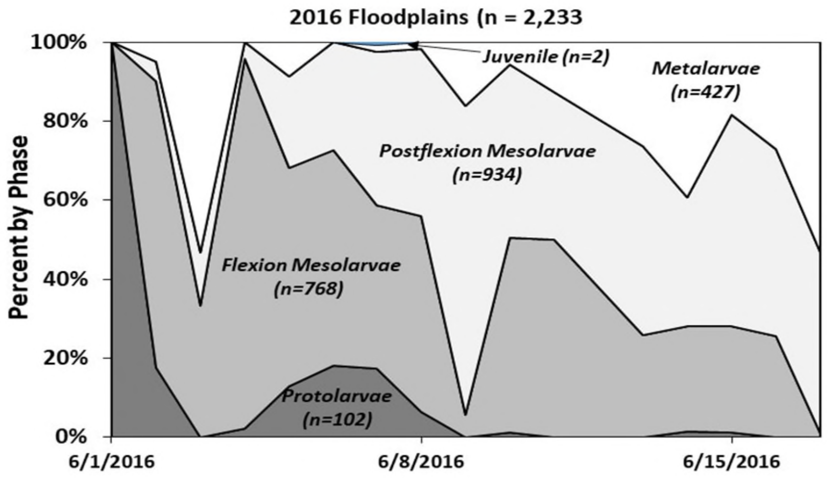


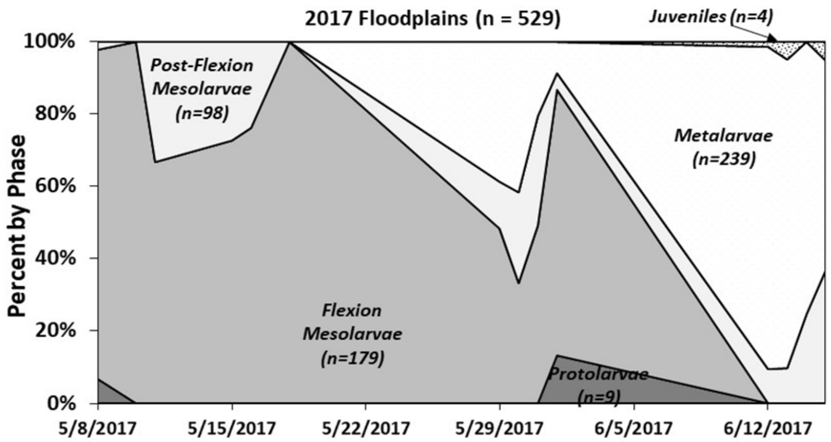


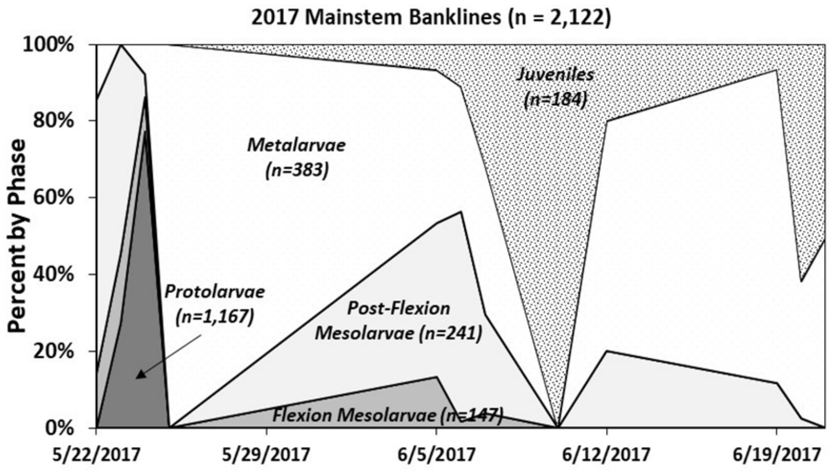
Finding:

6. RGSM larvae stay in floodplains 20-40 days (leave by juvenile stage)





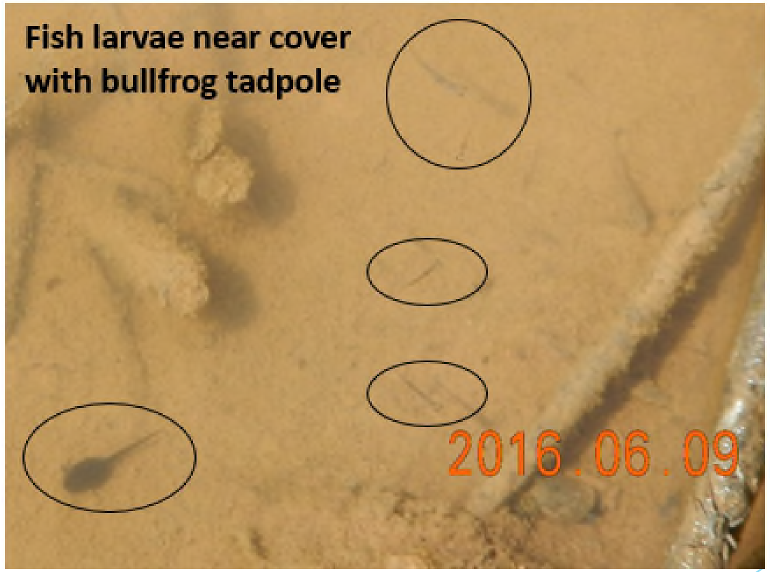


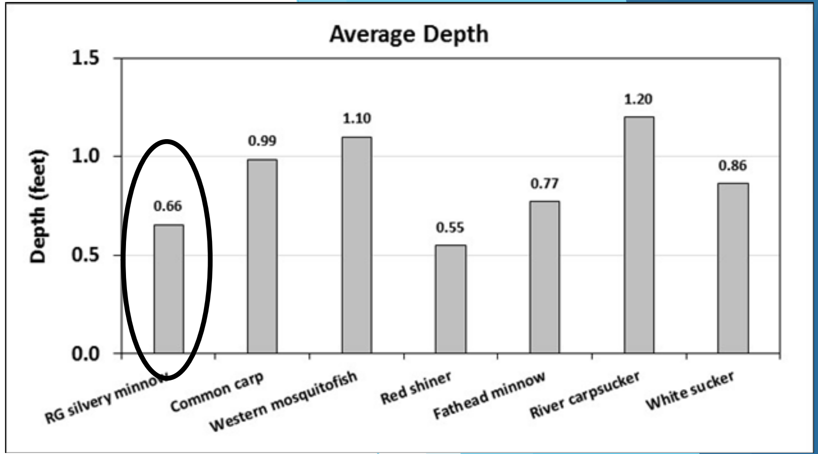


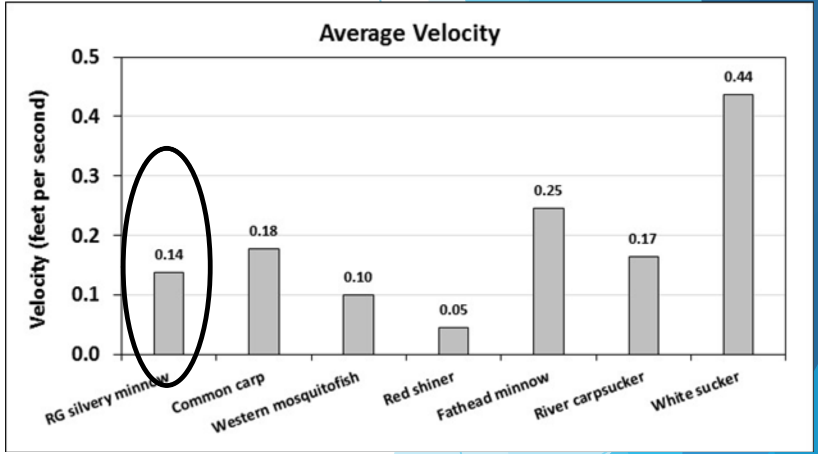
Findings:

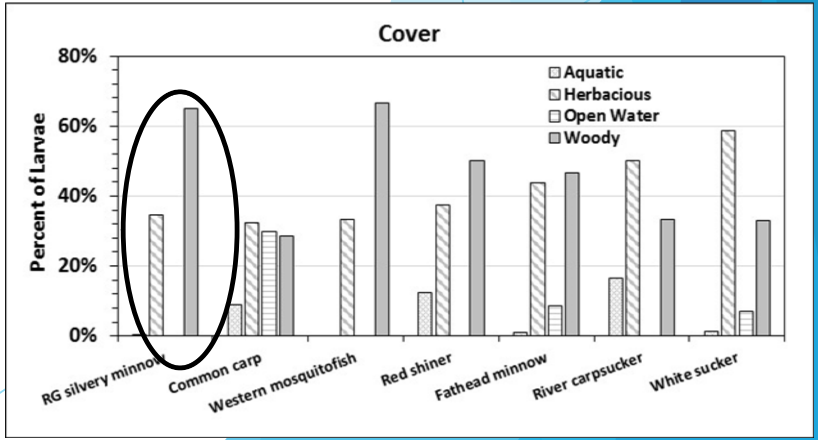
7. RGSM larvae are most abundant fish species in floodplains
8. RGSM larvae use shallow, warm, low-velocity habitat with little cover
9. RGSM larvae stay near green “bathtub ring”

- 72-90% of all fish larvae are RGSM
- Warm, shallow (8-20 cm), low velocity
- Larvae in moderate cover (3-25%)
- Near water’s edge (0.4-2.7 m)
- Associated with “bathtub ring”









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- Fluder, J.J. 2006. **Human modification of the Upper Middle Rio Grande**: using GIT techniques to measure change between Albuquerque and Cochiti Dam, New Mexico. Hydrology and Water Resources in Arizona and the Southwest.
- Fluder, J.J., M. Porter, and B. McAlpine. 2007. **Analyzing floodplain and aquatic nursery habitat** of the Rio Grande silvery minnow at different hydrologic flows using GIS. International Symposium on GIS/Spatial Analysis in Fisheries and Aquatic Sciences , 3: 387–398.
- Kehmeier, J.W., with R.A. Valdez, C.N. Medley, and O.B. Myers. 2007. **Relationship of fish mesohabitat to flow** in a sand-bed southwestern river. North American Journal of Fisheries Management.
- Gonzales, E.J., G.M. Haggerty, and A. Lundahl. 2012. **Using fyke-net capture data** to assess daily trends in abundance of spawning Rio Grande silvery minnow. North American Journal of Fisheries Management 32:544–547.
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- Gonzales, E.J., D. Tave, and G.M. Haggerty. 2014. Endangered **Rio Grande silvery minnow use constructed floodplain habitat**. Ecohydrology 7: 1087–1093.
- Valdez, R.A., G.M. Haggerty, K. Richard, and D. Klobucar. 2019. **Managed spring runoff to improve nursery floodplain habitat** for endangered Rio Grande silvery minnow. Ecohydrology 12(7).
- Valdez, R.A., S.A. Zipper, S.J. Kline, and G.M. Haggerty. 2020. **Use of restored floodplains** by fishes of the Middle Rio Grande, New Mexico, USA. Ecohydrology 14(2).
- Yackulic, C.B., T.P Archdeacon, R.A. Valdez, M. Hobbs, M.D. Porter, A. Tanner, E.J. Gonzales, D.Y Lee, and G.M. Haggerty. 2022. **Quantifying flow and nonflow management impacts on an endangered fish** by integrating data, research, and expert opinion. Journal of Freshwater Ecology.
- Zipper, S.A., R.A. Valdez, and G.M. Haggerty. 2023. **Lapillar otoliths to determine daily age, growth rate, and estimated hatch dates** from of wild captured larval Rio Grande Silvery Minnow Hybognathus amarus. North American Journal of Fisheries Management (in review).