

COLORADO SQUAWFISH

Revised  
RECOVERY PLAN

(Original Approval: March 16, 1978)

Prepared by the Colorado River Fishes Recovery Team

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

Approved: *Robert B. Buntel*  
Regional Director, U.S. Fish and Wildlife Service

Date: AUGUST 7, 1991

## EXECUTIVE SUMMARY

Current Species Status: The Colorado squawfish (Ptychocheilus lucius) was listed as endangered on March 11, 1967. The original recovery plan was approved on March 16, 1978. This is a revision of that plan. The Colorado squawfish population has declined from historic levels. This decline may be due to various human-caused physical and biological changes in the Colorado River system where the fish occurs.

Habitat Requirements and Limiting Factors: The present range of natural populations of the Colorado squawfish is restricted to the Upper Colorado River Basin (Upper Basin) in Colorado, New Mexico, Utah, and Wyoming, although hatchery reared Colorado squawfish have been reintroduced into the Salt and Verde Rivers in Arizona. The decline in the numbers and distribution of Colorado squawfish is due to physical changes in the river system, including stream alteration and habitat fragmentation as a result of dam construction, irrigation, dewatering, and channelization. Biological changes including competition with and predation by introduced nonnative fish also are factors in the squawfish decline.

Recovery Objective: Delisting. Each Colorado Squawfish Recovery Area (Recovery Area) can be delisted as recovery objectives are achieved.

Recovery Criteria: Each Recovery Area will remain listed until such time as their recovery criteria are met. The species can be downlisted or delisted when all Recovery Areas have been downlisted or delisted. The Colorado squawfish will be considered eligible for reclassification to threatened when naturally self-sustaining populations are maintained in the Upper Basin in the following Recovery Areas:

- (a) the Green River subbasin including the Green River from its confluence with the Colorado River to its confluence with the Yampa River, the lower 220 km (137 miles) of the Yampa River, and the lower 240 km (150 miles) of the White River;
- (b) the Colorado River from Palisade, Colorado, to Lake Powell; and
- (c) the San Juan River from Lake Powell upstream to the confluence of the Animas River near Farmington, New Mexico.

(The Colorado squawfish may be downlisted separately by Recovery Area with the Green River and Colorado River areas being downlisted concurrently.)

The Colorado squawfish will be considered eligible for delisting when:

- (a) downlisting criteria have been met;

- (b) a population in either the Salt River from a diversion dam upstream of Roosevelt Lake to Apache Falls or in the Verde River from Horseshoe Reservoir upstream to Paulden, Arizona, is reestablished and habitats and flows are protected. Feasibility of this effort will be reevaluated at the conclusion of the 1995 Lower Basin Agreement. At that time, the need for inclusion of these areas in the delisting criteria will be reconsidered;
- (c) the threat of significant fragmentation (e.g., fragmentation that would impair the reproductive success of the population or limit/impact the adult population size) is removed;
- (d) essential habitats, primary migration routes, required streamflows, and necessary water quality are legally protected; and
- (e) other identifiable threats, if any, which may significantly affect the population are removed.

(The Colorado squawfish may be delisted separately by Recovery Area, with the Green River and Colorado River areas being delisted concurrently.)

Actions Needed: Major actions needed to achieve the recovery of the Colorado squawfish are:

1. Monitor population status and define the life history requirements of the Colorado squawfish.
2. Implement management plans to protect and maintain Colorado squawfish populations and their habitat.
3. Reintroduce Colorado squawfish into their historic range.
4. Promote and encourage improved communication and information dissemination.
5. Determine biological criteria/objectives for downlisting/delisting the Colorado squawfish.

Date of Recovery: The Colorado squawfish is being recovered in correlation with the bonytail chub, the humpback chub, and the razorback sucker. This recovery plan addresses the recovery needs of the Colorado squawfish in both the upper and lower basins of the Colorado River. The "Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin" (Recovery Program) identifies specific recovery tasks and strategies to be employed in recovering the Colorado River fishes in the Upper Basin, excluding the San Juan River. The goal of the implementation program is to recover these Colorado River fishes in the Upper Basin area in 15 years at an estimated cost of \$53 million. The Recovery Program will be considered a stepdown effort of the Colorado squawfish Recovery Plan and will provide the primary mechanism for implementing the recovery plan in the Upper Basin. A recovery program specifically covering the San Juan River is currently being developed. Development of an endangered fishes management program for the lower basin is being planned.

## ACKNOWLEDGEMENTS

The Colorado Squawfish Recovery Plan was prepared by the Colorado River Fishes Recovery Team, composed of the following individuals:

Jim St. Amant, Team Member, California Department of Fish and Game,  
1975-1982, Team Leader, 1982-1989,  
Steve Petersburg, Team Secretary, National Park Service, 1976-1989, Team  
Leader 1989-present,  
Harold Tyus, Team Member, U.S. Fish and wildlife Service, 1979-present  
Reed Harris, Team Member, Bureau of Reclamation, 1980-1990  
Jim Bennett, Team Member, Colorado Division of wildlife, 1982-present  
Gerry Burton, Team Member, U.S. Fish and wildlife Service, 1982-1988  
Randy Radant, Team Member, Utah Division of wildlife Resources, 1982-1989  
Dave Buck, Team Member, Nevada Department of wildlife, 1984-present  
Dean Hendrickson, Team Member, Arizona Department of Game and Fish,  
1987-1990  
Denise Knight, Team Member, Utah Division of wildlife Resources,  
1988-1990  
Frank Baucum, Team Member, U.S. Fish and wildlife Service, 1988-present  
David Probst, Team Member, New Mexico Department of Game and Fish,  
1988-present  
Glenn Black, Team Member, California Department of Fish and Game,  
1988-present

Numerous other persons provided reviews and/or information for the preparation of this plan. The Fish and wildlife Service greatly appreciates the invaluable assistance provided by team members (past and present), consultants, and other individuals who contributed to the preparation of this document.

PART I  
INTRODUCTION

History

The Colorado squawfish (*Ptychocheilus lucius*) is the largest of four living species of the genus *Ptychocheilus*. Although the specific name *lucius* means "pike like," the Colorado squawfish is taxonomically placed in the large and diverse minnow family Cyprinidae. It is the largest cyprinid in North America (Miller 1961), a voracious predator, and the top native carnivore of the Colorado River system. Maximum weights exceeding 36 kg (79 lbs) and lengths of nearly 1.8 m (71 in.) have been recorded; however, specimens weighing more than 7 kg (15 lbs) have been rare in recent times (Minckley 1973; Behnke and Benson 1980). Its substantial size and migratory habit resulted in use of the common names "white salmon," "Colorado salmon," or simply "salmon" in early literature (Minckley 1973; Behnke and Benson 1980).

The evolutionary history of *Ptychocheilus lucius* has been marked by scores of oscillations between pluvial- and arid-dominated habitats caused by climatic fluctuations during the Miocene, Pliocene, and early Pleistocene epochs (G. Smith 1981). *P. lucius* was adapted to swift water by the mid-Pliocene (Uyeno and Miller 1965), but fossil evidence indicates that it may have used lakes as well as rivers (G. Smith 1975, 1981; M. Smith 1981). The species may have developed the capability to survive in either lakes or rivers, depending on prevailing climatic conditions (Tyus 1986). Large size, great mobility, and spawning migrations would be adaptations to drier seasons when suitable spawning habitats are limited or far-removed from other adult habitats (G. Smith 1981). These adaptive life strategies that formerly benefited the fish (Tyus and McAda 1984; Tyus 1986) may now be contributing to its decline.

The other three living members of the genus *Ptychocheilus* include the Sacramento squawfish (*P. grandis*) of the Sacramento-San Joaquin, Pajaro, Salinas, and Russian Rivers in California; the Northern squawfish (*P. oregonensis*) of the Columbia River Basin in Nevada, Oregon, Washington, Idaho, and Montana, north to the Nass River, British Columbia; and the Umpqua squawfish (*P. umpquae*) in the Umpqua and Siuslaw Rivers in Oregon (Lee et al. 1980). Unlike the Colorado squawfish, these three species remain common in their native waters.

The Colorado squawfish was listed as endangered by the U.S. Fish and Wildlife Service (Service) in the Endangered Species List published in the Federal Register (Vol. 32[43]:40001) on March 11, 1967. Full protection under the Endangered Species Act of 1973, as amended, occurred upon its listing in the Federal Register (Vol. 39[3]:1175) on January 4, 1974. The States of California, Arizona, New Mexico, Utah, and Colorado each have laws protecting the Colorado squawfish within State waters.

## General Description

The Colorado squawfish is an elongated pike-like fish. The mouth is large and nearly horizontal, with a pharyngeal tooth formula of 2,5-4,2; the long, slender pharyngeal teeth are adapted for grasping and holding prey. The anal and dorsal fin each have nine principal rays and the dorsal fin originates slightly posterior to the insertion of the pelvic fins. The scales are small and embedded on the belly, breast, and nape, and number 80-95 in the lateral line. Adults are strongly countershaded with a dark, olivaceous back; lighter sides; and a white belly. Young are silvery and usually have a dark, wedge-shaped spot at the base of the caudal fin.

## Distribution and Abundance

### Historic Distribution

The Colorado squawfish is endemic to the Colorado River basin. Early records indicate it was abundant in the mainstem Colorado River, most of its major tributaries, and in the Colorado River delta in Mexico (Jordan and Evermann 1896) (Figure 1). Colorado squawfish have been reported at the following locations:

1. Arizona: Gila River and its tributaries, the San Pedro, Salt, and Verde Rivers; the Colorado River mainstem from the United States-Mexico border to the Utah-Arizona State line and the lower most Little Colorado River (Minckley 1973, 1985).
2. California: Colorado River mainstem from the United States-Mexico border to the Nevada State line and the Salton Sea, which was sporadically filled with water from the Colorado River (Minckley 1973, 1985; Moyle 1976).
3. Colorado: Colorado River and lower reaches of the Gunnison, White, Yampa, Little Snake, Dolores, San Juan, Uncompahgre, and Animas Rivers (Jordan 1891; Ellis 1914; Beckman 1952; Lemons 1954; Johnson 1976; Valdez et al. 1982a), and Plateau Creek, a tributary of the Dolores River (Bob Burdick, U.S. Fish and Wildlife Service, pers. comm. 1990.).
4. Nevada: Colorado River mainstem (La Rivers 1962).
5. New Mexico: San Juan and Animas Rivers (Koster 1957, 1960; Platania 1990).
6. Utah: Colorado, Green, Duchesne, San Juan, White, and Dolores Rivers, and probably numerous smaller streams (Ellis 1914; Holden 1973; Seethaler 1978).
7. Wyoming: Green River mainstem (Baxter and Simon 1970; Bosley 1960; Johnson and Oberholtzer 1987) and Little Snake River (Marsh et al. 1991).
8. Mexico: Mainstem Colorado River and its tributaries and sloughs from the United States-Mexico border to the Gulf of California (Sonora and Baja California del Norte) (Follett 1961; Minckley 1979).

# COLORADO SQUAWFISH

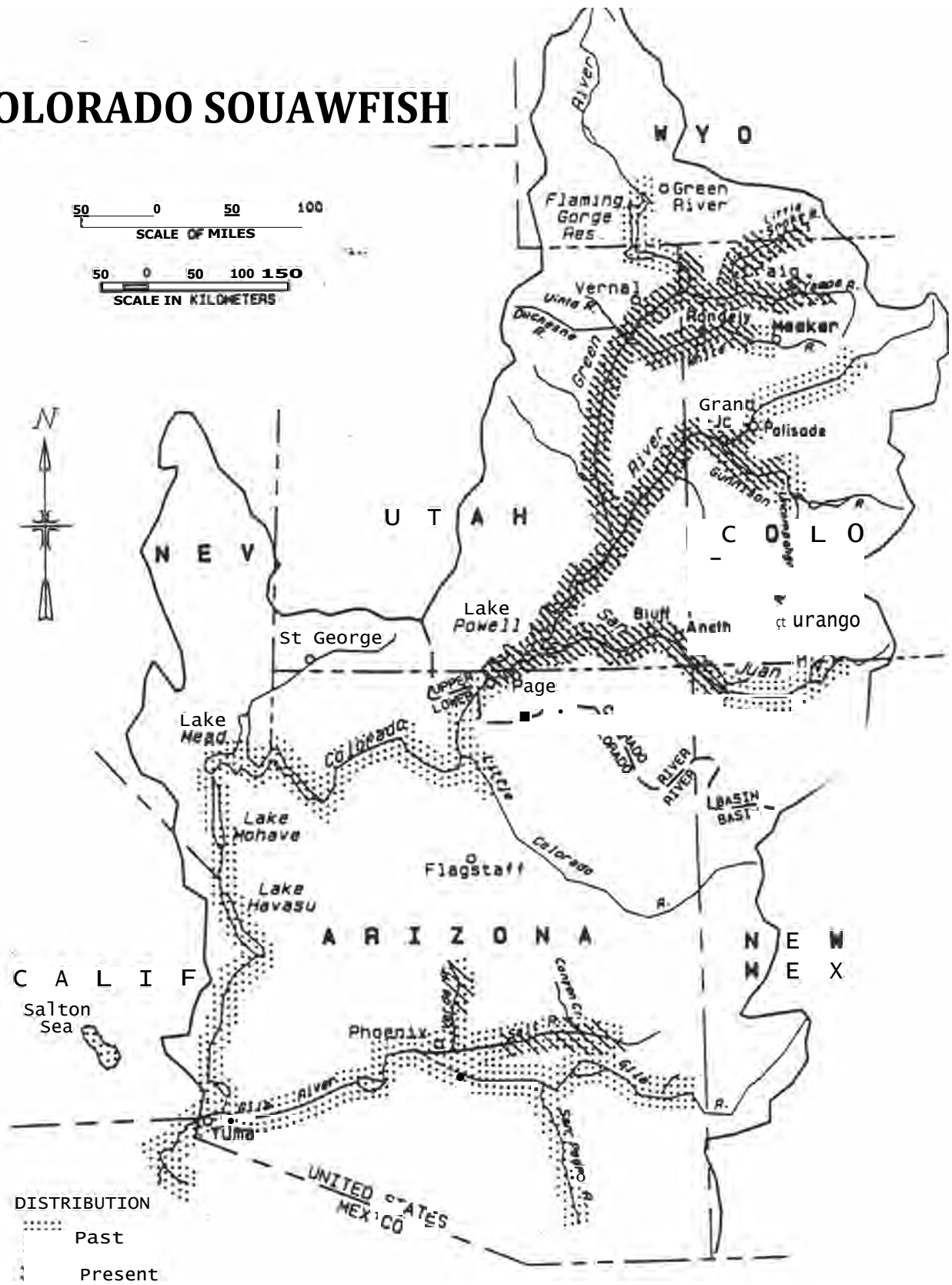


FIGURE 1. Past and Present Distribution of the Colorado Squawfish in the Colorado River System.

# COLORADO SQUAWFISH

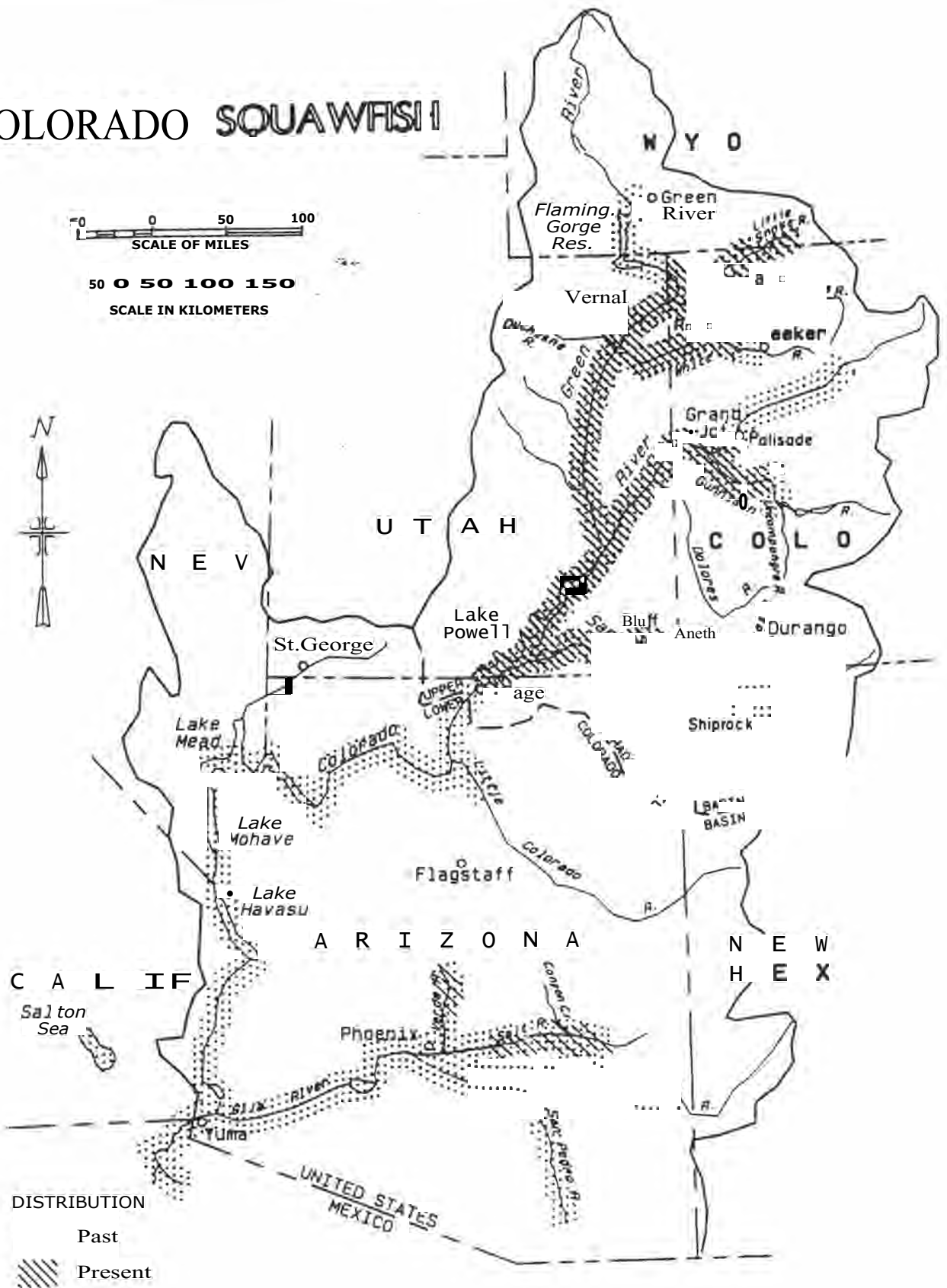


FIGURE 1 Past and Present Distribution of the Colorado Squawfish in the Colorado River System.



An indication of the prior abundance of Colorado squawfish was its use for food and fertilizer (Miller 1961; Minckley 1973) and its widespread favorable reputation with early settlers as a food and game fish from Colorado downstream into Arizona (Ellis 1914; Dill 1944; Carhart 1950; Rostlund 1952; LaRivers 1962; Sigler and Miller 1963; Minckley 1965, 1973.).

#### Present Distribution and Abundance

Natural populations of the Colorado squawfish are restricted to the Upper Colorado River Basin (Upper Basin) in Wyoming, Colorado, Utah, and New Mexico. The species is most abundant in the Green River below the confluence with the Yampa River; the Yampa River from near Hayden, Colorado, to the confluence of the Green River; the White River from Taylor Draw Dam near Rangely, Colorado, downstream to the confluence with the Green River; and mainstem Colorado River from Palisade, Colorado, downstream to Lake Powell (Holden and Wick 1982; Miller et al. 1982b; Tyus et al. 1982b, Tyus et al. 1987; Wick et al. 1985, 1986; Archer et al. 1985).

Catches of young, juvenile, and adult Colorado squawfish are reported to be an order of magnitude higher in the Green River subbasin of Colorado and Utah than elsewhere (Tyus et al. 1986; Tyus 1990). Recent investigations have found many young, juveniles, and adults in the Green River from the mouth of the Yampa River to its confluence with the Colorado (Holden 1973; Holden and Stalnaker 1975a, 1975b; Tyus et al. 1982a, 1982b, 1987; Archer et al. 1985). Adults have been captured in the lower 199 km (124 miles) of the Yampa River and in Lodore Canyon of the Green River (Tyus et al. 1982a; Miller et al. 1982b), and larvae were identified from the lower 30 km (19 miles) of the Yampa River in Dinosaur National Monument (Wick et al. 1981, 1985, 1986; Haynes et al. 1984; Tyus and Haines 1991). Two adult Colorado squawfish implanted with radio transmitters ascended the Little Snake River in 1988 (Wick and Hawkins 1989). Investigation of the Green and Little Snake Rivers in Wyoming in 1986 failed to produce any Colorado squawfish, (Johnson and Oberholtzer 1987); however, an adult Colorado squawfish was found in the Little Snake River in Wyoming in 1990 (Marsh et al. 1991).

Colorado squawfish have been found in the lower 243 km (151 miles) of the White River in Utah and Colorado (Prewitt et al. 1978; Wick et al. 1979, 1981; Carlson et al. 1979; Lanigan and Berry 1981; Miller et al. 1982a; Martinez 1986a). In the Duchesne River, a fisherman caught a Colorado squawfish at the mouth of the Uinta River in 1975 (Seethaler 1978) and a specimen implanted with a radio transmitter ascended the Duchesne River in 1980 (Tyus et al. 1982b).

Adult and young Colorado squawfish still inhabit Lake Powell (Minckley 1973; Wick et al. 1981; Valdez et al. 1982b; Miller et al. 1984). Adult Colorado squawfish were captured in the riverine portion of the reservoir in 1980 (Persons and Bulkley 1982). Valdez (1990) also reported both adult and juvenile Colorado squawfish in Cataract Canyon at the inlet of Lake Powell, indicating that the species is reproducing in or above that reach.

A small reproducing population of Colorado squawfish exists in the San Juan River. A single juvenile squawfish was captured in the San Juan River just below the confluence of McElmo Creek near Aneth, Utah, in 1978 (Minckley and Carothers 1980; VTN 1978). Platania et al. (1991) summarized captures of squawfish in New Mexico and Utah from 1987 to 1989. Eight adults and nineteen young-of-the-year were captured (two additional adults were observed but not captured). Except for one adult captured in the San Juan arm of Lake Powell, the adults were captured in the San Juan River between River Mile (RM) 89 near Bluff, Utah, and RM 163 near Shiprock, New Mexico. In 1987, 18 young-of-the-year were collected from the San Juan River. Two were collected downstream of Shiprock, New Mexico (Platania et al. 1991), six near Bluff, Utah, and ten in the Lake Powell inflow area. A young-of-the-year captured in 1988, also was taken from this inflow area. In 1990, another young-of-the-year was collected near Bluff, Utah (Bill Bates, Utah Division of wildlife, pers. comm. 1990).

In the Lower Colorado River Basin (Lower Basin), Miller and Lowe (1964), and Minckley and Deacon (1968) considered Colorado squawfish extirpated from the Gila River system, and Minckley (1973, 1979) later expanded this to include all Arizona waters except above Glen Canyon Dam in Lake Powell. No Colorado squawfish (other than stocked fish) have been taken from the Gila River basin since 1950 (Miller 1961); a 1958 record of this species from the Salt River, Arizona (Branson et al. 1966), was based on misidentified roundtail chub (*Gila robusta*) (R.R. Miller pers. comm. to W.L. Minckley). The last adult squawfish from the mainstem lower Colorado River was taken by a fisherman in 1967 in Lake Mohave (Minckley and Deacon 1968).

Although natural populations of the species were extirpated from the Lower Basin, hatchery-reared Colorado squawfish have been introduced in several locations. More than 96,000 fingerling and 442 larger Colorado squawfish, 355-405 mm (14-16 in.) total length (TL), were introduced at six locations on the Salt and Verde Rivers, Arizona, in 1985 (Brooks 1986). Seven of the larger squawfish were captured in experimental trammel nets within 10 days after stocking, and five more fish of the larger size group were captured about 5 months after stocking. In 1987, 31,750 fingerling Colorado squawfish from Dexter National Fish Hatchery were stocked at two sites in the Salt River drainage (including 6,750 into Canyon Creek) and 100 Colorado squawfish were stocked into the Verde River. Arizona Game and Fish Department biologists recaptured three in Canyon Creek, and one in the Salt River. In 1988, Dexter National Fish Hatchery personnel stocked 20,000 fingerlings into the Salt River, 18,000 into Canyon Creek, and 89,303 into the Verde River. Bubbling Ponds State Fish Hatchery personnel stocked 120,604 fingerlings into the Verde River and 1,194 into Sycamore Creek, a tributary to the Verde River. In 1988, 57 Colorado squawfish were recaptured on Verde River, and six from the Salt River. Recaptures during both years included fish which had been at large for 3 months to 1 year (Dean Hendrickson, Arizona Game and Fish, pers. comm. 1990). Colorado squawfish stockings continue in the Salt and Verde Rivers, and expansion of the program is planned.

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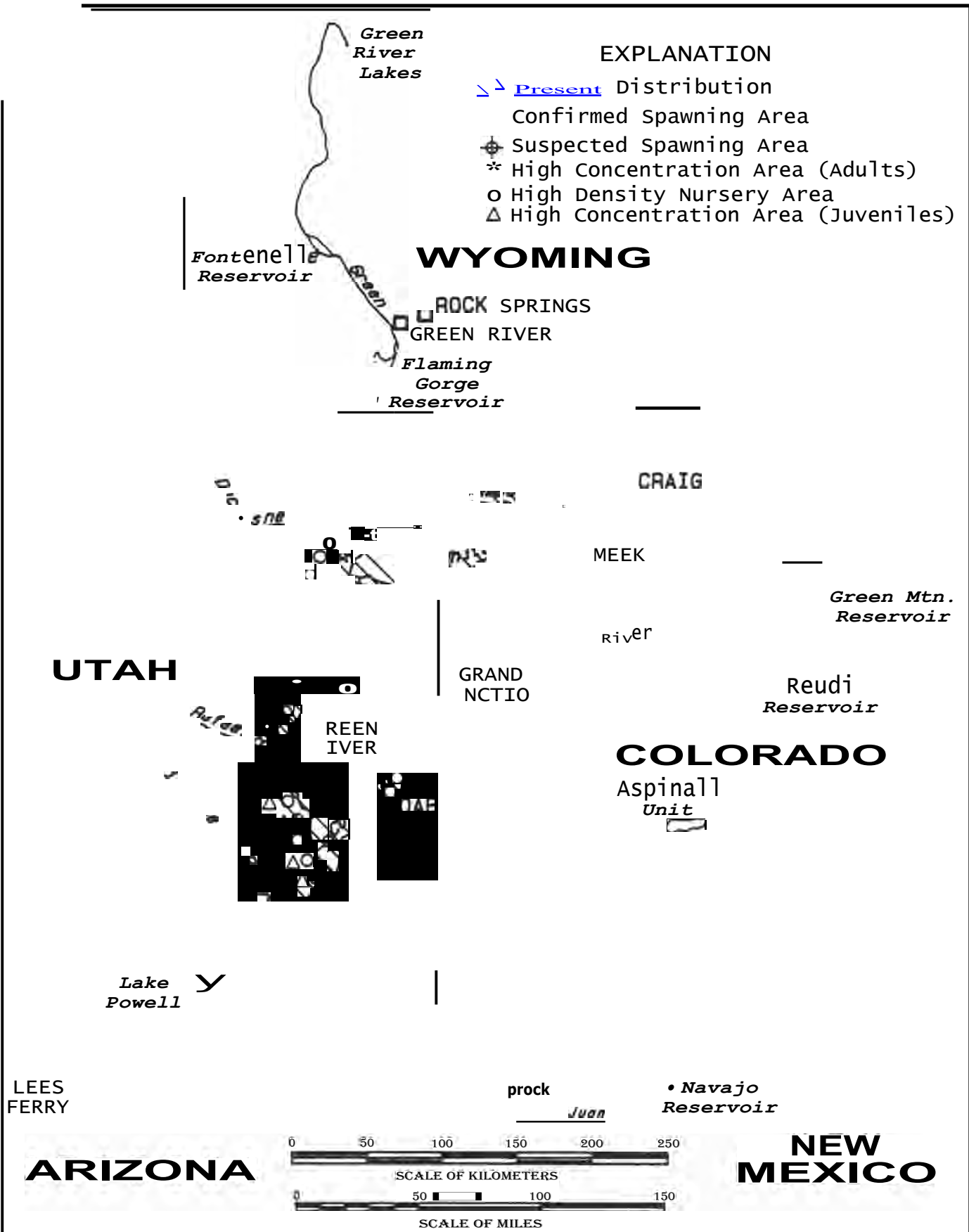


FIGURE 3. Colorado Squawfish sensitive areas identified by the Upper Colorado River Coordinating Committee (1987). (San Juan River information provided by Utah and New Mexico.)

## Narrative

### 1. Monitor population status and define the life history requirements of the Colorado squawfish.

#### 11 Monitor Colorado squawfish populations.

Intensive field investigations have been conducted to locate Colorado squawfish populations in most of the known occupied habitat. Reaches should be identified for long-term monitoring of important life stages of Colorado squawfish.

##### 111. Compile and analyze population data.

Information on population abundance, distribution, migration, and other general biological information should be compiled and evaluated to: (a) identify index monitoring sites; and (b) determine baseline population status and trends at the index monitoring sites.

##### 112. Develop standardized monitoring procedures.

Standardized procedures should be developed by an interagency group to ensure that efficient and compatible monitoring procedures are used throughout the Colorado River basin. Monitoring procedures including electrofishing, handling, tagging, and larval fish sampling should be evaluated for impacts to squawfish populations.

##### 113. Determine population status and trends.

An intensive monitoring program using procedures developed in Task 112 should be conducted to determine population status over time (i.e., identify age classes, hatching and rearing success, relative abundance, etc.).

#### 12 Research and expand the life history information.

Important aspects of the life history of the Colorado squawfish will be described. Efforts should be made to maximize scientific use of fish. All fish mortalities will be sent to the Service facility at Fort Collins, Colorado; Arizona State University; or other suitable facility as determined by the Service for cataloging and storage.

##### 121. Refine information related to life history/spawning and recruitment requirements.

Additional life history information should be collected to determine critical or limiting life stages of the Colorado squawfish. Major emphasis should focus on better understanding the factors affecting spawning, larval and young-of-the-year transport, and recruitment success. Priority studies include:

construction of **facilities** such as a hatchery, fish passageways, etc. Private entities proposing water projects will support the program by **providing** a one-time contribution of \$10 per acre-foot of the average annual depletion of the project.

The Recovery Program (U.S. Fish and Wildlife Service 1987) is intended to provide for the coordinated implementation of the Service's recovery plans for one endangered bonytail chub, humpback chub, Colorado squawfish, and the proposed endangered razorback sucker in the Upper Basin (excluding the San Juan River). Therefore, the Recovery Program will be considered a stepdown effort of this recovery plan and become the primary mechanism for implementing the recovery plan in the Upper Basin.

A recovery implementation program for the Colorado squawfish and the razorback sucker is currently being developed for the San Juan River by the Service in coordination with appropriate Federal and State agencies, Indian tribes, environmental groups, and water development interests. This will be the primary mechanism for implementing this recovery plan in the San Juan River.

An additional cooperative interagency plan for recovery actions for these endangered fish in the Lower Basin is being planned. When completed, this Lower Basin Recovery Action Plan will be considered the Lower Basin stepdown effort of this recovery plan and will be the primary mechanism for implementing this recovery plan in the Lower Basin. The Service should ensure that the Upper Basin Recovery Program, the San Juan Recovery Program, and the Lower Basin Recovery Action Plan currently being developed are fully coordinated.

3. Reintroduce Colorado squawfish into their historic range.

Colorado squawfish are now being reintroduced into unoccupied habitat areas in the Lower Basin with highest recovery potential (i.e., the Salt River, the Verde River, and the Lower Colorado River). Based on research accomplished in Task 331, augmentation of Colorado squawfish in the upper Colorado River and San Juan River subbasins may be needed to support research and recovery activities. Studies on age class structure, distribution, and creel census will determine success of the stocking program. Results of these studies will help to determine future stocking requirements.

All fish stocked in the Upper Basin will be marked before release into the wild, consistent with ongoing efforts. Restocked areas will be sampled by standard fishery techniques to assess survival, growth, etc. Followup stockings in reintroduction sites should be based on monitoring results to determine if initial stocking is contributing to the reestablishment of a self-sustaining population.

31. Develop capabilities to produce adequate numbers of Colorado squawfish for research and management.

Produce an adequate supply of genetically diverse and disease-free Colorado squawfish to support research, recovery, and reintroduction efforts and to maintain a refugium population.

311. Develop or improve propagation, holding, and rearing techniques to optimize production.

Additional information on propagation, rearing, and holding techniques must be developed to optimize production. Methods to induce maturation of gonads have been developed. However, there is a need to determine optimum loading capacities of holding/rearing facilities for different sizes of fish. Additional production and rearing capability should be developed to meet anticipated needs, but emphasis should be placed on maximizing the use of existing capabilities (e.g., Dexter and Willow Beach National Fish Hatcheries, State facilities).

312. Maintain a diversified gene pool.

Studies should be undertaken to determine whether significant genetic differences exist among fish from different subbasins and to determine the number of brood fish needed to provide natural genetic diversity for at least 20 generations. If little or no genetic impact is indicated, hatchery broodstock will be supplemented as necessary with wild fish or gametes from wild fish of different rivers to maintain genetic diversity.

32. Conduct reintroduction programs in the Lower Basin.

Reintroduction programs have been initiated in the Lower Basin. Because there are no existing populations in the Lower Basin, reintroduction is the only potential method for reestablishing Colorado Squawfish populations.

321. Identify areas for reintroduction/augmentation.

An evaluation of each potential reintroduction site will be conducted based on information gathered in Tasks 231, 232, and 233. Primary candidate sites for reintroduction are in the Lower Basin. Fish stocked in the Lower Basin in the Salt and Verde Rivers have been designated as nonessential experimental populations.

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322. Restore or •re are stockin sites as needed.

Habitat enhancement should be considered based on the results of Task 243. Improvements could include physical habitat modifications such as addition of large boulders for cover or the creation of side channels and **backwaters**, as well as biological modifications such as eradication of **nonnative** species or a moratorium on stocking **nonnative** species where Colorado squawfish recovery activities will be initiated.

323. Stock and monitor reintroduced/stocked populations.

Stock specific reintroduction sites identified in Task 321. Stocking is planned to continue in the Salt and Verde Rivers through 1995. At least annual monitoring of stocked areas should be conducted to determine survival, movement, and habitat selection of the stocked fish, plus other attributes of the ecosystem such as relative abundance of fish species encountered. After the stocking period, the success of the program will be evaluated and recommendations for further recovery efforts in the Lower Basin may be formulated. Regular monitoring will determine if it is contributing to the establishment of a self-sustaining population.

33. Conduct augmentation/reintroduction ~~p~~.rogram in the Upper Basin.

Colorado squawfish populations occur in several reaches of Upper Basin rivers. Stocking programs will need to be evaluated to determine if they will contribute to reproduction and establishment of self-sustaining populations. If so, programs will be initiated to augment existing populations and reestablish populations in reaches where Colorado squawfish are absent.

331. Assess the role of artificial propagation of Colorado squawfish in providing fish for research and for augmentation ~~s~~tocking.

Some basic questions about size at stocking, habitat use, interspecific competition, olfactory cues and imprinting, and reproductive success must be answered to determine the feasibility of stocking artificially propagated Colorado squawfish. This may require carefully planned experimental stocking. Questions associated with artificial propagation include size, capacity, location, **etc.**, of facilities needed to rear Colorado squawfish for research and for stocking.

332. Conduct reintroduction/augmentation programs.

If stocking of captive-reared Colorado squawfish is determined to be feasible in successfully restoring or augmenting self-sustaining populations of Colorado squawfish, then efforts to initiate stocking programs will begin. This will include

identification of appropriate stocking sites, development of stocking plans at each site, restoration or preparation of stocking sites, and implementation of monitoring of stocking programs.

4. Promote and encourage improved communication and information dissemination.

Information and education programs should be implemented at local, regional, and national levels to focus on the value of the Colorado squawfish as an endemic natural resource. An active effort will be made by the Service and State agencies to inform the public of recovery activities and the eventual sportfishing potential of Colorado squawfish.

Inter- and intra-agency communications, the sharing of information, and the education of the public about the goals, objectives, methods, and benefits of the recovery program are essential for a successful program.

41. Conduct nationwide information and education programs.

Conduct a national campaign to inform the public of the need to recover the Colorado squawfish. News of restoration efforts **should** be published in the Service's Endangered Species Technical Bulletin. Also, national environmental groups, newspapers, and the media should be contacted and encouraged to promote the value of recovering the Colorado squawfish.

42. Conduct local information and education programs.

All State wildlife agencies should continue to develop and provide leaflets for use by the local chapters of sportsmen and environmental groups, river runners, newspapers, and the media. Efforts should focus on recent investigations, problems facing the squawfish, and recovery efforts. The ecological value of the Colorado squawfish as an endemic species should be emphasized.

421. Minimize incidental take of squawfish through information and education programs.

Specific measures to minimize take may include: (a) education at the time of license purchase, including identification of the species and information on penalties for taking Colorado squawfish; (b) increased contact of anglers by Federal and State enforcement and management personnel; or (c) posting of signs at high concentration angler use areas.

422. Assess the sportfishery potential for Colorado squawfish.

One way to gain support for recovery programs would be generating interest in and support for a Colorado squawfish sportfishery. An assessment of the squawfish as a sport fish

identification of appropriate stocking sites, development of stocking plans at each site, restoration or preparation of stocking sites, and implementation of monitoring of stocking programs.

4. Promote and encourage improved communication and information dissemination.

Information and education programs should be implemented at local, regional, and national levels to focus on the value of the Colorado squawfish as an endemic natural resource. An active effort will be made by the Service and State agencies to inform the public of recovery activities and the eventual sportfishing potential of Colorado squawfish.

Inter- and intra-agency communications, the sharing of information, and the education of the public about the goals, objectives, methods, and benefits of the recovery program are essential for a successful program.

41. Conduct nationwide information and education programs.

Conduct a national campaign to inform the public of the need to recover the Colorado squawfish. News of restoration efforts should be published in the Service's Endangered Species Technical Bulletin. Also, national environmental groups, newspapers, and the media should be contacted and encouraged to promote the value of recovering the Colorado squawfish.

42. Conduct local information and education programs.

All State wildlife agencies should continue to develop and provide leaflets for use by the local chapters of sportsmen and environmental groups, river runners, newspapers, and the media. Efforts should focus on recent investigations, problems facing the squawfish, and recovery efforts. The ecological value of the Colorado squawfish as an endemic species should be emphasized.

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