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December 20, 2016

Memorandum

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

From: Regional Director, Region 6 Noreen E. Walsh

Subject: Final 2015—2016 Assessment of Sufficient Progress Under the Upper Colorado River Endangered Fish Recovery Program in the Upper Colorado River Basin, and Implementation of Action Items in the January 10, 2005, Final Programmatic Biological Opinion on the Management Plan for Endangered Fishes in the Yampa River Basin

I. "SUFFICIENT PROGRESS"

In accordance with the Section 7, Sufficient Progress, and Historic Projects Agreement, the U.S. Fish and Wildlife Service (Service) is reviewing 2015—2016 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:

- 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;
- status of the fish populations;
- adequacy of flows; and
- magnitude of the impact of projects.

The final April 29, 2016, assessment of accomplishments and shortcomings of the Recovery Program under the Recovery Implementation Program Recovery Action Plan (RIPRAP) from February 1, 2015, through January 31, 2016, is incorporated in the tables to the RIPRAP found at on the Recovery Program's website (http://www.coloradoriverrecovery.org/documents-publications/foundational-documents/recovery-action-plan.html). Although this memo focuses on the RIPRAP assessment timeframe of February 1, 2015 - January 31, 2016, more recent information 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 October 7, 2015

A. Status of the Species in the Upper Basin

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 that would indicate when threats to the species would be ameliorated. A minimum viable population is identified for each species as a gauge for recovery. In addition, key requirements of the population criteria include no net loss of fish over established monitoring periods, and recruitment of young fish into the adult population must occur at a rate to maintain the population. Significant changes in the status of the four species generally are not detected on a year-to-year basis due to species' life history (i.e., recapture rates over long lifespan) as well as variable confidence intervals around population estimates and potential influence of sampling on capture probability. Since the Recovery Goals were completed in 2002, the Recovery Programs, the Glen Canyon Dam Adaptive Management Program, and the Lower Colorado River Multi-Species Conservation Program have gathered new information and a greater understanding about the endangered species ecological needs, population dynamics, and how to manage threats. The Recovery Program is currently working with the Service to update recovery plans (including the 2002 Recovery Goal) for the Colorado pikeminnow and humpback chub, and possibly for the razorback sucker (see discussion of pending 5-year Status Reviews below).

Hatchery-produced, stocked fish form the foundation for the reestablishment of naturally self-sustaining populations[1] of razorback sucker and bonytail in the upper Colorado and Green river systems (Figure 1). The Recovery Program has been implementing an integrated stocking plan (Nesler et al. 2003) 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 reproducing and wild juvenile razorbacks are starting to be captured. Recaptures of stocked bonytail are rarer. However, increasing numbers of bonytail have been detected by stationary PIT-tag reading antennas and traditional sampling methods throughout the upper Colorado River basin. A more rigorous assessment of bonytail recapture information should be one of the first queries of the Recovery Program's new STReaMS database. Survival of stocked bonytail may be improving or the relatively new stationary antennas may be a better method of detecting stocked fish than other, ongoing active sampling methods. The stocking plan was recently revised to stock fewer and larger razorback sucker and more and larger bonytail (Integrated Stocking Plan Revision Committee 2015).

In 2015, species status assessments (SSAs) were initiated for humpback chub and razorback sucker. In addition, a population viability analysis (PVA) was begun for Colorado pikeminnow, which will contribute to an SSA for that species. All three SSAs are scheduled for completion in FY17. The 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 Endangered

[1] To achieve naturally self-sustaining populations, adults must reproduce and recruitment of naturally spawned young fish into the adult population must occur at a rate to maintain the population at a minimum that meets the demographic criteria identified in the recovery goals. Also, because of their longevity, hatchery produced adult razorback sucker and bonytail (and Colorado pikeminnow in the SJRRIP) will contribute toward recovery.

Species Act, including recovery planning, species status reviews, inter-agency consultations, and species reclassifications. The framework of an SSA considers species needs, species current condition, and species viability. The SSA is not a decision document. However, the SSAs will streamline and serve as the basis for the next 5-year Status Reviews to be completed in 2017. The 5-year Status Reviews will include the Service's decision on the need for revision of species' recovery plans and whether the agency will explore a re-classification.

Figure 1. Map of the Upper Colorado River drainage.

Colorado Pikeminnow

Table 1. Summary of Colorado pikeminnow status and trends

Subbasin	Life Stage	2002 Recovery Goal Downlisting Criteria[2]	Long-term[3] abundance / trend	Short-term (5 most recent data points) abundance / trend	Summary
Colorado River	Adults (≥450mm TL)	N = >700 individuals	N = 596	N = 446	Population increased from 1992 – 2005; declined since 2005.
	Recruits (400–449mm 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 recently, but a record high catch in 2015	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 (avg. of ten point estimates since 2000)	N = 2,267 (avg. of 5 estimates since 2007)	Incorporating earlier CPUE data: population increased from 1991 to 2000; declined since 2000.
	Recruits (400–449mm TL)	Estimates exceed annual adult mortality	Number of recruits has fluctuated greatly since 2000, but averages near 400 individuals. Abundances do not appear to meet criteria in most years.		Precision of estimates varies greatly; recruitment appears insufficient to offset overall adult mortality since 2000, but has done so in individual 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.	Recent analysis demonstrates base flow magnitude is correlated with age-0 survival; management actions appear to have driven response in last 2 years.

Wild, self-sustaining populations of Colorado pikeminnow occur in the upper Colorado and Green River systems. These populations have been studied since the 1960s, and population dynamics and responses to management actions have been evaluated since the early 1980s. Closed-population, multiple mark-recapture estimators are being used in the upper Colorado River basin to track Colorado pikeminnow population trends. The accuracy and precision of

[2] Please see Recovery Goals (USFWS 2002a) for a complete description of demographic requirements.
[3] "Long-term" refers to the breadth of Recovery Program monitoring information, which varies between subbasins and by life stage (discussed in text).

each point estimate is assessed by the Service in cooperation with the Recovery Program and in consultation with investigators developing the point estimates and with qualified statisticians and population ecologists. Recovery goals for the Colorado pikeminnow require the Service to evaluate annual point estimates for each population in order to determine if the estimates are accurate, precise, and reliable. The Service accepts the Colorado pikeminnow estimates described below as the best available information. However, the Service recognizes that trends for some of these populations have declined since the first estimates were made, and that delisting would not occur until the currently approved demographic criteria are met and threats to the species are addressed to the point that the species is no longer threatened.

From a population viability perspective, it is important to note that Colorado pikeminnow populations in the Colorado and Green river subbasins are 'wild', i.e., they have not been maintained by stocking hatchery produced fish. Colorado pikeminnow were stocked for a very short period of time (in 2003 and 2004) [4] in the upper reaches of the Colorado and Gunnison rivers in an effort to repatriate areas long cut off from the lower river by main channel diversion dams. Osmundson and White (2014) estimated that survival of those stocked fish was 4% in their first year and had diminished to 0.03% by 2008. No stocked fish were recaptured after 2008.

In 2015, the Service, the Colorado pikeminnow recovery team, and Recovery Program stakeholders agreed to initiate a Population Viability Analysis (PVA). The PVA will describe risk of extinction in the near-term (30 years in the future) and long-term (100 years in the future) under varying levels of threat management. The PVA is expected to provide important information to a Species Status Assessment to be completed in 2017 and the pending revision of the species' recovery plan.

Colorado River Juveniles and Adults

Population estimates for adult Colorado pikeminnow (≥450 mm total length [TL]) began in 1992 on the Colorado River from the Price-Stubb Diversion to the confluence with the Green River (see Figure 2). Population estimates are conducted in three consecutive years followed by two years of no estimates. In their most recent Recovery Program approved summary of those data, (Osmundson and White 2014) the principal investigators concluded:

> *During the 19-year study period* [1992–2010], *the population remained self-sustaining. This was evidenced by: 1) annual abundance estimates of sub-adults (400–449 mm TL) about to recruit that indicated recruitment roughly balanced estimated adult mortality in years for which data were available, and 2) results of a weighted regression analysis of river-wide adult abundance estimates that indicated the intercept-only model as having the greatest weight, suggesting population stability. However, weighted regression of just the upper-reach adult population gave greatest weight to the quadratic model, suggesting the population increased and then later declined.*

[4] Over a 2-year period (2003–2004) 4,214 Colorado pikeminnow (>150mm TL) were stocked in the Colorado River (upstream of the Grand Valley Project Diversion) and upstream of the Redlands Diversion on the Gunnison River. When it was determined that stocked fish were moving downstream into habitat occupied by wild fish, the Recovery Program's Biology Committee immediately decided to cease stocking.

The current downlisting demographic criteria (see Table 1 above) for Colorado pikeminnow (USFWS 2002a) in the Upper Colorado River Subbasin 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; Figure 3), naturally-produced fish must equal or exceed mean adult annual mortality (estimated to be about 20%). The average of all adult estimates (1992–2015; with 2013–2015 estimates considered preliminary) is 596. The average of the five most recent annual adult population estimates is 446. Osmundson and White (2014), which only considered estimates collected through 2010, 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 $\geq$ 450 mm TL. Although the Colorado River population appears to meet the trend or 'self-sustainability' criterion, it has not met the abundance criterion 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.

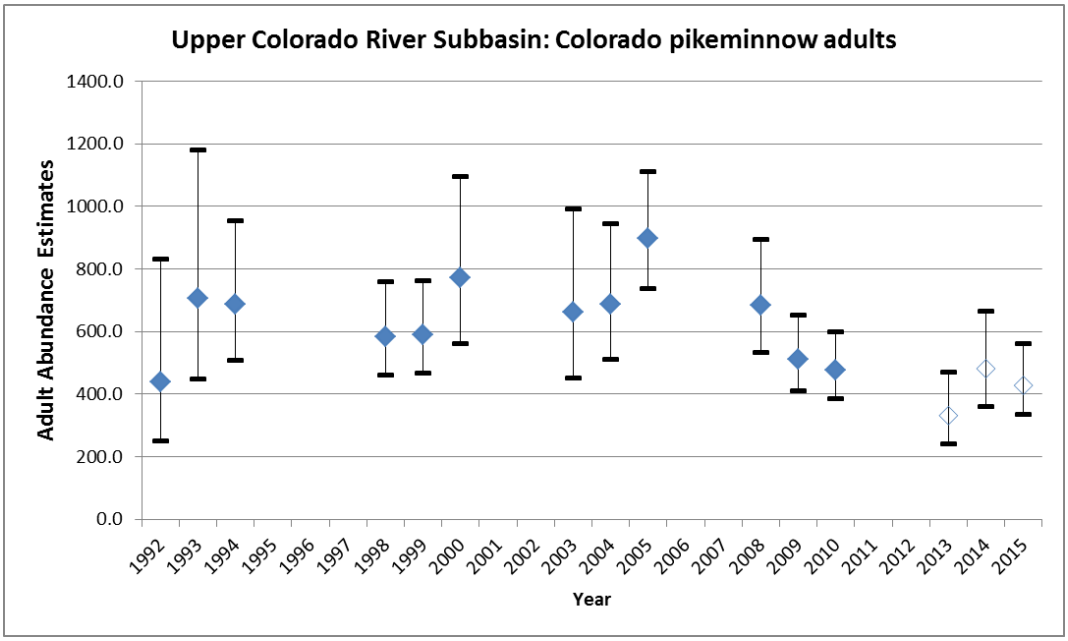

Figure 2. Adult Colorado pikeminnow population abundance estimates for the Colorado River (Osmundson and Burnham 1998; Osmundson and White 2009; 2014). Error bars represent 95% confidence intervals. The 2013–2015 data are preliminary (D. Ryden, USFWS, personal communication) and are represented by hollow data points.

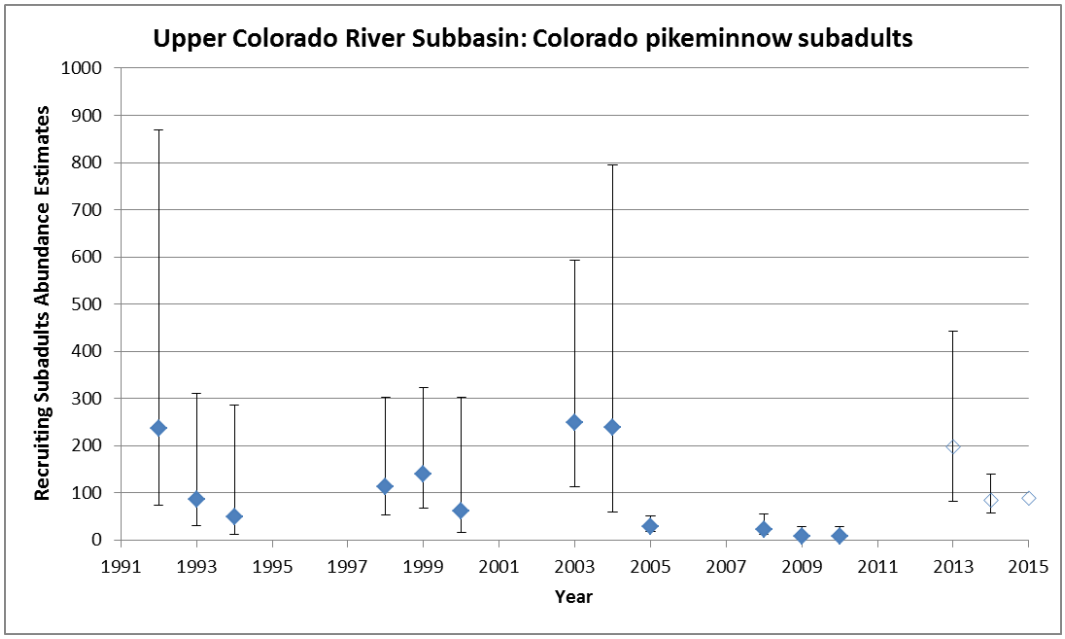

Figure 3. Colorado pikeminnow recruitment abundance estimates (calculated using the same mark recapture methodology as for the adults) for the Colorado River (Osmundson and White 2009; 2014). Recruits are age-6 (400–449mm TL). Error bars represent 95% confidence intervals. The 2013–2015 data are preliminary (D. Ryden, USFWS, personal communication) and are represented by hollow data points.

Here we review some anecdotal life history information gleaned from recent Recovery Program annual reports to more fully describe the current state of the Colorado pikeminnow population in the Colorado River Subbasin. Colorado pikeminnow population size structure has been consistently tracked through time (Osmundson and White 2014). Elverud and Ryden (2015) report that of the 203 individual Colorado pikeminnow collected in 2015, 81 (40%) were juvenile fish (<399 mm TL), indicating a pulse of sub-adults recruiting into the adult portion of the population. All of the 81 individual juvenile Colorado pikeminnow were between 300–399 mm TL. Twenty (10%) of the 203 individual Colorado pikeminnow were sub-adults (400–449 mm TL). The remaining 102 individual Colorado pikeminnow captured in 2015 were adult size (>450 mm TL). The adult Colorado pikeminnow ranged from 451 mm TL to 928 mm TL. No Colorado pikeminnow were collected in 2015 that were below the minimum size (150 mm TL) to be PIT-tagged. A healthy number of Colorado pikeminnow spawned 4–5 years ago are poised to enter the adult cohort. These recruit-sized Colorado pikeminnow present in the system today have largely made it through the gauntlet of troublesome densities of smallmouth bass and the relatively recent influx of nonnative walleye in the lower Colorado River. However, Recovery Program researchers can only speculate how much stronger the current pulse of recruitment would have been in the absence of these nonnative predators. Nonnative predation and competition is currently considered the greatest threat to the Colorado pikeminnow population in the Colorado River Subbasin.

Elverud and Ryden (2015) cautioned that the absence of Colorado pikeminnow <300 mm TL in the collections from 2015 suggests spawning success and/or recruitment has been poor the previous three years. Osmundson and White (2014) also expressed concern that pulses of recruitment in this population are too infrequent to provide the recruitment needed to offset adult mortality in the long term. However, some encouraging captures of age-0 Colorado pikeminnow in recent years, particularly in 2015, are discussed below.

Green River Juveniles and Adults

Population estimates for adult Colorado pikeminnow in the Green River Subbasin began in 2000. Sampling occurs on the mainstem Green River from the Yampa confluence to the confluence with the Colorado River and in the Yampa and White rivers. The initial year of sampling did not include the lower Green River (from near the confluence of the White River to the confluence with the Colorado River). Beginning in 2001, the sampling regime has consisted of three years of estimates followed by two years of no estimates. The first set of estimates (2000 to 2003) showed a declining trend. The most recent interpretation (Bestgen et al. 2016; in review) of the estimates collected in 2006–2008 and 2011–2013 revealed a gradual but persistent decline in the adult population (Figure 4). In support of an ongoing Population Viability Analysis, Dr. Kevin Bestgen (Colorado State University) correlated the much more robust Mark/Recapture (M/R) population estimates of recent years with Catch per Unit Effort (CPUE: number of adults collected per hour of electrofishing) metrics. This correlation analysis allowed researchers to extend trend analyses back to 1991 (Figure 5). This retrospective and more expansive view of population trend indicates that the Recovery Program initiated M/R population estimates at a high point in historical abundance and that the Green River population of Colorado pikeminnow had exhibited a period of positive growth immediately prior to initiating M/R in 2000.

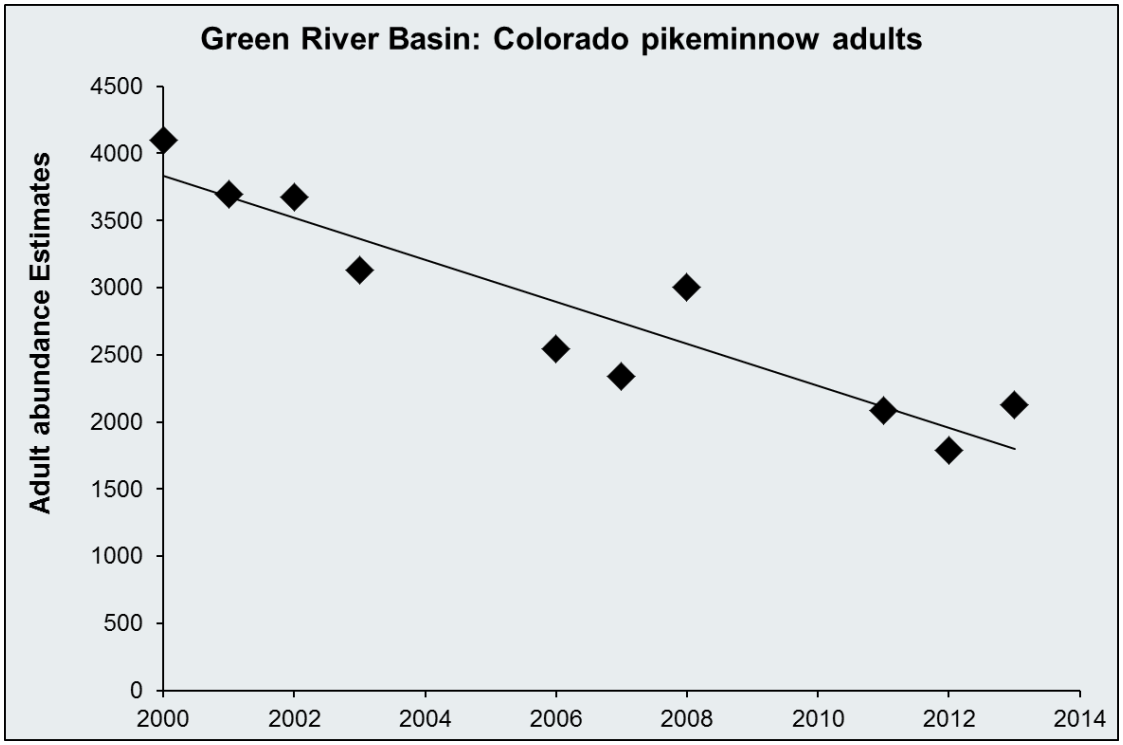

Figure 4. Adult Colorado pikeminnow population abundance estimates for the Green River Subbasin (2000–2013) as reported in Bestgen et al. 2016 (in review). The recent model runs caused recalculation of some earlier (2000–2008) estimates; 95% confidence intervals not available at this time. In 2000, the lower Green River was not sampled. The data depicted for 2000 incorporates an extrapolated lower Green River contribution to the overall population estimate.

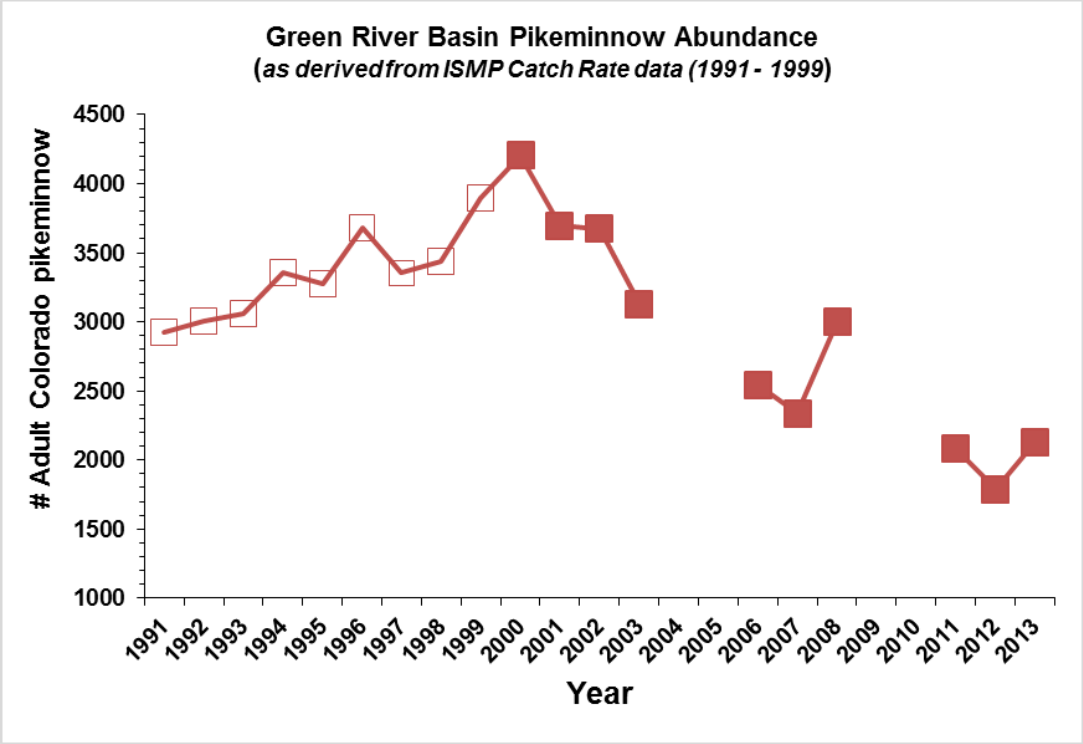

Figure 5. Adult Colorado pikeminnow population abundance estimates for the Green River basin (1991–2013). Estimates from 2000–2013 are reproduced from Figure 4 (solid markers and discussed above). Pre-2000 data (open markers) were derived (via correlation analysis; Dr. K. Bestgen, Colorado State University, personal communication) from CPUE metrics collected as part of the Interagency Standardized Monitoring Program.

The downlisting demographic criteria for Colorado pikeminnow in the Green River Subbasin require that separate adult point estimates for the middle Green River (including the Yampa and White river sub-populations) and lower Green River do not decline significantly over a 5-year period, and each estimate for the Green River Subbasin exceeds 2,600 adults (estimated minimum viable population [MVP] number). The average of all estimates (1991–2013; including the CPUE-derived estimates) is 3,083 adult Colorado pikeminnow. The average of the more robust M/R population estimates (2000–2013) is 2,859 adults. The average of the three most recent M/R population estimates (2011–2013) is 1,999 adults. Despite a positive trend in the subbasin population in the early years of the Recovery Program (1991–2000), the most recent trend is clearly negative (Causes for this recent decline and the Recovery Program's responses are discussed below.) Population estimation resumed throughout the Green River Subbasin in 2016 and will continue in 2017 and 2018.

Another demographic requirement in the 2002 Recovery Goals is that recruitment of age-6; naturally-produced fish must equal or exceed mean annual adult mortality. Estimates of recruitment age fish (subadults; 400–449mm TL) have averaged 1,455 since 2001, but have varied widely (Figure 6). Recruitment exceeded annual adult mortality only during the 2006–2008 periods. The numbers of recruits throughout the Green River Subbasin were high in 2011, but declined in subsequent years.

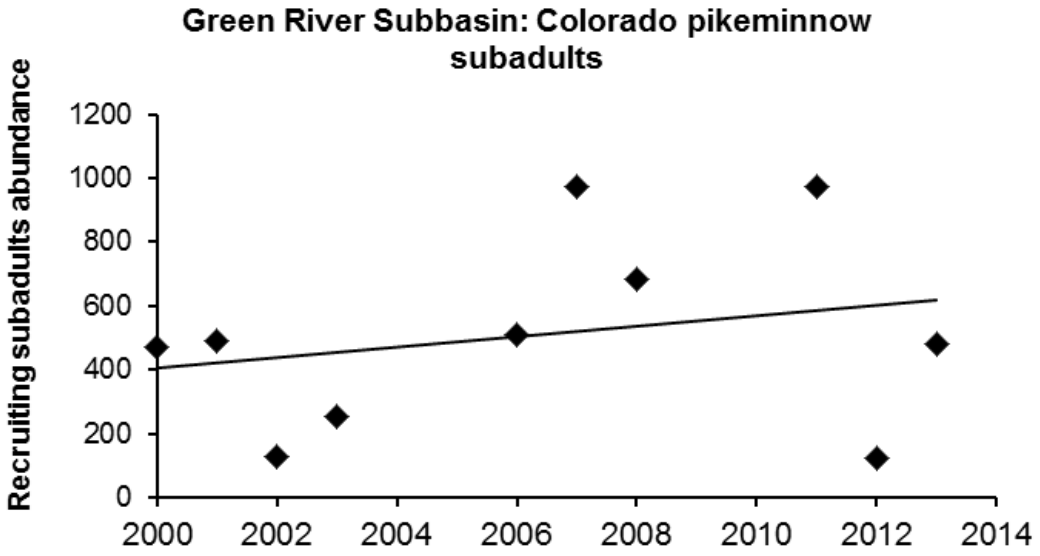

Figure 6. Estimated numbers of Colorado pikeminnow recruits (400–449 mm TL) in the Green River Subbasin (Yampa, White, Middle Green, Desolation-Gray Canyons, and Lower Green) for 2000–2013. Data from Bestgen et al. 2016 (in review). 95% confidence intervals not available at this time.

Upper Basin Age-0

Bestgen et al. 2016 (in review) recognized that the mechanism driving frequency and strength of recruitment events was likely the strength of age-0 Colorado pikeminnow production in backwater nursery habitats. More specifically, they recognized the importance of considering multiple consecutive years of age-0 densities to describe adult densities 7–10 years later. Osmundson and White (2014) saw a similar relationship between a strong age-0 cohort in 1986 and subsequent recruitment of late juveniles five years later, but that relationship was more tenuous in later years. Researchers are particularly concerned with what appears to be very weak age-0 representation in the Middle Green reach (1994 through 2008) and in the lower Colorado River (2001 through 2008) (Figure 7). Bestgen and Hill (2015) reviewed fall densities of age-0 Colorado pikeminnow collected in the middle and lower Green River that date back to 1979. They compared those densities to August and September base flows and discovered that declines in summer base flow magnitude were correlated with declining densities of age-0 Colorado pikeminnow in both reaches. As a result, they recommended new base flow magnitudes to support increased age-0 production. Specifically, base flows between 1,700 and 3,000 cfs in the middle Green River, and 1,700–3,800 cfs in the lower Green River, increase the frequency and magnitude of age-0 Colorado pikeminnow production.

Reclamation and the Recovery Program have coordinated experimental higher summer base flow releases from Flaming Gorge in recent years based on the recommendations from Bestgen and Hill (2015). Base flow levels fell within these ranges for both reaches in 2015 and a significant increase in fall recruitment was observed, underscoring the value of manipulating Flaming Gorge

Dam releases as a main recovery action to benefit Colorado pikeminnow recruitment in the Green River.

A preliminary analysis of age-0 densities and summer base flows on the lower Colorado River has revealed a similar relationship. Record high densities of age-0 pikeminnow were recorded from the lower Colorado River in 2015 (see Figure 7) when August–September base flows fell within a preferable range.

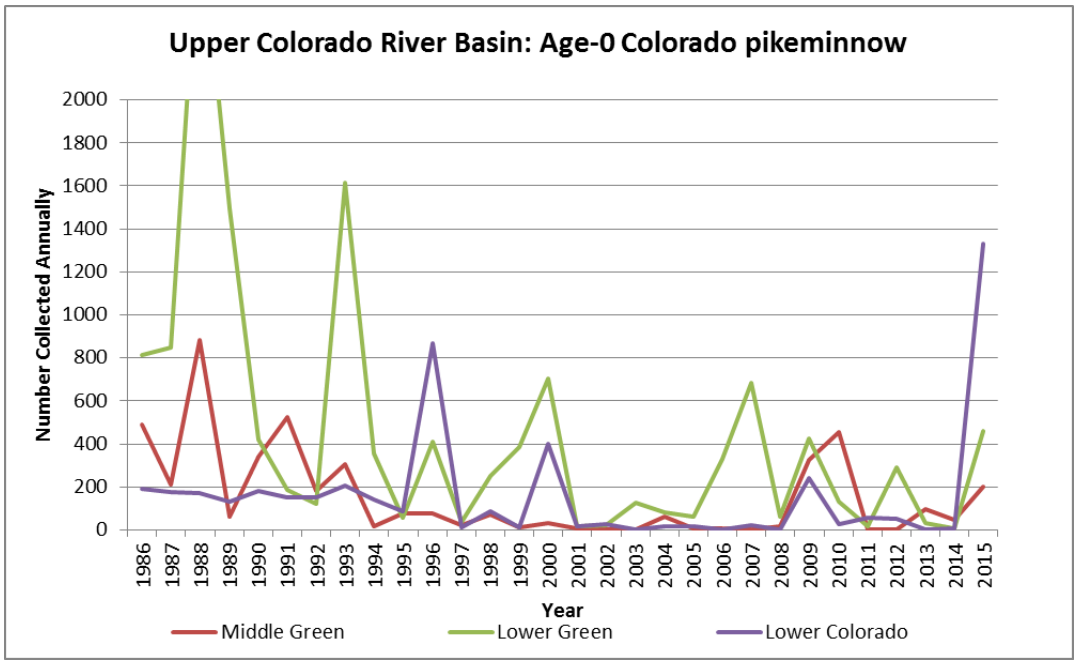

Figure 7. Numbers of age-0 Colorado pikeminnow collected each year from three different habitat reaches of river. A total of 2,892 age-0 fish were collected in the lower Green River in 1988 (Data from Breen et al. 2015.)

Discussion of Declines in Abundance of Adult Colorado pikeminnow

Researchers have identified two main causes for the recent decline in Colorado pikeminnow throughout the Green River Subbasin: 1) persistent competition and predation from nonnative predatory species (northern pike, smallmouth bass, and walleye), particularly in the Yampa River and lower portions of the Green River mainstem; and 2) too much variability in August and September base flow management. The latter cause and the Recovery Program's response were discussed above. A discussion of competition and predation by nonnative predators follows.

Based on data collected in 2006–2008(Bestgen et al. 2010), suspected that nonnative northern pike were suppressing numbers of Colorado pikeminnow in the Yampa River where northern pike outnumbered Colorado pikeminnow at least 3:1. Results from 2011 to 2013 indicate that the Yampa River portion of the Green River Colorado pikeminnow population continued to decline (Bestgen et al. 2016; in review). Furthermore, Bestgen et al. 2016 (in review) now report that the decline in adult and subadult Colorado pikeminnow has spread through the entire Green River Subbasin.

The Recovery Program initiated a campaign to remove nonnative northern pike and smallmouth bass from the Yampa River in the early 2000s when it became apparent those predators were decimating the native fish populations (Anderson 2005). Unfortunately, smallmouth bass subsequently spread from the Yampa River into the Green and White rivers and flared up in the upper Colorado River, as well. Through the years, the Recovery Program systematically increased mechanical removal (primarily boat/raft- based electrofishing and backwater / reservoir gillnetting), targeting spawning congregations of northern pike and smallmouth bass throughout 600 river miles in the Green and Colorado river subbasins. Removal takes place 10 times per year in many reaches.

Nonnative walleye have recently invaded the lower and middle Green River and the lower Colorado River (Figure 9). Possible sources include Lake Powell, Rifle Gap Reservoir[5] in the upper Colorado River drainage and Starvation and Red Fleet reservoirs in the middle Green River drainage. In 2013, the Recovery Program recognized the need to expand an already expansive in-river removal program to target this species.

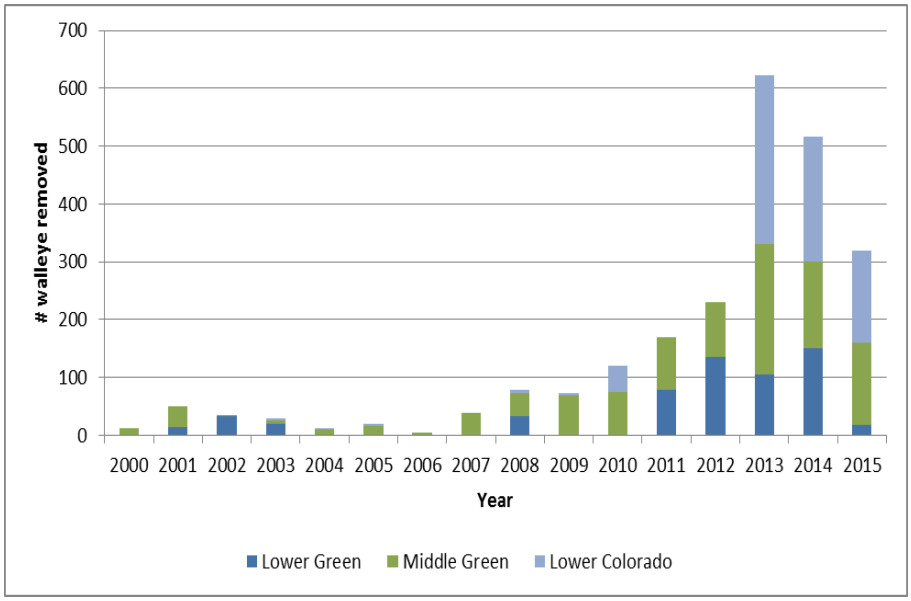

Figure 8. The number of nonnative walleye removed from three reaches of the Colorado and Green rivers.

In 2014, the Recovery Program approved an Upper Colorado River Basin Nonnative and Invasive Aquatic Species Prevention and Control Strategy (Nonnative Fish ad hoc Committee 2014). In a very general sense, that Strategy recognized the importance of continued and focused in-river mechanical control; the need to eliminate off-channel sources; and appropriate changes in State policy, regulation, and management to promote sport fishing opportunities that

[5] Spillway releases from Rifle Gap Reservoir were effectively screened in 2013. CPW reports that annual sampling below screen found no walleye in 2013and subsequent years.

utilize species compatible with endangered fish recovery. Actions to implement the Strategy currently include:

- Within the past 4-5 years, in-river mechanical control has achieved maximum efficiency and effect based on available resources.
- Controlling off-channel source populations is a Recovery Program priority and is moving forward.
    - Chemical treatments have occurred in Colorado in Miramonte Reservoir (target species smallmouth bass) and Paonia Reservoir (target species northern pike) and in Utah in Red Fleet Reservoir (target species walleye).
    - Controlling escapement (screening reservoir releases) has occurred in Colorado at Rifle Gap Reservoir (installed in spring 2013), Elkhead Reservoir (installed in September 2016), Highline Lake, Juniata Reservoir, and Rio Blanco Lake and is planned / budgeted for at Catamount Reservoir and Ridgway Reservoir, and in Utah has occurred at Pelican Lake, Starvation Reservoir (temporary) and is planned / budgeted for at Starvation Reservoir (FY18) (permanent) and at Red Fleet Reservoir (FY19).
    - In-reservoir mechanical removal efforts: Catamount Lake, Crawford Reservoir, and the Mamm Creek Pit along the banks of the Colorado River, and several private ponds in the upper Yampa River drainage.
- The Upper Basin states have made changes to fishing regulations to signal to the public that the worst-of-the-worst nonnative predators (smallmouth bass, northern pike, and walleye) cannot be tolerated in Upper Colorado River basin waters. Additional changes are under discussion with Colorado.

The status of recovery actions associated with the Strategy is more closely scrutinized in Tables 2 and 3 and in the Appendix Table.

The Service's 5-year status review of Colorado pikeminnow was completed in 2011; the next review is scheduled for completion in FY17. Although the Service determined that a good portion of the recovery factor criteria (USFWS 2002a) were being adequately addressed at that time, nonnative fish species abundances and the Recovery Program's response were considered problematic. As discussed above, the Recovery Program has greatly expanded their nonnative control program since 2011. Also, the Service recognized the threat of heavy metal contamination (e.g. mercury) as an unaddressed threat in the 5-year review. Remediation of heavy metal contamination is beyond the scope of the San Juan River and Upper Colorado River programs. The programs are trying to offset impacts of heavy metal contamination indirectly (e.g. increased nonnative fish control).

Humpback Chub

Table 2. Summary of humpback chub status and trends

	Population	Life Stage	2002 Recovery Goal Downlisting Criteria[6]	Long-term[7] abundance (avg.) / trend	Short-term abundance (avg.) / trend (5 most recent data points)	Summary
Colorado River	**Core Population[8] - (Black Rocks + Westwater)**	**Adults (≥200 mm TL)**	N = >2,100	N = 3,124 (avg. of 9 point estimates since 1998)	N =1,975 (avg. of 5 estimates since 2004)	Steep decline in the late 1990s; adult numbers appear stable since 2007, but below core criteria level.
	1. Black Rocks	**Adults (≥200 mm TL)**	Point estimates do not decline significantly for 5 years	N = 579 adults (avg. of 9 point estimates since 1998)	N = 403 (avg. of 5 estimates since 2004)	Steep decline in the late 1990s. Stable at low levels since 2007; adult survival appears stable since 1998.
		Recruits (150–199mm TL)	Estimates exceed annual adult mortality	Not enough mark / recapture information to estimate abundance of recruits		Based on fluctuating adult population, we assume this criteria was not met through 2004; met since.
	2. Westwater Canyon	**Adults (≥200 mm TL)**	Point estimates do not decline significantly for 5 years	N = 2,490 (avg. of 10 point estimates since 1998)	N = 1,426 (avg. of 5 estimates since 2004)	Steep decline in the late 1990s. Stable at low levels since 2007; adult survival appears stable since 1998.
		Recruits (150–199 mm TL)	Estimates exceed annual adult mortality	Not enough mark / recapture information to estimate abundance of recruits		Based on fluctuating adult population, we assume this criteria was met sporadically through 2004; met since.
	3. Cataract Canyon	**Adults (≥200 mm TL)**	Point estimates do not decline significantly for 5 years	Population too small to generate reliable M/R point estimates. Monitoring consists of catch / effort (CPUE) metrics		CPUE since 1991 indicates the population appears stable at low levels.
		Recruits (150–199mm TL)	Estimates exceed annual adult mortality			
Green River Subbasin	**4. Desolation Canyon**	**Adults (≥200 mm TL)**	Point estimates do not decline significantly for 5 years	N = 1,711 (avg. of 7 point estimates collected since 2001). Abundance sampling program has changed over time, complicating long-term comparisons		CPUE estimates since 1985 indicate long-term stability in adults; captures of recruits have been low in recent years.
		Recruits (150–199 mm TL)	Estimates exceed annual adult mortality	Not enough mark / recapture information to estimate abundance of recruits		
	5. Yampa / Whirlpool Canyon	**Adults (≥200 mm TL)**	Point estimates do not decline significantly for 5 years	From 1998 to 2000, researchers estimated 400 adults occupied Yampa Canyon. Catch declined in the early 2000's to the point that too few fish were captured to estimate abundance. Currently it is not known if pure humpback chub occur in these canyons.		

[6] Please see Recovery Goals (USFWS 2002b) for a complete description of demographic requirements.
[7] "Long-term" refers to the breadth of Recovery Program monitoring information, which varies by population. (discussed in text).
[8] 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.

In 2015, the Service convened a humpback chub recovery team to revise the species' recovery plan. In accordance with the Service's new Recovery Planning and Implementation[9], the first step in that process is to complete a Species Status Assessment (SSA). The SSA is scheduled for completion in FY17. The SSA will serve as the basis for the Service's next 5-year Status Review (also scheduled for completion in FY17) and for pending revision of the species' recovery plan.

Five populations of humpback chub exist in the upper Colorado River basin (see Table 2 above) and one occurs in in canyon-bound reaches of the lower Colorado River basin.

Recovery goal downlisting demographic criteria (USFWS 2002b) for humpback chub require each of five populations in the upper Colorado River basin to be self-sustaining over a 5-year period, with a trend in adult point estimates that does not decline significantly. Secondarily, recruitment of age-3 (150–199 mm TL) naturally produced fish must equal or exceed mean adult annual mortality. In addition, one of the five populations (e.g., Black Rocks/Westwater Canyon or Desolation/Gray Canyons) must be maintained as a "core" population such that each estimate exceeds 2,100 adults (estimated minimum viable population [MVP] number). (Note: Data are not currently available to make reliable mark-recapture estimates of humpback chub recruitment. The Service will need to address this matter when revising the species' recovery plan). In UDWR's 2012 annual report, Brandon Gerig mentioned that *Gila* spp. (including native roundtail chub) recruitment appears strong in Westwater.

Yampa River population (Green River Subbasin)

The Yampa River humpback chub population exists in the lower Yampa River Canyon and into the Green River through Split Mountain Canyon. This population is small, with an estimate of about 400 wild adults in 1998-2000 (Haines and Modde 2002). Sampling during 2003–2004 caught only 13 fish, too few to estimate population size. In 2007, the Recovery Program brought 400 young-of-year *Gila* spp. caught in Yampa Canyon into captivity as a research activity to determine the best methods for capture, transport, and holding at two different hatchery facilities for the purpose of developing a broodstock. Approximately 15 percent of the *Gila* species were tentatively identified as humpback chub by physical characteristics (*Gila* identified as roundtail chub were returned to the river in Dinosaur National Monument [DNM]). Geneticists at Southwestern Native Aquatic Resources and Recovery Center (Southwestern ARRC), Dexter, NM, have since provided preliminary results indicating that the Yampa fish in captivity that were believed to be humpback chubs were hybrids between humpback chub and roundtail chub (Wade Wilson, U.S. Fish and Wildlife Service, personal communication). These fish were considered unsuitable for broodstock and were released into the Green River in DNM. Currently, it is not known if pure humpback chubs occur in Yampa Canyon. Researchers are taking fin clip samples from all suspected humpback chub for genetic analysis. Humpback chub genetics and population status will be discussed and reevaluated in the revised recovery plan.

Desolation / Gray Canyon population (Green River Subbasin)

[9] https://sites.google.com/a/fws.gov/recovery-planning-and-implementation/

The Desolation/Gray Canyons population of wild adults was estimated at 1,254 in 2001, 2,612 in 2002, and 937 in 2003 (Howard 2014) (Table 3). Sampling in 2001 and 2002 was conducted in summer, but shifted to fall beginning in 2003 to avoid capturing Colorado pikeminnow that use Desolation Canyon for spawning. The shift in sampling timing may influence the 2003 population estimate. In a report on 2006–2007 estimates, researchers (Badame 2012; Figure 9) indicated that this population was trending downward. Badame (2012) linked declining catch of humpback chub in the upper portions of Desolation Canyon in the 2006–2007 estimates with increasing densities of nonnative smallmouth bass.

Table 3. A summary of population estimates and 95% confidence intervals (when available) for humpback chub in Desolation Canyon, Green River, Utah. *No estimate has yet been calculated for 2015 and no estimate was calculated for 2011 due to insufficient recaptures; therefore, the number of individuals captured is presented. Excerpted from UDWR's Project 129 Annual Report for 2015 (Howard 2015).

Year	N	95% CI
(2015*)	(70)	—
2014	1,863	924–2,802
(2011*)	(55)	—
2010	1,625	1,023–5,465
2007	1,108	1,071–4,914
2006	2,578	1,151–9,736
2003	937	636–1,520
2002	2,612	1,477–8,509
2001	1,254	733–2,697

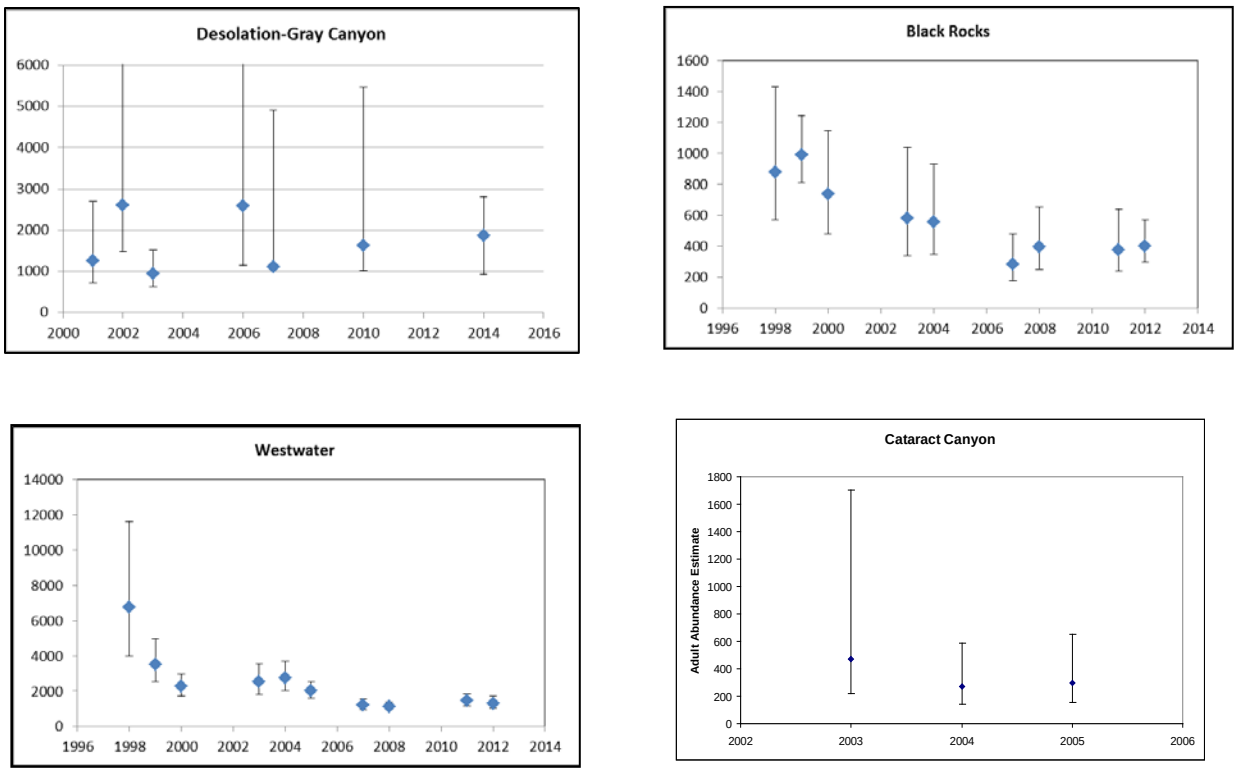

Figure 9. Adult humpback chub population estimates with confidence intervals for four populations in the upper Colorado River Basin (note that the scale differs among the graphs for the different populations). Clockwise from upper left: Desolation-Gray Canyons (from Badame 2011, 2012; Howard 2014); Black Rocks (from Francis and McAda 2011; Francis et al. 2016); Westwater Canyon (from Elverud 2011; Hines et al. 2016); and Cataract Canyon (from Badame 2008).

When considering the much longer term, but less rigorous CPUE (number of humpback chub captured / trammel net hour) data (Figure 10), UDWR researchers (Howard 2015) concluded the humpback chub population in Desolation demonstrates stability. However, they remain concerned that recruitment apparently has remained low in recent years.

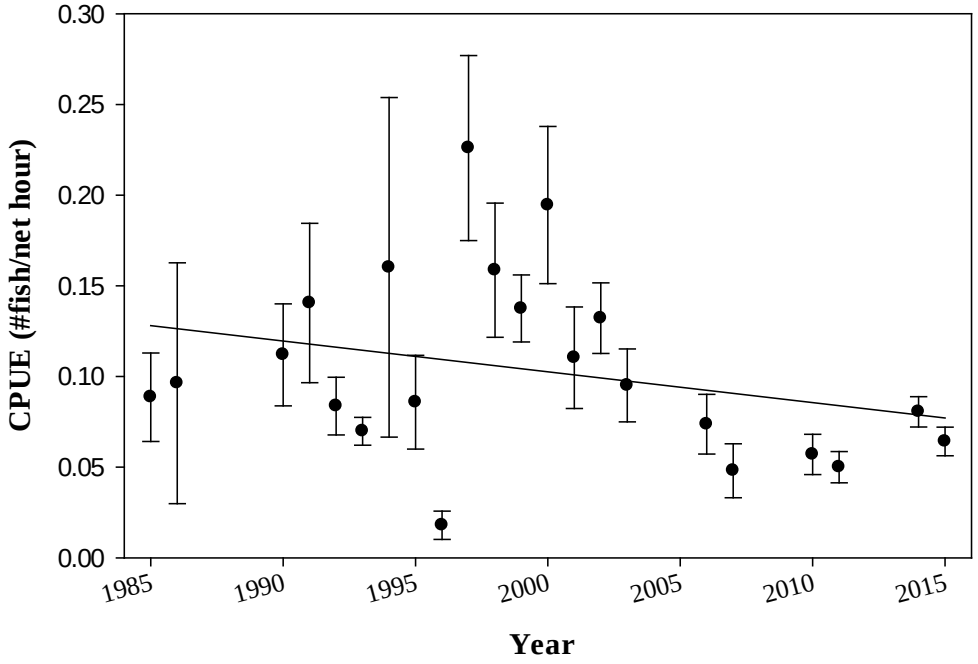

Figure 10. Long-term trend site mean CPUE for all humpback chub (trammel net captures only) in Desolation Canyon, Green River, 1985–2015 including both summer and fall sampling events. The 1989 data point has been excluded as an outlier (0.59) to maintain scale. Error bars represent one standard error. The trend line is based on linear regression and was not significant (r^2 = 0.083, p = 0.194) (reproduced from Howard (2015).

UDWR researchers recommended securing in captivity a representative sample of adults from Desolation Canyon. In 2009, 25 adults were taken to Ouray National Fish Hatchery. Of those, 12 have survived. In 2011, six sites throughout Desolation Canyon were monitored for adults, 55 individual adults were encountered, but recaptures were too few to calculate a population estimate.

Black Rocks and Westwater Canyon populations (Colorado River Subbasin)

Black Rocks and Westwater Canyon are reaches of the Colorado River mainstem near the Colorado-Utah state line. These areas are separated by fewer than 10 river miles. The Service identified specific demographic criteria for each population in their 2002 Recovery Goals (USFWS 2002b). However, because researchers have documented considerable exchange of individuals between these populations, the Service also characterized these populations in combination as a "core" population with specific core demographic criteria. Black Rocks and Westwater Canyon are therefore discussed both individually and together as a "core" population.

In Black Rocks, population estimates of wild adults have varied from N = 994 in 1999 to a low of N = 283 individuals recorded in 2007 (Figure 9). The most recent estimates collected in 2011 and 2012 were 379 and 403, respectively, representing a slight rebound. Researchers reported

that 78 largemouth bass and the same number of gizzard shad were collected in Black Rocks in 2012 (this represents a ten-fold increase over the 2011 catch).

The Westwater Canyon estimates of wild adults range from N = 6,746 in 1998 to N = 1,139 in 2008 (Figure 9). The most recent estimates collected in 2011 and 2012 were 1,466 and 1,314, respectively. The large declines in humpback chub densities in both Black Rocks and Westwater Canyons occurred in the late 1990s prior to more recent increases of nonnative predators in the Colorado River.

In 2008, the "core" population (Black Rocks/Westwater combined) dropped below the Service's population size downlist criterion (MVP = 2,100 adults) for the first time. In 2011 and 2012, we saw some recovery in those populations ("core" estimates averaged 1,782 individuals in those years) (Figure 11). 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. Colorado State University'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. Principal investigators agree that reinitiating an age-0 monitoring component is advisable. The sampling program was modified in 2016 to monitor age 0 humpback chub. It should be noted that 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 (Francis et al. 2016; Hines et al. 2016).

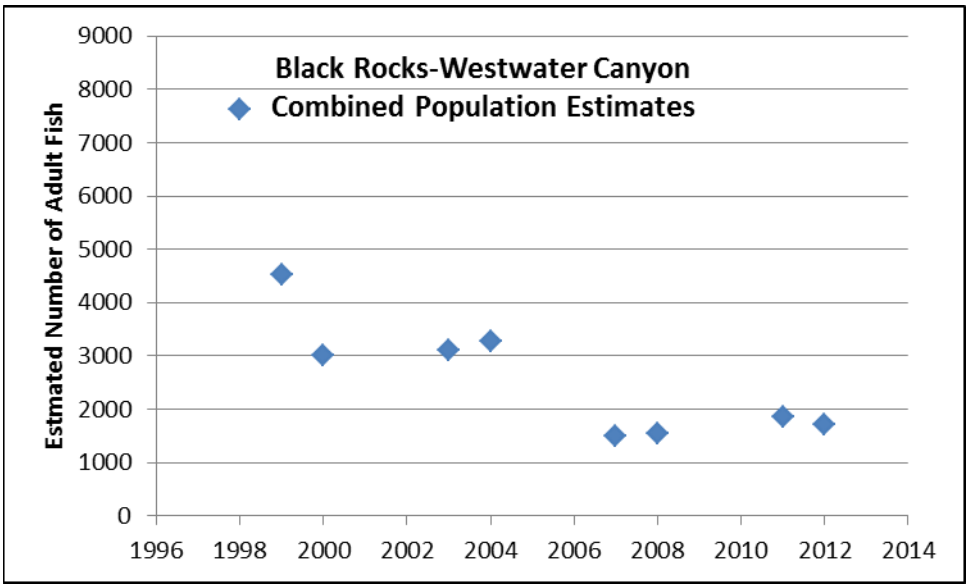

Figure 11. Combined population estimates for humpback chub in Black Rocks and Westwater Canyon based on a robust open model created by Drs. Bestgen and White, Colorado State University. The 2002 Recovery Goal downlist criteria for these combined ("core" population) estimates is 2,100 adults.

Cataract Canyon population

The Cataract Canyon humpback chub population is small, with estimates of about 150 wild adults in 2003 and 66 in 2005. Estimates are difficult to obtain in Cataract; therefore, catch-per-unit-effort (CPUE) has been determined to be an acceptable replacement (began in 2008 on a 2-years-on, 2-years-off sampling regime). In 2015, UDWR (Ahrens 2015) reported that the Cataract population appears to be stable with CPUE ranging between 0.010 and 0.035 fish/net-hour (Figure 12). In 2011 and 2012, sampling was reinitiated below the Big Drop rapids after a sampling hiatus in this reach since 2008. Biologists were interested in returning to this area because riverine habitat was being exposed with dropping Lake Powell surface elevation. No additional humpback chub were encountered in the new riverine habitat. Due to high site fidelity often observed in humpback chub, it is likely that re-colonization of this recently created habitat would be slow (Howard 2013).

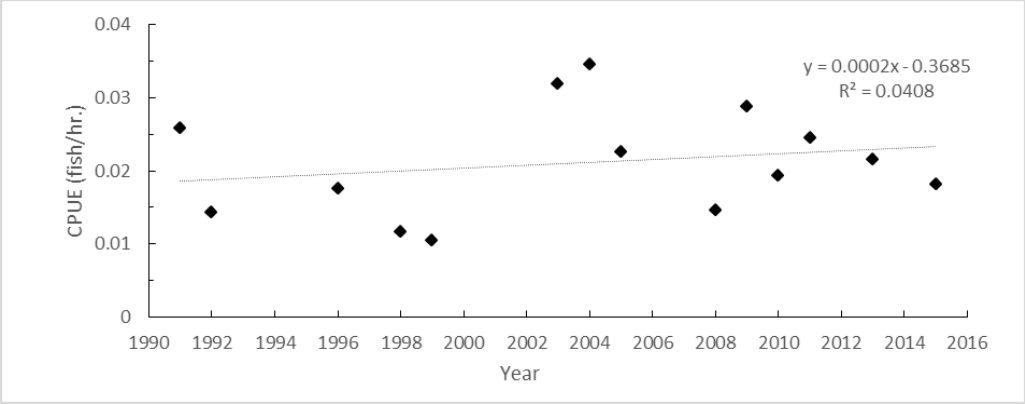

Figure 12. Annual trammel net catch per unit effort (CPUE) for adult humpback chubs in Cataract Canyon, 1991–2015 (reproduced from Ahrens (2015).

The Service's 5-year status review of humpback chub completed in 2011 reported that 60% of the downlisting recovery factor criteria (USFWS 2002b) have been addressed to varying degrees. The next 5-year status review is scheduled for completion in FY17 and will tier directly from the pending SSA.

Razorback Sucker

Table 4. Summary of razorback sucker status and trends

Subbasin	Life Stage	2002 Recovery Goal Downlisting Criteria[10]	Long-term[11] abundance	Short-term abundance (5 most recent data points)	Summary
Colorado River	Adults (≥400mm TL)	N = >5,800 individuals	Program is just starting to generate abundance estimates	N = 3,356 adults and juveniles (avg. of 4 estimates collected 2005–2010)	Since 2000, number of stocked adults has been accumulating and now considered abundant. Observations of spawning congregations have increased in recent years.
	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)	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 in the lower Colorado River in 2013.
Green River	Adults (>400 mm TL)	N = >5,800 individuals	Program is just beginning to generate abundance estimates	From 2006 to 2008, avg. abundance for lower Green = 3,110 individuals; Deso / Gray = 1,297 individuals; middle Green River = 1,646 individuals	Since 2000, number of stocked adults has been accumulating and now considered abundant. Observations of spawning congregations have increased in recent years.
	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)	Increasing larval captures in middle and lower Green River	Generally increasing with a record high catch of larvae in 2013 in the middle Green River	Age-0 survival greatly improved since 2012 because of intensive floodplain management coupled with spring releases from Flaming Gorge dam timed coincident with larval presence

The Recovery Program is rebuilding razorback sucker populations (Table 4) with hatchery stocks. As populations increase, the Program is conducting mark-recapture population estimates on adult razorback sucker. Many stocked razorback sucker are being recaptured as part of other studies. Razorback sucker stocked in the Green and Colorado rivers have been recaptured in reproductive condition and often in spawning groups.

[10] Please see Recovery Goals (USFWS 2002c) for a complete description of demographic requirements.
[11] "Long-term" refers to the breadth of Recovery Program monitoring information, which varies between subbasins and by life stage (discussed in text).

Larval captures in the Green, Gunnison, and Colorado rivers document reproduction. Collections of larvae by light trap in the middle Green River have generally been increasing since 2003; in 2013, the largest collection of light trapped larvae occurred (n = 7,376; Figure 13). Survival of larvae through their first year is compromised because of a historical decrease in the availability of warm, food-rich floodplain areas and predation by a suite of nonnatives when the floodplain nursery habitats are available (Bestgen et al. 2011). However, occasional captures of juveniles (just over age-1) in the Green and Colorado rivers indicate that survival of early life stages is occurring. In 2011, researchers documented spawning by razorback sucker in the White River for the first time.

Major advancements over the last decade have addressed the bottleneck to a self-sustaining wild population of razorback suckers which is larval recruitment to juvenile life stages. By tailoring peak spring releases from Flaming Gorge dam to overlap with larval razorback sucker drift under the Larval Trigger Study Plan (LTSP ad hoc Committee 2012); flows have been high enough in recent years to connect the Green River to off-channel wetland nursery habitats for larval razorback sucker. Picket weirs and similar devices exclude most large-bodied nonnative fishes from certain wetlands, improving water quality and reducing predation pressure on razorback sucker larvae during their most vulnerable first weeks. At Stewart Lake, a gated wetland near Jensen, Utah, managed by the Utah Division of Wildlife Resources, these management practices have made possible releases of wild-spawned young-of-year razorback suckers to the Green River during annual autumn draining every year since 2013.

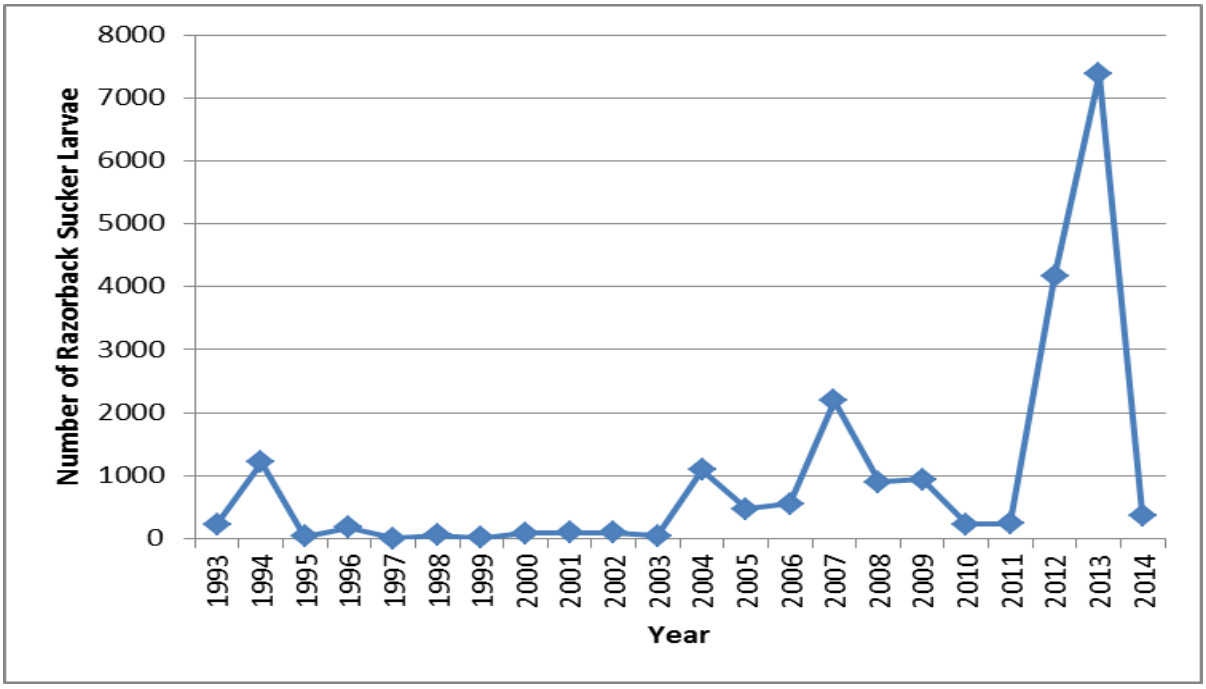

Figure 13. Numbers of razorback sucker larvae collected in light traps in the middle Green River since 1993.

Since 1995, more than 386,000 subadult razorback suckers have been stocked in the Green and upper Colorado River subbasins. Two reports on survival estimates of stocked razorback sucker

recommended stocking larger fish during spring, fall and winter (Zelasko et al. 2004; 2008). From 2004 to 2007, approximately 96,400 fish were stocked and 1,511 recapture events from 1,470 unique individuals were encountered from 2005 to 2008. The recently revised integrated stocking plan (Integrated Stocking Plan Revision Committee 2015) has essentially been implemented since 2013, stocking fewer but larger razorback sucker.

In 2012 and 2013, PIT tag-reading antennas (PIAs) were placed on a spawning bar in the middle Green River near Dinosaur National Monument in northeast Utah. Webber and Beers (2014) report that 59 razorback sucker were detected in 2012, and 553 were detected in 2013. Of the 59 fish detected by the PIAs in 2012, only three razorback suckers were detected again by the PIAs in 2013. The oldest razorback sucker detected was 15 y old, and the youngest were 3-year-old fish that were stocked in 2011and detected in 2013. Researchers had recaptured forty of these razorback suckers between stocking and detection on the PIA. However, for the remaining 529 razorback suckers (93%), detection at the PIA was the first time they were detected since stocking.

During sampling for Colorado pikeminnow estimates in the Ouray to Green River, Utah, reach of the main channel of the Green River, 938 and 765 razorback suckers were captured in 2011 and 2012, respectively. In the razorback sucker monitoring plan (Bestgen et al. 2012), estimates of large juvenile to adult razorback sucker in three reaches of the Green River ranged from 474 to over 5,000 within a reach. Although these estimates are highly imprecise, they provide further confirmation that stocked fish are surviving in the wild.

Preliminary population estimates were generated for razorback sucker in the Colorado River as a whole (from Palisade, Colorado downstream to its confluence with the Green River). Data used to generate these razorback sucker population estimates was obtained during the Colorado pikeminnow population estimate studies done in 2005 and 2008–2010 (Figure 14; D. Ryden and D. Elverud, USFWS, personal communication, 2015).

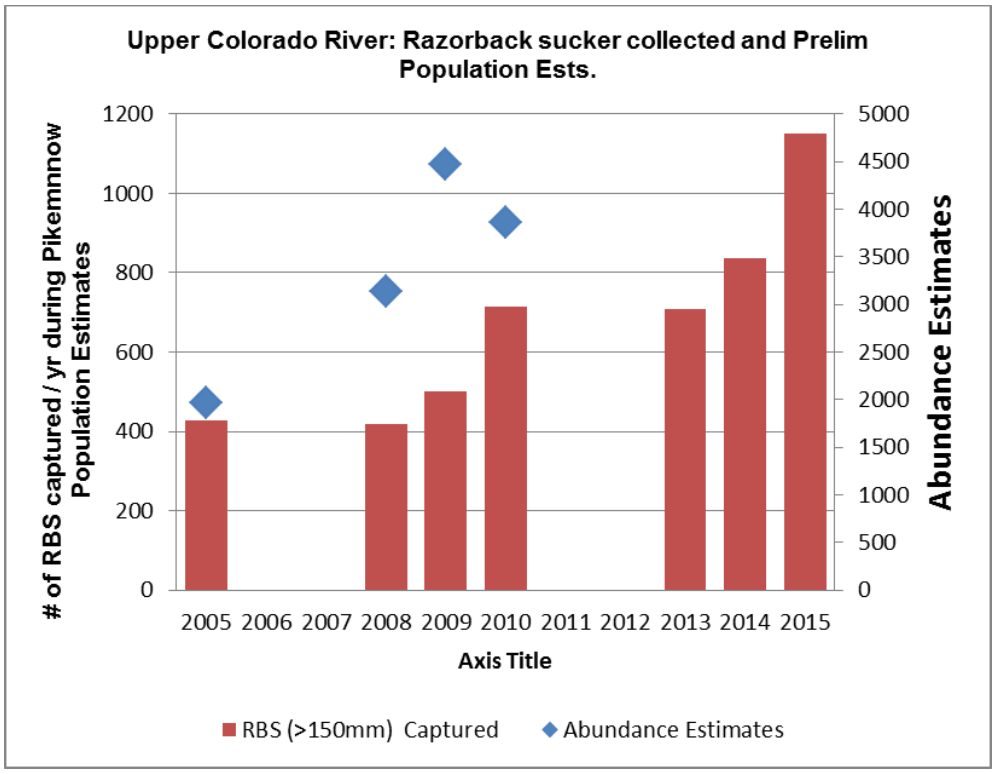

Figure 14. Captures and preliminary population estimates of razorback sucker (juveniles and adults) in the Colorado River (Palisade, Colorado to the confluence of the Green River).

Three razorback sucker stocked in the San Juan River near Farmington, New Mexico by the San Juan Recovery Program were captured between Moab, Utah, and the state line with Colorado in 2008, which demonstrates exchange of stocked razorback sucker between the San Juan River and the Upper Colorado River subbasins. Researchers have confirmed that hundreds of razorback sucker are using both transitional inflow areas of the Colorado River and San Juan River and fully lacustrine (lake-like) habitats in Lake Powell. Razorback sucker are spawning in the lake and biologists have evidence that recruitment may be occurring.

The Service's 5-year status review of razorback sucker completed in 2012 reported that 85% of the downlisting recovery factor criteria (USFWS 2002c) have been addressed to varying degrees. The Recovery Program (in coordination with the San Juan River Basin Recovery Implementation Program, the Glen Canyon Dam Adaptive Management Program, and the Lower Colorado River Multi-Species Conservation Program) initiated a Species Status Assessment in 2015, which should be completed in FY17. This SSA will serve as the basis for a 5-year status review to be completed the same year.

Bonytail

Table 5. Summary of bonytail status and trends

Subbasin	Life Stage	2002 Recovery Goal Downlisting Criteria[12]	Long-term[13] abundance	Short-term abundance (5 most recent data points)	Summary
Colorado River	Adults (≥250mm TL)	N = >4,400 individuals	N/A	No estimates; beginning to see some returns of stocked individuals	Stocked adults increasing since 2013.
	Recruits (150–249 mm TL)	Estimates exceed annual adult mortality	N/A	N/A	Stocked recruits increasing since 2013.
	Age-0	N/A	N/A	N/A	N/A
Green River	Adults (>250 mm TL)	N = >4,400 individuals	N/A	No estimates; beginning to see some returns of stocked individuals	Stocked adults increasing since 2013.
	Recruits (150–249 mm TL)	Estimates exceed annual adult mortality	N/A	N/A	Stocked recruits increasing since 2013.
	Age-0	N/A	N/A	N/A	Researchers documented successful reproduction in managed floodplains in 2015 and 2016.

Since 1996, over 490,000 tagged bonytail subadults have been stocked in the Green River and upper Colorado River subbasins. Stocking continues in an effort to reestablish populations in the upper Colorado River basin. Until recently, very few of these stocked fish had been recaptured (see Table 5 above), and most of those were captured shortly after they were stocked and in poor condition (Bestgen et al. 2008). The bonytail reintroduction effort in the upper Colorado River basin has not been nearly as successful as the razorback sucker reintroduction efforts in the Upper Colorado and San Juan river basins. The recently revised integrated stocking plan (Integrated Stocking Plan Revision Committee 2015) has essentially been implemented by the Recovery Program since 2013, stocking far greater (about 35,000 per year) and larger bonytail (averaging 250 mm).

When the Recovery Program began, the bonytail had essentially disappeared and little was known about its habitat requirements. Hatchery personnel continue to experiment with: 1) improving fitness of hatchery fish prior to stocking; 2) stocking sites (e.g., floodplain habitats as opposed to the main channel); and 3) stocking times (e.g., recent research suggests that stocking when the river has warmed to bonytail spawning temperature could be advantageous). The changes in hatchery protocols are included in a revised Integrated Stocking Plan (Integrated

[12] Please see Recovery Goals (USFWS 2002d) for a complete description of demographic requirements.
[13] "Long-term" refers to the breadth of Recovery Program monitoring information, which varies between subbasins and by life stage (discussed in text).

Stocking Plan Revision Committee 2015). In recent years, researchers have begun to see some encouraging results. All stocked fish receive a PIT tag before being released in the wild. Since 2009, an increasing number of bonytail have been detected at several locations throughout the Upper Colorado River Basin where stationary tag-reading antennas are used. During high spring flows in 2011, more than 1,100 bonytail (16.6% of the 6,804 stocked in early April of that year) were detected by antenna arrays in the breach of the Stirrup floodplain on the Green River. The Price-Stubb antenna array near Grand Junction on the Colorado River detected 356 individual bonytail between November 2010 and September 2014. The fish detected in fall 2011 had been stocked in Debeque Canyon above Price-Stubb, but in spring 2012, some of those fish were moving upstream through the Grand Valley fish passage. In 2015, 22 were detected and 59% were moving upstream, the others were either moving downstream or direction could not be determined (Francis and Ryden 2015a). In addition, 44 bonytail used the Redlands fish ladder and were moved above the diversion for further upstream access to the Gunnison River (Francis and Ryden 2015b).

In 2015, for the first time in a dozen years, evidence was seen that stocked bonytail successfully spawned in the upper Colorado River basin (Bestgen et al. 2016; in review). At least 5 adult bonytail stocked in the Green River gained access to Stewart Lake, a managed floodplain in the middle Green River, Utah, during high flows in May. During the draining in September, 19 age-0 *Gila* sp. (37 to 64 mm TL) among over 405,000 collected fish. Four preserved specimens (41–48 mm TL) were verified as *G. elegans* using morphological and molecular techniques. These fish hatched in late June, well after the wetland was disconnected from the river, which confirmed that reproduction occurred in Stewart Lake. In spite of abundant small-bodied nonnative fish, these young bonytail survived.

The Service's 5-year status review of bonytail completed in 2012 reported that 72% of the downlisting recovery factor criteria (USFWS 2002d) have been addressed to varying degrees. The next status review is scheduled for completion in FY18.

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

Recovery Program participants accomplished a number of important objectives in 2015 and early 2016. These accomplishments are described in Table 2 below. Following that is Table 3, which describes Service concerns about shortcomings in the progress of some ongoing and future recovery actions and outlines action items recommended by the Service to address those concerns/shortcomings. The second column in both of these tables identifies *how* 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. Those criteria are:

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. magnitude of the impact of water projects.

More detail about Program accomplishments and shortcomings can be found in the final April 29, 2016, assessment of accomplishments and shortcomings of the Recovery Program under the Recovery Implementation Program Recovery Action Plan (RIPRAP) from February 1, 2015, through January 31, 2016 (see assessment column in the tables to the RIPRAP).

Table 6. SIGNIFICANT ACCOMPLISHMENTS
(February 1, 2015, through January 31, 2016)

Accomplishment	Sufficient Progress Criteria Affected
General – Upper Basin-wide	
The Colorado Oil and Gas Conservation Commission tightened rules for oil and gas operations in Colorado floodplains in March 2015. In Colorado, as of summer 2015, new oil and gas wells within a floodplain are required to have remote shut-in capabilities and have secondary containment areas. Operators of new wells will be required to notify the director of the COGCC and have a reaction plan if the site is within a floodplain. All wells in a floodplain must be created or retrofitted with containment berms constructed of steel rings or the engineered equivalent to protect from floodwater or debris. New and existing tanks must be anchored to the ground with anchors engineered to resist flotation, collapse, and other instability.	1 – Reduce threat of contamination of critical habitat.
At the December 2015 Nonnative Fish Workshop PI's, managers, and others discussed results from 2015 field studies, which resulted in adding four days to White River smallmouth bass removal. Changes implemented in 2015, such as backwater netting for northern pike in the Yampa River, disrupting smallmouth bass spawning in multiple locations (aka "the surge"), and fall and spring walleye removal continue at 2015 rates, with adjustments by PIs as needed.	1 – Reduce threat of nonnative predation and competition on endangered and native fish.
Utah chemically renovated Red Fleet Reservoir and removed the population of walleye and smallmouth bass. CPW revised the Rifle Gap and Elkhead Reservoir LMPs to include actions to disadvantage northern pike. CPW will build and install a Merwin Trap dedicated solely to control the Mamm Creek Unite Gravel Pit Pond northern pike population. CPW presented new harvest regulations to the CPW Commission in September 2015, which were ratified in November 2015, and went into effect on April 1, 2016 CPW again conducted a smallmouth	1 – Reduce threat of nonnative predation and competition on endangered and native fish.

Accomplishment	Sufficient Progress Criteria Affected
bass fishing tournament at Ridgway Reservoir, with anglers removing about a third of the population. CPW also hosted a fishing tournament at Elkhead Reservoir to engage anglers in smallmouth bass and northern pike removal. Tri-County Water Conservancy District has been able to continue to avoid spills of Ridgway Reservoir; meanwhile, working group evaluating permanent screen solutions to prevent nonnative fish escapement.	
Bonytail spawned in the Stewart Lake floodplain during spring/summer 2015. This was the first documented spawning in the wild for this species since 2003 when some experimentally stocked adult bonytail spawned in the Above Brennan floodplain and likely the Leota-10 floodplain, as well. Razorback adults continue to accumulate in the Green and Colorado subbasins (including Colorado and San Juan inflows to Lake Powell) and larval catch has increased considerably in recent years. Spawning activity has been observed in numerous locations in the Green River, Colorado River and in the White River. A record high catch of age-0 Colorado pikeminnow was collected in the lower Colorado River in fall 2015. Despite low numbers of adult Colorado pikeminnow detected in this subbasin (2013–2015), researchers (preliminarily) report good catches of sub-adults.	2 – Improving status of fish populations.
PIT antennas have been placed in several locations throughout the basins, increasing PIT detections significantly. Researchers are incorporating these data into demographic analyses, but there are some limitations. Reclamation has funded USU to investigate how to interpret and incorporate more PIT tag data into these analyses.	2 – Improving ability to detect status of fish populations.
Green River	
2015 was characterized as a moderately dry year for inflows to Flaming Gorge Reservoir. Reclamation operated Flaming Gorge Dam under the ROD and Biological Opinion to meet or exceed a peak target of 8,300 cfs at Jensen, Utah for 7 days. The actual peak was 14,900 cfs with two days above 14,000 cfs, and 40 days above 8,300 cfs during larval razorback sucker presence, providing possible larval access to the Stewart Lake, Escalante, and Johnson Bottom floodplains. This was the fourth year of operating under the Larval Trigger Study Plan [LTSP] for peak releases, and research results to date have been very positive. The Recovery Program detected wild-produced razorback sucker larvae on May 7, 2015. Reclamation began their ramp-up to bypass flows on May 11, 2015, achieving a peak release of ~8,000 cfs on May 14, and initiated ramp down to base flows 7 days later. An unexpected, prolonged surge in Yampa River flows following an initial peak led to a Green River instantaneous spring peak flow of 15,800 cfs (provisional) at Jensen recorded early evening on May 21. In 2015, Reach 2 and 3 base flows were within Bestgen and Hill's (2015 draft; BW-Synth report) “proposed base flow range”; UDWR reported capture of n = 202 and n = 461 age-0 pikeminnow in the middle and lower Green River reaches, respectively. Those catches represented the third highest catch in the past 20 years for both reaches.	1 – Improve habitat and reduce threat of extinction; 3 – Improve flows; 4 – Reduce magnitude of project impact.
Prior to 2015 LTSP inundation, Stewart Lake was noted to have water and small nonnative cyprinids. Stewart Lake was fully drained and free of nonnative fishes by March. In May during wetland filling, UDWR Vernal excluded large-bodied nonnative fish at the inlet and outlet gates using exclusionary picket weirs. Common carp were observed jumping over the weir to enter Stewart Lake, and the weir was reinforced. Nevertheless, scores of adult carp and at least one adult northern pike were later determined to have entered the wetland (adult bonytail also entered the wetland). A variety of trammel, fyke, and gill nets were	1 – Improve habitat and reduce threat of extinction; 2 – Improve status of fish population.

Accomplishment	Sufficient Progress Criteria Affected
deployed to remove nonnative fish until endangered fish (bonytail) were also caught (Nonnative fish made up well over 99.9% of fish during fall draining; of note was an explosion of green sunfish in 2015, constituting 33% of the total fishes processed.). UDWR returned 97 razorback suckers to the Green River during drawdown of Stewart Lake. Most remarkably, nineteen age-0 bonytail also were captured when Stewart Lake was drained. Under an increasing number of hydrologic scenarios, Stewart Lake continues to demonstrate the potential of managed wetlands for razorback sucker recovery under the Larval Trigger Study Plan.	
The newly improved Johnson Bottom floodplain also connected during LTSP flows which provided approximately 5.5 feet of depth in the wetland. Larval razorback sucker were confirmed after the inlet gates were closed and young fish were verified later in the summer. Supplemental water was added to the wetland in late summer to enhance habitat conditions. During draining of Johnson Bottom, 2 adult bonytail were detected, but no razorback suckers were encountered.	1 – Improve habitat and reduce threat of extinction; 2 – Improve status of fish population.
NRCS, Utah Dept. of Ag. & Food, and local water users secured funding to rebuild the Tusher Wash diversion structure that was damaged during high flows in 2011. Construction began in winter of 2015 (completed May 2016). The new structure includes upstream and downstream fish passage, downstream boat passage, and fish tracking antennas in the new diversion and fish passage. The upstream fish passage is very similar in design to the Price-Stubb passage.	1 – Improve habitat and reduce threat of extinction.
Yampa River	
The 2015 water supply forecast for May - July was 78% of average for the Yampa River at Maybell and flows peaked at 7,540 cfs. With an average flow August through October of 215 cfs, the Program called for release of all 5,000 af from the Elkhead Reservoir fish pool. An additional 2,400 af was released the first half of October to lower the reservoir elevation to prepare for anchoring a net to prevent nonnative fish escapement. Water users convened a committee to resolve issues of protecting Elkhead Reservoir releases for endangered fish and administration/operation of the Maybell Ditch; improvements have been funded (including $62,700 from Program Section 7 funds for an automated gate for return of Elkhead Reservoir releases.	1 – Improve habitat through augmented flows; reduce threat of extinction by hindering smallmouth bass recruitment and removing nonnative fishes.
Program participants discussed chemical reclamation of Elkhead Reservoir, but based on water users' and public concerns and the need for a permanent solution to nonnative fish escapement, approved screening the reservoir, which was completed in September 2016. Colorado also finalized a new Elkhead Lake Management Plan to establish a fishery compatible with endangered fish recovery.	1 – Reduce threat of extinction by preventing escapement of nonnative fishes.
CPW convened a working group of stakeholders in November 2014 to develop and implement a comprehensive suite of nonnative fish management actions (as an alternative to must-kill regulations, which Colorado has considered but decided not to pursue). The meetings have continued and the group is discussing a draft report to be submitted to CPW Director Bob Broscheid. Accomplishments are discussed in more detail in the appendix table.	1 – Reduce threat of extinction by reducing nonnative fishes.
Duchesne River	
DOI has a lease for up to 1,500 af of water in Big Sand Wash to support base flows; lease exercised for the fourth year in a row in 2015 (1,136 af released). Flows from Daniels Diversion continue to be delivered. Once released from Starvation Reservoir, flows from the Daniels Diversion are protected by agreement among the parties of a CCAA/SHA (rather than via State water law). CUWCD must internally manage this water in accordance with Central Utah	1 – Improve habitat through augmented flows; 3 – Improve flows.

Accomplishment	Sufficient Progress Criteria Affected
Project Completion Act (CUPCA) provision (Public Law 102-575), project purposes as given in the congressionally-approved Supplement to the 1988 Definite Plan Report for the Bonneville Unit (DPR), and other CUWCD contracts. If the CCAA/SHA is successful, FWS recommends investigating how it might be modified to add water users between Myton and Green River, thus legally protecting flows all the way to the confluence. (Flows apparently are currently protected in principal, but not legally protected.)	
The Myton fish passage was completed in fall 2015 and became operational for the 2016 irrigation season.	1 – Improve habitat through fish passage
Colorado River	
The June 1 runoff forecast for April-July at Cameo was 60% average for 2015. With the reservoirs full from 2014, USFWS suggested a baseflow target in the mid-range of 1,240 cfs. The average flow was 1,157 cfs for August–October. A total of 98,600 af was provided for baseflow augmentation in water year 2015; 24,412 af from Ruedi, 4,712 af from Wolford Mountain Reservoir, 5415 af from Granby, 54,610 af from Green Mountain, 8,162 af from the Palisade Bypass Pipeline, 1,289 af from Williams Fork, 9,918 af from Willow Creek, and 3,718 af from Windy Gap. 2015 saw the first successful coordinated reservoir operations (CROS) releases since 2010. 42,119 af were released for a peak of 18,900 cfs at Palisade. CWCB leased 9,000 af of water from the Ute Water Conservancy District out of Ruedi Reservoir in 2015.	3 – Improve flows; 4 – Reduce magnitude of project impact.
Water savings from the thirty-three canal check structures were constructed on the Orchard Mesa Irrigation District (OMID) in 2014 continues. The canal automation regulating reservoir is under construction and the project will be fully implemented by 2018. Saved water is stored in Green Mountain Reservoir and delivered to the 15-Mile Reach of the Colorado River.	3 – Improve flows; 4 – Reduce magnitude of project impact.
Gunnison River	
In 2015 the water supply forecast for Blue Mesa Reservoir April - July was 73% of average. The peak runoff target for Whitewater was attained (average dry) for 10 days at half bankfull (8,070 cfs). A one day peak of 10,600 was achieved; it was beyond the forecast as a result of all the precipitation in "Miracle May."	3 – Improve flows; 4 – Reduce magnitude of project impact.

Table 7. SERVICE CONCERNS AND RECOMMENDATIONS (focused on February 1, 2015, through January 31, 2016)

Service Concern	Sufficient Progress Criteria Affected	Recommended Action Items (see also Appendix table of nonnative fish management actions)
General – Upper Basin-wide		
Current low densities of Colorado pikeminnow throughout the upper basin are linked to the persistence of nonnative predators. Large-bodied predatory species of concern appear to be expanding in other segments of critical habitat (e.g. walleye in Colorado pikeminnow nursery habitat). (Adult [>450mmTL] Colorado pikeminnow estimates in the Colorado River appear as low as the Recovery Program has recorded since 1992: 2013 N = 332; 2014 N = 482; 2015 N = 429. Declines in Green River adult/subadult populations also detected.)	1– Increases threat of extinction; 2 – Declining status of fish populations.	The persistent and prolonged threat of expanding nonnative fish populations needs to be ameliorated. The Recovery Program needs to fully implement the comprehensive *Upper Colorado River Basin Nonnative and Invasive Aquatic Species Prevention and Control Strategy* and continue work with the States to implement the specific, tangible actions added to the RIPRAP in 2013 (see Appendix table for more information), which in the aggregate have a high likelihood of stopping the expansion of invasive species and of reducing existing concentrations. Reductions in nonnative 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.
Downward trends in some humpback chub populations (particularly Yampa Canyon and in Desolation Canyon of the Green River) have been attributed to increased nonnative fish abundance and habitat changes associated with dry weather and low river flows. Declines in adult humpback chub catch rates for sites in the upper 45 miles of Desolation Canyon correlate strongly to the appearance and persistence of a smallmouth bass population and recent increases in number of walleye. Declines in the proportion of first year adults (200–220 mm TL) support the idea that smallmouth bass and walleye predation may be suppressing the smaller *Gila*.	2 – Declining status of fish populations.	The Recovery Program is addressing habitat/flow requirements through operations of Flaming Gorge Reservoir on the Green River and releases from Elkhead Reservoir for the Yampa River. The Program has committed to reducing nonnative impacts to the humpback chub population in Yampa Canyon since 2001. In 2004, the Recovery Program transitioned Project 110 from a nonnative catfish control effort in Yampa Canyon to smallmouth bass removal. That effort is ongoing and is complemented by similar efforts upstream (Projects 125, 98a, and 98b) and downstream (project 123a). In Desolation Canyon, smallmouth bass, walleye, and other nonnative species are removed during Colorado pikeminnow population estimates (Project 128) and during specific nonnative control trips conducted under Project 123b. The Program should develop and implement a specific, prioritized plan for humpback chub broodstock development. Research conducted on the Colorado River indicates that humpback chub fare better in periods of

Service Concern	**Sufficient Progress Criteria Affected**	**Recommended Action Items** (see also Appendix table of nonnative fish management actions)
		average and wetter hydrologies. The Recovery Program is working to improve low flow conditions in the lower Yampa River with flow augmentation from Elkhead Reservoir, and on the Green River through releases from Flaming Gorge Dam.
CSU/FWS/UDWR recent draft robust population estimate analysis more clearly indicates that declines in the Westwater and Black Rock humpback chub populations are due to lapses in recruitment (adult survival rates have remained stable).	2 – Declining status of fish populations.	The Program needs to determine how to investigate age-0 and age-1 humpback chub mortality (especially in Black Rocks/Westwater and Desolation canyons) as recommended in the Research Framework**.** The difficulty in working with these size classes is they can't be identified to species. PI's agree that reinitiating an age-0 monitoring component is advisable and a pilot effort was begun in 2016.
Despite the Recovery Program's extensive removal efforts, nonnative aquatic invasive species continue to threaten survival and recovery of the endangered fishes in the upper Colorado River basin. Basin-wide, weak year classes of smallmouth bass were produced in 2014 and 2015, a result of average to above-average flows. However, crews still removed large numbers of smallmouth that were produced in the strong year classes of 2012 and 2013 (lower water years). Collections of adult smallmouth bass were very high in canyon habitats in 2014, potentially representing a range expansion of adult fish. Northern pike numbers continue to be a concern, particularly as strong year classes are produced, such as in 2011. Crews are now removing pre-spawn northern pike where they most densely populate the Yampa, Green, and Colorado rivers to control riverine reproduction. Catches of walleye appeared to have stabilized in the Green and Colorado rivers in 2015 and may be in decline in the lower Green River. Catch locations overlap with nursery areas for endangered fish, representing a potential impairment to recruitment. In a 2016 draft report, CSU researchers have implicated walleye predation as a main contributing cause for the loss of a juvenile cohort (2011 year class) of Colorado pikeminnow in the lower Green River. Evidence of walleye reproduction in Upper Basin rivers has been documented, but		The Service agrees that the impacts of nonnative fish on recovery of the listed species must be controlled. The Recovery Program must continue current levels of in-river removal that now capitalizes on removal of pre-spawn and spawning adults. To combat immigration from reservoir sources, Program Partners are implementing the comprehensive *Upper Colorado River Basin Nonnative and Invasive Aquatic Species Prevention and Control Strategy*. Adequate progress has been made to control nonnative predator escapement from Elkhead, Rifle Gap, Red Fleet, and Starvation reservoirs. UDWR chemically renovated Red Fleet Reservoir to eradicate an illegally introduced population of walleye. Utah and Wyoming have implemented must-kill policies to support nonnative predator removal. In 2015, CPW eliminated bag and possession limits for the 'worst-of-the-worst' nonnative predators on the West Slope and is promoting removal through incentivized harvest (Ridgway, Elkhead and Green Mountain reservoirs) and 'catch and keep' messaging. CPW continues to work with their NNF Management Work Group to develop a suite of actions (some of which are mentioned here) to adequately address this persistent threat.

Service Concern	Sufficient Progress Criteria Affected	Recommended Action Items (see also Appendix table of nonnative fish management actions)
currently appears to only occur at very low levels. Escapement from reservoirs has been deemed adequate to overcompensate for in-river removal efforts. Therefore, the Program is investigating the feasibility of screening reservoirs with populations of problematic species and working with state partners to revise lake management plans for fisheries to replace the problematic species.		
Green River		
Old Charley Wash, an important 'dry year' sampling site identified in the Larval Trigger Study Plan has been unavailable as the Service not been able to renew lease with Northern Ute Tribe.	Hampers ability to 1 – Improve habitat through augmented flows	Service and the Northern Ute Tribe are in dialogue and the Service continues request that the lease be renewed.
Yampa River		
CWCB still needs to provide the accounting of past depletions for the Yampa River due in 2010; a back-casted baseline of current depletions; and a recommendation and justification addressing projected future depletions and whether or not additional instream flow filings or other flow protections mechanisms should be considered.	Hampers ability to 3 – Determine adequacy of flows.	CWCB was to complete accounting of past depletions using the StateCU model (Due date from YPBO - 1st report July 1, 2010; 2nd report July 1, 2015). These depletion accounting reports are to include a discussion of the need for flow protection (which would require a peak flow recommendation). The irrigated acreage assessment was completed. Another contract was awarded to update the dataset. CWCB has said the models will be updated through at least 2012. An initial estimate of agricultural consumptive use (CU) was completed and, at first glance, do 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. Colorado has placed a high priority on the Yampa and Colorado river basins portion of this work, but has not yet completed it. CWCB should establish mechanism and schedule to complete no later than September 2017. Given CWCB's limited staff, perhaps their contractor, Wilson Water Group, could complete the work.
Efforts to reduce densities of smallmouth bass in Little Yampa Canyon and other reaches of the Yampa River appear	Hampers ability to 1 – Reduce threat of extinction by	The expanded Yampa River "surge" effort to target smallmouth bass was continued in 2015. Net was installed

Service Concern	**Sufficient Progress Criteria Affected**	**Recommended Action Items** (see also Appendix table of nonnative fish management actions)
to be hampered by the immigration of smallmouth bass adults and recruits from adjacent reaches, particularly upstream sources that sustain propagule pressure and the proliferative/invasive capacity of this species. Escapement of adult smallmouth bass from Elkhead Reservoir remains problematic.	decreasing numbers of nonnative fish.	on Elkhead Reservoir in September 2016 to eliminate the release of nonnative predators over the spillway. CPW has revised the lake management plan to transition to a compatible reservoir sportfishery.
Efforts to reduce densities of northern pike in the Yampa River appear to be hampered by immigration from upstream sources (Catamount, Elkhead, and the upper river) and ongoing in-river reproduction.	Hampers ability to 1 – Reduce threat of extinction by decreasing numbers of nonnative fish	CPW has continued work at Catamount Reservoir to reduce northern pike. CPW would like to eradicate the illegally-established population of northern pike in Chapman Reservoir, as well, and has been working with reservoir operators and water owners. CPW is negotiating a water trade that could allow them to draw down the reservoir to conduct analyses and treat the reservoir in September 2016. Ice fishing tournaments at Stagecoach in February 2014 and 2015 required must-kill for northern pike and walleye caught by tournament participants. Two ice fishing tournaments were held this winter, both with mandatory harvest on pike and walleye. The first yielded no pike or walleye; results pending on the second tournament. Spring netting of connected backwaters was continued in 2015 to disrupt spawning and remove large reproducing adults (450 northern pike removed). The Service recommends that such netting efforts be continued and that CPW and the Recovery Program continue ongoing efforts to pursue habitat modification at the Walton Creek confluence. Also, because conflict can occur between desired and proposed wetlands creation/restoration in the upper Yampa River and the high density of northern pike, review protocol may be needed with counties prior to pond construction in areas where undesirable nonnative fish may invade (e.g., golf course ponds). The Service agrees that Program partners' focus on controlling escapement of nonnative predators from Elkhead Reservoir and CPW's revision of their lake management plan to transition to compatible sportfishery are appropriate recovery actions. CPW should continue to undertake the pike removal project at Catamount and

Service Concern	Sufficient Progress Criteria Affected	Recommended Action Items (see also Appendix table of nonnative fish management actions)
		should remove any pike from Stagecoach during their standard sampling (i.e. discontinue tagging). CPW and the Upper Yampa Water Conservancy District should continue to investigate the feasibility of managing water levels to help control pike in Stagecoach Reservoir. CPW has committed to these actions.
Duchesne River		
Extent of contribution of smallmouth bass or walleye produced in the Duchesne River below Starvation and entering Green River remains unknown. Nonnative fish are not currently being monitored or removed from the Duchesne River due to access issues.	1 – Increases threat of extinction.	The Service supports efforts to maintain a temporary screen below the Starvation spillway until a permanent screen can be installed (projected for fall 2017; dependent on completion and approval of an LMP). The temporary screen needs repair for spring 2017. The Service continues to pursue government-to-government consultation with Northern Ute Tribe so that in-river removal nonnative control can be resumed
White River		
The schedule outlined in the approved scope of work for developing the White River Management Plan has slipped.	Hampers ability to 1 – Improve habitat through protected/augmented flows; and 3 – Inadequacy of flows.	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 Roundtables. The Yampa/White Basin Roundtable contracted with Wilson Water Group to convert StateMod from a monthly to a daily model (done). CWCB needs to develop on contract to convert Utah water rights to StateMod and on an RFP for the remaining work on the project.
Smallmouth bass abundance has increased in the White River. A significant increase was first detected in 2011; removal projects began in 2012, and continue through 2016. Bass production was high in 2012 and 2013, primarily within Colorado. In 2015, overall catch rates were lower than the previous three years, and in general exhibited a trend of decreasing bass densities moving downstream. However, catch rates for adult smallmouth bass increased in all but the most upstream reach, as researchers continue to track the 2012 and 2013 cohorts. Bass densities are highest in the uppermost section below Taylor Draw Dam. Smallmouth bass are	1 – Increases threat of extinction.	Efforts to reduce the abundance of smallmouth bass are as high as possible in the Colorado portion. Four additional removal days were added in the Utah portion in 2016 to allow for more targeted disruption of spawning adults. The Recovery Program continues to support and encourage the multi-agency effort to designate the White River as a native fish conservation area.

Service Concern	Sufficient Progress Criteria Affected	Recommended Action Items (see also Appendix table of nonnative fish management actions)
unknown in the White River drainage above Taylor Dram Dam, thus are believed to have invaded via the Green River. They now are reproducing within the White River.		
Colorado River		
The Recovery Program still struggles to meet flow recommendations in drought years. The Service emphasizes the importance of meeting the flow recommendation. Some of these recommendations have not been met historically and may be unattainable.	Hampers ability to 1 – Improve habitat through augmented flows; and 3 – Inadequacy of flows.	The Program is working to improve the overall strategy for flow augmentation in the 15-Mile Reach to be considered each spring and adjusted as the year progresses, addressing all possible sources of water, priorities, antecedent conditions, projected flows and supplies, including OMID, Grand Valley Project, CFOPS, etc. In 2015, Ute Water Conservancy District proposed leasing up to 12,000 af of water to CWCB for an instream flow and CWCB leased 9,000 af of water that year. The OMID Canal Automation Project is expected to provide about 17,000 af of water in most years. The check structures in the OMID project are complete (partial water savings became available in the 2014 irrigation season) and the reregulating reservoir is under construction. The project will be fully implemented in 2019 (regulating reservoir will be completed in 2017; however, the final completion of all OMID Canal Automation Project components likely deferred to 2019 as a result of the priority for Program's cost-share of $1.5 million for Grand Valley Power Plant rehabilitation).
CWCB still needs to provide the depletion accounting report that was due July 1, 2010.	Hampers ability to 3 – Determine adequacy of flows.	Still overdue; however, an initial estimate of agricultural consumptive use (CU) has been completed and, at first glance, do not appear to be increasing: Average Annual Ag CU, AF, Colorado River 15-Mile Reach: 1975–1995 = 473,274 1996–2012 = 445,524 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. *See also first item under Yampa River.* The Service recommends that CWCB provide a depletion accounting progress report to be included in the current

Service Concern	Sufficient Progress Criteria Affected	Recommended Action Items (see also Appendix table of nonnative fish management actions)
		review of the 15-Mile Reach PBO.
CFOPs report (evaluation of options for providing and protecting additional peak flows to the 15-Mile Reach) overdue.	Hampers ability to 1 – Improve habitat through augmented flows; and 3 – Improve flows.	CFOPS Phase III draft report distributed April 2, 2014 and comments received; the next draft will identify the Service's "fish pools" and which ones are subject to exchange (base to peak flows) (will require State Engineer legal review). The CFOPS report should be included in the 2015 review of the 15-Mile Reach PBO.
Walleye captures in the Colorado River went from being 'rare' from 2003-2009 to 'common' in 2010, and then increased dramatically in 2013 and 2014. Distribution within the lower reach in 2010 appeared to be restricted below RM 80; however, by 2013 and 2014, captures extended upstream to RM 112, indicating upstream range expansion. Unlike smallmouth and largemouth bass, whose primary distribution is in the upper reach, walleye directly overlap habitat of small size classes of both Colorado pikeminnow and razorback sucker. In fact, crews documented walleye predation on two juvenile pikeminnow in 2014.	1 – Increases threat of extinction.	The Service supports ongoing additional/expanded effort to target walleye. 75 walleye were removed from Cisco to Potash, UT, in fall 2015. This is a decrease from 2014's catch (n = 107). Spring 2015 removal efforts, conducted from Cisco, UT downstream to the confluence of the Green River during Colorado pikeminnow abundance estimation sampling, resulted in 83 walleye removed. This is a substantial decrease from the 2013 catch (n = 268). All walleye captured were adults.
Gizzard shad were discovered in Highline Reservoir during standard annual sampling in October 2015, and appeared to be very abundant. Possible sources include the Government Highline Canal, illegal introduction and/or illegal use of live fish as bait. No gizzard shad were collected in Mack Wash, suggesting that the net has been effective in preventing escapement from the reservoir. However, Highline may now be an additional source of gizzard shad for illegal transport (intentional or live bait).	1 – Increases threat of extinction.	PDO and CPW will develop appropriate action items.
Gunnison River		
A northern pike source population in Crawford Reservoir remains of concern due to its invasive potential in the Gunnison River.	1 – Increases threat of extinction.	The Service supports CPW initiation of mechanical removal of northern pike from Crawford. In 2014, the initial year of removal, CPW reduced the estimated population from 238 adults pre-removal (95% CI: 205-271) to 62 post-removal (95% CI: 40-84). The 2015 pre-removal estimate was 91 (95% CI 69-113), reflecting some recruitment into the adult size class, and the post-removal estimate was 29 (95% CI 7-51). CPW is not conducting removal in 2016 because the low number of

Service Concern	Sufficient Progress Criteria Affected	Recommended Action Items (see also Appendix table of nonnative fish management actions)
		adults makes it cost-ineffective, but will continue to monitor the population (removing any pike captured during monitoring), and will re-initiate removals in the future if appropriate. Crawford Reservoir does not connect unless it spills. Every effort should be made to ensure that the Gunnison River remains a native fish stronghold.
Illegal introduction of smallmouth bass in Ridgway Reservoir was confirmed in 2013. Sampling demonstrated multiple size classes, but low densities of adult fish, indicating the population may be expanding from initial introduction. Densities of smallmouth bass near the spillway were high, indicating a high risk of escarpment from reservoir spilling.	1 – Increases threat of extinction.	The Service applauds the efforts of Tri-County Water Conservancy District (which successfully avoided a spill in 2014, 2015, and 2016) and recommends spills continue to be avoided in the future. The Service supports CPW regulatory actions to implement unlimited bag and possession limits for smallmouth bass at Ridgway and added information concerning the illegal introduction and its effects to the 2015 Fishing Guidebook. CPW held a harvest tournament in 2015 (36% removal) and 2016 (24% removal). Riverine habitats in the Gunnison River drainage remain a native fish stronghold. All manner of prevention needs to take place to prevent nonnative fish from colonizing the Gunnison River. Therefore, the Service encourages speedy development of a long-term solution to prevent nonnative fish from escaping Ridgway. Preliminary evaluation indicates that a net, coanda screen, or rigid screen likely are the most effective and feasible alternatives. A net seems to be the leading candidate, but debris loading, costs, and dam safety components must be considered. A working group meets semi-annually to discuss screening options; Tri-County and Reclamation are investigating the potential role. Tri-County is willing to play and a net is scheduled for installation in 2019.

C. Conclusion on Sufficient Progress

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

1) Instream Flow Management
   - Continued cooperation to manage Green River flows. Spring releases from Flaming Gorge Dam to meet objectives of the Larval Trigger Study Plan are clearly paying dividends in terms of improved survival of young razorback sucker. Reclamation's summer base flow releases now target a preferred flow range to improve survival of young Colorado pikeminnow.
   - Program stakeholders (Reclamation, East and West Slope water users, and Grand Valley irrigators) continue to improve habitat conditions in the 15-Mile Reach during both the spring and base flow periods. Particular appreciation goes to the Colorado Water Conservation Board for working with the Ute Water Conservancy District to secure additional water in this regard.
   - The Service applauds the work of various stakeholders who: a) developed a timeline and sequence to complete a White River Management Plan and PBO; and b) coordinated with the Yampa/ White / Green Basin Roundtable to secure a contractor to initiate important flow modeling needed to validate the Recovery Program's draft flow recommendations.

2) Nonnative Fish Management
   - In the past few years, the Recovery Program's nonnative control program has become more robust and effective via: a) a focused and efficient in-river control program that targets spawning congregations of invasive smallmouth bass, northern pike, and walleye throughout 600+ miles of occupied riverine habitat; b) eliminating or reducing escapement of nonnative predators from off-channel sources (details below); and c) a specific, cooperative approach to develop an effective strategy in the State of Colorado that includes greater public involvement through various forms of outreach.

     - Nonnative Fish Control at Off- Channel Sources - We applaud the State of Utah for reclaiming Red Fleet Reservoir to eliminate an illegally-introduced population of invasive walleye. We also applaud the State of Colorado's efforts to establish an incentivized harvest tournament to control an illegally-introduced population of smallmouth bass at Ridgway Reservoir, and for modifying their fishing regulations, which liberalized bag and possession limits for the 'worst of the worst' invasive species on the West Slope. And we recognize the successful installation of a $1.2M spillway net at Elkhead Reservoir in September 2016. This project represents a major step forward in the Recovery Program's campaign to control invasive species and was accomplished by balancing science with community input.

3) Endangered Species Status:
- Record high production of age-0 Colorado pikeminnow in the Colorado River in 2015.
- High catches of age-0 pikeminnow in the middle and lower Green River in 2015, which indicate that "preferred base flow" releases from Flaming Gorge Dam are on the right track.
- Continued encouraging reports of an expanding population of razorback sucker throughout the Upper Basin, including another year of wild-produced young that were released to the Green River from Stewart Lake.
- First recent documentation of bonytail spawning in the wild in 2015.
- Researchers report that humpback chub populations in 4 of 5 occupied reaches have demonstrated stability over the past decade.

The Service also recognizes the efforts of Program partners to augment traditional funding sources.
- Reclamation's contributions to endangered fish investigations in Lake Powell which continue to produce encouraging information about the expanding Upper Basin razorback sucker population.
- CWCB's contributions from their Species Conservation Trust Fund to supplement nonnative fish control and to lease water from the Ute Water Conservancy District to support base flows in the 15 Mile Reach of the Colorado River.
- The Service's approval of a second Cooperative Recovery Initiative grant to improve nursery habitat for the endangered fish at Shepard Bottom on the Ouray National Wildlife Refuge (following the first grant for this purpose at Johnson Bottom at Ouray).
- Stakeholders working with Green River irrigators and the Natural Resource Conservation Service reconstruct the Tusher Diversion on the Green River. Included in this rebuild were both upstream and downstream fish passage structures and screens on east side diversion structures. This rebuild improves conditions for the endangered fish over the historical situation.

Despite good cooperation among Program partners and 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 subbasins. And we remain concerned over the apparent loss of humpback chub from the lower Yampa River and particularly slow progress toward recovery of bonytail. We advise that the Recovery Program continue to focus on several specific recovery actions in the coming year. We categorize those actions under: 1) nonnative fish management; 2) flow management; and 3) reducing endangered fish entrainment in irrigation canals, as follows.

Nonnative Fish Management

Overall, the Service is very pleased with the Program's progress on the action items developed during our review in 2014 (and reviewed here in the Appendix Table). We applaud Colorado Parks and Wildlife (CPW) for their continued leadership of a Nonnative Fish Management Work Group to discuss and develop public outreach strategies to communicate the importance of compatible sport fisheries. The group met for the first time in November 2014 and eventually focused on submitting necessary

changes in fishing regulations to the Colorado Wildlife Commission and developing a harvest incentive strategy to reduce the worst-of-the-worst nonnative predators. The Wildlife Commission approved all of the proposed regulation changes in November 2015. The Work Group also recommended and CPW effectively implemented a smallmouth bass fishing tournament at Ridgway Reservoir in 2015 and 2016 and established a tournament at Elkhead Reservoir in 2016.

We commend Utah Division of Wildlife and Wyoming Game and Fish for their continued promotion of 'must kill' regulations for nonnative predatory species in the Green River drainage, and for their chemical renovation of Red Fleet Reservoir in the fall of 2015.

As mentioned, the Service believes that predation and competition from nonnative predatory species poses the greatest threat to the recovery of the endangered Colorado River Fish. It is our assessment that the Recovery Program is now making the best and most efficient use of available annual funds to control riverine populations of nonnative smallmouth bass, northern pike, and walleye throughout 600+ miles of river. We stress how important it is for the Recovery Program to maintain those levels of in-river control and continue to investigate innovative ways to improve that effort.

Off channel sources of the worst-of-the-worst nonnative predators remain problematic (e.g., Ridgway Reservoir, Starvation Reservoir, and Catamount Lake). We encourage the Recovery Program to build on recent successes (e.g. reclamation of Red Fleet Reservoir and the spillway net installation at Elkhead Reservoir) to address these lingering off-channel sources of nonnative fish.

Flow Management

In our 2014 and 2015 Sufficient Progress reviews, the Service was concerned that the timeline for development of a White River management plan had slipped. We recognize that significant efforts and outreach with the Yampa/White/ Green roundtable occurred this past year in this regard. We also recognize a contractor has been hired to assist with fundamental modeling to test draft endangered fish flow recommendations against future water demand scenarios as presented in the Basin Implementation Plan. We encourage the Recovery Program to adhere to the schedule outlined in the White River Management Plan / PBO Sequence and Timeline document approved this past year. We also encourage CWCB, in the coming year, to follow through on their generous allocation of Species Conservation Trust Funds to augment the existing contract to extend the modeling effort downstream to the confluence with the Green River

We also encourage Program partners to continue to pursue protection of endangered fish flows in the Green River now that the Green River Utah Water Acquisition Team's modeling efforts are complete. Finally, we ask Program partners continue to explore flexibility in operations and storage throughout the upper Colorado River drainage, particularly during dry years and with respect to priorities and antecedent conditions, to

reduce the amount of time flows drop below the minimum average monthly flow of 810cfs in the 15-Mile Reach.

We stress the importance of completing depletion accounting for the Colorado and Yampa rivers. This accounting will serve as a cornerstone in our pending evaluation of progress made under the 15 Mile Reach Programmatic Biological Opinion, signed in 1999.

Endangered fish entrainment at irrigation canals

The number of endangered fish detected in the Green River irrigation canal (Tusher Wash Diversion) in 2013 was astonishing. We understand that detections of endangered fish were fewer during the higher flows experienced in 2014 and that the Recovery Program funded an important canal salvage effort following the 2014 irrigation season, which yielded only one Colorado pikeminnow. The Service applauds the Biology Committee on their important decision this past winter to endorse a weir-wall type solution for the Green River canal, which is similar to the solution implemented by the San Juan River Recovery Program at the Hogback Diversion. We agree that prior to construction at the Green River canal, the San Juan project should provide proof of concept, but we encourage the Upper Colorado Program to act as quickly as reasonably possible to implement a solution to fish entrainment in the canal.

The Service shares the Recovery Program's concern about the number of native and endangered fish salvaged each year from Grand Valley canals following the irrigation season. We don't know if the screens at the GVIC, GVP, and Redlands diversions can be operated more frequently, but we implore Program partners to thoroughly investigate this issue to determine if and how the Recovery Program can assist the irrigation companies to further reduce entrainment.

The Recovery Program has made strong progress in protecting and improving flows and restoring habitat and has demonstrated strong resolve to manage nonnative fishes in recent years. Four of the 16 accomplishments listed in the table above relate to nonnative fishes, as do 10 of the 18 concerns. The Service agrees that the Recovery Program is at a critical juncture in its nonnative fish management activities and must build on recent momentum to ensure significant progress on this front. The Service strongly encourages Program participants to push hard to implement the actions needed to manage problematic nonnative fishes and prevent new problematic species and any resurgence of existing problematic nonnative fishes. 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 clearly taking longer than the Service and the Recovery Program stakeholders initially envisioned in 1988; however we sense 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. 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), the focus on nonnative 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 acre feet[14]. Furthermore, that sufficient progress provides continued avoidance of jeopardy for the water projects and depletions currently provided with ESA compliance by the Program, i.e., 2,101 projects depleting 2.86 million af per year. Projects exceeding 4,500 acre feet or that have direct or indirect effects in addition to water depletions will be evaluated to determine if they jeopardize the species' continued existence on a case by case basis.

This concludes the Service's 2015-2016 assessment of progress. Specific questions about sufficient progress should be directed to Tom Chart, Recovery Program Director, 303-236-9885, tom_chart@fws.gov or Angela Kantola, Deputy Director, 303-236-9882, angela_kantola@fws.gov.

[14] 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 acre-feet 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 acre-feet per year of existing depletions and up to 53,000 acre-feet 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 acre-feet/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.

II. IMPLEMENTATION OF ITEMS IN THE YAMPA RIVER BASIN PROGRAMMATIC BIOLOGICAL OPINIONS

On January 10, 2005, the Service issued a final programmatic biological opinion on the *Management Plan for Endangered Fishes in the Yampa River Basin*. Known as the "Yampa River Programmatic Biological Opinion (PBO)", this document determined that implementation of the *Management Plan for Endangered Fishes in the Yampa River Basin* would not likely jeopardize the continued existence of the endangered fishes. The PBO cites action items in the Program's Recovery Action Plan (RIPRAP) and charges the Recovery Program with the responsibility to ensure that these action items are completed and/or implemented. Page 74 of the PBO states: "In 2006 and every 2 years thereafter, for the life of the Recovery Program, the Service and Recovery Program will review implementation of the Recovery Action Plan actions to determine timely compliance with applicable schedules. The Service recently conducted this review (2012) in consultation with Recovery Program partners (see attached status report) and concluded that the Recovery Program is making sufficient progress in accomplishing most of the action items listed in the PBO. Although the schedule for some tasks has slipped, the PBO recognized this might happen. Page 73 of the PBO states: "The Recovery Action Plan is an adaptive management plan because additional information, changing priorities, and the development of the States' entitlement may require modification of the Recovery Action Plan. Therefore, the Recovery Action Plan is reviewed annually and updated and changed when necessary and the required time frames include changes in timing approved by means of the normal procedures of the Recovery Program, as explained in the description of the proposed action." If the circumstances surrounding changes in the Recovery Action Plan impact the listed species in a manner(s) not previously considered, reinitiation of the PBO may be needed.

The Service recognizes the following significant recovery accomplishments that have occurred since 2005:

1. Completion of Elkhead Reservoir enlargement and subsequent base flow augmentation from Recovery Program pool and leased water.

2. Installation and maintenance of screens on Elkhead Reservoir outlet towers.
3. Completion of the comprehensive Upper Colorado River Basin Nonnative and Invasive Aquatic Species Prevention and Control Strategy.

4. Analysis of escapement of nonnative fish from Elkhead Reservoir and installation of net to prevent further nonnative fish escapement.

5. Ongoing and expanded mechanical removal of nonnative fish in the Yampa River.

6. Removal of more than 10,000 northern pike from Catamount Reservoir by CPW as part of an effort to restore the trout fishery and reduce downstream impacts on native and endangered fish.

7. Evaluation of fish entrainment in the Maybell Canal. (The Service concluded that due to relatively low rates of entrainment detected, an exclusion device would not be cost effective. The Recovery Program is offsetting impacts at the Maybell Canal by completing the Yampa River nonnative fish control actions identified in the RIPRAP addendum [as required in the 2012-2103 Sufficient Progress memo] and by installing an automated gate to return Elkhead fish releases.)

While recognizing these accomplishments, the Service hopes the Recovery Program can build on its history of cooperation to improve in three specific recovery areas: 1) achieve greater success controlling expanding populations of nonnative predators, eliminating nonnative species at their sources, and preventing introduction of new nonnative species; 2) identify and correct factors limiting wild populations of humpback chub; and 3) complete the update of the model which accounts for past depletions to monitor impacts to peak flows on the Yampa River in critical habitat and assess need for peak flow protection. The concerns raised here are specific to the Yampa River, but are generally consistent with those raised in the Regional Director's overall review of the Recovery Program's progress.

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Appendix Table

Upper Colorado River Endangered Fish Recovery Program

Nonnative Fish Management Actions: an Addendum to the Recovery Action Plan

October 2016 Update on Progress

River / Action	Responsible Entity(s)	New RIPRAP#	2013	2014	2015	Out years	PDO/MC update 3/2015
General (in addition to ongoing projects / actions)							
Finalize the UCR Basin Nonnative and Invasive Aquatic Species Prevention and Control Strategy (Basinwide Strategy).	Program Director's Office (PDO)	III.D.	X				*Complete; Feb, 2014.*
Cease translocation of all nonnative predators to any fishery within the UCR.	States / Program	III.E.		X	X	X	*Implemented 2014 field season and beyond.*
The States will commit to remove northern pike and / or replace them with a Compatible (compatible with recovery) species (as identified in the Basinwide Strategy) throughout the UCR Basin. Specific waters will be targeted based on risk of escapement, opportunity and available resources.	States / Program	III.F.	States will convey this message in their Fishing Brochure / Guidebook starting in 2014				*CSU programmatic synthesis of northern pike removal efforts (Zelasko et al. 2014) recommended focusing on preventing emigration from reservoir escapement. CPW treated Paonia Reservoir in 2012. Elkhead Reservoir spillway net installed in September 2016, preventing northern pike escapement. CPW removed pike from Crawford in 2014 and 2015 and continues its intensive removal in Catamount Reservoir. CSU programmatic synthesis of northern pike removal efforts also recommended focusing on preventing in-river reproduction. CPW & FWS have removed pre-spawn northern pike in the Yampa River since 2014, removing a large portion of the adult population prior to reproduction. CSU monitored and removed northern pike from Steamboat*

River / Action	Responsible Entity(s)	New RIPRAP#	2013	2014	2015	Out years	PDO/MC update 3/2015
							Springs to Hayden in 2016. CPW performed habitat restoration projects near Steamboat to limit northern pike spawning habitat and is investigating work at Walton Creek confluence.
Implement 'must kill' regulations for northern pike throughout the UCR basin (exceptions may include waters where northern pike are being replaced by tiger muskie).	WY and UT	III.F.1.		X	X	X	*Complete in Wyoming and Utah in appropriate waters.*
Continue discussions concerning "must kill' regulations on northern pike throughout the UCR Basin to develop a proposal supported by law enforcement for regulatory consideration.	CO	III.F.2.	X	X	X	X	*CPW updated all west slope harvest regulations for northern pike to unlimited catch beginning April 2016. Colorado does not support must-kill regulations throughout the UCR basin in Colorado. However the State has implemented a number of alternative actions in concert with Program partners, such as angling tournaments (Elkhead & Stagecoach), habitat restoration (near Steamboat Springs), and intensive river removal in Yampa River backwaters and Colorado River off-channel gravel pits.*
Remove smallmouth bass and / or replace them with a Compatible species (as identified in the Basinwide Strategy) everywhere they occur throughout the UCRB (exceptions = McPhee Res., Lake Powell Res., and upstream of Flaming Gorge Dam; and 'containment' may prove to be a viable management option	States / Program	III.G.	States will convey this message in their Fishing Brochure / Guidebook starting in 2014				*CSU programmatic synthesis of smallmouth bass removal efforts (Breton et al. 2014) recommended focusing on preventing emigration from reservoir escapement. CPW treated Miramonte in 2013. Elkhead Reservoir spillway net installed in September 2016,*

River / Action	Responsible Entity(s)	New RIPRAP#	2013	2014	2015	Out years	PDO/MC update 3/2015
for smallmouth bass at Starvation Res.). Specific waters will be targeted based on risk of escapement, opportunity and available resources.							*preventing northern pike escapement. Program partners evaluating potential screening options for illegally introduced smallmouth at Ridgway Reservoir. Tri-County has operated Ridgway to prevent spilling since 2014. Starvation Reservoir screened since 2014 with a temporary structure. LMP and permanent screen in planning process. Rifle Gap screened since 2013. Juanita screened.* *CSU programmatic synthesis of smallmouth bass removal efforts also recommended focusing on preventing in-river reproduction. Program partners implement intensive coordinated removal effort at spawning locations and times. Bestgen & Hill (2016) recommend using flow patterns to harm young bass survival.*
Implement 'must kill' regulations for smallmouth bass throughout the UCR basin (see exceptions above).	WY and UT	III.G.1.		X	X	X	*Completed in Wyoming and Utah in appropriate waters.*
Continue discussions concerning "must kill' regulations on smallmouth bass throughout the UCR Basin to develop a proposal supported by law enforcement for regulatory consideration.	CO	III.G.2.	X	X	X	X	*CPW updated all west slope harvest regulations for smallmouth bass to unlimited catch beginning April 2016 (except McPhee Reservoir). Colorado does not support must-kill regulations throughout the UCR basin in Colorado. However the State has*

River / Action	Responsible Entity(s)	New RIPRAP#	2013	2014	2015	Out years	PDO/MC update 3/2015
							implemented a number of alternative actions in concert with Program partners, such as angling tournaments (Elkhead & Ridgway) and intensive river removal in the White, Yampa, and Colorado.
The States are dedicated to reducing burbot numbers through all means practicable (including targeted removal) throughout the UCR Basin. Current management practices (e.g., 'must kill' regulations; fishing derbies at Flaming Gorge) considered adequate.	States / USFWS	III.H.	States will convey this message in their Fishing Brochure / Guidebook starting in 2014				
Implement 'must kill' regulations for burbot throughout the UCR basin. Done in WY and UT. Wyoming and Utah implementing burbot bash; WY research projects.	WY and UT	III.H.1.	X	X	X	X	*Completed.*
Continue discussions concerning "must kill' regulations on burbot (as a preemptive measure) throughout the UCR Basin to develop a proposal supported by law enforcement for regulatory consideration.	CO	III.H.2.	X	X	X	X	*Burbot is a prohibited species in Colorado, making it illegal to stock or release.*
Promote increased production of sterile gamefish (e.g., hybrids, triploids), as Compatible sport fish.	Service / States / Program	III.I.	X	X	X	X	*Sterile walleye stocked at Red Fleet Reservoir after rotenone treatment, at Big Sand Wash to hamper illegally introduced population, and at Rifle Gap Reservoir to replace fertile population. Stockings guided by approved lake management plans. FWS, CPW, and UDWR are investigating research and technology to promote this technique.*

River / Action	Responsible Entity(s)	New RIPRAP#	2013	2014	2015	Out years	PDO/MC update 3/2015
Work with State Wildlife agencies and water user groups to increase awareness amongst States' legislatures and the courts of the ecological and financial ramifications of illicit introductions.	States and PDO via the Implementation Committee	III.J.	X	X	X	X	*Ongoing in all states. (WY reg changes (leg)); PDO spoke to Judicial College in Reno; raised at IC meeting Sep 2013.*
Yampa River (in addition to ongoing projects)							
Elkhead Reservoir – establish a compatible sport fishery		III.B.1.a.(2)(a)					*CPW completed new LMP for Elkhead, including replacing smallmouth bass with largemouth bass and not promoting northern pike. Largemouth stocked in 2016.*
Coordinate / schedule drawdown with Colorado River Water Conservation District (CRWCD)	CPW / Program / CRWCD	III.B.1.a.(2)(a)(i)	X				*Complete. Reservoir managed to assist in net installation in 2016.*
Develop / Implement Communications Plan	CPW / Program	III.B.1.a.(2)(a)(ii)	X				*Complete. Held public meeting in February 2015 and March 2016. Worked with local newspaper on multiple news stories.*
Complete necessary environmental compliance	CPW / CRWCD	III.B.1.a.(2)(a)(iii)	X	X			*Complete.*
Identify and secure sources of replacement compatible sport fish.	CPW	III.B.1.a.(2)(a)(iv)	X	X			*Complete. Largemouth bass stocked in summer2016 with help of local anglers.*
Treat reservoir and necessary habitats in the upper Elkhead Creek drainage.	CPW / Program / CRWCD	III.B.1.a.(2)(a)(v)		X			*Not pursued. Deferred in favor of screening first.*
Stock compatible sport fish	CPW	III.B.1.a.(2)(a)(vi)			X		*Complete. Largemouth bass stocked in summer2016 with help of local anglers.*
Evaluate / treat if necessary	CPW / Program / CRWCD	III.B.1.a.(2)(a)(vii)				X	*Success of screen in limiting escapement to be monitored. Harvest tournament held to promote removal of smallmouth bass and northern pike.*

River / Action	Responsible Entity(s)	New RIPRAP#	2013	2014	2015	Out years	PDO/MC update 3/2015
Walton Creek confluence area							
Evaluate feasibility of habitat modification to eliminate / reduce northern pike spawning habitat.	CPW / Program / BOR	III.B.1.d.(1)(b)(i)	X	X			*Feasibility Report Complete. Program contributed $30K Section 7 funds to feasibility report.*
Modify habitat as indicated through feasibility investigations.	CPW / Program / BOR	III.B.1.d.(1)(b)(ii)		X	X	?	*CPW working with local stakeholders and all seem supportive. $500K secured for modification from SCTF.*
Upper River (upstream of Hayden, CO)							
Increase mechanical removal of northern pike in main channel and floodplain habitats as directed by Colorado Parks and Wildlife.	CPW / Program	III.B.2.d.(1)		X	X	X	*Flows made work difficult to complete in 2015. Undertaken in 2016.*
Stagecoach Reservoir.							
Convert and extend the ongoing northern pike escapement study to a removal effort (will require an addendum to existing FERC Biological Opinion).	CPW / potentially Program in outyears	III.B.1.f.		X	X	X	*Stakeholders agreed to end the tagging portion of the escapement study (recaptures downstream will continue). CPW will remove all pike encountered under standard sampling (including tagged fish), but doesn't have resources to implement a Catamount style pike removal project (removal from Catamount being the higher priority).CPW is amenable to a Program-led removal project in Stagecoach, contingent on implementation details.* *CPW continues to remove pike from Catamount and also has plans to eradicate the illegally established population of northern pike in Chapman Res.*

River / Action	Responsible Entity(s)	New RIPRAP#	2013	2014	2015	Out years	PDO/MC update 3/2015
White River							
Determine and implement an adequate level of mechanical removal to reduce smallmouth bass.	CPW / Program	III.B.2.a.	X	X	X	X	*Program implementing as much mechanical removal as possible below Kenney Reservoir.*
Develop a measure of successful suppression of SMB	Program	General:III. B.2.a.(1)		X			*Pending. Sampling crews continue to remove as many fish as possible.*
Green River (in addition to ongoing projects)							
Direct new (or shift existing) nonnative fish removal efforts to address increasing numbers of walleye.	Program	III.A.4.d.	X	X	X	X	*Complete. Additional walleye removal work added in the middle Green, lower Green, and lower Colorado in 2015 and 2016.* *UDWR chemically treated Red Fleet Reservoir in October 2015 and restocked with a compatible sportfishery. Screen installation planned.*
Develop a management strategy to address escapement of walleye (and smallmouth bass) from Starvation Reservoir.	UDWR	III.A.4.e.	Dec., 2013				*UDWR produced a timely feasibility report for screening options and installed a temporary screen in spill channel during 2014, 2015 and 2016 runoff; included rotenone treatment of the stilling basin. . UDWR is revising the LMP in 2016 with plans for a permanent screen in 2017.*
Implement recommendations from the management strategy.	UDWR / Program	III.A.4.e.(1)		X	X	X	*Pending.*

River / Action	Responsible Entity(s)	New RIPRAP#	2013	2014	2015	Out years	PDO/MC update 3/2015
Colorado River (in addition to ongoing projects)							
Upstream of Grand Valley Project dam: Determine and implement an adequate level of mechanical removal in the main channel. More importantly, use all techniques available to eradicate northern pike (and other nonnative species of concern) from floodplain habitats.	CPW / Program	III.A.9.	X	X	X	X	*CPW implements adequate removal effort in river and has targeted off-channel gravel pits as a potential source of northern pike.*
Develop a measure(s) of successful suppressions of northern pike (and other nonnative species of concern).	Program			X			*Pending.*
Direct new (or shift existing) nonnative fish removal efforts to address increasing numbers of walleye in the lower river.	Program	III.A.8.	X	X	X	X	*Complete. Additional work being funded and undertaken in the lower Colorado River. UDWR completed Lake Powell LMP. Program investigating otoliths from captured walleye to determine possible emigration from Lake Powell*

Spread-sheet Line Number	Recovery Actions in Yampa Mgmt. Plan PBO	RIPRAP Item #	Status	PBO Page #
2	**LEGEND:** Items in red are part of the Terms & Conditions in the PBO. RPM = Reasonable and prudent measure; CM = Conservation measure; T&C = Terms & conditions.			
3	The Recovery Program will provide an annual assessment of Yampa River recovery actions.	General: VIIA7	Done annually as part of RIPRAP assessment	RPM: 68
4	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 nonnative 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.	General: VIIA7, IIIA2c; Yampa: IIIA1	Recovery actions are reviewed anually via RIPRAP assessment, which feeds into the Service's review of sufficient progress. Nonnative fish removal is reviewed annually and then the next season's nonnative fish management actions are modified as needed. Colorado revised the Yampa River Aquatic Management Plan in 2010 (see http://www.coloradoriverrecovery.org/general-information/program-elements/nna/YampaBasinPlan10262010.pdf). A comprehensive Upper Colorado River Basin Nonnative 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 (see http://www.coloradoriverrecovery.org/general-information/program-elements/nna/BASINWIDENNFSTRATEGYFeb2014.pdf). Colorado and water users convened a nonnative fish management work group that is developing recommendations for containing nonnative fish at their sources, changing regulations, and promoting a catch-and-keep outreach strategy. Project #140 to evaluate response of native fishes is ongoing and reports an increase in native species richness in Little Yampa Canyon and an increase in abundance of native fishes and their frequency in samples between 2008 and 2011. 2012 -2015 native fish numbers dropped precipitously compared to 2011, however. 2015 catches of native fish increased somewhat compared to 2014. Comparison of native fish frequency and abundance in a control and treatment reach suggested that both nonnative predator removals, as well as environmental effects due mostly to higher water, are responsible for gains, and increase in bass reproduction in 2012 and 2013 are responsible for declines. 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 nonnative predator abundances are reduced. Synthesis report planned for FY-17.	T&C 7: 70

Spread-sheet Line Number	Recovery Actions in Yampa Mgmt. Plan PBO	RIPRAP Item #	Status	PBO Page #
5	Provide and Protect Instream Flows			
6	Implement a base-flow augmentation plan on the Yampa River. (Implement augmentation protocol to meet flow recommendations through 5,000 af "Permanent Water Supply," and 2,000 af lease ["Shortterm Water Supply"] from enlarged Elkhead Reservoir).	Yampa: IB2a(2)(b)	The PBO brackets Elkhead releases between 78-138 cfs for July-Oct and 109-169 cfs for Nov-Feb. The minimum target was set at 134 cfs to recognize the variability in the Modde et al. 1999 datasets and to experiment with higher baseflow targets to assist with native fish recruitment and to hinder nonnative species. The 2014 Yampa River@Maybell May-July water supply forecast was 129% of average. Peak flow at Maybell was 13,100 cfs. Average flow August-October was 506 cfs, so only 1,578 af of Elkhead water releases (Jul 20 -23) to facilitate a final sampling trip for nonnative fish removal (939 af of the 1,578 af was purchased water carried over from 2013). The 200 cfs target was being met at Maybell, so the Recovery Program did not need additional water and 4,361 af was left in Elkhead for recreation. In 2015, Yampa River@Deerlodge Apr-Jul 2015 water supply florecast was 78% of average. Peak flow at Maybell was 7,540 cfs. August-October average flow was 215 cfs (half of the average in 2014) The entire 5000 af Elkhead pool was released. An additional 2,400 af was released the first half of October to lower the reservoir elevation to prepare for anchoring a net to prevent nonnative fish escapement. Water users convened a committee to resolve issues of protecting Elkhead Reservoir releases for endangered fish and administration/operation of the Maybell Ditch and developed a proposal for physical improvements and operational modifications. Program is providing $62,700 in Section 7 funds to install an automated gate to return Elkhead fish releases. The Colorado River Water Conservation District, Maybell Irrigation District, and the Yampa-White River Roundtable are providing an additional $134,675 for a headgate flume and canal improvements.	CM: 8
7	The Service will notify CRWCD of its intent to lease water in accordance with a three-tiered schedule	Yampa: IB2a(2)(b)	Done; see above.	CM: 10
8	The Recovery Program will monitor all new water depletion projects over 100 AF/year to determine impacts to peak flows on the Yampa River.	See next row.	See next row.	RPM: 68

Spread-sheet Line Number	Recovery Actions in Yampa Mgmt. Plan PBO	RIPRAP Item #	Status	PBO Page #
9	The Recovery Program will use the 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.	Yampa: IB3d	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 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 we are still examining our 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, do 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.	T&C 1: 69
10	Manage Nonnative Fish Populations			
11	The Recovery Program will continue efforts to minimize the impacts of nonnative fishes on the four listed fish species.	See below.	See below.	RPM: 68
12	Implement the Nonnative Fish Stocking Procedures	Yampa: IIIB2	Ongoing (and Procedures revised April 2009).	CM: 12
13	The Recovery Program will screen Elkhead Reservoir to minimize escapement of nonnative fishes.	Yampa: IIIA1a(2)	Screens were constructed on the outlet towers when reservoir enlargement was completed. The initial expense of this screen and need for ongoing maintenance demonstrate how fallible screens are and emphasize the point that no screen is a substitute for limiting stocking to species compatible with endangered fish recovery.	CM: 12
14	Prior to construction drawdown, screen existing outlet to prevent escapement of nonnatives through the outlet during draw-downs following spring runoff in 2005 and 2006. Divers will install rigid, wedge-wire screens with ¼-inch openings on the existing outlet prior to drawing down the reservoir.	Yampa: IIIA1a(2)	Done.	CM: 14
15	Prior to 2005 spring runoff, the existing spillway will be partially removed, effectively lowering the spillway crest elevation by about 19 feet. To prevent escapement of adult and subadult nonnative fishes, an 8-foot high, 85-foot long, ¼-inch mesh screen will be installed in the excavated channel leading to the spillway notch.	Yampa: IIIA1a(2)	A screen was installed in 2005, but it failed; nonnative fish removal was expanded in 2006 to compensate.	CM: 14
16	Following construction, operate controlled outlets in a manner which minimizes releases over the spillway. Up to 540 cfs will be discharged through the tower (450cfs) outlet and service outlet (90 cfs) during spring runoff. Flows over the spillway will occur only when inflows exceed 540 cfs.	Yampa: IIIA1a(2)	Outlet tower screens up to 540 cfs of spring runoff to reduce nonnative fish escapement from the reservoir, but the effectiveness of pre-spring releases to reduce spills are very limited in this system due to the capacity of Elkhead Reservoir relative to the size of the Elkhead Creek drainage. See next line.	CM: 14

Spread-sheet Line Number	Recovery Actions in Yampa Mgmt. Plan PBO	RIPRAP Item #	Status	PBO Page #
17	The Recovery Program will continue to monitor the escapement of fish from the spillway. The Biology Committee will develop criteria for an escapement threshold that would trigger a decision to screen the spillway and/or curtail stocking into Elkhead Reservoir.	Yampa: IIIA1a(1)	Specific criteria not developed, but escapement documented through the CSU programmatic smallmouth bass synthesis, which showed high smallmouth bass escapement rates both pre- and post- reservoir enlargement. (The estimate did not include un-tagged resident smallmouth bass which are presumed to escape at a similar rate.) Also, escapement of tagged northern pike from Elkhead Reservoir has occurred and an estimate of northern pike abundance in 2011 indicated a high density population of this species in the reservoir. The Recovery Program no longer translocates nonnative fish to Elkhead Reservoir and as of 2014, the Program ceased all translocation of nonnative predators to any fishery within the upper Colorado River basin. The high risk to endangered fish indicated analysis of nonnative fish escapement mandated an adaptive management response from the Recovery Program. Reservoir reclamation was contemplated, but CPW and PDO recommend screening first and a net was installed in September 2016.	CM: 14
18	All controlled releases of water will be screened. This will include installation of ¼-inch wedge-wire screens on all three of the tower intakes and the service intake.	Yampa: IIIA1a(2)	The enlarged Elkhead Reservoir and screens were fully operational beginning with spring runoff 2007.	CM: 14
19	Anchors for a spillway net will be installed while the reservoir is drawn down for construction. Future installation of a spillway net will be considered based on results of spillway escapement monitoring and nonnative fish control efforts in the Yampa River.	Yampa: IIIA1a(2)	Anchors were installed (and additional anchors added in 2016).	CM: 14
20	New water storage projects that have a sport fisheries component will comply with the NNSP (e.g., screening to prevent escapement and/or stocking restrictions) in the project design and specifications, if these measures are warranted based upon location and connectivity with the river.	General: IIIB2	No new water storage projects formally proposed at this point.	CM: 12
21	The Colorado Wildlife Commission approved removing bag and possession limits for northern pike statewide, and channel catfish , black bullhead (Ameiurus melas), walleye (Stizostedion vitreum), smallmouth bass, largemouth bass (Micropterus salmoides), green sunfish (Lepomis cyanellus), bluegill (L. macrochirus) and black crappie (Pomoxis nigromaculatus) in the Yampa and Green rivers in Colorado.	Yampa: IIIA1e	Complete	CM: 12

Spread-sheet Line Number	Recovery Actions in Yampa Mgmt. Plan PBO	RIPRAP Item #	Status	PBO Page #
			Translocation discontinued in most areas by 2013 and ceased entirely in 2014 (all nonnative fish are removed). CPW continues work at Catamount Reservoir to reduce northern pike and also is working with reservoir operaters and water owners toward a goal of eradicating the illegally-established pike population in Chapman Reservoir (negotiating a water trade that could allow them to draw down the reservoir to conduct analyses and treat the reservoir in September 2016). CPW removes all pike collected under standard monitoring at Stagecoach Reservoir. Ice fishing tournament at Stagecoach in February 2014 & 2015 required must-kill for northern pike and walleye. Two ice fishing tournaments were held winter 2016, both with mandatory harvest on pike and walleye. The first yielded no pike or walleye; results pending on the second tournament. During the 2015 sampling season, 1132 northern pike were handled and euthanized. Compared to 2014, this (critical habitat) river section yielded an overall increased catch per unit effort, almost entirely attributable to a strong 2015 northern pike age-class captured during late season electrofishing ("the Surge"). Based on 2015 capture data and growth rates, ~68% of all northern pike captured were from the 2015 year class. Ten northern pike were removed from the Yampa Canyon reach. Fewer smallmouth bass (5) and northern pike (154) were removed in 2015 than previous years; white suckers removed (2,123) was similar to previous years. Lower pike catch rates likely resulted from CPW gill netting removal shortly before electrofishing began. LFL began pike removal from Steamboat to Hayden in 2015. Intitial population estimates were 215 northern pike in the reach (95% confidence interval placing between 51 and 379 pike in the reach). LFL removed 91 pike or 42% of the estimated population on two removal passes using raft electrofishing. Population estiamates seem to indicate pike numbers similar to those in mid-2000s.	CM: 13-15
22	Remove and translocate northern pike and smallmouth bass.	Yampa: IIIA1b&d		

Spread-sheet Line Number	Recovery Actions in Yampa Mgmt. Plan PBO	RIPRAP Item #	Status	PBO Page #
23	Lethal removal of channel catfish and smallmouth bass from Yampa Canyon	Yampa: IIIA1c(1)&d	Channel catfish >400mm are removed as part of smallmouth bass removal efforts in Yampa Canyon. Efforts to reduce smallmouth densities in Little Yampa Canyon and other reaches of the river appear to be hampered by the immigration of smallmouth bass adults and recruits from adjacent reaches, particularly upstream sources which sustain propagule pressure and the proliferative/invasive capacity of this species. Population estimates for adult bass in Little Yampa Canyon in 2015 were 611 adult smallmouth bass (284—938, 95% CI) and 4,265 sub-adult smallmouth bass (200—8,330, 95% CI). Estimated adult population is approximately 75% less than estimates the previous two years. Subadult density in this reach remains high. Catch rates of juveniles and sub-adults in Upper Maybell increased dramatically: juvenile captures increased seven-fold and sub-adult increased eight-fold from 2014 to 2015. Crews interested in working in more areas in Upper Maybell to target this population. 2015 catch rates were down in Yampa Canyon compared to 2014 levels. 2016 work will continue to intensify smallmouth bass removal / nesting disruption further into the spawning period (e.g., sampling schedules being extended to exploit smallmouth bass in post-peak flows on the Yampa). Smallmouth bass produced strong year classes in 2012 and 2013.	CM: 13-15
24	The Recovery Program will continue to coordinate a targeted public outreach program to inform local stakeholders of the nonnative fish management activities and to educate anglers.	See below	See below.	RPM: 68
25	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.	General: VIC	Signs targeting anglers posted at key locations along the Yampa include drawings of the fish & info. about returning them to the river alive. The Recovery Program prepared a comprehensive communications plan to raise public awareness of the purpose and nature of nonnative fish management and annually informs stakeholders and the public of nonnative fish management activities. The I&E Committee helped draft theoutreach section in the Upper Colorado River Basin Nonnative and Invasive Aquatic Species Prevention and Control Strategy. The Recovery Program worked with the River District 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. Program and CPW are maintaining consistent community outreach for this project, which will include outreach during post-net stocking. Outreach is a key component of the actions recommended by the nonnative fish management work group convened by Colorado and water users to achieve the goals of the Upper Colorado River Basin Nonnative and Invasive Aquatic Species Prevention and Control Strategy in the Yampa Basin. CPW held angler tournament to reduce smallmouth bass in Elkhead in 2016.	

Spread-sheet Line Number	Recovery Actions in Yampa Mgmt. Plan PBO	RIPRAP Item #	Status	PBO Page #
26	Within one year of the issuance of this biological opinion (that is, by Jan. 10, 2006), 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.	Green: VC1&2; Green: VB1; Yampa: VA;Green: IVA1d; Yampa: IVA1b	Results from the the 2011–2013 Colorado pikeminnow population estimates indicate adults and sub-adults are in decline throughout the entire Green River sub-basin, reinforcing concerns that competition and predation from nonnatives, especially in the Yampa River, must be reduced. Encouraging numbers of age-0 pikeminnow were seen in the middle and lower Green rivers in 2015, yielding 202 YOY and 461 YOY, respectfully. Antenna arrays were deployed to spawning bars in the Yampa River; 25 Colorado pikeminnow detected at Echo Park Bar and 61 detected at Cleopatra's Couch in 2015. Humpback chub in Yampa Canyon and immediately downstream in Whirlpool Canyon are considered extremely rare. Continued effort to control nonnative fish (primarily smallmouth bass and northern pike) is the highest priority threat removal action at this time. Deso-Gray adult humpback chub declined in the early 1990's, but have remained fairly stable since. Antennas deployed during razorback sucker spawning in 2015 and detected 582 tagged razorback sucker, 5 bonytail, and 9 Colorado pikeminnow (majority of fish detected had not been otherwise captured in active sampling).	RPM: 68
27	The Yampa River has seen recent declines in populations of all native fish species. In 2006, the Recovery Program will examine the results of the ongoing native fish population response study and determine if there has been an increase or decrease in native fish populations in the Yampa River associated with ongoing nonnative fish control actions.	General: IIIA2c	Project #140 to evaluate response of native fishes is ongoing and reports an increase in native species richness in Little Yampa Canyon and an increase in abundance of native fishes and their frequency in samples between 2008 and 2011. 2012 -2015 native fish numbers dropped precipitously compared to 2011, however. 2015 catches of native fish increased somewhat compared to 2014. Comparison of native fish frequency and abundance in a control and treatment reach suggested that both nonnative predator removals, as well as environmental effects due mostly to higher water, are responsible for gains, and increase in bass reproduction in 2012 and 2013 are responsible for declines. 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 nonnative predator abundances are reduced. Synthesis report planned for FY-17.	T&C 6.b: 70
28	The Recovery Program is conducting pikeminnow population estimates for 2000–2003 for the Green River subbasin. This includes population estimates for the Lower Green, Middle Green, White and Yampa rivers. These estimates will be used to determine existing conditions for the purposes of a population response. The Program is also conducting estimates of the Desolation-Gray and Yampa Canyon populations of humpback in the Green River subbasin. The next estimate will be conducted for the years 2006–2008. The population response criteria will use these population estimates to determine a positive response or a significant decline. Evaluations of stocked razorback and bonytail will be used to develop population criteria for these species.	Green: VC1&2; Green: VB1; Yampa: VA;Green: IVA1d; Yampa: IVA1b	See row 26.	T&C 6.c: 70

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29	The Yampa River contains one of two major spawning areas for the Colorado pikeminnow documented by collection of larval fish. 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.	Green: VC1&2	Larval reproduction has been documented every year and sampling continues (see graph). 2,515 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).	T&C 6.d: 70
30	Recruitment to the adult population is an important factor in determining population trends. Therefore, recruitment rates will be incorporated into the population response criteria.	Green: VC1&2	Draft 2011–2013 Green River basin Colorado pikeminnow population estimate report (Bestgen et al 2016) indicates 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 recruit or juvenile abundance has been made for the Yampa River population due to poor catch rates of fish ≤450mm. 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.	T&C 6.e: 70
31	In addition, the status of nonnative fish populations will be used to assess the effectiveness of nonnative fish control activities in reducing the abundance of nonnative 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 nonnative fishes.	See below.	The Recovery Program tracks densities of nonnative predators via the following projects: for northern pike (Projects 98a, 98b, and 98c); and for smallmouth bass (Projects 125 and 110). Native fish populations are tracked via Projects 140 and 128). In the Service's 2012–2013 Sufficient Progress letter, the Regional Director recognized that downlisting Colorado pikeminnow needed to be delayed in large part because of an imbalance in large-bodied predators in the Yampa River. The Regional Director instructed the Program Director's Office and the States to develop a list of nonnative fish control actions to be completed in the next three years that would most likely result in a positive change in this nonnative versus native predator imbalance. Those nonnative fish control actions were incorporated into the Program's RIPRAP in early 2014.	RPM: 68
32	One major element of the proposed action is to implement nonnative fish control measures in the Yampa River. Therefore the Service is anticipating a significant reduction in the nonnative fishes in the Yampa River, especially smallmouth bass and northern pike. Data from the nonnative control program will be examined annually with the first data synthesis expected in 2006 to determine if there has been a depletive effect in nonnative fish populations in the Yampa River.	General: IIA2c1&2	See rows 22 and 23, above. Data are reviewed annually. Programmatic syntheses / evaluation of the Recovery Program's approach to northern pike and smallmouth bass control have been completed.	T&C 6.a: 70
33	CDOW 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.	NA	Complete and revised in 2016.	T&C 4: 69
34	Restore Habitat			

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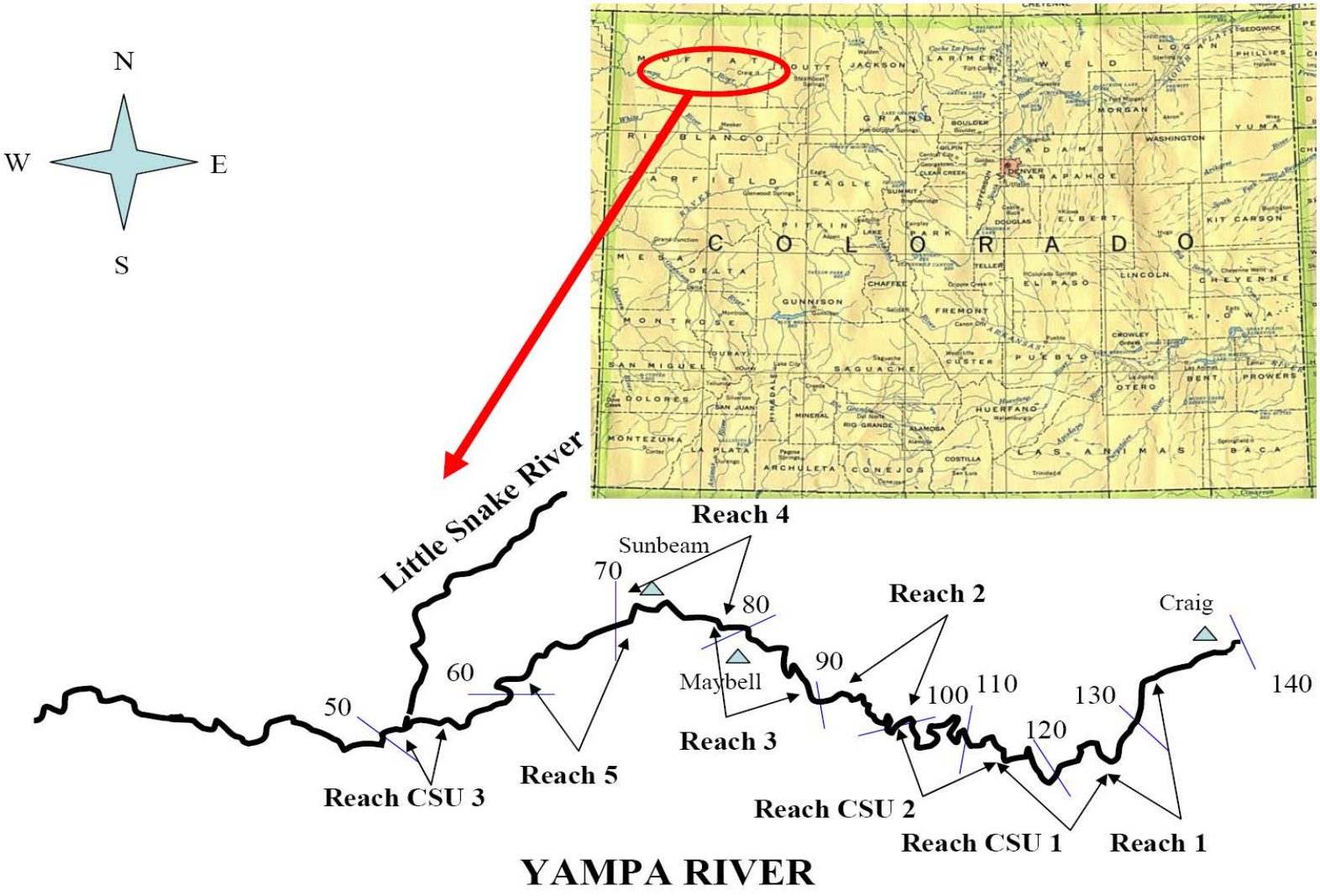
			Ongoing. The Green River Larval Trigger Study Plan was finalized in March 2012 and Flaming Gorge operations have been coordinated with the larval trigger program with positive results. 2015 was moderately dry with a peak target of 8,300 cfs for 7 days. Actual peak was 14,900 cfs with 2 days above 14,000 cfs measured at Jensen, and 40 days above 8,300 cf during larval presence, providing fish access to the Stewart Lake, Escalante, and Johnson Bottom floodplains. Larval razorback emergence in the Green River was observed on May 7, 2015, over a week earlier than ever recorded. Reclamation began stepping up releases from Flaming Gorge Dam on 11 May 2015. Using floodgate structures to control flows, Stewart Lake was nearly filled to capacity in 2015 during the larval drift period. UDWR returned 87 razorback sucker to the Green River during drawdown of Stewart Lake. Under an increasing number of hydrologic scenarios, Stewart Lake continues to demonstrate the potential of managed wetlands for razorback sucker recovery under the Larval Trigger Study Plan. Johnson Bottom connected during LTSP flows which provided approximately 5.5 feet of depth in the wetland. Larval razorback sucker were confirmed after the inlet gates were closed and young fish were verified later in the summer. Supplemental water was added to the wetland in late summer to enhance habitat conditions. During draining of Johnson Bottom, 2 adult bonytail were detected, but no razorback sucker were encountered.	CM: 15
35	Acquire and enhance floodplain habitats along the Green River			
36	Restore/maintain native fish passage at diversion structures		No remedial action is required to facilitate fish passage at any existing diversion structures, as currently constructed and operated.	CM: 16
37	Recovery Program will provide written guidelines for construction of any new/modified diversions and other structures in critical habitat on the Yampa River to facilitate fish passage and to minimize impacts inherent to their routine maintenance. Guidelines will describe specific parameters for fish passage, such as minimum depth and maximum slope/rise and velocity. The incremental construction cost, if any, will be borne by the Recovery Program if structures were in service on or before January 22, 1988, regardless of whether such modifications allow diversion of more water than they had historically. If structures were placed into service after January 22, 1988, the incremental costs of passage would have to be borne by the project proponents.	NA	Service needs to develop guidelines (using thresholds for passage as identified in Yampa Management Plan). Currently, no new/modified diversions proposed.	CM: 16
38	Evaluate/remediate entrainment of endangered fishes by diversion structures	See below.	See below.	CM: 16

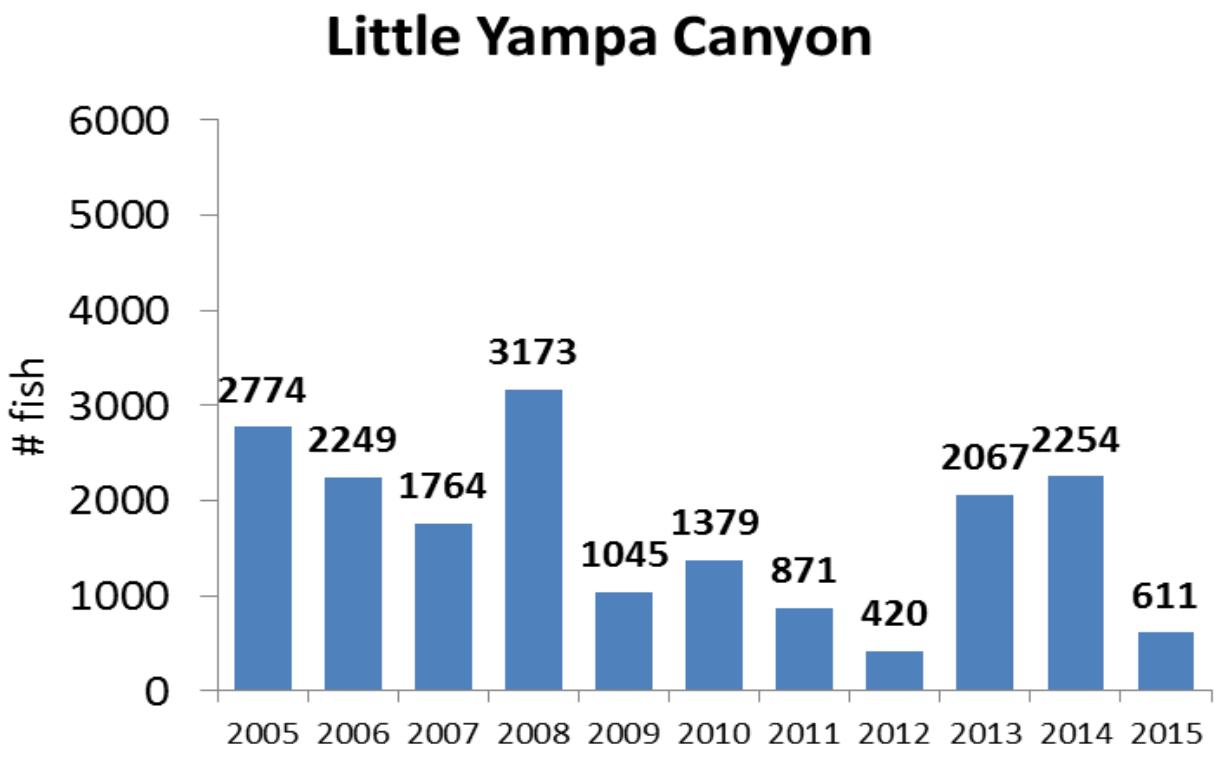
Spread-sheet Line Number	Recovery Actions in Yampa Mgmt. Plan PBO	RIPRAP Item #	Status	PBO Page #
39	CM: Develop plan to evaluate CPM entrainment in existing diversion canals. Plan will evaluate & minimize potential incidental take due to entrainment. RPM: Program will eval. level of incidental take due to entrainment of CPM by diversion canals within critical habitat on the Yampa. T&C: Program will develop plan to monitor the amount of take by 12/31/05, and add it to the RIPRAP. Specific implementation elements and timing will be determined in the plan. At minimum, and as an initial effort, assessment will involve survey of Maybell Canal, after the end of the irrigation season. Survey will evaluate take and, if any endangered fishes found, salvage 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. 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. Evaluation of take will include recommendations for minimizing take at diversion canals in critical habitat.	Yampa: IIA2a	Hawkins (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.) work 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 can 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.	CM: 16; RPM: 68; T&C 2: 69
40	CM: If native fish are found to enter irrigation canals or other diversion structures, the Recovery Program initially will salvage any native fish found alive and return them to the river. Unless initial investigations establish that endangered fish do not enter the canals or enter only with very low frequency, the Program will develop a plan to remediate this potential problem, which could include annual fish salvage operations or installation of fish preclusion devices on the problem structure(s). RPM: 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. T&C: If found appropriate in the evaluation and after approval by the Service, the Recovery Program will implement one or both of the following: i. Design and construct fish preclusion devices to prevent or reduce adult and subadult fish (>300 mm TL) from entering diversion canal(s).ii. 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.	Yampa: IIA2b	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 nonnative fish control actions identified in the RIPRAP addendum (as required in the 2012–2013 Sufficient Progress memo) in a timely manner.]	CM: 16; RPM: 68; T&C 3: 69
41	Manage genetic diversity/augment or restore populations			
42	CDOW developed a plan to stock bonytail in the Yampa and Green rivers in Colorado. This stocking plan was revised in 2001 (CDOW 2001). Restoring bonytail through stocking above Lodore Canyon on the Green River and within the lower reaches of the Yampa is a high priority for the CDOW. Stocking began in 2000, with a total of 23,000 juvenile bonytail stocked to date in the Green River near Brown's Park, Colorado, and in the Yampa River near its confluence with the Green River at Echo Park. Both sites are within Dinosaur National Monument (DNM), and stocking is carried out by the CDOW with the cooperation of the National Park Service (NPS).	Yampa: IVA1a1; Green: IVA1c	The Recovery Program continues to stock tagged bonytail subadults in the Green and upper Colorado River subbasins (see graphs). CPW received permission from Hell's Canyon Ranch (former Mantle Ranch) owners for access for stocking bonytail (2,700 stocked 9/7/16) and bonytail have been stocked directly to the Yampa at Deerlodge Park.	CM: 17
43	The State of Utah stocks razorback sucker to the Green River below Split Mountain to supplement the Middle Green/Yampa population. This activity also is a high priority for the Recovery Program.	Green: IVA1c	The Recovery Program continues to stock tagged razorback sucker with considerable success (see graphs).	CM: 17
44	Monitor Populations and Habitat			

Spread-sheet Line Number	Recovery Actions in Yampa Mgmt. Plan PBO	RIPRAP Item #	Status	PBO Page #
45	The Recovery Program will monitor adult pikeminnow, razorback and humpback 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. Endangered fish population data will be collected fortuitously during nonnative fish management activities; conversely, the status of nonnative fish populations also can be monitored in conjunction with endangered fish population surveys to make the most efficient use of the Recovery Program's limited resources.	See above.	See monitoring under nonnative fish management, in rows 28–29, above.	CM: 17
46	A substantial decline in numbers of nonnatives fishes is presumptive evidence of a benefit to the endangered fishes; however, to confirm that nonnative fish management has, in fact, achieved the desired benefits for native species, it will be necessary to examine populations of the endangered fishes, and/or surrogate native species, such as roundtail chub and flannelmouth sucker, which suffer similar impacts due to competition and predation by nonnatives. An increase in their overall abundance, especially younger, smaller life stages, would be indicative of reproduction, larval survival, and potential recruitment into the adult populations, thereby allowing the endangered fish populations to become self-sustaining.	See above.	See monitoring activities discussed under nonnative fish management, in rows 27–29, above. Service is monitoring the pikeminnow spawning bar and Echo Park razorback sucker spawning bar with remote antennas and have detected both species at both of these locations in the Yampa River. Native fish monitoring occurs during Yampa Canyon nonnative fish removal (detecting mostly flannelmouth and bluehead suckers and roundtail chub) and researchers have evidence that Green River roundtail chub are moving into the Yampa River to spawn.	CM: 17-18
47	The Recovery Program will coordinate with the U.S. Geological Survey (USGS) to review and compile past data at the priority sites and begin collection of suspended sediment data at USGS stream flow gages on the Green River at Jensen, Utah, and on the Gunnison River at Whitewater, Colorado. Other sediment sampling stations will be added as additional funding becomes available. Based on the results of the USGS data the Recovery Program will design and implement a long-term basinwide habitat monitoring program.	General: IA4b; Green: ID	Sediment monitoring work 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 at the Green River near Jensen. In FY 06, 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 FWS 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 PD's office convened a panel of fish biologists geomorphologists to review findngs of the Project 85f report and develop research / management recomendations 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 will be implemented in FY17, which will expand an existing sediment monitoring network in the Yampa River (established and currently funded by NPS and USGS) into the Green River.	CM: 18

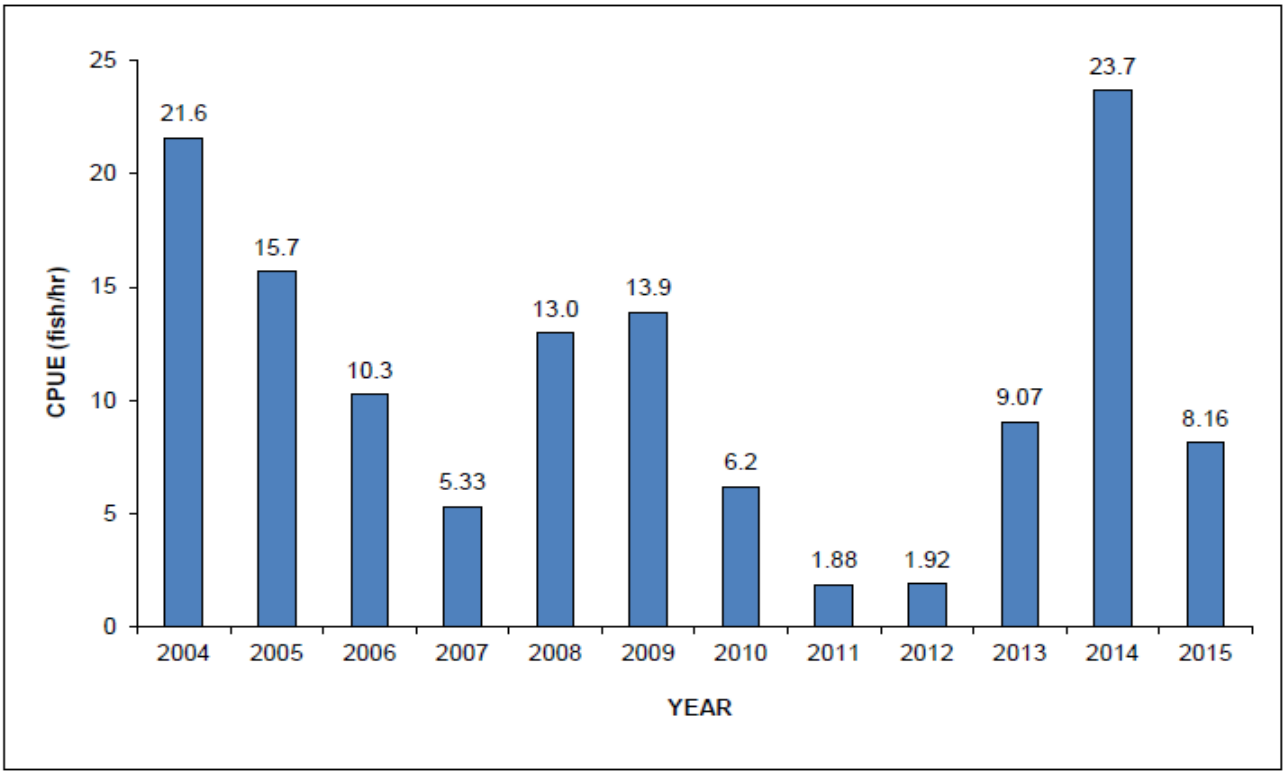
Yampa River Map



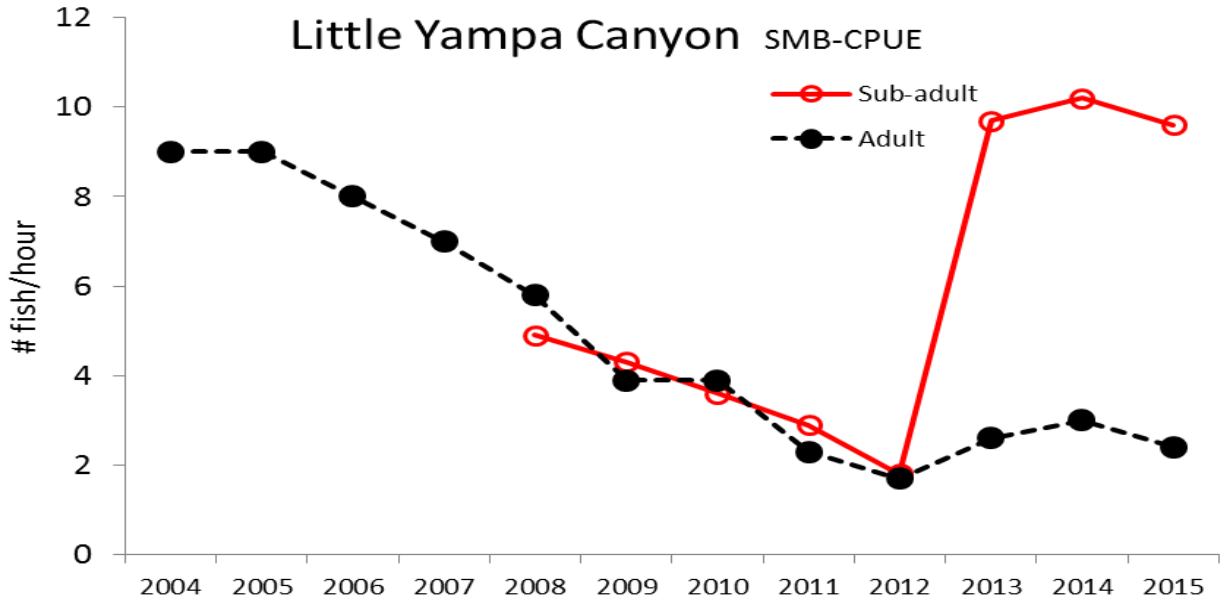
NONNATIVE FISH



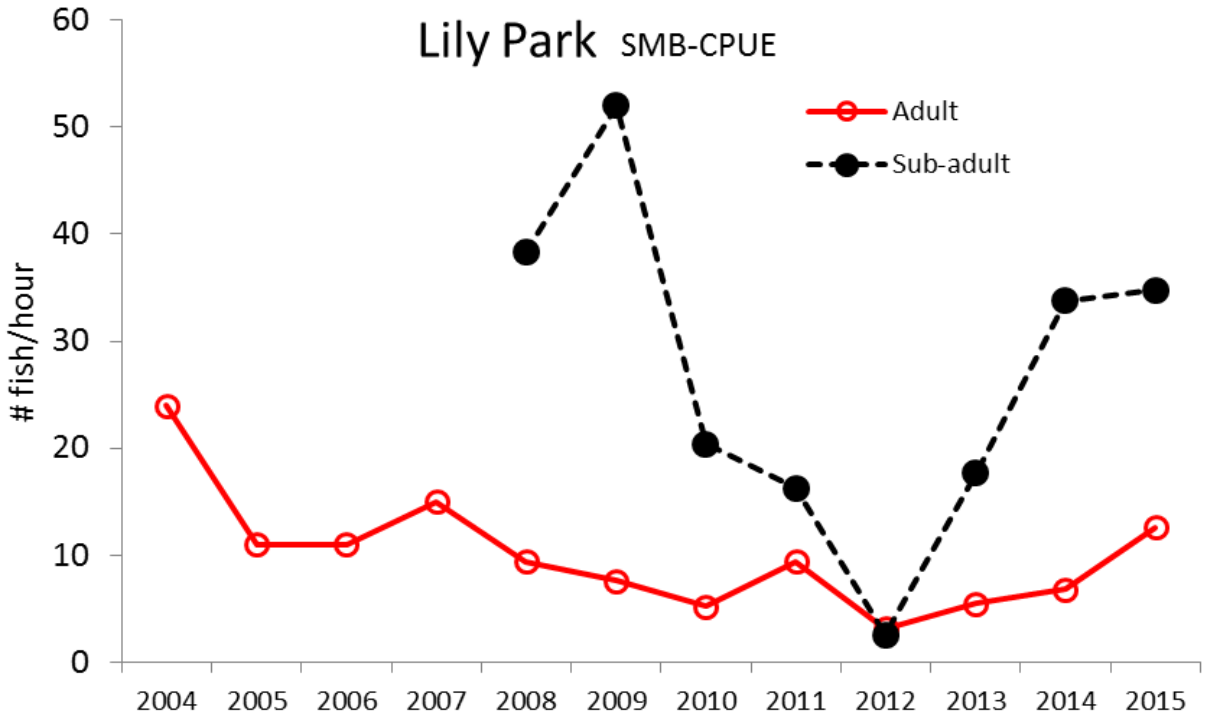
Estimated abundance of adult smallmouth bass(≥ 200 mm) in Little Yampa Canyon in the Yampa River, 2004–2015. (J. Hawkins, Project#125 annual report.)

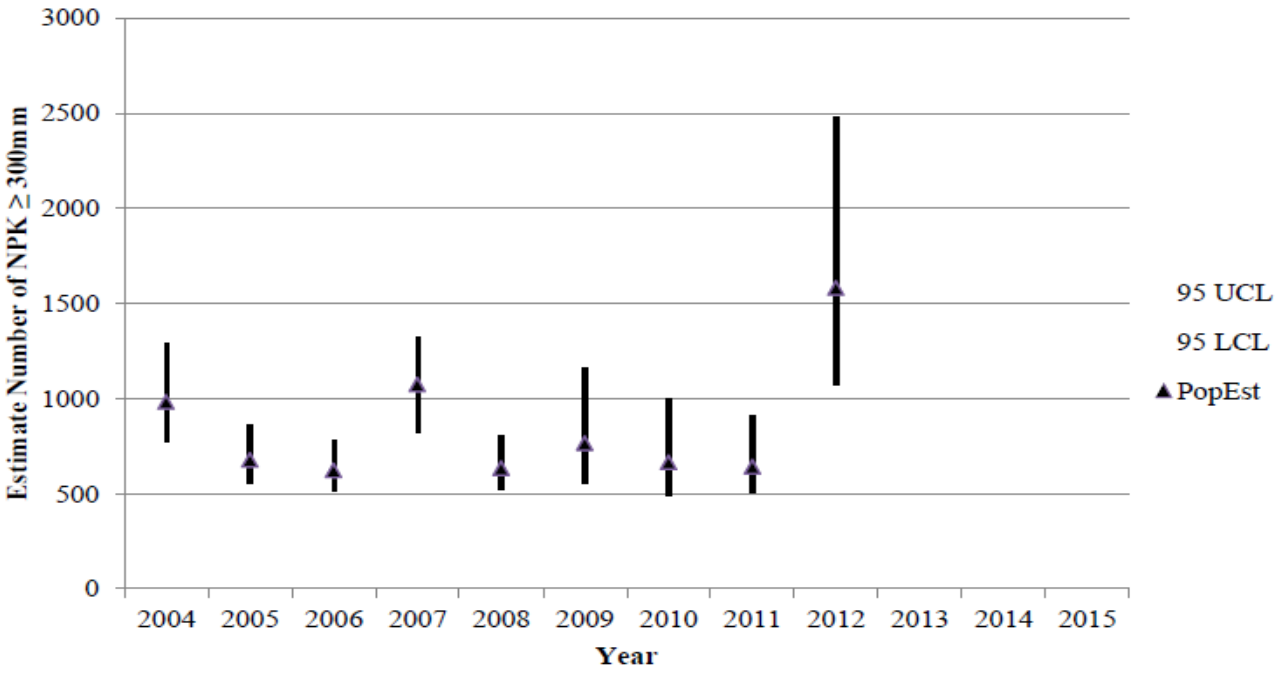


Yampa Canyon overall catch rate for smallmouth bass ≥100mm for all passes combined, 2004–2015 (T. Jones, Project #110 2015 annual report)

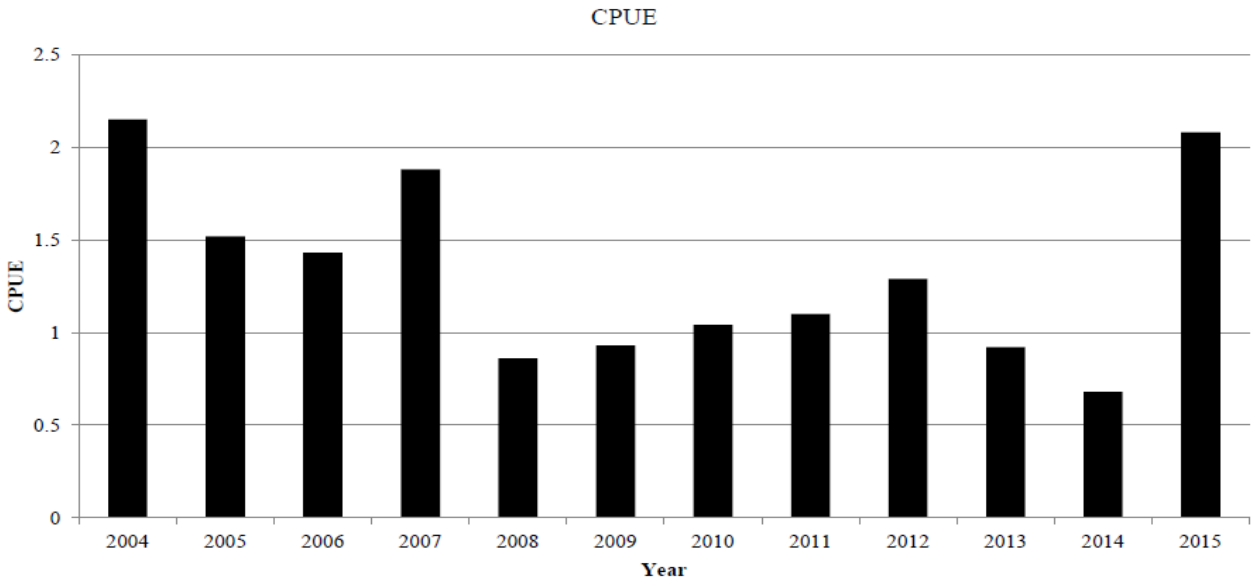


Number of adult (≥200 mm) smallmouth bass captured per hour of boat electrofishing in two reaches of the Yampa River, 2004-2015. (J. Hawkins, Project#125 annual report.)

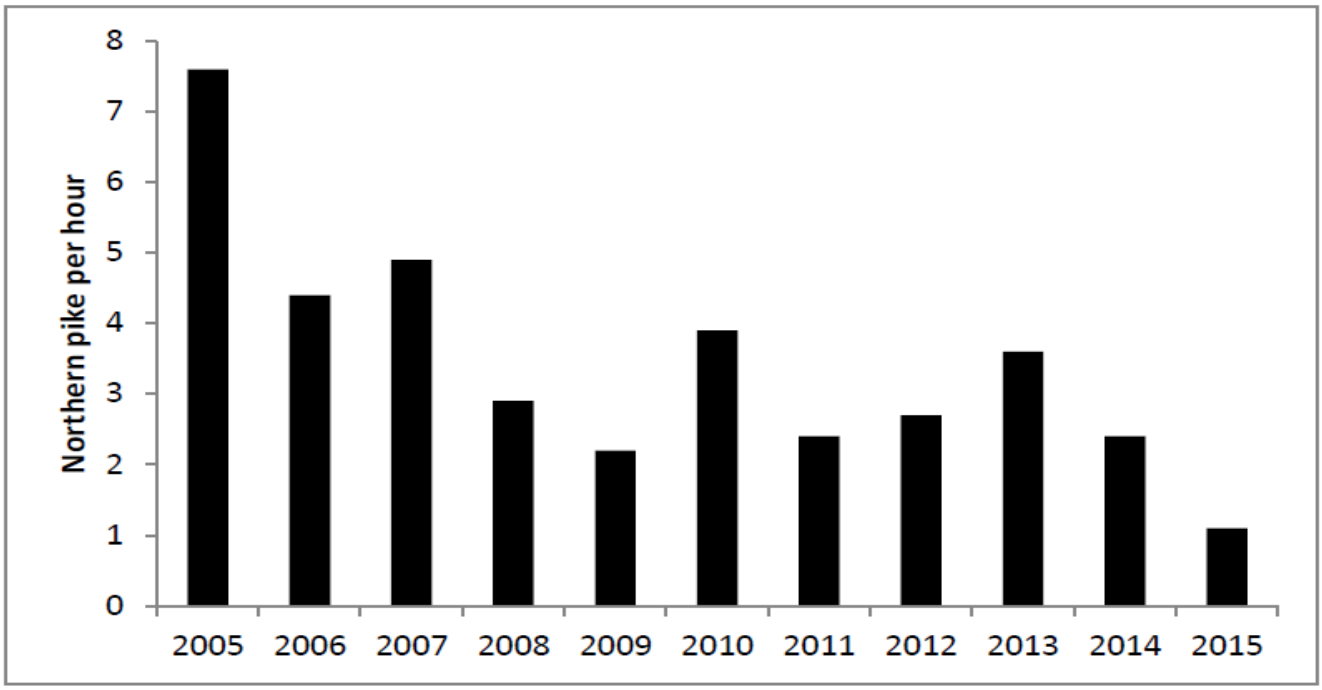




Yampa River northern pike ≥300 mm TL population estimates and 95% confidence interval, river mile 134.2 to 50.5 (no 2013–2015 population estimates as no marking passes conducted [all pike euthanized]). K. Battige, Project #98a 2015 annual report.

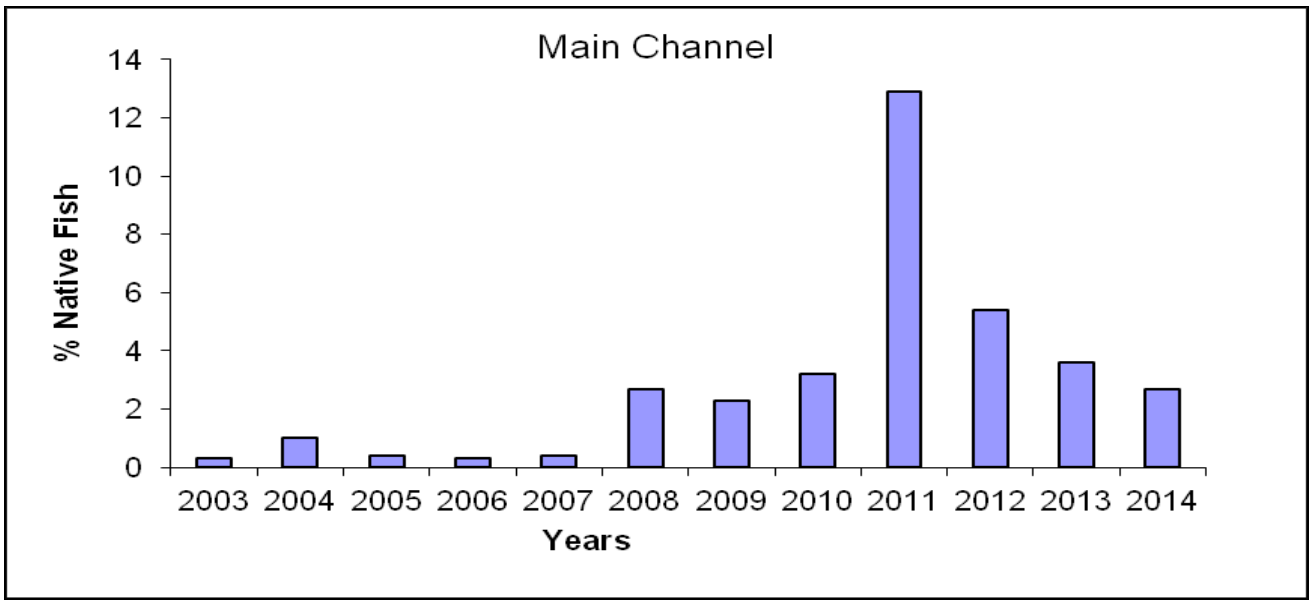


Northern pike catch per unit effort (CPUE; number of NPK/hour) across all passes in entire study area sampled by CPW and CSU, 2004 through 2015. (K. Battige #98a 2015 annual report.)

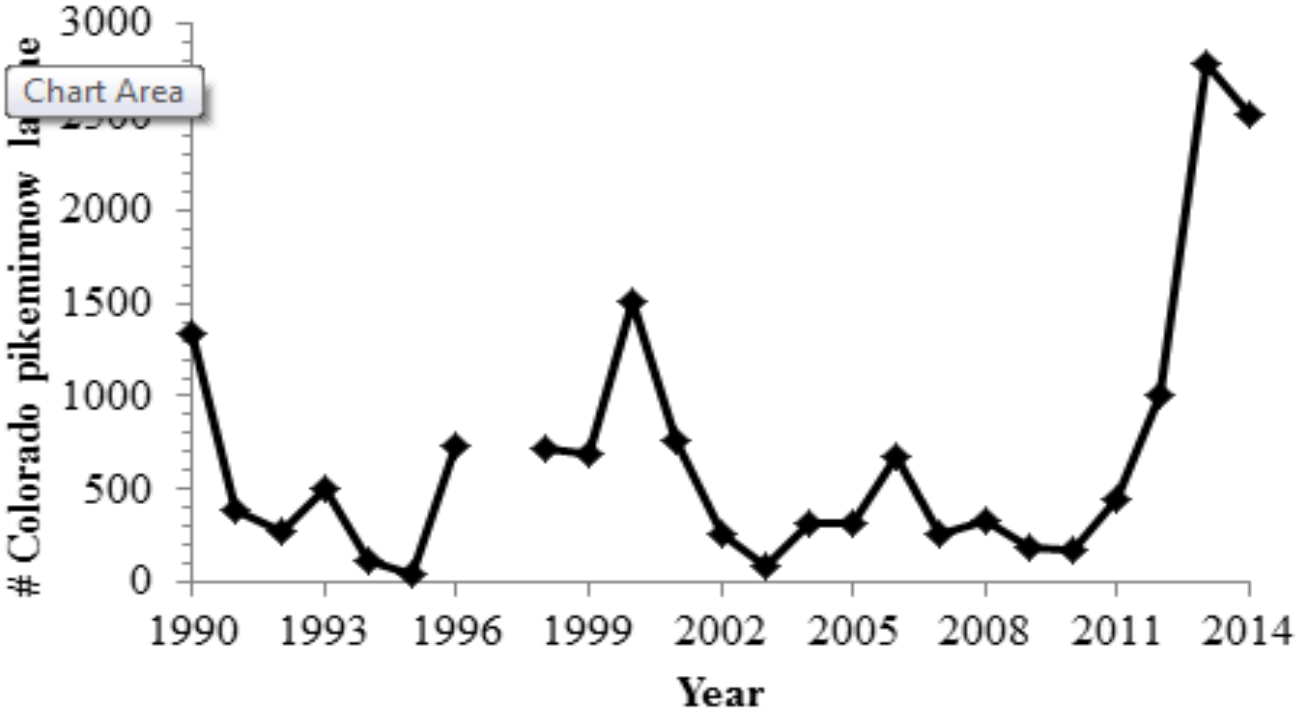


Overall northern pike catch rates by hour, 2005-2013. (C. Smith, project #98b 2015 annual report)

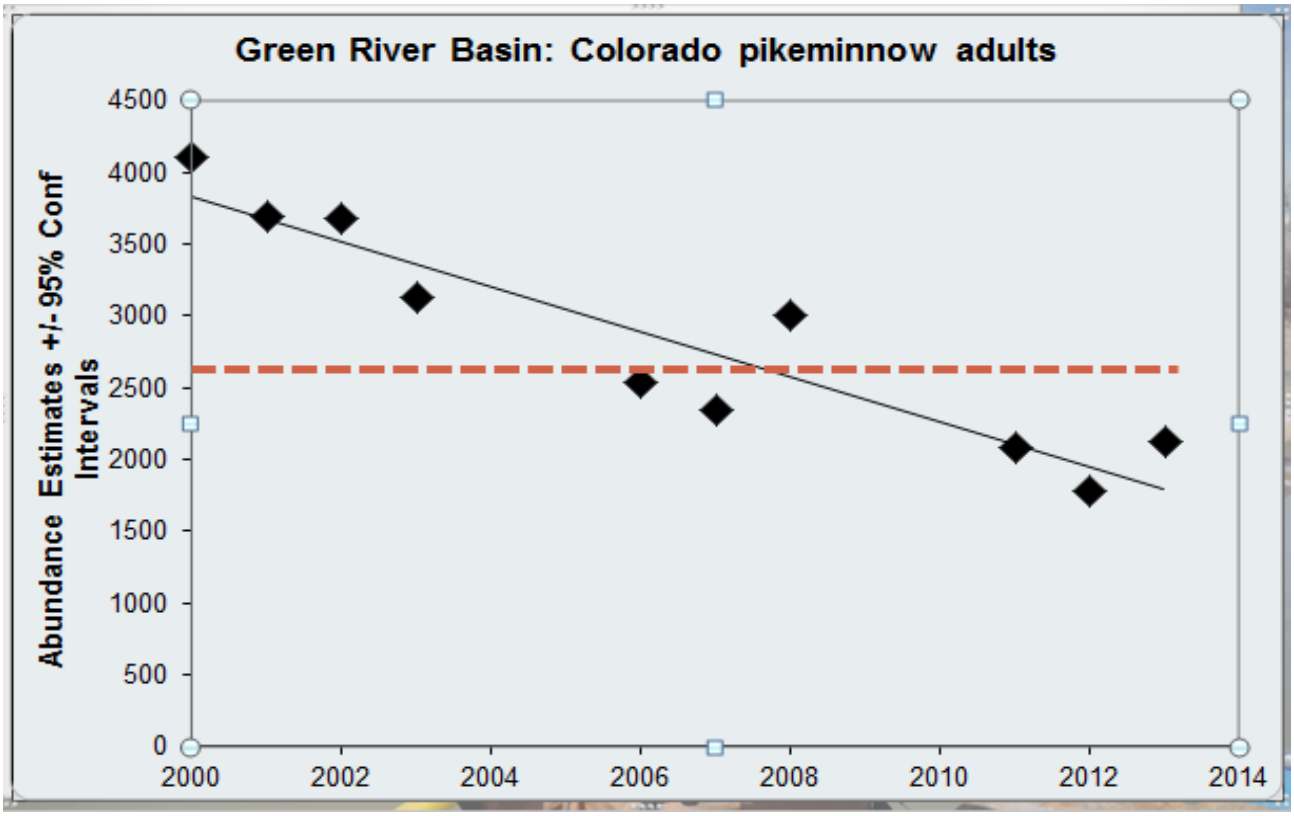
NATIVE FISH



Percent composition of native fishes in the Yampa River, 2003–2014, in samples collected from the main channel in Little Yampa Canyon. (K. Bestgen, Project #140 2015 annual report.)



Number of Colorado pikeminnow larvae captured from 1990 to 2014 in the lower Yampa River, Colorado, during summer in drift nets. (K. Bestgen, Project #22f 2015 annual report.)

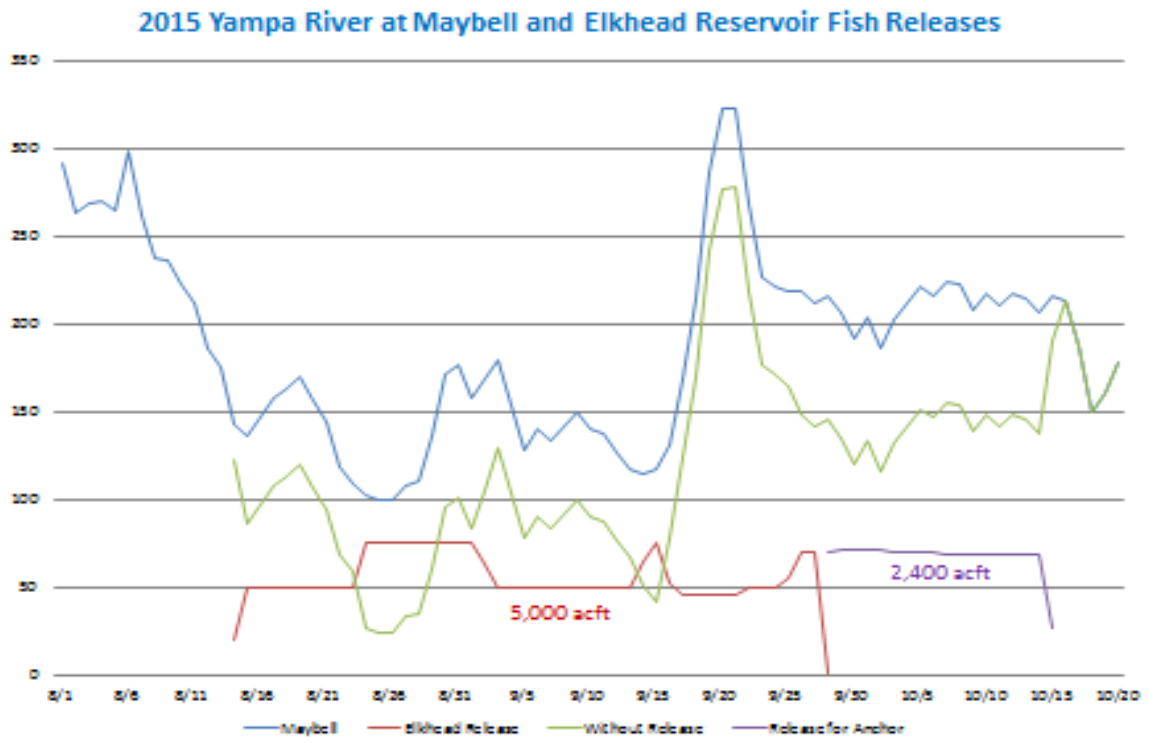


Green River Basin Colorado pikeminnow adult population estimates.

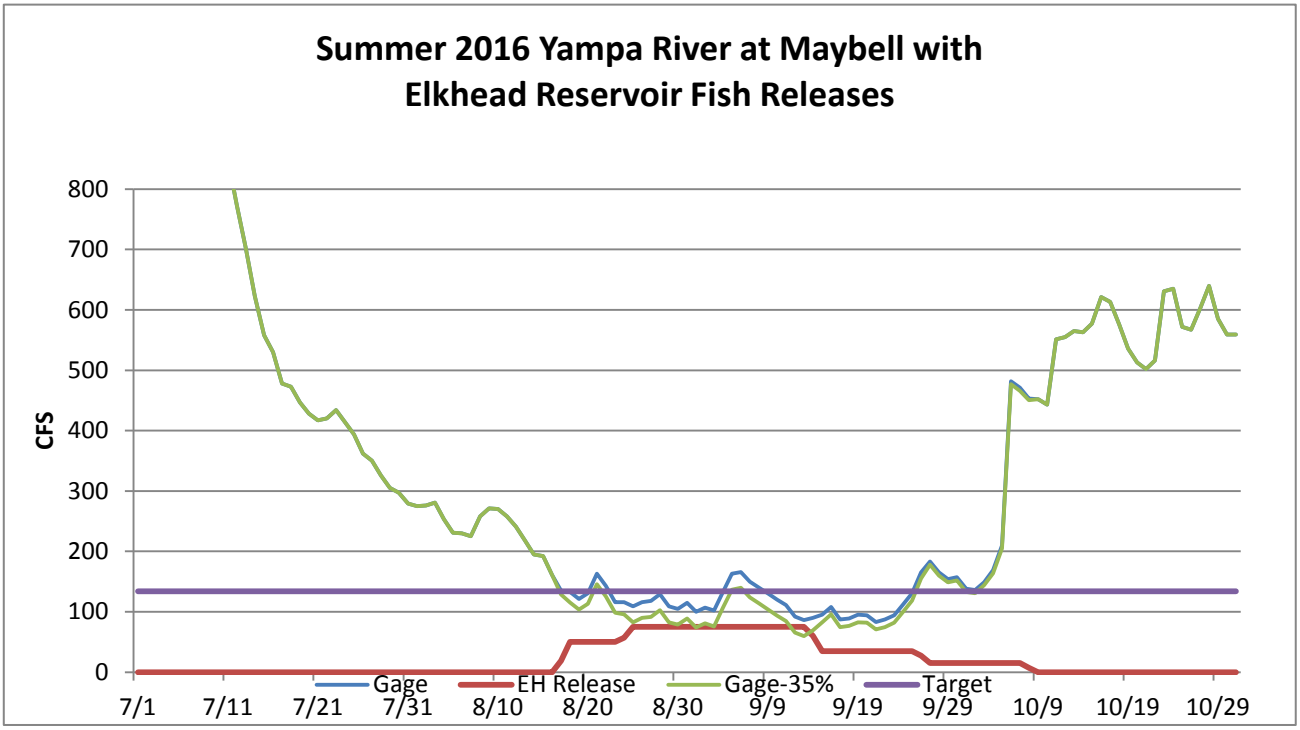
Razorback sucker stocked by river				
Facility	**River**	**Stocked**		
Grand Valley	Upper Colo	2,673		
	Gunnison	492		
Ouray	Middle Gre	5,892		
Bonytail stocked by river				
River	**Grand Valle**	**Ouray**	**Wahweap**	**Mumma**
Middle Green		10,131	4,439	2,713
Lower Green			4,479	
Colorado	11594		4,509	2,780

2015 native fish stocking

STREAMFLOW



In July, August and September of 2013, there were 4 days below 93 cfs and 21 days below 134 cfs.



2015 peak flows and baseflows vs Recovery Program

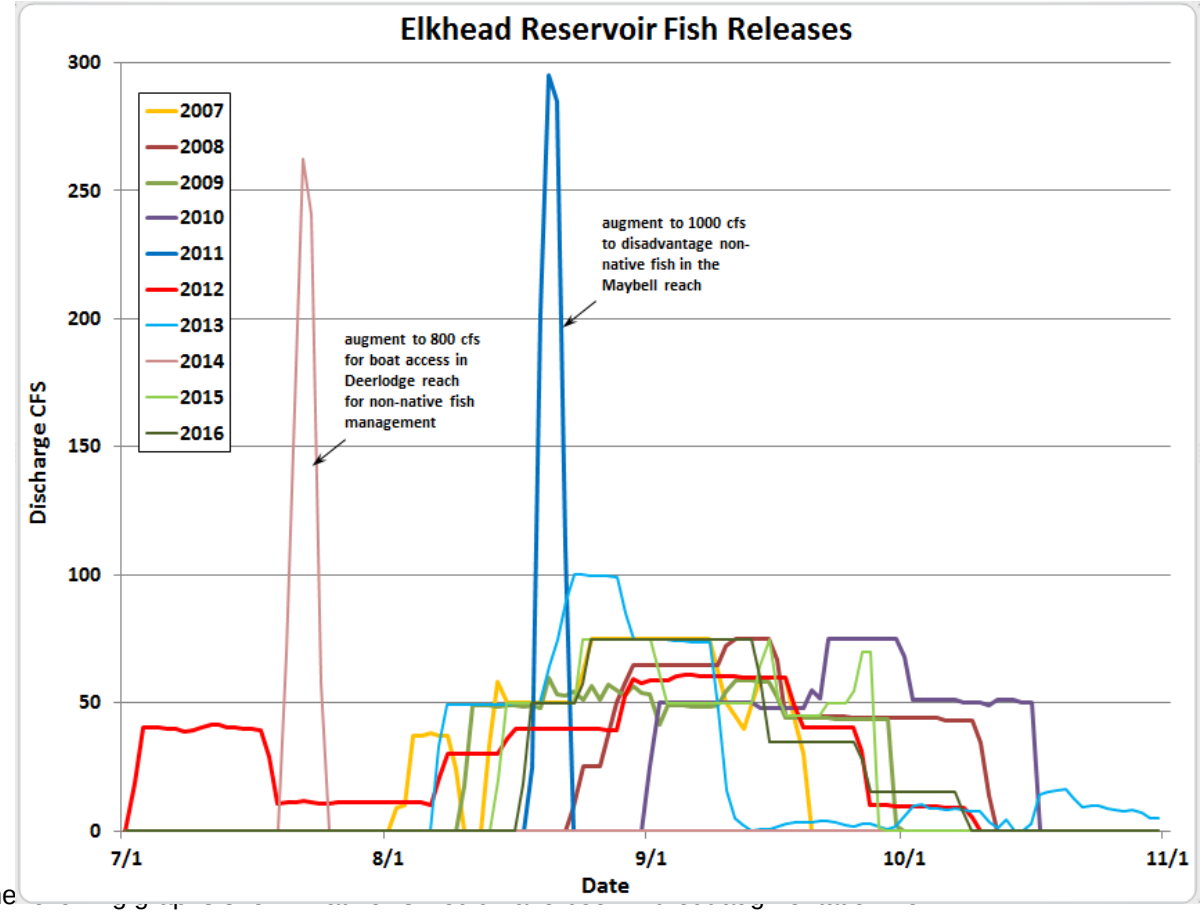
2015 (%snowpack)	Peak Target	2015
Yampa R. at Maybell (72%)	N/A	7,540 cfs

2015 (%snowpack)	Base Flow Target	2015 Aug-Oct AVG	%	2015 Min.
Yampa R. at Maybell	Wet 200 cfs	215 cfs	66%	115 cfs

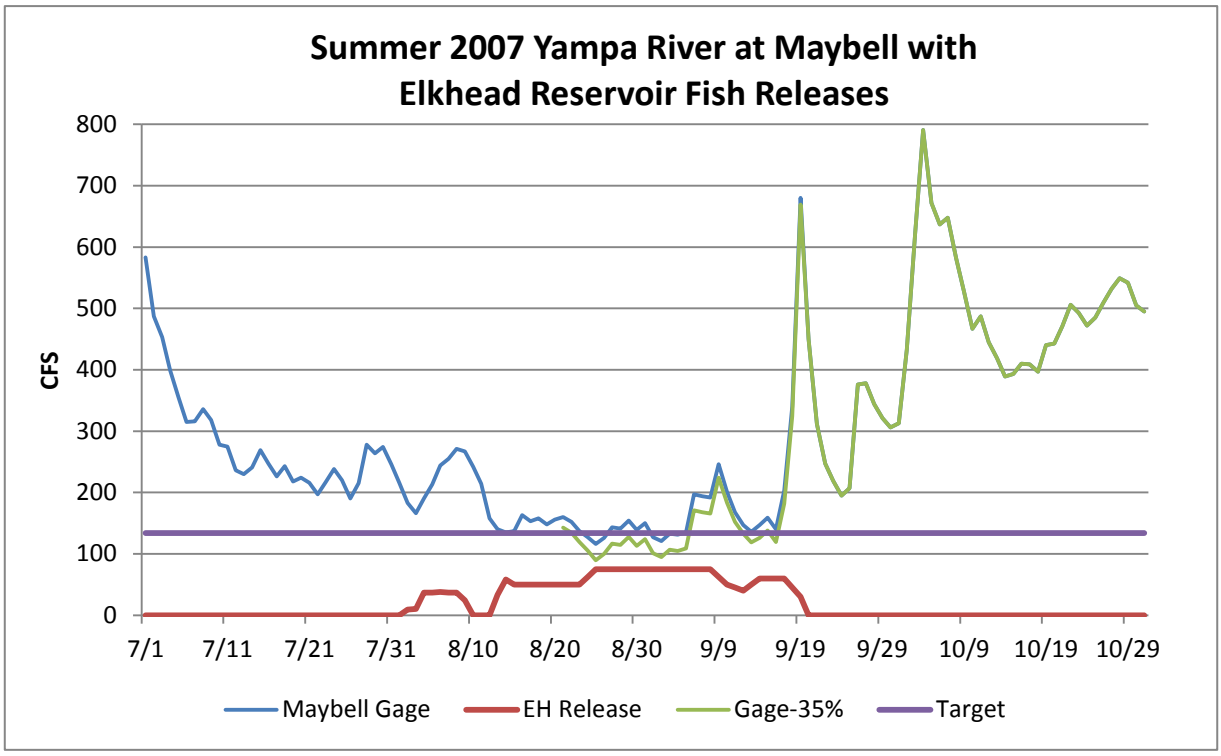
2016 peak flows and baseflows vs Recovery Program flow targets (cfs.) In August and September there were 7 days below 93 cfs, and 33 days below 134 cfs.

2016	Peak Target	2016
Yampa R. at Maybell water supply Apr-Jul (126% of Avg)	N/A	10,600 cfs

Base Flow Target	2016 Aug-Oct Avg	2016 Min
Avg 134 cfs	198 cfs	83 cfs



The [illegible] Elkhead reservoir (green line). There is an estimated delivery loss of 35%. This number should be examined more closely. The few times the group looked at it the loss seemed more like 25% or less.


Summer 2007 Yampa River at Maybell with Elkhead Reservoir Fish Releases
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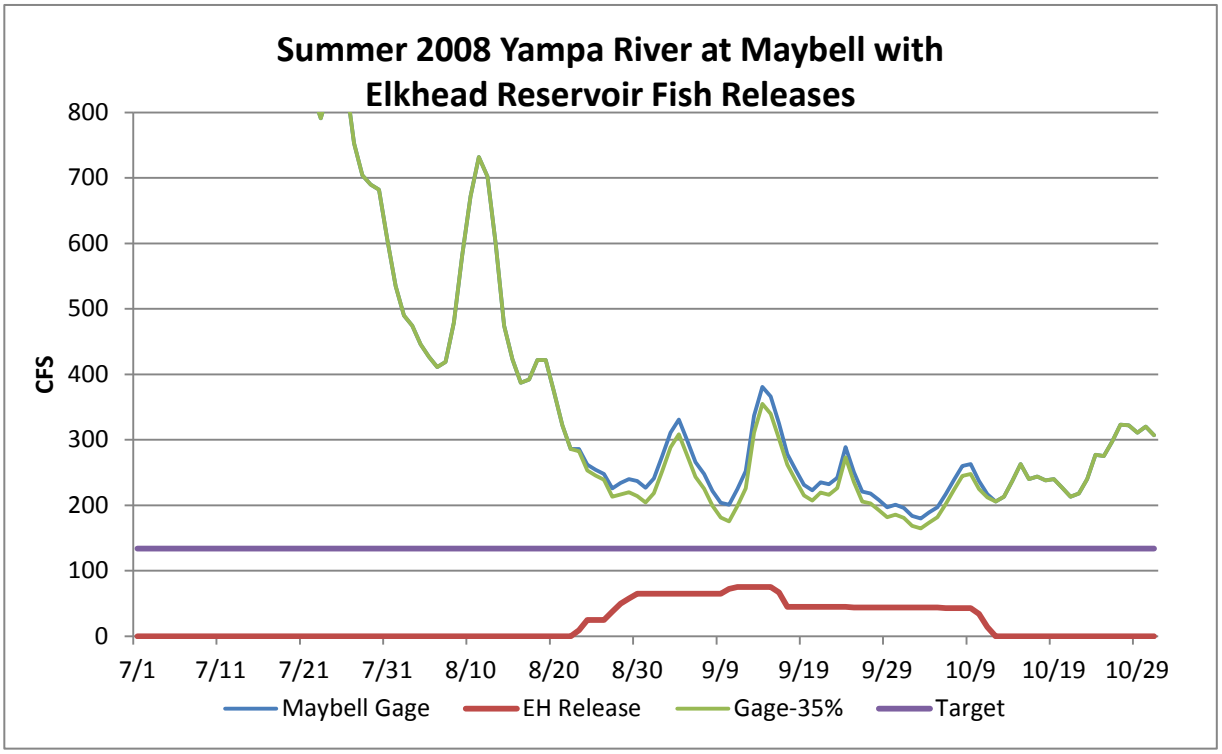
Maybell Gage
EH Release
Gage-35%
Target


Summer 2008 Yampa River at Maybell with Elkhead Reservoir Fish Releases
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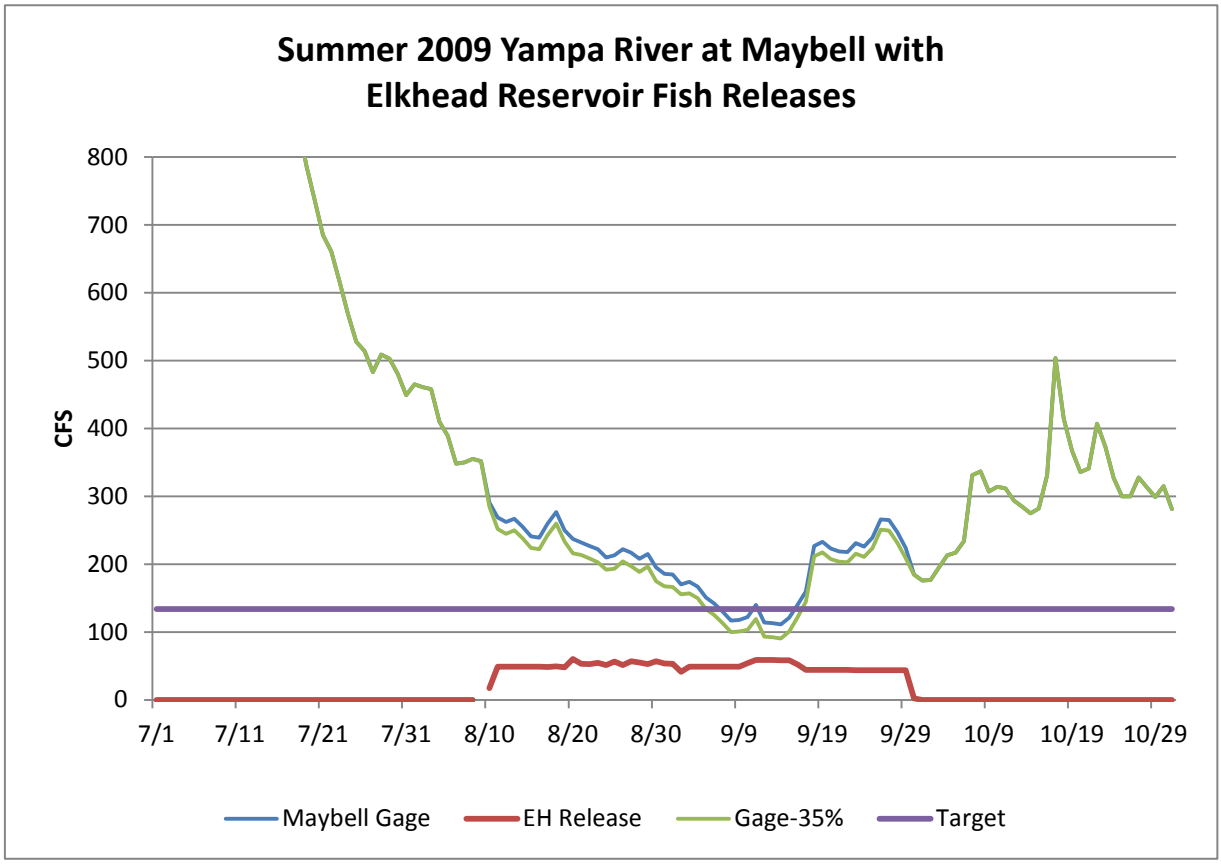
Maybell Gage
EH Release
Gage-35%
Target


Summer 2009 Yampa River at Maybell with Elkhead Reservoir Fish Releases
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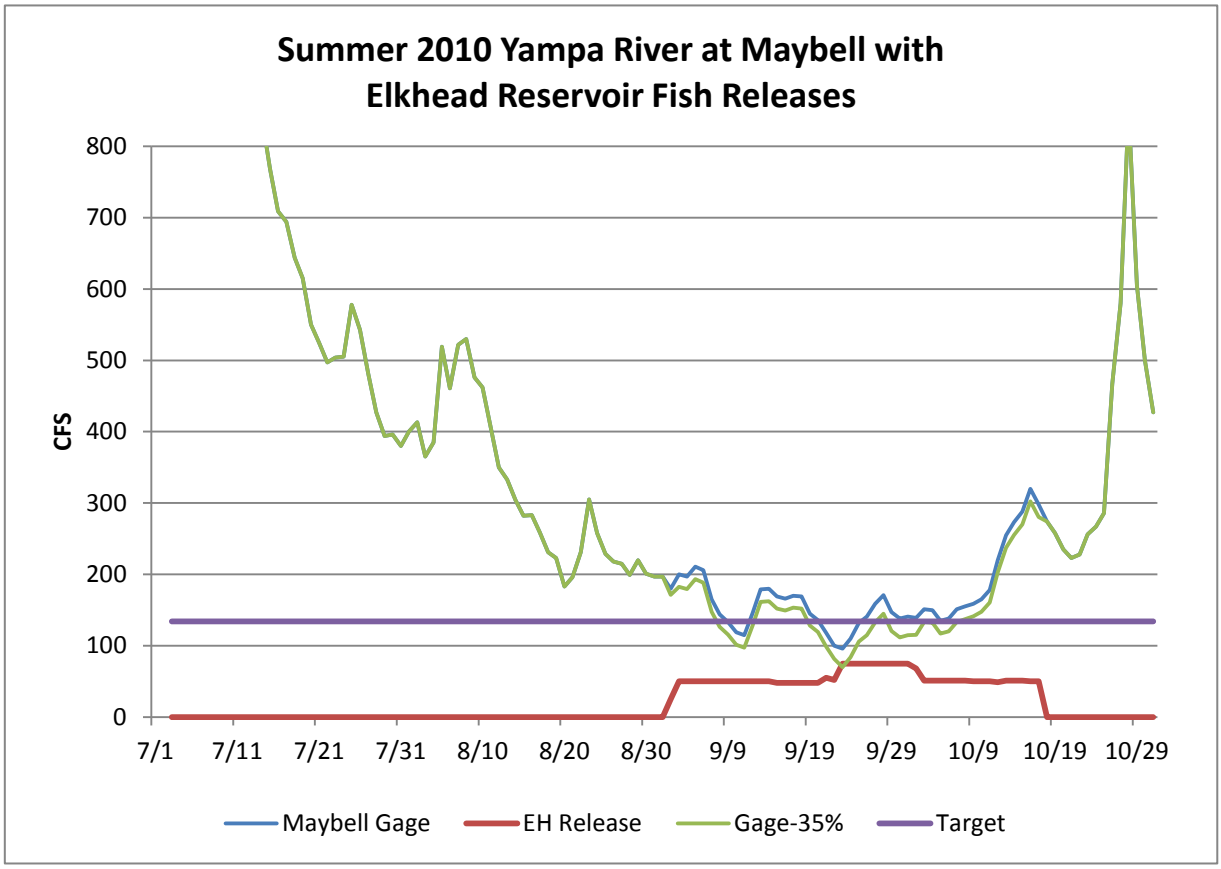
Maybell Gage
EH Release
Gage-35%
Target


Summer 2010 Yampa River at Maybell with Elkhead Reservoir Fish Releases
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Maybell Gage
EH Release
Gage-35%
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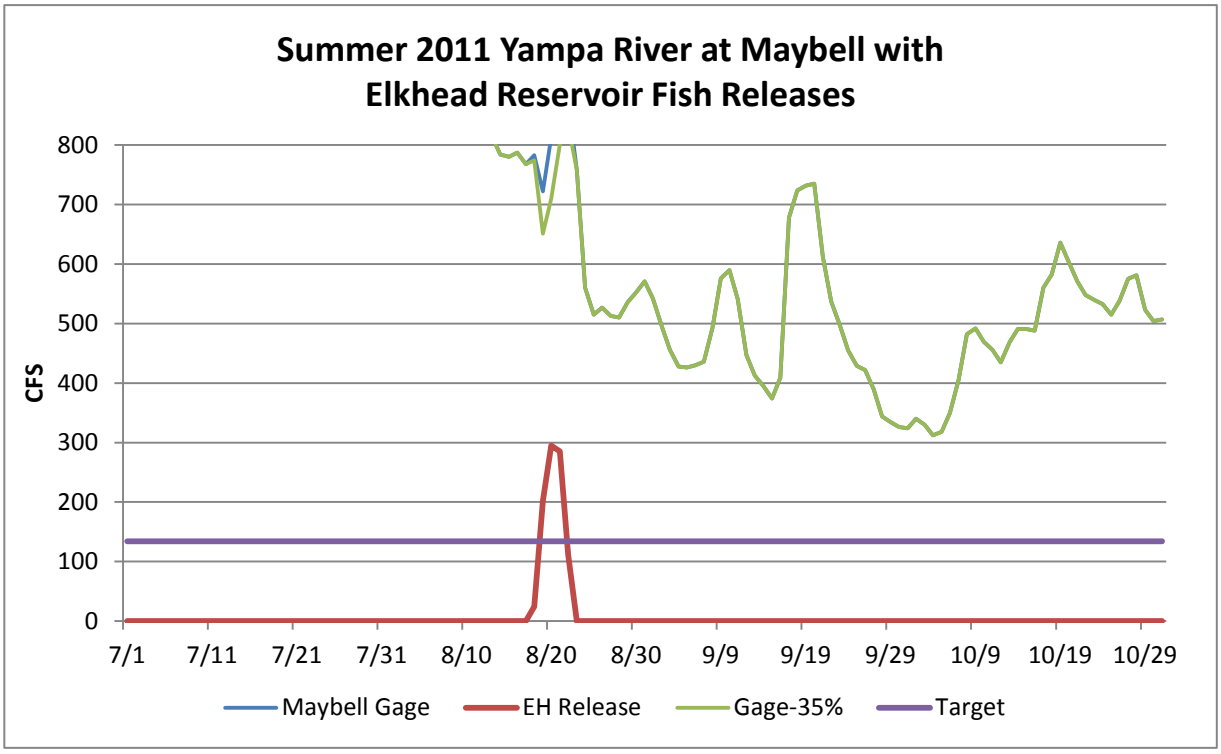
Summer 2011 Yampa River at Maybell with
Elkhead Reservoir Fish Releases
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Maybell Gage
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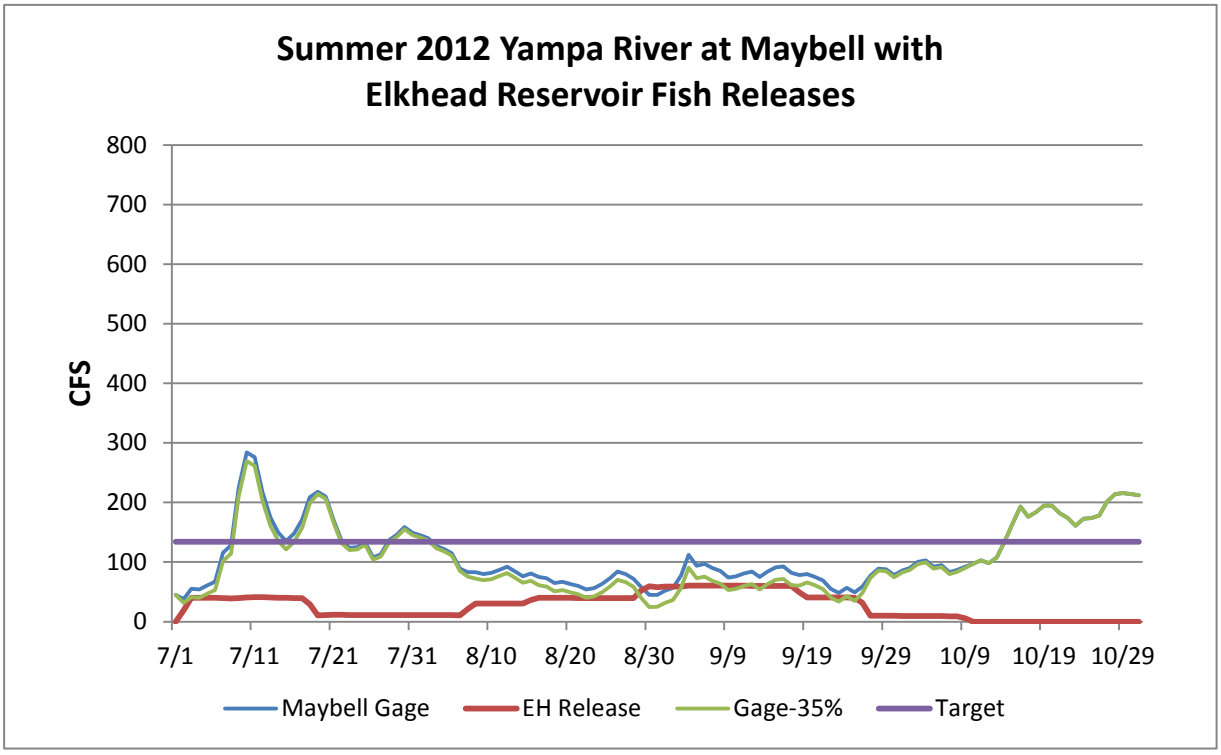
Summer 2012 Yampa River at Maybell with
Elkhead Reservoir Fish Releases
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Maybell Gage
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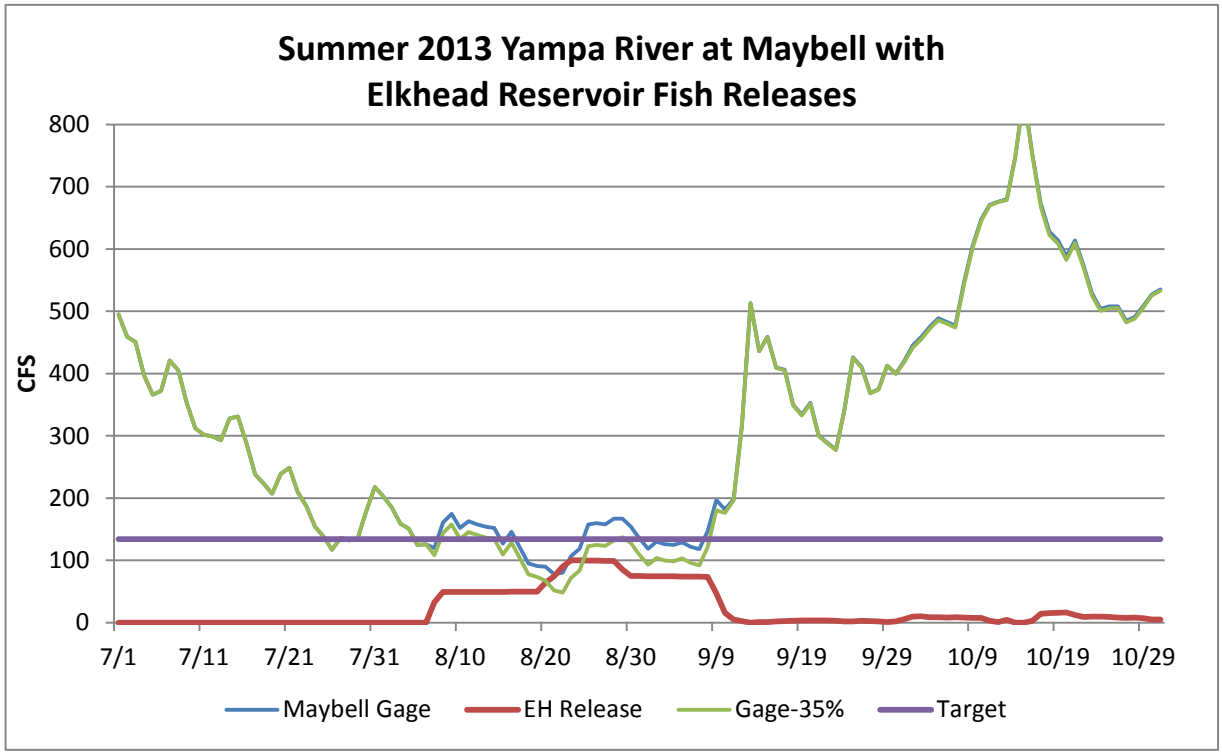
Summer 2013 Yampa River at Maybell with Elkhead Reservoir Fish Releases
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Maybell Gage
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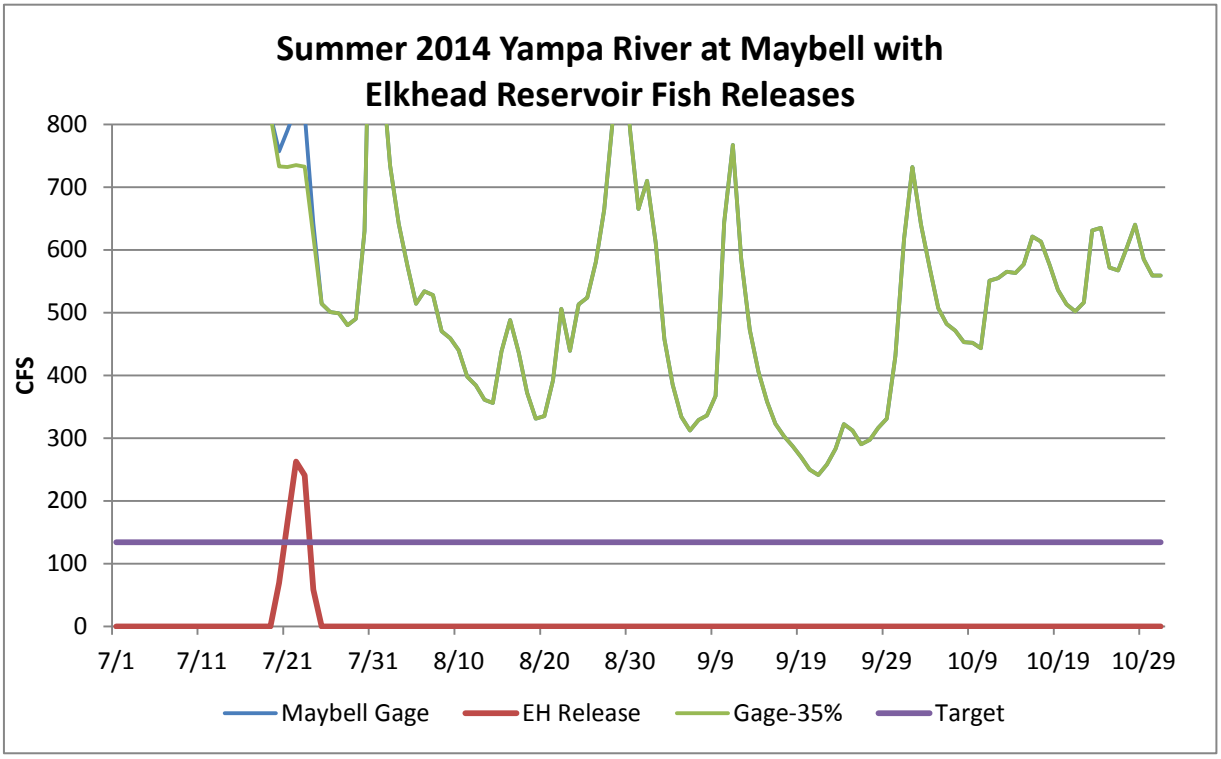
Target


Summer 2014 Yampa River at Maybell with Elkhead Reservoir Fish Releases
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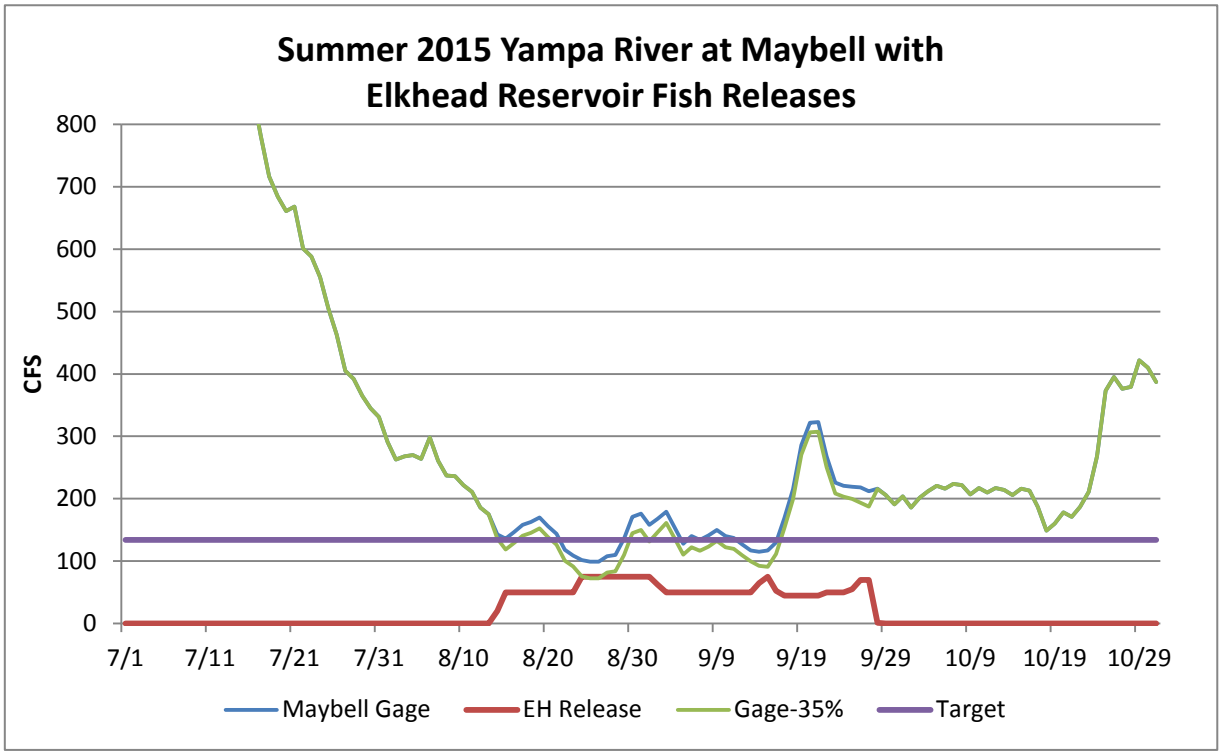
Summer 2015 Yampa River at Maybell with Elkhead Reservoir Fish Releases
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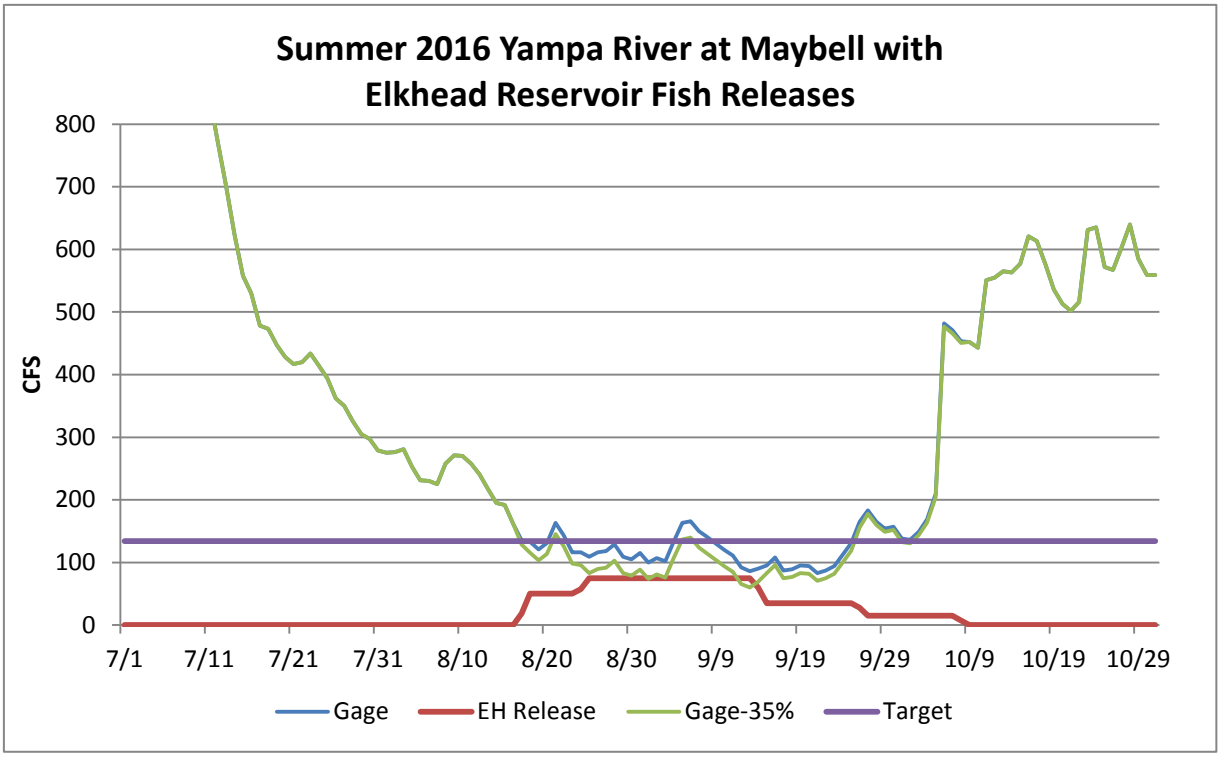
Summer 2016 Yampa River at Maybell with Elkhead Reservoir Fish Releases
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