Use of Middle Rio Grande Floodplains by the Endangered Rio Grande Silvery Minnow

Richard A. Valdez, Ph.D.
SWCA Environmental Consultants

Grace M. Haggerty
New Mexico Interstate Stream Commission
Hydrobiological Objectives (HBOs)

- Production Strategy
- Survival Strategy

I submit that:

Positive relationship between high spring flow and RGSM density is related to floodplain inundation and survival of larvae.
Fish Species Composition in Floodplains (2016, 2017)

**2016 Fyke**
(n = 746)

- Rio Grande silvery minnow – 19%
- Red shiner – 73%

11 species

**2017 Fyke**
(n = 6,611)

- Rio Grande silvery minnow – 16%
- Red shiner – 32%
- Common Carp – 41%

14 species

RGSM dominated larval fish (73% & 79%)

RGSM was second most abundant large-bodied species (19% & 16%)
RGSM Adults In Floodplains (SWCA Studies)
Large number of adults indicates spawning in floodplains

- 2019, n = 471 (Zipper et al. 2019)
- 2017, n = 292 (Valdez et al. In Prep)
- 2016, n = 127 (Valdez et al. 2019)
- 2008-2009, n = 11,602 (Gonzales et al. 2014)
## Fish Species Composition in Mainstem and Floodplains of the Middle Rio Grande

<table>
<thead>
<tr>
<th>Code</th>
<th>Number of Specimens</th>
<th>2016</th>
<th>2017</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>HYBAMA</td>
<td>Rio Grande silvery minnow</td>
<td>13</td>
<td>16</td>
<td>11</td>
<td>14</td>
</tr>
<tr>
<td>CYPLUT</td>
<td>Red shiner</td>
<td>53%</td>
<td>47%</td>
<td>19%</td>
<td>16%</td>
</tr>
<tr>
<td>RHICAT</td>
<td>Longnose dace</td>
<td>10%</td>
<td>2%</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>PLAGRA</td>
<td>Flathead chub</td>
<td>9%</td>
<td>9%</td>
<td>2%</td>
<td>1%</td>
</tr>
<tr>
<td>ICTPUN</td>
<td>Channel catfish</td>
<td>3%</td>
<td>1%</td>
<td>1%</td>
<td>0.14%</td>
</tr>
<tr>
<td>CYPAR</td>
<td>Common carp</td>
<td>3%</td>
<td>8%</td>
<td>1%</td>
<td>41%</td>
</tr>
<tr>
<td>PIMPRO</td>
<td>Fathead minnow</td>
<td>3%</td>
<td>1%</td>
<td>2%</td>
<td>0.27%</td>
</tr>
<tr>
<td>CARCAR</td>
<td>River carpsucker</td>
<td>2%</td>
<td>0.18%</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>CATCOM</td>
<td>White sucker</td>
<td>1%</td>
<td>3%</td>
<td>1%</td>
<td>9%</td>
</tr>
<tr>
<td>GAMAFF</td>
<td>Western mosquitofish</td>
<td>1%</td>
<td>2%</td>
<td>0.14%</td>
<td>0.39%</td>
</tr>
<tr>
<td>AMENAT</td>
<td>Yellow bullhead</td>
<td>0.04%</td>
<td>0.02%</td>
<td>0.14%</td>
<td>--</td>
</tr>
<tr>
<td>ICTFUR</td>
<td>Blue catfish</td>
<td>0.04%</td>
<td>1%</td>
<td>--</td>
<td>0.02%</td>
</tr>
<tr>
<td>LEPMAC</td>
<td>Bluegill</td>
<td>0.04%</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>DORPET</td>
<td>Threadfin shad</td>
<td>--</td>
<td>0.08%</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>DORCEP</td>
<td>Gizzard shad</td>
<td>--</td>
<td>0.04%</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>MORCHR</td>
<td>White bass</td>
<td>--</td>
<td>0.02%</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>POMANN</td>
<td>White crappie</td>
<td>--</td>
<td>0.02%</td>
<td>0.41%</td>
<td>0.02%</td>
</tr>
<tr>
<td>LEPCYA</td>
<td>Green sunfish</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>0.14%</td>
</tr>
<tr>
<td>PYLOLI</td>
<td>Flathead catfish</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>0.05%</td>
</tr>
<tr>
<td>MICSAL</td>
<td>Largemouth bass</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>0.02%</td>
</tr>
</tbody>
</table>

*13 species have been found as larvae or young in floodplains (2016-2017)*
RGSM Larvae in Floodplains

Floodplains are important nurseries

- RGSM larvae are most abundant species in floodplains (73-79%) 
- Hatching occurred mid-April to late May, 2016 and 2017 (spawn 2 days earlier) 
- Mainstem temp = 12.5°C and 10.6°C, respectively 
- Annual Cumulative Degree-Days (ACDD above 5°C) = 692 and 694, respectively 
- Spawning driven by photoperiod, temperature, flow
Development of Larvae
Larvae may leave 14-22 dph

- Swimming ability improves in metalarval phase
- Mesolarvae have full complement of fin rays, except for lateral fins
- Metalarvae have full complement of fin rays

Illustrations by William Howard Brandenburg (DBA Lateral Lines, Albuquerque, NM)
Larval Phases in Floodplains

Larvae remain in floodplains

- All 4 phases are present in floodplains, but few juveniles
- All phases are present in mainstem, but increasing numbers of juveniles
- Larvae appear to leave floodplains as postflexion mesolarvae (14 d) and metalarvae (22 d)
Floodplains and Hatch (2016)
Survival related to floodplain duration

- Synchrony of hatching and floodplain inundation is vital to RGSM larval survival
- Postflexion mesolnarvae (~14 dph)
- Metalarvae (~22 dph)
- In 2016, only about 30% of hatch occurred during floodplain inundation

1. Agree with Medley and Shirey (2013)—RGSM is primarily demersal floodplain spawner.

2. Ho: Long distance transport of propagules and upstream return of young is an artifact of contemporary flow management and channelization that has led to reduced lateral connectivity and delinking of the floodplain.

3. Mechanism behind the HBO is retention of larvae in sheltered low-velocity habitats (e.g., floodplains) as critical to larval survival and recruitment.

4. Hence, floodplain restoration that allows TIMELY floodplain inundation provides necessary nursery habitat.
Acknowledgements

- New Mexico Interstate Stream Commission: Grace Haggerty, Rolf Schmidt-Peterson

- Albuquerque Bernalillo County Water Utility Authority: Rick Billings, Kate Mendoza, Mo Hobbs

- SWCA: Steve Zipper, Jason Kline, Brian Bader, Paulettta Dodge, Taylor Guest, Matt McMillan, Jesse Shuck, William Youmans, Deanna Klobucar, Evan Crawford, Ian Dolly, Connor Flyn, Joanna Franks, Sam McKitrick, Ariel Perraglio, Joe Toya

- Middle Rio Grande Conservancy District: David Gensler, Anne Markin

- U.S. Bureau of Reclamation: Ken Richard, Eric Gonzales, Carolyn Donnelly, Ed Kandl

- U.S. Army Corps of Engineers: Mickey Porter, Ryan Gronewold, Nabil Shafike

- U.S. Fish and Wildlife Service: Joel Lusk, Thomas Archdeacon