



# United States Department of the Interior



## FISH AND WILDLIFE SERVICE Mountain-Prairie Region

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### Memorandum

To: Implementation/Management Committee, Consultants, and Interested Parties

From: Regional Director, Mountain-Prairie Region *Narain E. Walsh*

Subject: 2017—2018 Abbreviated Assessment of Sufficient Progress under the Upper Colorado River Endangered Fish Recovery Program in the Upper Colorado River Basin, and of Implementation of Action Items in the December 20, 1999, 15-Mile Reach Programmatic Biological Opinion, the December 4, 2009, Gunnison River Basin Programmatic Biological Opinion, and the January 10, 2005, Yampa River Basin Programmatic Biological Opinion

In accordance with the Section 7, Sufficient Progress, and Historic Projects Agreement, the U.S. Fish and Wildlife Service (Service) is reviewing 2017—2018 and cumulative accomplishments and shortcomings of the Upper Colorado River Endangered Fish Recovery Program (Recovery Program) in the upper Colorado River basin. Per that Agreement, the Service uses the following criteria to evaluate whether the Recovery Program is making “sufficient progress” toward recovery of the four listed fish species:

1. Actions which result in a measurable population response, a measurable improvement in habitat for the fishes, legal protection of flows needed for recovery, or a reduction in the threat of immediate extinction;
2. Status of the fish populations;
3. Adequacy of flows; and
4. The magnitude of the impact of projects.

Beginning in 2017, the Service began providing an abbreviated review of Recovery Program accomplishments and shortcomings to evaluate progress toward endangered species recovery and the ability of the Recovery Program to provide Endangered Species Act (ESA) compliance for water projects. Periodically the Service will provide a more comprehensive review, including a more exhaustive overview of species status. However, as we complete Species Status Assessments for the federally listed fish, we encourage partners and interested parties to refer to those documents for this type of information as well.

This Sufficient Progress Review continues with the abbreviated format but does include a review of action items in the 15-Mile Reach (Appendix I), Gunnison River (Appendix II), and Yampa River Basin (Appendix III) programmatic biological opinions (PBOs).

The final May 17, 2018, assessment of accomplishments and shortcomings of the Recovery Program under the Recovery Implementation Program Recovery Action Plan (RIPRAP) from February 1, 2017, through January 31, 2018, is incorporated in the [tables to the RIPRAP](#) found at on the Recovery Program's website.

Although this memo focuses on the RIPRAP assessment timeframe of February 1, 2017 - January 31, 2018, more information that is recent has been incorporated where warranted. Previous years' accomplishments and shortcomings are described in [previous "sufficient progress" memoranda](#) and outlined in the RIPRAP itself.

The Service issued its [most recent sufficient progress memorandum](#) on December 17, 2017.

#### **A. Status of the Species in the Upper Basin**

In the upper Colorado and Green river sub-basins (Figure 1, below), Colorado pikeminnow and humpback chub exist as wild populations with no support from hatchery-reared fish. The Recovery Program monitors the adult abundance of both species under a number of independent projects.

Adult Colorado pikeminnow abundance in the Colorado River sub-basin increased from 1992 – 2005, but has declined since 2005; similarly, adult abundance in the Green River sub-basin increased from 1991 to 2000 but has declined since 2000 (Table 1). Although populations have declined over the past 10-20 years, this species still supports itself through wild reproduction and natural recruitment to sexual maturity. In the Colorado River sub-basin, recruitment appears adequate to support a sustainable population. However, in the Green River sub-basin, recruitment has declined over the past 15 years and may not be sufficient to support a sustainable population. A Species Status Assessment<sup>1</sup> (SSA) for Colorado pikeminnow is scheduled for completion in 2019. In support of the SSA, the Recovery Program completed a population viability analysis (PVA) for Colorado pikeminnow (Miller 2018), which will greatly assist in describing the future condition and viability of the species.

Humpback chub exist in four populations in the Upper Basin, three in the Colorado River and one in the Green River (Table 2). The fifth population in Dinosaur National Monument is now considered extirpated; humpback chubs have not been collected in this location for over a decade. In the Colorado River, adult abundance estimates of the Black Rocks and Westwater Canyon populations, which comprise an upper Basin core population, indicate stability since 2007.

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<sup>1</sup> A Species Status Assessment (SSA) is an analytical tool used by the Service to summarize biological and ecological information that can help inform a variety of decisions and activities under the ESA, including recovery planning, species status reviews, inter-agency consultations, and species reclassifications. The framework of an SSA considers species needs, species current and future conditions, and species viability. The SSA is not a decision document, but rather a document used to inform future decisions.

In the fall of 2017, researchers reported an increasing number of juvenile humpback chub in Westwater Canyon and Black Rocks on the Colorado River. The Cataract Canyon population, located below the confluence of the Green and Colorado rivers, appears stable at low densities. In the Green River, adult abundance estimates in Desolation Canyon indicate stability since 1985, but captures of recruits have been low in recent years. The Recovery Program is evaluating the feasibility of and strategies for re-introducing fish to Dinosaur National Monument. The 2002 recovery goals require the maintenance of all five populations. A SSA for humpback chub was completed in December 2017. Based, in part, on the resilience of the upper basin populations and that of a large, stable population in the Grand Canyon, the Service decided (via a 5-yr Review signed in March 2018) to pursue reclassification of humpback chub as a threatened species (i.e., downlist from endangered status). This represents the first proposal to reclassify a listed Colorado River fish species.

Hatchery-produced stocked fish form the foundation for reestablishing naturally self-sustaining populations<sup>2</sup> of razorback sucker (Table 3) and bonytail (Table 4) in the upper Colorado and Green river systems. The Recovery Program has been implementing an integrated stocking plan ([Integrated Stocking Plan Revisions Committee 2015](#)) with the goal of establishing self-sustaining populations of razorback sucker and bonytail in the upper Colorado River basin. The Recovery Program has been largely successful in meeting the plan's annual stocking targets.

Stocked razorback sucker are surviving in the wild, expanding their range into previously unoccupied areas, and annually reproducing in both the Green and Colorado River sub-basins; wild juvenile razorback sucker (ages 0, 1, and 2) are starting to be captured in small numbers. During this reporting period, the Program Director's Office led a team of (17) species experts in drafting a SSA for this species.

Recaptures of stocked bonytail are rare, especially recaptures that demonstrate long-term survival of stocked individuals. However, increasing numbers of bonytail have been detected by the stationary passive integrated transponder (PIT)-tag reading antennas and traditional sampling methods throughout the upper Colorado River basin. The first reproduction by stocked bonytail was confirmed in floodplain habitats in the Green River in 2015, in 2016 (Bestgen et al. 2017) and most recently in 2017.

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<sup>2</sup> To achieve naturally self-sustaining populations, adults must reproduce and their young must recruit to the adult life stage in numbers sufficient to meet the demographic criteria identified in the current version of the [recovery goals](#). In addition, because of their longevity, hatchery produced adult razorback sucker and bonytail (and Colorado pikeminnow in the San Juan River) will contribute toward recovery.



Figure 1. Map of the upper Colorado River basin, which includes the areas managed by the Recovery Program and the San Juan River Basin Recovery Implementation Program.

In 2002, the Service developed Recovery Goals (USFWS 2002 a–d) to supplement the individual endangered species recovery plans. The Recovery Goals contain specific demographic criteria to maintain self-sustaining populations and recovery factor criteria to ameliorate threats to the species. In Tables 1-4, we review the demographic criteria for the four listed species. In the recent 5-year review for humpback chub, the Service recommended that the recovery goals for the species be revised to incorporate new information.

Table 1. Summary of Colorado pikeminnow status and trends.

Sub-basin	Life Stage	2002 Recovery Goal Downlisting Criteria <sup>3</sup>	Long-term <sup>4</sup> abundance / trend	Short-term abundance / trend; 5 most recent data points	Summary
Colorado River	Adults (≥450 mm TL)	N = >700 individuals	N = 596.	N = 446. (average of 5 estimates collected 2009 - 2015)	Population increased from 1999–2005; declined since 2005.
	Recruits (400–449 mm TL)	Estimates exceed annual adult mortality.	Criteria met in roughly 50% of years, consistent with indications of long-term stability in the adult population.	Criteria likely not met in recent years, consistent with recent declines in the adult population.	Criteria appear to have been met in many but not all years, consistent with a fluctuating population that demonstrates general long-term stability.
	Age-0	N/A (no specific recovery goal criteria for this life stage).	Densities dropped in 2001 and remained low through 2008.	Relatively low since mid-1990s, but record-high catch in 2015 and above average in 2016.	Pulses of recruitment may not be frequent enough to support stability in the adult populations in the long term.
Green River	Adults (>450 mm TL)	N = >2,600 individuals.	N = 2,859 (average of 10 point estimates since 2000).	N = 2,267 (average of 5 estimates 2007–2012). Estimates completed in 2016-2018; not analyzed.	Incorporating earlier CPUE data: population increased 1991–2000; declined since 2000. PVA completed in 2018.
	Recruits (400–449 mm TL)	Estimates exceed annual adult mortality.	Number of recruits has fluctuated greatly since 2000, but averages near 400 individuals. Average annual abundances of recruits not sufficient to offset adult mortality since 2000.		Precision of estimates varies greatly; recruitment appears insufficient to offset overall adult mortality since 2000 (in most years).
	Age-0	N/A (no specific recovery goal criteria for this life stage).	Densities in middle Green River precariously low 1994–2008; more stable in the lower Green River.	Densities in middle Green River rebounded in 2009, 2010, and 2015 but were very low in both reaches in 2017 perhaps due to the extremely high, prolonged spring flows.	Recent analysis demonstrates base flow magnitude and timing are correlated with age-0 survival. Reclamation is incorporating new information into base flow management (using flexibility in their 2006 ROD).

<sup>3</sup> Please see [Recovery Goals \(USFWS 2002a\)](#) for a complete description of demographic requirements.

<sup>4</sup> “Long-term” refers to all Recovery Program monitoring information, which varies between subbasins and by life stage.

Table 2. Summary of humpback chub status and trends.

	Population	Life Stage	2002 Recovery Goal Downlisting Criteria <sup>5</sup>	Long-term <sup>4</sup> abundance (average) / trend	Short-term abundance (average) / trend; 5 most recent data points	Summary
Colorado River Sub-basin	1. Black Rocks (BR)	Adults (≥200 mm TL)	Point estimates do not decline significantly for 5 years.	N = 579 adults (average of 9 BR-specific point estimates since 1998).	N = 403 (average of 5 point estimates 2004–2012).	Steep decline in the late 1990s. Stable at low levels since 2007; adult estimates from 2016 & 2017 pending.
		Recruits (150–199 mm TL)	Estimates exceed annual adult mortality.	Not enough mark / recapture information to estimate abundance of recruits.		We assume criterion not met 1998 – 2004 because number of adults declined then; likely has been met since 2007.
	2. Westwater Canyon (WW)	Adults (≥200 mm TL)	Point estimates do not decline significantly for 5 years.	N = 2,490 (average of 10 point estimates since 1998).	N = 1,426 (average of 5 estimates 2004–2012).	Stable at low levels since 2007; Preliminary model averaged estimate for 2017 is 3,656 (95% CI 1,177-6,133)
		Recruits (150–199 mm TL)	Estimates exceed annual adult mortality.	Not enough mark / recapture information to estimate abundance of recruits.		We assume criterion was met sporadically through 2004 because number of adults declined; likely has been met since 2007.
	<u>Core Population<sup>6</sup></u> - (Black Rocks & Westwater combined)	Adults (≥200 mm TL)	N = >2,100.	N = 3,124 (average of 9 combined (BR+WW) point estimates since 1998).	N = 1,975 (average of 5 combined (BR+WW) estimates 2004–2012).	Adult numbers appear stable since 2007. The core population appears to have rebounded to > 2,100 adults in 2016.
3. Cataract Canyon	Adults (≥200 mm TL)	Point estimates do not decline significantly for 5 years.	Population too small to generate reliable mark/recapture point estimates. Monitoring consists of catch / effort (CPUE) metrics.		In 2017, Utah Division of Wildlife Resources (UDWR) reports their highest catch rates since sampling began in 1991	
Recruits (150–199 mm TL)	Estimates exceed annual adult mortality.					
Green River Sub-basin	4. Desolation Canyon	Adults (≥200 mm TL)	Point estimates do not decline significantly for 5 years.	N = 2,141 (average of 5 extrapolated point estimates collected since 2006). Abundance sampling program has changed over time, complicating long-term comparisons.		CPUE estimates since 1985 suggest long-term stability, but more robust measures of abundance indicate the population appears to be in a slow decline since about the year 2000.
		Recruits (150–199 mm TL)	Estimates exceed annual adult mortality.	Not enough mark / recapture information to estimate abundance of recruits.		
	5. Dinosaur National Monument	Adults (≥200 mm TL)	Point estimates do not decline significantly for 5 years.	From 1998 to 2000, researchers estimated ~400 adult has occupied Yampa Canyon. Density has declined below level of detection since early 2000s and the population is now considered extirpated. Most recent attempt to estimate population size (Finney 2006) did not capture enough fish to generate a population estimate.		

<sup>5</sup> Please see [Recovery Goals \(USFWS 2002b\)](#) for a complete description of demographic requirements.

<sup>6</sup> Core populations must meet minimum viable population criteria metrics (e.g., N = 2,100 adults) as well as demonstrating long-term stability. Non-core populations must demonstrate long-term stability.

Table 3. Summary of razorback sucker status and trends.

Sub-basin <sup>7</sup>	Life Stage	2002 Recovery Goal Downlisting Criteria <sup>8</sup>	Long-term abundance <sup>4</sup>	Short-term abundance; 5 most recent data points	Summary
Colorado River	Adults (≥400 mm TL)	N = >5,800 individuals.	Population of stocked adults increased steadily since 2005.	N = 4,482 adults and juveniles (average of 6 estimates collected 2008–2015).	Abundance of hatchery produced adults increased steadily since 2005. Observations of spawning congregations have increased in recent years.
	Recruits (300–399 mm TL)	Estimates exceed annual adult mortality.	No wild-produced recruits have been detected yet.		Wild-produced recruits have not been captured. Criterion has not been met.
	Age-0	N/A (no specific recovery goal criteria for this life stage).	Wild-produced larvae have been detected in the Gunnison and Colorado River – new information pending.		Small numbers of wild-produced juveniles (age-2, 3) collected periodically.
Green River	Adults (>400 mm TL)	N = >5,800 individuals.	Population of stocked adults increased steadily since 2006.	Current estimates of hatchery produced adults in Green and Yampa rivers is ~36,000 individuals.	Demographic criterion appears to have been achieved since 2011.
	Recruits (300–399 mm TL)	Estimates exceed annual adult mortality.	No wild-produced recruits have yet been detected.		Wild-produced recruits have not been captured. This criterion has not been met.
	Age-0	N/A (no specific recovery goal criteria for this life stage).	Larvae consistently captured in middle and lower Green River.	Generally increasing with a record high catch of larvae in 2013 in the middle Green River.	Over-summer survival of age-0 greatly improved since 2012; highest number of fall age-0 documented in 2016.

<sup>7</sup> The Lake Powell inflow areas were not considered as potential population centers in the 2002 Recovery Goals; researchers now report that hatchery produced razorback sucker are commonly collected there. Spawning has been detected in the lake.

<sup>8</sup> Please see [Recovery Goals \(USFWS 2002c\)](#) for a complete description of demographic requirements.

Table 4. Summary of bonytail status and trends.

<b>Sub-basin</b>	<b>Life Stage</b>	<b>2002 Recovery Goal Downlisting Criteria<sup>9</sup></b>	<b>Long-term<sup>4</sup> abundance</b>	<b>Short-term abundance; 5 most recent data points</b>	<b>Summary</b>
<b>Colorado River</b>	<b>Adults (≥250 mm TL)</b>	N = >4,400 individuals.	N/A	No estimates; beginning to see some return of stocked individuals.	Stocking program began in 1996 on an experimental basis; full stocking program implemented in 2003. Observations / detections of stocked adults increasing since 2013.
	<b>Recruits (150–249 mm TL)</b>	Estimates exceed annual adult mortality.	N/A	N/A	No wild recruitment has been detected.
	<b>Age-0</b>	N/A	N/A	N/A	N/A
<b>Green River</b>	<b>Adults (&gt;250 mm TL)</b>	N = >4,400 individuals.	N/A	No estimates; beginning to see some returns of stocked individuals.	Observations / detections of stocked adults increasing since 2013.
	<b>Recruits (150–249 mm TL)</b>	Estimates exceed annual adult mortality.	N/A	N/A	No wild recruitment has been detected.
	<b>Age-0</b>	N/A	N/A	N/A	Researchers documented successful reproduction in the wild (in floodplain habitats) in 2015, 2016, and 2017.

<sup>9</sup> Please see [Recovery Goals \(USFWS 2002d\)](#) for a complete description of demographic requirements.

**B. Recovery Program Accomplishments, Areas of Concern, and Recommended Action Items**

Recovery Program participants accomplished a number of important objectives in 2017 and early 2018. These accomplishments are described in Table 5 below. (Note: some of these accomplishments reference preliminary findings that we did not include in Tables 1–4 above). The Service has concerns about shortcomings in the progress of some ongoing and future recovery actions, which are described in Table 6. Table 6 also outlines action items recommended by the Service to address those concerns/shortcomings. The second column in both of these tables identifies *how* Recovery Program accomplishments are meeting or falling short of the criteria used by the Service to evaluate whether the Recovery Program is making “sufficient progress” toward recovery.

More detail about Recovery Program accomplishments and shortcomings can be found in the final May 17, 2018, RIPRAP, which assesses actions from February 1, 2017, through January 31, 2018 (see assessment column in the tables to the [RIPRAP](#)).

Table 5. SIGNIFICANT ACCOMPLISHMENTS (February 1, 2017, through January 31, 2018)

Accomplishment	Sufficient Progress Criteria Affected
<b>General – Upper Basin-wide</b>	
<p>Detections of all PIT-tagged fish continue to increase in number and geographic extent, (in part due to greater deployment of PIT detection arrays)</p> <p>A SSA for humpback chub was completed in December 2017. Based on that SSA, the Service’s Regional Director signed a 5-year review, which recommended that a proposal to downlist humpback chub be prepared (<i>in a draft</i>). In the fall of 2017, researchers reported an increasing number of juvenile humpback chub in Westwater Canyon and Black Rocks on the Colorado River.</p> <p>Razorback sucker adults (stocked fish) continue to accumulate throughout the basin (including the Colorado River inflow to Lake Powell). Over-summer (and some over-winter) survival of age-0 fish, primarily ones that benefited from managed floodplains on the Green River, greatly improved since 2012.</p> <p>Wild bonytail reproduction was confirmed for the first time in Green River floodplains in 2015 and was documented again in 2016 and 2017.</p>	<p>2 – Improving status of fish populations.</p>
<p>Recovery Program projects continue to remove all sizes of northern pike, walleye, and smallmouth bass that are encountered. Projects focus on reducing in-river reproduction. Crews now remove non-native predators in 600+ miles of river annually at the cost of approximately \$1.7 million.</p> <p>Recovery Program stakeholders have increased focus on reservoir escapement based on results of smallmouth bass (<a href="#">Breton et al. 2014</a>) and northern pike syntheses (<a href="#">Zelasko et al. 2015</a>), and consistent walleye catches (see individual sub-basins for specific actions).</p> <p>Colorado Parks and Wildlife’s (CPW) and Recovery Program participants have formed an ongoing non-native Fish Workgroup to enhance non-native fish control</p>	<p>1 – Reduce threat of non-native predation and competition on endangered and native fish.</p>

<p>in Colorado. The group has made numerous recommendations that have been implemented.</p> <p>East and West Slope water organizations have distributed articles and bill stuffers to more than 200,000 customers explaining the need for non-native fish control and the benefits of protecting/recovering native and endangered fish.</p>	
<b>Green River</b>	
<p>In 2017, unregulated Apr – July inflow to Flaming Gorge Reservoir was approximately 226% of the 1981-2010 average. Reclamation safely operated Flaming Gorge Dam through this near-record spring runoff; extended periods of full bypass (~8,600 cfs) likely accomplished significant sediment transport in Reaches 1 and 2.</p> <p>Average August and September base flows recorded in Reach 2 were 2,805cfs and 2,684 cfs respectively. These summer flows fell within a preferred base flow range (1,700 - 3,000 cfs; <a href="#">Bestgen and Hill 2016</a>).</p>	<p>1 – Improve habitat and reduce threat of extinction; 3 – Improve flows; 4 – Reduce magnitude of project impact.</p>
<p>Stewart Lake was managed to take advantage of the high Green River spring flows and Larval Trigger Study Plan (LTSP) operations. Two age-0 razorback sucker and 13 presumptive age-0 bonytail were collected when the wetland was drained in late September 2017. This was the third consecutive year bonytail spawned in this floodplain. UDWR coordinated with local and state agencies to conduct a controlled burn (objective – reduce cattail growth) at this site in April 2018.</p> <p>Johnson Bottom was managed to take advantage of the high Green River spring flows and LTSP operations. A total of 45 age-0 razorback suckers were collected in the fall, but these could have been hatchery-produced larvae experimentally stocked in the spring. The growth of bonytail stocked in this floodplain was high relative to the growth of this species in the Stirrup floodplain.</p> <p>Sheppard Bottom Cooperative Recovery Initiative was funded by the Service in 2016 and construction completed in time for inundation in 2017. Thirteen age-0 razorback sucker were collected in the unscreened portion of this floodplain on July 11, although no native fish were collected in subsequent fall sampling at this site.</p> <p>Larval razorback sucker was also collected in the Stirrup wetland.</p>	<p>1 – Improve habitat and reduce threat of extinction; 2 – Improve status of fish populations.</p>
<p>Estimates of adult razorback sucker abundance in the Green River sub-basin 2011-2013 ranged from N=25,482 in 2011 to N=36,355 in 2013. Low capture probabilities explain high variability associated with these estimates.</p>	<p>2 – Improving status of fish populations.</p>
<p>Recovery Program representatives and Reclamation met with the Green River Canal Company Board and agreed on a concept for fish exclusion. Weir wall and fish screen construction are scheduled for winter of 2018/2019. An O&amp;M contract with the Green River Canal Company was signed in April 2018.</p>	<p>1 – Improve habitat and reduce threat of extinction; 4 – Reduce magnitude of project impact.</p>
<p>All necessary permitting to construct a fish exclusion device in the Green River Canal was completed in 2017.</p>	<p>1 – Improve habitat and reduce threat of extinction.</p>
<b>Yampa River</b>	
<p>Structural improvements at the Maybell Canal headgates, installation of check structures in the canal, and automation of a return flow gate, partially financed by the Recovery Program, went into operation in 2017 for the first time. These improvements allow for improved operation and control of the Irrigation District's diversions and internal water use, leaving more flow in the river.</p>	<p>1 – Improve habitat and reduce threat of extinction; 3 – Improve flows; 4 – Reduce magnitude of project impact.</p>

<p>Releases from Elkhead Res., in 2017, supported flows above 100 cfs at the Maybell, CO gage for the overwhelming majority of the summer.</p>	<p>1 – Improve habitat and reduce threat of extinction; 3 – Improve flows;</p>
<p>Colorado Parks and Wildlife, with financial support from the Colorado Water Conservation Board, held their second fishing tournament at Elkhead Reservoir. Anglers removed over 2,000 smallmouth bass and 400 northern pikes.</p>	<p>1 – Improve habitat and reduce threat of extinction; 2 – Improving status of fish populations.</p>
<p>Northern pike electrofishing catch rates were the lowest since intensive, annual electrofishing in the study area began in 2004. Intensive backwater netting and main channel electrofishing contributed to this recent reduction in catch rate.</p>	<p>1 – Reduce threat of non-native predation and competition on endangered and native fish.</p>
<p><b>Duchesne River</b></p>	
<p>UDWR has contained walleye and smallmouth bass escaping via the spillway at Starvation Reservoir. A temporary barrier was installed in 2015. A permanent downstream screen in the stilling basin is planned for construction in fall of 2020.</p> <p>UDWR, working with the Northern Ute Tribe, resumed fish sampling in the Duchesne in 2017. Seven bonytail and seven Colorado pikeminnow were collected; razorback suckers were too numerous to count. Researchers believe they will need more information before they can evaluate the flow recommendations.</p> <p>Duchesne River base flow management resulted in 0 days &lt; 50cfs and only 1 day &lt; 115 cfs.</p>	<p>1 – Reduce threat of non-native predation and competition on endangered and native fish.</p> <p>1 – Improve habitat and reduce threat of extinction; 3 – Improve flows</p> <p>1 – Improve habitat and reduce threat of extinction; 3 – Improve flows</p>
<p><b>Colorado River</b></p>	
<p>For the third year in a row, Coordinated Reservoir Operations (CROS) successfully boosted peak flows in the 15-Mile Reach, resulting in a daily peak flow at the Cameo gage of 16,600 cfs (compared to an average of 14,000 cfs), and 14,900 cfs at the Palisade gage. CROS has added a total of 348,467 ac-ft. to the 15-mile reach since 1997. (In the past three years (2015-2017) a total of 97,226 ac-ft. have been provided)</p> <p>The base flow target for the 15-Mile Reach was 1,240 cfs. A cumulative total 79,037 AF was released from the Green Mountain, Ruedi, Wolford, and Granby Reservoirs; August - October base flows averaged 1,366 cfs.</p>	<p>1 – Improve habitat and reduce threat of extinction; 3 – Improve flows; 4 – Reduce magnitude of project impact.</p>
<p>Since 2015, Colorado Water Conservation Board (CWCB) and Ute Water have implemented a short-term lease that provides an additional 6,000 to 12,000 ac-ft. of flow augmentation from Ruedi Reservoir. This lease, combined with the other summer augmentation pools, offsets the (2012) expiration of the 10,825 ac-ft. pool in Ruedi and supplements the other longer-term Ruedi Reservoir agreements that provide fish water for the 15-Mile Reach. The Ute lease provided 6,000 ac-ft. of augmentation water in 2017, bringing the total annual contribution from Ruedi to 21,413 ac-ft.</p> <p>In 2017, Orchard Mesa Irrigation District (OMID) completed construction of a 74 ac-ft. re-regulating reservoir (financed by the Recovery Program), and initiated its operation during the 2017 irrigation season. At full operation, this reservoir is anticipated to reduce diversions by approximately 17,000 ac-ft. annually, making that water available for flow augmentations of the 15-mile reach.</p>	<p>3 – Improve flows; 4 – Reduce magnitude of project impact.</p>
<p>Operation of the Grand Valley Water Users Association (GVWUA) fish screen in 2017 began on Mar 27 and terminated Oct 31. These screens operated <u>100%</u> of days during the irrigation season (281 days total), with only brief (hourly)</p>	<p>1 – Improve habitat and reduce threat of extinction;</p>

<p>interruptions for minor operational and maintenance needs.</p>	<p>4 – Reduce magnitude of project impact.</p>
<p>As per CPW Rifle Gap Lake Management Plan, fertile walleye were removed in Spring 2017; triploid (sterile) walleye are being stocked to replace those individuals and establish a compatible fishery.</p>	<p>1 – Reduce threat of non-native predation and competition on endangered and native fish.</p>
<p>The preliminary model-averaged estimate for humpback chub in Westwater Canyon for 2017 is 3,656 (95% CI 1,177-6,133, SE=1097, CV=0.30), indicating this population has stabilized since 2007 and now appears to be increasing. Catch rates dropped from 2016 levels but were the third highest since sampling began in the late 1990s.</p>	<p>2 – Improving status of fish populations.</p>
<p>Reclamation is working with Grand Valley Irrigation Company (GVIC) to explore structural improvements to the GVIC diversion and fish screen to increase the number of days the screen is in operation</p>	<p>1 – Improve habitat and reduce threat of extinction; 4 – Reduce magnitude of project impact.</p>
<p><b>Gunnison River</b></p>	
<p>May 15, 2017, forecast Apr-Jul inflow for Blue Mesa Reservoir was an "Average Wet" 825,000 ac-ft., corresponding to a target peak flow at the Whitewater gage of 14,040 cfs for two days, plus 8,070 cfs (half-bankfull) for 20 days, and Aug-Dec base flow of 1,050 cfs. Actual Blue Mesa inflow volume was 915,000 ac-ft. (11% greater than forecast). A daily mean peak of 15,900 cfs was achieved at the Whitewater gage on May 26, with four days of flow above 14,040 cfs and 23 days above half-bankfull (all exceeding targets). Base flow was maintained above 1,050 cfs for the entire Aug-Dec period.</p> <p>Reclamation continues to lead selenium remediation in the Gunnison River drainage via their Selenium Management Program (funded through the Salinity Program), which has become a model of grassroots support and cooperation.</p>	<p>1 – Improve habitat and reduce threat of extinction; 3 – Improve flows; 4 – Reduce magnitude of project impact.</p>
<p>In 2017, the Redlands fish passageway was operational from April 19 to Oct 20. This was the 22nd year of operation. Seven Colorado pikeminnow were captured this year, bringing the total captured at this site since 1996 to 187. One razorback sucker was captured, bringing the 22-year total to 36. Two bonytail were captured. One humpback chub was captured. Captured endangered fish are released above the passage. Captured non-natives are removed.</p>	<p>1 – Improve habitat and reduce threat of extinction; 4 – Reduce magnitude of project impact.</p>
<p>TriCounty Water Conservancy District successfully avoided spills from Ridgway Reservoir and thereby contained invasive smallmouth bass from 2014 through 2017, even with substantial runoff in 2017.</p> <p>CPW has conducted a harvest tournament for smallmouth bass at Ridgway Reservoir each summer since 2015. They estimate that 53% of the smallmouth bass population was removed during the tournament in 2017, the highest percentage yet.</p>	<p>1 – Reduce threat of non-native predation and competition on endangered and native fish.</p>

Table 6. SERVICE CONCERNS AND RECOMMENDATIONS (focused on February 1, 2016, through January 31, 2017)

Service Concern	Sufficient Progress Criteria Affected	Recommended Action Items
<b>General – Upper Basin-wide</b>		
<p>Current densities of Colorado pikeminnow throughout the upper basin are low, which is linked to insufficient recruitment of young fish into the adult population caused by the persistence of non-native predators and summer habitat base flow conditions (primarily in the Green River).</p> <ul style="list-style-type: none"> <li>• Large-bodied predatory species of concern have spread through large segments of critical habitat, especially Colorado pikeminnow nursery habitats.</li> <li>• A recent summary of 30+ years of fall age-0 pikeminnow monitoring indicates that survival was better when summer base flows in the middle Green River ranged between 1,700 to 3,000 cfs.</li> </ul> <p>Bonytail survival continues to be low.</p>	<p>1 – Increases threat of extinction; 2 – Declining status of fish populations.</p>	<p>The persistent and prolonged threat of expanding non-native fish populations needs to be managed to an acceptable level to benefit all the endangered fishes. Reductions in non-native fish populations should allow expansion of the range of Colorado pikeminnow, increase survival of pikeminnow of all age classes, and reduce competition for forage for pikeminnow. The Service recommends that the Program continue to seek efficiency in their riverine removal program and strive to complete off-channel reservoir screening projects as expediently as possible.</p> <p>Reclamation should continue to exercise operational flexibility within their 2006 Flaming Gorge Record of Decision to provide summer base flows in the range of 1,700 – 3,000 cfs when possible.</p> <p>The Service encourages continued use of PIT technology as a complement to traditional sampling techniques and one that does not require handling sensitive species. Methodology needs to be developed to incorporate detections of endangered fish at these antennae into population estimates. The Service strongly encourages that the next 3-yr, adult Colorado pikeminnow population estimation project on the Colorado River be initiated in 2019 (originally scheduled to start in 2018).</p> <p>Bonytail production has increased under the Revised Integrated Stocking Plan. Bonytail should continue to be stocked into floodplain locations to determine the</p>

<p>Humpback chub is now considered extirpated from Dinosaur National Monument</p> <p>Wild razorback sucker have yet to reach sexual maturity in either sub-basin.</p>		<p>importance of this habitat to the species and to see if survival of stocked fish will increase.</p> <p>The working group should continue to determine the feasibility of translocating or stocking humpback chub into Yampa Canyon to repatriate this population and move forward on the decision in 2019.</p> <p>The Recovery Program should continue to modify and manage floodplain habitats and control non-native predators in floodplain habitats to improve survival of wild age-0 and juvenile razorback sucker.</p>
<p>New non-native species continue to appear in the Upper Basin. Gizzard shad, a preferred food item of non-native walleye, populations expanded upstream of Lake Powell during the mid-2000s, invading both the Green and Colorado rivers. This expansion may be exacerbating the increase in walleye as gizzard shad are a preferred prey item for walleye. In 2017, 13 non-native yellow perch were collected in Stewart Lake – a new occurrence.</p> <p>Larval grass carp were confirmed from Lake Powell in 2015 and again in 2016, representing the first instance of this species reproducing in the upper Colorado River basin. Subsequently, additional diploid grass carp have been collected in the Green and Colorado rivers. All three grass carp collected in the Green River in 2017 were diploid.</p> <p>Reservoir screening project schedule has started to slip. The risk of escapement of non-native predators (e.g., smallmouth bass from Ridgway Reservoir) remains high.</p>	<p>Hampers ability to 1 – Reduce threat of extinction by decreasing numbers of non-native fish.</p>	<p>Continue to restrict the establishment of new non-native species in the basin through stocking regulations. All grass carp stocking in the upper basin states is required to be with triploid (sterile) fish. Diploid fish may have come from an illicit internet order or an inadvertent delivery from a supplier who holds both diploid and triploid fish. UDWR and the Service will explore options for additional sampling via light trapping in 2018.</p> <p>Continue to discuss new non-native fish findings with state and regional organizations. The Program Director’s office has provided information to the Western Association of Fish and Wildlife Agencies and the Fish and Wildlife Council, and the issue was raised in coordination meetings with the States.</p> <p>The Program Director’s Office (PDO), States, and Reclamation need to work opportunistically to complete screening projects at Ridgway, Starvation, Red Fleet, and Catamount reservoirs as expeditiously as possible prior to 2023).</p>

<p>Program stakeholders need to develop strategies for long-term flow protection throughout the upper Colorado River basin.</p>	<p>Hampers ability to 1 – Improve habitat through protected/augmented flows.</p>	<p>Continue to identify the ways and means for long-term flow protection beyond delisting throughout the upper Colorado River basin (e.g., Green River Water User Acquisition Team, White River Working Group, etc.).</p>
<p>Despite remarkable accomplishments since the Recovery Program’s inception in 1988, it is clear that recovery of the four endangered fish will not be accomplished by 2023 when the Cooperative Agreement expires. A post-2023 solution (e.g., an extension of the existing Recovery Program) must be developed.</p>	<p>Hampers ability to 1 – Reduce threat of extinction by decreasing numbers of non-native fish; Improve habitat through protected/augmented flows;</p>	<p>Current funding re-authorization legislation (HR 4465/S.2166) requires a Report to Congress in FY21, which will describe actions, projected costs post-2023, and institutional/funding arrangements post-2023. The Service encourages Program partners to assist the Secretary in developing a solution that builds on 30 years of programmatic experience, continues to provide ESA coverage for historical and future water depletive projects, and leads to recovery of the endangered fish. The partners’ draft report should be completed by the end of FY2020.</p>
<p><b>Green River</b></p>		
<p>Evaluation and recommended revision of flow and temperature recommendations are behind schedule.</p> <p>In Spring 2017, the Program realized limitations of not being able to use the spillway at Flaming Gorge dam to achieve endangered fish flow targets. Despite 230+% snowpack in the upper Green River drainage an average year peak, flow target (18,600 cfs) was not achieved in Reach 2. Also, water temperature recommendations (not to exceed a 5°C differential between Green and Yampa rivers at their confluence) was not met in 2017 due to the extended high, cold flow releases from Flaming Gorge Dam coupled with Yampa River temperatures associated with average-dry hydrology. The temperature difference likely negatively influenced the survival of larval Colorado pikeminnow drifting out of the Yampa River.</p>	<p>Hampers ability to 3 – Determine adequacy of flows.</p>	<p>A writing team has been working since 2015 to complete an evaluation of the <a href="#">Muth et al. (2000) Flow and Temperature recommendations</a>. The Service recommends submitting a draft for Technical and Management Committees’ review by the end of CY 2018.</p> <p>When this hydrological scenario happens again, Reclamation and the Flaming Gorge Technical Work Group need to communicate more closely to discuss real-time larval Colorado pikeminnow emergence or predictions of larval emergence.</p> <p>The Service recommends that the Program and Reclamation continue to coordinate / communicate with the Green River Stakeholders to better understand their concerns (e.g., landowner flooding and impacts to tailrace trout fishery) stemming from high spring dam releases.</p>

<p>Smallmouth bass persists in the Green River because of their highly successful reproduction during below average flow years.</p> <p>Walleye numbers in middle and lower Green River threaten recovery because of habitat overlap with young Colorado pikeminnow.</p> <p>A high abundance of young northern pike was identified in the Browns Park reach of the Green River, and downstream, following the high and extended spring flow releases from Flaming Gorge in 2017. Thirty-one age-0 northern pike were caught at Browns Park NWR in July; the most since sampling began in 2002.</p>	<p>Hampers ability to 1 – Reduce threat of extinction by decreasing numbers of non-native fish.</p>	<p>In addition to ongoing non-native fish control activities, the Service supports the development of a smallmouth bass spike flow study (e.g., short-duration, high magnitude dam release) to disrupt smallmouth bass spawning on a reach-wide scale.</p> <p>Continue walleye-specific removal to reduce the number of adult walleye in the system. Reduce escapement from of walleye from upper basin reservoirs.</p> <p>Continue to monitor fish community in this reach of the river to understand the benefits and consequences of high, extended dam releases on the entire fish community. Continue to eliminate any northern pike captured during monitoring efforts.</p>
<p>Cattails continue to encroach at Stewart Lake and other wetland sites compromising the utility of these critically important floodplain nursery habitats for razorback sucker and other endangered fish.</p>	<p>Hampers ability to 1 – Improve habitat through protected/augmented flows.</p>	<p>The Recovery Program should continue working closely with the State of Utah, Reclamation, and the Service to develop and implement long-term management plans (e.g., prescribed burning) to reduce cattails. In 2018, UDWR developed important experience in coordinating and conducting a controlled burn at Stewart Lake.</p>
<p>Understanding the effects of and reducing selenium concentrations may still be a concern at Stewart Lake.</p>	<p>May hamper ability to 1 – Improve habitat.</p>	<p>The Service should complete analysis of selenium levels in fish to determine if levels are above what is recommended for recovery. The Service and Reclamation should continue to manage supplemental flows at Stewart Lake to assist in selenium remediation.</p>
<p><b>Yampa River</b></p>		
<p>Colorado has submitted depletion data as required by the Yampa Management Plan, but needs to be compiled in report format. The Recovery Program’s evaluation of the need for additional instream flow water rights to protect the endangered fishes is dependent on the updated report.</p>	<p>Hampers ability to 3 – Determine adequacy of flows.</p>	<p>Review of Colorado’s depletion data is pending. The Recovery Program’s evaluation of the need for additional instream flow water rights to protect the endangered fishes should be revisited based on the newest information.</p>
<p>Despite significant efforts, smallmouth bass densities in Little Yampa Canyon and other reaches of the Yampa River remain a concern; northern pike remains a concern in upstream reaches. In-river control efforts are compromised by unscreened upstream sources and in-river reproduction.</p>	<p>Hampers ability to 1 – Reduce threat of extinction by decreasing numbers of non-native fish.</p>	<p>The Recovery Program should continue intense smallmouth bass removal, focusing on nest disruption further into the spawning period, adjusting sampling schedules to exploit post-peak flows and look for efficiencies during their control efforts.</p>

		The Recovery Program should continue to work with the Catamount Metropolitan District on the installation of a net/screen to prevent northern pike escapement. In the meantime, we encourage CPW to continue their northern pike control efforts at this reservoir. Efforts to identify and prevent the use of riverine spawning habitat should continue.
<b>Duchesne River</b>		
The extent of the contribution of smallmouth bass or walleye produced in the Duchesne River below Starvation and entering Green River remains unknown.  Construction of the permanent screen below Starvation Reservoir has reverted back to the design phase.	Hampers ability to 1 – Reduce threat of extinction by decreasing numbers of non-native fish.	UDWR, in coordination with the Northern Ute tribe, was able to reinitiate some sampling in the Duchesne in 2017.  Reclamation, Central Utah Water Conservation District (CUWCD), UDWR and the PDO should focus necessary effort to complete this important non-native fish containment project as quickly as possible.
<b>White River</b>		
The schedule outlined in the approved scope of work for developing the White River Management Plan has slipped. Although behind schedule, the Service is encouraged by recent progress on the development of this management plan. Colorado completed the State Water Plan (December 2015) through a grassroots effort with Basin Roundtables. The Yampa/White Basin Roundtable contracted with Wilson Water Group to convert StateMod from a monthly to a daily model (done), and a White River Planning Team has been evaluating possible future development scenarios using this model.	Hampers ability to 1 – Improve habitat through protected/augmented flows; and 3 – Inadequacy of flows.	Recommendations: 1) extend StateMod to the Green River confluence (done) and incorporate State of Utah and Ute Indian Tribe of the Uintah and Ouray Reservation water demands; 2) the Recovery Program should finalize White River endangered fish flow recommendations; 3) the draft Management Plan and Biological Assessment should be completed as soon as possible.
A dense population of smallmouth bass has established in the White River below Taylor Draw Dam. Spawning adults are densest near the clear releases from Taylor Draw Dam and continue downstream to Douglass Creek. Catch rates in Utah demonstrate a downstream expansion, especially of smaller size classes. Spawning is successful even during higher water years. Additional removal activities are not possible because of access, safety, and potential native fish effects. Non-mechanical removal actions may be needed to protect this native fish community.	Hampers ability to 1 – Reduce threat of extinction by decreasing numbers of non-native fish.	Efforts to reduce the abundance of smallmouth bass are maximized based on access and effectiveness. Other options (e.g., spike flows from Taylor Draw Dam) besides electrofishing removal should be considered to disadvantage, and reduce or eliminate this established population.

<b>Colorado River</b>		
<p>The 15-Mile Reach Depletion Accounting Report was due December 31, 2011. The delayed submittal of this report has delayed completion of the Service’s 2015 15-Mile Reach PBO review. That review provides one component of assessing ESA compliance for approximately 1 million ac-ft. per year of existing depletions and 120,000 ac-ft. per year of future depletions.</p>	<p>Hampers ability to 3 – Determine adequacy of flows.</p>	<p>The average total depletions have not increased during the 2006-2015 period. The average overall depletions above the 15-Mile Reach during the 2006-2015 period (1,038,546 AF/yr.) are slightly lower than both the average total depletions for the longer period of 1971-2015 (1,058,718 AF/yr.) and the period of 1971-1995 (1,059,541 AF/yr.). The CWCB has provided the required depletion data to the Recovery Program (in the form of an email), which includes depletion data for both reporting periods from 2006-2010 and 2011-2015. However, the depletion report is still needed. Colorado has placed a high priority on completion of the report. A firm schedule for producing the depletions report as required by the 15-Mile Reach PBO should be established and adhered to in the future.</p>
<p>The ‘2015’ 15-Mile Reach PBO Review is overdue awaiting Colorado Water Conservation Board’s (CWCB) depletion accounting report. A draft was distributed to the BC and WAC in August 2016. That review was revised based on comments received from water user and environmental representatives. Flow recommendations in the 15-Mile Reach have not been met in all years, particularly during dry hydrologies. The PBO recognizes that flow recommendations will not be met in all years</p>	<p>Hampers ability to 3 – Determine adequacy of flows.</p>	<p>CWCB provided raw depletion accounting information in late FY18; a final report is pending. That information should be incorporated into the PBO Review as soon as possible. Program stakeholders should continue to work with Colorado River water managers to identify opportunities to meet flow recommendations with greater frequency.</p>
<p>The Recovery Program needs to evaluate the adequacy of current flow protection. The determination for additional flow protection rests with the Recovery Program and its Water Acquisition Committee (WAC) and will be recorded within the report that includes depletion data provided by CWCB every five years. The WAC discussed this in July and November 2011 and determined that pursuing additional instream flow filings was not prudent at that time. It appears unlikely that there have been significant new depletions in the Colorado River. A Long-Term Flow Protection workgroup has been formed to evaluate various mechanisms to achieve long-term flow protection (e.g., conservation agreements) needed to support endangered species recovery.</p>	<p>Hampers ability to 3 – Determine adequacy of flows.</p>	<p>The Recovery Program should continue to track depletions and evaluate the need for additional flow protection. The Long-Term Flow Protection workgroup should begin identifying the ways and means of long-term flow protection to achieve recovery and to maintain recovery in the post-delisting period. Long-term flow protection strategies should consider the best available information on climate change.</p>

<p>High catches (68) of walleye only five miles below the Westwater Canyon humpback chub population represents new information on distribution and abundance for this invasive predator.</p> <p>In 2017, more than 2800 gizzard shad (33-475mm) were removed from the Colorado River in Colorado and Utah, which may be linked to the increase in walleye numbers. Gizzard shad are a preferred food item of walleye.</p> <p>Both adult grass carp collected and removed from the Colorado River in 2017 were found to be fertile fish, despite regulations that require all grass carp stocked in the upper basin states to be triploid (sterile) fish.</p>	<p>Hampers ability to 1 – Reduce threat of extinction by decreasing numbers of non-native fish.</p>	<p>Reservoir screening projects and increased removal should reduce walleye numbers. The Recovery Program should determine the adequacy of efforts to remove walleye from the river and expeditiously implement reservoir-screening projects.</p> <p>The States and the Service should review stocking protocols to see if stronger regulations are warranted. Program sampling crews should continue to remove all grass carp whenever / wherever encountered.</p>
<p><b>Gunnison River</b></p>		
<p>The illegally introduced population of smallmouth bass in Ridgway Reservoir represents a major threat to the largely intact native fish community in the Gunnison River downstream. Containing and eliminating this population is of the utmost priority.</p>	<p>Hampers ability to 1 – Reduce threat of extinction by decreasing numbers of non-native fish.</p>	<p>The stakeholder group should continue to implement actions (spill avoidance and angler incentivized harvest) and implement the net on Ridgway as soon as possible. Funding an escapement solution should be a high priority for the Recovery Program and its partners. Continued diligence towards a solution is critical. CWCB has identified a substantial cost share for this project.</p>
<p><b>Dolores River</b></p>		
<p>Persistence of smallmouth bass in the upper Dolores River raises concern that the species may expand into downstream areas.</p> <p>Sampling in 2017 demonstrated that 94% of fish in Slick Rock Canyon were native species, indicating that the smallmouth bass population is primarily upstream of Disappointment Creek and near the confluence with Colorado. CPW and the Bureau of Land Management conducted smallmouth bass removal below Snaggletooth Rapid in 2017</p>	<p>Hampers ability to 1 – Reduce threat of extinction by decreasing numbers of non-native fish.</p>	<p>Management actions in addition to electrofishing should be implemented as needed to disadvantage, reduce, and control this population.</p> <p>In 2017, Reclamation coordinated with CPW and others to time a spring ‘spill’ from McPhee Reservoir to coincide with smallmouth bass spawning and thereby negatively affect reproductive success. The Recovery Program should continue to assess the non-native fish threat on the Dolores River to determine if resources should be directed there.</p>

## C. Conclusion on Sufficient Progress

### Significant Accomplishments

The Service recognizes significant accomplishments have occurred over the course of the past year, including:

#### *Instream Flow Management*

- 1) Flows were effectively managed in the Colorado River 15-Mile Reach, via:
  - successfully implementing Coordinated Reservoir Operations to augment spring peak flows;
  - coordinating releases from available pools at Green Mountain Reservoir, Lake Granby, Wolford Mountain Reservoir, and Ruedi Reservoir to augment base flows and maintain August-October flows near or above monthly targets;
  - CWCB and Ute Water Conservancy District (UWCD) entering into another temporary lease of UWCD's water in Ruedi Reservoir to augment late summer/autumn flows; and
  - making significant progress on the Orchard Mesa Irrigation District irrigation efficiency project.
- 2) Reclamation's Aspinall Unit operations resulted in achieving the Program's spring and base flow targets for the Gunnison River.
- 3) On the Green River, a near-record snowpack above Flaming Gorge Reservoir dictated Reclamation's safety of dam operations at Flaming Gorge Dam. Although the resulting flows marginally met the objectives of the LTSP in the spring and objectives of summer base flow management, we are hopeful that significant channel maintenance was accomplished.
- 4) On the Yampa River, low summer flows were augmented with Elkhead Reservoir fish pool releases. While daily flows failed to meet average-year targets for several weeks in late August and September, the magnitude and frequency of shortfalls to those targets were minimized, and critically low Yampa River flows were averted. Implementation of improvements on the Maybell diversion and headgate and in the canal will enhance flows in the Yampa River.

#### *Status of the Fish*

- 1) Preliminary reports indicate that adult humpback chub populations in Westwater and Black Rocks canyons appeared to have stabilized and rebounded above the 2002 Recovery Goal Core Population criterion of at least 2,100 adults.

- 2) The Service has decided to propose reclassifying the humpback chub as a threatened species, based on the persistence of four upper basin populations and the resiliency of the largest population in the Grand Canyon near the confluence with the Little Colorado River.
- 3) In recent years (see a specific exception in 2017 discussed above), Reclamation's Larval Triggered Study Plan operations coupled with improved floodplain management practices have resulted in record high production of wild, age-0 razorback sucker.
- 4) Bonytail spawning was documented for the third consecutive year in Green River floodplains.

#### *Non-native Fish Management*

- 1) CPW, CWCB, and the Recovery Program installed a spillway net at Elkhead Reservoir on September 2016, which performed well through the 2017 runoff. CPW is stocking the reservoir with largemouth bass to replace an undesirable smallmouth bass fishery.
- 2) CPW continued to organize incentivized harvest tournaments at Elkhead and Ridgway reservoirs to enlist public support with the removal of smallmouth bass and northern pike.
- 3) The recent focus on controlling off-channel sources of predatory non-native species (invasive smallmouth bass, northern pike, and walleye), coupled with the Recovery Program's longer-standing commitment to control these fish in riverine environments, comprise a strategy that the Service thinks is now on track.

Despite good cooperation among Recovery Program partners to implement a comprehensive suite of recovery actions, the Service remains concerned with recent reports of low densities of Colorado pikeminnow adults in the Green and Colorado River sub-basins. The Service strongly encourages that the next 3-yr, adult Colorado pikeminnow population estimation project in the Colorado River starts in 2019 (originally scheduled to start in 2018). We also remain concerned over extirpation of humpback chub from the lower Yampa River and particularly slow progress toward recovery of bonytail.

#### Priority Actions Looking Forward

We advise that the Recovery Program continue to focus on several specific recovery actions in the coming year. We categorize those actions under: 1) non-native fish management; and 2) flow and habitat management, as follows:

#### *Non-native Fish Management*

- 1) Maintain current levels of river removal effort, while continuing to look for further efficiencies.
- 2) Maintain the Recovery Program's reservoir screening schedule with a particular focus on the Ridgway Reservoir netting project. The Service is very concerned that smallmouth bass could escape from that reservoir and become established downstream in the Gunnison River, a native species stronghold.

*Flow and Habitat Management*

- 1) Depletion accounting reports must be completed by CWCB to ensure compliance with the Yampa and Colorado River PBO's.
- 2) Finalize White River endangered fish flow recommendations and develop a White River Management Plan / PBO.
- 3) Over the next few years, the Service encourages the Recovery Program to establish long-term (post-Program and post-delisting) flow protection strategies throughout the basin. These strategies are necessary to achieve recovery, to maintain recovery in the post-delisting period, and should consider the best available information on climate change.
- 4) Adhere to the current schedule of constructing a fish exclusion device in the Green River Canal on the Tusher Diversion during winter 2018/2019.

Finally, in light of the Recovery Program's [Cooperative Agreement](#) expiring in 2023, the Service encourages the Management Committee to continue discussions and negotiations to define post-2023 Recovery Program actions and requisite institutional/funding mechanisms. More specifically, the Service applauds the non-federal partners for including language in the current funding reauthorization bills to provide funding for the programs through FY20-23 (S. 2166 and HR 4465) that commits the Secretary of the Interior to submit a Report to Congress in FY2021. The intent of that report will be to describe and predict progress to species recovery, funds expended to date, a description of necessary recovery actions and costs post-2023, and recommended institutional/funding arrangements. For FY2019, the Office of Management and Budget directed Western Area Power Administration to return hydropower revenues to the U.S. Treasury that had been intended to fund various environmental and recovery programs. The non-federal partners were successful in achieving a full funding solution for FY2019 (PL 115-244) in late FY18. Recovery of these endangered fish has been and continues to be expensive. However, continued implementation of the successful recovery activities, through a sustained funding commitment has factored heavily into the Service's determination of sufficient progress in the past as well as our recommendation to pursue reclassification of humpback chub.

The Recovery Program has made strong progress in protecting and improving flows and restoring habitat and has demonstrated strong resolve to manage non-native fishes in recent years. The Service agrees with Recovery Program stakeholders that we need to build on recent momentum in non-native fish management and related public outreach. The Service will assist and support the Program by identifying accomplishments and important recovery actions that remain as we revise the Colorado River endangered fish recovery plans.

The Service is confident that with continued cooperation by all Recovery Program participants, the Recovery Program will continue to make significant strides toward recovery of the four endangered fishes. Recovery of the endangered fish is taking longer than the Service, and the Recovery Program stakeholders initially envisioned in 1988; however, there is an appropriate sense of urgency amongst stakeholders to achieve success as quickly as possible.

The Service remains convinced that the best chance for success, i.e., recovery, rests with this collaborative Recovery Program. The Service's recent decision to pursue reclassification of humpback chub from endangered to threatened status is a testament to sufficient progress.

Based on our comprehensive evaluation of the status of the endangered fish, provision of flows (particularly during periods of drought), the magnitude of new depletion impacts (relatively minor in the historical context), non-native threats, and cumulative Recovery Program accomplishments and shortcomings, the Service concludes that when implemented as Conservation Measures (i.e., part of the proposed action), the Recovery Program is making sufficient progress to continue avoiding the likelihood of jeopardy resulting from depletion impacts of new projects that have an annual depletion of up to 4,500 AF<sup>10</sup>. Furthermore, that sufficient progress provides a continued avoidance of jeopardy for the water projects and depletions currently provided with ESA compliance by the Program, i.e., 2,149 projects depleting more than 2.86 million acre-feet of water per year. Projects exceeding 4,500 acre-feet or that have direct or indirect effects in addition to water depletion will be evaluated to determine if they jeopardize the species' continued existence on a case-by-case basis.

This concludes the Service's 2017-2018 "abbreviated" assessment of progress. Specific questions about sufficient progress should be directed to Tom Chart, Recovery Program Director, at 303-236-9885, [Tom\\_Chart@fws.gov](mailto:Tom_Chart@fws.gov) or Kevin McAbee, Deputy Director, at 303-236-9887, [Kevin\\_Mcabee@fws.gov](mailto:Kevin_Mcabee@fws.gov).

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<sup>10</sup> The 15-Mile Reach programmatic biological opinion covers an average depletion of up to 1 million acre-feet per year of existing depletions (through September 30, 1995) and up to 120,000 AF of new depletions (since September 30, 1995) in the Colorado River above the confluence with the Gunnison River. The Yampa River programmatic biological opinion covers an average depletion of up to 168,000 AF per year of existing depletions and up to 53,000 AF per year of new depletions. The Gunnison River PBO covers all existing water depletions in the Gunnison River Basin (estimated annual average of 602,700 AF/year) and future depletions up to 3,500 AF basinwide as well as future depletions up to 22,200 AF in the upper Gunnison Basin in accordance with the Upper Gunnison Basin Subordination Agreement and 12,200 AF in the Dallas Creek Project which has been contracted for but is not used at this time.

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## Appendix I 15-Mile Reach PBO Review

In the December 1999, final Programmatic Biological Opinion (PBO) for the Upper Colorado River above the confluence with the Gunnison River (15-Mile Reach), the U.S. Fish and Wildlife Service (Service) determined that depletions from the Colorado River basin might adversely affect endangered fish and their critical habitat. The Service also concluded that the Upper Colorado River Endangered Fish Recovery Program (Program) was designed to go considerably beyond offsetting water depletion impacts by providing for the full recovery of the four endangered fishes in the basin. This was to be accomplished by offsetting depletions and minimizing take, including harm from existing (approximately 1 million ac-ft./year) and future depletions (120,000 ac-ft./year), as defined in the proposed action. Page 74 of the PBO says: "...every 2 years, for the life of the Recovery Program, the Service and Recovery Program will review the implementation of the Recovery Action Plan actions to determine timely compliance with applicable schedules." A review of action items from the PBO follows below, with status updates in italics.

The following elements of the Recovery Action Plan are measures completed, ongoing or future actions, which are considered part of the PBO review. The beneficial effects of these recovery actions are taken into consideration in the jeopardy and incidental take analysis (pages 8-19 of the PBO).

### 1. Habitat Protection Element

- a. Enforcement Agreement between the Service and the Colorado Water Conservation Board (CWCB) providing a legal mechanism to protect flows managed by the Program.  
*Completed in 1993.*
- b. Late Summer and Fall base flow period augmentation (e.g., Figure 1)
  - i. Instream flow decree for 581 cfs from the Orchard Mesa Pumping and Power Plant return in the 15-Mile Reach during July, August and September. *Completed in 1997.*
  - ii. Instream flow water right for 300 cfs for water accretions occurring in the 15-Mile Reach during July, August, and September. *Completed in 1997.*
  - iii. 5,000 ac-ft. of water annually from Ruedi Reservoir plus an additional 5,000 ac-ft. of water in 4 out of 5 years, provided by the Bureau of Reclamation (Reclamation).  
*Ongoing since 1989 (see Table 1).*
  - iv. 21,650 ac-ft. /year from Ruedi Reservoir from both Reclamation and water users, split evenly. (This includes the 10,000 ac-ft. in Item iii.) *In most years since 1998, at least 20,000 ac-ft. of water has been made available annually from Ruedi Reservoir for base flow augmentation (Table 1), including 10,000 ac-ft. provided by Reclamation, 5,412.5 ac-ft. provided by West Slope water users, 5,412.5 of replacement water provided by East Slope water users, and in recent years, additional water leased by CWCB (see below).*

It has been very difficult to maintain average summer monthly flows of 810 cfs in the 15-Mile Reach during drier hydrologies (Table 2). In addition to the other fish pools recognized above, since 2015, the CWCB has pursued renewable 1-year leases of up to 12,000 ac-ft. of water in Ruedi Reservoir from Ute Water Conservancy District (Ute Water) to further augment base flows. In 2017, Orchard Mesa Irrigation District (Palisade, Colorado) completed construction of a 74 ac-ft. re-regulating reservoir (financed by the Recovery Program and CWCB), and initiated its operation during the 2017 irrigation season. Initial results have been positive, resulting in reduced diversions from the Colorado River as the District benefits from increased efficiencies in its water deliveries. At full operation, this reservoir is anticipated to reduce diversions by approximately 17,000 ac-ft. annually.

- v. Agreements between the Service and water users to provide a permanent source of 10,825 ac-ft. (divided equally between east and west slope). *Completed in 2014.*
- vi. Colorado River Water Conservation District makes available up to 6,000 ac-ft. annually from Wolford Mountain Reservoir (10% of the storable inflow). *Ongoing since 1996.*
- vii. Grand Valley Water Management - Study of canal operations showed spills from the Government Highline Canal averaged 31,400 ac-ft. (Aug-Oct) from 1992-1994. GVWM will reduce canal spills by 19,400 ac-ft. and ~9,000 ac-ft. will be returned to the Colorado River through Palisade Pipeline. *Complete.* See tables. The Municipal/Recreation contract allowing for Green Mountain Reservoir water that is surplus to user needs to be delivered to the 15-Mile Reach was originally signed in 2002, renewed on 8/29/07 through 12/31/12, and 40-year contract completed in April 2015.

Table 1. Summary of reservoir releases to augment August through October 15-Mile Reach base flows since 1998 (AF).

Reservoir	Lake Granby	Green Mountain	Palisade Bypass	Ruedi	Williams Fork	Willow Creek	Windy Gap	Wolford Mountain	Total acre-feet
1998		31,736		20,803				11,516	64,054
1999	26,914	29,277		20,418	1,825	649		4,939	64,022
2000		47,187		19,064	3,858			11,072	81,181
2001		34,668		21,345	5,369			8,577	69,947
2002		-	2,053	10,975	3,757			308	17,093
2003		47,528	10,161	20,434	3,757			288	82,164
2004		119	13,654	15,981	2,578			-	32,431
2005		31,200	19,143	17,163	3,614			1,000	72,321
2006		25,358	10,612	20,045	5,712			10,842	72,769
2007		32,745	10,825	14,650	2,824			7,037	67,881
2008	849	61,433	15,997	20,423	9,389		764		108,655
2009	3,144	56,290	18,302	20,822	5,411			6,747	112,716
2010	992	57,813	20,817	20,826	5,113		893	8,413	114,866
2011		37,132	20,486	15,251	5,412			8,413	86,674
2012		-	14,616	20,596	5,412			5,320	45,944
2013	5,412	2,514	13,937	10,412				1,501	35,776
2014	5,413	59,342	19,317	15,413				3,000	102,485
2015	5,415	54,610	8,162	24,412	1,289*			4,712	97,311
2016	5,413	55,390	12,210	27,413	234*			5,766	108,192
2017	5,439	46,218	20,272	21,413	139*			6,000	99,310
<b>Sum</b>	<b>58,961</b>	<b>710,645</b>	<b>232,344</b>	<b>377,857</b>	<b>64,131</b>	<b>649</b>	<b>1,657</b>	<b>107,449</b>	<b>1,553,592</b>

\* Denotes water exchanged from Granby into Willow Creek Reservoir temporarily; these numbers are not additive to the total volume released for flow augmentation.

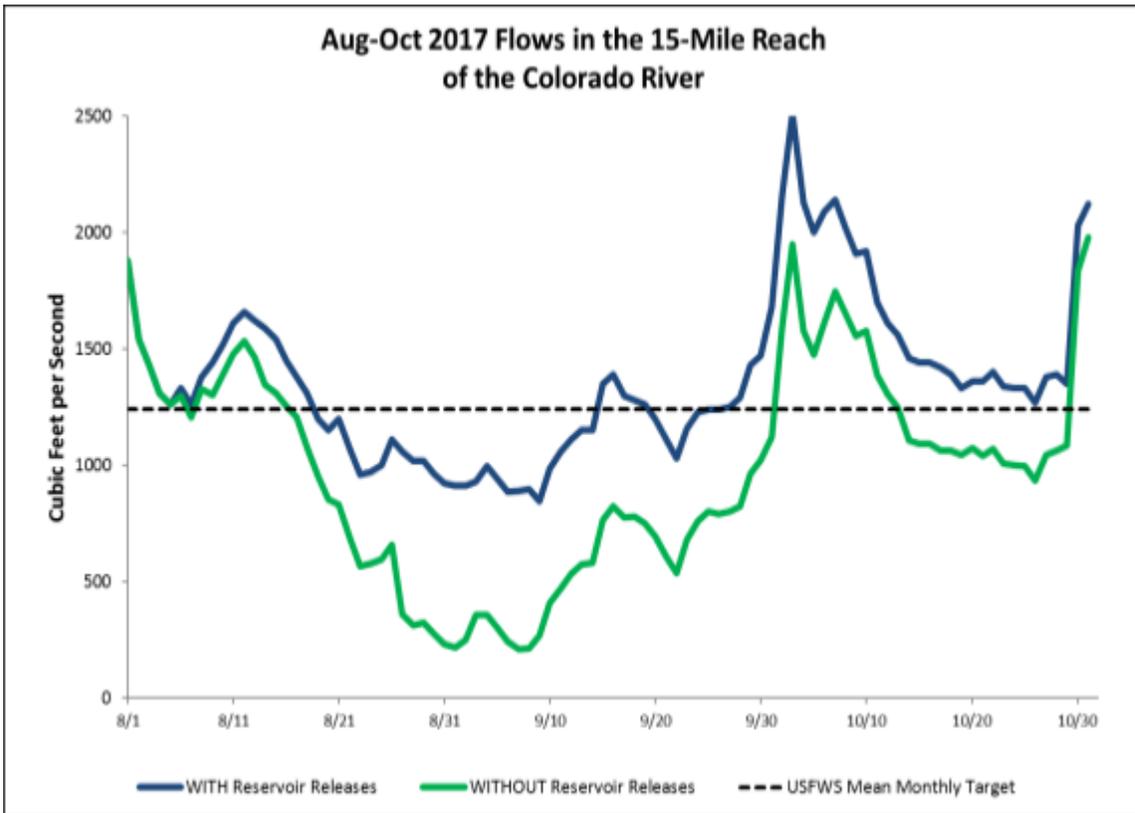


Figure 1. 2017 15-Mile Reach Flow Augmentation: Estimated mean daily flow at the Palisade, Colorado, gage location with versus without Program water releases for base flow augmentation.

Table 2. Summary of average monthly base flows in the 15 MR; 1991 - 2016.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
'Wet' Year (<25% Exceedance) - Avg Monthly Flow Targets	1,630	1,630	1,630	3,210	10,720	15,660	7,060	1,630	1,630	1,630	1,630	1,630
2011	1,627	1,642	2,041	3,230	10,320	26,430	16,130	2,879	1,762	1,777	2,221	1,840
1997	2,179	2,122	2,798	3,402	12,870	20,860	5,213	3,574	2,461	2,560	2,484	2,370
1995	1,429	1,449	1,749	962	5,415	20,040	16,010	3,897	1,339	1,477	2,373	2,198
2014	1,703	1,816	2,200	3,892	10,120	13,740	4,435	1,837	1,786	1,945	2,094	1,928
1993	1,449	1,544	2,015	2,540	14,160	15,830	6,702	1,788	1,287	1,279	1,837	1,873
2008	1,566	1,813	1,933	2,192	10,300	17,290	6,816	1,877	1,703	1,510	2,127	1,839
'Wet / Avg' Year (26 - 50% Exceedance) - Avg Monthly Flow Targets	1,630	1,630	1,630	2,440	9,380	14,250	5,370	1,630	1,630	1,630	1,630	1,630
1996	2,093	2,416	2,787	4,837	11,820	12,360	4,105	876	1,085	1,423	2,248	2,200
2009	1,831	1,770	1,874	2,337	11,720	11,870	4,841	1,461	1,127	1,413	1,870	1,453
2015	1,747	1,755	1,990	1,441	6,096	14,980	4,921	1,045	1,241	2,379	1,827	1,520
1998	2,375	2,292	2,913	3,361	10,400	7,931	4,184	1,849	1,284	1,550	2,332	1,910
2005	1,677	1,429	1,512	2,140	7,808	10,030	4,154	1,353	1,305	1,528	2,272	2,015
2006	1,849	1,782	2,229	4,364	9,305	6,140	2,044	1,152	1,271	1,996	2,166	1,880
1999	1,939	1,854	1,789	996.3	4,794	11,000	4,556	2,183	1,771	1,837	2,054	1,780
'Dry / Avg' Year (51-80% Exceedance) - Avg Monthly Flow Targets	1,630	1,630	1,630	2,260	7,710	11,350	3,150	1,240	1,240	1,240	1,630	1,630
2010	1,526	1,508	1,568	2,243	4,561	12,780	2,012	1,362	891.2	1,106	1,893	1,855
2003	1,145	1,156	1,336	709.8	5,906	7,244	1,052	611.2	1,088	1,078	1,419	1,403
2016	1,457	1,548	1,687	2,564	7,637	14,040	4,285	2,540	2,329	2,228	1,681	1,495
1991	1,280	1,297	1,302	1,148	5,059	8,488	2,168	797.4	979.8	853.9	1,918	1,502
2007	1,565	1,705	2,368	1,795	6,132	5,951	1,616	893	1,353	1,553	1,870	1,825
2000	1,931	2,002	1,930	1,927	7,040	6,017	1,272	912.6	986.4	901.5	1,701	1,496
'Dry' Year (81 - 100% Exceedance) - Avg Monthly Flow Targets	1,240	1,240	1,240	1,860	7,260	6,850	1,480	810	810	810	1,240	1,240
1994	1,794	1,903	2,109	1,802	4,874	4,585	744.6	557.5	650	843.4	1,220	1,460
2001	1,322	1,352	1,476	972.7	5,149	3,764	995.3	1,133	1,014	807.1	1,573	1,345
1992	1,378	1,475	1,684	1,773	4,603	3,164	1,196	822	800.9	628.1	1,628	1,423
2004	1,322	1,300	1,597	1,086	3,297	2,976	973.5	497.6	830.3	1,078	1,801	1,487
2013	1,137	1,147	1,204	307.6	4,043	4,306	742.6	727.4	1,272	1,288	2,031	1,707
2012	1,765	1,600	2,026	1,131	1,840	1,052	615.1	454.1	371.7	528.6	1,404	1,188
2002	1,405	1,286	1,396	1,010	1,016	934.9	161	115.4	240.9	526.2	1,618	1,217

*observed average monthly flow target met*

*observed average monthly flow target not met, but > minimum monthly (810 cfs)*

*observed average monthly flow < 810 cfs*

## c. Spring Peak enhancement

- i. Coordinated Reservoir Operations (CROS) are to occur in all but extremely wet or dry years (See Table 3). *Ongoing since 1997*. Spring peak flows were augmented in 1997, 1998, 1999, 2006, 2008, 2009, 2010, 2015, 2016, and 2017 (e.g., Figure 2). Spring peak flows in 2000, 2001, 2002, 2004, 2012, and 2013 were below the 12,900 cfs threshold for implementing coordinated reservoir operations under CROS. CROS implementation plan completed 2/28/06.

Table 3. Summary of Coordinated Reservoir Operations (CROS) to boost 15-Mile-Reach peak flows, since 1997 (years without CROS operations not listed). Values in total acre-feet released for peak flow augmentation.

Reservoir	Homestake	Lake Granby	Green Mtn	Ruedi	Williams Fork	Willow Creek	Windy Gap	Wolford Mtn	Moffat Tunnel	Total AF
<b>1997</b>			3,568	693	946			10,635		<b>15,842</b>
<b>1998</b>			12,482	5,106	1,672			4,431		<b>23,691</b>
<b>1999</b>		8,515	11,010	3,602	1,543	6,631		8,555		<b>39,856</b>
<b>2006</b>			6,788	6,297	6,625			9,007		<b>28,717</b>
<b>2008</b>			2,101	4,848						<b>6,949</b>
<b>2009</b>			14,113	5,858	5,044	2,638	2,061	13,069		<b>42,783</b>
<b>2010</b>			34,666	10,050	19,982			9,273		<b>73,971</b>
<b>2015</b>		18,002	11,292	4,599	2,733	8,000	906	4,587		<b>32,117</b>
<b>2016</b>	1,430		8,632	4,007	4,893			8,452	1,960	<b>29,374</b>
<b>2017</b>			14,410	4,502	3,293	7,206		4,245	2,079	<b>35,735</b>
<b>Sum</b>	<b>1,430</b>	<b>26,517</b>	<b>119,062</b>	<b>49,562</b>	<b>46,731</b>	<b>24,475</b>	<b>2,967</b>	<b>72,254</b>	<b>4,039</b>	<b>348,467</b>

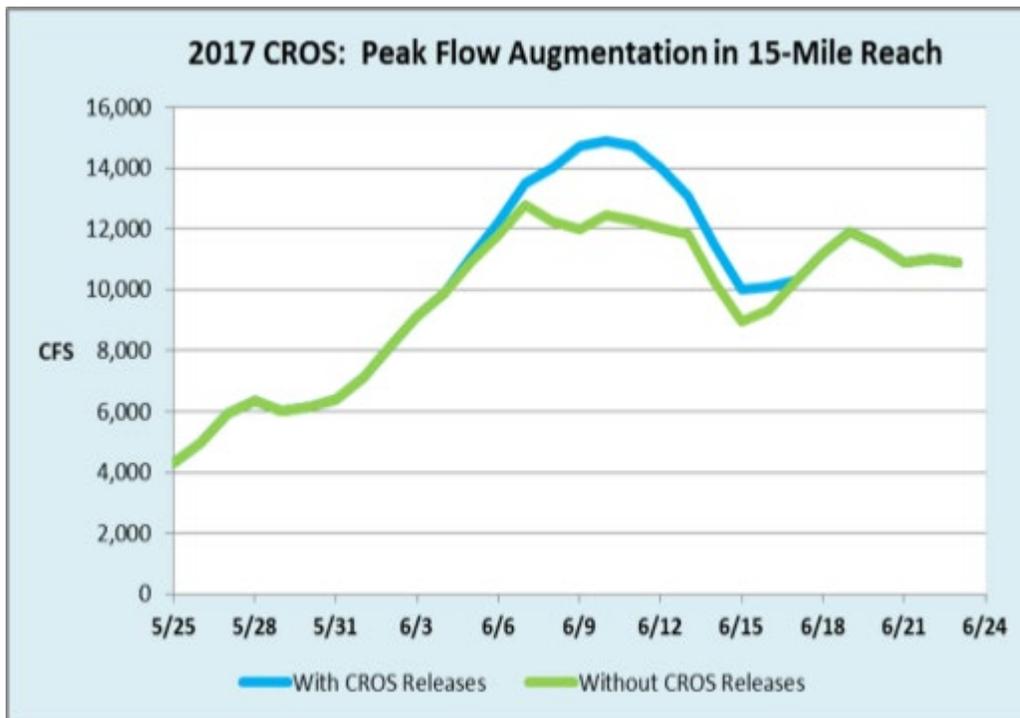


Figure 2. CROS Operations 2017: Estimated mean daily flow at the Palisade, Colorado, and gage location versus without CROS releases for flow augmentation.

- ii. Coordinated Facilities Operations Program (CFOPS) is to provide up to 20,000 ac-ft. of water per year when available. The Phase II report & recommendations of the Executive Committee were completed in 2003, but no additional water was provided under CFOPS. Implementation of CFOPS linked to CROS (see above). With assistance of the State Engineer's Office, CWCB, and reservoir owners, the Service identified reservoirs that could participate in CFOPS. The amount of water that could be released depends on the size of an insurance pool that would be designated by the Service ~May 5 of each year from existing base flow environmental pools in Ruedi Reservoir and the water users' 10,825 pool. In years where augmentation could be expanded through use of CFOPS, Service will review antecedent conditions, determine if additional augmentation is needed, and level of augmentation based on the size of the "insurance pool." CFOPS report should be included in the 2015 review of the 15-Mile Reach PBO. As of 2018, no additional peak flow augmentation water has been provided to the 15-Mile Reach through CFOPS implementation. A revised draft of the Phase III CFOPS report was provided for Program staff review by Water Consult Engineering and Planning Consultants (Loveland, Colorado) in 2017.

Based on that review, Water Consult submitted a draft CFOPS Report to the Recovery Program, incorporating comments received, including input from the Bureau of Reclamation concerning Ruedi Reservoir options. Water Consult Engineering will soon distribute this document to the Program's technical committees for comment.

2. Habitat Development and Maintenance Element - Operation, maintenance and evaluation of sites incorporated into Colorado River Sub-basin Floodplain Management Plan (Valdez and Nelson 2006).
  - a. Floodplain Restoration and Selenium Remediation
    - i. Gardner Pond (29-<sup>5</sup>/<sub>8</sub> Road Gravel Pit) - *Construction complete*; Beswick pond used as a grow out pond in 2010 & 2011. Restoration of this "Hot Spot Complex" was on hold pending completion of new Horsethief ponds, which is now completed, but the Service no longer recommends reconnecting gravel pits due to non-native fish concerns.
    - ii. Jarvis - *Construction complete; operation ongoing*. Program removed sediment build-up at the Jarvis pond inlet/outlet structure in 2012 (same as work performed in 2010 and 2003).
    - iii. Adobe Creek - *Construction for the research study complete*, but no funding available through National Irrigation Water Quality Program (NIWQP) to complete selenium remediation. The need to pursue restoration of this site for razorback sucker recovery should be revisited. Dikes placed for research study in tertiary channel should be removed.
    - iv. Walter Walker - *Construction complete; operation ongoing*. More levee was removed in 2004. Habitat enhancements at the Audubon and Walter Walker sites were evaluated over a range of flows during 2006 spring runoff and performed well (i.e., as per design and construction). CPW actively manages Walter Walker and encourages waterfowl hunting there.
    - v. Land acquisition and levee removal. *Incomplete; revised targets based on landowner interest*. PBO estimate of acquiring interest in up to 3,500 acres in the Grand Valley and along the Gunnison was quite high based on landowner response. However, restoration was determined more expensive than anticipated; few landowners were willing to participate. Program acquired 592 acres of floodplain/wetland habitat in the upper Colorado River sub-basin (393.5 acres along the Colorado River and 198.2 acres along the Gunnison River), and is working to best manage the floodplain currently available. Restoration completed at Butch Craig property & Escalante State Wildlife Area (SWA) on the Gunnison, and the Audubon property on the Colorado. Staff at the Service's Grand Junction Office (GJ-Fish and Wildlife Conservation Office (GJ-FWCO)) are scheduled to draft a report that includes a summary of larval razorback sucker collection in recent years.

This information will be critical to understanding proper placement / focus for managed floodplains in the Upper Colorado River drainage.

The adult population of hatchery produced adult razorback sucker has increased from extremely low numbers in 2005 to approximately 8,000 individuals in 2013 (see Population Estimate tab in the RIPRAP spreadsheets). The Service and Program coordinated with the landowner at Soaring Eagle Gravel Pit to determine best method for reconnection (at landowner's cost, per biological opinion) in light of potential non-native fish invasion. Grand Junction Pipe site (Program property) was reclaimed (using rotenone) in March 2012 prior to levee breaching (construction completed by private industry as per project Section 7 consultation).

The Program and the GJ-FWCO have been in communication with the local chapter of the Audubon Society regarding potential renovation of that floodplain site.

b. Fish Passageways

- i. Price-Stubb passage – *Completed in April 2008 (and operated annually since)*. Passive PIT-tag monitoring station installed in 2010. 2011 high-flow damage repaired in 2012. A variety of native fish have used the passage structure since its creation, including razorback sucker (698), bonytail (630), flannelmouth sucker (224), bluehead sucker (213), roundtail chub (148) and Colorado pikeminnow (48).
- ii. GVIC passage - *Completed in 1998*, and operated annually. Obermeyer gate installed in 2006; and raised when flows are low (operated intermittently [due to low flow years]). Native fish that make it past the screen are actively removed during fall canal salvage. To date, salvage efforts have returned primarily roundtail chub, flannelmouth sucker, speckled dace and bluehead sucker to the river. Razorback sucker and bonytail have also been found in small numbers. GVIC and Reclamation have initiated a project to improve operation and maintenance of the GVIC fish screen with the objective of increasing the time the fish screen is in operation and making O&M by GVIC less time-consuming.
- iii. Grand Valley Project (Government Highline) fish passage - *Completed in 2004* Full operation began in 2008 (with completion of Price-Stubb passage). To date (thru 2017), the GJ-FWCO reports the following endangered fish use: (5) Colorado pikeminnow; (247) razorback sucker; (102) bonytail; and (5) humpback chub. In addition, more than 120,000 native fish and approximately 26,000 non-native fish have used or been removed at the facility during the same period of time.

3. Native Fish Stocking Element

- a. Raising native fish in hatcheries and grow out ponds, and stocking them in the riverine habitat. *Ongoing*
  - i. The integrated stocking plan for the Upper Colorado River Basin was completed in March 2003 and revised in 2015. Annual stocking targets of 10,000 subadult bonytail (>250mm) and 6,000 razorback sucker (>350mm) in the upper Colorado River sub-basin are being met.

4. Non-native Fish Control Element

- a. Regulations and Agreements
  - i. 1996 Non-native Stocking Procedures. *Complete, revised in 2009.*
  - ii. 1999 Restriction of stocking of private ponds in Colorado. *Complete; report on evaluation of Colorado's non-native fish stocking regulations completed in July 2004.*
  - iii. Bag limits removed for non-native warm-water sport fishes in critical habitat in Colorado. *Complete.*
  - iv. Close river reaches to angling where and when angling mortality is determined to be significant to native fish. *Complete. CPW agreed to do this when and where necessary (to date, it has not been deemed necessary.)*
  - v. CPW Colorado River fisheries management plan. *Plan completed in 2005.*

- vi. CPW and Recovery Program participants have formed an ongoing Non-native Fish Workgroup to enhance non-native fish control in Colorado. The group has made numerous recommendations that have been implemented.
- b. Removal Efforts
  - i. Pond Reclamation. *Pond reclamation has been accomplished, but proved ineffective.* Research was initiated to document sources of non-native fish so the Program can determine if they can be controlled at the source. The final report was completed February 2004. CPW, the Service, and the Program are discussing how to control non-native fishes in Mamm Creek Ponds (which may require chemical reclamation since the notch was specifically engineered to maintain equilibrium between the ponds and the river during runoff). In the interim, CPW has operated a Merwin fish trap in Mamm Creek ponds since 2015. In 2017, CPW removed 1,616 fish from the pond: (1,040) carp; (76) green sunfish; (172) largemouth bass; (306) northern pike; (20) yellow perch; and one white sucker. CPW will opportunistically inventory ponds with permitted notches, identify the non-native fish threat, and recommend action as necessary.
  - ii. Removal of non-native fishes from backwaters. *Pilot program to remove small cyprinids and centrarchids complete; techniques and level of effort produced some short-term depletions, but provided no solutions to long-term control.* Final reports completed in 2002 and 2003. Preliminary results of research on sources of non-native fish (which may provide another avenue of control) indicate younger centrarchids (age-0 to age-3) were produced in main channel habitats, as opposed to having escaped from floodplain ponds. However, almost 50% of age-4+ centrarchids escaped from ponds, likely during years when higher flows connected the ponds with the river. CSU investigations have resulted in otolith markers for water chemistry for reservoirs throughout the basin (Johnson *et al.* 2014).
  - iii. Management of non-native fish populations. *Management of bass and other centrarchids in the Colorado River has been ongoing since 2004;* channel catfish management on hold pending development of effective techniques. Centrarchid removal efforts increased beginning in 2007. Goal is to remove as many smallmouth bass as possible from: 1) a 66-mile reach from between the Grand Valley Project dam in CO downstream to the Westwater boat landing in eastern UT; and 2) a 45-mile reach between Rifle and Beavertail Mountain in CO using multiple removal passes/year. In 2017, GJ-FWCO removed 1,755 smallmouth bass, 1,937 largemouth bass, 116 walleye, two northern pike, three striped bass, two grass carp and various amounts of other non-native fish. Smallmouth bass continue to reproduce successfully during drier hydrologies. CPW reports much lower catch rates for smallmouth bass and northern pike in the upper reaches of the river. Walleye abundance and distribution in the lower reach increased around 2008 and remains problematic. In 2017, GJ-FWCO personnel report high catches of walleye immediately downstream of Westwater Canyon. Fortunately, Utah Division of Wildlife Resources (UDWR) did not catch walleye while sampling for humpback chub in Westwater Canyon.

CPW has removed all bag and possession limits for problematic non-native fishes in the warmwater reaches of the Green, Yampa, White, Colorado, and Gunnison rivers on

the western slope in Colorado. Colorado's Non-native Fish Management Work group has evaluated options for increasing effectiveness of non-native fish control (e.g., expanding Information and Education and public awareness; harvest incentive programs; and harvest regulations, more compatible species/hybrids; modifying reservoir operations; and reservoir screening and containment).

5. Research, Monitoring, and Data Management Element

- a. Population estimates will be used to determine if Recovery Actions result in a positive population response.
  - i. The current downlisting demographic criteria for Colorado pikeminnow (USFWS 2002a) in the Upper Colorado River Sub-basin is a self-sustaining population of at least 700 adults maintained over a 5-year period, with a trend in adult point estimates that does not decline significantly.

Secondarily, recruitment of age-6 (400–449 mm TL), naturally produced fish must equal or exceed mean adult annual mortality (estimated to be about 20%) (Figures 3 & 4). The average of all adult estimates (1992 – 2015; estimates from 2013 thru 2015 are considered preliminary is ~600. Osmundson and White (2014) determined that recruitment rates were less than annual adult mortality in six years and exceeded adult mortality in the other six years when sampling occurred. The estimated net gain for the 12 years studied was 32 fish > 450 mm total length (TL).

Whereas the Colorado River population appears to meet the trend or 'self-sustainability' criterion, it has not met the abundance criteria of 'at least 700 adults' during the most recent five-year period. The Service is reevaluating the demographic and threat removal criteria for Colorado pikeminnow through revision of the species' recovery plan. The Service's status review of Colorado pikeminnow was completed in 2011. Although a good portion of the recovery factor criteria (USFWS 2002a) are being addressed, non-native fish species continue to be problematic and researchers now speculate that mercury may pose a more significant threat to Colorado pikeminnow populations of the upper Colorado River basin than previously recognized (see discussion in sufficient progress assessment). The Recovery Program completed a population viability analysis for Colorado pikeminnow in 2018, which will inform the species viability portion of a Species Status Assessment (scheduled for completion in 2019).

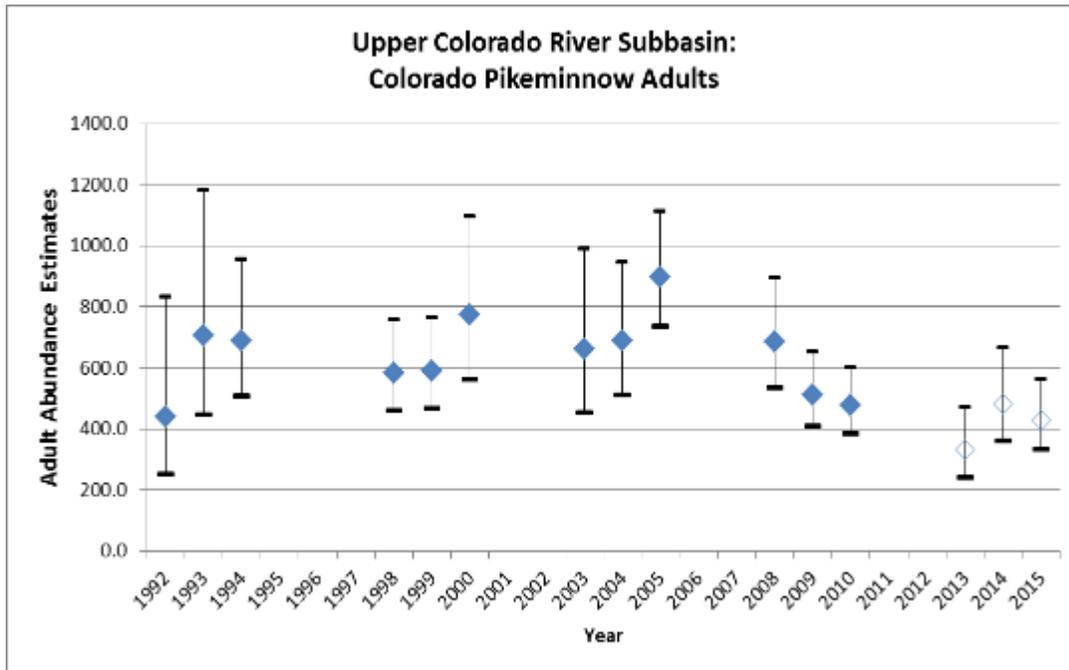


Figure 3. Adult Colorado pikeminnow population abundance estimates for the Colorado River (Osmundson and Burnham 1998; Osmundson and White 2009; 2014). Error bars represent the 95% confidence intervals. The data presented for 2013 thru 2015 data are preliminary and represented by hollow data points. Populations estimation was scheduled to resume in 2018, but will be postponed until 2019.

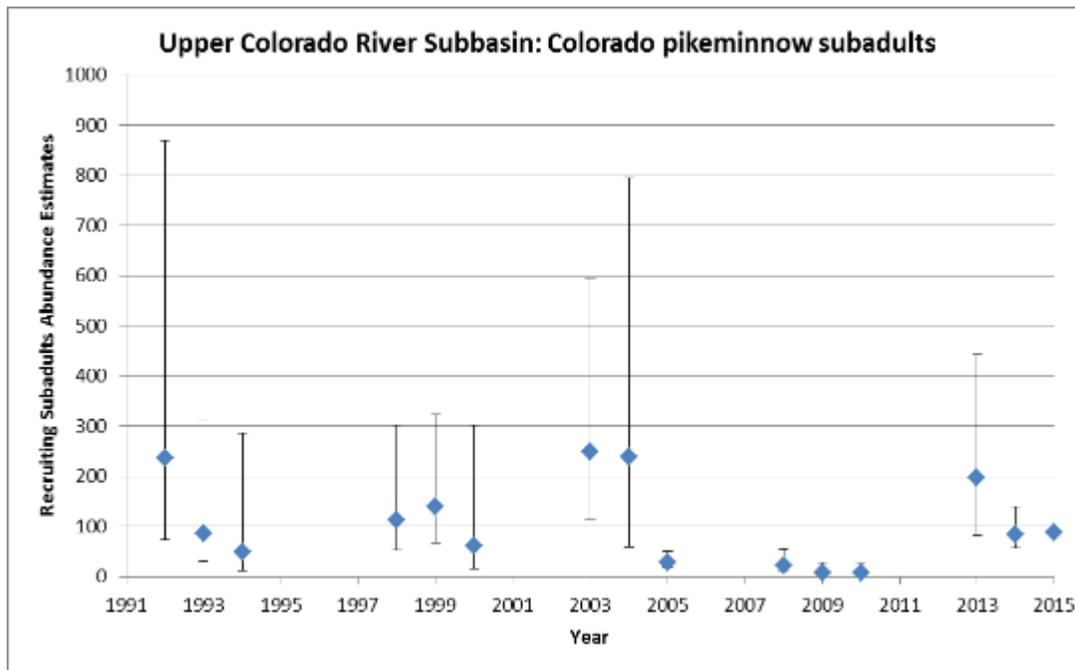


Figure 4. Colorado pikeminnow recruitment abundance estimates (calculated using the same mark recapture methodology as for the adults) for the Colorado River (Osmundson and White 2009; 2014). Recruits are age-6 (400-449mm TL). The data presented for 2013 through 2015 should be considered preliminary. Population's estimation was scheduled to resume in 2018, but will be postponed until 2019.

- ii. The most recent adult humpback chub population estimates in Black Rocks are as follows: 2007–2008 adult estimates were 345 and 287, respectively; 2011-2012 were 379 and 403, respectively. Abundance sampling occurred in 2016 and 2017, but estimates have not yet been developed. The Westwater Canyon estimates (see Figure 5) of wild adults range from about  $N = 4,700$  in 1998 to  $N = 2,500$  in 1999, 2000, to  $N = 1,525$  in 2007–2008, and back above 3,600 adults in 2017. Although researchers link humpback chub declines in the upper portions of Desolation Canyon to increasing abundance of non-native smallmouth bass there, a different mechanism appears to have impacted humpback chub in the Colorado River canyons. The large declines in humpback chub densities in both Black Rocks and Westwater Canyons occurred in the late 1990's prior to more recent increases of non-native predators in the Colorado River. In 2008, the core population (Black Rocks/Westwater combined) dropped below the population size downlist criterion ( $MVP = 2,100$  adults) for the first time. In 2011, the estimate for adults in Westwater Canyon alone was 1,467; however, UDWR reported 1,315 adults in 2012. Core population estimates in 2011 and 2012 were 1846 and 1718, respectively.

Population estimates in both Black Rocks and Westwater canyons declined dramatically during the first population estimation rotation in the late 1990s, but have remained relatively stable since that time.

The core population has clearly increased above the 2,100 adult criteria in 2017. CSU's recent robust population estimate analysis more clearly indicated that declines in the Westwater and Black Rock humpback chub populations are due to lapses in recruitment, because adult survival rates have remained stable. Age-0 monitoring was reinstated in recent years. Whatever is affecting humpback chub recruitment has not affected sympatric populations of native roundtail chub (a Conservation Agreement species); roundtail chub populations in both canyons have remained stable or have increased since population estimation started. In addition to the potential and recent negative interactions between humpback chub and non-native predators discussed above, both the Westwater and Black Rocks populations are at risk of potential chemical contamination due to the proximity of a railroad located on the right bank of the Colorado River which at times transports toxic substances. The Service completed an SSA for humpback chub in December 2017, which recommended a reclassification of the species from endangered to threatened status. The proposed rule is expected to be published in 2019.

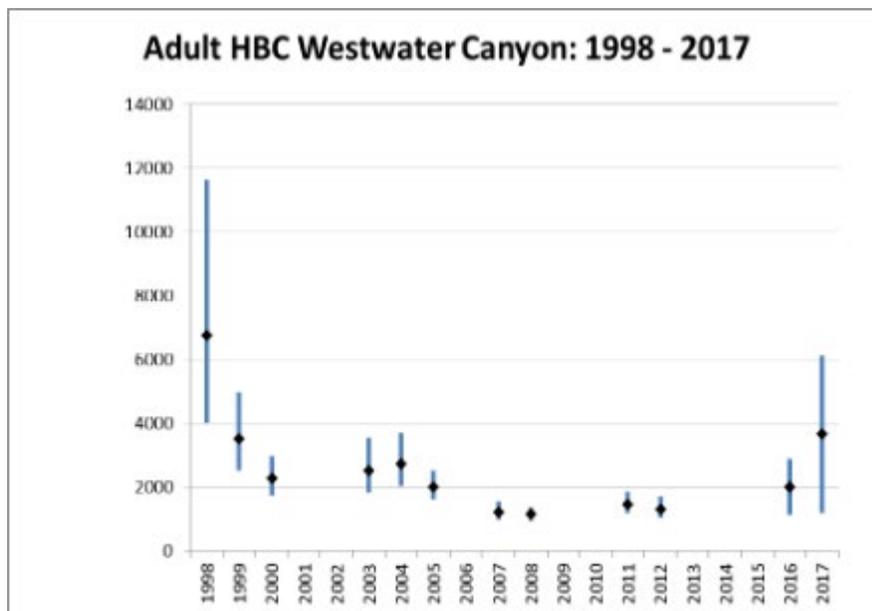


Figure 5. Population estimates for humpback chub in Westwater Canyon (UDWR; Hines 2017). Black Rocks population estimates have not yet been reported for 2016 and 2017.

- iii. Stocking of razorback sucker and bonytail continues. Preliminary population estimates were generated for razorback sucker in the Colorado River as a whole (from Palisade, CO downstream to its confluence with the Green River), for adult fish > 400 mm TL, (data obtained during Colorado pikeminnow population estimate studies in 2005 and 2008–2010 and 2013–2015 [Figure 6]). The recently revised integrated stocking plan (ISP) has been implemented since 2013 stocking fewer but larger razorback sucker. The bonytail reintroduction effort has not been nearly as successful for razorback sucker.

Also in accordance with the revised ISP, since 2013 the Recovery Program is stocking far greater (about 35,000) and larger bonytail (averaging 250 millimeters total length). Increasing numbers of stocked bonytail have been detected where stationary tag-reading antennas are used.

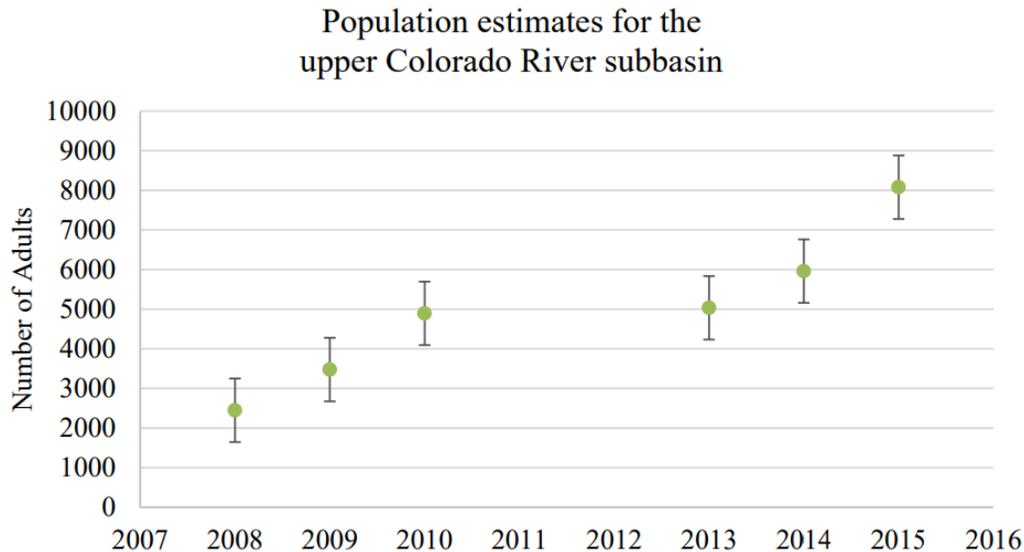


Figure 6. Preliminary population estimates of adult razorback sucker in the Colorado River (Palisade, CO to the confluence of the Green River). Error bars represent the 95% confidence intervals.

- b. Recovery goal development - If population meets or exceeds recovery or the goals outlined in Appendix B of the PBO, it will be considered to exhibit a positive population response. *Recovery goals completed in 2002.* The Service requires a Species Status Assessment (SSA) be completed for each species as the first step in revising recovery plans. A SSA was completed for humpback chub in December 2017, which supported a 5-yr review in March 2018). The humpback chub 5 year review recommended revising the species Recovery Plan and reclassifying the species as threatened.

The razorback sucker SSA is scheduled to be finalized in the summer of 2018, which will lead to a 5-yr scheduled for completion in FY18. An SSA and 5-yr review for Colorado pikeminnow are scheduled for completion in FY19. A 5-yr review for bonytail is also scheduled for completion in FY19.

6. Long-term Funding and Annual Appropriations. *Complete and ongoing.*
- a. Recovery Agreements
    - i. With consultations. *Ongoing.*
    - ii. By water users controlling a majority of existing depletions above the Gunnison River. *Complete.*
  - b. Depletion Charges on New Depletions. *Ongoing.*

c. Incidental Take

- i. Develop plan to monitor incidental take of endangered fish in diversion structures. 3/32" mesh screens on Grand Valley Project, and GVIC diversion dams prevent entrainment of adult, subadult, and juvenile fish (preventing entrainment of adult and subadult fish required is by recovery goals). "Plan" complete in that fish are retrieved from canals (annually) whenever canal screens cannot be fully operated. Canal salvage at the GVIC project has occurred every year since 2002. The greatest number of fish were recovered at the end of the 2012 irrigation season (n=5,744); in 2016, 3,442 fish were recovered. To date (i.e., over the course of 15 yrs.), (18) razorback sucker; (15) bonytail and no Colorado pikeminnow nor humpback chub have been recovered from the GVIC canal. GJ-FWCO reports that following the 2016 irrigation season, a total of 54,254 fish were collected in the GVWU canal, including (in descending order) 24,612 speckled dace, 25,455 roundtail chub, 4,004 flannelmouth sucker, and 183 bluehead sucker. The vast majority of these fish were collected from a short section of the canal (dubbed the "Hotspot") between 35 & 3/10 and 35 & 8/10 roads in Palisade, CO. Twenty-four Colorado pikeminnow were recovered from the GVWU canal in 2004, but those were hatchery produced fish stocked above the diversion. No pikeminnow have been captured in post-irrigation season salvage effort at the GVWU canal since 2004.
- ii. Estimate amount of incidental take of young razorback and pikeminnow in the 15-Mile Reach. Service believes screening of diversion structures has resolved entrainment issues; anytime screens are not fully operational, the Service conducts fall sampling in the canals to retrieve endangered and other native fish.

REASONABLE AND PRUDENT MEASURES (from page 70-71 of PBO)

The screening of two diversions were listed in the PBO as Reasonable and Prudent measures as they have the greatest potential for access by the endangered fish because of their location and the amount of the river diverted at each facility.

1. *GVIC screen is complete.* However, operation of the GVIC is problematic, with extended period of non-operation particularly in drier hydrologies. In 2017, the screen was functioning 71% of the days during the irrigation season. The Recovery Program, Reclamation, and GVIC are exploring retrofits and other potential solutions to make screen operations less problematic and more reliable.
2. *Grand Valley Project Government Highline screen is complete.* In 2017, Grand Valley Water User's operated the screen 100% of the irrigation season - an incredible accomplishment!

All Terms and Conditions outlined in the PBO have been met with the successful installation of these screens.

## **Appendix II Gunnison River PBO Review**

In the December 4, 2009 final Gunnison River Basin Programmatic Biological Opinion (PBO), the U.S. Fish and Wildlife Service (Service or USFWS) determined that the proposed reoperation of the Aspinnall Unit, the proposed Selenium Management Program, and the remaining Recovery Action Plan items are sufficient to avoid the likelihood of jeopardy and/or adverse modification of critical habitat from the impacts for existing depletions (estimated average annual 602,700 ac-ft./year) and future depletions (37,900 ac-ft./year), as defined in the proposed action. Page 83 of the PBO says: “Every two years, for the life of the Recovery Program, the Service and Recovery Program will review implementation of the Recovery Action Plan actions that are included in this biological opinion to determine timely compliance with applicable schedules.” A review of action items from the PBO follows below, with status updates in italics.

### CONSERVATION MEASURES APPLICABLE TO THE GUNNISON AND COLORADO RIVERS (From pages 17-18 of PBO)

- 1) Monitoring of Endangered Fish Populations - The Recovery Program is responsible for monitoring endangered fish populations. The Recovery Program monitors Colorado pikeminnow populations and is developing a basin-wide razorback sucker-monitoring program that will include monitoring of multiple life stages. Design of the monitoring program is expected to be completed in fiscal year 2010. Implementation will begin in 2010. It will include multi-life stage monitoring on the lower Gunnison River. Density estimates will be developed for Colorado pikeminnow and razorback sucker in the lower Gunnison River. Monitoring the endangered fish populations will help determine the status of the species before and after the SMP is implemented.  
*Ongoing.* A long-term, multi-life-stage, monitoring program for Colorado pikeminnow and razorback sucker was started in FY11 in the Gunnison and Colorado rivers whereby population responses can be used to evaluate the effectiveness of implementation of Aspinnall re-operation (as summarized in [Elverud and Ryden 2017](#)) and the Selenium Management Program (SMP). Evaluation of effects of reoperation on critical habitat in the Colorado River from the Gunnison River confluence to Lake Powell will occur after the flow recommendations above the Gunnison River have been evaluated. Interim draft fish community monitoring report including adult, age-0, and larval sampling is due August 2018. The first contaminants report was finalized in November 2013; the next is scheduled for late 2020.
- 2) During fish community monitoring in the lower Gunnison River, tissue samples will be collected from razorback suckers, as well as a chosen surrogate species, to determine selenium concentrations. These samples will be collected at intervals to assess reduction in selenium contamination from implementation of the SMP.  
*Complete.* Since FY11, researchers with the USFWS – Colorado River Fishery Project (CRFP) Grand Junction (conducting the fish community monitoring on the Gunnison and Colorado rivers) have coordinated with USFWS - Ecological Services contaminant biologists to collect appropriate tissue samples.

TERMS AND CONDITIONS (From pages 80 – 81 of PBO)

1. Reclamation will work through the Recovery Program technical committees to develop a Study Plan to evaluate the effects of the proposed operations of the Aspinall Unit and how it improves habitat and thereby contributes to recovery. The Study Plan should be completed within one year of the finalization of this biological opinion and should focus on previously identified uncertainties related to geomorphic processes, floodplain inundation, and temperatures (see Uncertainties section). The Study Plan should also include an evaluation of the effects of reoperation on critical habitat in the Colorado River from the Gunnison River confluence to Lake Powell.

*Study plan completed in May 2011; implementation in progress with fish community monitoring beginning in FY11.*

2. Reclamation will provide to the Service and Recovery Program a concise annual operations report by December 31 of each year. The primary purpose of the annual report is to provide an assessment of how well operations of the Aspinall Unit contributed to meeting target flows in the Gunnison and Colorado Rivers. The report should include information on the planned operations based on the forecast and the actual operations; flows provided at Whitewater and below the Redlands; the Colorado River at the Colorado/Utah state line and the Cisco gage; and any operational issues (spillway inspections, etc.).

*Annual reports provided (2015; most recent), however, Reclamation posts summary hydrology on the [Aspinall Working Group website](#).*

The **2015 water year** (Figure 1) was considered a moderately dry year. Year type is determined by the forecasted April through July inflow volume to Blue Mesa Reservoir. Moderately dry years are defined as years where the forecasted inflow volume is greater than 381,000-acre-feet and less than 516,000 acre-feet. The April 1 runoff forecast predicted 480,000 acre-feet of inflow to Blue Mesa Reservoir. The actual April through July inflow volume for 2015 totaled 708,000 acre-feet, mainly due to very high spring rainfall. The May 1 runoff forecast placed 2015 into a moderately dry year category with a peak flow target of 4,991 cfs at the Whitewater gage. Average monthly base flows at the Whitewater gage exceeded the recommended targets for a moderately dry year. The lowest average monthly flow (1436cfs) for the 2015 water year occurred in December, nearly twice the recommended base flow target of 750cfs for that month.

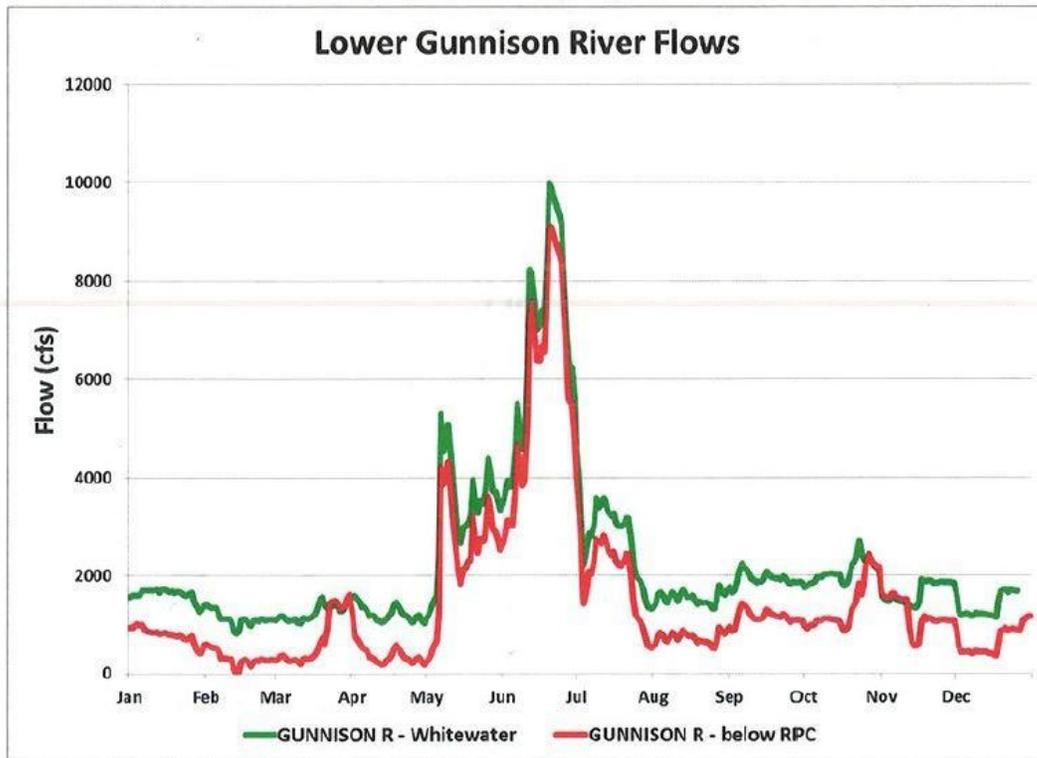


Figure 1. Gunnison River flows, 2015.

Based on the April 1<sup>st</sup> forecast of 515 KAF, the **2016 water year** (Figure 2) was on the cusp of a moderately dry (381 – 516 KAF) and an average dry (516 – 709KAF) year. The Bureau of Reclamation targeted the average dry spring peak of 10 days > 8,070cfs. The actual inflow was later determined to 602KAF, which supported the decision. Average monthly base flows at the Whitewater gage exceeded the recommended targets for a moderately dry year. The lowest average monthly flow (1203cfs) for the 2016 water year occurred in January, which exceeded the recommended monthly base flow target of 750cfs.

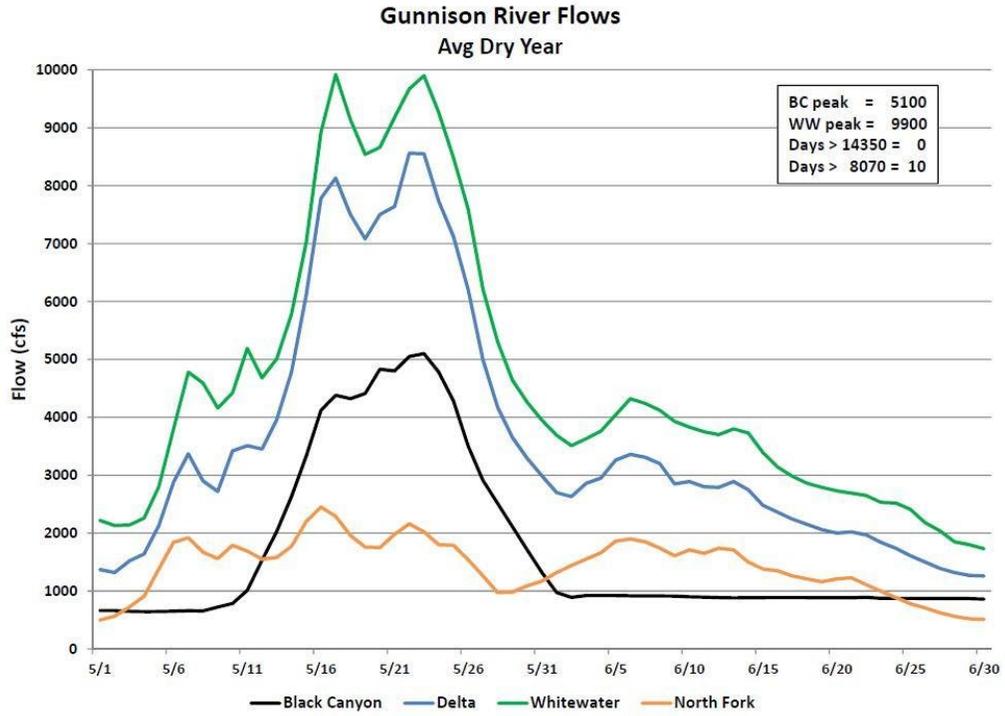


Figure 2. Gunnison River flows and flow target performance, 2016.

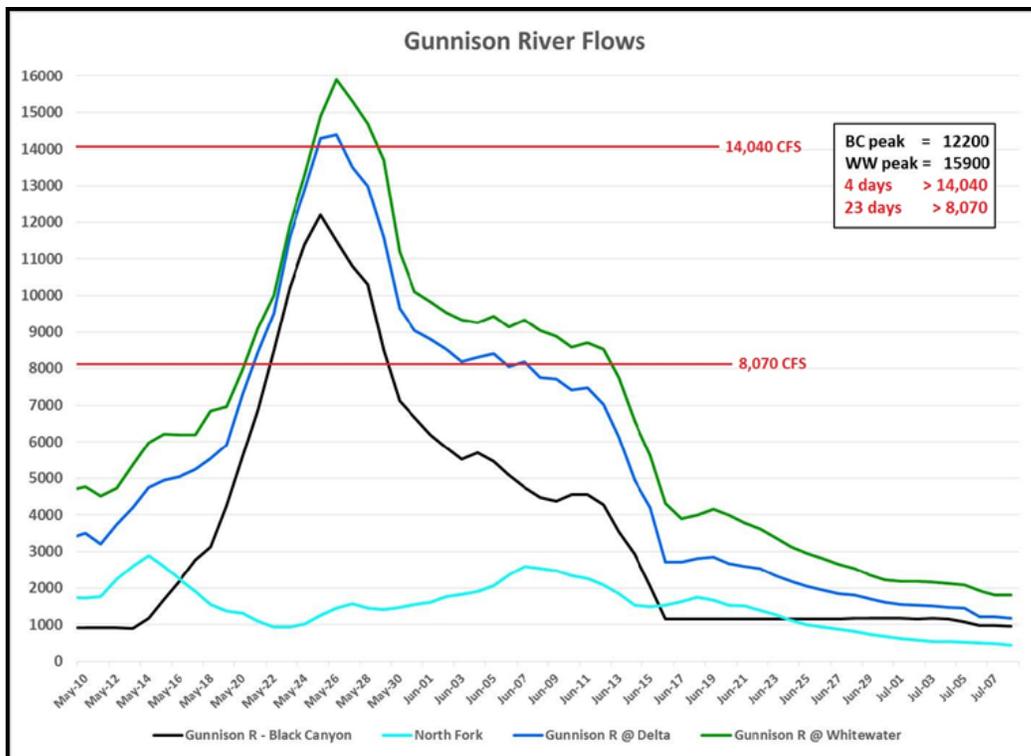


Figure 3. Gunnison River flows, 2017.

Based on the April 1<sup>st</sup> forecast of 930 KAF, the **2017 water year** (Figure 3) fell into the moderately wet category (831 – 1123 KAF), which called for 40 days > 8,070cfs and ten days > 14,350cfs. The actual inflow was later determined to 915KAF, which supported the moderately wet year decision. Average monthly base flows at the Whitewater gage exceeded the recommended targets for a moderately wet year. The lowest average monthly flow (2115cfs) for the 2017 water year occurred in September, nearly twice the recommended base flow target of 1050cfs for that month.

3. Eight months after the final PBO is issued Reclamation will complete an MOA or similar mechanism, with appropriate parties, to develop the [Selenium Management Program](#). *Reclamation led this effort, and the ongoing Selenium Management Program was established in 2011 with substantial local support and participation.*
4. Six months after the final PBO is issued, and every six months thereafter, Reclamation will provide an update to the Service on the status of the development of Selenium Management Program. *Reclamation led this effort; Selenium Management Program established in 2011 and had reported periodically.*
5. Eighteen months after the final PBO is issued, Reclamation will provide the draft Selenium Management Program document, and a final document with associated agreements with key cooperators to the Service within 24 months. *Selenium Program Formulation Document was developed by the Selenium Management Program (SMP) Workgroup and finalized in December 2011*
6. Implementation of the initial components of the SMP not already underway will begin within five years of issuance of this opinion. *SMP implementation began in January 2012. The SMP Workgroup meets on a quarterly basis or more frequently as needed. The SMP continues to work to reduce existing selenium loads and prevent/minimize/mitigate new selenium loading. Highlights are shown below; full report available at <http://www.usbr.gov/uc/wcao/progact/smp/docs/SMP-2014AnnualRep.pdf>.*
7. Reclamation will provide annual water quality summary reports to the Service by December 31 of each year. *“Selenium Management Program Gunnison River Basin, Colorado Annual Progress Report 2015” Prepared by Selenium Management Program Workgroup, Compiled by the Bureau of Reclamation.*
8. Reclamation will provide a report on biological monitoring (including fish monitoring in the Gunnison and Colorado Rivers) to the Service by December 31 in years when monitoring is conducted. *“Selenium Management Program Gunnison River Basin, Colorado Annual Progress Report 2015” also summarized biological and water quality data collected during the previous year.*

#### CONSERVATION RECOMMENDATIONS APPLICABLE TO THE DOLORES RIVER (From pages 81 – 82 of PBO)

1. The Service recommends that Reclamation continue to support the efforts of the three species conservation strategy (UDWR 2006) on a range-wide basis, including conservation efforts on the Dolores River. *Ongoing*

The Bureau of Reclamation has been an active participant of the Dolores River Dialogue since its inception in 2004 and is currently active in the Implementation Team efforts to manage downstream releases to the lower Dolores River (from McPhee Dam to the confluence of the San Juan Miguel River) for native fishes and rafting. Reclamation has: set up a PIT-tag array upstream of Disappointment Creek to monitor the movement of native fishes in the Dolores River, established early water temperature suppression criteria to prevent premature spawning before a large controlled release from McPhee Dam, developed release ramping criteria that will perform sediment movement and channel maintenance while achieving boater goals for rafting.

Installation of two PIT antennas in the Dolores River near Disappointment Creek and upstream of the confluence with the Colorado River to monitor native fishes completed in 2014. Utah Division of Wildlife Resources (UDWR) completed surveys in 2013: a high abundance of 3-species, one adult Colorado pikeminnow (observed), and three smallmouth bass. Antenna data from 2014-2017 indicate the presence of Colorado pikeminnow (in summer months), razorback sucker (typically in spring) and bonytail (most were stocked in the Dolores). Bonytail survival to three years has been documented in the Dolores. Colorado Parks and Wildlife (CPW) samples the Dolores River annually. Two thousand seventeen surveys found a native community largely intact in Slickrock Canyon (downstream of the confluence with Disappointment Creek), with high percentages of roundtail chub, flannelmouth sucker, and bluehead sucker. Populations are stable, with reproduction occurring in all three species. Upstream, all three native species were found, but high densities of smallmouth bass were also present (Pyramid Mountain reach).

In addition to requesting that Reclamation provide annual reports on its conservation-related activities, page 82 of the PBO directs that “after three years, Reclamation will assess and report the extent to which such flow management [on the Dolores River] may contribute to endangered fish recovery.”

In 2018, Reclamation produced a report entitled: *Flow Management and Endangered Fish in the Dolores River during 2012-2017*, which provides this assessment, and concludes that “while it seems clear that a small subset of endangered fish utilize the lower reaches of the Dolores River on a seasonal basis, available information appears insufficient to identify linkages between Reclamation’s flow management at McPhee Dam and endangered fish recovery.”

2. The Service recommends that Reclamation continue to work with the Dolores Project Biology Committee to consider spill and flow management options to benefit the native fishery in the middle and lower Dolores River while continuing to honor commitments related to downstream rafting.

Excerpts from Speas, D. 2018. *Flow Management and Endangered Fish in the Dolores River during 2012-2017*:

**2012**

The water year 2012 was relatively dry, and McPhee Reservoir did not spill. Sediment transport thresholds were not realized in the vicinity immediately below McPhee Reservoir and flow near Slick Rock exceeded the lower tier flushing flows threshold (400 cfs) for one day. At Rio Mesa Center, flows exceeded the upper tier flushing flows threshold (800 cfs) for nine days, mostly due to spring runoff flows from the San Miguel River.

Base flow releases from McPhee Dam largely met the lower thresholds of all seasonal base flow objectives and exceeded the summer base flow minimum (60 cfs) for most of June – August. Flows at Slick Rock and Rio Mesa Center also exceeded seasonal base flow targets most of the time.

### **2013**

The water year 2013 was extremely dry in the Dolores River basin, and the reservoir did not spill. Project water allocations received only a 26% supply. The downstream releases volume was 8,163 ac-ft.

No sediment transport flow objectives were met near McPhee Dam, but the lower flushing flow threshold (400 cfs) near Slick Rock was exceeded for two days. Lower tier flushing flow thresholds were exceeded for 36 days at the Rio Mesa Center (again mostly due to runoff from the San Miguel River; and the upper flushing flow threshold (800 cfs) was exceeded for one day).

No seasonal base flow objectives were met in 2013 at McPhee Dam (Figure 9). Summer flows near Slick Rock were erratic due to flash flood activity, so base flow thresholds were exceeded sporadically throughout much of the summer period. Flows at the Rio Mesa Center were mostly above base flow targets for much of the year.

### **2014**

McPhee Reservoir did not spill in 2014. Project water allocations received a nearly full supply, and the downstream releases volume was 26,392 AF.

No sediment transport flow objectives were met in the vicinity of McPhee Dam, but the lower flushing flow threshold was exceeded for one day near Slick Rock, and for 99 days at the Rio Mesa Center (again mostly due to contributions from the San Miguel River; where the upper flushing flow threshold was also exceeded for 33 days).

Base flow releases from McPhee Dam were below the 50 cfs recommendation for the months of March and April and dipped below the summer objective in July, and a similar pattern was observed near Slick Rock. Flows at Rio Mesa Center exceeded seasonal base flow targets most of the time.

### **2015**

McPhee Reservoir did not spill in 2015. Project water allocations received a full supply. The downstream releases volume was 31,798 ac-ft.

No sediment transport flow objectives were met in the vicinity of McPhee Dam, but the lower flushing flow threshold was exceeded for one day near Slick Rock and was exceeded or 86 days at the Rio Mesa Center (again mostly due to flows from the San Miguel River). The upper flushing flow threshold was exceeded for 51 days at the Rio Mesa Center and, the lower habitat maintenance flow threshold (2,000 cfs) was exceeded for three days. Base flow releases from McPhee Dam were below flow objectives for March and April (50 cfs) but exceeded the summer base flow minimum (60 cfs) for most of June – August; a similar pattern was observed near Slick Rock. Flows at Rio Mesa Center exceeded seasonal base flow targets most of the time.

**2016**

In 2016, McPhee Reservoir spilled 27,037 ac-ft. as well as providing a full project water supply of 31,798 ac-ft. below McPhee Dam.

The lower flushing flow threshold was exceeded for 16 days near McPhee Dam, and the upper threshold was exceeded for seven days. The lower flushing flow threshold was exceeded for 17 days near Slick Rock, and the upper threshold was exceeded for eight days. Lower flushing flow thresholds were exceeded for 119 days at the Rio Mesa Center (again mostly due to runoff from the San Miguel River), the upper flushing flow threshold was exceeded for 76 days, and the lower habitat maintenance flow threshold was exceeded for 11 days.

Base flow releases from McPhee Dam largely met the lower thresholds of all seasonal base flow objectives and exceeded the summer base flow minimum (60 cfs) for most of June – August. Flows near Slick Rock were below the lower threshold during August through the following fall. Flows at the Rio Mesa Center exceeded seasonal base flow targets most of the time.

**2017**

In 2017, McPhee Reservoir spilled 204,908 ac-ft. as well as providing a full Project water supply of 31,798 ac-ft. below McPhee Dam.

Immediately below McPhee Dam, all sediment transport flow thresholds were exceeded for 80, 63, 7 and four days for both the lower and upper flushing flow thresholds and the lower and upper (3,400 cfs) habitat maintenance flow thresholds, respectively; a nearly identical distribution of exceedances was also observed near Slick Rock. Flows at the Rio Mesa Center exceeded all sediment transport thresholds for 140, 107, 43 and five days at the lower and upper flushing flow thresholds and the lower and upper habitat maintenance flow thresholds, respectively. Base flow releases from McPhee Dam largely met the lower thresholds of all seasonal base flow objectives, as did flows near Slick Rock and the Rio Mesa Center.

3. The Service recommends that Reclamation continue to take an active role in the Dolores River Dialogue, in particular, activities related to native fish. *Ongoing*

A final “Way Forward” report presented nine potential management opportunities that may assist with the improvement of the native fish: spill management, base flow management, sediment transport flows, habitat maintenance flows, thermal regime modification, reducing the effects of introduced cold-water species, reducing the effects of introduced warm water species, and supplementing native fishes.

Upon completion of the Way Forward final report, an Implementation Team (IT) consisting of water managers, NGOs, and State and Federal Agencies was formed to find ways to implement the nine recommendations. The IT, with the financial assistance of the Colorado Water Conservation Board, completed its first iteration of “The Lower Dolores River Implementation Monitoring and Evaluation Plan for Native Fish” dated August 2012.

Public comments to the plan were received, and the second iteration was published in June 2014. An electronic version of this plan and appendices can be obtained from the Dolores River Dialogue website: <http://ocs.fortlewis.edu/drd/implementationTeamReports.htm>

#### CONSERVATION RECOMMENDATIONS APPLICABLE TO WATER QUALITY

1. We recommend that the Recovery Program initiate investigations to determine appropriate levels of selenium to ensure recovery of Colorado pikeminnow and razorback sucker. We recognize any new studies would follow established Recovery Program protocol for priority and funding. *Ongoing* – Reclamation leads

The Recovery Program has not funded any new selenium investigations but does collect tissues from endangered fish/surrogate species as part of Gunnison River fish community monitoring. Muscle plugs continue to be collected from endangered fish and surrogate species (evaluation funded outside of Program). Results from this selenium study will be used in the Selenium Management Program (SMP) to determine baseline selenium concentrations and evaluate the effectiveness of selenium remediation efforts.

### Appendix III 2017-2018 Yampa PBO Review

On January 10, 2005, final [Yampa River Basin Programmatic Biological Opinion](#) (PBO), the U.S. Fish and Wildlife Service (Service) determined that depletions from the Colorado River basin might adversely affect endangered fish and their critical habitat. The Service also concluded that although the flow-related recovery actions would not be sufficient to fully offset the adverse effects of historic and new water depletions in the Yampa River (see map [Figure 1]), a combination of flow and non-flow management activities would provide suitable habitat for increasing numbers of the endangered fishes. Those activities would also likely restore, maintain and protect critical habitat to adequately offset such depletions and to minimize take, including harm from existing (estimated average annual 168,000 af/year) and future depletions (53,500 af/year), as defined in the proposed action. Page 73 of the PBO says: “Every two years, for the life of the Recovery Program, the Service and Recovery Program will review the implementation of the Recovery Action Plan actions that are included in this biological opinion to determine timely compliance with applicable schedules.” A review of action items from the PBO follows below, with status updates in italics.

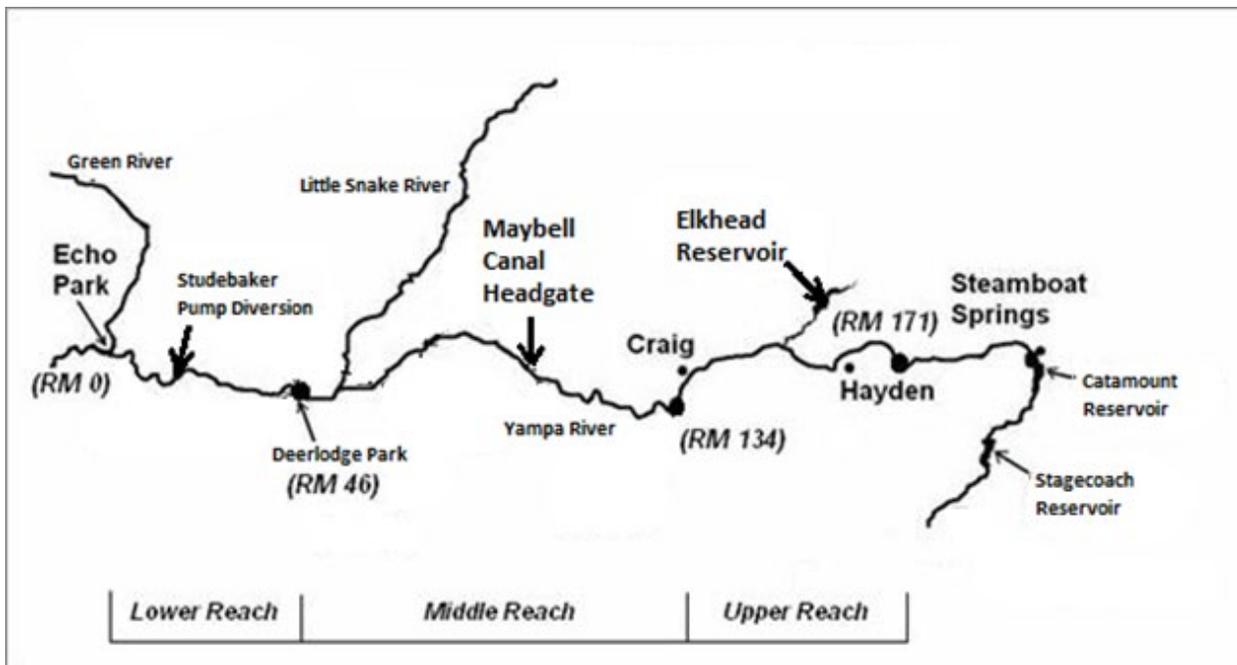


Figure 1. Map of the Yampa River system, including key flow management features and locations

#### Conservation Measures (from pages 7-8 of PBO)

Conservation measures are actions that the action agency agrees to implement to further the recovery of the species under review. The Recovery Program implements the Yampa Plan annually through the Recovery Implementation Program Recovery Action Plan (RIPRAP), which is generally divided into five categories.

This section of this review provides broad descriptions of ongoing actions and specific actions not mentioned in other sections of the review.

1. Provide and Protect Instream Flows

- a. Implement a base-flow augmentation plan on the Yampa River.

The PBO brackets Elkhead releases between 78-138 cfs for July-Oct and 109-169 cfs for Nov-Feb. [Note: subsequent Service evaluations led to the adoption of Aug-Oct base flow targets of 93 cfs, 134 cfs, and 200 cfs in the Yampa River at the Maybell gage location in dry, average, and wet years, respectively ([Mohrman and Anderson, 2017](#)).] Efforts to meet these instream flow targets include releasing water from Elkhead Reservoir using pools allocated or leased for this purpose. Table 1 and Figure 2 below summarize Yampa hydrology and Program operations up to 2017 relevant to these flow targets.

Table 1. Summary of hydrologic conditions and releases from Elkhead Reservoir to augment Yampa River base flows 2014-2017.

Year	CBRFC Yampa River Forecast	Peak Flow	Mean Flow	Target Min Flow	Program Elkhead Reservoir Releases				Days Below Thresholds in Aug-Oct		
					Apr-Jul Water Supply as % Avg	July-Oct Avg (CFS)	Start Date	Permanent Pool Release (AF)	Temp Pool Lease Release (AF)	Total Release (AF)	<93 CFS
2014	144%	13,600	647	200	22-Jul	639	940*	1,579#	0	0	0
2015	78%	7,910	387	134	14-Aug	5,000	0	5,000	0	13	45
2016	58% **	11,100	338	134	17-Aug	5,000	0	5,000	13	35	52
2017	80%	8,250	384	134	28-Aug	4,171	0	4,171	4	27	37

\* This 940 AF of leased water was carried over from that not used in 2013.

\*\* Unanticipated May precipitation substantially boosted the actual water supply relative to this April forecast.

# Released only to briefly augment high flows in 2011 and 2014.

In 2016, water users convened a committee to resolve issues around protecting Elkhead Reservoir releases for endangered fish and administration/operation of the Maybell Irrigation District diversions and developed a proposal for physical improvements and operational modifications.

The Recovery Program provided \$62,700 in Section 7 funds to install: a) a measuring flume in the canal at the diversion, and b) an automated gate one mile downstream of the head of the senior Maybell Ditch. These improvements contributed to the return of excess diversions to the river and allowed better control of check structures. They also resulted in increased operational efficiency of deliveries to users, and reduced both diversions and return flows. The Colorado River Water Conservation District (CRWCD), Maybell Irrigation District, and the Yampa-White River Roundtable provided an additional \$134,675 for a head gate flume and canal improvements to more efficiently measure and manage water diversions. These improvements were completed in 2017. These measures will increase flows in the lower Yampa River downstream of the Maybell diversion.

The Service would like to track the following items in out years: a) an additional 2,000 acre-feet of Elkhead Reservoir short term pool water was leased by the Program in 2018 to augment late-summer base flows; and b) the Division Engineer revised transit losses assessed on reservoir releases from 0.5%/mile down to 0.1%/mile late in the 2018 base flow season. The Program will work with Colorado Water Conservation Board (CWCB), the State Engineer’s Office, and CRWCD during the winter of 2018-2019 to review, and refine if necessary, this adjustment to transit losses.

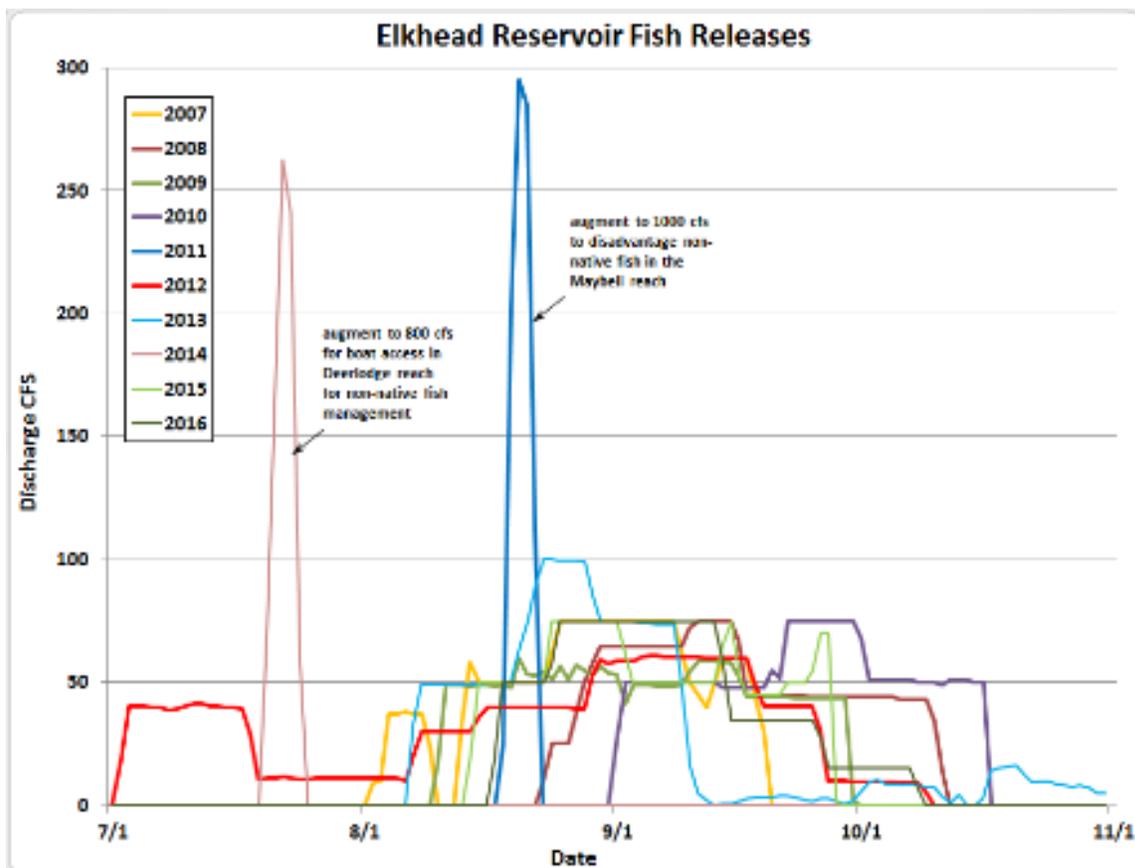


Figure 2. Summary of releases from the Elkhead Reservoir endangered fish pool: 2007 - 2016

## 2. Reduce Negative Impacts of Non-native Fishes

- a. Implement the non-native fish stocking procedures: *Implemented*.
  - i. The [Procedures for Stocking Non-native Fish in the Upper Colorado River Basin](#) was revised in 2009 and signed by the Service and the States of Colorado, Wyoming, and Utah. The states and Service have been implementing these revised procedures since signatory in 2009.
  - ii. The Elkhead Reservoir Lake Management Plan was completed in 2017 and meets all criteria of the non-native fish stocking procedures.
- b. Remove angler bag and possession limits in Colorado: *Complete*
  - i. The Colorado Wildlife Commission approved removing bag and possession limits for northern pike statewide, and channel catfish, black bullhead, walleye, smallmouth bass, largemouth bass, green sunfish, bluegill and black crappie in the Yampa and Green Rivers in Colorado.
- c. Remove/translocate northern pike and smallmouth bass: *Ongoing / discontinued*
  - i. Translocation discontinued in 2014 because of escapement of translocated fish back into river habitats. All non-native fish are now removed.
  - ii. CPW, Colorado State University (CSU), and the Service continue to remove northern pike and smallmouth bass in the Yampa River. CPW backwater gillnetting in the Yampa River captures pre-spawning and spawning adult northern pike to efficiently reduce the pike population. Annual catches of northern pike have declined from >1,000 adults in 2005 to fewer than 200 individuals in 2017 (Figure 3; [Smith and Jones 2017](#)). Coordinated removal of smallmouth bass during the spawning period, called 'The Surge,' has taken place annually since approximately 2010. This effort removes large numbers of adult bass and reduces reproductive success by disrupting nest building, spawning, and nest guarding. An abundance of adult Smallmouth Bass in 2017 was among the three lowest of the past 14 years (Figure 4; [Hawkins 2017](#)). However, the population is still robust, and smallmouth bass reproductive success is high during average and drier hydrologies. CSU crews also removed northern pike in the Yampa River between Steamboat Springs and Hayden in 2017.
  - iii. Removal of non-native species also takes place in upstream reservoirs in the Yampa River basin. CPW continues to reduce northern pike at Catamount Reservoir through the netting. Approximately 13,000 northern pikes have been removed by CPW from Catamount Reservoir. CPW also removes all northern pike and walleye collected under standard monitoring at Stagecoach Reservoir. Ice fishing tournaments at Stagecoach require mandatory harvest on pike and walleye. Removal actions at Elkhead Reservoir are summarized in bullet (d) below.

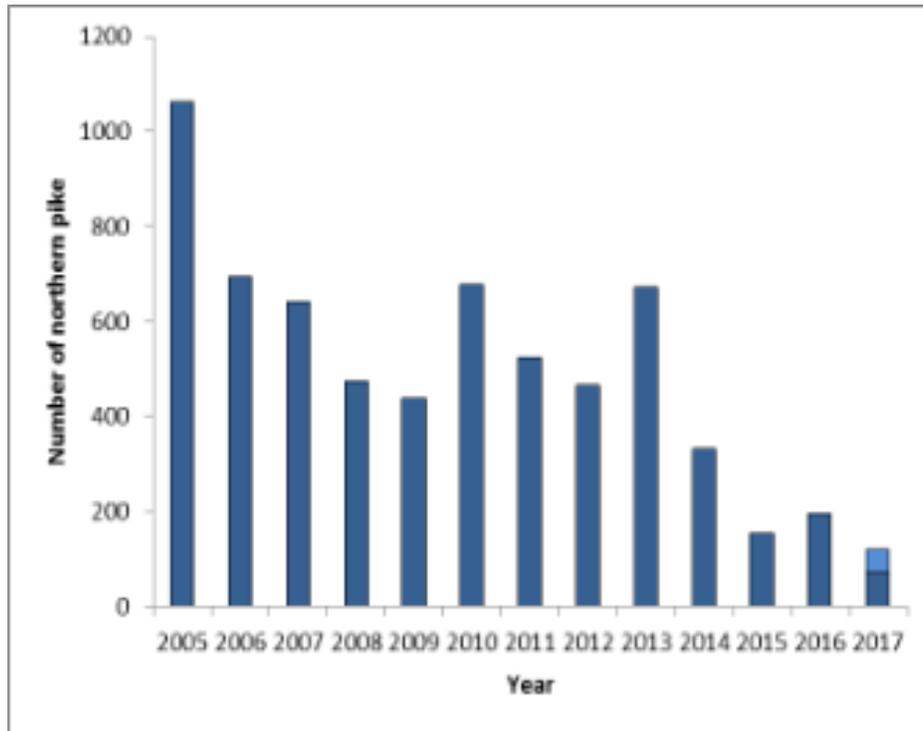


Figure 3. The number of northern pike removed annually in Project 98b from 2005 – 2017 in the Yampa River between Hayden and Craig, Colorado. The portion of northern pike caught in 2017 passes 1 – 3 are shown in the dark blue, with passes 4 – 6 (The Surge) displayed in light blue.

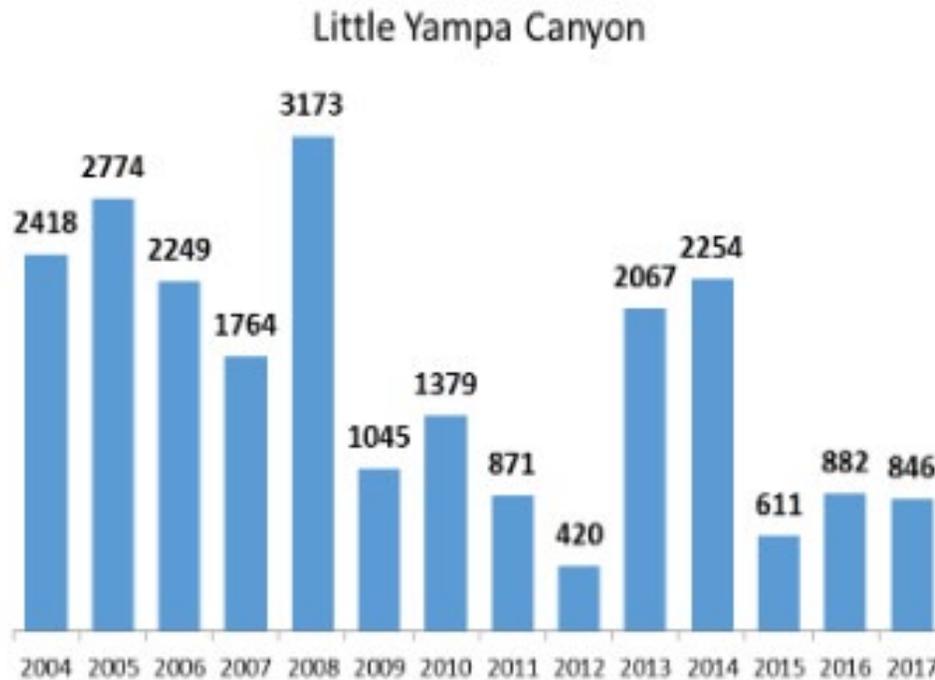


Figure 4. Estimated abundance of adult Smallmouth Bass ( $\geq 200$  mm) in Little Yampa Canyon, Yampa River, 2004—2017.

- d. Controlling escapement of non-native fishes from Elkhead Reservoir: *Complete*.
- i. During the Elkhead Reservoir expansion, the outlet works were screened to preclude fish escapement. The spillway was not screened, and investigations were conducted to determine escapement rates of translocated smallmouth bass over the spillway. Escapement rates of translocated smallmouth bass from Elkhead Reservoir spillway were demonstrated to be sufficient to offset in-river control downstream ([Breton et al. 2013](#)). Translocations of smallmouth bass into Elkhead Reservoir ceased in 2014. In order to prevent escapement of resident smallmouth bass, the Recovery Program and reservoir stakeholders installed a dynema net across the spillway. The net is approximately 600 feet long, has  $\frac{1}{4}$ -inch mesh, and is anchored to the shoreline and reservoir bottom to preclude fish from reaching the spillway. The net was installed prior to the prolonged runoff in spring of 2017. The spillway net and the outlet works screen prevent fish from escaping through all water releases at Elkhead Reservoir.
  - ii. In order to limit the risk of predatory non-native fish escapement during net failure or other means, Colorado Parks and Wildlife committed to replacing the resident smallmouth bass and northern pike populations with species compatible with endangered fish recovery.

To do so, CPW has held angler tournaments in 2017 and 2018 to remove these two species. CPW then stocked the reservoir with largemouth bass to replace the individuals removed during the tournaments.

These actions are described in the Elkhead Reservoir Lake Management Plan, which was approved under the [Procedures for Stocking Non-native Fish in the Upper Colorado River Basin](#) (see 2.a.i above). Additional tournaments will take place at Elkhead as long as the tournaments are effective in removing small mouth bass and northern pike.

- e. Lethal removal of channel catfish and smallmouth bass from Yampa Canyon: *Ongoing*.
  - i. Smallmouth bass and channel catfish (>400mm) are removed annually in Yampa Canyon under Recovery Program project 110. Two thousand seventeen catch rates in Yampa Canyon were down to 2.3 smallmouth bass per hour (>100mm TL) compared to 2014 levels (23.7 fish/hr.) ([Jones 2017](#)).

3. Restore Habitat (Habitat Development and Maintenance – *in the PBO the Service recognized the linkage between Yampa flow and sediment inputs to the larger Green River*)

- a. Sediment monitoring began in 2005. A retrospective analysis of historic data was done for key sites on the Colorado, Gunnison, and Green River near Green River. Automated suspended-sediment samplers were installed at the Whitewater gage on the Gunnison River and the Green River near Jensen. In FY06, United States Geological Survey (USGS) began developing a topological dataset and water-level elevation dataset sufficient for input into the Surface Water Modeling System (SWMS). USGS completed a sediment mobility model solution to help the Service evaluate flow recommendations for Flaming Gorge. The data summary report was completed in 2008 and the draft technical series report completed in 2011 (final pending). The Recovery Program's office convened a panel of fish biologist's geomorphologists to review findings of the Project 85f report and develop research/management recommendations to assist in evaluating spring flow recommendations. The panel completed a Peak Flow Technical Supplement, which prioritized sediment monitoring at Jensen and Ouray. A sediment monitoring scope of work was implemented in FY17, which will expand an existing sediment-monitoring network in the Yampa River (established and currently funded by National Park Service (NPS) and USGS into the Green River.
- b. Acquire and enhance floodplain habitats along the Green River. *Ongoing*.
  - i. Easements of private floodplains along the Green River were acquired and are managed by Ouray National Wildlife Refuge annually.
  - ii. Off-channel floodplain habitats are being modified and managed to improve razorback sucker entrainment, growth, and over-summer survival. Stewart Lake, which has produced as many as 2000+ age-0 razorback sucker in a single summer, is the model for floodplain modification and management (operating water control structures and large-bodied fish exclusion devices and utilizing supplemental water). The Service completed two floodplain modification projects, at Johnson and Sheppard Bottoms, to enhance habitat for razorback sucker. The Recovery Program is also planning to modify the Stirrup floodplain for a similar project.
  - iii. In order for these floodplains to have the desired benefit to razorback sucker, flow management must be managed to provide connections when larval razorback sucker are present in the river.

To accomplish this, the Green River Larval Trigger Study Plan was finalized in March 2012; Flaming Gorge operations have been coordinated with the larval trigger program with positive results

- iv. Bonytail reproduction has been detected in several floodplain habitats in 2015-2017, demonstrating the importance of floodplain habitats for this species.
  - c. Restore/maintain native fish passage at diversion structures: *Complete*.
    - i. No remedial action is required to facilitate fish passage at any existing diversion structures in the Yampa River, and no new/modified diversions have been proposed. The only diversion structure in the main stem Green River, the Tusher Diversion near Green River, Utah, was rebuilt in the winter of 2016 and included a fish passage structure. With the completion of that structure, native fish can freely access all designated critical habitat in the entire Green and Yampa rivers.
  - d. Evaluate/remediate entrainment of endangered fishes by diversion structures: *Complete*.
    - i. The Program evaluated entrainment in the Maybell Canal and determined that fish entrainment was low ([Speas et al. 2014](#)).
    - ii. The last remaining irrigation canal in the Green River sub-basin needing fish entrainment prevention, the Green River Canal near Green River, Utah, will have a fish screen and weir wall constructed in winter of 2018.
4. Manage Genetic Diversity/Augment or Restore Populations: *Ongoing*.
- a. The Recovery Program continues to stock bonytail and razorback sucker in the Green and upper Colorado River sub-basins according to the revised [Integrated Stocking Procedures](#).
  - b. Bonytail is directly stocked into the Yampa River at Deerlodge Park. Additionally, CPW received access permission from Hell's Canyon Ranch (former Mantle Ranch) to stock bonytail in recent years.
5. Monitor Populations and Habitat
- a. The Recovery Program will monitor adult Colorado pikeminnow, razorback sucker, and humpback chub populations to ascertain the status of these populations (e.g., numerical abundance, age-class structure, evidence of recruitment), using standardized protocols. Larval sampling will determine whether and to what extent these populations are spawning. Survival of stocked fish also will be assessed: *Complete and Ongoing*.
    - i. Colorado pikeminnow adult monitoring: Results from the 2011–2013 Colorado pikeminnow adult population estimates indicate adults and sub-adults are in decline throughout the entire Green River sub-basin (Figure 5) especially in the Yampa River.
    - ii. Colorado pikeminnow larval monitoring: Encouraging numbers of age-0 pikeminnow were seen in the middle and lower Green Rivers in 2015, yielding 202 YOY and 461 YOY, respectfully. Unfortunately, age-0 pikeminnow catch dropped to very low levels in the Green River in 2016 and 2017.
    - iii. Humpback chub adult monitoring: Humpback chub are now considered functionally extirpated in Yampa Canyon and immediately downstream in Whirlpool Canyon. No adults have been collected in these locations for approximately ten years. In downstream Desolation and Grey Canyons, adult humpback chub have remained stable since around 2005.

- iv. Adult razorback sucker monitoring: Occasional captures of adult razorback sucker occur in the Yampa River; refer to the 2017-2018 Sufficient Progress memo for a summary of adult razorback sucker abundance in the Green River.
- v. Larval razorback sucker monitoring does not occur in the Yampa River; refer to the Sufficient Progress memo for a summary of larval razorback sucker abundance in the Green River. Larval razorback sucker captures increased in 2007 and has fluctuated greatly since.
- vi. Native fish community monitoring: Yampa Canyon native fish monitoring demonstrates that native suckers are the most abundant species (flannelmouth and bluehead suckers). Roundtail chub continue to be present in Yampa Canyon, with evidence that Green River roundtail chub are moving into the Yampa River to spawn. Farther upstream, native fish densities are much lower, with the middle Yampa River dominated by non-native species.

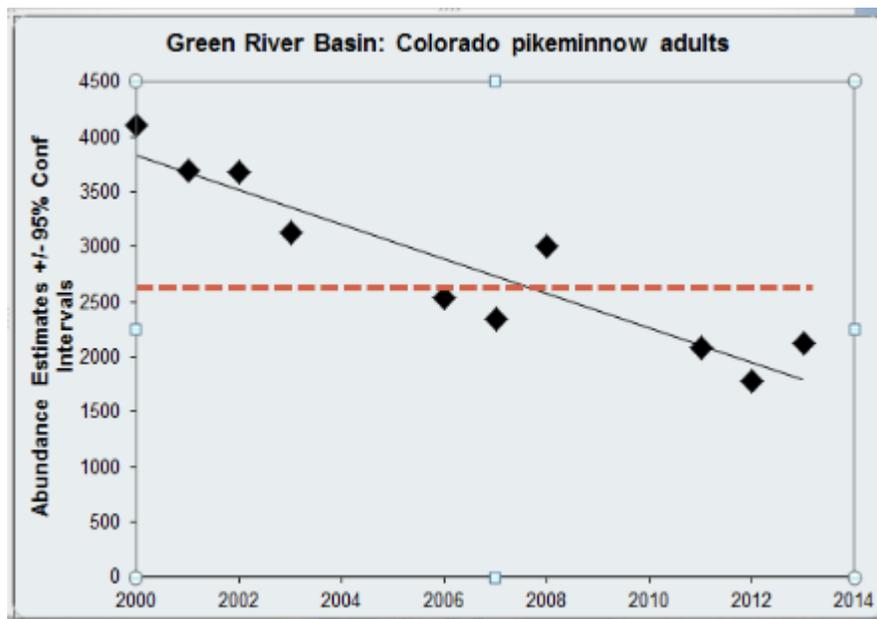


Figure 5. Green River Basin Colorado pikeminnow adult population estimates.

REASONABLE AND PRUDENT MEASURES (from page 68 of PBO)

The implementation of the Recovery Program and the specific actions outlined in the Yampa plan is intended to recover the listed species and minimize impacts of water depletion. Therefore, the recovery action items outlined in the biological opinion will also serve as reasonable and prudent measures for minimizing the take that results from the water depletions addressed in the biological opinion. To reduce the level of incidental take of adult and subadult Colorado pikeminnow, the following reasonable and prudent measures were developed to minimize take:

1. The Recovery Program will monitor all new water depletion projects over 100 AF/year to determine impacts to peak flows on the Yampa River.

- a. *Complete and Ongoing.* The Recovery Program monitors all water depletions covered under this Biological Opinion. Data can be [found here](#). See Terms and Conditions #1.
2. The Recovery Program will evaluate the level of incidental take due to entrainment of Colorado pikeminnow by diversion canals within critical habitat on the Yampa River.
  - a. *Complete.* See Conservation Measure 3c and Terms and Conditions #2.
3. If found appropriate in the evaluation, the Recovery Program will implement measures to reduce take at diversion canals within critical habitat on the Yampa River.
  - a. *Not appropriate.* See Conservation Measure 3c and Terms and Conditions #3.
4. The Recovery Program will continue efforts to minimize the impacts of non-native fishes on the four listed fish species.
  - a. *Complete and ongoing.* See Conservation Measure 2.
5. The Recovery Program will continue to coordinate a targeted public outreach program to inform local stakeholders of the non-native fish management activities and to educate anglers.
  - a. *Complete and Ongoing.* Recovery Program performs targeted outreach events in the Yampa River basin. See Terms and Conditions #5.
6. Within one year of the issuance of this biological opinion, the Recovery Program will develop criteria to determine positive or negative population responses for Colorado pikeminnow. When population estimates for wild humpback chub are finalized, they will be used to determine population response. These two species will serve as surrogates for bonytail and razorback sucker until population estimates for those species are possible. In addition, the status of non-native fish populations will be used to assess the effectiveness of non-native fish control activities in reducing the abundance of non-native fishes, and the status of native fish populations will be used to assess any response of the native fish community to reductions in the abundance of non-native fishes.
  - a. *Complete and ongoing.* See Conservation Measure 5.
7. The Recovery Program will provide an annual assessment of Yampa River recovery actions.
  - a. *Complete and ongoing.* This is done annually as part of the Recovery Program's RIPRAP assessment.

#### TERMS AND CONDITIONS (From pages 69-71 of PBO)

In order to be exempt from the prohibitions of section 9 of the Act, the following terms and conditions, which implement the reasonable and prudent measures described above, must be satisfied. These terms and conditions are nondiscretionary.

1. The Recovery Program will use the Colorado River Decision Support System (CRDSS) hydrologic model to track and analyze all new water depletion projects over 100 AF/year to determine impacts to peak flows on the Yampa River in critical habitat. The Recovery Program will provide the results of the analysis to the Service. *Ongoing*

Wyoming submitted the Little Snake River Depletions Accounting Report 8/19/10. TNC updated the PBO baseline, 1975–1998, to Colorado's StateMOD. CWCB is still behind schedule in completing accounting of past depletions using the StateCU model (Due date from YPBO - 1st report July 1, 2010; 2nd report July 1, 2015). The depletion accounting report will include a discussion of the need for flow protection (which would require a peak flow recommendation). It appears unlikely that there have been significant new depletions in the Yampa, but CWCB is still examining the ability to model past depletion trends in the Yampa River accounting. If significant new depletions are projected or proposed in excess of those in the Yampa PBO, then flow protection may be warranted even if the current level of depletions has not changed much at all.

An initial estimate of agricultural consumptive use (CU) has been completed and, at first glance, does not appear to be increasing: Average Annual Ag CU, AF, Yampa River above Maybell: 1975-1995 = 118,499 , 1996-2012 = 117,851. Other depletions (M&E, transbasin exports, etc.) are still being estimated. The models will be updated through at least 2012. Colorado has prioritized the Yampa and Colorado River basins portion of this work.

2. The Recovery Program will develop a plan to monitor the amount of take due to entrainment by December 31, 2005, and add it to the Recovery Action Plan. Specific implementation elements and timing will be determined in the plan. At a minimum, and as an initial effort, this assessment will involve a survey of the Maybell Canal, following the end of the irrigation season. Such a survey will serve a dual purpose of evaluating take and, if any endangered fishes are found, salvaging surviving individuals and returning them to the river alive. Because endangered fishes are rare upstream from Yampa Canyon, other native species >300 mm in length may serve as surrogates for the endangered fishes. The rate of entrainment would be determined based on the number of individuals of endangered or surrogate species recovered from the canal versus an estimate of population densities in the river. The evaluation of take will include recommendations for minimization of take at diversion canals in critical habitat. *Complete*

Hawkins' work (Hawkins, J.A. 2009. An evaluation of fish entrainment into the Maybell Ditch on the Yampa River, Colorado, 2007 and 2008. Project No. 146 Final Report for the Upper Colorado River Endangered Fish Recovery Program. Contribution 151 of the Larval Fish Laboratory, Colorado State University, Fort Collins, Colorado.) recommended sampling incoming ditch flow for entrained large-bodied fish during the Colorado pikeminnow migration period. A PIT-tag reader installed in the Maybell Ditch in 2011 (no fish detected), and 2012 (one Colorado pikeminnow detected, representing between 0.3 and 1.3% [0.7% of the point estimate] of the most recent [2008] estimate of population size in the Yampa River [140 individuals; 95% CI 75–297]). The final report (Speas et al. 2014) concluded the ditch could entrain large-bodied native fish over a range of flows during or immediately following the peak flow period or during the late summer low flow period.

3. If found appropriate in the evaluation and after approval by the Service, the Recovery Program will implement one or both of the following:

- a. Design and construct fish preclusion devices to prevent or reduce adult and subadult fish (>300 mm TL) from entering diversion canal(s).
- b. Undertake annual fish salvage activities to recover any endangered fish that may be trapped in diversion canals and return these fish to the river Alive.

*Complete.* The Service concluded that due to relatively low rates of entrainment detected at the Maybell Canal an exclusion device would not be cost effective. However, the Recovery Program should offset impacts at the Maybell Canal by completing the Yampa River non-native fish control actions identified in the RIPRAP addendum (as required in the 2012–2013 Sufficient Progress memo) in a timely manner.

4. CPW is in the process of developing a Lake Management Plan for Elkhead Reservoir. The Recovery Program will ensure completion of a Final Lake Management Plan for Elkhead Reservoir that has been approved by the Service, prior to stocking fish in the reservoir.

*Complete and revised in 2016.* CPW has been stocking largemouth bass for the past three years in an effort to replace smallmouth bass in the long term.

5. The Recovery Program will strategically place and maintain signs and implement public outreach on the following: how to identify the endangered fishes; proper handling prior to and during release back to the river; and the legal ramifications for failing to exercise due caution and care with respect to these species. The Recovery Program will maintain an active public outreach program to inform local stakeholders of Recovery Program activities in the Yampa River basin.

*Complete, but ongoing.* Signs targeting anglers have been posted at key locations along the Yampa include drawings of the fish and information about returning them to the river alive. The Recovery Program prepared comprehensive communications to plan to raise public awareness of the purpose and nature of non-native fish management and annually informs stakeholders and the public of non-native fish management activities. The Information & Education Committee helped draft the outreach section in the Upper Colorado River Basin Non-native and Invasive Aquatic Species Prevention and Control Strategy. The Recovery Program worked with the Colorado River Water Conservation District (CRWCD) to produce and install interpretive signs at Elkhead Reservoir.

CPW held a public meeting concerning the Elkhead net in February 2015 at Craig City Hall.

Outreach is a key component of the actions recommended by the non-native fish management work group convened by Colorado and water users to achieve the goals of the Upper Colorado River Basin Non-native and Invasive Aquatic Species Prevention and Control Strategy in the Yampa Basin. CPW held angler tournaments to reduce non-native smallmouth bass and northern pike in Elkhead Reservoir in 2016, 2017, and 2018.

6. The population response criteria will be based on the following factors. Factors a and b will be used as an interim assessment of the status of the species.
  - a. Measure non-native fish abundance to assess species trends. *Ongoing*. See Conservation Measure 2 above.  
Data are reviewed annually. Programmatic syntheses/evaluation of the Recovery Program's approach to northern pike and smallmouth bass control have been completed. Researchers now track long-term trends in non-native fish catch, and where possible, exploitation rates, in their annual reports.
  - b. The Recovery Program will examine the native fish population and determine if there has been an increase or decrease in native fish populations in the Yampa River associated with ongoing non-native fish control actions. *See Conservation Measure 5 above. Ongoing*. Researchers now track long-term trends in non-native fish catch, and where possible, exploitation rates, in their annual reports.
7. Complete population estimates for Colorado pikeminnow and humpback chub. *Ongoing - See Conservation Measure 5 above*.
  - a. The Yampa River contains one of two major spawning areas for the Colorado pikeminnow documented by a collection of larval fish (Figure 6). Any indication that reproduction has ceased to occur or has been significantly diminished in the Yampa River would be a factor in determining population response.

*See Conservation Measure 5 above. Ongoing*. Larval reproduction has been documented every year, and sampling continues (see graph). 2,515 Colorado pikeminnow larvae were captured in 2014 and, 2,792 were captured in 2013. These are the largest number of larvae ever captured (sampling began in 1990). Larval captures in 2015, 2016, and 2017 are considered low in the context of this 28 period of record. However, Bestgen and Hill (2016) described the trend in larval production from the Yampa River spawning bar as relatively stable.

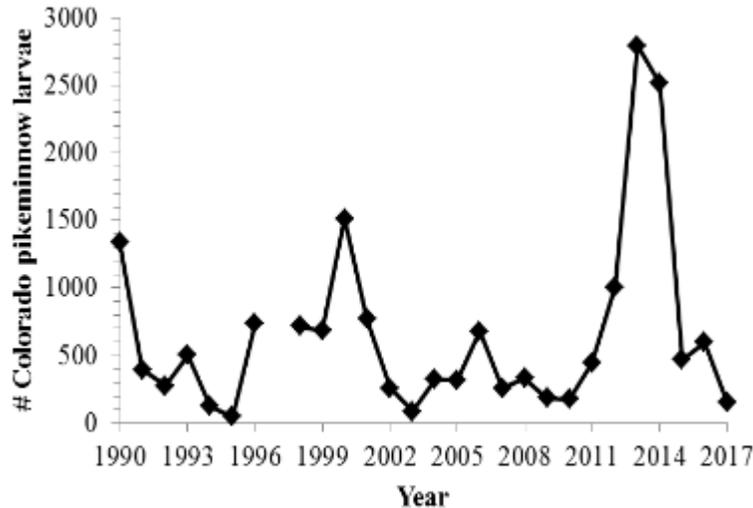


Figure 6. Number of Colorado pikeminnow larvae captured from 1990 to 2017 in the lower Yampa River, Colorado. (K. Bestgen, Project #22f 2017 annual report.)

- b. Recruitment to the adult population is an important factor in determining population trends. Therefore, recruitment rates will be incorporated into the population response criteria.

The draft 2011–2013 Green River basin Colorado pikeminnow population estimate report (Bestgen et al. 2016) indicates a continued decline in adult pikeminnow in the Yampa River. 2000–2001 adult abundance was estimated at ~300, whereas only six and seven individuals were captured in 2011 and 2012. Although researchers track recruitment, no estimate of recruitment or juvenile abundance has been made for the Yampa River population due to poor catch rates of fish  $\leq 450$ mm.

In 2015, antennas placed on a known spawning bar in the middle Green River in Dinosaur National Monument in northeast Utah detected 584-razorback sucker. The majority of these were stocked in 2010 and 2011, but a few were stocked as long ago as 2004. Submersible antennas used near the Green and Yampa River confluence detected 10-razorback sucker, more than captured in the Yampa River in the past 20 years.

8. The Recovery Program shall provide an annual report on the status of recovery actions in the Green and Yampa River Basins. This will include a report on non-native fish removal, its impact on the status of the four listed fish and plans for future management. Based on these annual reports, the Recovery Program will continue native fish monitoring in accordance with Colorado's Aquatic Management Plan and determine a native fish response. Non-endangered native fishes serve as a surrogate for endangered fishes as an indicator of aquatic ecosystem health.

*Ongoing.* Recovery actions are reviewed annually via RIPRAP assessment and factored into the Service's review of sufficient progress. Non-native fish removal is reviewed annually and then the next season's non-native fish management actions are modified as needed.

Colorado revised the [Yampa River Aquatic Management Plan](#) in 2010. A comprehensive [Upper Colorado River Basin Non-native and Invasive Aquatic Species Prevention and Control Strategy](#), which recommends focusing on prevention, eradication and swift control of problematic species, was completed in February 2014. Colorado and water users convened a non-native fish management workgroup that is developing recommendations for containing non-native fish at their sources, changing regulations, and promoting a catch-and-keep outreach strategy. Project #140 to evaluate the response of native fishes is ongoing and reports the following: numbers of age-0 SMB have remained stable since sampling began in 2003; numbers of small-bodied native species has gradually increased and now (thru 2016) comprise ~ 4% of the catch. Native species remain a strong component of the fish community in Lily Park and Yampa Canyon, which would presumably serve as a source to upstream reaches when non-native predator abundances are reduced. A synthesis report is planned for FY19.