



Provo River Restoration Project

Fish and Wildlife Studies

January 2002

The Provo River Restoration Project (PRRP) is being implemented by the Utah Reclamation Mitigation and Conservation Commission to restore the natural pattern and ecological function to the middle Provo River between Jordanelle dam and Deer Creek reservoir. Its design is based on the latest scientific information available. An interdisciplinary team of scientists are contributing their expertise to PRRP by designing and implementing several studies. These biological and physical studies provide three essential components for restoration: 1) they thoroughly describe the existing physical condition of biological communities (i.e., baseline condition); 2) they provide a basis for restoration design; and 3) they initiate monitoring that enables planners to detect measurable change due to restoration activities and to make informed management decisions.

BIOLOGICAL STUDIES

This group of studies investigates biological communities along and within the Provo River. Brigham Young University, University of Nevada-Reno, Utah Division of Wildlife Resources, U.S. Fish and Wildlife Service, Arizona State University, Idaho State University, Utah State University and Commission staff contribute to these studies that help designers 1) determine the condition of the biological community; 2) understand habitat needs of native plants and animals; and 3) plan for desirable habitat conditions for plants and animals.

Fish Community: A primary PRRP goal is to increase game fish populations and suitable habitat. Restoring a meandering river channel has its most immediate effects on game fish populations by quickly increasing availability of cover, suitable spawning areas, and rearing areas. The Utah Division of Wildlife Resources has three fish population sampling stations on the Provo River within the Project area. They are: Casperville Bridge, near Deer Creek Reservoir; Johnson Old Mill Site; and White Bridge Station, near Jordanelle Dam.

The Division samples these stations on a three-year schedule using electrofishing techniques. The last sampling was completed October, 2000. Fish species found include: brown trout, rainbow trout, mountain whitefish and Utah suckers. Brown trout was the dominant species found at all of the sites. Of the three sites, the Johnson Old Mill Site had the highest number of fish.

At the Casperville Bridge station, an 800-foot stream section was sampled in October, 2000. The brown trout (size >150 mm ~ 6 inches)



Brown Trout

population estimate was 144 lb/acre. Brown trout made up 79% of the fish sampled (267 fish). Remaining fish species were rainbow trout (11%) and whitefish (10%). The brown trout standing crop in 1997 was 148 lb/acre, based on a 528-foot stream section sample site.

At the Johnson Old Mill Site, 700 feet of stream was sampled in October, 2000. The brown trout (size >150 mm) population estimate for this stream reach was 478 lb/acre. Brown trout made up 81% of the fish sampled (824 fish). Other fish species found were rainbow trout (0.5%), Utah sucker (10%), mountain sucker (5%) and mountain whitefish (3.5%). In 1997, the station reach was 528 feet and the brown trout (>150 mm) standing crop estimate was 161 lb/acre.

The fish sampling site below the White Bridge is entirely within the PRRP pilot project. At this station, 700 feet of stream was sampled in October, 2000. The brown trout (size >150 mm) population estimate for this site was 223 lb/acre. Brown trout made up almost 99% of the sample (357 fish) with rainbow trout, Utah sucker and mountain whitefish making up the rest. By comparison, the brown trout (>150 mm) population estimate in 1997, based on a 528 foot-long station was 36 lb/acre.

This monitoring effort will continue throughout the restoration and recovery phase of PRRP. Changes in fish communities because of channel restoration will be reflected through this continued population monitoring.

Habitats favoring native non-game fish will be constructed during PRRP. Fish sampling surveys indicate seven native fish species exist in the PRRP area.



Redside Shiner

They are: mottled sculpin, mountain whitefish, Utah sucker, Longnose dace, speckled dace, mountain sucker and redbone shiner. Ongoing studies determine what types of channel

features should be considered to favor habitats for native fishes. For example, studies show that native fish, particularly leatherside chub, are vulnerable to predation by brown trout in simplified habitats, and therefore are found in refuge habitats in channels other than the main stem of the Provo River. Backwater areas and side channels are suitable habitats where small native fish may escape predation. An increase in aquatic habitat diversity, such as side channels, undercut banks and increased cover by bank vegetation, will benefit survival of both game and non-game fishes. Off-channel habitats in particular, such as ponds and old

channel cutoffs, support native fish species and are included in restoration planning.

Macroinvertebrates (i.e. stoneflies, mayflies, midges, etc): A PRRP project goal is to create a river channel with more diverse habitat for fish as well as aquatic invertebrates, such as stoneflies, mayflies, midges etc. This will be accomplished by adding habitats missing in the existing river channel – mainly backwaters and slower water environments. With increased habitat diversity, an increase in aquatic invertebrate diversity is also expected.

During construction, through removal or moving of river bed materials, or complete relocation of the river channel, aquatic communities are impacted. However, with time, restored reaches are recolonized through both the drift of insects from upstream areas (drift is downstream movement of insects by the current) and egg deposition by flying adult insects. Insect species that tend to actively drift will be the first colonizers. *Baetis* [nymphs of the blue winged olive] and midges [Chironomidae], for example, will show up in restored sites almost immediately. Other groups, such as ephemereid mayflies [eg. *Drunella grandis* - the western green drake], and some caddisflies and stoneflies, will take up to several years to reach normal population densities.

Aquatic invertebrate monitoring is being conducted using intensive, semi-quantitative techniques to monitor changes in aquatic insect populations over time. Preliminary results bear out what was anticipated: early colonizers moved into restored sections within three months of construction. And a year after construction many of the common Provo River insects were becoming abundant again.

A year and a half after the first reach of PRRP construction, *Baetis*, *Brachycentrus* and chironomids were at their pre-construction numbers within that reach. *Drunella* and *Epeorus* [the Yellow Quill mayfly] were almost at pre-restoration levels.



Skwala

The stonefly, *Pteronarcella badia*, had increased by 800% and *Isoperla* had increased by 650%, but were still less than half their original density. *Skwala*,

which was not found in the reach immediately after reconstruction, eventually became the most abundant stonefly.

Increased habitat diversity resulting from restoration will also change relative abundances of aquatic invertebrates in the river. Some insects may be reduced in abundance, but others will be increased. A year and a half following reconstruction, the mayfly *Paraleptophlebia* [the Mahogany dun] and oligochaetes became more abundant than they were prior to restoration. The trichopteran, *Brachycentrus echo*, became much more abundant as well. The increase in diversity will extend periods when emerging insects will be available to fish.

Bird Studies: Birds, especially migratory songbirds, were one of the main groups of wildlife used to develop habitat restoration guidelines. Birds can be easily watched and studied. They are

sensitive indicators of which riparian and wetland habitats are missing or in poor condition. By searching for areas where sensitive species thrive, scientists learn what plant types and environmental factors need to be restored in order to rehabilitate the full complement of bird species once found along the middle Provo River. The associations of birds with habitat are used to refine PRRP's revegetation plan, track restoration progress and demonstrate PRRP's benefits to wildlife.

Scientists recently completed a three-year baseline study and final report, which included habitat analysis. The study related the abundance of riparian birds to vegetation types. A statistical habitat analysis involved a variety of vegetation attributes (such as tree density, number of tree species, wetland coverage, shrub coverage, etc.) and the presence of certain birds. A set of bird species was used for the analysis based on their value as indicators of healthy habitats.



Warbling Vireo

For instance, the Warbling Vireo was strongly associated with woodland cover. So, for the benefit of refining the revegetation plan, tree density in areas where this bird is common was measured and used as a guideline for how densely to plant nursery trees in restoration areas. Secondly, restoration efforts should increase Vireo-associated habitat over baseline conditions, and Warbling Vireo numbers should likewise increase. Thus, an increase in Warbling Vireos along with an increase in woodland cover would mean the restoration benefited wildlife. However, since Warbling Vireos cannot represent all wildlife, a whole suite of riparian birds are used to track restoration success in a similar fashion.

Bald Eagles: With increasing game fish populations and eventual recovery of old mature cottonwood trees, wintering Bald Eagles will consequently receive additional habitat along the Provo River. Currently, wintering bald eagles are monitored in an annual sweep survey along the river, in which exact locations of eagles are recorded on a digitized map. Over time, changes in numbers or habitat shift by eagles within the corridor will be detected through Geographic Information System analysis.

Spotted Frogs: Spotted frogs, important amphibians greatly on the decline in Utah, will benefit significantly from PRRP. Spotted frog monitoring involves an annual full inventory of spotted frog use in the Provo River corridor throughout the restoration project area. All existing wetlands in the PRRP corridor have been mapped. Standardized surveys are conducted for spotted frog use in each wetland site. PRRP created eighteen additional wetlands in 1999 according to design criteria derived from researchers' input. By the following spring, sixty



Spotted Frog Photo by Stacey Smith

percent of the new wetlands contained egg masses, evidence of breeding frogs. Individual frogs were observed in an even greater proportion of these wetlands. Many adult frogs appeared out of nowhere to colonize the new wetlands and appeared to be actively using them throughout the 2000 construction season. Many more wetlands were created in the 2000 and 2001 PRRP construction phases. These new wetlands are being monitored for frog use.

Vegetation studies: A botanical study was conducted along the PRRP corridor to learn physical requirements for establishing native riparian and wetland plants. Plant species were combined into groups according to their requirements for soils, ground water, elevation, flow regimes, and location in relation to river and wetlands. The various requirements are being used for revegetating reconstructed streambanks and wetlands. All areas disturbed by PRRP construction from 1999 through Spring, 2001 have been seeded and planted. Approximately sixty acres have been seeded with a mixture of grasses and forbs (wheat grass, brome and wild rye grasses); and, about 110,000 seedlings of mostly cottonwoods, willows, alders, hawthorns and woods' rose have been installed. Revegetated areas are examined annually. So far, while weed control is an issue, plant survival is high. It is estimated to take about five years to gauge overall revegetation success at a site.

Ute ladies'-tress: Small colonies of native orchid plants known as Ute ladies'-tress, which are federally listed as threatened, have been identified and monitored for several years in the Provo River corridor. Studies are being conducted for restoration planning purposes to better define the plants' habitat and understand how to manage them. Preliminary data shows Ute ladies'-tress are found in more open areas around other plants that don't have dense shrub and tree growth. This substantiates other researchers' data. Because PRRP is creating a mosaic of habitats, it is expected to result in creating more habitat for Ute ladies'-tress. Ongoing monitoring of the colonies and recording number of plants and timing of flowering, will continue throughout PRRP and its recovery phase.



Ute ladies'-tress
Photo courtesy of Utah Division of Wildlife Resources

PHYSICAL STUDIES

This group of studies investigates the Provo River physical environment. Scientists involved in these studies have included hydrologists, geologists, and geomorphologists from the US Geological Survey, Arizona State University, and Commission staff. The types of physical studies and their importance are discussed below:

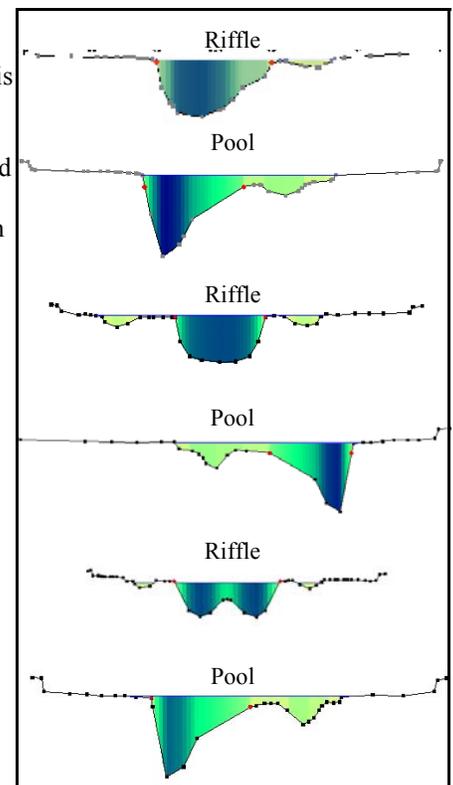
Geological Setting: To understand the character of the middle Provo River, scientists reviewed the geologic history and geological setting of the Heber Valley. This provided insight into the natural Provo River condition prior to human disturbance. Understanding the undisturbed, natural condition is important because restoration planners assume that most native organisms are adapted to this natural condition and that creation of similar conditions will benefit most native organisms.

Hydrology Studies: Hydrologists have evaluated old hydrologic records, used computer simulations of natural conditions and stream gage records to reconstruct natural Provo River hydrological conditions. Flow variation within a year and across years is important. For example, the establishment of cottonwood and willow seedlings requires soil disturbance created by large flood flows, but also depends on an extended period of lesser flows. Many plants and wildlife species are adapted to and depend on seasonal variations of natural flows. Unfortunately the same species are greatly impacted by flow modification. Using information from hydrologists' studies, the Commission works with the Central Utah Water Conservancy District, Provo River Water Users Association, U.S. Bureau of Reclamation and others to implement flows that mimic natural flow patterns while continuing to meet water users needs.

River Mechanics studies: The forces of flowing water carve a river channel. Channel size, shape, and pattern are related to flow magnitude, duration, and frequency as well as valley soils and slope. River mechanics experts determined the middle Provo River's forces and sediment transport capability. With this data, designers identify expected channel characteristics and are designing channels that will be sustained by natural processes. The channels also should provide flow depths and velocities consistent with native species habitat needs.

For example, shown to the right is a series of cross sections from a draft Provo River Restoration channel design. The cross-sections show the shape of the channel, flow elevation and velocity simulated at 1775 cfs (considered bankful) as the river flows down through riffles, pools and critically important new side channels.

The black line in each diagram is the ground surface. Flow velocity is indicated by color with darkest blue being the fastest moving water and lightest green being the slowest. The simulation was done with the U.S. Army Corps of Engineers' HEC-RAS model.



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