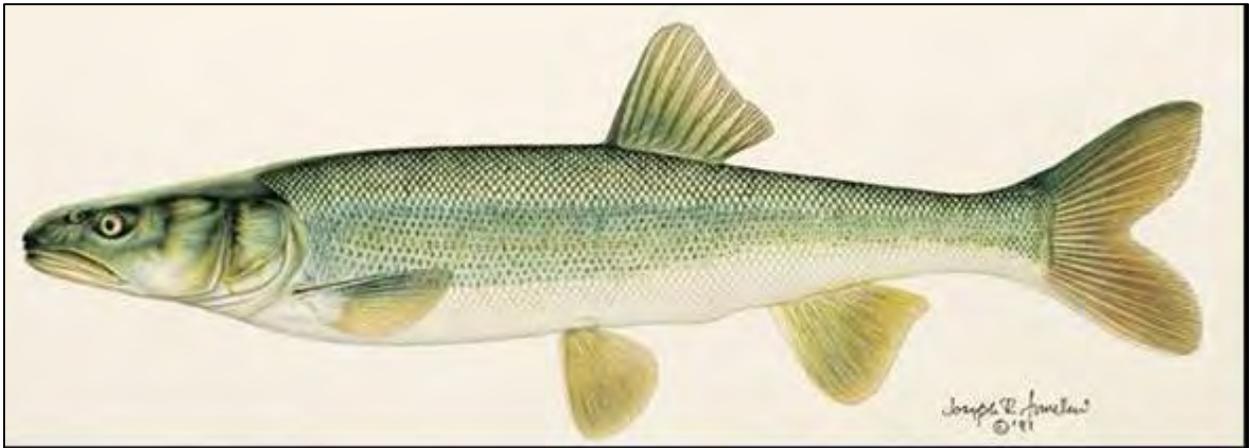


Colorado Pikeminnow *(Ptychocheilus lucius)*

5-Year Review: Summary and Evaluation



**U.S. Fish and Wildlife Service
Upper Colorado River Endangered Fish Recovery Program
Denver, Colorado**

2011

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5-YEAR REVIEW
Colorado pikeminnow (*Ptychocheilus lucius*)

1.0 GENERAL INFORMATION

1.1 Purpose of 5-year Reviews

The U.S. Fish and Wildlife Service (Service) is required by section 4(c)(2) of the Endangered Species Act (Act) to conduct a status review of each listed species at least once every 5 years. The purpose of a 5-year review is to evaluate whether or not the species' status has changed since it was listed (or since the most recent 5-year review). Based on the 5-year review, we recommend whether the species should be removed from the list of endangered and threatened species, be changed in status from endangered to threatened, or be changed in status from threatened to endangered. Our original listing as endangered or threatened is based on the species' status considering the five threat factors described in section 4(a)(1) of the Act. These same five factors are considered in any subsequent reclassification or delisting decisions. In the 5-year review, we consider the best available scientific and commercial data on the species, and focus on new information available since the species was listed or last reviewed. If we recommend a change in listing status based on the results of the 5-year review, we must propose to do so through a separate rule-making process including public review and comment.

1.2 Reviewers

Lead Regional Office: Mountain-Prairie Region (6)

Mike Thabault, Assistant Regional Director-Ecological Services, 303/236-4210

Bridget Fahey, Chief of Endangered Species, 303/236-4258

Seth Willey, Regional Recovery Coordinator, 303/236-4257

Lead Field Office:

Upper Colorado River Endangered Fish Recovery Program

Thomas Chart, Program Director, 303/969-7322, ext. 226

Cooperating Field Offices:

Ecological Services Field Office, Grand Junction, Colorado

Al Pfister, Assistant Field Supervisor, 970/243-2778

Colorado River Fisheries Program, Grand Junction, Colorado

Michelle Shaughnessy, Field Supervisor, 970/245-9319, ext.19

Ecological Services Field Office, Salt Lake City, Utah

Larry Crist, Field Supervisor, 801/975-3330, ext. 126

Ecological Services Field Office, Cheyenne, Wyoming

Mark Sattelberg, Field Supervisor, 307/772-2374, ext. 34

San Juan River Recovery Implementation Program, Albuquerque, New Mexico
Dave Campbell, Program Director 505/346-2525, ext. 4745

New Mexico Fishery Resources Office, Albuquerque, New Mexico
Jim Brooks, Field Supervisor, 505/342-9900, ext. 102

Ecological Services Field Office, Albuquerque, New Mexico
Wally Murphy, Field Supervisor, 505/761-4781

Arizona Fishery Resources Office, Whiteriver, Arizona
Stewart Jacks, Field Supervisor, 928/338-4288

Lower Colorado River Coordinator, Phoenix, Arizona
Sam Spiller, Coordinator, 602/242-0210, ext. 240

Ecological Services Field Office, Phoenix, Arizona
Steve Spangle, Field Supervisor, 602/242-0210, ext. 244

California-Nevada Ecological Services Field Office, Reno, Nevada
Ted Koch, Field Supervisor, 775/861-6331

Cooperating Regional Office(s):

Southwest Region (2)

Beth Oms, Acting Assistant Regional Director-Ecological Services, 505/248-6646

Susan Jacobsen, Chief of Endangered Species, 505/248-6641

Wendy Brown, Regional Recovery Coordinator, 505/248-6664

Pacific Southwest Region (8)

Larry Rabin, Deputy Division Chief for Listing, Recovery, and Environmental
Contaminants, 916/414-6464

1.3 Methodology Used to Complete the Review:

On April 18, 2007, we published a Notice of Review in the *Federal Register* (72 FR 19549) soliciting any new information on the Colorado pikeminnow that may have a bearing on its classification as endangered or threatened. Fewer than 20 people/agencies provided comments. All substantive comments and issues raised were considered. This 5-year review was primarily written by the Upper Colorado River Endangered Fish Recovery Program Office with substantive contributions and review by cooperating field and regional offices. It summarizes and evaluates information provided in the recovery goals, current scientific research, and surveys related to the species. All pertinent literature and documents on file at the Upper Colorado River Endangered Fish Recovery Program Office were used for this review (see References section below for cited documents). Interviews with individuals familiar with Colorado pikeminnow were conducted as needed to clarify or obtain specific information.

1.4 Background

1.4.1 FR Notice Citation Announcing Initiation of This Review:

72 FR 19549, April 18, 2007.

1.4.2 Listing History

Original Listing

FR notice: 32 FR 4001, March 11, 1967

Entity listed: Pikeminnow (=squawfish), Colorado; *Ptychocheilus lucius*

Classification: Endangered, rangewide.

1.4.3 Associated Rulemakings:

50 FR 30194; July 24, 1985 - Experimental nonessential populations established in the Salt and Verde Rivers.

59 FR 13374; March 21, 1994 - Critical Habitat Designated.

66 FR 47033, September 10, 2001. Notice of availability of draft recovery goals for four endangered fishes of the Colorado River Basin.

66 FR 58748, November 23, 2001. Reopening of public comment on draft recovery goals for four endangered fishes of the Colorado River Basin.

67 FR 55270, August 28, 2002. Notice of availability of recovery goals for four endangered fishes of the Colorado River Basin.

1.4.4 Review History: Historic 5-year reviews for all species, including the Colorado pikeminnow, were initiated by the Service's Washington, D.C., office in 1979, 1985, and 1991 (44 FR 29566, May 21, 1979; 50 FR 29901, July 22, 1985; 56 FR 56882, November 6, 1991). The Colorado pikeminnow's status also was considered in the 1978, 1991, and 2002 recovery plans (Service 1991; 2002).

1.4.5 Species' Recovery Priority Number at Start of 5-year Review:

The Colorado pikeminnow has a recovery priority number of 8C meaning there is a moderate degree of threat, a high degree of recovery potential and it is at the species level taxonomically. The "C" identifies the potential for conflicts between needed recovery actions and economic activities.

| Degree of Threat | Recovery Potential | Taxonomy | Priority | Conflict |
|------------------|--------------------|-----------------|----------|----------|
| High | High | Monotypic Genus | 1 | 1C |
| | | Species | 2 | 2C |
| | | Subspecies/DPS | 3 | 3C |
| | Low | Monotypic Genus | 4 | 4C |
| | | Species | 5 | 5C |
| | | Subspecies/DPS | 6 | 6C |
| Moderate | High | Monotypic Genus | 7 | 7C |
| | | Species | 8 | 8C |
| | | Subspecies/DPS | 9 | 9C |
| | Low | Monotypic Genus | 10 | 10C |
| | | Species | 11 | 11C |
| | | Subspecies/DPS | 12 | 12C |
| Low | High | Monotypic Genus | 13 | 13C |
| | | Species | 14 | 14C |
| | | Subspecies/DPS | 15 | 15C |
| | Low | Monotypic Genus | 16 | 16C |
| | | Species | 17 | 17C |
| | | Subspecies/DPS | 18 | 18C |

The above ranking system for determining Recovery Priority Numbers was established in 1983 (48 FR 43098, September 21, 1983 as corrected in 48 FR 51985, November 15, 1983).

1.4.6 Recovery Plan

Name of plan or outline: Colorado Pikeminnow (*Ptychocheilus lucius*)

Recovery Goals: Amendment and Supplement to the Colorado Squawfish Recovery Plan

Date approved: August 1, 2002

Dates of previous revisions, if applicable: March 1978; August 1991.

2.0 REVIEW ANALYSIS

2.1 Application of the 1996 Distinct Population Segment Policy

This section of the 5-year review is not applicable to this species because the Colorado pikeminnow was not listed as a distinct population segment nor is there relevant new information for this species regarding the application of the distinct population segment policy.

2.2 Recovery Criteria

Recovery plans provide guidance to the Service, States, and other partners and interested parties on ways to minimize threats to listed species, and on criteria that may be used to determine when recovery goals are achieved. There are many paths to accomplishing the recovery of a species and recovery may be achieved without fully meeting all recovery plan criteria. For example, one or more criteria may have been exceeded while other criteria may not have been accomplished. In that instance, we may determine that, over all, the threats have been minimized sufficiently, and the species is robust enough, to downlist or delist the species. In other cases, new recovery approaches and/or opportunities unknown at the time the recovery plan was finalized may be more appropriate ways to achieve recovery. Likewise, new information may change the extent that criteria need to be met for recognizing recovery of the species. Overall, recovery is a dynamic process requiring adaptive management, and assessing a species' degree of recovery is likewise an adaptive process that may, or may not, fully follow the guidance provided in a recovery plan. We focus our evaluation of species status in this 5-year review on progress that has been made toward recovery since the species was listed (or since the most recent 5-year review) by eliminating or reducing the threats discussed in the five-factor analysis. In that context, progress towards fulfilling recovery criteria serves to indicate the extent to which threat factors have been reduced or eliminated.

There are two recovery programs in the Upper Colorado River Basin working to recover Colorado pikeminnow: The San Juan River Recovery Implementation Program and the Upper Colorado River Endangered Species Recovery Program (Recovery Program; collectively programs). Each program has its own website that contains information about its respective program, projects and reports that were used to analyze the status of Colorado pikeminnow.

2.2.1 Does the species have a final, approved recovery plan containing objective, measurable criteria?

Yes
 No

2.2.2 Adequacy of recovery criteria.

2.2.2.1 Do the recovery criteria reflect the best available and most up-to-date information on the biology of the species and its habitat?

Yes
 No

We recommend revising the Service's 2002 Colorado Pikeminnow Recovery Goals to incorporate new information on population dynamics as presented for the Green River subbasin (Bestgen et al. 2010) and Colorado River subbasin populations (Osmundson and White 2009). More specifically, the as-written Recovery Goal requirement that these populations always display positive recruitment (i.e., recruitment that is greater than adult mortality) contradicts the best available information that indicates these populations have and likely will experience fluctuations.

2.2.2.2 Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and is there no new information to consider regarding existing or new threats)?

Yes
 No

2.2.3 List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information:

The current status of Colorado pikeminnow is endangered. Only the downlisting criteria are considered in this 5-year status review to determine if status can be changed (downlisted) to threatened. Analysis for each downlisting criterion is provided in italics directly below the criterion. Recovery of the species is considered necessary only in the upper basin (Colorado, New Mexico, Utah, and Wyoming) (Service 2002); Colorado pikeminnow historic populations in the lower basin (Arizona, California, Nevada, and New Mexico) are extirpated and the only extant population is a nonessential, experimental population in the Salt and Verde Rivers, which continues to be stocked. Based on the best available information, the Service maintains that recovery of the species is only required in the upper basin. The downlisting criteria are derived from the recovery goals established by the Service (Service 2002, Section 5.3 Objective, Measurable Recovery Criteria, pp. 44–47):

DEMOGRAPHIC DOWNLISTING CRITERIA FOR COLORADO PIKEMINNOW

The Colorado pikeminnow is endemic to the Colorado River basin, where it was once widespread and abundant in warm-water rivers and tributaries. Wild populations of Colorado pikeminnow are found only in the upper basin of the Colorado River (above Lake Powell). Three wild populations of Colorado pikeminnow are found in about 1,090 miles of riverine habitat in the Green River, upper Colorado River, and San Juan River subbasins.

Green River Subbasin Criterion 1a: A self-sustaining population is maintained over a 5-year period, starting with the first point estimates acceptable to the Service, such that the trends in separate adult (age-7+; ≥ 450 mm TL) point estimates for the middle Green River and the lower Green River do not decline significantly.

Status of Green River Subbasin Criterion 1a. *This criterion has been partially met. Whereas during the period of 2000-2003 the middle Green River population experienced a significant decline, the variability associated with the most recent sampling rotation (2006–2008) precludes a clear determination with regard to this criterion. The next 3-year sampling rotation is scheduled to commence in 2011. If the population estimates for these two reaches does not deviate significantly from the previous 3-year mean (2001–2003) this criterion will have been met. When the recovery goals were written biologists thought that there may be separate populations of Colorado pikeminnow in the middle and lower Green River reaches. However, since then the Green River is considered as one population. For this criterion, the entire Green River population of Colorado pikeminnow is considered, which includes tributaries of the Yampa, White, and reaches of the Green Rivers (middle, Desolation/Grey Canyons and lower reaches; Figure 1). This criterion has been met with respect to the entire Green River population. A Huggins robust design multi-strata model suggested about a 50% increase in abundance of adults throughout the Green River Basin from 2006 to 2008, and about a 70% increase over 2003 estimates. Population models measure a variety of parameters, including probability of capture; these parameters provide a level of certainty and reliability to the Service for these estimates in determining acceptance. As a result, we can accept these estimates and consider the population to be self-sustaining and since 2007 above the minimum viable population (MVP) value (Figure 1).*

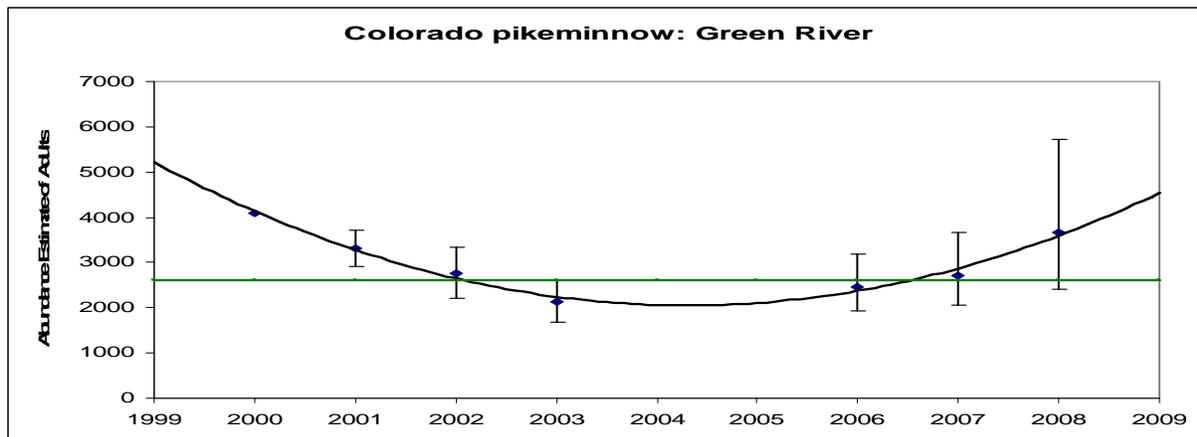


FIGURE 1. Colorado pikeminnow adult estimates, confidence intervals and trends for the entire Green River subbasin. The horizontal line represents the current demographic criterion of 2,600 adults, the number calculated for a MVP value in the recovery goals (Service 2002).

Green River Subbasin Criterion 1b: A self-sustaining population is maintained over a 5-year period, starting with the first point estimates acceptable to the Service, such that mean estimated recruitment of age-6 (400 to 449 mm TL) naturally produced fish equals or exceeds mean annual adult mortality for the Green River subbasin.

Status of Green River Subbasin Criterion 1b. *This criterion references the entire Green River subbasin population and has been partially met.* Abundance estimates for recruitment sized fish (400 to 449 mm TL) during 2000-2003 averaged 8.9% (4.7 to 13.3%) of the estimated abundance of adult Colorado pikeminnow (Bestgen et al. 2005; Figure 2). Average survival rate for adult Colorado pikeminnow was 0.65 (95% CI: 0.586–0.708), (i.e., 35% mortality) from 2000–2003 (Bestgen et al. 2005). Hence, the number of fish recruiting to adults (approximately 10% of the adult population or about 300) was not sufficient to offset the number of adults that had died (about 950 based on 65% survival rate). From 2006–2008, average annual adult survival rate was estimated as 0.80 (95% CI: 0.60–0.91), (i.e., 20% mortality) a substantial increase over the 0.65 rate for the 2000–2003 period (Bestgen, et al. 2010). Abundance estimates of recruitment-sized fish during 2006–2008 averaged 22%; thus recruitment rates were more than sufficient to offset mortality rates of adults (Bestgen, et al. 2010; Figure 2). This criterion is currently being revised to accommodate a longer tracking period to accommodate natural population fluctuations as witnessed in the Green River population from 2001–2008.

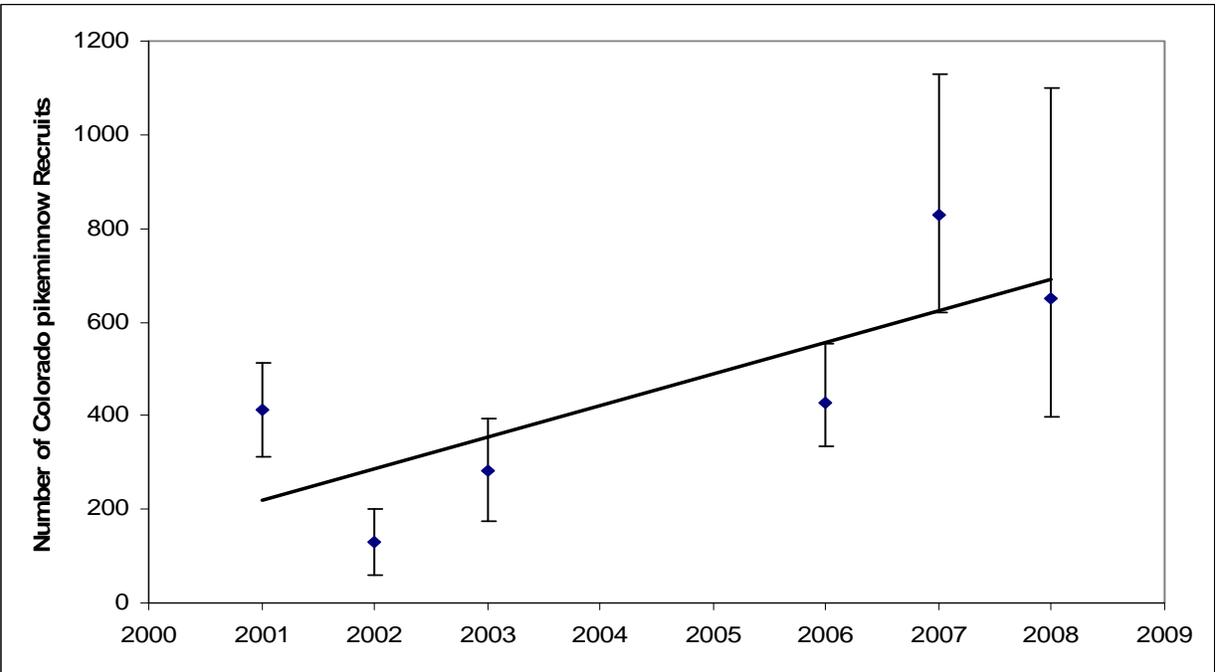


FIGURE 2. Colorado pikeminnow recruits (400 to 450 mm TL) estimates, confidence intervals and trend for the Green River.

Green River Subbasin Criterion 1c: A self-sustaining population is maintained over a 5-year period, starting with the first point estimates acceptable to the Service, such that each population point estimate for the Green River subbasin exceeds 2,600 adults [Note: 2,600 adults is the estimated MVP number; see section 3.3.2].

Status of Green River Subbasin Criterion 1c. *This criterion references the entire Green River subbasin population and has been partially met.* See 1.a. above. As identified earlier for the years 2001, 2002, 2007, and 2008 the estimated adult abundance exceeded 2,600 MVP number. This criterion is currently being revised to incorporate the best available information on adult Colorado pikeminnow survival (Bestgen et al. 2005, 2010), which factors heavily into the calculation of the MVP.

Upper Colorado River Subbasin Criterion 1a. A self-sustaining population of at least 700 adults (number based on inferences about carrying capacity) is maintained over a 5-year period, starting with the first point estimate acceptable to the Service, such that the trend in adult (age-7+; ≥ 450 mm TL) point estimates does not decline significantly.

Status of Upper Colorado River Subbasin Criterion 1a. *This criterion has been partially met.* The population trend aspect of this criterion has been met; maintenance of the carrying capacity metric, although very close to being met, has not been met. A general increasing trend in adult Colorado pikeminnow has occurred since the early 1990s, from around 440 in 1992 (95% CI: 251–832; Osmundson and Burnham 1996; Figure 3) to about 890 (95% CI: 746-1075) in 2005 (Osmundson and White 2009). In years that population estimates were conducted (1992–2005, not all years), the estimate was above 700 in 1993, 2000, and 2005. The fourth 3-year sampling rotation was completed in 2010 and will be reported in 2011.

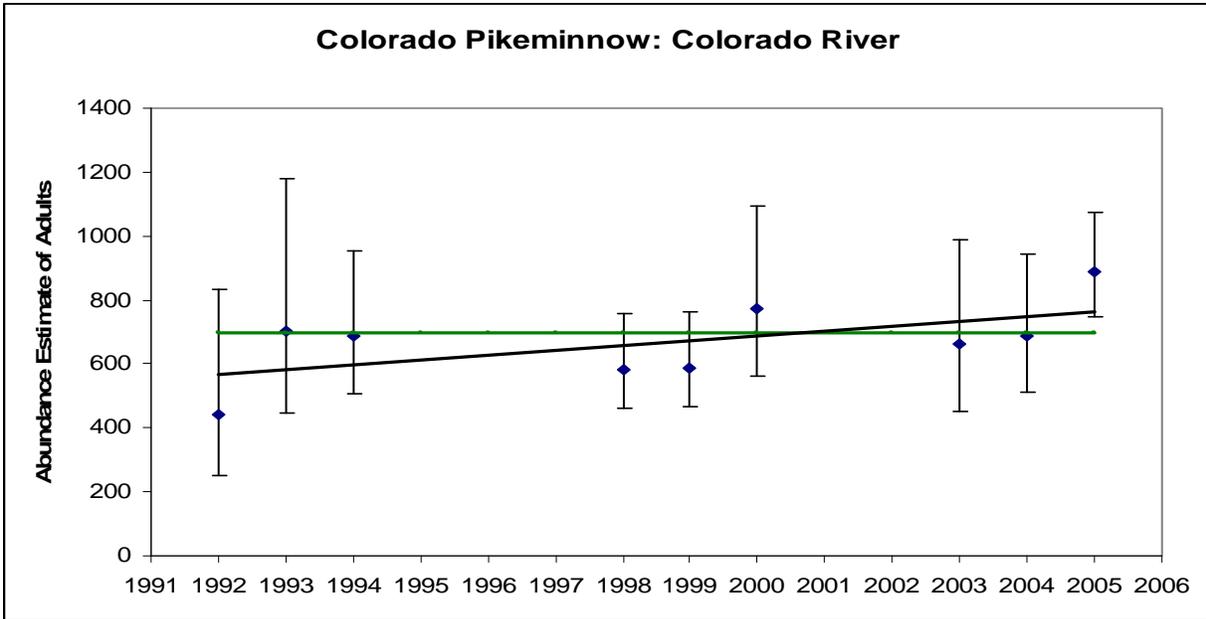


FIGURE 3. Colorado pikeminnow adult population abundance estimates in the Colorado River with 95% confidence intervals and trend line. The horizontal line represents the demographic criterion of 700 adults; number identified in the recovery goals (Service 2002)

Upper Colorado River Subbasin Criterion 1b. A self-sustaining population of at least 700 adults (number based on inferences about carrying capacity) is maintained over a 5-year period, starting with the first point estimate acceptable to the Service, such that mean estimated recruitment of age-6 (400 to 449 mm TL) naturally produced fish equals or exceeds mean annual adult mortality.

Status of Upper Colorado River Subbasin Criterion 1b. *This criterion has been partially met.* Length frequency was used to estimate that 23 captured sub-adults (400 to 449 mm) in 2003 represented about 14% of the estimated population of Colorado pikeminnow >250 mm that year, providing an estimate of 203 sub-adults (Osmundson and White 2009). In 2004, these calculations resulted in an estimate of 110 sub-adults. In both cases, the estimates were larger than the number of adults expected to die in each year (118 in 2003 and 72 in 2004), assuming an annual mortality rate of 15% (Osmundson et al. 1997). Hence, in 2003 and 2004, recruitment (as measured by the number of sub-adults) exceeded expected adult mortality resulting in overall net gains to the adult population. In 2005, only 7 of the 306 different fish captured fell between 400 to 449 mm in length, representing about 2.3% of the population, or 21 of the estimated 931 pikeminnow >250 mm (Osmundson and White 2009). Recruitment of these individuals will be insufficient to balance out the estimated 134 expected to die in 2005 (assuming an annual adult mortality rate of 15% and a population size of 890 adults). The estimated number of recruits, with variability and trend are depicted in Figure 4. This criterion is currently being revised to accommodate a longer tracking period to accommodate natural population fluctuations as witnessed in the Green River population from 2001–2008.

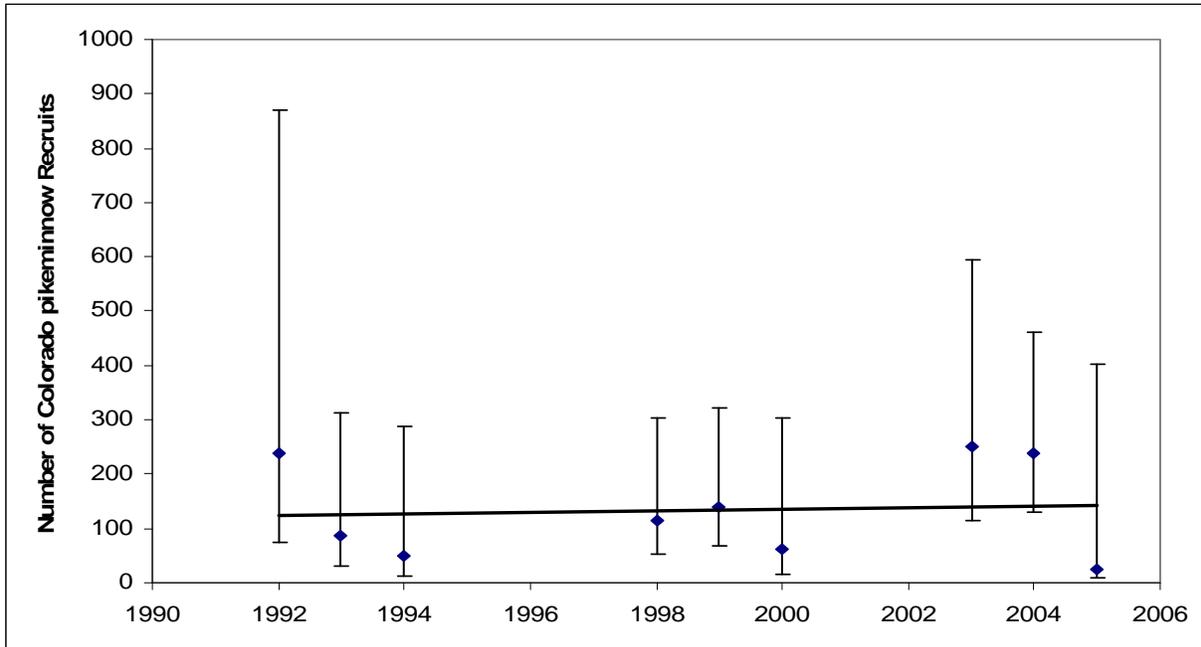


FIGURE 4. Colorado pikeminnow recruits (400 to 450 mm TL) estimates, confidence intervals and trend for the Colorado River.

San Juan River Subbasin Criterion 1. A target of 1,000 age-5+ fish (≥ 300 mm TL; number based on estimated survival of stocked fish and inferences about carrying capacity) is established through augmentation and/or natural reproduction.

Status of San Juan River Subbasin Criterion 1. *This criterion has been partially met. A stocking plan has been developed (Ryden 2003) and is being implemented to meet delisting requirements of 1,000 age-7+ adult Colorado pikeminnow in the San Juan River. About 983 stocked Colorado pikeminnow were recaptured from the San Juan River in 2004–2008 (Ryden 2009).*

Recovery Factor Downlisting Criteria for Colorado Pikeminnow to Minimize or Remove Threats to the Species

Factor A.—Adequate habitat and range for recovered populations provided.

Streamflow regulation and associated habitat modification are identified as primary threats to Colorado pikeminnow populations. The Colorado pikeminnow was first listed as endangered following a period of dam construction throughout the Colorado River Basin. Total Colorado pikeminnow habitat lost to reservoir inundation in the upper basin is about 435 miles, including Flaming Gorge on the Green River (99 miles), Lake Powell (199 miles on the Colorado River and 75 miles on the San Juan River), and Navajo Reservoir on the San Juan River (62 miles). Cold-water releases have eliminated most native fishes from river reaches immediately downstream of dams.

Adult Colorado pikeminnow are long-distance migrators to and from spawning sites; 10 barriers are identified in the upper basin upstream of Glen Canyon Dam within occupied habitat of Colorado pikeminnow.

Maintenance of streamflow is important to the ecological integrity of large western rivers. Flow recommendations have been developed for some river systems in the Upper Colorado River Basin that identify and describe flows with necessary magnitude, frequency, duration, and timing to benefit the endangered fish species. Flows necessary to restore and maintain required habitats of Colorado pikeminnow mimic the natural hydrograph and include spring peaks flows and summer–winter base flows. Flow recommendations have been developed that specifically consider flow habitat relationships within occupied habitat of Colorado pikeminnow in the upper Colorado River.

- Criterion 1.** Flow regimes to benefit Colorado pikeminnow populations in the Green River, upper Colorado River, and San Juan River subbasins should be identified, implemented, evaluated, and revised, such that:
- a. Adequate spawning habitat and appropriate spawning cues (e.g., flow patterns and water temperatures) are available to maintain self-sustaining populations, as reflected by downlisting demographic criteria.
 - b. Adequate nursery habitat is available to maintain self-sustaining populations, as reflected by downlisting demographic criteria.
 - c. Adequate juvenile and adult habitat (e.g., cover, resting, and feeding areas) is available to maintain self-sustaining populations, as reflected by downlisting demographic criteria.

Status of Criterion 1. *Criterion 1 has been partially met. Flow recommendations have been developed throughout the Green River subbasin (Irving et al. 2004 [White River]; Muth et al. 2000 [Green River]; Modde and Keleher 2003 [Duchesne River]; Modde et al. 1999 [Yampa River]; the upper Colorado River subbasin (Osmundson et al. 1995 [15-mile reach] and McAda 2003 [upper Colorado and Gunnison Rivers]); and the San Juan River subbasin (Holden 1999). These flow recommendations are being implemented and monitored. A Green River study plan has been developed (Green River Study Plan ad hoc Committee 2007) to determine the response of Colorado pikeminnow to the implemented flow recommendations downstream of Flaming Gorge. The Recovery Program collaborated with the Colorado River Water Conservancy District (District) and the City of Craig, Colorado, on the enlargement of Elkhead Reservoir in the Yampa River drainage and thereby secured 5,000 ac-ft of “fish water” (with the option to lease an additional 2,000 ac-ft annually) to augment Yampa River baseflows. Since the enlargement was completed in 2007, the “fish water” has been delivered every year. Since 1997, Water Users, the District, and Bureau of Reclamation have coordinated with the Service to deliver in excess of a million ac-ft of water to assist in the recovery of the endangered fish in the Colorado River (Table 1).*

TABLE 1. Coordinated Water Releases to Benefit Endangered Fish in the Colorado River, CO; 1997–2010

| RESERVOIRS | ACRE-FEET |
|-------------------|------------------|
| Windy Gap | 3,718 |
| Willow Creek | 9,853 |
| Granby | 39,914 |
| Palisade Bypass | 72,572 |
| Williams Fork | 84,471 |
| Wolford Mountain | 129,465 |
| Ruedi | 258,180 |
| Green Mountain | 500,120 |
| Total | 1,098,292 |

Colorado pikeminnow have successfully spawned in Green River and Colorado River subbasins every year since the Recovery Goals were approved in 2002. Colorado pikeminnow spawning has been documented in 6 of the last 15 years in the San Juan River. As discussed above, researchers have documented periods of positive recruitment in both the Green and Colorado Rivers. However, we cannot say this criterion has been fully met until we are convinced the demographic criteria have been met.

Criterion 2. Passage over Redlands Diversion and Grand Valley Diversion should be continued to allow adequate movement of Colorado pikeminnow in the upper Colorado River and Gunnison River.

Status of Criterion 2. Criterion 2 has been met. *A 350-foot long, U-shaped fish passage at the Redlands Water and Power Company diversion dam on the Gunnison River was completed in 1996. The passage restored access to 50 miles of critical habitat for the endangered fish. To date, 108 Colorado pikeminnow, 27 razorback sucker (*Xyrauchen texanus*), 1 bonytail (*Gila elegans*), 1 humpback chub (*G. cypha*), and over 97,000 other native fish have used the passage (Burdick 2010). Colorado pikeminnow and razorback sucker reproduction has been documented in reaches upstream of the fish passage (Osmundson and Seal 2009).*

A 300-foot long, rock channel fish passage at the Grand Valley Irrigation Company diversion dam on the Colorado River became operational in 1998. Unlike the fish passage structure at the Redlands diversion, this fish passage is a “non-selective” passage, meaning that all fish species are allowed to move through it. An Obermeyer Gate was installed in 2007 to remotely open and close the passage. The Obermeyer Gate system is most simply described as a row of steel gate panels supported on their downstream side by inflatable air bladders. By controlling the pressure in the bladders, the pond elevation maintained by the gates can be infinitely adjusted within the system control range (full inflation to full deflation) and accurately maintained at user-selected set-points.

These passages continue to be operated.

Criterion 3. Modification of Price-Stubb Dam and Government Highline Dam should be initiated to allow adequate movement of Colorado pikeminnow in the upper Colorado River.

Status of Criterion 3. *Criterion 3 has been met. Construction of a passive non-selective fish passage structure was completed on Price-Stubb diversion and began functioning on March 20, 2008.*

Construction of a 373-foot long concrete fish passage at the Grand Valley Project diversion dam (also referred to as the Government Highline Dam) on the Colorado River was completed in 2005. The structure provides selective fish passage at this historic, roller dam that is 15 feet high and spans 546 feet across the Colorado River. During trial operations in 2005 and 2006, which consisted of only a few weeks, 1 razorback sucker, 3 humpback chubs, and about 14,000 other native fish moved upstream. Beginning in 2008, the passage has operated from the spring through the fall, passing 1 razorback sucker in 2008 and over 20,900 native fish for both years.

Criterion 4. Barriers on the San Juan River should be identified and evaluated, and modifications should be initiated to allow adequate movement of Colorado pikeminnow.

Status of Criterion 4. *Criterion 4 has been met. Fish access has been restored to 36 miles of critical habitat on the San Juan River with the construction of passages at the Public Service Company of New Mexico weir, the Hogback Diversion Dam, and removal of the Cudei Diversion Dam. The Hogback Diversion Dam was modified with a 500-foot long rock channel fish passage to provide nonselective fish passage in 2001.*

Construction of a 400-foot long, selective fish passage at the Public Service Company of New Mexico weir was completed in 2003. Since then, 22 razorback sucker, 29 Colorado pikeminnow, and nearly 87,000 other native fish have used this passage which is operated by the Navajo Nation. No new construction is required to prevent fish entrainment.

Additional projects beyond 2011 will include addressing the need for fish passage at Arizona Public Service (APS) Diversion and Fruitland Diversion Dam. Stamp and Golden (2005) concluded that the APS Diversion has the potential to impede passage at flows less than 5,000 cfs. This means that, in most years, there is the potential for spawning Colorado pikeminnow to be impeded by the APS Diversion and unable to access 16 miles of upstream habitat. A selective fish barrier above Lake Powell is also being considered to prevent the upstream movement of nonnative fish species. These additional tasks were not contemplated when the recovery goals were developed.

Criterion 5. Investigations should be initiated on the feasibility of modifying releases from Aspinall Unit dams to increase water temperatures in the Gunnison River that would allow for upstream range expansion of Colorado pikeminnow.

Status of Criterion 5. *Criterion 5 has been met.* Osmundson (1999) recommended a feasibility study for increasing Gunnison River temperatures near Delta, Colorado, by modification of outlet structures on the Aspinall Unit dams. A two-phased study that suggested temperature could be modified through the timing of release through Crystal Dam was completed in 2004 (Hydrosphere Resource Consultants 2001, 2004; Boyer and Cutler 2004). The results of this feasibility study indicated that the installation of a multi-level outlet would be needed at Blue Mesa Reservoir to create a measurable warming effect in the Gunnison River at Delta, Colorado. The Recovery Program concluded that the apparent limited benefit was not worth the associated costs based on the available information.

Criterion 6. Measures should be identified and implemented to minimize entrainment of sub-adult and adult Colorado pikeminnow at problematic diversion structures.

Status of Criterion 6. *Criterion 6 has been partially met.* Screens are in place and operating at Grand Valley Irrigation Company (2002), Grand Valley Project (2004), and Redlands Diversion (2007). Screen mesh size on these facilities is 3/32 inch. The programs are still considering a screening option at the Tusher Wash Diversion on the lower Green River. A fish screen in the Hoagback Diversion Canal to prevent entrainment has been designed.

Factor B.—Protection from overutilization for commercial, recreational, scientific, or educational purposes.

Overutilization of Colorado pikeminnow for commercial, recreational, scientific, or educational purposes is not currently considered a threat to the species. Historically, Colorado pikeminnow were opportunistically used as food by American Indians and early explorers to the region, and were commercially harvested as “white salmon” in the early 1900s. Collection of Colorado pikeminnow for scientific or educational purposes is regulated by the Service under the Act.

Criterion 7. Overutilization of Colorado pikeminnow for commercial, recreational, scientific, or educational purposes should be reevaluated and, if necessary, actions should be identified to ensure adequate protection.

Status of Criterion 7. *Criterion 7 has been met.* No commercial or recreational activities exist. Educational activities are minimal and do not threaten Colorado pikeminnow. Bestgen et al. (2005) indicate that sampling methods for research (electrofishing, trammel nets, etc.) are not a cause of mortality.

Factor C.—Adequate protection from diseases and predation.

Diseases and parasites are not currently considered to be significant in the decline of the Colorado pikeminnow.

Colorado pikeminnow populations in the upper basin live sympatrically with about 20 species of warm-water, nonnative fishes that are potential predators, competitors, and vectors for parasites and diseases. Channel catfish and northern pike have been identified as the principal nonnative threats to sub-adult and adult Colorado pikeminnow in the upper basin. A Strategic Plan for Nonnative Fish Control was developed for the Upper Colorado River Basin. Control of the release and escapement of nonnative fishes into the main river, floodplain, and tributaries also is a necessary management action to stop the introduction of new fish species into occupied habitats and to thwart periodic escapement of highly predaceous nonnatives from riverside features. Annual flooding of the river can inundate riverside ponds potentially containing large numbers of green sunfish (*Lepomis cyanellus*), black bullhead (*Ameiurus melas*), largemouth bass (*Micropterus salmoides*), and other nonnative fishes that may escape to the river during high flows. Three management actions are identified to reduce the threat of nonnative fishes: high spring flows, nonnative fish control strategies, and stocking agreements. Active control programs should be implemented or continued for problematic nonnative fishes in Colorado pikeminnow nursery habitats, northern pike (*Esox lucius*) in the Yampa and middle Green Rivers, and channel catfish (*Ictalurus punctatus*) in river reaches occupied by Colorado pikeminnow.

Criterion 8. Effects of diseases and parasites on Colorado pikeminnow populations should be reevaluated and, if necessary, actions should be identified to ensure adequate protection.

Status of Criterion 8. *Criterion 8 has not been met. The effects of disease and parasites on Colorado pikeminnow populations have not been reevaluated.*

Criterion 9. Procedures should be developed, implemented, evaluated, and revised for stocking nonnative fish species in the Upper Colorado River Basin (including the San Juan River subbasin) to minimize negative interactions between nonnative fishes and Colorado pikeminnow.

Status of Criterion 9. *Criterion 9 has been met. Nonnative fish stocking procedures were initially developed in 1996 and modified in 2009 for the Green River and Colorado River Subbasins, these procedures are being implemented (Service 1996; 2009). The San Juan River Subbasin is developing similar procedures.*

Criterion 10. Control programs for small-bodied nonnative fishes in backwater nursery habitats in river reaches occupied by young Colorado pikeminnow should be developed and implemented to identify levels of control that will minimize negative interactions.

Status of Criterion 10. *Criterion 10 has been met. Small-bodied cyprinid control studies indicate that reduction in the numbers of small-bodied cyprinids only lasted for a short period of time (Trammel et al. 2004). However, in response to poor catches of age-0 Colorado pikeminnow in the middle Green River since the mid-1990s a study was recently initiated to reduce competition*

and predation on Colorado pikeminnow larvae by nonnative fish (predominantly cyprinids) in backwaters. Prior to Colorado pikeminnow larval drift researchers seine nonnatives from backwaters; then place screens at entrances to the backwaters with a mesh size that allows entry of Colorado pikeminnow larvae but precludes entry of adult nonnative cyprinids. Catches of age-0 Colorado pikeminnow in the middle Green River have rebounded in 2009 and 2010; however, no clear correlation has been made with this new nonnative fish removal effort.

Criterion 11. Channel catfish control programs in river reaches occupied by Colorado pikeminnow should be developed and implemented to identify levels of control that will minimize negative interactions.

Status of Criterion 11. *Criterion 11 has been partially met. Channel catfish control has been implemented in the San Juan River, but levels of control necessary to minimize negative interactions have not been identified. Various attempts (Fuller 2009; Badame and Jones 2009) in the Upper Colorado River Basin have indicated mechanical removal has no effect on channel catfish populations.*

Criterion 12. Northern pike control programs in reaches of the Yampa and middle Green Rivers occupied by Colorado pikeminnow should be developed and implemented to identify levels of control that will minimize negative interactions.

Status of Criterion 12. *Criterion 12 has been partially met. Interim Yampa River Nonnative Fish Removal Criteria have been developed and a Yampa River Nonnative Fish Control Strategy (Valdez et al. 2008) are being implemented. Northern pike control in the Yampa and Green Rivers is specifically implemented through four ongoing projects by the Recovery Program. Northern pike are removed whenever encountered during all other Recovery Program projects.*

Factor D.—Adequate existing regulatory mechanisms.

Implementation of regulatory mechanisms is necessary for the recovery of Colorado pikeminnow and to ensure long-term conservation of the species. After removal from the list of species protected by the Act, the Colorado pikeminnow and its habitat will continue to receive consideration and some protection through the following Federal laws and related State statutes: National Environmental Policy Act; Clean Water Act; Organic Act; and Fish and Wildlife Coordination Act.

The need for conservation plans and agreements was identified to provide reasonable assurances that recovered Colorado pikeminnow populations will be maintained.

Criterion 13. Mechanisms should be determined for legal protection of adequate habitat.

Status of Criterion 13. *Criterion 13 has been partially met. Filing for legal rights to protect water for fish would be junior to the legal rights of others that have already claimed water for irrigation and power. Utah is currently reviewing the water rights from Flaming Gorge and how they may be modified for fish protection. See also Status of Criterion 1 above.*

Criterion 14. Elements of conservation plans should be identified that are necessary to provide for the long-term management and protection of Colorado pikeminnow populations.

Status of Criterion 14. *Criterion 14 has not been met. Conservation plans and the necessary elements have not been developed.*

Factor E.—Other natural or manmade factors for which protection has been provided.

The potential role of pesticides and pollutants in suppressing populations of Colorado pikeminnow is not well understood. Potential spills of petroleum products threaten wild populations of Colorado pikeminnow. All States have hazardous-materials spills emergency-response plans that provide a quick cleanup response to accidental spills.

Another cause of degraded water quality is the Atlas Mills tailings pile located on the north bank of the Colorado River near Moab, Utah. There are two significant threats to endangered fish posed by the Atlas Mills tailings pile: toxic discharges of pollutants, particularly ammonia; and the risk of catastrophic pile failure.

Selenium is hypothesized as contributing to the decline of endangered fishes of the Colorado River Basin.

Criterion 15. State and Federal hazardous-materials spills emergency-response plans should be reviewed and modified to ensure adequate protection for Colorado pikeminnow populations from hazardous-materials spills.

Status of Criterion 15. *Criterion 15 has not been met. Hazardous-materials spills emergency-response plans have not been reviewed or modified.*

Criterion 16. Locations of all petroleum-product pipelines within the 100-year floodplain of critical habitat should be identified and the need for emergency shut-off valves should be assessed.

Status of Criterion 16. *Criterion 16 has partially been met. Although some progress has been made in locating all petroleum-product pipelines, determination for the need of emergency shut off valves has not been assessed. The Service now requires (via section 7 consultation) that new pipelines crossing the rivers are equipped with emergency shut-off valves.*

Criterion 17. Actions should be identified for remediation of groundwater contamination at the Atlas Mills tailings pile located near Moab, Utah.

Status of Criterion 17. *Criterion 17 has been met.* Under the Moab Uranium Mill Tailings Remedial Action Project Site Record of Decision (70 FR 55358), the action identified for remediation of groundwater contamination (principally ammonia) at the Atlas Mills tailings pile located near Moab, Utah, was to remove the tailings pile to Crescent Junction, Utah. The pile is currently in the process of being moved and ground water remediation (a very long-term commitment) is underway.

Criterion 18. Effects of selenium contamination on Colorado pikeminnow reproductive success and survival of young should be reevaluated and, if necessary, actions should be identified to reduce deleterious levels of selenium contamination.

Status of Criterion 18. *Criterion 18 has not been met.* Levels of selenium contamination in certain reaches of endangered fish critical and occupied river habitat exceed those shown to impact fish and wildlife elsewhere (e.g., Stephens et al. 1992; Stephens and Waddell 1998; Thomas et al. 1998; Simpson and Lusk 1999; U.S. Bureau of Reclamation 2006; Thomas et al. 2008). Tissue samples from endangered fish in some of these areas (Simpson and Lusk 1999; Osmundson et al. 2008) had selenium concentrations greater than toxicity guidelines for fish muscle tissue suggested by Lemly (1996) and NIWQP (1998) for protection of reproductive health in freshwater fish. The Bureau of Reclamation has committed to developing the Selenium Management Program (a remediation program) on the Gunnison River as a requirement of the Aspinall programmatic biological opinion.

2.3 Synthesis

Recovery is based on reduction or removal of threats and improvement of the demographic status of a species during the period in which it is listed, and not just from the time a listed species is proposed for reclassification. Environmental conditions and the structure of populations change over time, and threats recognized at listing or in subsequent recovery plans may no longer be directly applicable when reclassification is considered. Management actions and tasks identified for listed species are expected to minimize or remove threats and improve the species' status.

Recovery is achieved when management actions and associated tasks have been implemented and/or completed to allow genetically and demographically viable, self-sustaining populations to thrive under minimal ongoing management and investment of resources. Achievement of recovery does not mandate returning a species to all or a significant portion of its historic range, nor does it mandate establishing populations in all possible habitats, or everywhere the species can be established or reestablished.

At the time of listing, habitat losses were documented but the threats to Colorado pikeminnow were poorly understood and distribution and abundance of the species were not well known. The decline of the species was probably a combination of threats, including direct loss of habitat, changes in flow and temperature, and blockage of migration routes by the construction of large reservoirs. In addition, interaction with nonnative fish may have had a decimating effect in waters not affected by dams.

Recovery of Colorado pikeminnow is considered in the Upper Colorado River Basin, which includes the Green River, upper Colorado River, and San Juan subbasins. The analysis above of the demographic criteria has shown, none of the 6 downlisting demographic subcriteria has been fully met; all have been partially met (Table 2). From the above list of recovery factor criteria: 9 of the 18 downlisting recovery factor criteria have been met, 5 have been partially met, and 4 have not been met. Although the category “has been partially met” is identified, this is only to reflect that some progress is being made on that particular criterion. Since less than half of the all downlisting criteria/subcriteria have been met (1 of 6 demographic and 9 of 18 recovery factor), no change in the endangered status of Colorado pikeminnow is recommended. The definition of endangered applies here until the demographic criteria are met and the threats minimized or removed.

TABLE 2. Summary of the downlisting demographic and recovery factor criteria in the Upper Colorado River Basin and a determination if the criteria have been met, partially met or not met for analyzing whether Colorado pikeminnow can be downlisted.

| Criteria for Downlisting | Has been met | Has been partially met | Has not been met |
|---------------------------------|---------------------|-------------------------------|-------------------------|
| Demographic | | | |
| Green River Subbasin | | 1a, 1b, 1c | |
| Colorado River Subbasin | | 1a, 1b | |
| San Juan Subbasin | | 1 | |
| Recovery Factor A | 2, 3, 4, 5 | 1, 6 | |
| Recovery Factor B | 7 | | |
| Recovery Factor C | 9, 10 | 11, 12 | 8 |
| Recovery Factor D | | 13 | 14 |
| Recovery Factor E | 17 | 16 | 15, 18 |

3.0 RESULTS

3.1 Recommended Classification:

X No change is needed

3.2 New Recovery Priority Number: We do not recommend a change in the Recovery Priority Number. The degree of threat is moderate, with a high degree of recovery potential representing a species, which falls under the 8c category for a recovery priority number according to the “Endangered and threatened species listing and recovery priority guidance” (48 FR 43098).

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

The San Juan River Recovery Implementation Program and the Upper Colorado River Endangered Species Recovery Program continue working to meet the recovery factor criteria to minimize or remove threats: 9 of the 18 have been met, 5 have been partially met, and 4 have not been met. These programs develop annual work plans through adaptive management (Recovery Implementation Program Recovery Action Plan, i.e., “RIPRAP” and Long Range Plan), to recover the fish by achieving the recovery factor criteria. By meeting these criteria, the demographics of the species should improve. This is somewhat evidenced by the fact that flow recommendations are being implemented in the upper Colorado River reach and fish passage and screens are in place and a subsequent increasing trend in adult abundance has been detected. More work on control of nonnative fish and meeting the recovery factors will improve the status of the species.

We recommend revising the Service’s 2002 Colorado Pikeminnow Recovery Goals to incorporate new information on population dynamics as presented for the Green River subbasin (Bestgen et al. 2010) and Colorado River subbasin populations (Osmundson and White 2009). More specifically, the as-written Recovery Goal requirement that these populations always display positive recruitment (i.e., recruitment that is greater than adult mortality) contradicts the best available information that indicates these populations have and likely will experience fluctuations.

In addition, the recovery goal revision needs to consider the impacts of mercury. Beckvar et al. (2005) associated studies involving survival, growth, reproduction, and behavior and recommended that 0.2 mg/kg in whole fish be viewed as protective, while adverse biological effects are more likely at higher concentrations. Based on this threshold, the majority (64 %) of Colorado pikeminnow may be experiencing some reproductive impairment through mercury exposure. Management strategies for controlling anthropogenic mercury emissions are necessary as atmospheric pollution can indirectly affect this endangered species, its critical habitat, and its recovery by ambient air exposure, deposition into aquatic habitat and bioaccumulation in diet and in fish tissues.

Uncertainty surrounding the effects of climate change to Colorado pikeminnow should be considered for each of the threats as those impacts are realized. For example, the potential for alteration of flows in the basin as a result of climate change should be in the recovery goals. Climate change could have large impacts on the basin’s aquatic ecosystem, including (but not limited to):

- Change in the timing of peak flows from an earlier snowmelt;
- Change in the size of peak flows because of altered snowpacks; and
- Higher water temperatures from increased air temperature.

Not only would climate change affect the ecology of the species because of the factors listed above, but it also would greatly affect the management of the programs through changes in politics and economics, such as:

- Greater evaporation losses in the larger reservoirs may reduce flexibility of operations; and
- Drier conditions in the basin may cause irrigators to call on their water rights more often or request more water rights.

Colorado pikeminnow is a spotlight species within the Service.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Colorado pikeminnow*

Current Classification: Endangered

Recommendation resulting from the 5-Year Review:

- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change needed

Review Conducted By: Upper Colorado River Endangered Fish Recovery Program Office

FIELD OFFICE APPROVAL:

Tom Chart, Upper Colorado River Endangered Fish Recovery Program
Lead Field Supervisor, Fish and Wildlife Service

Approve Tom Chart Date 2/17/11

REGIONAL OFFICE APPROVAL:

FOR
Steve Guertin, Regional Director, Mountain-Prairie Region (6)
Lead Regional Director, Fish and Wildlife Service

Approve Richard A. Coleman Date 2/28/11

OTHER REGIONAL OFFICES (within range of species)

FOR
Dr. Benjamin Tuggle, Regional Director, Southwest Region (2)
Cooperating Regional Director, Fish and Wildlife Service

Concur Do Not Concur

FOR
Signature Joy E. Nicholopoulou Date 8/11/11

FOR
Michael Fris, Assistant Regional Director, Pacific Southwest Region (8)
Cooperating Assistant Regional Director, Ecological Services

Concur Do Not Concur

Signature [Signature] Date 8/29/11