Lower Colorado River Multi-Species Conservation Program

Balancing Resource Use and Conservation

Genetic and Demographic Studies to Guide Conservation Management of Bonytail and Razorback Sucker in Off-channel Habitats

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Lower Colorado River
Multi-Species Conservation Program

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Off channel ponds and impounded backwaters could potentially provide valuable habitat for the conservation of razorback sucker and bonytail chub (Minckley et al. 2003). Therefore, it is important to obtain essential information for informed management of these species in such habitats. Here we provide an interim report on our assessment of reproductive success of individual razorback suckers in impounded backwaters.

Two isolated backwaters on Lake Mohave, Arizona Juvenile (AJ) and Dandy backwaters, were selected due to past history of productivity as grow out ponds for razorback sucker as well as known reproductive success. Each was stocked with two hundred adult-size razorbacks in the early spring of 2010 and 2011. We attempted to use equal numbers of males and females, however, small size of stocked individuals in 2010 made accurate determination of sex difficult. Microsatellite analysis of larvae was used to re-sex represented individuals (see below), providing the adjusted numbers in Table 1. After stocking, each backwater was sampled periodically over the ensuing spawning seasons, and larvae were collected and sent to Arizona State University (ASU) for characterization with microsatellites. Remaining progeny were removed during autumn of each year, and a subset was fin clipped; fin clips were sent to ASU for genetic analysis.

Adult razorback sucker in Dandy and AJ backwaters were tracked using remote PIT scanners deployed at the time of larval sampling in 2010 and 2011. The vast majority of fish stocked were contacted at least once during the spawning season (Table 1), and the number of known live adult razorback sucker based on remote PIT scanning and harvest data provided a reliable metric of male and female abundance in each backwater.

A summary of larval samples obtained during the last two years is presented in Table 2. In spring 2010, 209 larvae were collected from Dandy backwater, representing six different time

periods, whereas 216 larvae were collected during four time periods from AJ backwater. In autumn 2010, 42 and 60 juvenile fin clips were taken from Dandy and AJ backwaters, respectively. In spring of 2011, no larvae were found in Dandy backwater despite extensive effort, while 308 larvae were collected from AJ backwater, representing five time periods. Juveniles had not been collected for autumn 2011 at the time of this report.

DNA was extracted from all adults and progeny as described in Tibbets and Dowling (1996). Unfortunately none of the extractions from juvenile fin clips sampled in 2010 yielded usable DNA because the fin clips were stored in methylated alcohol that interferes with amplification. Samples of each parent and larvae was characterized with 14 dinucleotide microsatellite markers using the technical and statistical methods described in Turner et al. (2009) and Dowling et al. (in review a, b). Each of the larvae genotyped were assigned to parental pairs using the program MYKISS (Kalinowski 2008).

All of the adults stocked into Dandy backwater during 2010, as well as 207 of 209 of the larvae collected, were genotyped. The 207 larvae were unambiguously assignable to 67 of the adults stocked (36 dam and 31 sires), representing 83 unique dam-sire pairings (Table 2). Several larvae represented identical dame-sire pairings collected over multiple dates spanning the spawning season, with 30 representing the most common pairing. We hypothesize that those larvae are from the same spawning date, but were captured during various stages of their development.

All of the adults stocked into AJ backwater during 2010, as well as 210 of the 216 larvae collected, were genotyped. Six larval samples could not be characterized due to poor DNA quality. The 210 larvae were unambiguously assignable to 105 of the adults stocked (66 dames and 39 sires) and represented 157 unique dame-sire pairings (Table 2). Similar to Dandy there

were several larvae representing identical dame-sire pairings collected over multiple dates spanning the spawning season, with 10 representing the most common pairing. We also think that those larvae are from the same spawning date, but were captured during various stages of their development.

All of the adults stocked into AJ backwater during 2011, as well as 305 of 308 larvae collected, were genotyped. Three larvae could not be characterized due to poor DNA quality. Each of the remaining 305 larvae were assigned to parental pairs using the program MYKISS (Kalinowski 2008) and represented 137 of the adults stocked (68 dames and 69 sires). There were 241 unique dame-sire pairings (Table 2). Again there were several larvae representing identical dame-sire pairings collected over multiple dates spanning the spawning season, with nine representing the most common pairing. In this year each larva was measured prior to DNA extraction to try to pinpoint if they were from the same spawning date. We have yet to develop an age-growth curve to estimate birthdates for each individual. If they share birthdates, they are likely siblings.

There appears to be a difference in reproductive potential/success between the two backwaters as larvae were much easier to collect in AJ than Dandy (Table 3). This is also reflected in contribution to larvae sampled. For 2010, a minimum of 33% (67 of 200) of the adults contributed to larvae sampled in Dandy. The minimum number of parents was much higher in AJ, with 52% (105 of 200) and 68% (137 of 200) of the adults represented in 2010 and 2011, respectively. In addition, larvae sampled in AJ were much more likely to be produced by a unique pair of individuals than those from Dandy.

Therefore, given the right conditions, a high level of reproduction can be achieved using backwater habitats, with large numbers of adults contributing. It will be of interest to examine

genetic diversity in the juveniles to test for nonrandom survivorship and to continue to assess consistency across years.

Literature cited

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Table 1. Summary of the number of adult razorback sucker detected by remote sensing or harvest from Dandy and Arizona Juvenile backwaters in 2010 and 2011. Small size of adults stocked in 2010 made sex determination difficult, so sex of individuals was inferred using maternity-paternity projections for larvae generated with microsatellites.

Date	Females	Males
Dandy		
2/17/2010 (Stocking)	99	101
3/15/2010	94	82
3/17/2010	93	82
3/29/2010	88	68
4/21/2010	84	65
4/29/2010	84	65
Harvested	84	64
Arizona Juvenile		
2/17/2010 (Stocking)	129	71
3/16/2010	117	61
3/18/2010	116	58
4/1/2010	109	49
4/26/2010	96	39
Harvested	86	35

Date	Females	Males
Dandy		
12/28/2011 (Stocking)	101	99
2/17/2011	85	88
3/14/2011	69	58
3/29/2011	67	38
4/27/2011	66	29
5/23/2011	66	28
Harvested	66	28
Arizona Juvenile		
12/28/2011 (Stocking)	100	100
2/17/2011	100	94
3/14/2011	83	69
3/29/2011	78	60
4/27/2011	76	48
5/23/2011	75	45
Harvested	70	42

Table 2. A summary of the number of larvae collected from Dandy and Arizona Juvenile backwaters in 2010 and 2011, with the number of parents that are associated with each collection date.

Date	Number of Larvae Collected and Genotyped	Number of Dames	Number of Sires
Dandy			
03/17/2010	16	1	2
03/30/2010	31	12	12
04/07/2010	50	23	20
04/14/2010	11	8	7
04/21/2010	50	21	17
04/26-29/2010	49	21	18
Arizona Juvenile			
03/18/2010	20	3	3
04/01/2010	47	29	26
04/14/2010	79	38	34
04/26/2010	64	36	27
03/15/2011	28	7	18
03/16/2011	30	15	22
03/31/2011	49	28	34
05/03/2011	99	46	45
05/24/2011	99	42	41

Table 3. Summary of reproductive output for Arizona Juvenile and Dandy backwaters after stocking with 200 adult razorback suckers for both 2010 and 2011. The percentage of unique dame-sire pairings is the number of distinct dame-sire pairing divided by the total number of larvae genotyped.

Year	Backwater	Number of larvae genotyped	Number of Dames	Number of Sires	Percentage of Unique Dame-Sire Pairings
2010	Dandy	207	36	31	40%
2011	Dandy	NA	NA	NA	NA
2010	Arizona Juvenile	210	66	39	75%
2011	Arizona Juvenile	305	68	69	79%