



# Lower Colorado River Multi-Species Conservation Program

*Balancing Resource Use and Conservation*

**COLORADO RIVER FISHES DATABASE MANAGEMENT  
OCTOBER 1, 2005 to SEPTEMBER 30, 2006**



September 2007

# **Lower Colorado River Multi-Species Conservation Program Steering Committee Members**

## **Federal Participant Group**

Bureau of Reclamation  
Fish and Wildlife Service  
National Park Service  
Bureau of Land Management  
Bureau of Indian Affairs  
Western Area Power Administration

## **Arizona Participant Group**

Arizona Department of Water Resources  
Arizona Electric Power Cooperative, Inc.  
Arizona Game and Fish Department  
Arizona Power Authority  
Central Arizona Water Conservation District  
Cibola Valley Irrigation and Drainage District  
City of Bullhead City  
City of Lake Havasu City  
City of Mesa  
City of Somerton  
City of Yuma  
Electrical District No. 3, Pinal County, Arizona  
Golden Shores Water Conservation District  
Mohave County Water Authority  
Mohave Valley Irrigation and Drainage District  
Mohave Water Conservation District  
North Gila Valley Irrigation and Drainage District  
Town of Fredonia  
Town of Thatcher  
Town of Wickenburg  
Salt River Project Agricultural Improvement and Power District  
Unit "B" Irrigation and Drainage District  
Wellton-Mohawk Irrigation and Drainage District  
Yuma County Water Users' Association  
Yuma Irrigation District  
Yuma Mesa Irrigation and Drainage District

## **Other Interested Parties Participant Group**

QuadState County Government Coalition  
Desert Wildlife Unlimited

## **California Participant Group**

California Department of Fish and Game  
City of Needles  
Coachella Valley Water District  
Colorado River Board of California  
Bard Water District  
Imperial Irrigation District  
Los Angeles Department of Water and Power  
Palo Verde Irrigation District  
San Diego County Water Authority  
Southern California Edison Company  
Southern California Public Power Authority  
The Metropolitan Water District of Southern California

## **Nevada Participant Group**

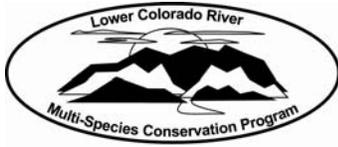
Colorado River Commission of Nevada  
Nevada Department of Wildlife  
Southern Nevada Water Authority  
Colorado River Commission Power Users  
Basic Water Company

## **Native American Participant Group**

Hualapai Tribe  
Colorado River Indian Tribes  
The Cocopah Indian Tribe

## **Conservation Participant Group**

Ducks Unlimited  
Lower Colorado River RC&D Area, Inc.



# Lower Colorado River Multi-Species Conservation Program

**COLORADO RIVER FISHES DATABASE MANAGEMENT,  
OCTOBER 1, 2005 to SEPTEMBER 30, 2006**

Lower Colorado River  
Multi-Species Conservation Program Office  
Bureau of Reclamation  
Lower Colorado Region  
Boulder City, Nevada  
<http://www.lcrmscp.gov>

September 2007

**COLORADO RIVER FISHES DATABASE MANAGEMENT,  
OCTOBER 1, 2005 to SEPTEMBER 30, 2006**

Final Annual Report  
to  
U.S. Bureau of Reclamation  
Lower Colorado Region  
Boulder City, NV 89006-1470  
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## SUMMARY

Among the primary purposes of the Colorado River native fishes database is support for periodic estimation of population abundance of razorback sucker in Lake Mohave in behalf of the species conservation in the lower basin. The March 2005 population estimate (based on sample data for 2005 and 2006) for wild adult razorback sucker in the lake was 507 fish, which was slightly (but not significantly) higher than the March 2004 estimate of 421 fish. The March 2005 repatriate razorback sucker population estimate was 4,221 fish, which was more than twice the 2004 estimate of 1,497 fish and represents about 3.9% of more than 108,000 fish stocked prior to March 1, 2005.

## BACKGROUND AND DATABASE MANAGEMENT

Arizona State University (ASU) has served for nearly 20 years as a central repository of field data gathered by the lower Colorado River Lake Mohave Native Fish Work Group (NFWG) which formed in 1990 with representation from Arizona Game and Fish Department (AZGFD), ASU, Biological Resources Division of U.S. Geological Survey (BRD-GS), Nevada Department of Wildlife (NDOW), U.S. Bureau of Reclamation (BR), U.S. Fish and Wildlife Service (FWS) and U.S. National Park Service (NPS). The primary mission of the NFWG is to capture and rear native lower Colorado River fishes for repatriation, in particular razorback sucker, *Xyrauchen texanus*. Larvae are collected annually during the winter-spring spawning season from the shallows along Lake Mohave's shorelines, and these initially were reared in several off-site facilities including Willow Beach National Fish Hatchery (NFH) AZ, Boulder City NV Golf Course Ponds, and Boulder City NV Wetland Ponds; the last two sites are no longer in service for native fish. Some fish are (or were) stocked directly into the lake from these sites, while others are retained at Willow Beach NFH or transferred for grow-out at various locations, including predator-free lakeside backwaters such as Yuma and Davis Coves in AZ, and Dandy and Chemehuevi Coves in NV, Lake Mohave. Once they attain a size thought to be relatively safe from predation (initially 25 cm, now increased to 50 cm), the juvenile fish are tagged with PIT tags, measured and stocked into the lake.

In addition to capturing young, the NFWG continues to oversee Lake Mohave monitoring programs that periodically assess population status of wild adult and repatriated razorback suckers, and other components of the fish community. W.L. Minckley and ASU initiated these programs in 1968. Members of the NFWG annually revisit the same localities at the same times of year and deploy the same kind of collection devices, capturing untagged and previously PIT-tagged native fishes as well as many non-native species. Field expeditions typically occur in May, March (also referred to as the Razorback Round-up) and November, generally targeting post-spawning, spawning and pre-spawning periods, respectively, and employing several fishing methods, primarily with trammel netting and electrofishing. It is during these expeditions that repatriates are captured and/or recaptured, generally as mature adults as they co-mingle with the few remaining wild adults on spawning grounds, but also as juveniles at scattered locations.

Field data sheets are regularly received at ASU and data are manually entered into electronic Excel spreadsheets (Microsoft® Excel 2000, © 1985-1999 Microsoft Corporation) while electronic data files are generally received already in Excel. Data generally include collection or stocking date, collection location, stocking or rearing site with associated state and river mileage (north from Davis Dam, for Lake Mohave), Global Positioning System (GPS) coordinates in either Universal Transverse Mercator (UTM) coordinates or in latitude/longitude degrees/minutes, agency, gear, PIT tag number, total length (TL in mm or cm), weight (g or lb), sex, status and field comments. Sex categories are defined as "juvenile" (a young fish that has not attained sexual maturity and does not exhibit external secondary characters that allow reliable sex determination), male, female, and "unknown" (an adult fish whose sex cannot reliably be determined). Status refers to fish capture, recapture or stocking history, and field comments are generally related to fish health but also may indicate mortality or involvement in an in-situ or hatchery research study.

All manually-entered PIT tagging data are proofed using text to speech software (Zoom Text® 8.1, © 2003-2004 Ai Squared) before they are imported into the NFWG's

database maintained in Access (Microsoft® Access 2000, ©1992-1999 Microsoft Corporation); electronic data files are generally sorted for duplicates, but not proofed. All razorback sucker data from reservoirs Mead, Mohave, Havasu and below Parker Dam are maintained in this single database, using a species/reservoir identification key to differentiate between reservoirs, and a record identification number to identify each individual record regardless of reservoir. Data queries are initiated based on information requirements and generically written to accommodate any reservoir.

ASU typically handled several dozen requests for specific searches each year from biologists working for a suite of state and federal entities until we made access to the database via the internet in FY 2005. This allowed NFWG members easier and faster retrieval of fish capture histories, capable of searching for one PIT tag/search online. However we also did this because the database in its entirety was no longer made available to NFWG members in any software format due to its complexity and size. Currently our website is hosted by Arizona State University.

This report provides a summary and analysis of information on razorback sucker and an assessment of wild adult and repatriated population status as of March 2005. For clarification, “short-term capture(s)” are captures within the same sampling period as capture.

## RESULTS

The Lake Mohave survey on 13-17 March 2006 captured 199 razorback suckers of which 27 (14%) were untagged and 172 (86%) were PIT-tagged (Table 1). Among all fish, 79 (40%) were female, 96 (48%) were male, 8 (4%) were juvenile, and 16 (8%) were of indeterminate sex. There were 10 short-term captures among the 172 encounters with 162 PIT-tagged fish, and these were omitted from further analysis. Of the remaining 162 PIT-tagged fish, 78% ( $N = 127$ ) were repatriates while 19% ( $N = 30$ ) were wild adults; five fish were not represented in the database and therefore categorized as “unknown” (Table 2). Ratio of tagged wild females to males (18:12) was

skewed toward females. Among repatriates collected, there were nearly half as many females as males (37:67). Off-site rearing facilities contributed 64% of the total number of repatriated fish sampled during the survey, with both off-site and lakeside backwaters supplying fish with average TL at stocking larger than 30 cm with the exception of fish reared Boulder City Golf Course ponds (Table 3). Release year ranged from 1992 to 2006. Approximately 20% of repatriates collected were released in 2006 ( $N = 25$  fish), and the average size of these fish at release was 41 cm (36 to 47 cm, min-max) (Table 4). Appendix A provides a summary of the rearing and release locations of repatriated razorback sucker collected with PIT tags 13-17 March 2006 in Lake Mohave.

#### Wild Adult Population Size

Wild adult razorback sucker population abundance of 507 fish as of March 2005 was estimated from 2005 and 2006 sample data and using the adjusted Peterson Method formula (i.e., the single census Chapman modification, Ricker 1975). The 95% confidence interval ranged from 263 to 1,067 fish. This estimate is significantly less than the most recently published estimate of 2,698 in 2001 (Marsh et al. 2003), which was derived from all of March data in 2001 and 2002; however, it confirms the dramatic population decline over the past decade when the estimate was near 44,000, which was still at that time substantially lower than historical estimates (see Minckley et al. 2003).

#### Juvenile Repatriate Stocking and Repatriate Population Size

From October 1, 2005 through September 30, 2006, a total of 15,321 razorback suckers juveniles were stocked into Lake Mohave, of which 15,255 fish were PIT-tagged; 66 fish with either missing or duplicate PIT tags were not included in any further analysis (Appendix B). The majority of fish were reared at the off-site facility, Willow Beach National Fish Hatchery ( $N = 13,536$  fish). Of the fish reared in lakeside backwaters ( $N = 1,583$  fish), Yuma Cove (Arizona Bay) AZ was the most productive backwater overall, contributing 956 fish.

Repatriation population size was estimated using March-only captures (1 March to 31 March) from 2005 and 2006 without short-term capture data and applying it to a modified Peterson method formula (i.e., Chapman modification; Seber 1973). The March 2005 repatriate razorback sucker population estimate was 4,221 fish, which was more than twice the 2004 estimate of 1,497 fish and represents about 3.9% of more than 108,000 fish stocked prior to March 1, 2005.

## CONCLUSIONS

Since 1992, the program to replicate the dwindling Lake Mohave population of wild adult razorback suckers with juveniles has been successful in repatriating a population of about 4,221 fish as of March 2005. However, that number is far from the target of 50,000 repatriates, and the wild population now has dwindled from probable recent-historical levels in the hundreds of thousands to fewer than 500. Repatriate capture/recapture data demonstrate unequivocally that fish released at larger size have a higher survival probability than smaller fish. Young razorback suckers should be reared to an individual minimum total length of 50 cm prior to release, and larger sizes should be attained if practical, even if that means fewer fish are being released.

We are perplexed by the apparent low overall survivorship of repatriated razorback suckers in Lake Mohave. It was predicted that a substantial increase in survivorship would accompany an increase in size at stocking, but this has not yet been reflected in the available capture data. This may change with the recent (2007) increase to 50 cm.

## ACKNOWLEDGEMENTS

NFWG members representing ASU, AZGFD, BR, FWS, NDOW, NFS and USGS-BRD and others are thanked for their continuing logistic and programmatic support. Appreciation is extended to all participants in field operations as well as Brian Kesner for statistical support and Marco Lopez Ivich for database support. Special appreciation for their leadership roles goes to Tom Burke (BR), Mike Burrell (NDOW), Andy Clark

(AZGFD), C.O. Minckley (FWS, now retired), Gordon Mueller (USGS-BRD) and Ross Haley (NPS). Reclamation, Boulder City NV provided funding for this project.

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Table 1. Field data summary for razorback sucker collected 13-17 March 2006 in Lake Mohave, AZ-NV.

Sampling agency	N fish (% Total; % Sum)		Sum (% Sum total)
	Without PIT tags	With PIT tags	
ASU	-	12 (7;100)	12 (6)
BR	10 (37;19)	44 (26;81)	54 (27)
FWS	12 (44;20)	49 (28;80)	61 (31)
NDOW and NPS	5 (19;7)	67 (39;93)	72 (36)
Total (% Sum total)	27 (14)	172 (86)	199
Fish gender			
Female	15 (55;19)	64 (37;81)	79 (40)
Male	11 (41;11)	85 (49;89)	96 (48)
Juvenile	-	8 (5;100)	8 (4)
Unknown	1 (4;6)	15 (9;94)	16 (8)
Total (% Sum total)	27 (14)	172 <sup>a</sup> (86)	199

<sup>a</sup>Includes 10 fish that were short-term captures.

Table 2. Summary of razorback sucker collected with PIT tags 13-17 March 2006 in Lake Mohave, AZ-NV. Classification into one of the three categories (wild, repatriate and unknown) was based upon information in the NFWG razorback sucker database; fish listed as unknown were recorded as "recaptures" in the field data, but had no information in the database to identify them as either wild adult or repatriate.

Fish gender	N fish (% Total; % Sum)			Sum (% Sum total)
	Wild adult	Repatriate	Unknown	
Female	18 (60;31)	37 (29;65)	2 (40;3)	57 (35)
Male	12 (40;15)	67 (53;82)	3 (60;4)	82 (51)
Juvenile	-	8 (6;100)	-	8 (5)
Unknown sex	-	15 (12;100)	-	15 (9)
Total (% Sum total)	30 (19)	127 (78)	5 (3)	162 <sup>a</sup>

<sup>a</sup>Ten fish were short-term captures and omitted from further analysis.

Table 3. Rearing locations and average TLs in mm at release of repatriated razorback sucker collected with PIT tags 13-17 March 2006 in Lake Mohave, AZ-NV.

Rearing location	N fish (% Total; % Grand total)	Release TL (mm)			
		Avg	SD	Min	Max
Lakeside backwater					
Arizona Juvenile	7 (15;6)	341	39	301	405
Davis Cove	3 (7;2)	302	87	234	400
Nevada Egg	1 (2;<1)	370	-	-	-
Nevada Larvae	4 (9;3)	317	50	250	370
Nine Miles Cove	2 (4;1)	320	49	285	355
North Chemehuevi Cove	1 (2;<1)	345	-	-	-
South Sidewinder Cove	6 (13;5)	307	33	268	350
Yuma Cove	21 (47;17)	355	85	223	520
Total (% Grand total)	45 (36)	338	68	-	-
Off-site facility					
Boulder City Golf Course Ponds	7 (9;6)	295	46	245	370
Boulder City Wetlands Park	24 (30;19)	356	56	250	450
Bubbling Ponds	5 (6;4)	318	34	275	370
Willow Beach NFH	45 (55;36)	389	32	310	465
Total (% Grand total)	81 (64)	366	51	245	465
Grand total	126 <sup>a</sup>	356	59	-	-

<sup>a</sup>One fish without capture data was omitted from this total and from further analysis.

Table 4. Time at large of repatriated razorback sucker collected with PIT tags 13-17 March 2006 in Lake Mohave, AZ-NV. Time at large is differentiated into days at large (DAL), months at large (MAL) and years at large (YAL).

Release year	<i>N</i> fish	DAL	MAL	YAL
2006	25	51	2	0
2005	18	287	10	1
2004	10	633	21	2
2003	2	952	32	3
2002	5	1,327	44	4
2001	11	1,693	56	5
2000	8	2,030	68	6
1999	11	2,385	79	7
1998	7	2,708	90	8
1997	3	3,131	104	9
1996	15	3,389	113	9
1995	4	3,738	125	10
1994	3	4,246	142	12
1993	1	4,495	150	12
1992	3	4,805	160	13
Total	126	-	-	-

Appendix A. Rearing and release locations of repatriated razorback sucker collected with PIT tags 13-17 March 2006 in Lake Mohave, AZ-NV.

Location		N fish
Rearing	Release	
Lakeside backwater		
Arizona Juvenile	Castle Cliff Light and Owl Point Cove	1
	Honey Hole	3
	Nine Mile Coves	1
	Tequila Cove	1
	Yuma Cove berm	1
Davis Cove	Tequila Cove	3
Nevada Egg	Tequila Cove	1
Nevada Larvae	Honey Hole	2
	Nine Mile Coves	1
	Tequila Cove	1
Nine Mile Coves	Yuma Cove berm	2
North Chemehuevi Cove	Honey Hole	1
South Sidewinder Cove	Carp Cove	1
	Honey Hole	1
	Nevada Larvae	1
	Tequila Cove	1
	Yuma Cove berm	2
Yuma Cove	Nine Mile Coves (north of)	1
	Nine Mile Coves (south of)	1
	Nine Mile Coves area at submerged willow tree	1
	Tequila Cove	11
	Waterwheel and Carp Coves (between)	1
	Yuma Cove berm	6
Total		45
Off-site facility		
Boulder City Golf Course Ponds	Honey Hole	1
	Nine Mile Coves area at submerged willow tree	1
	Tequila Cove	3
	Yuma Cove berm	2
Boulder City Wetlands Park	Carp Cove	3
	Cottonwood Basin East	1
	Honey Hole	2
	Nevada Larvae	1
	Nine Mile Coves	2

Appendix A, continued. Rearing and release locations of repatriated razorback sucker collected with PIT tags 13-17 March 2006 in Lake Mohave, AZ-NV.

Location		N fish
Rearing	Release	
Off-site facility		
Boulder City Wetlands Park	Nine Mile Coves (north of)	2
	Nine Mile Coves (south of)	1
	Nine Mile Coves area at submerged willow tree	1
	Tequila Cove	8
	Yuma Cove berm	3
Bubbling Ponds FH	Carp Cove	1
	Honey Hole	1
	Nine Mile Coves (north of)	1
	Nine Mile Coves area at submerged willow tree	1
	Tequila Cove	1
Willow Beach NFH	Carp Cove	2
	Castle Cliff Light and Jeff Davis Cove	1
	Castle Cliff Light and Owl Point Cove	1
	Cottonwood Basin East	2
	Half-way Wash (south of)	1
	Honey Hole	2
	Nine Mile Coves	3
	Nine Mile Coves (north of)	2
	Nine Mile Coves (south of)	1
	Nine Mile Coves area at submerged willow tree	2
	Tequila Cove	15
	Yuma Cove berm	13
Total		81
Total lakeside backwaters and off-site facilities		126

Appendix B. Rearing and release locations of repatriated PIT-tagged juvenile razorback suckers reared in lake-side backwaters repatriated in Lake Mohave, AZ-NV, October 1, 2005 to September 30, 2006. Sixty-six fish with either missing or duplicate PIT tags were not included in this table.

Location		N fish	Avg	SD	Min	Max
Rearing	Release					
Lakeside backwater						
Arizona Juvenile	Arizona Juvenile	189	238	37	150	295
Dandy Cove	Dandy Cove	376	382	27	310	485
Nevada Egg	Nevada Egg	6	445	19	420	470
Nevada Larvae	Nevada Larvae	18	370	22	325	420
Willow Cove	Willow Cove	38	444	23	390	495
Yuma Cove	Yuma Cove	956	395	47	220	555
Total		1,583	374	66	-	-
Offsite facility						
Dexter NFH	Princess Cove	136	382	33	350	530
Willow Beach NFH	45 to 49 RM	1,583	376	19	350	450
	48.4 RM	121	365	19	315	420
	48.45 RM	184	363	17	310	405
	48.5 RM	107	367	15	330	410
	49.5 RM	147	367	19	325	440
	Antelope Cove	504	377	21	350	450
	Apache Tear Cove	520	388	29	350	505
	Arizona Juvenile	993	391	28	340	485
	Catclaw to Great West Cove	838	374	19	350	450
	Fortune Cove	1,034	377	23	315	470
	Gold Cove	548	391	27	345	470
	Nevada Bay	496	370	19	350	520
	Nevada Sheep Cove (south of)	124	367	18	330	430
	Owl Cove	652	388	26	350	475
	Perkins and Valhalla Coves	1,205	356	28	235	480
	Perkins Cove (south of)	498	406	25	350	475
	Pot Cove	518	379	22	350	450
	Red Tail Cove	322	382	25	350	460
	Ringbolt Rapids	49	364	18	350	440
	Willow Beach NFH	1,084	366	18	305	435
Wrong Cove	518	391	25	350	460	
Yuma Cove	1,491	380	22	350	465	
Total		13,672	378	26	235	530
Total lakeside backwaters and off-site facilities		15,255	377	32	-	-