Reproductive success of individual razorback sucker in isolated backwaters: A progress report

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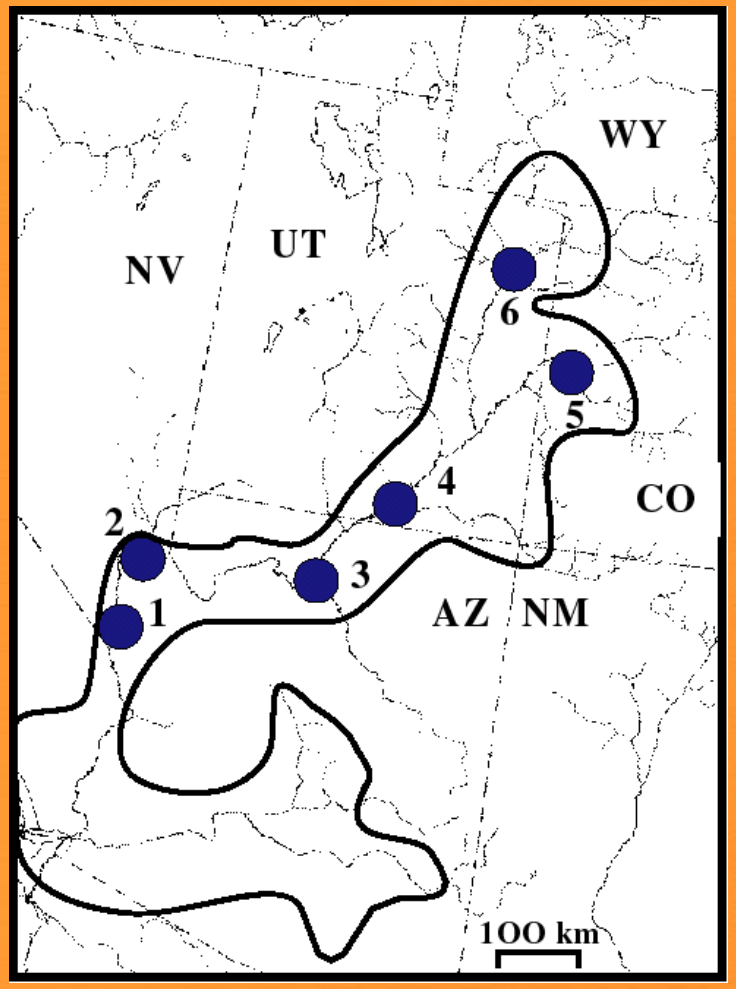
Funded by:

Razorback sucker (*Xyrauchen texanus*)

- Grows up to 1 m long and weight of 5 kg
- Live 40+ years
- Iteroparous
- Highly fecund
  - ca. 200,000 eggs/large adult female

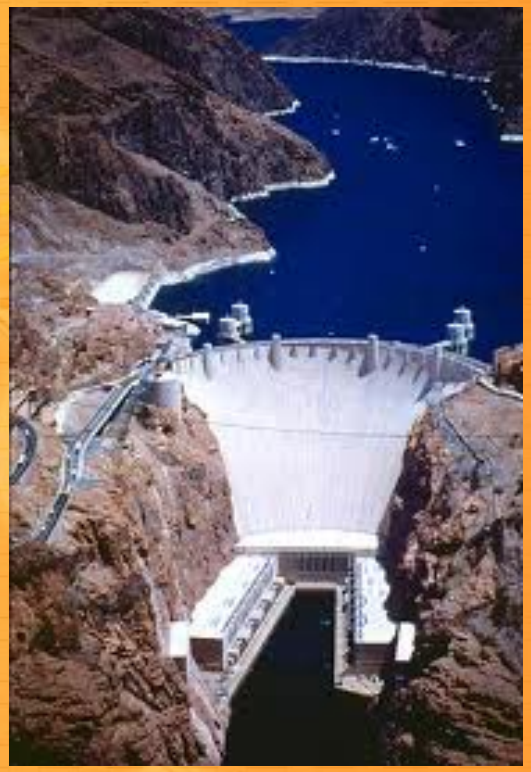
Background

- Endemic to Colorado River system
  - Formerly very abundant in main channels throughout the drainage
- Most abundant in Lake Mohave
  - Highest genetic diversity
  - Serves as a refuge



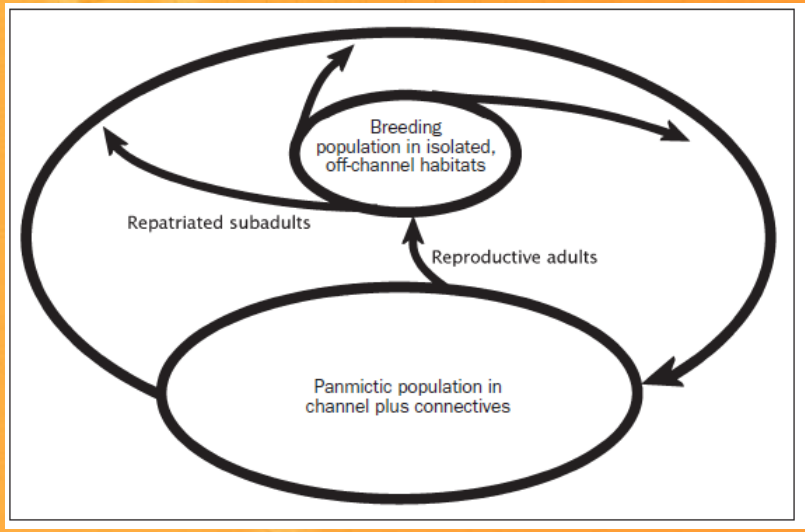
Background

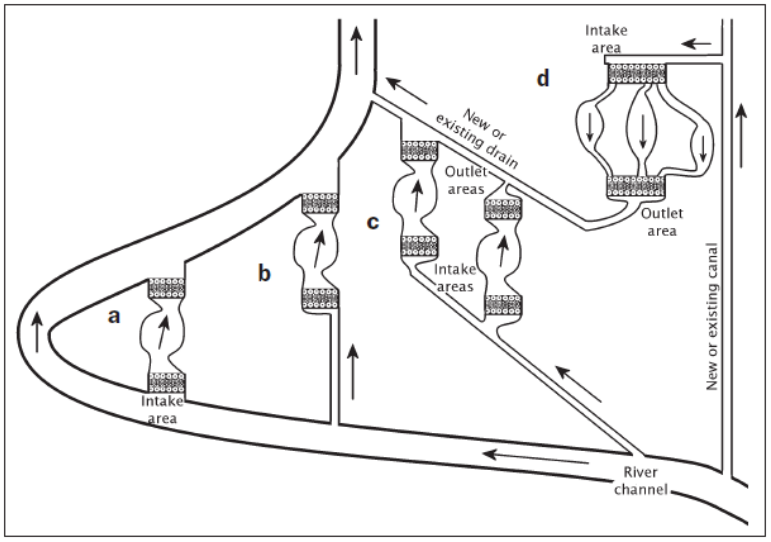
- Federally listed as endangered in 1991
- 50+ yrs no natural recruitment in Lake Mohave
  - Water development
  - Non-native fish predation and competition



How do we conserve the population?

- Rear in protective custody
- Develop isolated off-channel habitats
- Refuges for reproduction
- Interchange individuals with main river





Objective

- To obtain information about reproductive success of individual razorback sucker kept in backwaters

  - How many adults contribute?
  - What is the proportion of offspring from individual contributions?
  - Is there variation between backwaters?
  - How many individuals should we use in each pond?
  - How often do we supplement each pond?

Methods

- Stock adult razorback suckers in ponds prior to spawning season
- Equal sex ratios
  - 100 males
  - 100 females
- Fin clipped prior to release

Methods

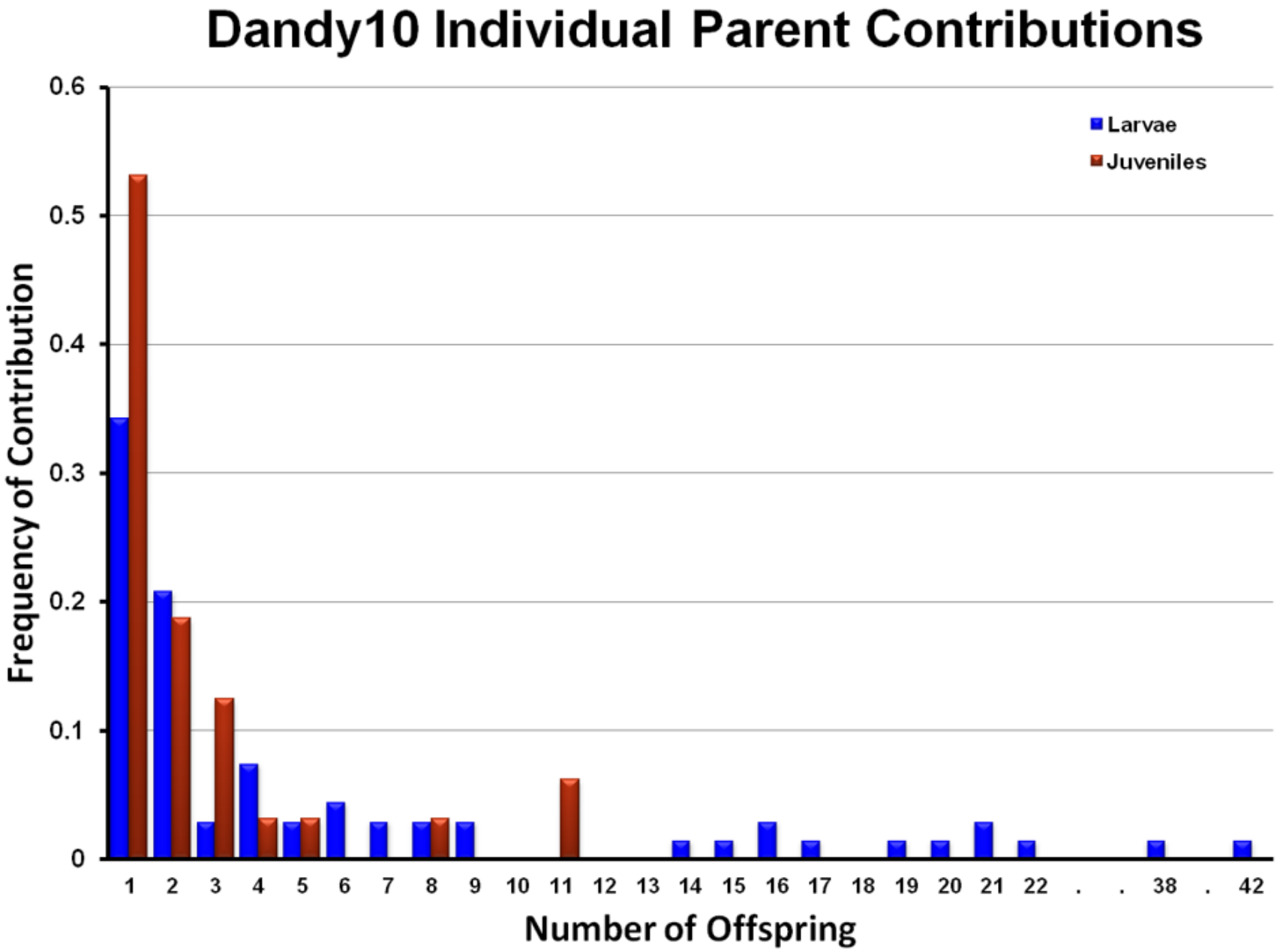
- Gather larvae throughout the spawning season, and juveniles during fall
- Measure lengths of larvae
- Genotype adults and offspring using microsatellites
  - 14 Loci
- Assign parentage

Backwaters used

- Ephemeral backwaters
  - To quantify reproductive success of specific individuals
  - Arizona Juvenile and Dandy
  - In use since 2010
    - Stocked each year
    - All adults and juveniles removed by the end of the year

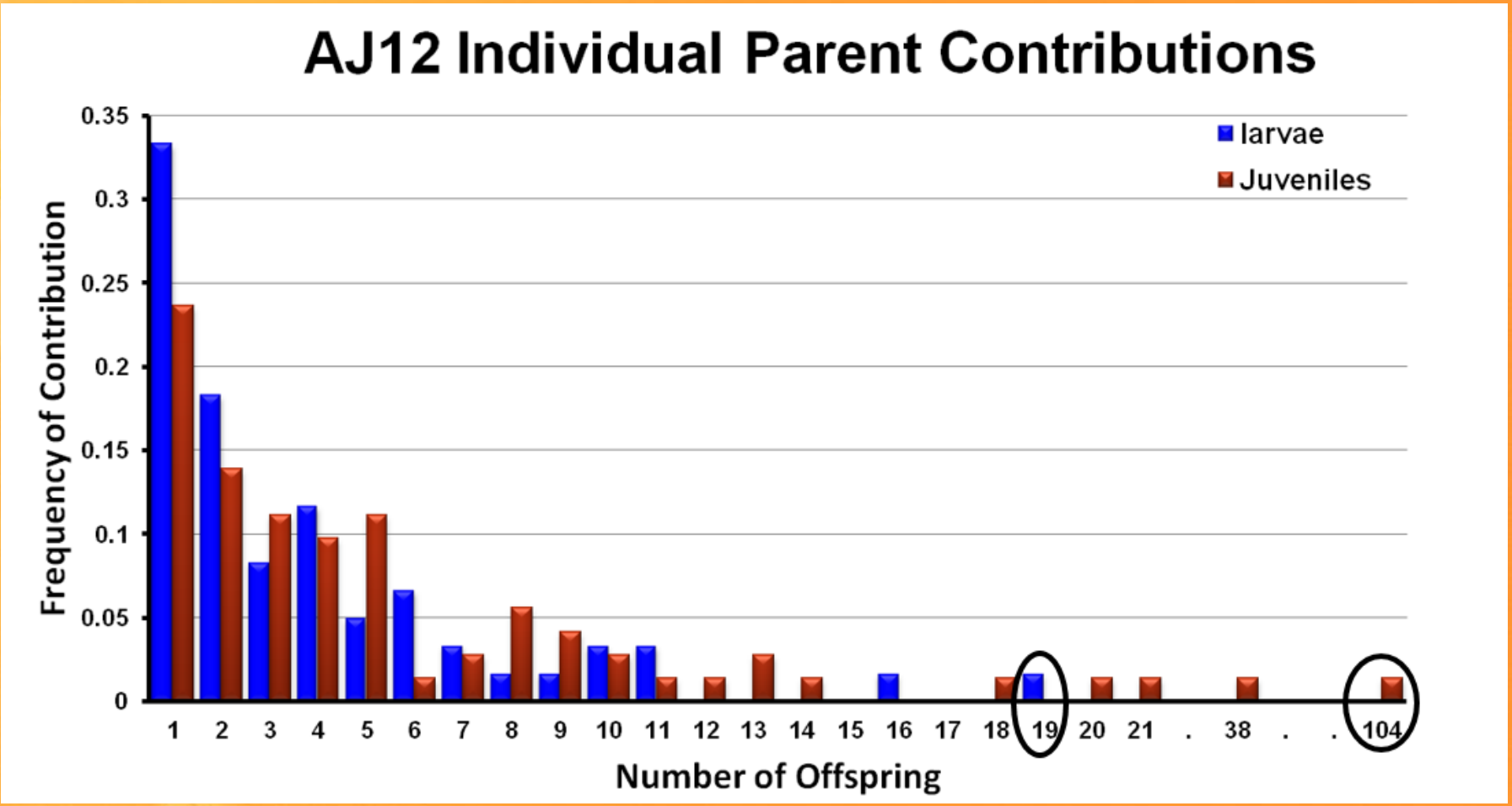
Dandy Backwater Summary

Year	life stage	# of Offspring	# of Parental Contributions Females	# of Parental Contributions Males	% contribute	% from Unique Male-Female Pairings
2010	larva	207	36	31	33	40%
	juvenile	40	17	15	16	55%
2011	larva	0	0	0	0	0%
	juvenile	0	0	0	0	0%
2012	larva	0	0	0	0	0%
	juvenile	4	4	4	4	100%
2013	larva	64	26	35	31	81%
	juvenile	275	54	51	53	50%
2014	larva	0	0	0	0	0%
	juvenile	0	0	0	0	0%
2015	larva	63	?	?	?	?
	juvenile	25	?	?	?	?


Dandy10 Individual Parent Contributions
Larvae
Juveniles
Frequency of Contribution
0.6
0.5
0.4
0.3
0.2
0.1
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 . . 38 . 42
Number of Offspring

Arizona Juvenile Backwater Summary

Year	life stage	# of Offspring	# of Parental Contributions		% contribute	% from Unique Male-Female Pairings
			Females	Males		
2010	larva	210	66	39	53%	75%
	juvenile	NA	NA	NA	NA	NA
2011	larva	305	68	69	69%	79%
	juvenile	201	43	52	48%	71%
2012	larva	116	25	35	30%	63%
	juvenile	246	33	39	36%	44%
2013	larva	241	19	46	33%	41%
	juvenile	44	11	20	16%	79%
2014	larva	215	12	7	10%	13%
	juvenile	59	6	6	6%	22%
2015	larva	545	49	61	55%	45%
	juvenile	51	19	29	24%	80%



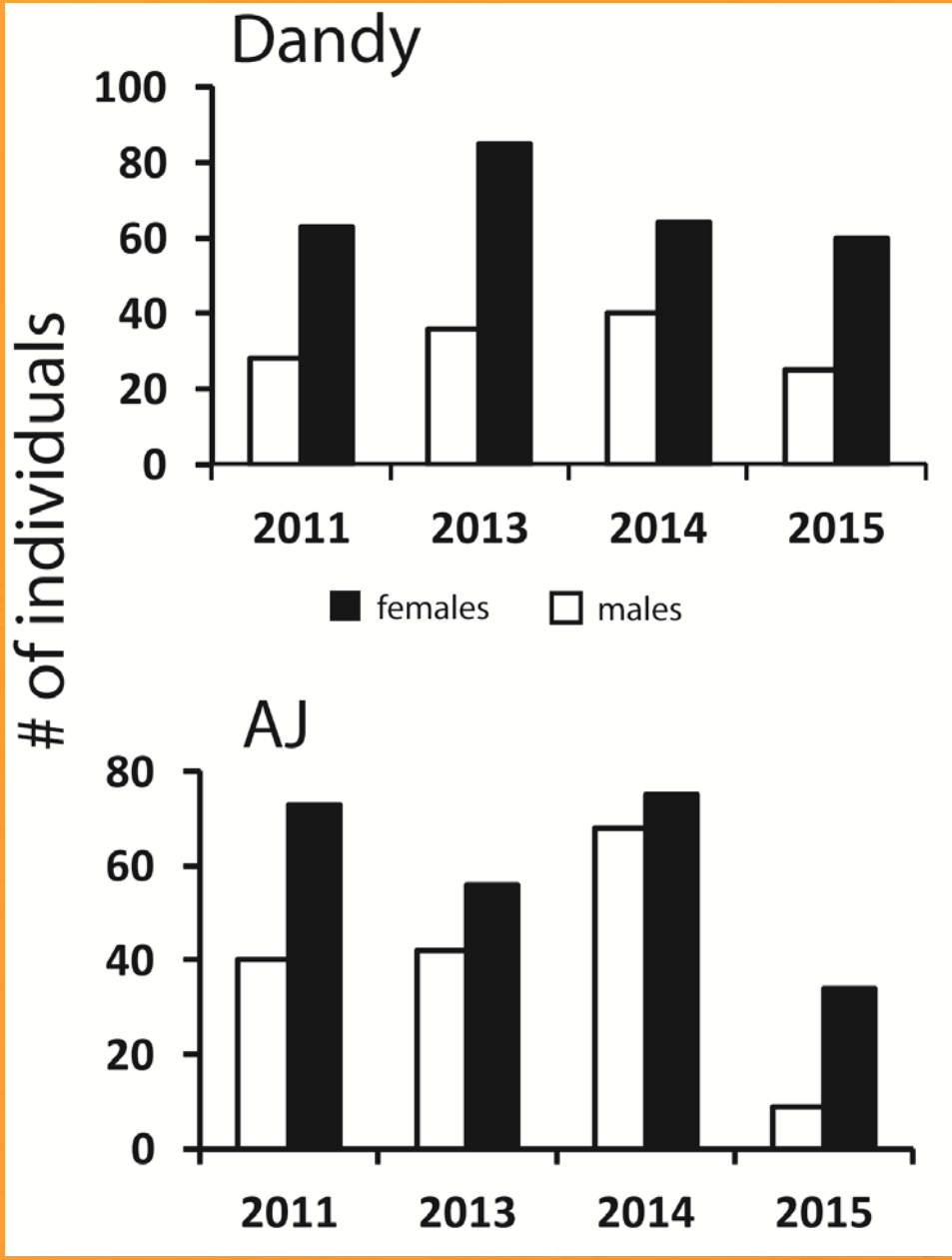
- **Even though many individuals contribute, single individuals can dominate reproduction**
  - **Female 179 contributed to 16% of larvae and 42% of juveniles**

Conclusions
Ephemeral backwaters

- Considerable variation in reproductive success among locations and years
- Potential for most individuals to reproduce each year
  - High fraction of progeny are produced by unique pairings
  - Some individuals contributed many progeny
  - Must be considered as we manage backwaters

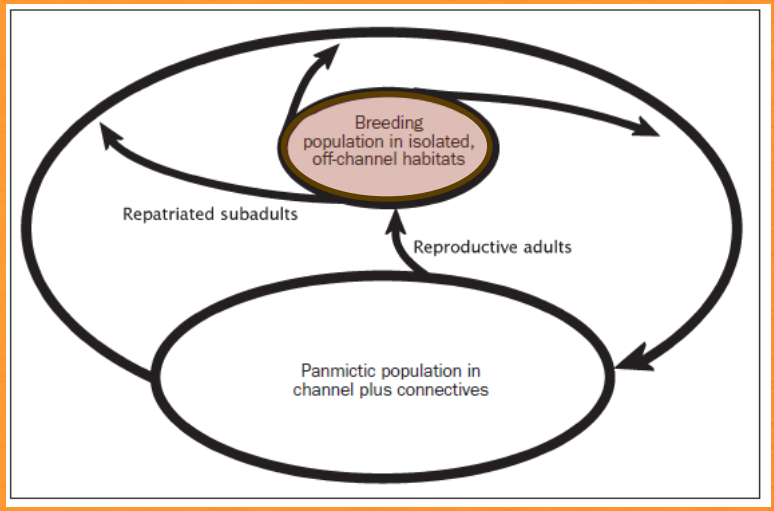
Biased survivorship

- Skewed sex ratios at the end of spawning season/harvest
- More females than males
  - Dandy
    - G = 54.4, P < 0.001
  - AJ
    - G = 27.5, P < 0.001
- Why?
  - Answer to this question critical



Backwaters used

- Permanent backwaters
  - Yuma backwater
  - In use since 2013
    - Permanent population
    - Individual manipulations to adjust density/# of breeding parents
    - In addition to estimating reproductive success, test for recruitment

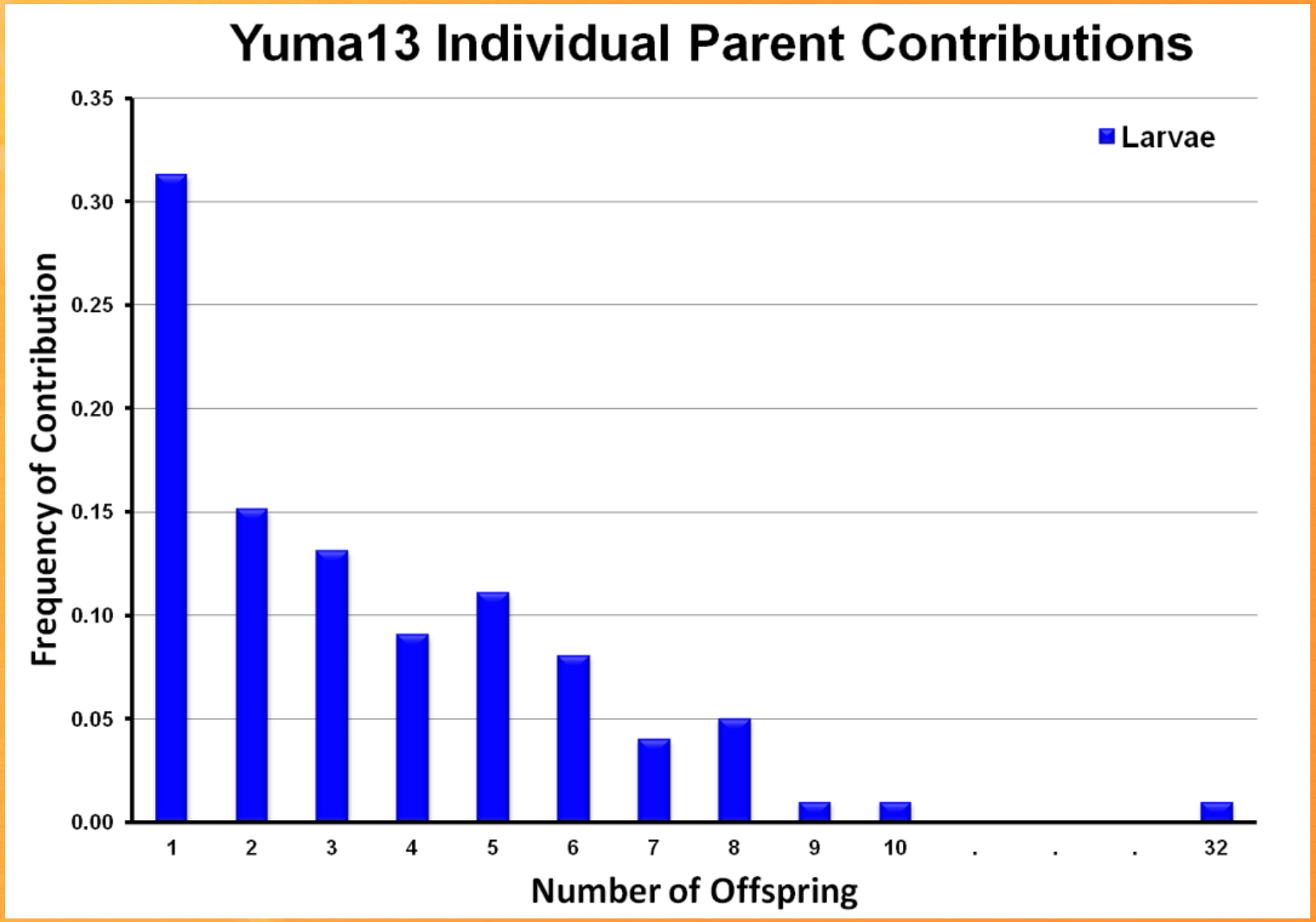


Yuma Backwater

2013 - Stocked 100 Females, 100 Males
2014 - Stocked 50 Females, 50 Males
2015 - Stocked 50 Females, 50 Males

Year	life stage	# of Offspring	# of Parental Contributions Females	# of Parental Contributions Males	% contribute	% from Unique Male-Female Pairings
2013	larva	180	49	49	49%	73%
	juvenile	124	14	21	17%	36%
2014	larva	257	51	20	24%	56%
	juvenile*	95	20	12	11%	45%
2015	larva	314	65	21	22%	66%

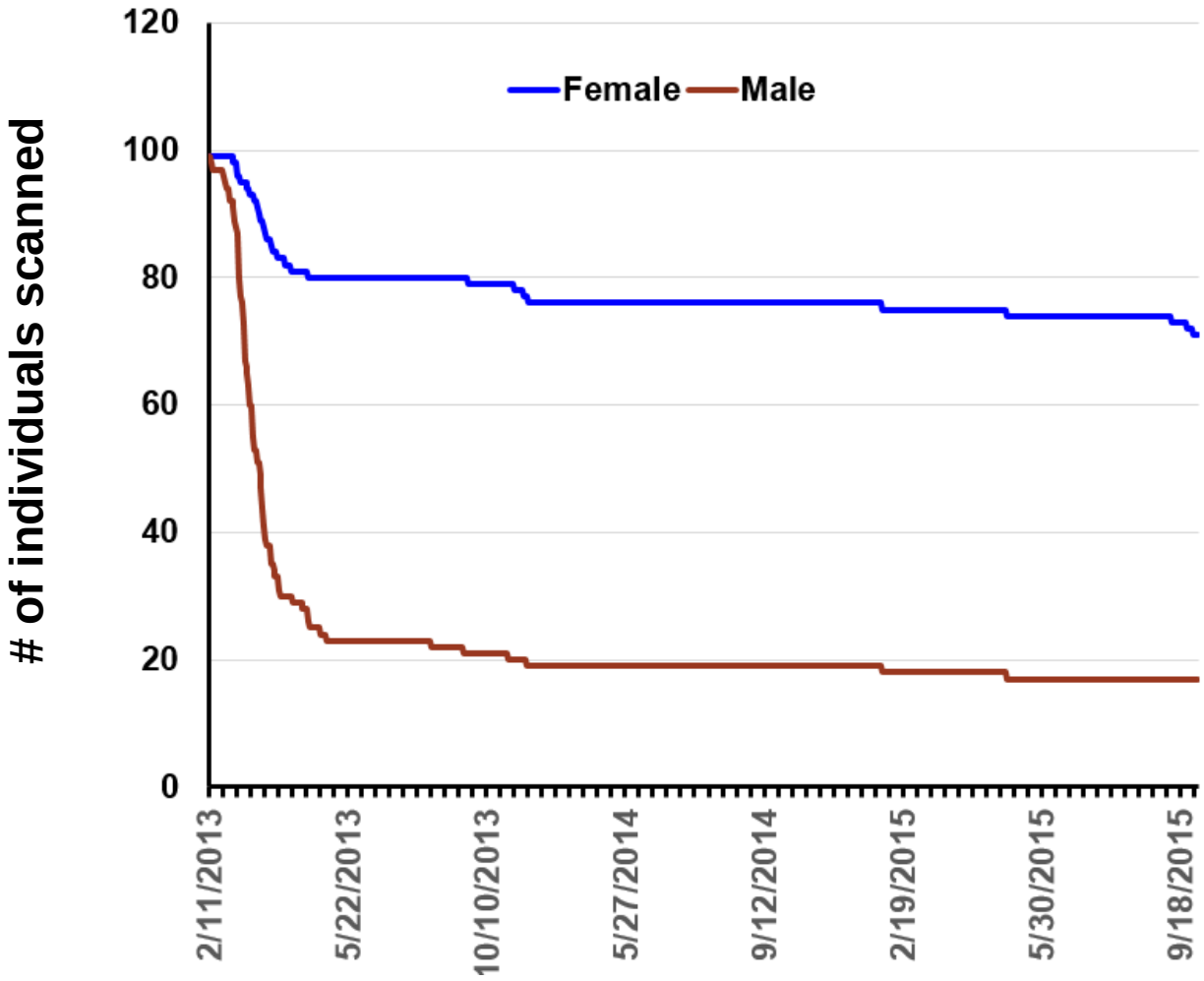
*sampled May 2015


Yuma13 Individual Parent Contributions
Larvae
Frequency of Contribution
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1
2
3
4
5
6
7
8
9
10
.
.
.
32
Number of Offspring

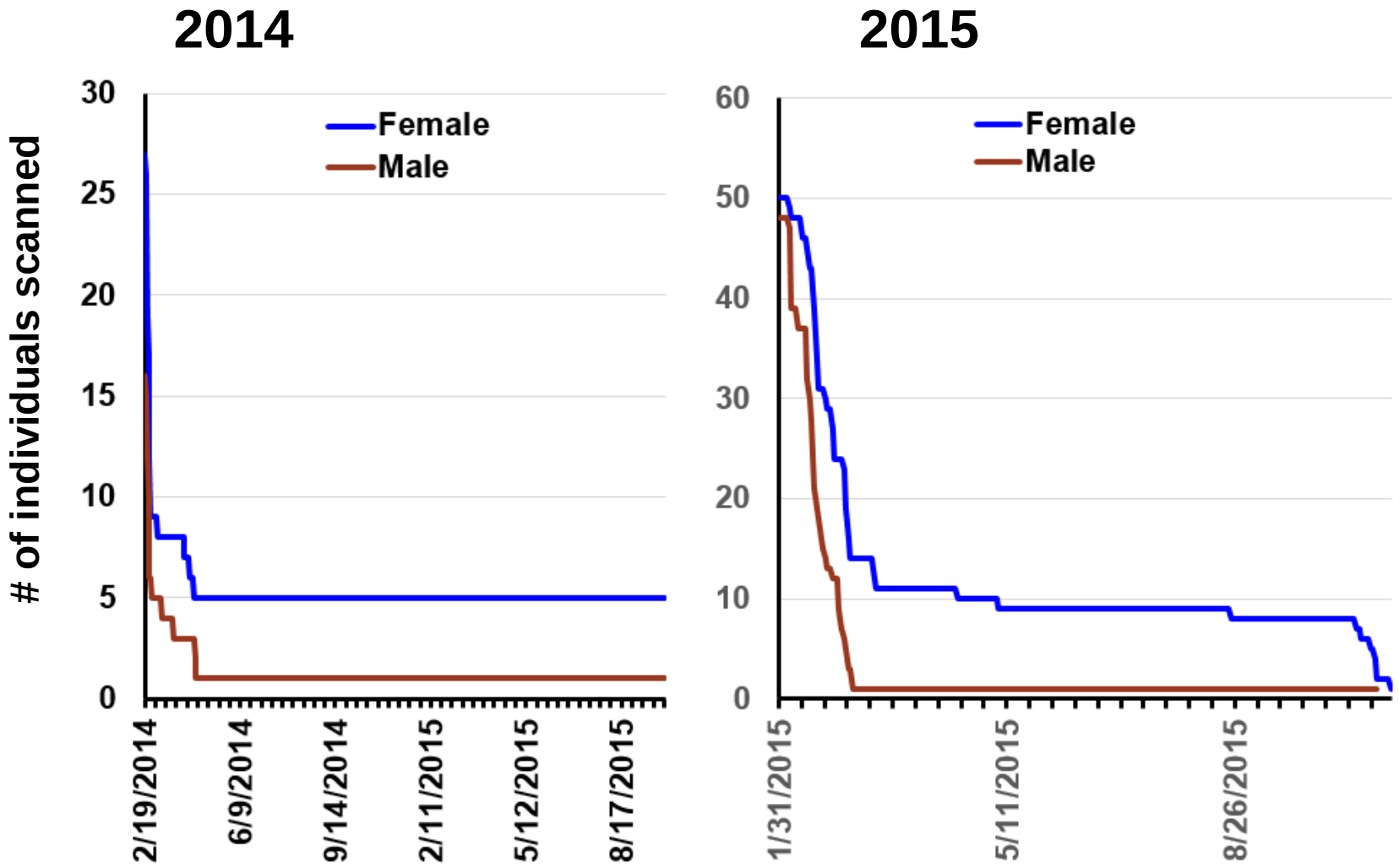
Yuma Backwater

- In 2015:
  - Only two of the 100 individuals stocked in 2014 reproduced (2 females, 0 males)
  - Only two of the 100 individuals stocked in 2015 reproduced (2 females, 0 males)
- Why?
  - Examined using scanning data to track individuals

Yuma Backwater 2013



Yuma Backwater



Conclusions
Permanent backwater

- **Similar patterns to ephemeral backwaters**
- **Biased survivorship**
  - **Population becomes shortly after initial stocking**
  - **Greatly reduced survivorship from additional stockings**
  - **Must be considered as we manage backwaters**

Future work

- Ephemeral backwaters
  - Test for density effects
  - Try to understand differences among ponds

- Permanent backwaters
  - Establish more replicates
  - Assess levels of recruitment
  - Assess the importance of demographic factors (e.g., density effects)