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

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New Mexico Interstate Stream Commission

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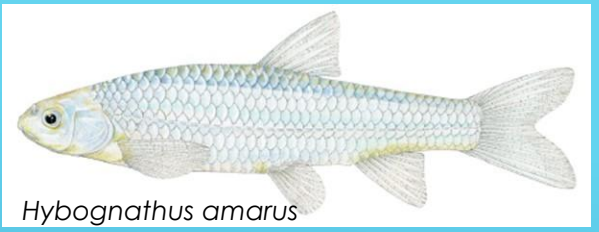
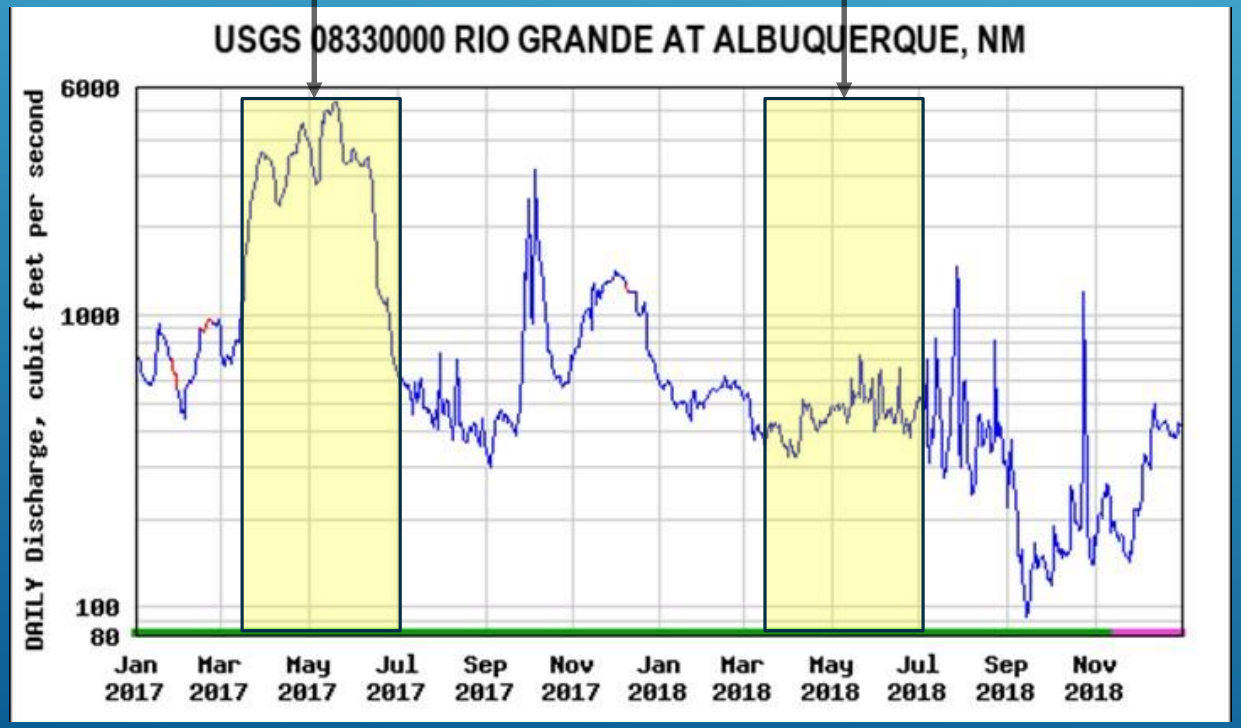
2016 Biological Opinion

- ***Hydrobiological Objectives (HBOs)***


Hybognathus amarus

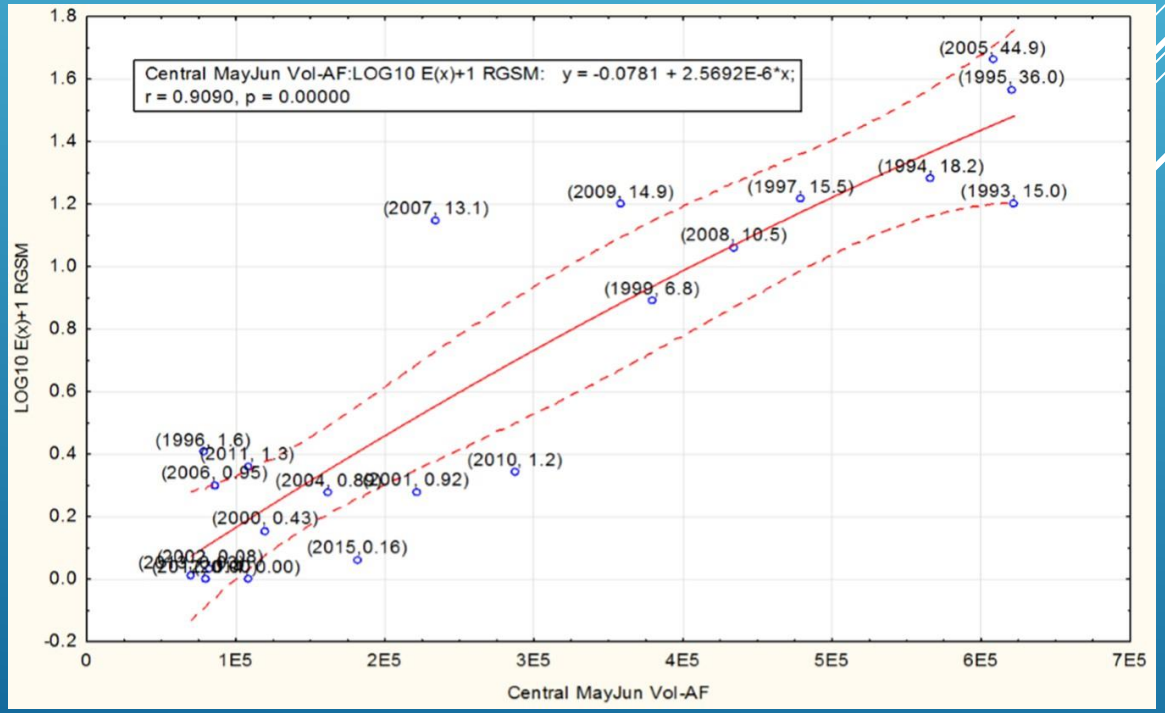
Production Strategy

Survival Strategy

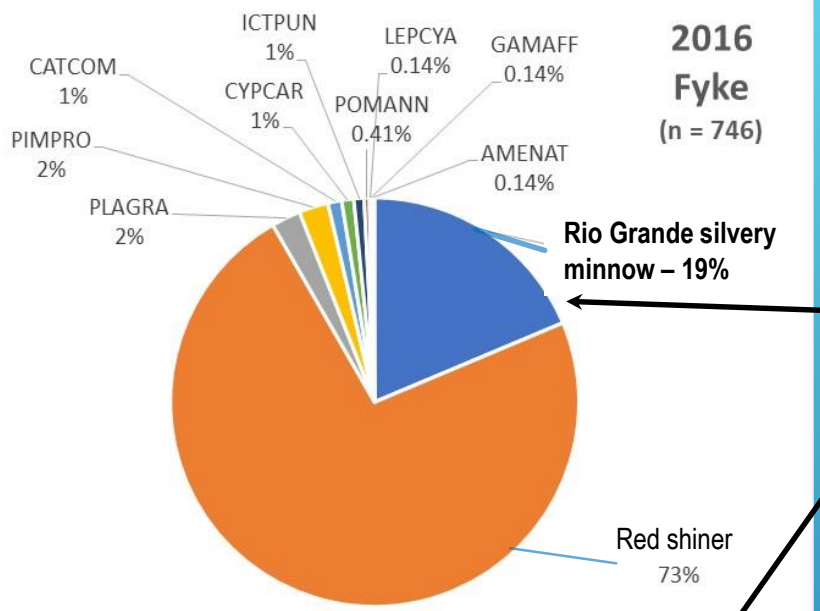


I submit that:

Positive relationship between high spring flow and RGSM density **is related to floodplain inundation and survival of larvae**

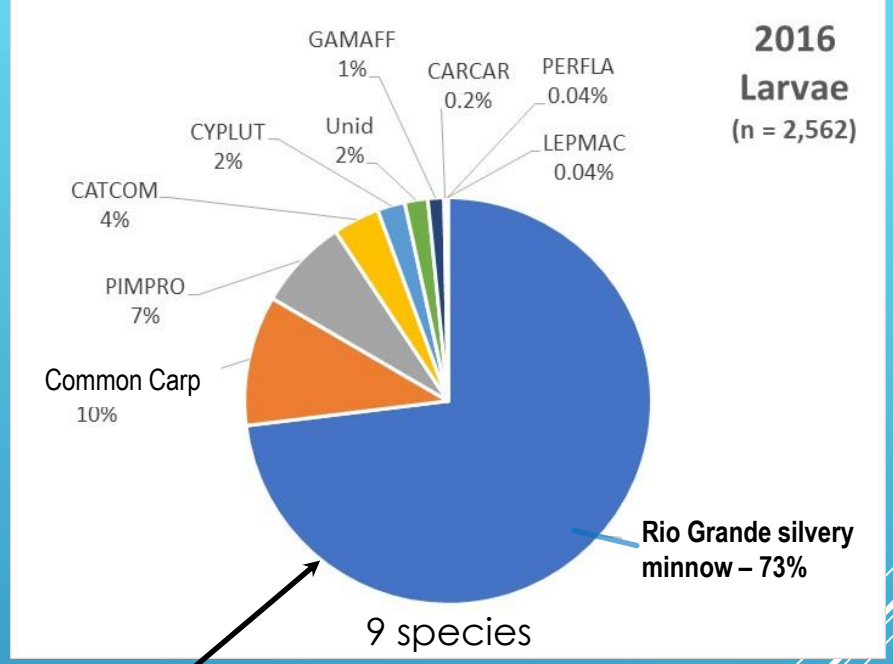


Fish Species Composition in Floodplains (2016, 2017)

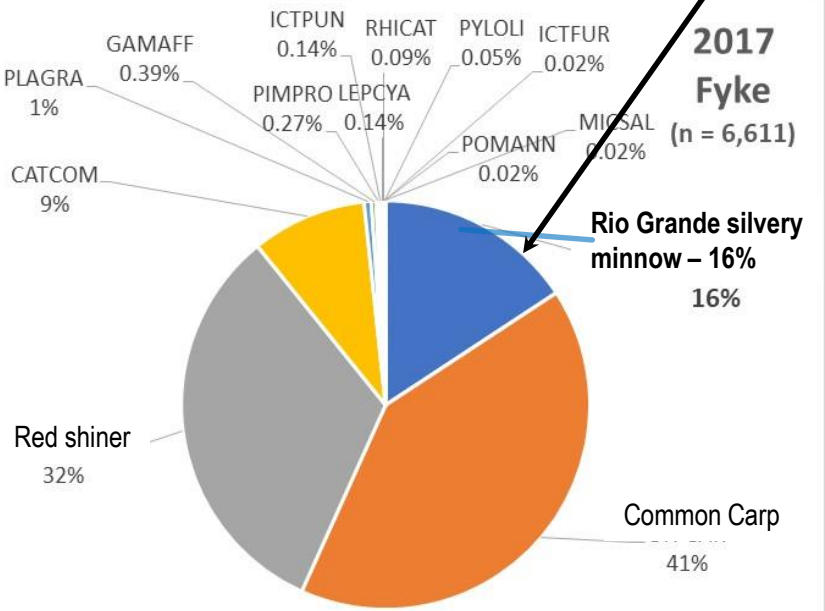


11 species

RGSM was second most abundant large-bodied species (19% & 16%)

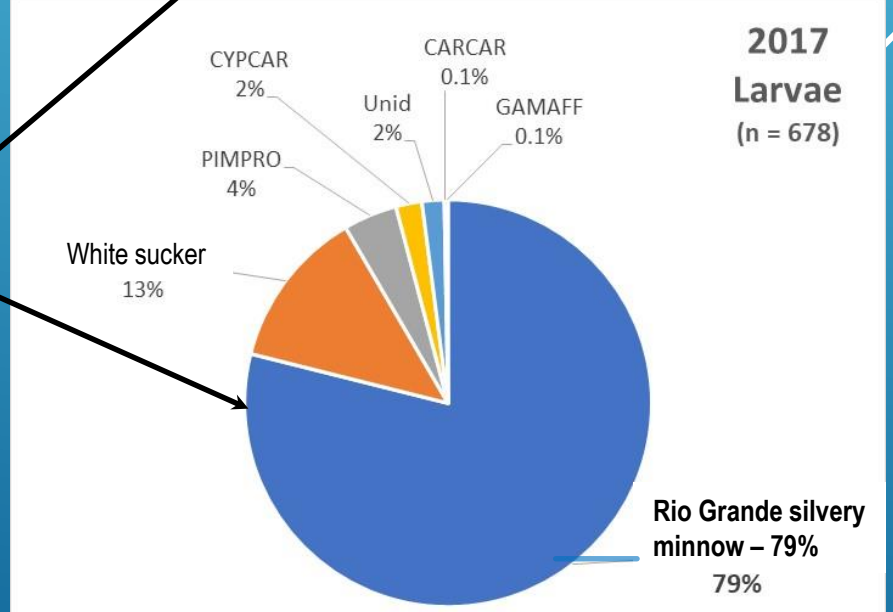


9 species



14 species

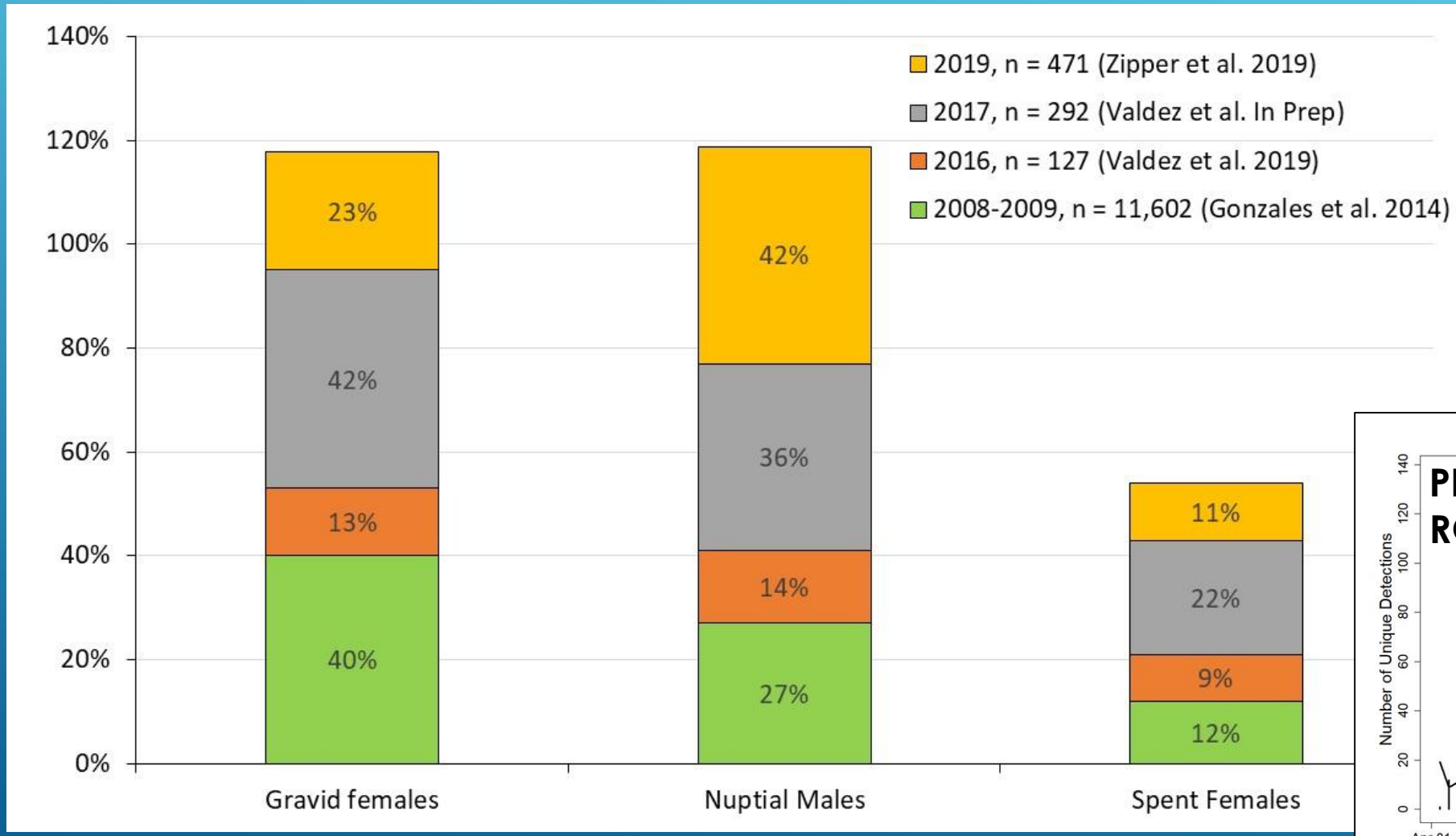
RGSM dominated larval fish (73% & 79%)

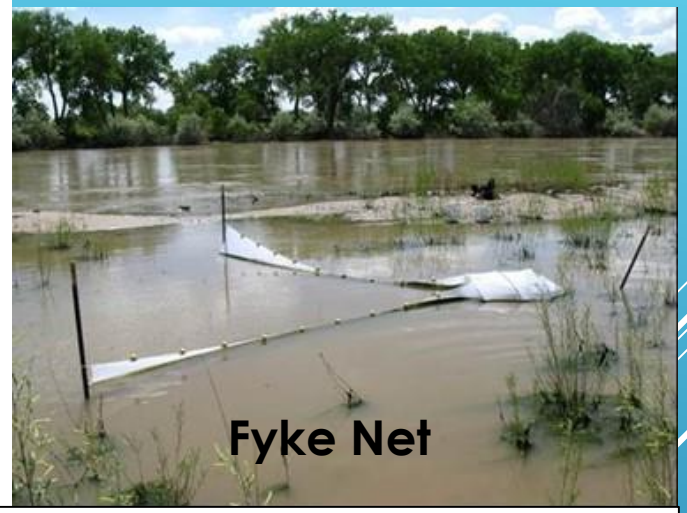


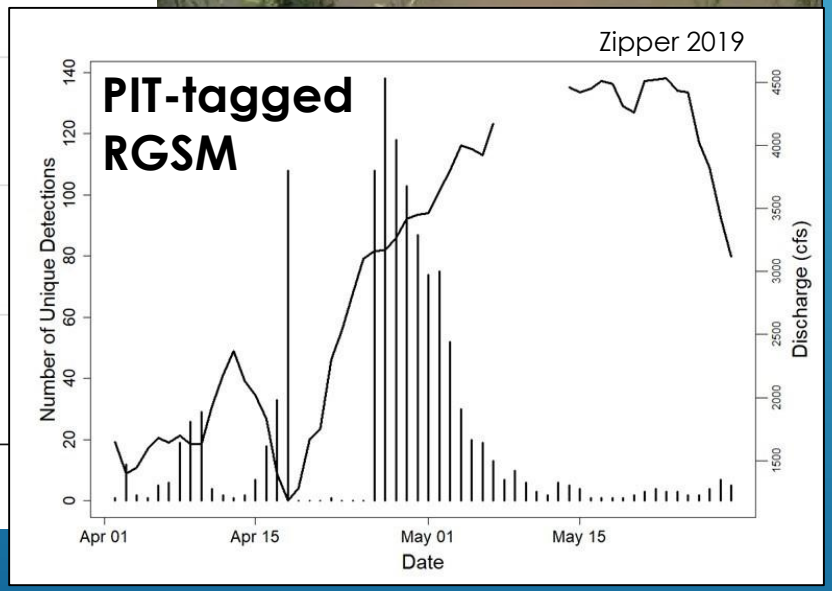
6 species

RGSM Adults In Floodplains (SWCA Studies)

Large number of adults indicates spawning in floodplains







Fish Species Composition in Mainstem and Floodplains of the Middle Rio Grande

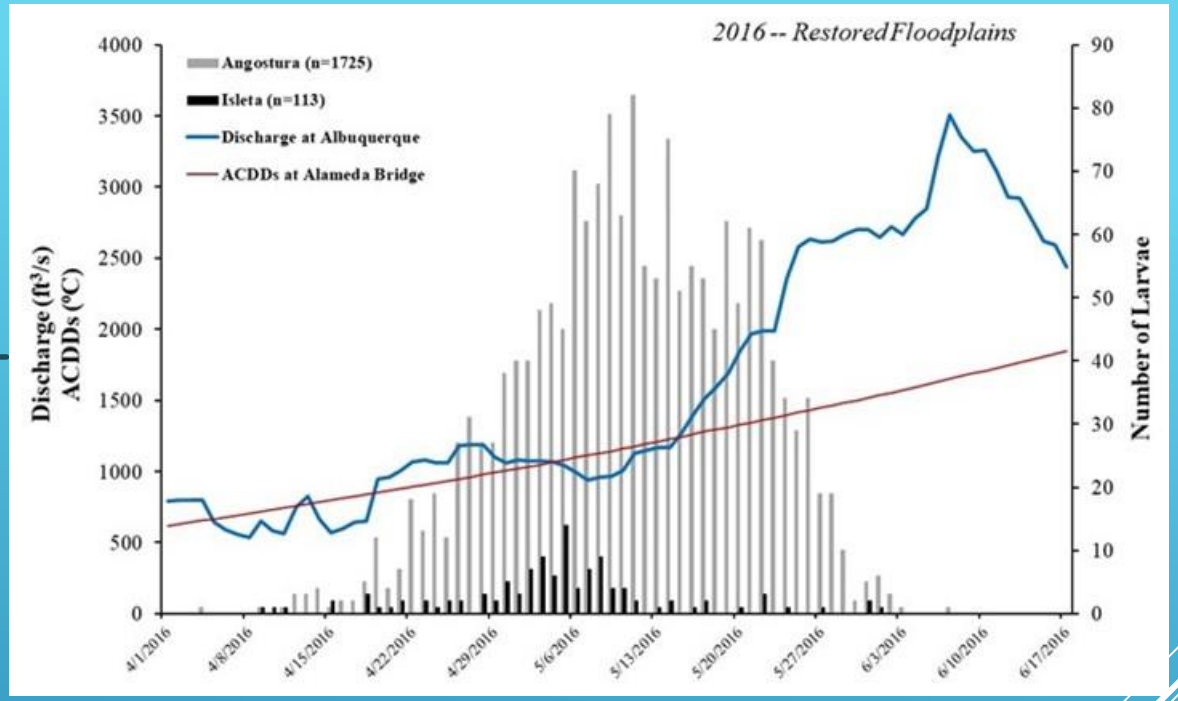
				Mainstem (Seines)		Floodplains (Fyke Nets)	
				2016	**2017**	**2016**	**2017**
	Code	**Number of Specimens**		**2,723**	**4,924**	**746**	**6,611**
		Number of Species		**13**	**16**	**11**	**14**
1	HYBAMA	Rio Grande silvery minnow	✓	53%	47%	19%	16%
2	CYPLUT	Red shiner	✓	16%	26%	73%	32%
3	RHICAT	Longnose dace	✓	10%	2%	--	0.09%
4	PLAGRA	Flathead chub	✓	9%	9%	2%	1%
5	ICTPUN	Channel catfish	✓	3%	1%	1%	0.14%
6	CYPCAR	Common carp	✓	3%	8%	1%	41%
7	PIMPRO	Fathead minnow	✓	3%	1%	2%	0.27%
8	CARCAR	River carpsucker	✓	2%	0.18%	--	--
9	CATCOM	White sucker	✓	1%	3%	1%	9%
10	GAMAFF	Western mosquitofish	✓	1%	2%	0.14%	0.39%
11	AMENAT	Yellow bullhead		0.04%	0.02%	0.14%	--
12	ICTFUR	Blue catfish		0.04%	1%	--	0.02%
13	LEPMAC	Bluegill	✓	0.04%	--	--	--
14	DORPET	Threadfin shad		--	0.08%	--	--
15	DORCEP	Gizzard shad		--	0.04%	--	--
16	MORCHR	White bass		--	0.02%	--	--
17	POMANN	White crappie		--	0.02%	0.41%	0.02%
18	LEPCYA	Green sunfish	✓	--	--	0.14%	0.14%
19	PYLOLI	Flathead catfish		--	--	--	0.05%
20	MICSAL	Largemouth bass		--	--	--	0.02%

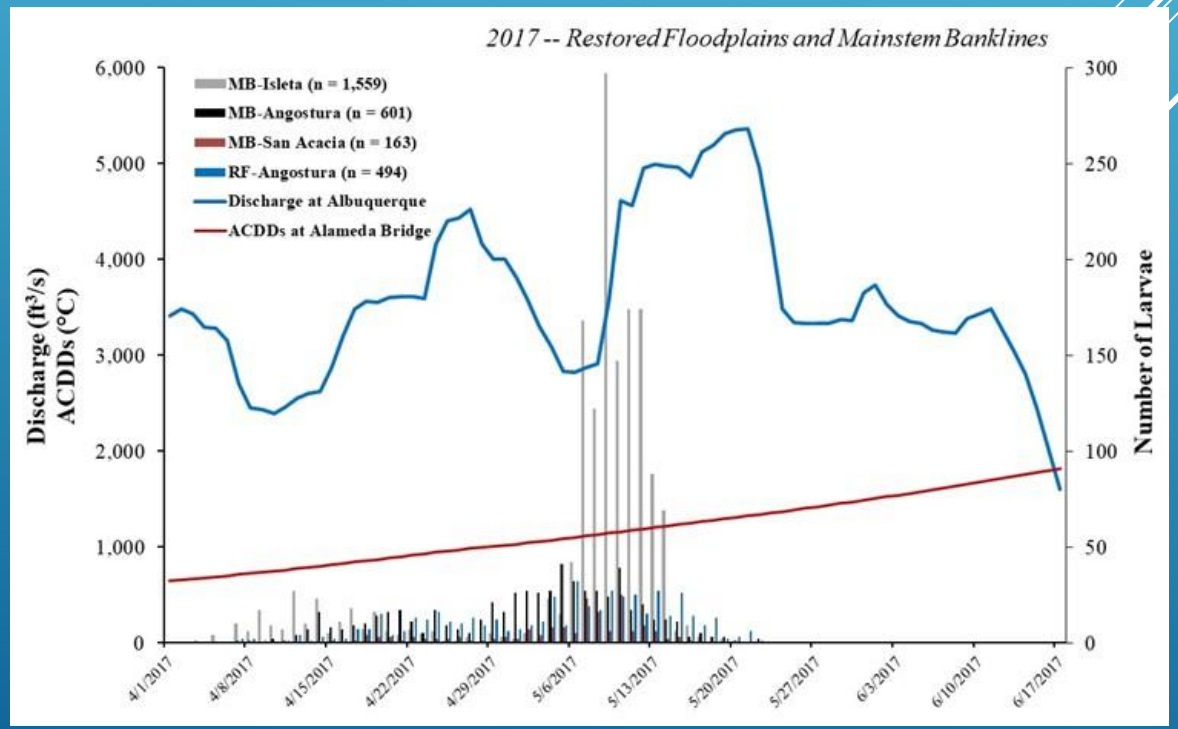
✓ 13 species have been found as larvae or young in floodplains (2016-2017)

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





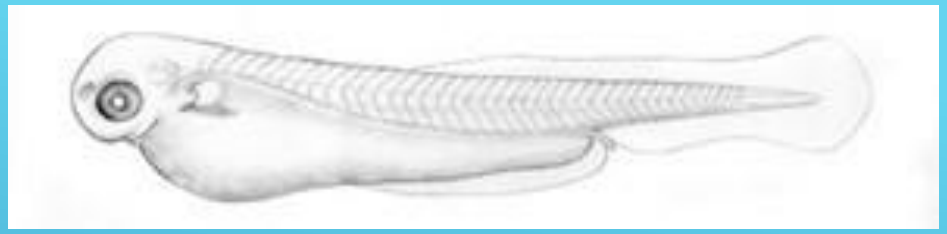
Development of Larvae

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

Rio Grande silvery minnow (*Hybognathus amarus*)

Protolarvae
1-day, 4 mm SL
(yolk sac, no fins)



Mesolarvae (flexion)
~7-day, 5-6 mm SL
(yolk sac absorbed, caudal fins rays)

Mesolarvae (postflexion)
~14-day, 6-8 mm SL
(dorsal, caudal, anal fin rays)

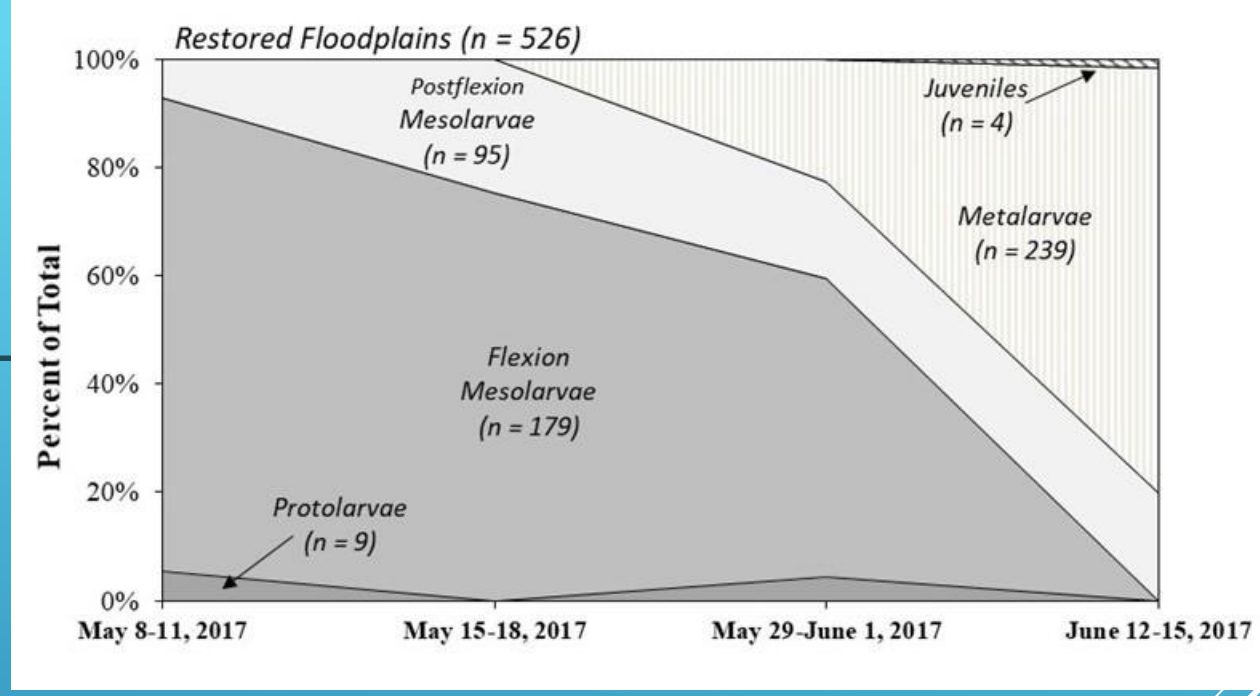
Metalarvae
~22-days, 9-10 mm SL
(fins formed)

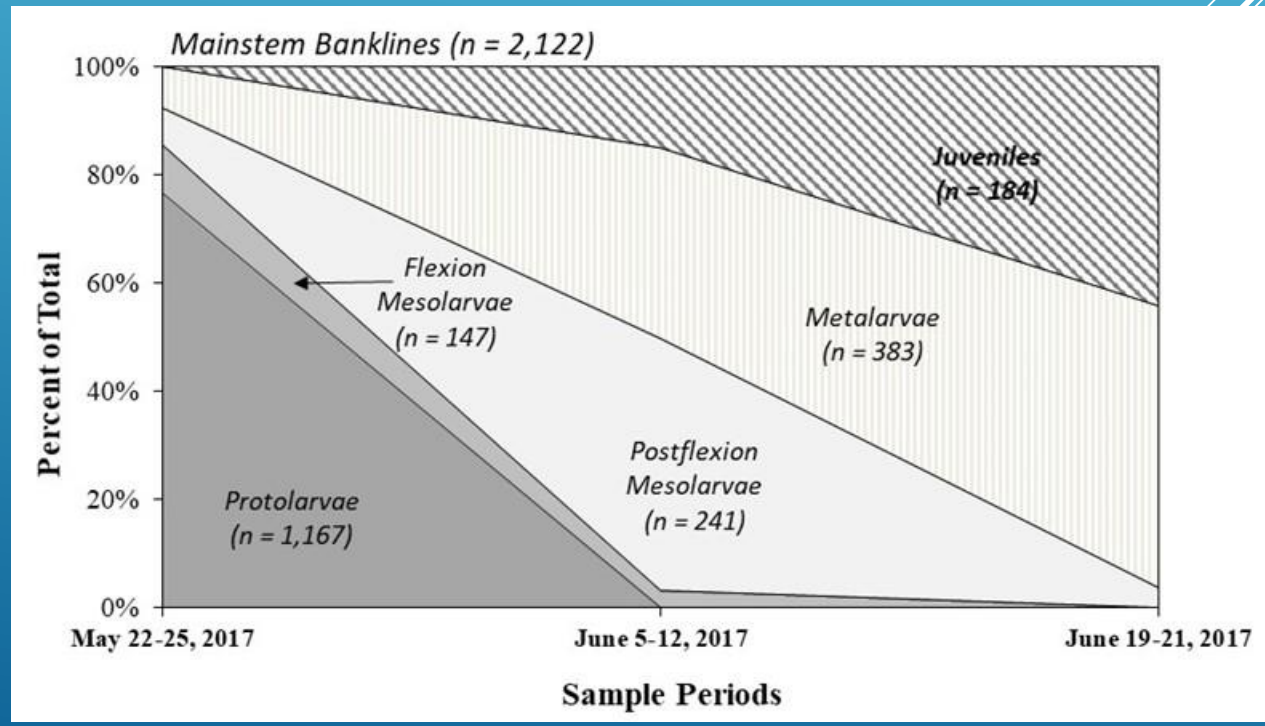
Illustrations by William Howard Brandenburg (DBA Lateral Lines, Albuquerque, NM)

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)

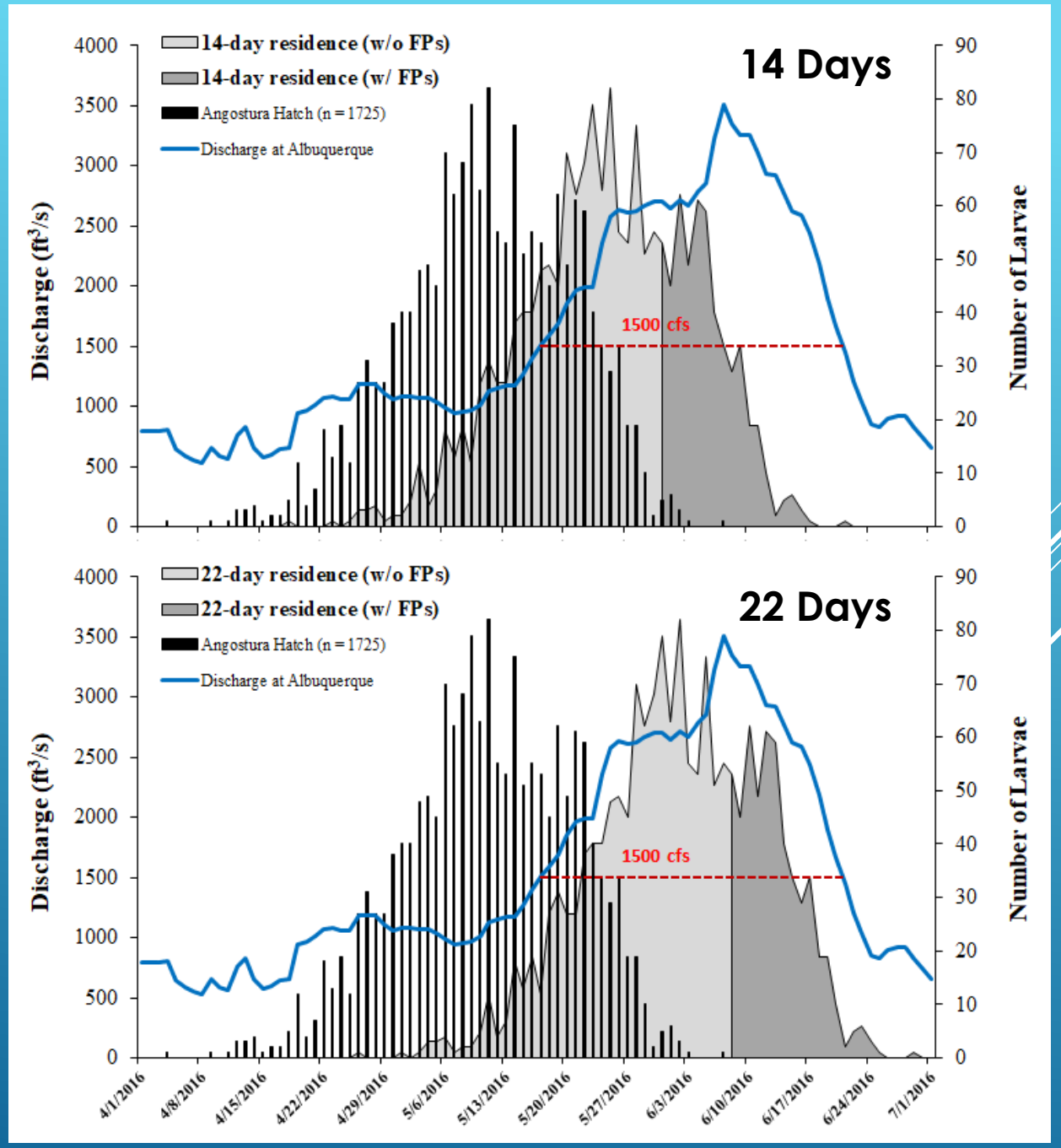




Floodplains and Hatch (2016)

Survival related to floodplain duration

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



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 DOI: 10.1002/eco.2134 .

Conclusions

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

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