BONYTAIL CHUB, Gila elegans

RECOVERY PLAN

Prepared by the Colorado River Fishes Recovery Team

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All Members Listed in Acknowledgments

For
Region 6
U.S. Fish and Wildlife Service
Denver, Colorado

Approved: _____
Director, U.S. Fish and Wildlife Service

Date: _____

DISCLAIMER

The U.S. Fish and Wildlife Service has approved this Bonytail Chub Recovery Plan. The plan does not necessarily represent official positions or approvals of cooperating agencies or the views of the recovery team members who contributed to its preparation. This plan is subject to modification as required by new findings, changes in species status, and completion of tasks described in the plan. The recovery goals and objectives will be attained and funds expended contingent upon appropriations, priorities and other constraints.

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PREFACE

The recovery plan was written by the Colorado River Fishes Recovery Team composed of representatives from Federal and State agencies with consultants from universities and private enterprise. Funding and guidance was furnished by the U.S. Fish and Wildlife Service. The final version of the plan was modified by the U.S. Fish and Wildlife Service to reflect realistic recovery activities that are influenced by constraints of time, money, personnel, and other endangered species priorities in Region 6.

The Bonytail Chub Recovery Plan summarizes available information on this fish including the description, distribution and abundance, life history, and reasons for its decline. It also outlines a stepdown plan and narrative of actions believed to be necessary to reduce the threat of extinction.

The implementation schedule includes estimated costs (1987 values) for accomplishing actions described in the recovery plan. The schedule also identifies cooperating agencies and organizations that will conduct studies or recovery activities and the proposed dates for accomplishing these activities.

ACKNOWLEDGEMENTS

This Bonytail Chub Recovery Plan dated _____ was prepared by the U.S. Fish and Wildlife Service in cooperation with the Colorado River Fishes Recovery Team, composed of the following individuals:

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Numerous other persons provided information for the preparation and review of this plan. 1

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I. INTRODUCTION

Background

Although the name bonytail is the acceptable common name for Gila elegans (American Fisheries Society 1980), bonytail chub was the name used when this species was listed in 1980, and is the name commonly used by biologists working in the Colorado River basin (Valdez and Clemmer 1982). Therefore, the name "bonytail chub" has been retained for the sake of continuity.

The bonytail chub (Gila elegans) was listed by the U.S. Fish and Wildlife Service (1980) as an endangered species on April 23, 1980. It was listed without designated critical habitat because the threat of extinction appeared imminent. This species is not reproducing--only single specimens of positive identification have been captured in widely separated locations of the Upper Colorado River Basin in recent years, and its ecological requirements are unknown. In the lower basin, adult fish have been collected from reservoirs such as Lake Mohave. These fish are old, and juvenile fish are rarely captured--indicating that this species is in jeopardy.

At present, the bonytail chub appears to be close to extinction. For this reason, the immediate goal of this recovery plan is to prevent extinction. Downlisting or delisting can be addressed only after the threat of extinction is removed.

General Description

The bonytail chub evolved in the swift waters of the Colorado River system. The roundtail chub (Gila robusta) and humpback chub (Gila cypha) are close

relatives. These three species form an apparent gradation in adaptation to the swift, torrential flows found in the mainstream rivers of the Colorado River system. The bonytail chub is intermediate in "swift water" adaptation, with a streamlined body, narrow caudal peduncle, and smooth nuchal hump.

The bonytail chub was originally described by Baird and Girard (1853). More recent taxonomic clarifications have been conducted by Holden and Stalnaker (1970) and Smith et al. (1979). The general description of the species has not changed significantly since 1853.

Bonytail chub commonly reach 30-35 cm in total length, although larger specimens have been taken from Mohave and Havasu Reservoirs on the lower Colorado River (Minckley 1973). The adult bonytail chub has a body which is elongated and somewhat compressed laterally, with a long, thin caudal peduncle. The head is small with a terminal somewhat oblique mouth. The skull is dorsally concave, and the head arches smoothly into a predorsal hump in adults. Scales are often lacking or embedded on the top of the hump, belly, or caudal peduncle (Minckley 1973). The fins are large with dorsal and anal fin rays usually numbering 10-10. The origin of the dorsal fin is much nearer the tip of the snout than the caudal fin base (Frontis). Pharyngeal teeth are typical for the large-river chubs at 2,5-4,2.

Adult bonytail chub have a gray or olivaceous back with white, silvery sides and belly. Breeding males have bright red-orange lateral slashes between the paired fins which is Similar to closely related chubs. Breeding males also have fine breeding tubercles on the head and anterior portions of the body. Breeding colors are more subdued and tubercles less developed in females. A slight orange coloration exists at the base of the fins in both sexes throughout much of the year (Vanicek 1967).

Traditionally, adult bonytail chubs were differentiated from roundtail and humpback chubs by dorsal/anal fin ray counts. These counts are usually 10-10 in bonytail chub, 9-9 in roundtail chubs and 9-10 in humpback chubs. Gill rakers are also used in identification. The number of gill rakers on the second arch are usually 18-21 in bonytail chub and 12-15 in roundtail chub. Bonytail chub have a much narrower caudal peduncle than roundtail chub, and they also have a nuchal hump. Humpback chub are differentiated from bonytail chub by having a more abrupt nuchal hump and an overhanging snout. Tyus et al. (1982) adopted a combination of techniques to identify bonytail chub from the Green River, including x-rays, gill raker counts and other morphological characteristics. Only one bonytail chub was tentatively identified from 19 suspected specimens collected from 1980-81.

Young bonytail chubs are differentiated from young roundtail chubs and young humpback chubs by the fin ray counts, larger eyes and a nonoverhanging snout (Smith et al. 1979). However, identification of juvenile Gila are most often made "tentative" even by knowledgeable investigators because of the difficulty of positive identification.

The positive identification of Gila sp. remains a problem in separating fish from the upper basin because many specimens have morphometric characteristics that overlap (Smith et al. 1979, Sutkus and Clemmer 1977; Valdez and Clemmer 1982). Only fish that have characteristics of the "type specimen" are easily recognized. Even in cases with large fish (i.e., adults), there can be questions about the validity of the identification because of the intermediate characteristics. Hybridization between the three species of Gila has been suggested by several investigators (Holden and Stalnaker 1970; Minckley 1973;

Smith et al. 1979, and R. R. Miller, personal communication). The significance of Gila sp. containing overlapping morphomeristic characteristics in the upper basin remains unsolved. To explore this issue more thoroughly, the U.S. Fish and Wildlife Service plans to have a team of experts review the Gila taxonomy problem and provide the recommendations to the Service on studies that are needed to resolve it.

Distribution and Abundance

Historic

The bonytail chub originally was found throughout the Colorado River system in the main channels and larger tributaries (Jordan 1891; Jordan and Evermann 1896) actual records for this species are few since many reaches were not sampled until recently. The records suggest a general distribution throughout the Colorado River system (Fig. 1). Records in the Green River indicate bonytail chub have been collected from the Flaming Gorge basin of southern Wyoming (Smith et al. 1979), the Dinosaur National Monument (DNM) area (Vanicek et al. 1970), the middle Green River including Desolation and Gray canyons (Holden 1978), and the lower Green River (Jordan 1981; Holden and Stalnaker 1975). In the Colorado River mainstem, they were reported from near the mouth of the San Juan River to near the mouth of the Colorado River at the Gulf of California (Smith et al. 1979). R. R. Miller (personal communication) reported several young bonytail chubs among specimens collected by Ellis (1914) near Grand Junction, Colorado. Major tributaries where they have been found include the Gila River to Ft. Thomas, Arizona, and the Salt River, a tributary of the Gila, to near the mouth of the Verde River (Smith et al. 1979), the Gunnison River, a tributary to the Colorado River in Colorado, near

Delta, Colorado (Jordan 1981; Smith et al. 1979), and the lower few miles of the Yampa River (Holden ana Stalnaker 1975). The bonytail chub has been taken from only one smaller tributary--the White River of Utah (Smith et al. 1979).

Portions of the basin that were not sampled, but which probably contained bonytail chub, include the Colorado River from near Grand Junction, Colorado, to the mouth of the San Juan River, and the lower San Juan River, especially that portion in Utah.

The bonytail chub was originally described from the Zuni River of New Mexico, where it was collected by the Sitgraves Expedition (Baird and Girard 1853). However, the Zuni River is a small tributary of the Little Colorado River and hardly appears to be suitable habitat for a fish considered to be a "large

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river" form. Smith et al. (1979) suggested the original specimens came from the Little Colorado River at the base of Grand Falls. The specimens could have come from the lower Gila River, where the Sitgraves Expedition also stopped.

The bonytail chub was apparently an abundant fish, at least in the late 1800s (Jordan and Evermann 1896). Jordan (1891) seined five in the Green River at Green River, Utah, and Kirsch (1888) cited an expedition on the Gila River at Ft. Thomas, Arizona, which indicated the fish "took the hook freely." A number of other reports also indicated they were common-to-abundant (Cope and Yarrow 1875; Gilbert and Scofield 1898; Chamberlain 1904).

Relatively few reports of bonytail chub are available for the Colorado basin in the first half of the 20th century. Reports from older fishermen indicated the species was caught in the upper Green River in the 1940s and 1950s. By the 1950s, bonytail chub were no longer captured from much of the Gila River system and the lower Colorado River (Miller 1961). The last known riverine area where bonytail chub were fairly common was the Green River in DNM where Vanicek (1967) and others collected 91 during 1962-1966 (Holden and Stalnaker 1970). Bonytail chub were also reported in Lake Powell soon after closure of Glen Canyon Dam in 1962, but their numbers have since declined steadily (Kent Miller and Dale Hepworth, personal communication).

The records of the 1950s and 1960s that stated "bonytail chub" created confusion because this common name were used for all three large river chubs, especially the roundtail chub in the upper basin. Therefore, records of the distribution and abundance of the bonytail chub must be interpreted with caution.

Present

The bonytail chub is presently very rare. In the lower basin, large, old adults, primarily females, are still found in Lakes Mohave and Havasu, but no reproductive success has been reported. W. L. Minckley (personal communication) indicated that individual fish are taken occasionally by fishermen in Lake Havasu, and since 1974, 19 have been collected by biologists from Lake Mohave and several more have been reported by anglers. The actual number of remaining bonytail chubs in these reservoirs are unknown.

Stocking efforts have been conducted by the U.S. Fish and Wildlife Service (FWS), Region 2 and the Arizona Game and Fish Department using bonytail chub from Dexter National Fish Hatchery. In 1982, approximately 4,500 tetracycline marked fingerlings were stocked in Lake Mohave. In 1983, approximately 45,000 swim-up fry were stocked into an isolated embayment in Lake Mohave. In 1984, 68,211 swim up fry were shipped to California Department of Fish and Game for stocking in a growout pond; approximately 400 of these fish were later stocked into ponds at the Imperial Natural Wildlife Refuge. In 1985, 12,618 4-inch fingerlings were stocked into Lake Mohave. Monitoring efforts produced limited results and it is, therefore, not known whether these reintroduction attempts were successful.

The present distribution and abundance of the bonytail chubs in the upper basin is described by Valdez and Clemmer (1982) and Tyus et al. (1982). Holden and Stalnaker (1975) found 36 adults in a 4-year study of the upper basin, 29 were captured in 1968, 3 in 1969, and 4 in 1970; all but 2 of these were found in the Green and Yampa rivers of DNM. No young were found during that study. Holden and Seethaler (personal communication) caught two bonytail chub adults in Desolation Canyon in 1974. Holden (1978) caught one adult near

Jensen, Utah, and one juvenile in Desolation Canyon in 1977. Holden and Crist (1981) reported one adult bonytail chub (275 mm) from the lower Yampa River in 1979, but none have been reported since then (Tyus et al. 1982; Archer et al. 1984). The FWS collected several fish resembling bonytail chubs from Gray Canyon of the Green River in 1980 and 1981 (Tyus et al. 1982).

The bonytail chub was common in the Green River below the mouth of the Yampa River after Flaming Gorge became operational in 1962. Vanicek (personal communication) stated he could usually catch adult bonytail chub in DNM (below the mouth of the Yampa River) during 1964-1966. These fish were collected from eddies with gill nets or electrofishing gear. In their life history analysis, Vanicek and Kramer (1969) used 49 roundtail chubs and 67 bonytail chubs. They found that bonytail chub above 200 mm had strong year classes in 1959, 1960, and 1961. Vanicek (1967) did not separate the two chubs at sizes below 200 mm because of uncertainty with identification.

Holden and Stalnaker (1975) examined the young chubs collected by Vanicek (1967), and their own collections from the Green River above Jensen, Utah. Only three potential bonytail chub were identified among several hundred chubs. Holden and Stalnaker (1975) found only 36 adult bonytail chubs during a 4-year study (1968-1971) of the upper Colorado basin. Thirty-four of these fish came from the upper Green River in DNM. Seethaler et al. (1976) sampled the Green and Yampa rivers of DNM in 1974-1976 and found no bonytail chub. Holden and Crist (1981) sampled this area in 1978-1980 and found only one adult. Miller et al. (1982, 1984) reported no adult bonytail chubs from DNM in 1981-1983 and Wick et at. (1979, 1981) could not distinguish among the larval Gila they collected in DNM.

No bonytail chubs have been collected in the Colorado River of Colorado or Utah, or its tributary, the Gunnison River, even though the FWS (Valdez et al. 1982; Miller et al. 1984) and Colorado Division of Wildlife (Wick et al. 1979, 1981) sampled portions of these areas from 1977 through 1983. No recent intensive fishery studies have been made in the lower San Juan River although VTN Consolidated, Inc. (1978) surveyed a portion of the river and found no bonytail chubs. Although roundtail chubs were found in the Green and Little Snake Rivers, Wyoming, during a survey in 1986, no bonytail chubs were sampled (Johnson and Oberholtzer 1987).

Present numbers of bonytail chub appear to be small. A single bonytail chub was collected in 1984 from the Black Rocks area of the Colorado River (Kaeding et al, 1986). Two suspected bonytail chubs (an adult of 386 mm TL and a juvenile of 46 mm TL) were sampled in Cataract Canyon of the Colorado River in 1985 (Valdez 1985). Reproduction is apparently nonexistent, or extremely low, with the most recent juveniles coming from the Desolation Canyon area (Holden 1978) and Cataract Canyon (Valdez 1985).

Life History

General

Very little is known about the life history of the bonytail chub. Many of the observations reported in the literature refer to fish in reservoirs, an artificial habitat. There is some question about how applicable that information is to its natural riverine habitat. Therefore, this life history discussion is separated into three sections (riverine, reservoir and hatchery) so that differences in observed life history requirements are not confused.

Riverine

Bonytail chubs have always been considered big-river or main stem species since they have seldom been collected from smaller tributaries. Jordan (1981) noted this distribution pattern, and indicated that the roundtail chub inhabited the tributaries. The two species overlapped in areas such as the Yampa and Green Rivers in DNM, the Gunnison River, and the upper Gila River drainage, including the Salt River. Vanicek (1967) noted no difference in habitat preference between adult bonytail chub and adult roundtail; both used pools and eddies rather than areas with more current.

Vanicek and Kramer (1969) determined the growth of bonytail chub through back-calculation from scales. Young were 55 mm their first growing season, 100 mm their second reason and 158 mm their third season in DNM. Bonytail chubs grew faster than roundtails after reaching 150 mm in length. The largest bonytail chub handled by Vanicek and Kramer (1969) was 388 mm and 7 years old.

In DNM, Vanicek and Kramer (1969) found that young chubs (not separated as bonytail chub or roundtail) ate primarily chironomid larvae and mayfly nymphs. Small fish became dependent on floating food items as they grew larger. Larger juvenile chubs ate a more diversified diet, including terrestrial and aquatic insects. Adult bonytail chubs fed on terrestrial insects, plant debris, and filamentous algae, indicating surface feeding. No fish remains were found in bonytail chub stomachs.

Spawning of bonytail chubs has not been observed in a river, but extrapolating from a collection of ripe fish suggested that spawning occurred in DNM during

late June and early July at water temperatures of about 18 C (Vanicek and Kramer 1969). Ripe bonytail chubs and roundtail chubs were found at the same time of year, but were spatially separated since they were never captured in the same gill net.

Reservoirs

Life history data on bonytail chub in reservoirs have been collected by a number of biologists and summarized by Minckley (1973). Bonytail chubs in Lake Mohave are generally found in lacustrine rather than riverine habitat. Minckley (personal communication) believes the cold water of the inflowing Colorado River precludes the use of apparently more favorable riverine habitat by bonytail chubs. The diet of bonytail chubs in reservoirs seems to be primarily plankton and algae, although thorough studies have not been made (Minckley 1973).

Spawning behavior has been observed in Lake Mohave (Jones and Sumner 1954), but no young have been observed. Fairly large numbers of bonytail chubs, approximately 500, congregated over a gravel bar in water up to 9 m deep. Typical of cyprinid spawning groups, the males outnumbered females about 2:1. Females were generally escorted by three to five males and fertilized eggs were deposited randomly. No attempt was made by either sex to guard the spawning areas.

Hatchery

Six female and five male bonytail chubs obtained from Lake Mohave were artificially spawned at Willow Beach National Fish hatchery in 1981 (Haman

1982b). Spawning began when the water temperature was 20 °C and 90 percent of the eggs hatched from 99 to 174 hours (h) later. Only 55 percent of the eggs placed in 16-17 °C water hatched (from 170-269 h) and 4 percent hatched at 12-13°C (from 334-498 h). Since 96 percent of eggs held at the coldest temperature failed to hatch, it is assumed that colder temperatures in the tailwaters of main stem reservoirs can be implicated as a factor in the decline of the bonytail chub.

Reasons for Decline

The bonytail chub population declined in the lower Colorado basin during the first half of the 20th Century, and disappeared from the Salt River before 1926. Miller (1961) stated that by 1940-42, the bonytail chub became rare in the Colorado and Gila Rivers near Yuma, Arizona, and were absent by 1950.

Miller (1961) cites the following reasons for the decline of bonytail chub in the Gila River system: flow depletions due to loss of vegetation which was from by overgrazing, depletion of ground water, dams and irrigation, mining, and introduction of nonnative species. The lower Gila River system was nearly dried up in the early 1900s, with greatly reduced flows, increased flash flooding, and channel cutting in most streams.

In the lower basin of the Colorado River main stem, the decline of the bonytail chub was associated with loss of riverine habitat, primarily due to the construction of dams. The bonytail chubs that remain in Lakes Mohave and Havasu are remnants from apparently large populations. Since no evidence of successful reproduction has been found, these populations could disappear in

the near future. Although 17,118 fingerling (1982 and 1985) and 13,211 bonytail chub fry (1983-1984) from Dexter National Fish Hatchery were stocked in Lake Mohave by the Service (Region 2) and the Arizona Game and Fish Department, the success of this attempted reintroduction is unknown.

The decline of the bonytail chub in the Upper Colorado River Basin occurred more recently. Reasons for decline in some areas of the Upper Colorado River Basin include the construction and operation of reservoirs which created lower summer tailwater temperatures, direct loss of riverine habitat in the reservoirs, and altered flow regimes below the dams. Other contributing factors may also include competition and predation from nonnative species and flow depletions due to irrigation and other consumptive water uses. Vanicek et al. (1970) indicated that the loss of bonytail chubs in the Green River immediately below Flaming Gorge Dam was due to a loss of riverine habitat from alteration of flow and water temperature patterns after the dam was closed in November 1962 and a preimpoundment fish eradication program.

Available information indicated a decrease in numbers of adult bonytail chub in the upper Green River beginning with the early 1960s. Reproduction appears to have dropped dramatically in 1963-1964, as evidenced by the failure of biologists to find young bonytail chubs during or after that time. Vanicek and Kramer (1969) reported that bonytail chubs exhibited slower growth after the closure of Flaming Gorge Dam in November 1962.

A similar situation probably occurred when Glen Canyon Dam was closed in 1963. Bonytail chub abundance declined below the dam, probably because of altered habitat. The bonytail chub was fairly common in the reservoir soon after closure, but the numbers declined within a few years. The bonytail chub did not persist in Lake Powell as in Lakes Mohave and Havasu, perhaps because they moved out of the reservoir into the Colorado, Green, and San Juan rivers.

Flows of the Colorado River were depleted earlier than those of the Green River (Joseph et al. 1977) and were further affected by major dams on the Gunnison River in the early 1960s. Therefore, reduced and unnatural flows may have contributed to the depletion of bonytail chub in this area.

The introduction of nonnative fish species may have contributed to the decline of the bonytail chub. Tyus et al. (1982) reported that much of the Upper Colorado River Basin has been colonized by a variety of nonnative fish species. Kaediny et al. (1986) suggested that the synergistic effect of increases in nonnative fishes and altered flow and temperature regimes had an adverse impact on the bonytail chub.

Hybridization between bonytail chub and other chub as suggested by Stalnaker and Holden (1973), may also be a factor in the decline of the bonytail chub. The very small number of remaining bonytail chubs increases the likelihood of hybridization with more abundant species. Loss of habitat for all Gila species may result in severe interspecific competition and niche partitioning between them.

In summary, the change in habitat and water quality/quantity caused by dams and other alterations appear to have been major factors in the decline of the bonytail chub in the Upper Colorado Basin. Main stem dams also appear to have been the primary factor in the decline of the bonytail chub in the lower basin.

II. RECOVERY

Interim Objective

The immediate goal is to prevent extinction of the bonytail chub.

Primary objective

The goals for downlisting and delisting can be addressed once the threat of immediate extinction is removed. The bonytail chub should be considered eligible for downlisting when at least four viable, self-sustaining populations are established and maintained. The bonytail chub will be considered for delisting when a total of six naturally self-sustaining populations are secured and their natural habitats are legally protected.

The numbers needed to maintain a self-sustaining population will be determined when sufficient information becomes available.

Stepdown Outline

1. Determine the status of the bonytail chub in its historical riverine range.

1.1 Compile historical population data.

1.2 Develop taxonomic criteria and improved techniques for identifying bonytail chub.

1.3 Conduct intensive sampling for all age classes of bonytail chub.

1.31 Sample the Green River in Gray and Desolation Canyons.

1.32 Sample the Green and Yampa Rivers within DNM.

1.33 Sample any other areas which may potentially support bonytail chub populations.

2. Determine threats to and protect any riverine bonytail chub populations and their habitat.

2.1 Monitor existing bonytail chub populations and their habitat.

2.11 Develop and implement monitoring procedures for bonytail chub populations.

2.12 Develop and implement habitat monitoring.

2.2 Assess impacts of development projects.

2.3 Identify and assess impacts of introduced nonnative species which compete with or prey on bonytail chub.

2.4 Study nature and extent of parasitism.

2.5 Determine impacts/significance of *Gila* spp. hybridization problem.

2.6 Protect any existing populations and their habitat.

2.61 Discontinue or prevent any introductions of nonnative fish species which may have a negative impact on the bonytail chub.

2.62 Enforce existing laws and regulations affecting the bonytail chub.

2.621 Inform agencies of their management/enforcement responsibilities.

2.622 Assure compliance with Section 7 of the Endangered Species Act by all Federal agencies.

2.623 Assess effectiveness of current regulations/management and draft additional regulations or increase protection as needed.

3. Augment existing life history information for the bonytail chub.

3.1 Describe spawning requirements.

3.2 Describe movement patterns.

3.3 Identify and describe habitat (specific requirements – spawning, nursery, over-winter, adult).

3.4 Describe food habits and feeding behavior.

3.5 Describe age distribution and growth rates.

3,6 Describe population dynamics and identify what constitutes a self-sustaining population.

3.7 Determine reasons for hybridization.

-4. Restore bonytail chub populations in their natural riverine environments.

4.1 Determine specific habitat requirements for bonytail chub and establish criteria for stocking site selection.

4.2 Reintroduce bonytail chub in selected locations.

4.21 Develop appropriate stocking procedures and strategies.

4.22 Develop propagation and holding techniques.

4.23 Maintain a diversified gene pool.

4.3 Monitor reintroduced populations and their habitats.

4.31 Develop monitoring procedures for bonytail chub.

4.32 Develop monitoring procedures for the habitat.

4.33 Designate monitoring agencies.

4.34 Assess success of reintroductions.

4.4 Improve or enhance potential riverine areas to create and protect spawning, nursery, and adult holding areas and winter habitats.

4.5 Enforce all laws and regulations protecting reintroduced bonytail chub.

4.6 Develop a basin-wide management plan.

5. Conduct information and education programs to gain support for the recovery program.

5.1 Inform the public and public agencies of the bonytail chub, its needs and status, and the recovery efforts underway.

5.11 Produce needed information and education (I & E) materials.

5.12 Disseminate I & E materials to the public and public agencies.

5.2 Provide workshops for public agencies to inform them of their responsibilities for endangered species and involve them in the I & E program.

6. Consider recommendation for downlisting when four self-sustaining riverine bonytail chub populations are established and maintained and their habitats are legally protected.

7. Consider recommendation for delisting when six self-sustaining riverine bonytail chub populations are established and their habitats are legally protected.

Stepdown Outline

1. Determine the status of the bonytail chub in its historical riverine range.

Recent sampling suggests that the bonytail chub is extremely rare. The relative abundance of bonytail chub 5 or 10 years ago is not known, nor is sufficient information available to determine present population status. A status determination is prerequisite to other recovery efforts.

1.1 Compile historical population data.

Historical information needs to be obtained and reviewed to determine former abundance and distribution of the species. This should be compiled and compared with current data that has been or will be collected.

1.2 Develop taxonomic criteria and improved techniques for identifying bonytail chub.

The bonytail chub (Gila elegans) is not readily separated from Gila cypha or Gila robusta, particularly in young and juvenile individuals. Intermediate or variants of the three species compound identification problems. Taxonomic studies are needed to aid in identifying specimens in the field and laboratory.

1.3 Conduct intensive sampling for all age classes of bonytail chub.

Collection of bonytail chub has often been incidental to sampling for other species or part of a randomized sampling design. An intensive sampling program specifically for the bonytail chub should be initiated in selected areas.

1.31 Sample the Green River in Gray and Desolation Canyons.

Gila spp. have been recently collected from this area. Sampling should continue in an attempt to assess bonytail chub numbers.

1.32 Sample the Green and Yampa Rivers within Dinosaur National Monument.

Bonytail chub were reported to be common at one time within DNM, but have become increasingly rare. The area should be intensively sampled.

1.33 Sample any other areas which may potentially support bonytail chub populations.

The populations in Lakes Havasu and Mohave need better quantification. Review of historical recent data may indicateother areas that support bonytail chub.

2. Determine threats to and protect any riverine bonytail chub populations and their habitat.

Bonytail chub abundance is extremely low. They need immediate protection and monitoring to assure their continued existence.

2.1 Monitor existing bonytail chub populations and their habitat.

Existing populations must be monitored to determine changes in theirstatus. Bonytail chub habitat needs to be monitored to record if and when changes occur.

2.11 Develop and implement monitoring procedures for bonytail chub.

Monitoring should include at least seasonal sampling. Populations of all age classes (young to adult) should be evaluated to determine if they are stable, increasing or decreasing. Most recent bonytail captures in the upper Colorado River basin have been in Utah and Colorado. Monitoring should be conducted and/or supervised by the Utah Division of Wildlife Resources and the Colorado Division of Wildlife for areas within their jurisdiction. The FWS will also help in the initial stages of monitoring. The FWS study in Lake Mohave should initially cover the monitoring required in Lake Mohave, but following that study, the Arizona Game and Fish Department will continue the monitoring.

2.12 Develop and implement monitoring procedures for the habitat.

Preferred habitat, once determined for all age classes (see tasks 3.7-3.8) will be monitored to record changes. The major emphasis of the habitat monitoring will be directed to factors necessary for successful reproduction including spawning sites, water temperature and flow, and larval fish rearing areas. This will include monitoring in Desolation and Gray Canyons and other areas as identified through intensive sampling, as well as keeping abreast of water diversions and depletions throughout the upper Colorado River basin.

2.2 Assess impacts of development projects.

Monitor all ongoing or proposed water development or related projects to determine their effects on bonytail chub populations and their habitat in terms of flow reductions, temperature changes, and water quality (turbidity, salinity, environmental contaminants). Seek changes in project operation to enhance habitat conditions for bonytail chub whenever possible.

2.3 Identify and assess the impacts of introduced nonnative species which compete with or prey on bonytail chub.

Studies should be conducted to determine the impact of competition by nonnative species on the bonytail chub and if such is a major factor in the species decline.

2.4 Study the nature and extent of parasitism.

Determine whether parasitism is playing a role in the decline of bonytail chub populations. More needs to be learned about the role of parasites and how this problem interrelates with the introduction of nonnative species and stress caused from competition and habitat changes.

2.5 Determine impacts/significance of Gila spp. hybridization problems.

Valdez and Clemmer (1982) hypothesized that changes in the water regimes (reduced flows and increased temperatures) have resulted in overlapping in the spawning periods of some Gila spp. and thus have altered those mechanisms which maintain the species' genetic isolation. The degree of impact on the species as a result of hybridization needs to be assessed. If necessary, habitat management techniques and criteria should be developed which would increase their genetic isolation.

2.6 Protect any existing populations and their habitat.

Immediate steps must be taken to protect bonytail chub populations and prevent further degradation of their habitat if extinction is to be prevented.

2.61 Discontinue or prevent introductions of nonnative fish species which may have a negative impact on the bonytail chub.

Prior to completion of task 2.3 or if studies show that such introductions will have a negative impact on the bonytail chub, stocking of competing nonnative species should be discontinued.

2.62 Enforce existing laws and regulations affecting the bonytail chub.

In order to reverse the threat of extinction all laws protecting the bonytail chub must be enforced.

2.621 Inform agencies of their management/enforcement responsibilities.

All agencies should be made aware of their responsibilities regarding the laws protecting listed species and their habitats.

2.622 Assure compliance with Section 7 of the ESA by Federal agencies.

Federal agencies should comply with Section 7 of the ESA and should consult with FWS on any project which may affect the bonytail chub, involving Federal permits, monies, etc. Water quality and flow criteria can then be applied through consultation etc.

2.623 Assess effectiveness of current regulations/management and draft additional regulations or increase protection as needed.

Current management practices, habitat requirement criteria, and protection or enforcement activities should be monitored to determine their effectiveness in conserving the species.

3. Augment life history information for the bonytail chub.

All aspect's of the life history of the bonytail chub need to be described. Little is known about this species, particularly in riverine habitat. More investigations are necessary to answer all life history questions. If during the studies, fish are accidentally sacrificed or mortalities occur, efforts should be made to maximize the scientific use of the specimens.

3.1 Describe spawning requirements.

Little is known about the reproduction of the bonytail chub. Understanding this life history requirement is vital in saving the bonytail chub from extirpation and eventually achieving recovery. The differences in bonytail requirements in riverine and reservoir environments must be understood, and the act of spawning and survival of the young documented in both types of habitat.

3.2 Describe movement patterns.

Tyus et al. 1982 describes migration and movement of Gila ssp. in the Green River, which may include some bonytail chub. Additional studies of reintroduced populations of bonytail chub should be conducted to provide additional information on the movement behavior of the bonytail chub.

3.3 Identify and describe habitat.

Specific physical, chemical, and biological components of the habitat for all life stages should be described (spawning, nursery, over-winter, adult).

3.4 Describe food habits and feeding behavior.

Some information has been collected, but further investigations are necessary to describe this life history requirement.

3.5 Describe age distribution and growth rates.

Continuous length and weight data should be kept by monitoring agencies. Scale samples should be obtained from hatchery and wild fish to estimate age and growth data.

3.6 Describe population dynamics and identify what constitutes a self-sustaining population.

Additional information on intra and interspecific competition and related biological and ecological interactions must be obtained. Studies designed to answer questions of competition and predation by nonnative species must be initiated in both riverine and reservoir habitats. Studies need to identify and define a self-sustaining bonytail chub population.

3.7 Determine reasons for hybridization.

Hybridization may pose as much of a threat to the continued existence of the bonytail chub as habitat destruction, introduction of nonnative species and other factors. Learning the reasons for, and reducing or preventing hybridization is an important step in recovery of the species.

4. Restore bonytail chub populations in their natural riverine environments.

If intensive sampling shows that bonytail chub have been extirpated or are in danger of extirpation, restoration measures will be initiated to augment any natural populations or establish additional populations.

4.1 Determine specific habitat requirements for bonytail chub and establish criteria for stocking site selection.

Basic habitat requirements should be determined through and analysis of field data and laboratory experiments. This information should then be used to develop specific criteria to be used in identifying, improving, and protecting potential habitat.

4.2 Reintroduce bon tail chub in selected locations.

The Green River is the last riverine area where bonytail chub have been found and, therefore, probably represents the best available habitat. Two areas for introduction should be used so comparisons between the areas can be made regarding success of introduced fish. The areas selected should be known bonytail chub habitat. Areas containing large numbers of roundtail chub or humpback chub should be avoided to prevent potential hybridization. Recommended reintroduction sites include:

- the Green River immediately below Jones Hole Creek, Island Park and Split Mountain Canyon; all in Dinosaur National Monument.

- the Green River in Desolation and Gray Canyons.

Another area for possible reintroduction is the upper Gila River in Arizona.

4.21 Develop appropriate stocking procedures and strategies.

The number and size of the introductions needed to establish viable, self-sustaining populations will be investigated. Determination of stocking methods will initially be based on data from other species and the experience of hatchery personnel. Fish planted in initial stocking attempts should be divided into various groups by marking. The success of such marking experiments should be measured by follow-up monitoring.

4.22 Develop propagation and holding techniques.

Additional information on propagation and holding techniques must be developed to maximize production of young and maintain healthy broodstock. Specific loading capacities must be determined for raising the required number of bonytail chub. Other issues include securing rearing ponds such as those at Page Springs Hatchery, Arizona, in addition to existing facilities at Dexter National Fish Hatchery (NFH). Other sites should be considered for a hatchery and rearing ponds including California, Arizona, and an upper basin location.

4.23 Maintain a diversified gene pool.

In 1981, adult male and female bonytail chub were captured in Lake Mohave. These fish were used to develop a captive brood

stock at the Dexter NFH. Additional broodstock as well as milt or fertilized eggs from other wild individuals are essential to supplement and secure the genetic heterozygosity of the existing gene pool for at least 20 generations.

4.3 Monitor reintroduced populations and their habitats.

Reintroduced populations must be monitored to determine success of the program. Fish habitat should be monitored to record if and when changes occur.

4.31 Develop monitoring procedures for reintroduced bonytail chub.

See Task 2.11

4.32 Develop monitoring procedures for the habitat.

See Task 2.12

4.33 Designate monitoring agencies.

Monitoring will be conducted and/or supervised by the Utah Division of Wildlife Resources, the Colorado Division of Wildlife and Arizona Game and Fish Department for areas within their jurisdiction. The Fish and Wildlife Service will help in the initial stages of monitoring.

4.34 Assess the success of reintroductions.

After an initial monitoring period, the need for modification of reintroduction procedures, continued monitoring and continued reintroductions will be analyzed.

4.4 Improve or enhance potential'riverine areas to create and protect spawning, nursery, adult holding areas, and winter habitat.

Enhancement of potential habitat should be conducted to allow for natural expansion of occupied habitat. Any enhancement should be based on the results of studies/analysis conducted under Tasks 3 and 4.3.

4.5 Enforce all laws and regulations protecting reintroduced bonytail chub.

See Task 2.621. Designation of reintroduced populations as experimental populations should be explored.

4.6 Develop a basin-wide management plan.

Once populations have been identified and/or restored, prepare a basin-wide management plan outlining monitoring requirements, management, and protection of these populations.

5. Conduct information and education programs to gain support for the recovery program.

The bonytail chub is relatively unknown and could benefit from publicity. Increased public awareness and support will aid the recovery effort by generating additional funding.

5.1 Inform the public and public agencies of the bonytail chub, its needs and status, and the recovery efforts underway.

Recovery activities for the bonytail chub must be based on widespread public support to be successful.

5.11 Produce needed information and education (I & E) materials.

The U.S. Fish and Wildlife Service should coordinate the production and distribution of leaflets and news releases to the public. A leaflet describing the bonytail chub, its habitat needs, factors limiting populations and planned recovery efforts must be developed. Frequent news releases describing current activities and information concerning the bonytail chub should be prepared. The Endangered Species Technical Bulletin can also publish seasonal summaries of recovery efforts.

5.12 Disseminate I & E materials to the public and public agencies.

Providing information to the public directly and through public agencies will help gain support for the bonytail chub recovery effort.

5.2 Provide workshops for public agencies to inform them of their res onsibilities for endan ered s ecies and to involve them in I & E programs.

Workshops will be developed, as needed, to inform public agency personnel about bonytail chub identification, recognition of essential habitat, and management techniques. Also, the potential uses of I & E materials should be dealt with as a part of the workshop. In this way, public agencies will get the most from the material and the overall public relations effort will have some unity. Other endemic fishes of the Colorado River systems would also be discussed at such workshops.

6. Consider recommendation for downlisting when four self-sustaining riverine bonytail chub populations are established and maintained and their habitats are legally protected.

Quantifiable goals must be determined for establishing self-sustaining populations once sufficient information or criteria are available. Once these goals are reached, a decision must be made whether to: (1) continue the recovery effort without a status change; (2) downlist and continue the recovery effort; or (3) downlist without further efforts. Continued monitoring will be required.

7. Consider recommendations for delisting when six self-sustaining riverine bonytail chub populations are established and their habitats are legally protected.

   A decision must be made at this time whether to delist the species or continue the recovery effort with no change in status.

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III. IMPLEMENTATION SCHEDULE

Definition of Priorities

Priority **1 - All** actions that are absolutely essential to prevent the extinction of the species.

Priority 2 - All actions necessary to maintain the species current population status.

Priority 3 - All other actions necessary to provide for full recovery of the species.

GENERAL CATEGORIES FOR IMPLEMENTATION SCHEDULES

Information Gathering - I or R (research)

1. Population status
2. Habitat status
3. Habitat requirements
4. Management techniques
5. Taxonomic studies
6. Demographic studies
7. Propagation
8. Migration
9. Predation
10. Competition
11. Disease
12. Environmental contaminant
13. Reintroduction
14. Other information

Management - M

1. Propagation
2. Reintroduction
3. Habitat maintenance and manipulation
4. Predator and competitor control
5. Depredation control
6. Disease control
7. Other management

Acquisition - A

1. Lease
2. Easement
3. Management agreement
4. Exchange
b. Withdrawal
6. Fee title
7. Other

Other - O

1. Information and education
2. Law enforcement
3. Regulations
4. Administration

Recovery Plan for The

Endangered Bonytail Chub

Gila elegans