

ROARING FORK CONSERVANCY

Comprehensive Lower Fryingpan River Assessment 2013-2015

Summary

Given current concerns over the health of the Fryingpan River and fishery, Roaring Fork Conservancy is pursuing a comprehensive study to better understand the current state of the Fryingpan, and create a long-term monitoring plan to track trends over time. Roaring Fork Conservancy's initial aquatic studies will examine macroinvertebrates, flows, and water temperatures. In addition, we will conduct an assessment of the American dipper population, the extent of *Didymosphenia Geminata*, and update the 2002 Fryingpan Valley Economic Study to evaluate the role of the river in community vitality. Roaring Fork Conservancy will also work with Ruedi Water and Power Authority, Bureau of Reclamation, Colorado River Water Conservation District, and U.S. Fish and Wildlife Service to investigate how new and existing contracts for Ruedi Reservoir water can be managed to ensure river and associated economic health.



Upon completion of these studies, Roaring Fork Conservancy will disseminate the findings to federal, state and local government agencies and residents of the Fryingpan River Valley.

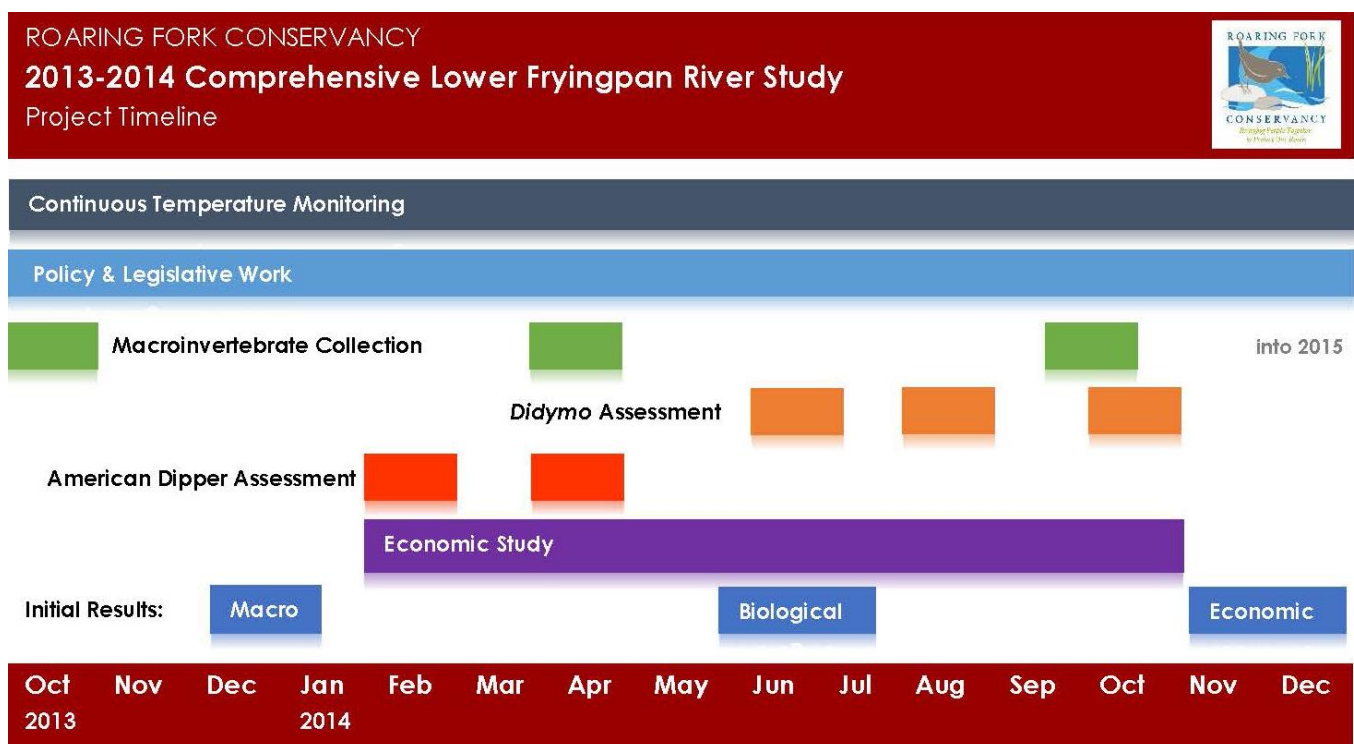
Goal

To ensure the environmental and economic sustainability of the Lower Fryingpan River, including its designation as a "Gold Medal Fishery".

Objectives

- Assess the current biological health of the Lower Fryingpan River and if impaired identify potential causal factors and solutions.
- Recommend a long-term monitoring strategy for the Fryingpan River.
- Update Roaring Fork Conservancy's 2002 *Fryingpan Valley Economic Study*.
- Determine and pursue voluntary and, if necessary, policy/legislative solutions for managing releases from Ruedi Reservoir to prevent negative economic and environmental impacts.

Components & Time Frame



BACKGROUND

The headwaters of the Fryingpan sub-watershed drain westward from the Continental Divide into the Fryingpan River, which meets the Roaring Fork River at Basalt. The Fryingpan-Arkansas (Fry-Ark) Project, constructed in the 1960s, is a large transmountain diversion project whose infrastructure is evident throughout the sub-watershed's headwaters in the form of diversion tunnels and Ruedi Reservoir, which was built to compensate the West Slope for the Fry-Ark Project's water depletions. The Fryingpan River Valley serves as a popular destination for outdoor recreation including angling and reservoir-based activities. One of the largest issues in this sub-watershed has been how management of Ruedi Reservoir affects stream flows, the aquatic ecosystem, and angling activities in the lower Fryingpan River.

The Fryingpan River below Ruedi Reservoir to the confluence with Roaring Fork River and the Roaring Fork River down to the confluence of the Colorado River is classified as a Gold Medal. Gold Medal Trout standards designate waters that provide the greatest potential for trophy trout and angling success. The criteria specify that a stream provides at least 60 pounds per acre of trout and more than 12 trout greater than 14 inches per acre. This status is supported by the high productivity of wild brown trout. The Roaring Fork Watershed has one of the longest contiguous sections of Gold Medal water in the state, extending along 14 miles of the Fryingpan River and 28 miles of the Roaring Fork. Only 168 miles (approximately 2%) of Colorado's 9,000 miles of trout streams carry the Gold Medal signature.

Given the lower Fryingpan River's dam-influenced flow regime, several studies have looked specifically at the effects of Ruedi Reservoir operations on the aquatic ecosystem. A study by Miller Ecological Consultants, Inc. (Ptacek et al., 2003) characterized the instream habitat and flow, macroinvertebrate community, spawning, trout populations, thermal regime, and hydrology for the lower Fryingpan and Roaring Fork rivers. Main conclusions from the study specific to the lower Fryingpan River include the following:

- The amount of suitable trout habitat has increased with post-dam conditions as compared to habitat available before the construction of the Ruedi Dam.
- Hypolimnetic releases and regulated flows in the Fryingpan River are responsible for maintaining extraordinarily high densities and biomass of macroinvertebrates. Densities were highest immediately below Ruedi Dam.
- Rainbow trout spawning success is temperature-limited and may be further reduced by whirling disease.
- Relative abundance of brown trout has significantly increased over the past 20 years and maximum size and overall biomass of brown trout have increased dramatically since installation of the dam.
- The annual maximum temperature of the thermal regime has shifted from late summer (pre-dam) to late fall/early winter (post-dam). Water released is warmer than normal in the fall and winter and cooler than normal in the late spring and summer.
- Since dam construction, base flows are augmented by reservoir releases and spring peak flows are reduced. Since 1989, reservoir releases have been significantly increased during the late summer/fall (August through October).
- Extreme fluctuations in reservoir releases on hourly and daily levels occur fairly frequently.

One of the key outcomes of this main study was a hypothesis that erratic changes in discharge have a negative impact on benthic macroinvertebrates. Therefore, a supplemental study undertaken collected enough information to suggest that the flow regime may have an important physical influence on benthic macroinvertebrate communities (Rees et al., 2003). An additional follow-up study evaluated potential impacts associated specifically with low winter flows (Miller Ecological Consultants, Inc., 2006). This study concluded that the impact to the macroinvertebrate community at the Basalt site from anchor ice appears to be influenced more by ambient air conditions than Ruedi-influenced base flow releases. The study's results also indicated that macroinvertebrate diversity and evenness appear to recover in one to two years after severe anchor ice formation

if winter flows remain greater than 70 cfs, and that flows greater than 70 cfs seem to result in less anchor ice in the upper half of the river than do flows around 40 cfs.

Current Conditions

In the summer of 2013, several long-time anglers familiar with the Fryingpan River and residents along the river reported seeing lower fish numbers, including fewer large trout; decreased numbers of macroinvertebrates and some questioned the distribution pattern; fewer birds, including dippers; and increased presence of *Didymosphenia Germinata* (Didymo). These conditions followed a particularly dry year, leaving Ruedi Reservoir lower than average (Ruedi went down to 61,000 acre feet this spring, its lowest level since 2008, when it went down to 55,000 acre feet). Roaring Fork Conservancy received many reports of

extensive and long-lasting anchor ice. Flows in the Lower Fryingpan River hovered around 40 cfs for almost four months. These low flows were not typical but were instituted by the Bureau of Reclamation to keep more water in the Reservoir and assure that it would come as close as possible to filling in the summer of 2013. The Bureau’s operating procedures generally call for winter releases in the 70-100 cfs range but drought conditions in 2012 and the winter of 2013 led them to reduce these flows. Future drought conditions resulting from climate change and increased demands on Ruedi may lead to increased instances of low winter flows in the future.

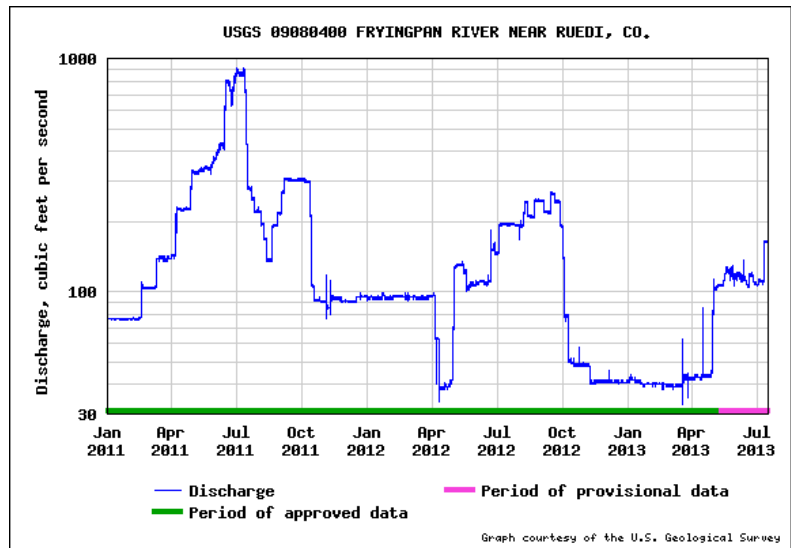


Figure 1. Flows below Ruedi Reservoir Jan. 2011-July 2013. Graph show prolonged period of low flows in the winter of 2012/2013.

Future Threats

Concurrently, Roaring Fork Conservancy provided comments on Bureau of Reclamation’s Ruedi Reservoir Round II Water Marketing Program–Repayment Contracts on 19,585.5 acre feet, Ruedi Dam and Reservoir, Fryingpan-Arkansas Project Draft Environmental Assessment (Draft EA). Roaring Fork Conservancy expressed concerns about the potential detrimental effects of the Proposed Action Alternative to the aquatic life and recreational economy in the Fryingpan River and requested that the contracts be awarded with stipulations or conditions that protect the aquatic resources of the Fryingpan River. Specifically, we were concerned that

“A decrease in average winter flows on the Fryingpan River will likely increase the formation of anchor ice, which creates the potential for adverse effects on aquatic vegetation, macroinvertebrate populations and fish populations, both directly and indirectly because of habitat alteration and scouring events.”

and,

“The potential exists for the lower Fryingpan River serving as a conduit for all contracted Ruedi Reservoir releases to see significantly higher flows in the late summer/early fall, increasing the hydrologic alteration in both the Lower Fryingpan and Roaring Fork Rivers”.


On August 2, 2013, the U.S. Bureau of Reclamation released the Final Environmental Assessment for Ruedi Contracting and the Finding of No Significant Impact. They found that the contracts for water:

“would not result in a significant impact to the human environment, or natural or cultural resources that were not already analyzed in the Final Record of Decision for Ruedi Reservoir Round II Water Marketing Program Final Supplement to the Environmental Statement (RRII FES).”


PROPOSED ASSESSMENTS

In response to these reports and potential additional alteration to flows, Roaring Fork Conservancy is conducting a macroinvertebrate, temperature, dipper and Didymo assessments as well as a repeat of our 2002 Economic Study. Data from Roaring Fork Conservancy's ongoing water quality monitoring program on the Fryingpan River and stream flow data from Colorado Division of Water Resources and USGS gages on the river will be used to help interpret these data. These studies will quantify existing conditions and the value of the resource to the surrounding communities; provide guidance for ongoing monitoring; inform discussions with water contractors and the BOR, the administrator of these contacts, regarding use of this contracted water for piscatorial purposes; and determine if there is a need to modify the Fryingpan-Arkansas Operating Principles.

Macroinvertebrates and Temperature Assessments


 Macroinvertebrates are aquatic insects large enough to be seen without a microscope. Some common macroinvertebrates that exist in high quality waters are the larval life stage of mayflies, caddisflies and stoneflies. Macroinvertebrates are an ideal bioindicator because of their limited mobility, relatively long aquatic life stage, high population densities, and sensitivity to disturbance. To understand existing conditions, Dr. Bill Miller of Miller Ecological Consultants will conduct a macroinvertebrate assessment similar to the study conducted in 2003-2004. He will work with Roaring Fork Conservancy to collect macroinvertebrates at three sites: downstream from the reservoir, near Taylor Creek, and downtown Basalt. These three sites were sampled fall, 2013 and will be sampled in the spring of 2014. Continuous temperature monitors have been placed near the bottom of the river at these three sites to monitor conditions ripe for anchor ice formation. Any hourly occurrence with a water temperature less than 32° F will be identified as an anchor ice occurrence. Concurrently, Roaring Fork Conservancy will continue to collect water quality data at two sites on the Fryingpan- one above Ruedi Reservoir (near Meredith) and the other below-Baetis Bridge. Analysis will include an evaluation of the relationship between temperature, macroinvertebrate, and flow data as well as comparison to the previous study.

Didymosphenia Geminata (Didymo) Assessment

 The third component of the aquatic study will document *Didymo*, a single celled alga also known as “rock snot” that can have detrimental effects on macroinvertebrates, and therefore fish. It can dominate stream surfaces by covering up to 100% of substrate with thicknesses of greater than 20 cm, greatly altering physical and biological conditions within streams. Macroinvertebrate species that consume *Didymo* are expected to be favored over those species that don't eat *Didymo* and species that require exposed sediment are expected to be negatively impacted by extensive coverage of *Didymo*. It thrives in sustained low flows and is often spread by the boots of anglers. High density blooms are frequent in rivers directly below impoundments. Large floods that scour the river bed can return biomass to a low level. However, in order to reduce cell biomass, floods must be high enough to cause the rocks on the streambed to mobilize, scouring the cells from rock surfaces. Understanding the extent and rate of spread will give a clearer picture of potential threats.

RFC has contracted with the Natural Resource Management Program at Colorado Mountain College (CMC) in Leadville to perform the *Didymo* study. CMC will collect *Didymo*, if it is present, samples using EPA protocol at 20 sample sites on the Lower Fryingpan. Sampling will occur three times a year (spring, summer, fall). The spring sample will not be taken until at least three weeks following the high flow event, allowing for re-colonization of the *Didymo* bloom. Cobbles at this site will be scraped, collecting samples to be further analyzed in a lab. At each site, water quality data (pH, specific conductance, temperature, and dissolved oxygen) will also be recorded. From these samples, CMC will produce a GIS map detailing *Didymo* occurrence and a comprehensive report which includes recommendations for future monitoring and management.

American Dipper (*Cinclus mexicanus*) Assessment

 The American dipper, an aquatic song bird that has evolved to a top-level predator-specialist in fast-flowing mountain streams of western North America, is also a good indicator of stream habitat quality. Dippers use several environmental characteristics to select suitable nesting sites, including water quality, stream habitat quality, and riparian habitat quality. Prey abundance, foraging ease, and nesting habitat are dependent on

these environmental variables, and if any of these variables are impaired dippers will reject the site. Although dippers can compensate for a degraded resource by increasing territory size, at a certain point energetics dictate against selecting an impaired territory. The dipper diet consists almost exclusively of macroinvertebrates and fish. Dippers prey selectively on caddisfly and mayfly nymphs and dipper abundance has been strongly correlated with the abundance of these insects. Members of both of these macroinvertebrate groups are generally intolerant of pollution or extreme ecological conditions. Pollution or sedimentation can destroy macroinvertebrate populations causing dippers to abandon the site.

With landowner permission, Delia Malone, a local ecologist, familiar with dipper surveys and the Fryingpan River will walk the Lower Fryingpan and conduct a pre-breeding survey (~ Feb. 2014) to determine territories, find nests, and determine number of breeding pairs. A second survey will be conducted after breeding to determine nest success.

Fryingpan Valley Economic Study

Understanding the rivers economic impacts on the Town of Basalt and the Roaring Fork Valley will aid in an overall view of the importance of keeping the river healthy, beyond biological needs. The proposed economic study would echo the work done nearly a decade ago by Roaring Fork Conservancy staff.

The Fryingpan Valley Economic Study (Crandall, 2002) revealed a wide range of information about the lower Fryingpan River, including specific results of economic impacts related to recreation activities. Some of the findings include:

- The 7.5 miles of publicly-accessible river on the lower Fryingpan River represent a significant tourist destination with related impacts on the local economy. Based on the study's data (collected from November 2000 through October 2001), the Fryingpan Valley's recreation activities contributed an estimated \$1.8 million annually in total economic output to Basalt's economy.
- A majority of Fryingpan River visitors come from outside of the Roaring Fork Watershed specifically to fish on the Fryingpan River. The study discovered that these visitors tended to spend nights in commercial accommodations, resulting in total direct spending as high as \$135 per visitor per day.
- Based on the study's data, commercial lodging represented an important component of lower Fryingpan River visitors' expenditure patterns, especially as a proportion of Basalt's total lodging sales.
- Based on visitor counts done as part of the study, the lower Fryingpan River supports an estimated 34,200 visitor days per year - attributable mainly to fly-fishing activities on the river. 70% of these visitor days occurred during the summer season and the other 30% during the off-season (Oct.-May).
- The study identified that lower Fryingpan River recreation supports sources of income and a number of jobs across several economic sectors both in the Basalt/El Jebel area and throughout the broader Roaring Fork Watershed.
- For the study period, although about half of the economic activity related to Fryingpan Valley recreation activities was felt in the Basalt area, spending by Fryingpan Valley visitors occurred throughout the Roaring Fork Watershed, as exemplified by the various towns in which visitors stayed overnight in commercial accommodations.
- Comments made by visitor survey respondents were wide-ranging, but a few common opinions emerged. A number of survey respondents stated their desire to return to the Fryingpan Valley.
- Ruedi Reservoir serves as a popular water-based recreation site for residents of the Roaring Fork Watershed. Based on the study's results, many of these local visitors make frequent trips during the summer season.
- For the study period (November 2000 through October 2001), 55 percent of Ruedi Reservoir visitors were local residents. The 45 percent from outside of the watershed had modest direct-spending patterns because they often were camping. Therefore, the resulting local and regional economic output related to Ruedi visitors was much lower than for visitors to the lower Fryingpan River.

- About half of Ruedi Reservoir respondents indicated they would take fewer trips if the reservoir followed a specific pattern of declining water levels throughout the season. In addition, some of the comments provided by survey respondents reflected opinions about Ruedi Reservoir water levels being too low.

RFC has contracted with Colorado State University (CSU) to update the Fryingpan Valley Economic Study. Dr. John Loomis will be updating survey questions to capture core data such as: party size, party origin (zip code), length of trip and expenditures by category including travel, gear and tackle, guide services, clothing accommodations, and food and beverage. The survey will also seek to capture influence of high late season flows and change in size or quantity of fish caught on the Fryingpan, as well as change in reservoir levels in Ruedi. Dr. Martin Shields is heading up the economic modeling process. Both will be assisted by a PhD Research Economist. Through this research, Roaring Fork Conservancy hopes to gain a better understanding of the current users of the Fryingpan River, their priorities and influences on local economy.

Policy and Legislative Options

The final piece of the overall study will involve investigating options for supplementing stream flow in the Fryingpan when necessary. One option to accomplish this may be arrangements with entities that have contracted for the delivery of water from Ruedi for the release of some of that water for piscatorial purposes. There are procedural, financial and legal implications to such arrangements that need to be investigated and analyzed. Pending board approval, RFC will be partnering with RWAPA for this portion of the study.

The most recent round of contracts for Ruedi water allow for the use of contracted water for piscatorial purposes but arranging for such a use would involve negotiations both with contractors and the Bureau of Reclamation. The first step in this process will be to contact contractors and determine their ability and willingness to make water available to augment stream flows. Piscatorial water would need to be secured through a sub-contract and the terms of those contracts could involve purchase or lease of water. The sub-contracts would also need to meet the Bureau of Reclamation's criteria and would need formal approval from the Bureau.

A second, more involved option would be the amendment of previous Ruedi contracts to also allow for piscatorial use of contracted water. This would make another several thousand acre-feet of potential supplemental water available but that water would then need to be secured through the same process outlined above.

A final strategy would be to amend the Ruedi Operating Principles to acknowledge the need for maintaining adequate stream flows in the Fryingpan and the value of the Fryingpan and Roaring Fork fisheries. Amendments could include specific requirements for minimum and maximum stream flows, the addition of maintaining local fisheries as one of Ruedi's operational goals, and requirements for ongoing evaluation of fishery health and adaptation of operations to respond to fishery needs. Ruedi's operating principles are based in Congressional documents that were adopted in conjunction with the authorization of the Fryingpan-Arkansas Project over 50 years ago, so revising or amending those documents would require action at the Federal level and might also require new legislation authorizing such amendments. This would be a long-term option that could be undertaken simultaneously with those described above.

One of the strategies that has been discussed is a challenge to the recently-released Environmental Assessment (EA) associated with the sale of Ruedi water. This is not recommended for the following reasons:

- The EA examines recent sales of Ruedi water and its conclusions mirror those of the previous EIS on Ruedi water sales. Neither document addressed low winter flows due to drought which is the presumed cause of last winter's anchor ice and this summer's observations of lower macroinvertebrate levels. Therefore a challenge based on low flows due to drought would not necessarily be accepted as relevant to EA's purpose, methods or conclusions.
- Because this summer's concerns were not included in any specific way in previous comments on the EA, they may not be accepted as a timely basis for challenge.

- Even if a challenge to the EA were successful, the result would be a revision to the EA to incorporate and analyze more data, with no guarantee that the EA's conclusions would change.
- A challenge to the EA would be seen as a threat to those entities who have been working to secure contracts for Ruedi water and, through that process, to settle a number of outstanding issues associated with Ruedi, like the final repayment of the debt on Ruedi construction and the finalization of Ruedi's annual obligation of water for endangered fish species. A challenge to the EA would be opposed both by the Bureau and by those other entities which include many agencies and governments in the Colorado River Valley. The challenge process would be controversial, prolonged, expensive and possibly inconclusive.

As we gain a better understanding of the potential issues and causes through the economic and biologic studies, we will identify and suggest creative options for the future management Ruedi Reservoir to maintain the environmental and economic assets of the Lower Fryingpan River. This could entail a mix of the policy and legislative options discussed here.