



Lower Colorado River Multi-Species Conservation Program

Balancing Resource Needs

Final Fish Augmentation Plan



August 16, 2006

Lower Colorado River Multi-Species Conservation Program Implementation 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.



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Multi-Species Conservation Program Office
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Lower Colorado Region
Boulder City, Nevada
<http://www.usbr.gov/lc/lcrmscp>

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Introduction

The Lower Colorado River Multi-Species Conservation Program (LCR MSCP) is a multi-stakeholder Federal and non-Federal partnership responding to the need to balance the use of lower Colorado River (LCR) water resources and the conservation of native species and their habitats in compliance with the Endangered Species Act (ESA). This is a long-term (50-year) plan to conserve at least 26 species along the LCR from Lake Mead to the Southerly International Boundary with Mexico through the implementation of a Habitat Conservation Plan. Most of the covered species are State and/or Federally-listed special status species. The Bureau of Reclamation (Reclamation) is the entity responsible for implementing the LCR MSCP over the 50-year term of the program. A Steering Committee currently consisting of 56 entities has been formed, as described in the *LCR MSCP Funding and Management Agreement* (LCR MSCP 2005) to provide input and oversight functions to support of LCR MSCP implementation.

This plan sets forth the implementation strategy for the augmentation stockings of 660,000 razorback sucker and 620,000 bonytail into the LCR and its connective channels, as described in the *LCR MSCP Habitat Conservation Plan* (HCP) (LCR MSCP 2004). Included in the numbers of fish for augmentation stockings shown above, are commitments to stock at least 270,000 razorback suckers and 200,000 bonytail in LCR MSCP Reaches 4 and 5 (Reach 4/5) (CDFG 2005).

Background

Razorback Sucker

As of January 2006, only two wild populations of razorback sucker are known to be in existence in the Colorado River below Grand Canyon. One small population (less than 500 adults) occupies Lake Mead, and a somewhat larger population (less than 1,000 fish) can be found in Lake Mohave. Both populations are under active study through separate actions, and both populations have been augmented in the past decade. Only augmented razorback sucker populations occupy the lakes and river reaches downstream of Davis Dam. These augmented populations have been established over the past two decades from releases of more than 100,000 razorback suckers by state and Federal agencies.

Bonytail

At this time it appears that no wild populations of bonytail exist in the LCR. It is possible that a few wild bonytail remain in Lake Mohave, but attempts to locate such fish have been unsuccessful for a number of years. Augmented populations of this species are known to be in

both Lake Havasu and Lake Mohave, and may be found in the river between these two reservoirs. No stocking of this species into the main river has occurred downstream of Parker Dam. However, fish were inadvertently released into the river near Parker, Arizona when they escaped from a local golf course pond through an outfall drain. Bonytail have been stocked into two isolated floodplain ponds within Reach 4/5: Cibola High Levee Pond near Blythe, California, and Achii Hanyo Hatchery ponds near Parker, Arizona.

Goal

The target goal of the augmentation program is to provide a total of 660,000 razorback sucker and 620,000 bonytail for reintroduction into the Colorado River over a fifty year period as a step toward recovery of the species.

Implementation Components

The primary components of implementing the fish augmentation program are:

- Brood stock,
- Fish rearing facilities and production goals,
- Stocking considerations,
- Monitoring and research considerations,
- Record keeping and data management,
- Conditions and criteria under which fish augmentation may cease, and
- Alternative measures to minimize and fully mitigate for authorized take in event fish augmentation measures cease.

Brood Stock

The extensive fish augmentation program committed to by the LCR MSCP cannot be accomplished without substantial brood stocks of razorback sucker and bonytail. These brood stocks must be of sufficient quantity and quality to sustain program needs for many years. Quantity and quality factors include considerations of general health, reproductive vigor and genetic make-up in order to assure maintenance of adequate genetic diversity of offspring produced and to guard against either genetic swamping or bottle-necking. The LCR MSCP will support the development and/or maintenance of brood stocks for each of the two fishes through the fish augmentation program.

For the razorback sucker, the Lake Mohave population has been recognized as the best genetic stock of this species. The Lake Mohave Native Fish Work Group was organized in 1989 for the sole purpose of rebuilding this brood stock to a population size of 50,000 adult fish.

Maintenance of this stock is a project feature of the LCR MSCP. The primary action being implemented is the capture of larval suckers from spawning areas each spring. The lake is divided up into different spawning zones, and quotas for larvae are set per zone per month. The larvae are then reared in captivity and returned to the lake as sub-adult fish. Over 300,000 larvae have been captured to date, and more than 100,000 juveniles have been repatriated since the Native Fish Work Group began (Table 1).

Table 1. Razorback Suckers Repatriated into Lake Mohave

YEAR	LAKESIDE PONDS	BOULDER CITY	FISH HATCHERIES	YEARLY TOTAL	CUMULATIVE TOTAL
1992	150			105	150
1993	542			542	692
1994	2,310			2,310	3,002
1995	1,645			1,645	4,647
1996	1,649	626		2,275	6,922
1997	3,303	2,504	1,615	7,422	14,344
1998	2,100	3,982	1,574	7,656	22,000
1999	3,591	3,906	8,533	16,030	38,030
2000	1,744	1,726	3,740	7,210	45,240
2001	2,705	2,343	6,348	11,396	56,636
2002	1,635	1,018	7,820	10,473	67,109
2003	1,716	266	14,859	16,483	83,952
2004	1,963		15,303	17,266	101,218
2005	1,691		10,509	12,200	113,418
TOTAL	26,746	16,371	70,301	---	113,418

Concurrent with larvae capture and off-site rearing, sub-samples of both the larvae removed from the lake and of the repatriates returned to the lake have been provided to Dr. Tom Dowling at Arizona State University for genetic analyses. Dr. Dowling was asked to compare the genetic diversity of each group with the known genetic diversity of the original founder population which occupied the lake in the early 1980s (based on mitochondrial DNA analyses). In response to the question, “Has the Native Fish Work Group successfully replaced the genetic diversity found in the original Lake Mohave spawning stock?”, Dr. Dowling concluded that the larvae captured did indeed represent the level of diversity of the parent stock. He also determined that the repatriates returned into the lake reflected the level of diversity found in the original spawning stock. There have not been enough collected samples of repatriated adults to determine if the spawning stock has been successfully replaced.

For bonytail, the U.S. Fish and Wildlife Service (Service) maintains the only brood stock for this species at Dexter National Fish Hatchery and Technology Center (Dexter), near Roswell, New Mexico. The original stock (parents of current brood fish) came from Lake Mohave from 1975 to 1985. Dexter has developed a captive management strategy which establishes protocols for

annual bonytail production to insure maximizing genetic diversity through time. Dexter hand-spawns bonytail each year and distributes fry, fingerling, sub-adults and adults throughout the Colorado River Basin.

Fish Rearing Facilities and Production Goals

The Service and the states of Arizona, Nevada, and California have mandated responsibility for fish and wildlife within the LCR MSCP project area. Each state agency (Arizona Game and Fish Department [AGFD], California Department of Fish and Game [CDFG], and Nevada Department of Wildlife [NDOW]) operates and maintains fish rearing facilities. As the lead implementation agent for the LCR MSCP, Reclamation will continue to work closely with these agencies to accomplish the augmentation requirements for razorback sucker and bonytail. Evaluation of the rearing production at existing state and Federal facilities indicates that they can produce all of the fish necessary to complete this conservation measure and that construction of new fish hatcheries will not be required.

At this time, the program will provide support to the following existing facilities which are currently rearing one or more of these species or have agreed to either enter into or to continue a partnership with the LCR MSCP to provide rearing space for these fishes:

- Willow Beach National Fish Hatchery,
- Achii Hanyo Native Fish Rearing Facility,
- Dexter National Fish Hatchery,
- Bubbling Ponds Hatchery,
- Lake Mead Hatchery,
- Uvalde National Fish Hatchery, and
- Overton Wildlife Management Area.

Maintenance, repair and replacement of infrastructure may be required at one or more of these facilities to develop and maintain needed fish rearing capabilities/capacities.

While not a comprehensive list, these activities will include such routine items as:

- Repairing/replacing solar and/or electric heating equipment,
- Repairing/replacing pond liners,
- Develop/repair/replace water delivery systems including pipes, valves, pumps, well motors, head-box boards, etc.,
- Construct new ponds,
- Install/repair fish collection kettles,
- Repair/replace bird netting and other predator control devices,
- Maintain access roads, work areas, lighting, security systems (alarms, fences), and
- Repair/replace backup power generators, load banks, electric service components.

Razorback Sucker Rearing Facilities

Reclamation has been working successfully since 1994 with both the Service at Willow Beach National Fish Hatchery (Willow Beach) and AGFD at Bubbling Ponds Fish Hatchery (Bubbling Ponds) to develop and expand their warm-water fish rearing capabilities. The focus has been on the refurbishing and retrofitting of existing facilities. Willow Beach and Bubbling Ponds have both demonstrated capability to produce 10,000 or more sub-adult razorback sucker per year. Dexter also raises razorback sucker, and routinely produces 3,000 to 5,000 razorback sucker fingerlings for distribution throughout the southwest. (Dexter is currently rearing razorback sucker to 500 mm for Lake Mohave to support brood stock development described previously.) Nevada Division of Wildlife's Lake Mead Hatchery has recently undergone major renovation and now has a portion of the facility dedicated to rearing native fishes. Over the past five years all of these facilities have collectively stocked out more than 20,000 razorback suckers per year to the LCR. Additional existing hatcheries, such as Uvalde National Fish Hatchery in west Texas, may be used for short periods to provide additional fish needed for brood stock development or for specific research actions.

Bonytail Rearing Facilities

Reclamation is working with the Service at three primary facilities to provide bonytail for the LCR MSCP: Dexter, Willow Beach and Achii Hanyo. Dexter maintains bonytail brood stock, produces fry and fingerling fish for the other two sites, and rears bonytail annually for release into the LCR. Willow Beach currently rears fingerlings for distribution to Achii Hanyo rearing station near Parker, Arizona. Willow Beach is currently rearing bonytail for stocking into Lake Mohave as a prior and separate commitment from the LCR MSCP. Until such time that this commitment is completed (estimated to occur in 2016), Dexter and Achii Hanyo will be the primary facilities providing sub-adult fish for LCR MSCP. Once the Service completes its Lake Mohave obligations, Willow Beach will provide bonytail for LCR MSCP requirements. (During FY06 Reclamation and the Service began work at Uvalde Hatchery in west Texas to determine the capability of this site for rearing bonytail.)

Production Goals

The fish augmentation program production needs are for 660,000 razorback sucker and 620,000 bonytail for stocking into the LCR MSCP waters. These augmentation stockings are of three types. In Type I, there are requirements to stock fish for simple population development/maintenance, with a few thousand fish to be stocked each year for 40 to 50 years. In Type II, fish are to be released in large quantities each year for five consecutive years. Type III stocking is to complete specific actions associated with conservation measures from previous ESA consultations that were incorporated into the program by the signing of the LCR MSCP.

These fish will all be reared at one or more of the hatcheries listed previously. These hatcheries are interrelated and dependent upon each other to affect this augmentation program. Reclamation believes that there currently is sufficient capacity among these hatcheries to rear the numbers of fish needed for the Type I and Type III stockings through 2011, and that sufficient capacity will be attained by 2011 to start the expanded stocking actions required to initiate the adaptive management research (Type II). (This expanded capacity will result from completion of refurbishment projects.)

Razorback Sucker Production Goals

Production needs for razorback sucker are 660,000 fish over 50 years. Razorback sucker production will require the annual capture of 60,000 to 75,000 larvae from Lake Mohave, all to be delivered to Willow Beach. Of these, 20,000 to 25,000 will be reared to fingerling size and shipped to Bubbling Ponds for rearing and ultimate stocking into Reaches 3 and 4/5 of the LCR (Type I stockings). Another 20,000 larvae will be reared at Willow Beach for repatriation to Lake Mohave as continued brood stock development, and to provide a backup source of fish for the Bubbling Ponds crop (Type III stockings). The remaining larvae are targeted for use at LCR MSCP backwater renovation sites as needed. Most of these fish will require 2 to 4 years grow out before being released. For any given year, each facility should receive an annual allotment of new fish, have one or two year classes on hand from previous years, and produce sub-adult fish of sufficient size for augmentation stocking.

The proposed routing for razorback sucker utilized in the augmentation program is diagrammed below (Figure 1a). The routing from Willow Beach to Bubbling Ponds to Reaches 3 and 4/5 is the Type I stocking and requires 300 mm fish. The routing from Willow Beach, Dexter and Uvalde to Lake Mohave is Type III stocking and currently requires 500 mm fish. (Target size increased from 350 mm to 500 mm at April 2006 Lake Mohave Native Fish Work Group meeting.) These larger fish are needed to accelerate development of the adult razorback sucker brood stock. Reclamation expects that once this brood stock has been developed (target population of 50,000 adults), Willow Beach will be able to rear sufficient razorback sucker to maintain the adult population and that support from Dexter and Uvalde will not be required. (These latter two facilities may then be available to support razorback sucker needs for Type II stockings.)

Because of the extensive work accomplished by Reclamation and its many partners since 1994, this production “pipeline” for razorback sucker is full and already in operation for supplying LCR MSCP augmentation needs. For example, FY06 is the first full year of the LCR MSCP. At the start of the year 10,000 razorback suckers were at Willow Beach, 12,000 razorback suckers were being reared at Bubbling Ponds, and 2,000 razorback sucker were being reared at Dexter for release into the LCR during 2006. In addition, each facility had sufficient numbers of 2003 to 2005 year class razorback suckers to provide for augmentation stockings in 2007. (These fish are 2002 to 2004 year classes of Lake Mohave wild-caught larvae.)

Figure 1. Production Routing

Figure 1a.

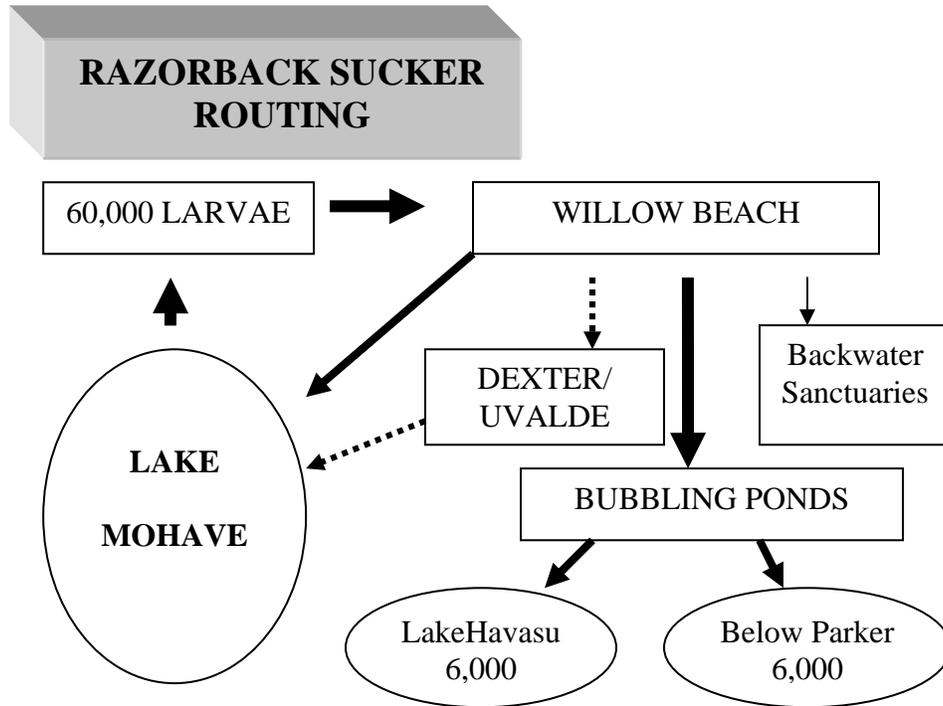
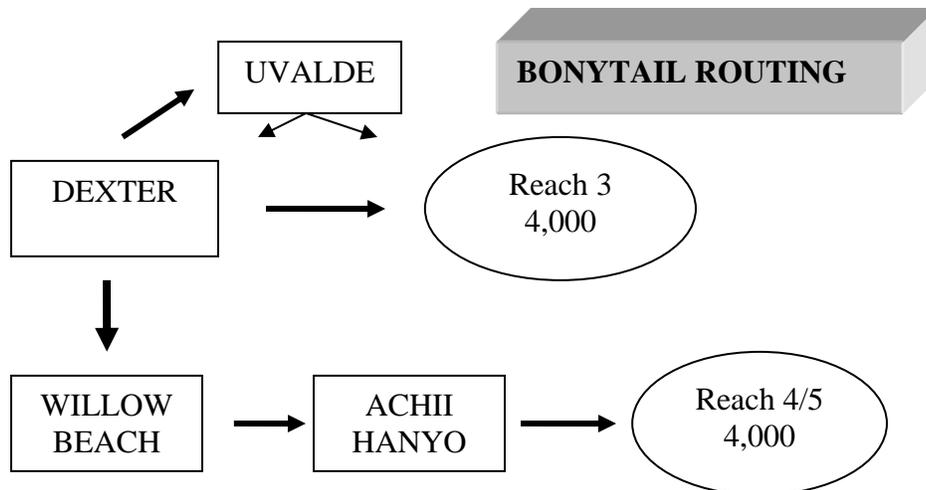


Figure 1b.



Bonytail Production Goals

Production needs for bonytail are 620,000 fish over 50 years. Reclamation will provide funds to the Service through interagency agreements for bonytail production and rearing at Willow Beach, Dexter and Achii Hanyo. The Service and Reclamation are cooperating under an interagency agreement to bring bonytail to Uvalde to determine their growth and survival at that site. (Uvalde represents a backup site for holding a second brood stock of bonytail, for rearing bonytail for augmentation stockings, and for conducting research into hauling, handling, and tagging this species.)

Bonytail will be routed through one or more of these facilities as diagrammed herein (Figure 1b). Bonytail adults will be hand spawned in the spring at Dexter and raised to fingerling size. Some of these fingerlings will be distributed to Willow Beach for initial rearing. Willow Beach will raise these fish to juveniles during the first year and transfer a portion to Achii Hanyo in late winter. Achii Hanyo will rear the fish through the following fall/winter for stocking into Reach 4/5. Some stock will be held at Dexter for rearing to target size for stocking into Reach 3. Some of the fish at Dexter will be transferred to Uvalde where they will be monitored through the summer and fall to assess growth rates. Fish will then be moved back to Dexter, and when target size is attained, the fish will be stocked into Reach 3. Similar to conditions for razorback sucker described earlier, all four facilities will have bonytail on station at the end of FY06. Achii Hanyo was stocked with 15,000 juvenile fish and FWS expects 10,000 of these to be harvested in November, with 4,000 of these targeted for Reach 4/5. Dexter has year class 2004, 2005 and 2006 on station and expects to have 4,000 sub-adult bonytail available for stocking into Lake Havasu. Willow Beach currently has 15,000 bonytail from the 2004 year class on station which now average 250 mm. A portion of these fish will be transferred to Achii Hanyo in January 2007. Finally, 12,000 bonytail fingerlings from Dexter have been transferred to Uvalde to evaluate bonytail production capability at this site. Some of these fish will be made available to keep the bonytail “pipeline” full for the LCR MSCP fish augmentation program.

Stocking Considerations

Stocking considerations include: 1) number of fish available and location of release; 2) season of release; 3) marking and tagging requirements; and 4) the need for acclimation and/or conditioning. Reclamation will develop an annual stocking summary to be posted to the LCR MSCP website each fall. This summary will provide a schedule for stocking during the coming year, including data on species, size, number and location.

Number of Fish and Stocking Location

The HCP established guidelines for both stocking numbers and stocking locations for each species. Stocking requirements are described below by LCR MSCP river reach and are

summarized in Table 2. Locations and boundaries for each river reach are depicted on the LCR MSCP Project Area map (Figure 2).

It should be noted that the California Endangered Species Act Incidental Take Permit requirements for Reaches 4 and 5 are 270,000 total razorback sucker and 200,000 bonytail. These requirements are incorporated into and are part of the total fish augmentation program stockings of 660,000 razorback sucker and 620,000 bonytail.

Reach 1

This is Lake Mead. There are stocking requirements for razorback sucker into Lake Mead, as part of the Interim Surplus Criteria/Secretarial Implementation Agreement (ISC/SIA) commitments. These are to capture and rear up to 5,000 larval razorback sucker from Lake Mead and return them to the lake. There are no bonytail requirements for this reach.

Reach 2

This is principally Lake Mohave. Razorback sucker stocking here is solely to support development and maintenance of the Lake Mohave brood stock. No specific target size or numbers were identified in the HCP for stocking. The Lake Mohave Native Fish Work Group has a brood stock population target of 50,000 adults, and fish for repatriation are currently being reared to 500 mm. Bonytail stocking into Lake Mohave under the augmentation program requires 200,000 fish (300 mm) or an annual stocking of 5,000 bonytail for 40 years. This will begin in 2016, following completion of the Service's own augmentation commitment for bonytail stocking into Lake Mohave.

Reach 3

Davis Dam to Parker Dam or Lake Havasu, the program is required to stock 6,000 razorback sucker (300 mm) annually for 45 years and 4,000 bonytail (300 mm) annually for 50 years. An additional 6,000 razorback suckers will be stocked annually for five years to facilitate species research.

Reach 4/5

These two reaches are grouped together and are generally referred to as the area "below Parker Dam." The HCP allocates stocking 6,000 razorback suckers annually for 45 years, plus an additional 6,000 per year for a five year period for species research. For bonytail, the allocation is 4,000 fish annually for 45 years with an additional 8,000 fish per year for a five year period for intensive research and monitoring. (All the above fish are to be 300 mm total length or greater.)

Figure 2. LCR MSCP Project Area

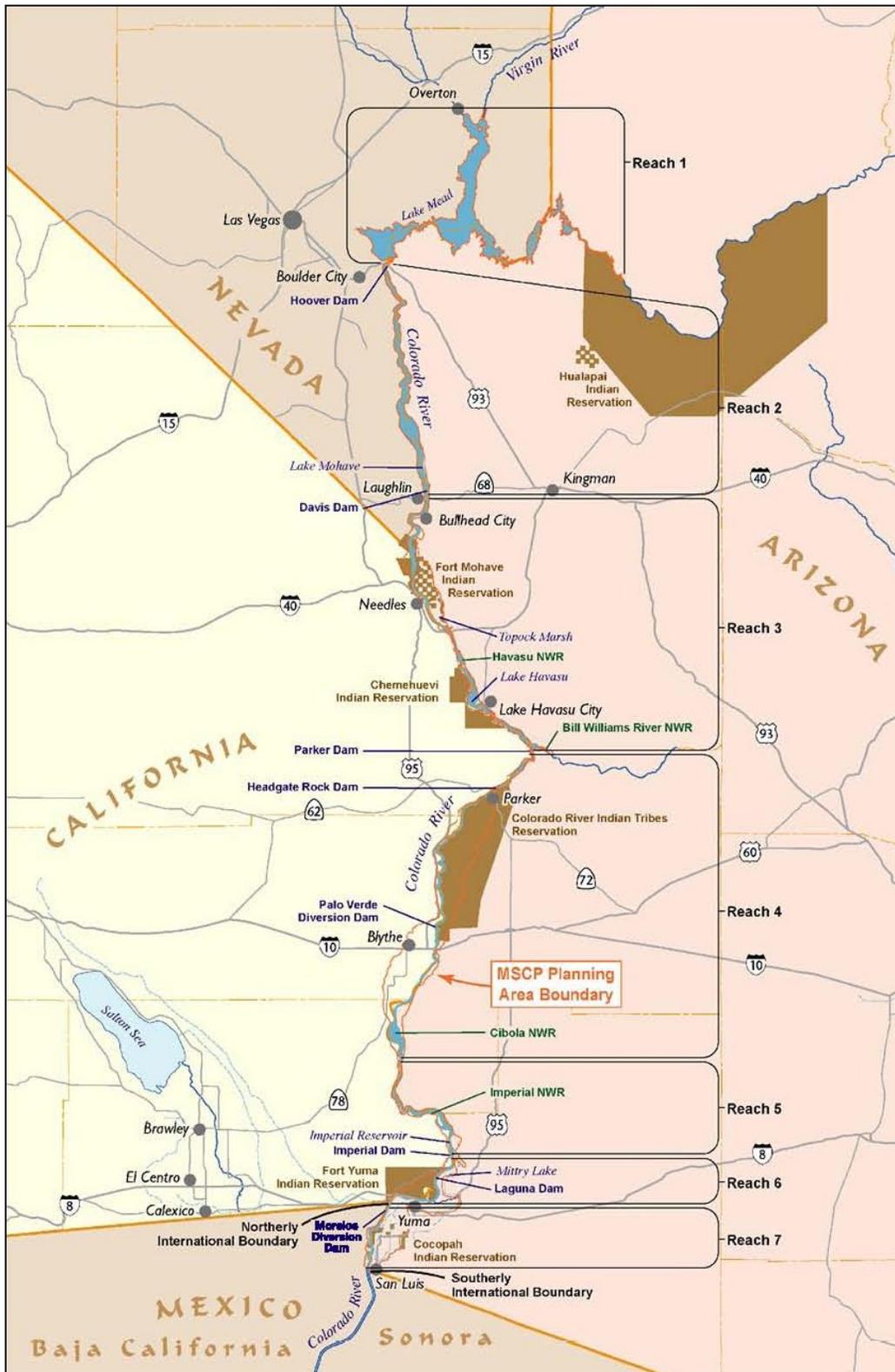


Table 2. Summary of Augmentation Stockings for LCR MSCP

Species	Location	Notes
Razorback Sucker	Reach 1	5,000 larvae reared to honor ISC/SIA commitments
Razorback Sucker	Reach 2	Sufficient numbers to maintain brood stock @ 50,000 adults
Razorback Sucker	Reach 3	6,000 per year (300 mm) into Lake Havasu for 45 years
Razorback Sucker	Reach 3, 4/5	24,000 per year for five consecutive years with at least 6,000 into Reach 3 and 6,000 into Reach 4/5 for research
Razorback Sucker	Reach 4/5	6,000 per year (300 mm) between Parker and Imperial Dams
Bonytail	Reach 2	5,000 per year (300 mm) into Lake Mohave for 40 years, to begin in 2016 (or completion of FWS BO actions)
Bonytail	Reach 3	4,000 per year (300 mm) into Lake Havasu for 50 years
Bonytail	Reach 4/5	8,000 per year (300 mm) between Parker and Imperial Dams for five consecutive years for research (Type II)
Bonytail	Reach 4/5	4,000 per year (300 mm) between Parker and Imperial Dams for 45 years

Season of Release

Due to extreme air and water temperatures during the summer along the LCR, routine stocking of razorback sucker and bonytail will generally be limited to September through April. Stocking of razorback sucker and bonytail into Lake Mohave (Reach 2) may be accomplished during the summer months by putting fish from Willow Beach into the upper reaches of the lake where water temperatures stay cold due to hypolimnetic water releases from Hoover Dam.

Tagging Requirements

To provide information for an effective adaptive management program, Reclamation proposes that all fish to be released be marked in some way for at least the first ten years of the augmentation program. Currently, for Reach 2, all razorback suckers receive PIT (passive integrated transponder) tags and bonytail receive wire tags. (Some bonytail receive PIT tags as well.) Within Reaches 3, 4 and 5 razorback suckers and bonytail are wire tagged upon initial release. At time of recapture, these fish receive a PIT tag. Throughout the LCR, fish occasionally receive radio tags or sonic tags to facilitate specific research protocols. In all cases, tagging requirements will evolve with research and will be evaluated through the adaptive management program.

Acclimation and Conditioning

Preliminary investigations suggest that acclimation and conditioning of native Colorado River fishes should be a consideration in any stocking program. These studies indicate that fish dumped straight from the hatchery truck into the river tend to bolt downstream. When acclimated in a net pen or backwater for as little as 2 or 3 days, these fish tend to more casually distribute themselves into adjacent river habitats both above and below the stocking site.

Based upon this knowledge, Reclamation is currently only releasing fish into backwater habitats. On Lake Mohave, fish are released in shoreline areas near weed beds to provide areas with cover where fish can acclimate to ambient conditions.

Conditioning refers to exercising fish before release so that they have stronger stamina. The hypothesis is that fish reared in ponds and then released into river habitats are not as strong swimmers as are fish reared in flow-through systems (such as raceways) prior to release. Preliminary investigations into the hypothesis are underway.

Monitoring and Research Considerations

Monitoring and research are required components of the HCP and are key elements of the adaptive management program. During the early phases of the LCR MSCP, monitoring and research for the fish augmentation program will focus on: 1) determining key environmental correlates affecting growth and survival during rearing; 2) understanding and minimizing adverse affects of transporting and stocking; and 3) understanding post-stocking distribution and survival.

Monitoring of augmentation stockings will be accomplished as follows:

- Through multi-agency annual spring and fall fish “round-ups” presently held on Lakes Mohave and Havasu,
- Through fish surveys conducted as part of specific research projects (e.g., Razorback Sucker Survival Study in Reach 4/5; Demographics and Post Stocking Survival of Repatriated Razorback Suckers study in Reach 2; and Flannelmouth Sucker study being conducted in Reach 3), and
- Through specific monitoring field surveys for LCR MSCP Reaches not otherwise being surveyed.

These observations help determine population size, fish distribution, post-stocking survival, and general status of the various stocks. Results of monitoring will be summarized in annual reports which will include: 1) statement of goals and objectives; 2) location of sampling sites; 3) description of sampling methods (number, frequency, timing, duration, equipment, and staff); and 4) results of sampling.

The LCR MSCP is committed to extensive monitoring of these stocked fish. Ten percent of the total number of fish (about 120,000) will be made available over a five year period for extensive species monitoring and research, expected to last 7 to 8 years. This focused monitoring/research will be targeted to fill data gaps in the life history information for these species.

Record Keeping and Data Management

Reclamation will maintain all field records for the fish augmentation program in bound, waterproof notebooks. Stocking and tagging data will be maintained in electronic format as well. Currently, Reclamation provides funds to Arizona State University (ASU) to maintain a database for native Colorado River fishes stocked downstream of Grand Canyon. This database includes fish from all state and Federal facilities and programs, and the data are available to these agencies and institutions. Reclamation has been supporting this work relating to both the Lake Mohave repatriation program and augmentations stockings required by past ESA consultations. Reclamation is planning to develop an in-house data management system for the LCR MSCP. Until this in-house system is in full operation, Reclamation will continue its use and support of the ASU database for the fish augmentation program.

Conditions and Criteria under Which Fish Augmentation May Cease

Stocking of razorback sucker and bonytail may cease in one or more Reaches if, through monitoring and research, it is determined (for the Reach) that:

1. Stocking efforts have resulted in adequate numbers of adults to provide genetic refuge or for evaluation of management activities related to creating a self-sustaining population (i.e., species recovery goals have been achieved),
2. Conservation actions other than stocking would be more effective in contributing to the recovery of the species,
3. There are factors within the reach which are not conducive to the survival of stocked fish to become adults or to be managed toward a self-sustaining population, and/or
4. Biological or other factors warrant cessation of stocking.

At this time, Reclamation anticipates that most of the above criteria may not be fully developed or realized before the year 2018 due to the following reasons:

- The adaptive management program requires a five year period of increased razorback sucker and bonytail stocking, once current rearing capacity is ramped up to provide 24,000 razorback sucker and 16,000 bonytail per year. This level of production is not expected to be available until the year 2011, and

- Once these accelerated stockings begin, the adaptive management strategy allows for a 7 to 8 year period of focused monitoring and research on these fishes. The observations from the monitoring and research will be analyzed to determine the effectiveness of the fish augmentation program and the need for cessation, continuation, or alteration of razorback sucker and bonytail stocking.

Alternative Measures to Minimize and Fully Mitigate For Authorized Take in Event Fish Augmentation Measures Cease

In the event that fish augmentation ceases for one or both species in one or more LCR Reach, Reclamation will consult with the Service and the state fishery resource agencies (AGFD, CDFG and NDOW) to determine alternative mitigation measures to be implemented which would fully mitigate for authorized take of these fish species. At a minimum, Reclamation will consider the following alternative actions:

- Stock fewer, but larger fish to substantially increase survival;
- Establish fish in additional isolated backwaters and off channel refugia that could be maintained free of non-native fishes; and/or
- Fund additional research to identify reasons for augmentation failures and develop and implement remedial measures.

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