Upper Colorado River Endangered Fish Recovery Program

Implementing Innovative Solutions to Manage Water and Hydropower Resources While Recovering Endangered Species

Highlights 2014-2015

San Juan River Basin Recovery Implementation Program

- The Upper Colorado River Endangered Fish Recovery Program and the San Juan River Basin Recovery Implementation Program use innovative, cost-effective measures to recover the endangered Colorado River fishes. At the same time, water and hydropower resources are managed within state and federal laws and tribal rights to meet the needs of people in growing western communities.
- The recovery programs' partners represent state and federal agencies, water and environmental organizations, power customers, and American Indian tribes who demonstrate that working cooperatively produces far greater results than independent efforts and minimizes conflicts such as lawsuits over water use.
- The recovery programs provide Endangered Species Act compliance for 2,427 federal, tribal, and non-federal water projects.
- The recovery programs use adaptive management to evaluate and revise management actions as new information becomes available.

Highlights *is produced annually to summarize the recovery programs' progress toward recovery of the endangered fishes. This document is not a publication of the U.S. Department of the Interior or its agencies. All uncredited photographs are courtesy of the recovery programs. All fish illustrations © Joseph Tomelleri.*

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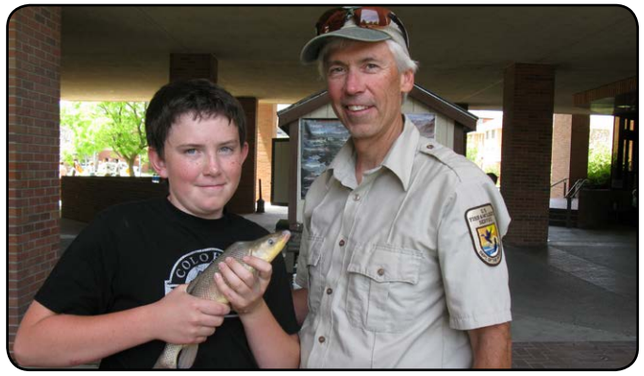
Creed Clayton, a U.S. Fish and Wildlife Service biologist, and his son, Conor, look after fish used for community outreach during the 2012 Children's Water Festival.

Reaching Out to Local Communities

The recovery programs work proactively to ensure the public is informed about endangered fish recovery actions. Information is provided through news and social media, public meetings, interpretive exhibits, water festivals and other events, newsletters, fact sheets, and web sites.

A child compares a fish trading card with an aquarium fish during an Endangered Species Day outreach event at the Denver Aquarium.



Conor Clayton son of Creed Clayton, a U.S. Fish and Wildlife Service biologist, holds a razorback sucker at the 2012 Children's Water Festival.

Brielle Troxel, 3, touches a fish during the annual Children's Water Festival held in western Colorado.

Partners' Long-Term Commitment, Collaboration, and Active Participation Drive Recovery Programs' Success

The Upper Colorado River Endangered Fish Recovery and San Juan River Basin Recovery Implementation Programs have a broad range of partners that includes state and federal agencies, water development interests, power customers, American Indian tribes, and environmental organizations. Partners have made long-term commitments to set aside individual interests and work collaboratively to create innovative solutions, helping to achieve the recovery programs' goals of species recovery while water development occurs.

Upper Colorado River Endangered Fish Recovery Program

State of Colorado
State of Utah
State of Wyoming
Bureau of Reclamation
Colorado River Energy Distributors Association
Colorado Water Congress
National Park Service
The Nature Conservancy
U.S. Fish and Wildlife Service
Utah Water Users Association
Western Area Power Administration
Western Resource Advocates
Wyoming Water Association

U.S. Department of the Interior
Cooperative Conservation Award
2008 RECIPIENTS

San Juan River Basin Recovery Implementation Program

State of Colorado
State of New Mexico
Jicarilla Apache Nation
Navajo Nation
Southern Ute Indian Tribe
Ute Mountain Ute Tribe
Bureau of Indian Affairs
Bureau of Land Management
Bureau of Reclamation
The Nature Conservancy
U.S. Fish and Wildlife Service
Water Development Interests

The Upper Colorado River Endangered Fish Recovery Program is recovering humpback chub, bonytail, Colorado pikeminnow, and razorback sucker in the Colorado River and its tributaries in Colorado, Utah, and Wyoming. The Recovery Program was initiated in 1988 with the signing of a cooperative agreement by the Governors of Colorado, Utah, and Wyoming; the Secretary of the Interior; and the Administrator of Western Area Power Administration. The cooperative agreement is active through September 30, 2023.

The San Juan River Basin Recovery Implementation Program is recovering Colorado pikeminnow and razorback sucker in the San Juan River and its tributaries in Colorado, New Mexico, and Utah. The Recovery Program was established in 1992 with the signing of a cooperative agreement by the Governors of Colorado and New Mexico; the Secretary of the Interior; the Southern Ute Indian Tribe, the Ute Mountain Ute Tribe, and the Jicarilla Apache Nation. The cooperative agreement is active through September 30, 2023.

State, Tribal, and Federal Leaders Endorse Recovery Program Accomplishments

State, tribal, and federal leaders have supported the recovery programs for their cost-effective and collaborative on-the-ground achievements. They recognize the challenges of meeting the water development and management needs of western communities, while working toward conservation of endangered fish species. The recovery programs are models of successful endangered species recovery efforts.

State Leaders Value Endangered Fish Recovery Programs' Accomplishments:

"The endangered fish recovery programs are models of collaborative, grassroots efforts that leverage cooperation from numerous stakeholders to ensure these remarkable ancient fish continue to swim in the Colorado River System. The programs support millions of people who depend on the river's water to grow food, generate electricity, and serve the needs of cities and towns."

John W. Hickenlooper, Governor, State of Colorado

"The State of New Mexico has a vested interest in the successful outcome of these programs. New Mexico is highly reliant upon continued use of the waters of the San Juan River system for continued economic growth in the state ... for power generation, for agricultural purposes, and for municipal and industrial uses ..."

Susana Martinez, Governor, State of New Mexico

"The success of the Upper Colorado River and San Juan River Endangered Species Recovery Programs is vital for Utah's continued use and development of Utah's Colorado River apportionment as part of our state's continued progress in providing for the needs of the citizens of Utah."

Gary R. Herbert, Governor, State of Utah

"Wyoming has been an active participant in the Recovery Program, ensuring the recovery of four endangered fish species while allowing for the development of the Compact appropriations. It is imperative that the Recovery Program remains viable and continues to provide reasonable and practical alternatives to assure ESA compliance."

Matthew H. Mead, Governor, State of Wyoming

Tribal Leaders Stress Recovery Programs' Contributions:

"Jicarilla Apache Nation has been a participant in the San Juan River Basin Recovery Implementation Program since its inception in 1992 ... The continuation of the Program is of the utmost importance to the Nation and the economic viability of the region."

Levi Pesata, President, Jicarilla Apache Nation

"The Navajo Nation is an active participant in, and strong supporter of, the San Juan River Basin Recovery Implementation Program ... These two successful, ongoing cooperative partnership programs involve the States of Colorado, New Mexico, Utah and Wyoming, Indian tribes, federal agencies and water, power, and environmental interests ..."

Ben Shelly, President, The Navajo Nation

The Department of the Interior Recognizes the Recovery Programs' Benefits:

"The Colorado River Recovery programs have become a national model for collaborative species recovery efforts. Here in one of the nation's fastest growing areas, we continue to work successfully with a broad array of partners to secure the future of the river's endangered native fishes, while meeting the water needs of communities across the river's watershed. As the impacts of a changing climate and human populations continue to grow, these partnerships will become increasingly vital to sustaining our natural heritage in the Colorado River basin."

Sally Jewell, Secretary of the Interior, 2014

"The strength of the Colorado River Recovery programs flows from the commitment and engagement of its partners. Management actions are developed and implemented with the equal participation of each partner, ensuring that those actions contribute effectively to recovery of the river's native fish species and allow for development of critical water projects. The U.S. Fish and Wildlife Service and the Department of the Interior play a key role in supporting these partnerships, and we are committed to strengthening and expanding our support for their vital work."

Dan Ashe, Director of the U.S. Fish and Wildlife Service, 2014

"In the Upper Colorado River Program, much progress has also been made ... in protecting the endangered fish in the Upper Colorado River through significant habitat improvements."

Ken Salazar, Secretary of the Interior, 2012

"The Upper Colorado River recovery programs are an excellent example of the power of collaboration among state, federal and local partners. With these programs we are able to meet the needs of many including agriculture, the environment, tribes, recreation and of course, the millions of people who live in the watershed."

Jennifer Gimbel, Principal Deputy Assistant Secretary for Water and Science, 2015

"The Upper Colorado River and San Juan River recovery programs serve as a model for how a broad spectrum of stakeholders can work toward a common goal of endangered species recovery, while respecting other important interests such as state and federal water rights and hydropower generation."

Michael L. Connor, Deputy Secretary of the Interior, 2015

Endangered Species Act Compliance Streamlined for Water and Hydropower Projects

The Upper Colorado River and San Juan River Basin recovery programs respond to the challenge of water managment by working with local, state, federal, and tribal agencies to meet the needs of people and endangered fish. The programs' goal is to achieve full recovery (delisting) of the endangered fishes, not just to avoid jeopardy (offset impacts of water project depletions) under the Endangered Species Act (ESA). The recovery programs provide ESA compliance for water development and management activities for federal, tribal, and non-federal water users. This includes Bureau of Reclamation-operated dams and projects across the Upper Colorado River Basin. Responsibilities to offset water project depletion impacts do not fall on individual projects or their proponents.

The recovery programs currently provide ESA compliance for 2,427 water projects depleting more than 3.7 million acre-feet per year. No lawsuits have been filed on ESA compliance for any of these water projects.

Upper Colorado River Endangered Fish Recovery Program Summary of Endangered Species Act Section 7 Consultations 1/1988 through 12/31/2014

		Historical Depletions	New Depletions	Total
State	**Number of Projects**	**Acre-Feet/Yr**	**Acre-Feet/Yr**	**Acre-Feet/Yr**
Colorado	1207	1,915,681	206,620	2,122,301
Utah	240	517,670	97,279	614,949
Wyoming	398	83,498	35,694	119,192
CO/UT/WY	238*	(Regional)	(Regional)	
Total	**2,083**	**2,516,849**	**339,593**	**2,856,442**

*Small depletion projects (<100 acre-feet per year) consulted on between July 3, 1994, and October 1, 1997, when the Recovery Program did not track the number of these projects by state. Depletion totals associated with these 238 projects are captured by state under new depletions.

San Juan River Basin Recovery Implementation Program Summary of Endangered Species Act Section 7 Consultations 1/1992 through 12/31/2014

State	Number of Consultations	Depletions Acre-Feet/Yr
New Mexico	23	653,758
Colorado	306	217,845
Utah	15	9,311
Total	**344**	**880,914**

Photo courtesy Bureau of Reclamation

Flaming Gorge Dam Powerplant Generators.

Hydroelectric power produced by the Flaming Gorge Dam powerplant generators help meet the power needs of the West.

Photo courtesy Bureau of Reclamation

Aerial View of Navajo Dam and reservior.

The Navajo Dam is located on the San Juan River in New Mexico. Navajo Reservoir extends 35 miles up the San Juan River.

The Programs Rely on Recovery Goals to Guide Management Actions and Measure Success

The overall goal for recovery of the four endangered fishes is to achieve naturally self-sustaining populations and protect the habitat on which those populations depend. Specific, basin-wide recovery goals for humpback chub, bonytail, Colorado pikeminnow, and razorback sucker were approved by the U.S. Fish and Wildlife Service (USFWS) on August 1, 2002, and are currently in revision to incorporate new information. The Upper Colorado and San Juan recovery programs implement actions to achieve the recovery goals in the Upper Colorado River Basin.

The recovery goals describe conditions necessary for downlisting and delisting each of the fish species by:

1) Identifying site-specific management actions* necessary to minimize or remove threats;
2) Establishing objective, measurable criteria that consider demographic and genetic needs for naturally self-sustaining, viable populations *(see Box 1)*;
3) Providing estimates of the time to achieve recovery.

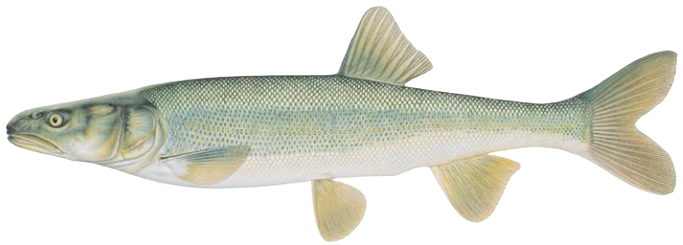
Box 1. DEMOGRAPHIC CRITERIA FOR RECOVERY

DOWNLISTING	DELISTING
Colorado pikeminnow	
Over a 5-year monitoring period: •Maintain the Upper Basin metapopulation •Maintain populations in the Green River and Upper Colorado River sub-basins ("no net loss") •Green River sub-basin population >2,600 adults •Upper Colorado River sub-basin population >700 adults •Establish 1,000 age 5+ subadults in the San Juan River	**For 7 years beyond downlisting:** •Maintain the Upper Basin metapopulation •Maintain populations in the Green River and Upper Colorado River sub-basins ("no net loss") •Green River sub-basin population >2,600 adults •Upper Colorado River sub-basin population >1,000 adults OR Upper Colorado River sub-basin population >700 adults and San Juan River population >800 adults
Bonytail	
Over a 5-year monitoring period: •Maintain reestablished populations in the Green River and Upper Colorado River sub-basins, each >4,400 adults •Maintain established genetic refuge of adults in Lower Basin •Maintain two reestablished populations in the Lower Basin, each >4,400 adults	**For 3 years beyond downlisting:** •Maintain populations in the Green River and Upper Colorado River sub-basins, each >4,400 adults •Maintain genetic refuge of adults in Lower Basin •Maintain two populations in the Lower Basin, each >4,400 adults
Razorback sucker	
Over a 5-year monitoring period: •Maintain reestablished populations in Green River sub-basin and EITHER in Upper Colorado River sub-basin or San Juan River, each >5,800 adults •Maintain established genetic refuge of adults in Lake Mohave •Maintain two reestablished populations in Lower Basin, each >5,800 adults	**For 3 years beyond downlisting:** •Maintain established populations in Green River sub-basin and EITHER in Upper Colorado River sub-basin or San Juan River, each >5,800 adults •Maintain genetic refuge of adults in Lake Mohave •Maintain two populations in Lower Basin, each >5,800 adults
Humpback chub	
Over a 5-year monitoring period: •Maintain the six extant populations ("no net loss") •One core population in Upper Basin > 2,100 adults •One core population in Lower Basin > 2,100 adults	**For 3 years beyond downlisting:** •Maintain the six populations ("no net loss") •Two core populations in Upper Basin > 2,100 adults •One core population in Lower Basin > 2,100 adults

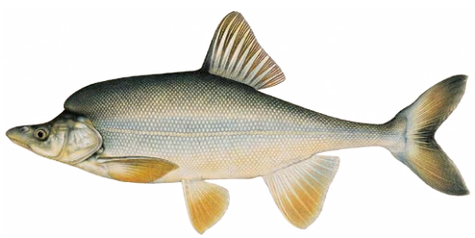
*__Habitat Management:__ Identify and provide adequate instream flows; **Habitat Development:** Restore and maintain habitat; **Nonnative Fish and Sportfishing:** Reduce the threat of certain nonnative fish species while maintaining sportfishing opportunities; **Endangered Fish Propagation and Stocking:** Produce genetically diverse fish in hatcheries and stock them in the river systems; and, **Research, Monitoring, and Data Management:** Provide data on life-history requirements of the endangered fishes, and monitor progress toward recovery.

Recovery Progress Report

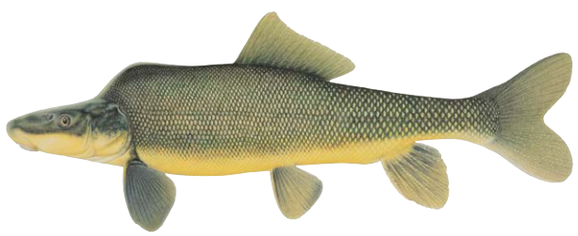
The overall goal of the recovery programs is to remove the four Colorado River fishes from Endangered Species Act (ESA) protection (delist) by 2023. For Colorado pikeminnow, recovery can occur solely in the Upper Basin; concurrent efforts in the Lower Basin will be required to recover the other three species. What follows is a summary of population status, major recovery accomplishments to date, and significant challenges that remain.



Colorado pikeminnow: The population of adult Colorado pikeminnow in the Colorado River sub-basin averages 613 individuals (1992 – 2014), however the 2014 preliminary estimate (N=377) is the lowest on record. The current USFWS criteria for downlisitng this population is >700. The population in the Green River sub-basin averaged 2,504 individuals (2001 – 2013; preliminary data 2011-2013). The current USFWS' criteria for downlisitng this population is >2,600. Stocked pikeminnow are accumulating in the San Juan River *(see page 16)*.
Major accomplishments – Flows are managed in all Upper Basin rivers to benefit all life stages; fish passage provided at all major migration barriers; species is self-sustaining (not stocked) in Green and Colorado rivers and a successful hatchery reintroduction program occurs in the San Juan River; management of nonnative competitors has been underway for 10+years.
Remaining challenges – Nonnative northern pike outnumber Colorado pikeminnow 3:1 in the Yampa River in northwestern Colorado. Also, alarming increases in the number of nonnative walleye in the lower reaches of the Colorado and Green rivers in recent years have been implicated in currently depressed Colorado pikeminnow population estimates. More successful management of these nonnative predatory fishes and a positive upturn in the Colorado pikeminnow populations basinwide will be required before delisting can occur.



Humpback chub: The Upper Basin "core" population, which consists of adult humpback chub in Black Rocks and Westwater Canyons has averaged 2,562 individuals since 1999. The USFWS' criteria for downlisting a core population is >2,100. However, this core adult population has been below 2,100 since 2004. The Lower Basin core population (Grand Canyon) greatly exceeds current demographic criteria.
Major accomplishments – Flows managed to benefit most populations; nonnative fish management actions benefit populations in Green River sub-basin.
Remaining challenges – Further study needed to understand declines in Upper Basin populations that occurred in the early 2000s.



Razorback sucker: The recovery programs have been stocking hatchery- reared razorback sucker since 2004 to rebuild populations. Stocked fish are surviving, spawning, and wild-produced juveniles were captured in 2013. The adult population in the Colorado River averaged 1,502 from 2005 – 2010. Capture of adults increased in 2013 and 2014 (n=661 and 835, respectively) indicating the most recent population estimates will increase.
Major accomplishments – Recent advances in flow management have benefitted larval survival evidenced by the capture and release of 749 wild-produced juveniles in the Green River. A small, but self-sustaining population occurs in Lake Mead.
Remaining challenges – All indications suggest that both programs are on track to recovery.

Bonytail: The Upper Colorado Program has been stocking hatchery-reared bonytail since 2004 to rebuild populations in the wild. Bonytail are still too scarce to warrant population estimates.
Major accomplishments – The Upper Colorado Program continues to refine hatchery techniques and stocking practices to improve reintroduction success. Remote sensing devices (stationary tag readers) deployed in recent years are producing encouraging recapture information. Lower Basin researchers continue to stock fish in predator free, low velocity habitats.
Remaining challenges – Continue to experiment with stocking practices and continue all other recovery actions.

Fish Illustrations © Joseph R. Tomelleri

State, Federal, and Tribal Facilities Help Reestablish Endangered Fish Populations

Genetically-diverse, hatchery-produced fish are stocked to reestablish naturally self-sustaining populations of razorback sucker and bonytail in the Upper Colorado River system and razorback sucker and Colorado pikeminnow in the San Juan River. Stocked fish will contribute* to meeting the demographic criteria of the recovery goals. The recovery programs monitor survival and reproduction of stocked fish to evaluate and improve stocking strategies. In most cases, the facilities are exceeding their annual production targets *(see pages 19 and 20)*.

Facility, Location (Target Number)	River, Number Stocked and Average Size in 2014		
	Green	Colorado	San Juan[1]
Bonytail (average size 10 inches)			
J.W. Mumma Native Aquatic Species Restoration Facility, Alamosa, CO (5,000)	**3,034; 12.7”**	**2,407; 12.7”**	
Wahweap State Fish Hatchery, Big Water, UT (10,000)	**5,233; 9.3”**	**10,438; 9.3”**	
Ouray National Fish Hatchery – Randlett Unit, Vernal, UT (10,000)	**15,196; 11”**		
Ouray National Fish Hatchery – Grand Valley Unit, Grand Junction, CO (10,000)		**9,529; 10”**	
Razorback sucker (average size 14 inches)			
Ouray National Fish Hatchery – Randlett Unit, Vernal, UT (6,000)	**6,601; 14.5”**		
Ouray National Fish Hatchery – Grand Valley Unit, Grand Junction, CO (6,000)		**6,062; 14.4”**	
Ouray National Fish Hatchery-Horsethief Canyon Native Fish Facility, Fruita, CO (2,000-3,000)			**2,015**
Navajo Agricultural Products Industry (NAPI) Ponds, Farmington, NM (6,000-8,000)			**6,170**
Colorado pikeminnow (age-0 fingerlings, 50-55 mm total length)			
Southwest Native Aquatic Resources and Recovery Center, Dexter, NM (400,000)			**393,442**

[1]The San Juan Program’s target size for razorback sucker is ≥12” total length.

USFWS Biologist Bobby Duran captured this razorback sucker during monitoring in the San Juan River in 2014.

• Three razorback sucker stocked near the Hogback diversion on the San Juan River were recaptured two to four years later in the Colorado River between Moab and the Utah-Colorado state line. They moved between 404 to 477 miles, including through 138 miles of Lake Powell that hosts nonnative predatory fish such as striped bass and walleye. This is the first documented movement of endangered fish between the San Juan River and the Colorado River.

• Construction of 22 grow-out ponds was completed in 2012 at the Horsethief Canyon Native Fish Facility near Fruita, Colorado, to increase production of razorback sucker for the Upper Colorado and San Juan programs. The ponds are a more cost-effective and efficient way to raise genetically-sound, endangered fish needed to achieve annual stocking goals.

The Ouray National Fish Hatchery - Grand Valley Unit will be used to raise several endangered species:bonytail, humpback chub and razorback.

*All four species of endangered fish are long-lived (up to 40 years). The U.S. Fish and Wildlife Service will include hatchery-produced fish in population estimates after those populations have been determined to be “self-sustaining.”

Cooperative Water Management Provides Flows for Endangered Fishes

Green River: provides spring and baseflows, Flaming Gorge, ROD Feb. 2006

Duchesne River: provides spring and baseflows, BO July 1998

15-Mile Reach–Colorado River: Flows managed with reservoir pools and an irrigation efficiency project (Grand Valley Water Management, GVWM) *(see table, top right and graph lower left)*, PBO Dec. 1999

Price River: minimum flows, Position Paper May 2012

Coordinated Water Releases (1997-2014) Benefit Endangered Fishes in the 15-Mile Reach in the Colorado River

Reservoirs			Acre-Feet
Granby	51,239	Green Mtn	635,308
Palisade Bypass	183,227	Ruedi	341,074
Williams Fork	99,943	Willow Creek	9,918
Windy Gap	3,718	Wolford Mtn	145,941
		Total Ac-Ft:	**1,470,368**

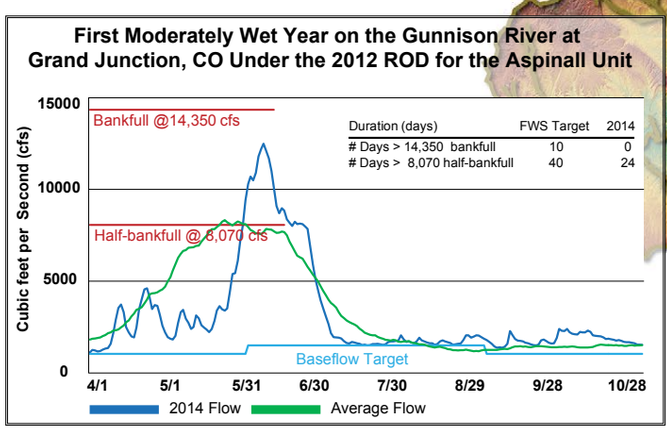
Yampa: Elkhead Reservior to manage baseflows, PBO Jan. 2005

White River: future Water Management Plan, PBO TBD

Aspinall Unit: assists to meet fish flows in Gunnison and Colorado Rivers, ROD May 2012

Lake Nighthorse: Completed in 2011 as part of the Animas-La Plata (ALP) Project. The 1991 BO for ALP established the San Juan River Basin Recovery Program

Navajo Reservior: Releases to meet spring and baseflow target, ROD July 2006



Reservoirs

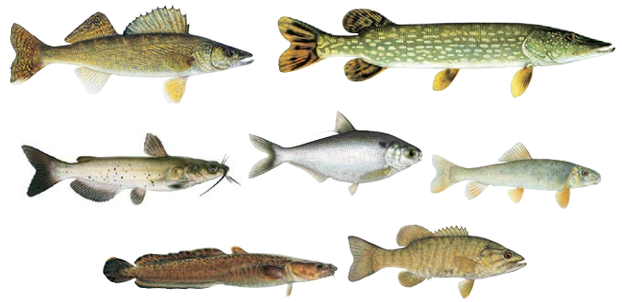
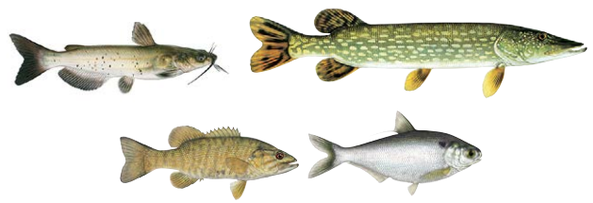
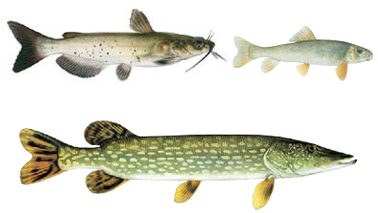
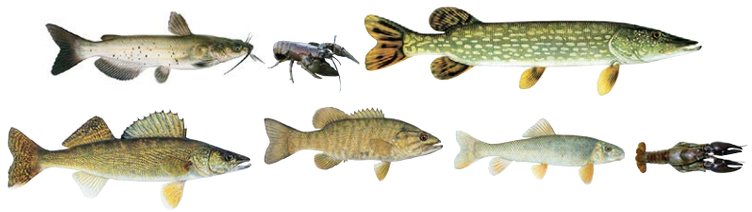
Critical Habitat

ROD = Record of Decision

PBO = Programmatic Biological Opinion

Nonnative Predators Delay Recovery in the Upper Colorado River

Predation or competition by nonnative fish species is considered the primary threat to endangered fish recovery and is now the most challenging to manage. One hundred years ago only 13 native species swam in the Upper Colorado River and its tributaries – today they have been joined by more than 50 nonnative species. The graphic below depicts the spread of a few of the most predaceous and invasive species through the life of the Upper Colorado Program.

River	Presence of Invasive Species	
	1988	Today
Colorado		
Gunnison		
Green		
White		
Yampa		

All fish illustrations © Joseph R. Tomelleri
Rusty crayfish photo courtesy of the United States Geological Survey
Virile Crayfish photo courtesy D. Gordon E. Robertson

Legend

Burbot	Channel catfish	Gizzard Shad	Northern pike	Rusty crayfish	Smallmouth bass	Striped bass	Virile crayfish	Walleye	White sucker

WHY ARE CERTAIN NON NATIVE FISH A PROBLEM?

The Upper Colorado River Program has focused the majority of its nonnative control efforts on northern pike, smallmouth bass, and walleye. The San Juan Program manages nonnative channel catfish and common carp. Since the early 2000s Upper Colorado Program removal activities have expanded from six miles in the Yampa River to over 600 miles in four rivers. Some river reaches are sampled more than a dozen times annually. Similar sampling intensity is expended in 164 miles of the San Juan River.

Closeup of a northern pike.

Photo courtesy UDWR

This northern pike, with a native sucker in its mouth, was captured while electrofishing.

Photo courtesy UDWR

Chase Franklin with a walleye on the middle Green river.

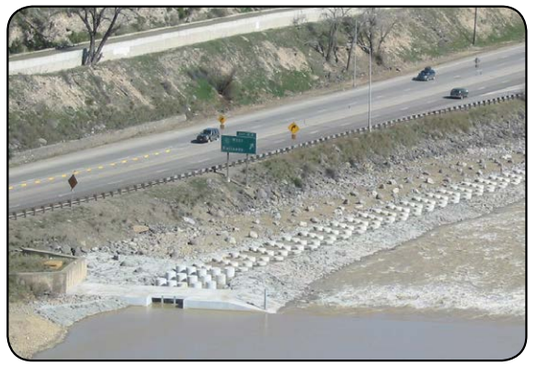
Photo courtesy UDWR

Joe Skorupski with two smallmouth bass on the middle Green River.

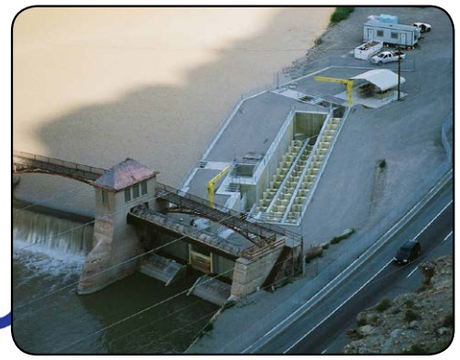
River	Species	History and Current Status
Colorado	Smallmouth bass	•Increases in abundance first observed in 2003; removal began in 2004. •Strong year class of smallmouth bass produced in western Colorado's Grand Valley in 2012 and 2013. Weak year classes produced in 2014.
	Northern pike	•Northern pike were captured in the river and an off-channel gravel pit near Rifle, Colorado, in 2014.
	Walleye	•Catches of walleye in the lower Colorado River greatly increased beginning in 2010. •Implemented walleye-specific fall and spring removal efforts in 2014. •Two juvenile Colorado pikeminnow found in the stomachs of walleye during removal efforts in 2014.
Green	Smallmouth bass	•Increases in abundance first observed in 2003; removal began in 2004. •Strong year classes produced in 2012 and 2013 because of lower flows. •Weak year class produced in 2014. Higher flows and cooler temperatures in 2014 delayed spawning and temperatures in 2014 delayed spawning and reduced growth. •Number of fish removed in Desolation and Gray canyons greatly increased in 2014 (from the 2012 and 2013 year classes).
	Northern pike	•Since removal began in 2001, abundance has been greatly reduced. •Numbers of adults captured increased markedly in 2012, but declined in 2013 and 2014.
	Walleye	•Catches of walleye increased in the middle and lower Green Rivers beginning in 2010. •Implemented walleye-specific spring and fall removal efforts in 2014. •Walleye escapement likely occurring from Red Fleet and Starvation reservoirs and Lake Powell.
Yampa	Smallmouth bass	•Increases in abundance first observed in 2001; removal began in 2004. •In-river reproduction and reservoir escapement must be halted before removal efforts can be successful. •Strong year classes produced in 2012 and 2013, but higher flows in 2014 produced a weak year class. •Numbers of bass removed in Yampa Canyon greatly increased in 2014 (from the 2012 and 2013 year classes).
	Northern pike	•Abundance steadily increased during the 1980s and 1990s; removal began in 1999. •In-river reproduction and reservoir escapement must be halted before removal efforts can be successful. •Using nets, biologists successfully removed large numbers of fish before they could spawn in 2014.
White River	Smallmouth bass	•This location is the most recent expansion of this species. Removal began in 2012. •The relatively intact native fish community in this river must be protected from smallmouth bass. •Greatest densities immediately downstream of Taylor Draw Dam in Rangely, Colorado.
San Juan	Channel catfish	•In the reaches with the longest period of nonnative removal effort, juvenile and adult channel catfish have significantly declined.
	Common carp	•Removal since 2001 has reduced the number of carp in the river. •Colorado pikeminnow and razorback sucker now outnumber common carp.

Capital Projects Important to Reconnect Endangered Fish Habitat

The recovery programs work cooperatively with American Indian tribes, water and power customers, and local landowners to improve endangered fish habitat. Habitat restoration and maintenance includes "undoing" habitat fragmentation through construction and operation of fish passages at irrigation diversion dams; preventing fish from entering and becoming trapped in irrigation diversion canals through construction and operation of fish screens; and acquisition, restoration, and management of floodplain habitat to serve primarily as fish nursery areas.

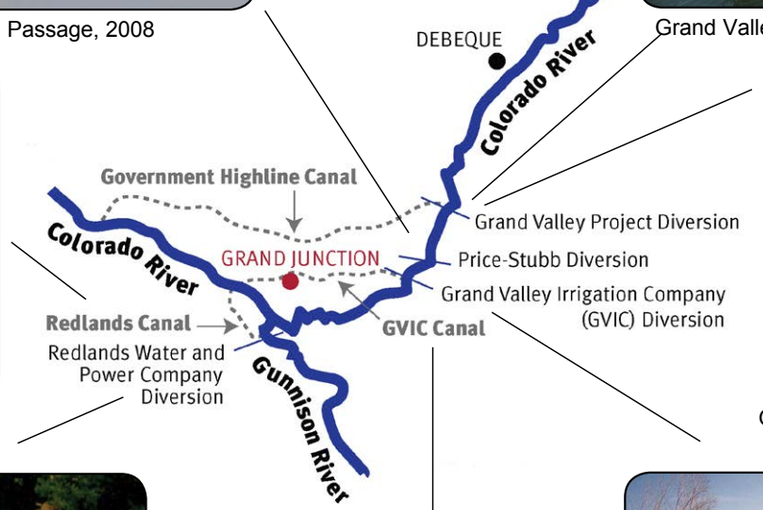


Price-Stubb Fish Passage, 2008

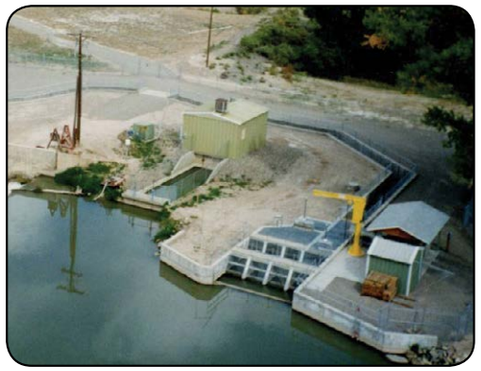


Grand Valley Project Fish Passage, 2004

Redlands Fish Screen, 2005



Grand Valley Project Fish Screen, 2007



Redlands Fish Passage, 1996

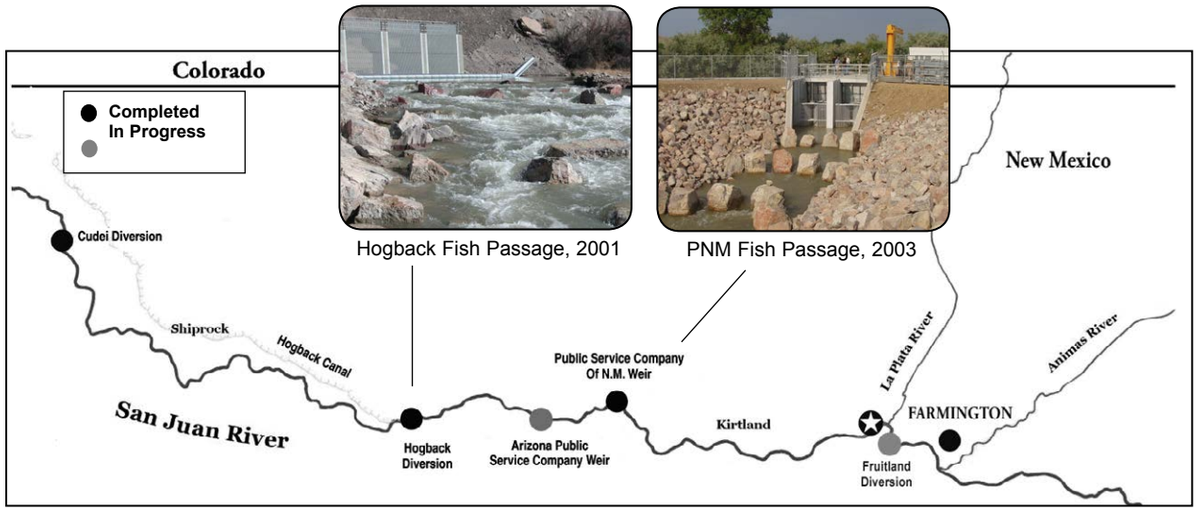
GVIC Fish Screen, 2002

GVIC Fish Passage, 1998

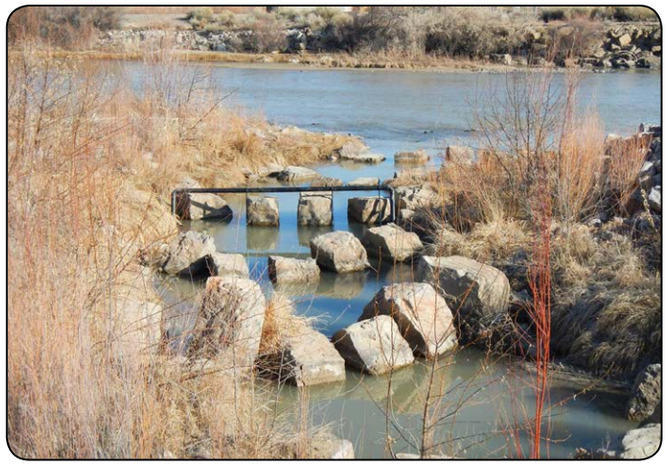
The majority of the Upper Colorado Program's construction projects needed to recover the endangered fishes are complete. Located in western Colorado, these fish passages and screens contribute to unimpeded access to approximately 340 miles of designated critical habitat in the Colorado and Gunnison rivers. The U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) will rehabilitate the Tusher Wash Diversion Dam on the Green River in eastern Utah starting in the fall of 2015. The Upper Colorado Program will work with local water users to install a barrier to prevent endangered fishes from entering and becoming trapped in the canal.

Hogback Fish Weir – In 2013, a weir wall was installed at the Hogback Diversion Dam on the San Juan River near Shiprock, NM to prevent endangered fish from getting trapped in the irrigation canal. This new, low maintenance design for fish barriers is being tested by the San Juan Program for its effectiveness at keeping fish out of canals and could be utilized at other diversion structures.

TNC Habitat Restoration –The Nature Conservancy (TNC) with assistance from the San Juan Program restored several backwater and side channels along the San Juan River in 2011 and 2014 to help recover endangered species by increasing channel complexity and improving habitat conditions. The San Juan Program is monitoring the restored sites for fish use, persistence, functionality, and reestablishment of nonnative vegetation.



Fish access has been restored to an additional 36 miles of critical habitat on the San Juan River with the construction of passages at the Public Service Company of New Mexico (PNM) Weir and the Hogback Diversion Dam, and removal of the Cudei Diversion Dam. The need for additional fish passages at Arizona Public Service Company and Fruitland irrigation diversion structures is being evaluated.



Remote PIT tag readers – The San Juan Recovery Program is installing passive integrated transponder (PIT) tag antenna arrays along the river to remotely detect and track year-round movement of PIT-tagged Colorado pikeminnow, razorback sucker, and other native species of interest. PIT tag detectors were installed at the Public Service Company of NM (PNM) fish passage facility and Hogback Fish Weir in 2014 and the mouth of McElmo Creek on the San Juan River on the Navajo Nation near the CO-UT border in 2012. An antenna array will be installed at the PNM Diversion Dam in February of 2015.

Status of Endangered Fishes

The recovery programs monitor reproduction, growth, survival, and abundance of endangered fishes in the wild. Results are used to track progress toward achieving recovery goals and to assess the effectiveness of management actions.

The core of the U.S. Fish and Wildlife Service's recovery goals for each species is achieving a sufficient number and size of self-sustaining populations that will persist. To achieve this, wild or re-introduced adults must survive and reproduce. Recruitment of young fish into the adult population must then maintain the minimum population level (demographic criteria) identified in the recovery goals (see page 6).

COLORADO PIKEMINNOW *(Ptychocheilus lucius)*

Photo courtesy UDWR

UDWR biologist, Natalie Boren, with a Colorado pikeminnow captured on the middle Green River.

Upper Colorado Program

◆ Wild Colorado pikeminnow populations occur in the Green and Colorado river sub-basins of the Upper Colorado River.

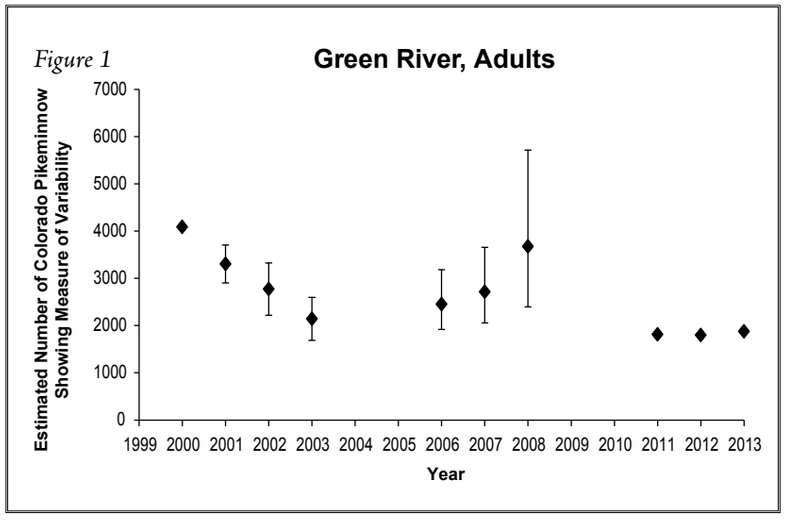
• The population in the Green River is the largest *(Figure 1; estimates for 2011-2013 are preliminary)*. The Service's current downlisting criteria for this sub-basin is 2,600 adults, but they are re-evaluating recent survival estimates to determine if revision of that criteria is necessary.

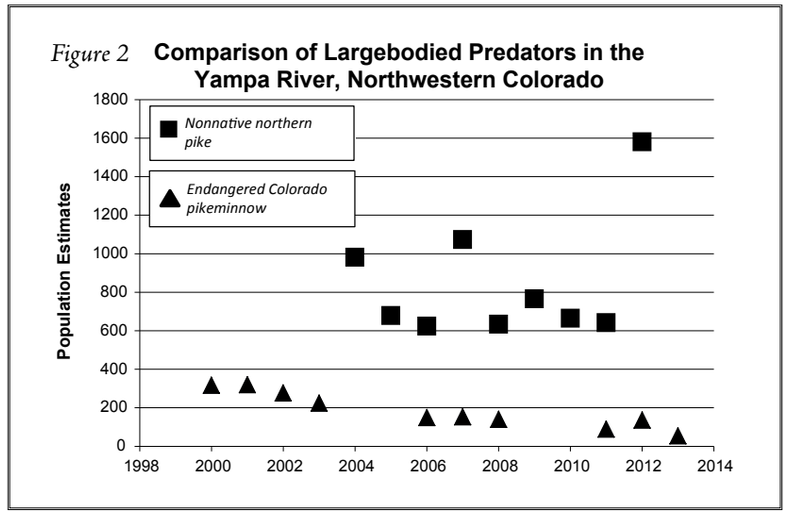
• Researchers are concerned that persistent densities of large nonnative predators are outcompeting Colorado pikeminnow and are the major cause for recent delines. *(Figure 2; estimates for 2011-2013 are preliminary)*.

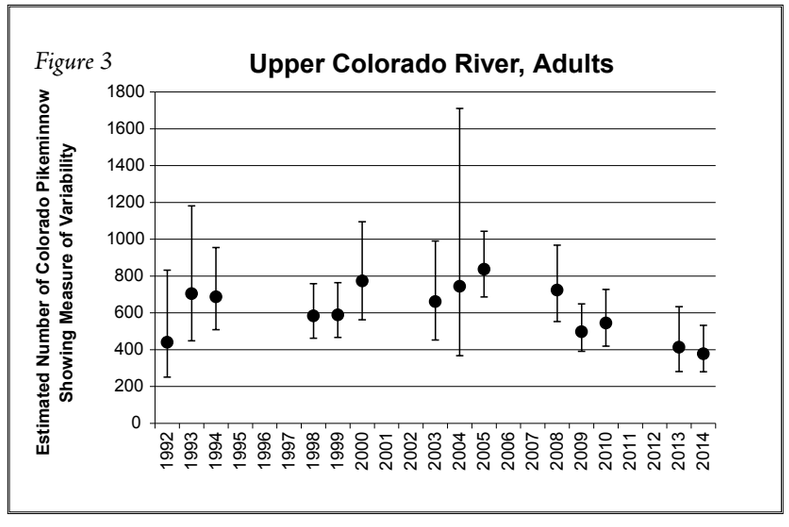
• The adult population in the Colorado River sub-basin is smaller *(Figure 3; estimates for 2013 and 2014 are preliminary)*, but appears to be more stable.

Photo courtesy UDWR

UDWR biologist, Matt Breen, with a Colorado pikeminnow on the White River.







San Juan Program

◆ Researchers are reestablishing a population of Colorado pikeminnow in the San Juan River. Stocking efforts have been very successful.

• Over the last six years, 2,242,816 age-0 Colorado pikeminnow have been stocked into the San Juan River.

• Annual monitoring efforts document that stocked fish are persisting in the San Juan River (Figure 4).

• Researchers captured a record high number (n=312) of wild produced Colorado pikeminnow in 2014! Only 58 larvae had been captured in the previous 20 years of sampling.

• Researchers believe removal of nonnative riparian vegetation is needed to restore secondary channel habitat – nursery habitat for young pikeminnow.

Hatchery raised bonytail being released into the river.

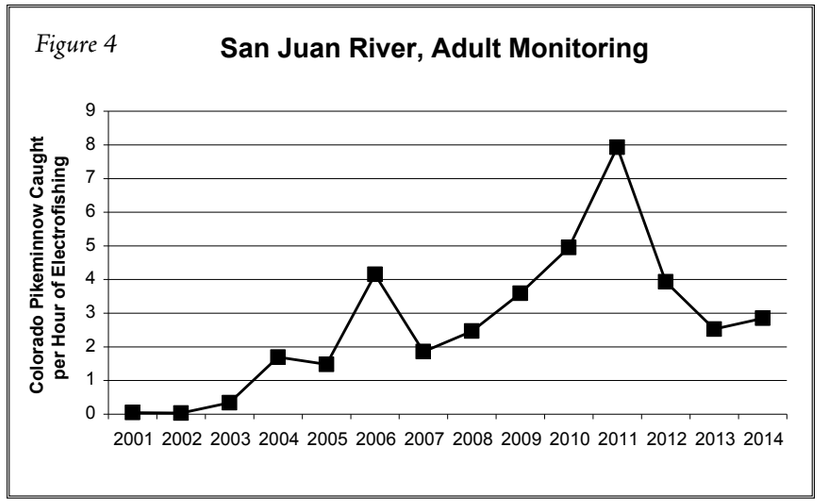


Photo by Kevin Kappenman

More than 30,000 bonytail are stocked each year in the Green and Colorado rivers.

Photo courtesy UDWR

Colorado pikeminnow showing spawning tubercles on head.

BONYTAIL *(Gila elegans)*

Upper Colorado Program

◆ Stocking continues to reestablish populations in the Upper Colorado River Basin. When the Upper Colorado Program was established, the bonytail had essentially disappeared and little was known of its habitat requirements. Key to bonytail recovery is research and monitoring of stocked fish to determine life history needs.

• Survival of stocked bonytail is low.Researchers are now experimenting with different stocking times and growing hatchery fish larger.

•All stocked fish receive an internal microchip tag before being released in the wild. Since 2009, increasing numbers of bonytail have been detected at locations throughout the Upper Colorado River Basin where stationary tag-reading antennas are used.

Upper Colorado Program's Performance to Meet Annual Bonytail Stocking Goals (%)

	Green River	Colorado/Gunnison River
2010	77%[1]	46%[1]
2011	201%	180%
2012	52%[2]	102%
2013[3]	30%[3]	108%
2014	127%	138%

Shaded cells indicate years when the stocking goal was not met (i.e., <100%).
[1] Approximately half of these bonytail scheduled for stocking in 2010 were held to ensure they were disease free – they were cleared for release in 2011.
[2] This 2012 group of fish were <10 inches total length and were transferred to Ouray National Fish Hatchery – Randlett Unit, for an overwinter study and were stocked in 2013.
[3] In 2013 some bonytail were held in a hatchery longer to achieve the 10-inch size. In 2014, three hatcheries are scheduled to stock 10,000 (10-inch) bonytail each, and another hatchery will produce 5,000 bonytail.

◆ When the recovery programs were established, numbers of wild razorback sucker had diminished to a few hundred adults in the Green River system and were considered lost from the Upper Colorado and San Juan rivers. Hatchery-produced fish are being stocked to reestablish the species in the wild. Preferred habitat is being restored via flow and flood-plain management, and nonnative predator control.

- The recovery programs are revising stocking strategies to incorporate recent stocked fish survival information. New data indicates that fall is the best time to stock and that fish should be at least 12 inches in length.
- Fish stocked in the Green, Colorado, and San Juan rivers *(Figure 5)* are recaptured in reproductive condition and often in spawning groups. Captures of wild-produced larvae in the Green *(Figure 6)*, Gunnison, Colorado, and San Juan rivers document that the stocked fish are spawning.

- Both recovery programs are experimenting with remote tag antenna systems. For the third year, antennas were placed on a known spawning bar in the middle Green River in Dinosaur National Monument in northeast Utah. In 2014, 465 razorback sucker were detected, which was similar to results in 2013. These detections included fish stocked every year since 2003. The majority of these razorback sucker had not been captured or detected since they were stocked.

- Wild-produced juveniles were captured for the first time in the Green and Colorado rivers in 2013 and in the San Juan River in 2014.

- The Upper Colorado Program and the Bureau of Reclamation continue to experiment with the timing of spring releases from Flaming Gorge Dam to connect floodplain habitats – important nursery habitat for larval razorback sucker *(Figure 7)*. In September, Utah researchers released 729 young of the year razorback sucker from Stewart Lake – some had grown more than 6 inches over the summer.

- Researchers have now confirmed that hundreds of razorback sucker are using transitional habitats at the inflows of both the Colorado and San Juan rivers into Lake Powell.

Larval sampling efficiency declines during wetter hydrologies because of large amounts of available habitat.

Programs' Performance to Meet Annual Razorback Sucker Stocking Goals (%)

	Green River	Colorado/Gunnison River	San Juan River
2010	106%	100%	250%
2011	109%	121%	165%
2012	108%	106%	118%
2013[1]	53%	101%	135%
2014	110%	109%	54%[2]

Shaded cells indicate years when stocking goal was not met (i.e., <100%).
1 The Upper Basin stocking strategy is being changed to shift some production from razorback sucker to bonytail.
2 Annual stocking target of 11,400 razorback/year not met, but the long-term target of 91,200 razorback/8 years exceeded (92,822 since 2009).

Figure 5

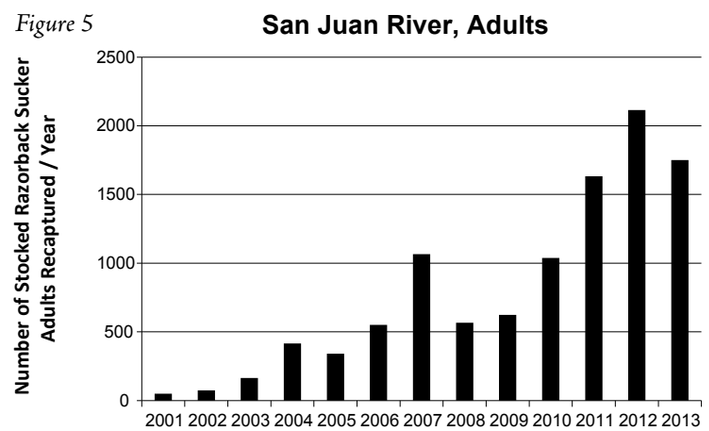


Photo courtesy UDWR

Wild-produced, juvenile razorback sucker were found for the first time in the Green and Colorado rivers in 2013.

Figure 6

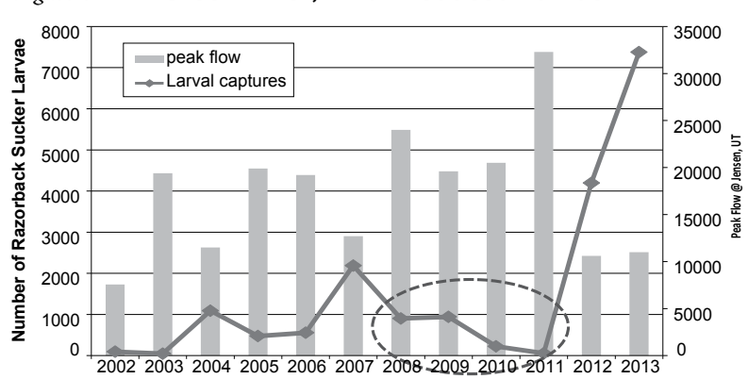
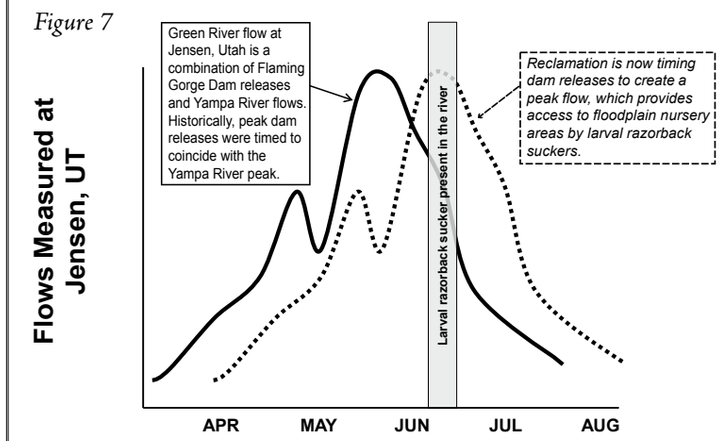


Figure 7



UDWR-Moab Native Aquatics Biologist Brian Hines captured this humpback chub in Cataract Canyon of the Colorado River in Utah.

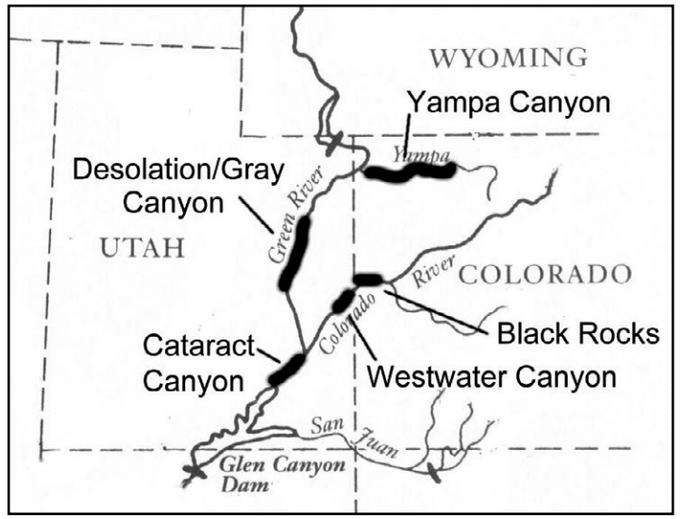
Susan Wood, Wildlife Technician for UDWR-Moab holds a humpback chub captured on the Colorado River.

The humpback chub is a relatively small fish by most standards – its maximum size is about 20 inches and 2.5 pounds.

HUMPBACK CHUB *(Gila cypha)*

◆ Five wild populations inhabit canyon-bound sections of the Colorado, Green, and Yampa rivers. Downward trends in some populations (particularly Yampa Canyon) have been attributed to increased abundance of nonnative fish and habitat changes associated with extended periods of drought.

• In 2014, researchers resumed humpback chub population estimation in Desolation and Gray canyons in the Green River (Figure 8; note high levels of variability / uncertainty associated with these estimates). These contiguous canyons provide ~45 river miles of occupied habitat. Researchers sample <20% of the available habitat each sampling season and then extrapolate those results to estimate overall population size. Although adult humpback chub survival and catch rates appear relatively stable for the past 15 years, researchers are currently concerned with low juvenile survival rates.



Locations of the five humpback chub populations in the Upper Basin.

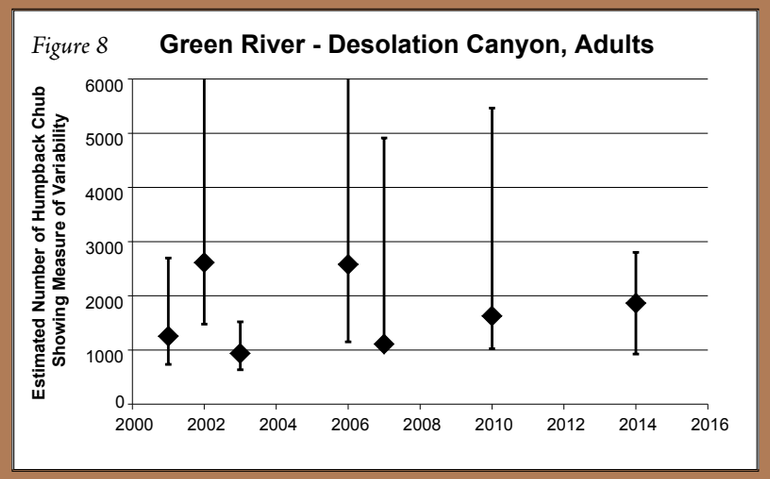
• The strongest population in the Upper Colorado River Basin consists of two groups in Black Rocks and nearby Westwater Canyon. Both populations experienced declines about 15 years ago, but have remained relatively stable since. Population estimation, scheduled to resume in 2015, will be delayed until 2016 to devote more effort to nonnative predator (walleye) control in the lower Colorado River.

• The humpback chub population in Cataract Canyon is small, but appears to be stable.

• Humpback chub in Yampa Canyon have never been common, but now are extremely rare. The Upper Colorado Program is developing an upper basin humpback chub brood stock to augment the population in Yampa Canyon if deemed necessary in the future.

• The U.S. Fish and Wildlife Service will begin revising the Humpback Chub Recovery Plan in 2015.

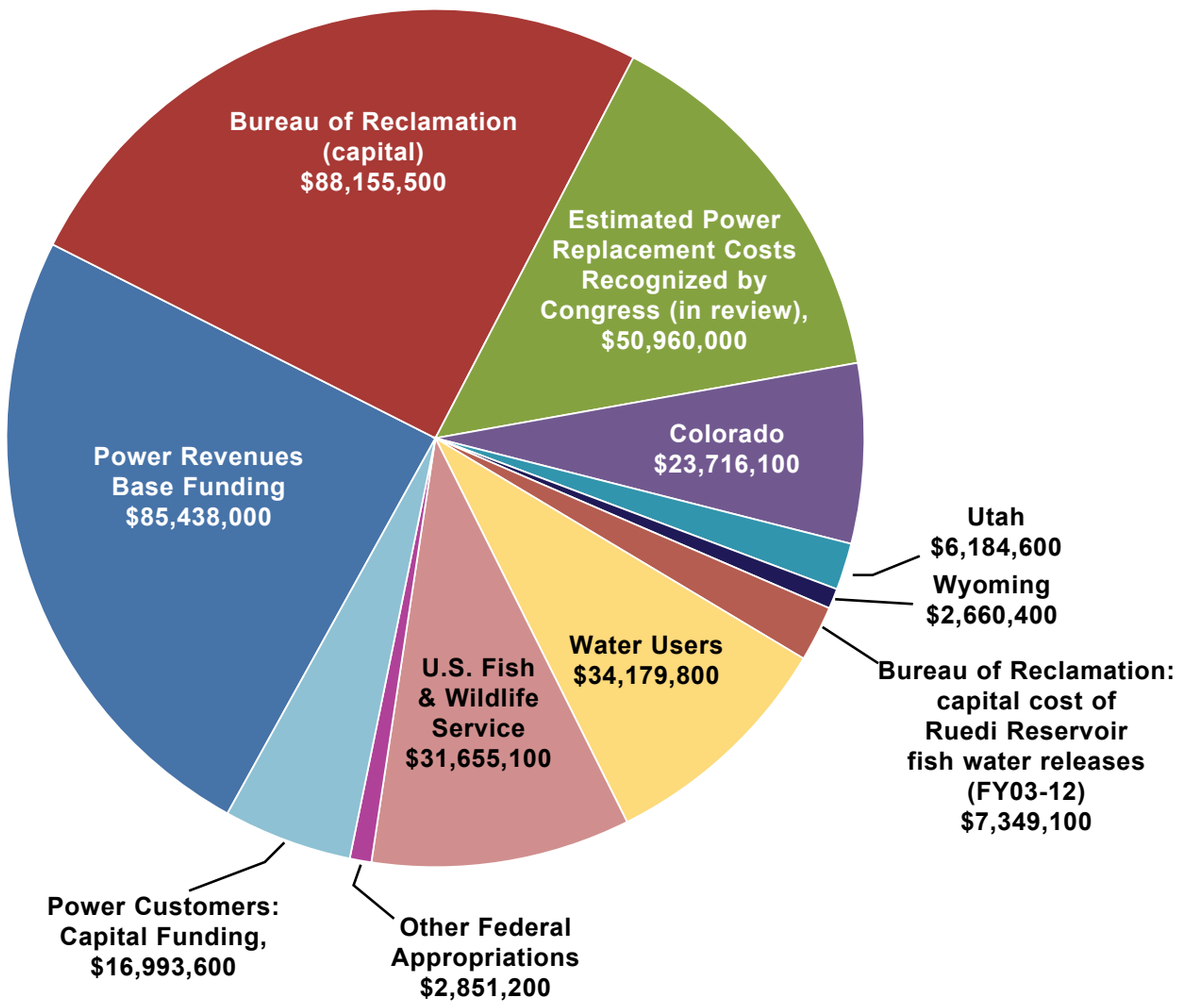
Historically, humpback chub inhabited the swift and turbulent waters in canyons of the Colorado River and three of its tributaries: the Green and Yampa rivers in Colorado and Utah, and the Little Colorado River in Arizona. The species was first discovered in 1946.



Expenditures
Upper Colorado River Endangered Fish Recovery Program

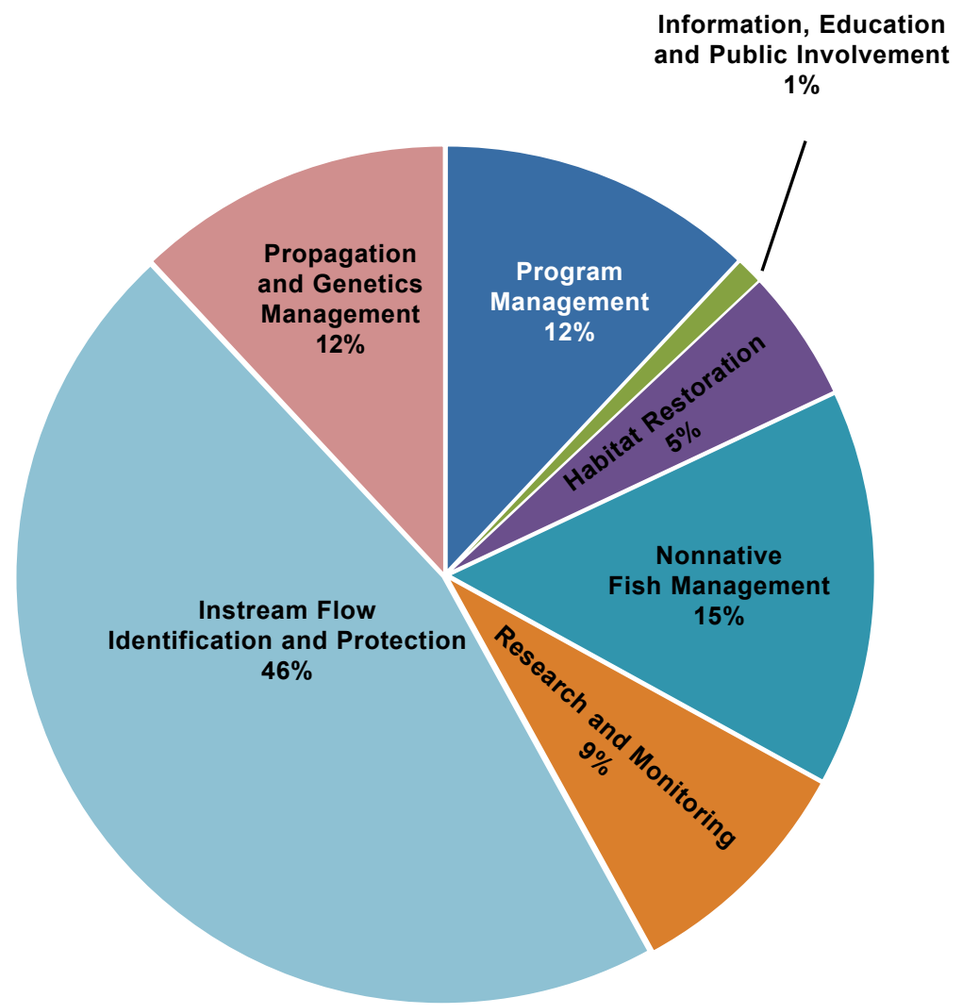
Total Partner Contributions = $350,143,400

(FY 1989-2015)



Projected Expenditures by Category

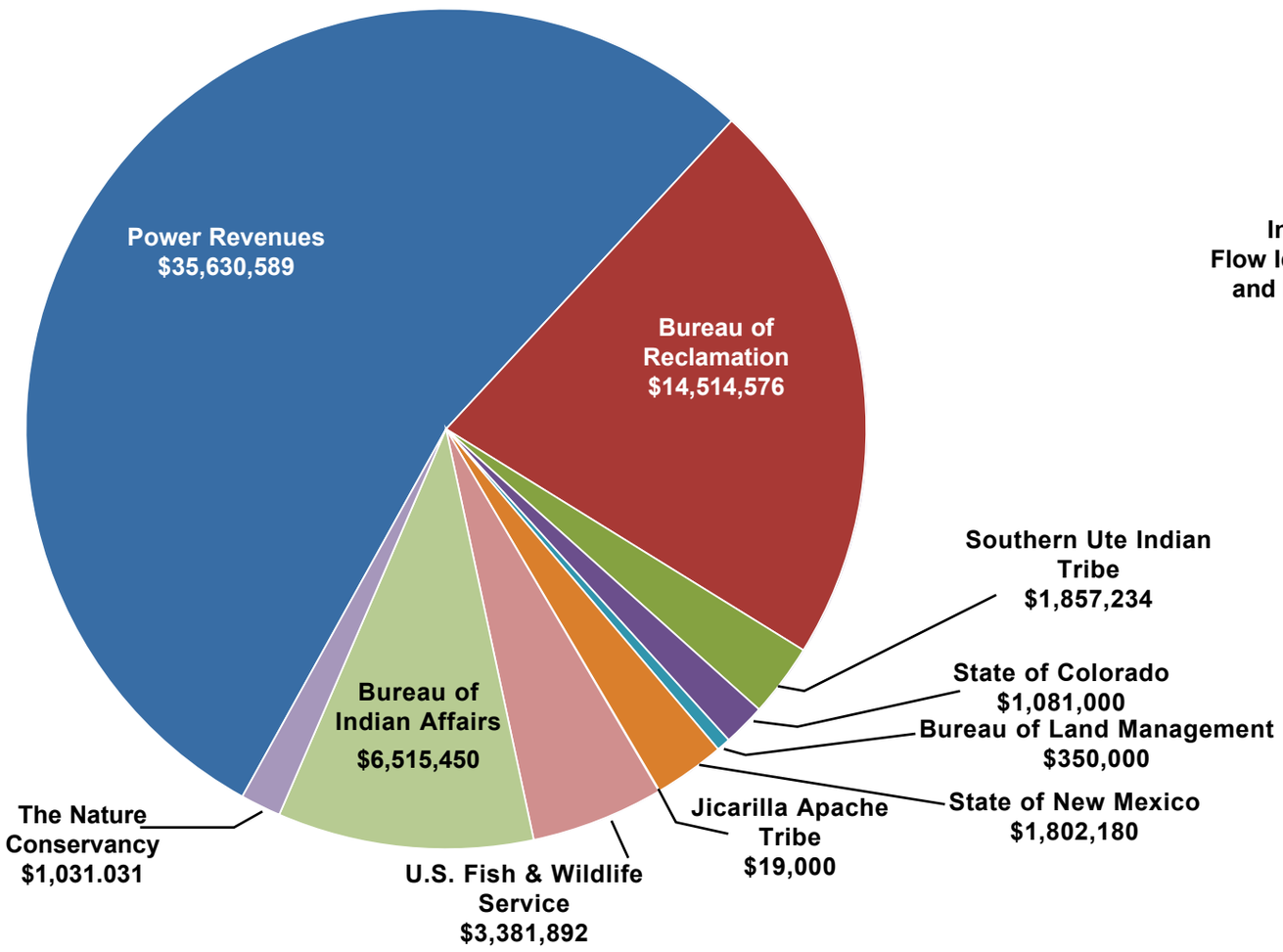
(FY 2015 only)



Expenditures
San Juan River Basin Recovery Implementation Program

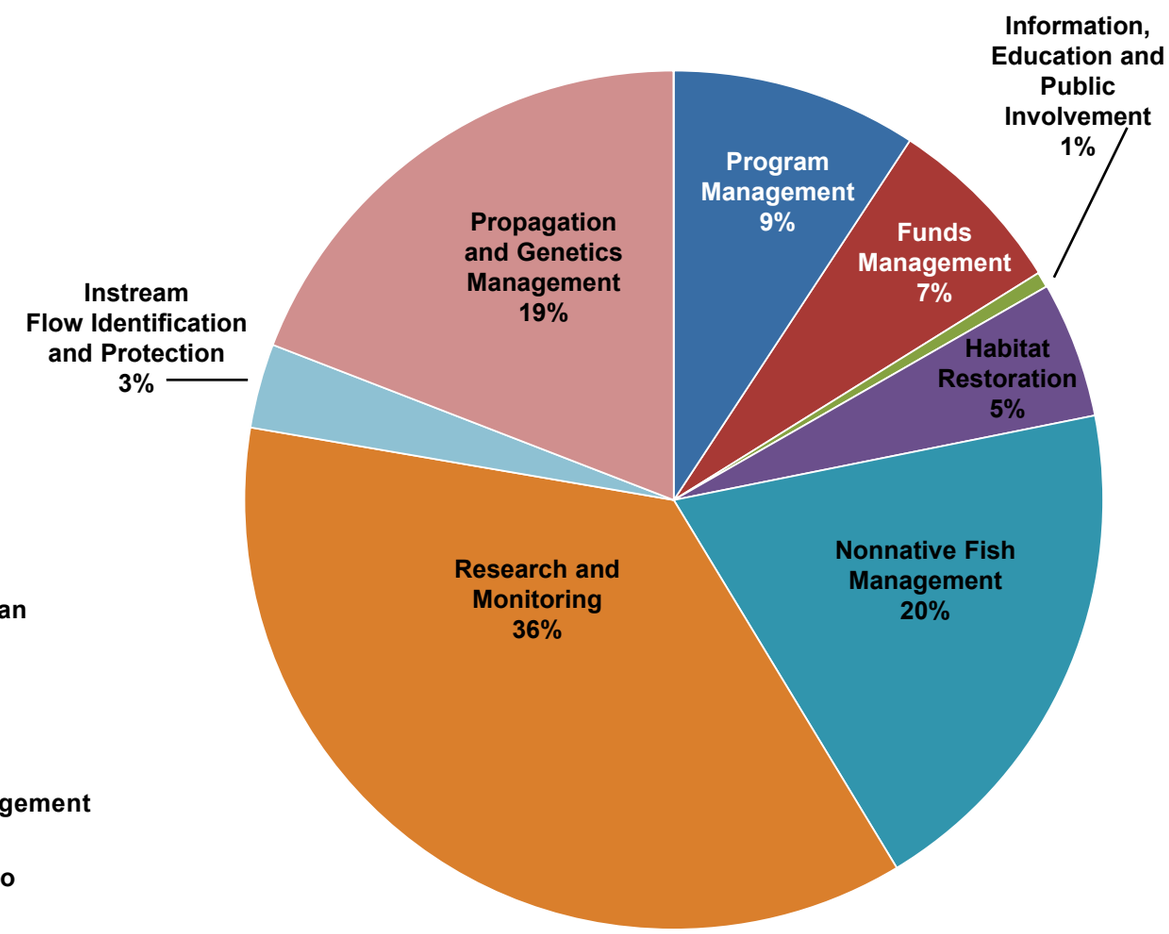
Total Partner Contributions = $62,761,925 (FY 1992-2015)

(Not including in-kind contributions)



Projected Expenditures by Category

(FY 2015 only)



Cost-Sharing Commitments and Power Revenues Support Species Recovery

Continuing the recovery programs' success requires funding to implement recovery actions. Public Law 112-270 (January 2013) extended annual funding at currently authorized levels through FY 2019. Capital funding has paid for extensive construction projects built with substantial non-federal cost-sharing (states' funds and Colorado River Storage Project power revenues) and federal appropriations.

ANNUAL FUNDS

P.L. 112-270 extended the funding authorization through fiscal year 2019. The programs may expend up to $6 million of Colorado River Storage Project (CRSP) power revenues per year (adjusted annually for inflation) for facility operation and maintenance expenses, endangered fish population and habitat monitoring, and critically important nonnative fish management, public involvement, and program administration.

The states, USFWS, water users and CRSP power customers contribute annual funding to both programs each year.

CAPITAL FUNDS

P.L. 106-392, as amended, authorizes the Bureau of Reclamation to cost-share capital construction projects. Water users, CRSP power customers, and the states of Colorado, New Mexico, Utah, and Wyoming have provided significant non-federal cost-sharing funds.

Capital funds have been used to construct hatchery facilities *(see page 8)*, **fish passages and screens** *(see pages 13-14)*; **complete water acquisition projects** *(see page 9)*; **and restore floodplain habitat.**

Power Revenues Cost-Share

$17 million of CRSP power revenues have been expended for capital construction projects. Consistent with P.L. 106-392, as amended, these revenues were treated as a non-federal contribution and as reimbursable costs assigned to power for repayment under Section 5 of the CRSP Act.

States Cost-Share ($17 Million)

•**Colorado's** Legislature created a Native Species Conservation Trust Fund in 2000. Its "Species Conservation Eligibility List" is annually funded by a joint resolution of the State's General Assembly.

•**New Mexico's** Legislature appropriated funds into the State's "operating reserve," thus making them available at any time and not tied to a specific calendar year. Application of the funds is subject to approval by the New Mexico Interstate Stream Commission.

•**Utah's** 1997 Legislature created a Species Protection Account within the General Fund which receives Brine Shrimp Royalty Act-created revenue. In 2000, Utah dedicated one-sixteenth of a one cent general sales tax to water development projects and directed funding to the Upper Colorado Program.

•**Wyoming's** Legislature appropriated its funding share during their 1998 and 1999 sessions.

Capital Construction Cost-Sharing for Upper Colorado and San Juan Programs

Upper Colorado Recovery Program	$179 million
San Juan Recovery Program	$30 million
Total	**$209 million***

***Sources of Revenue**

Federal	**Non-Federal**	
	Power Revenues:	$17 million
	States:	$17 million
	Water and Power:	$87 million**
		$121 million
Congress (Approps. in USBR's budget):		**$88 million**
Total Revenue		**$209 million**

Capital Project Cost-Sharing by the States

	Total Amount	Upper Colorado Program	San Juan Program
Colorado	$9.15 M	$8.07 M	$1.08 M
New Mexico	2.74 M	None	2.74 M
Utah	3.42 M	3.42 M	None
Wyoming	1.69 M	1.689 M	None
Total	**$17.00 M**	**$13.18 M**	**$3.82 M**

** Contributions by water and power customers are recognized and credited as cost-sharing towards recovery in Section 3(c)(4) of P.L. 106-392. These costs have included water provided from Wolford Mountain Reservoir and the Elkhead Reservoir enlargement and costs of replacement power purchased due to modifying the operation of the Colorado River Storage Project.