

Mussels protected from horses at Big South Fork

By Steve Bakaletz and Wallace Linder

THE BIG SOUTH FORK NATIONAL RIVER

and Recreation Area watershed in Tennessee and Kentucky is a national focus for major conservation efforts. The river is home to one of the most diverse freshwater assemblages of fish and mussel fauna in the United States. It harbors 31 endemic and restored mussel species, of which nine are federally listed or candidates for listing.

Two of the endangered mussel species (*Epioblasma walkeri* and *Pegias fabula*) are the only known reproducing populations in North America, and therefore have global significance. The U.S. Fish and Wildlife Service listed the park's major streams and the national river as critical habitat for mussels in October 2004. One hundred twenty-eight fish species (three are endangered) also live in the Big South Fork watershed.

Degraded upstream water quality is affecting park resources, and park management has plans to address the top three contributors to aquatic resource degradation: coal extraction, acid mine drainage, and oil and gas production. But park visitor activities, notably horseback riding, are contributing to the impact by increasing erosion and stream sediment load. Big South Fork National River and Recreation Area is one of the most frequented horse-riding parks in the National Park System, with 450 miles (724 km) of trails. Horse crossings impact the stream in three primary ways: (1) direct crushing of organisms (mussels), (2) disturbance and suspension of sediments, and (3) the accumulation of horse fecal matter near the water's edge. Other trail users such as mountain bike riders, hikers, and maintenance vehicles also ford creeks. Intersections where trails and creeks cross therefore require physical improvement to allow users to enjoy the

trails while protecting aquatic habitat from harm. Park staff has undertaken a project that protects the water and wildlife at crossings and reduces the risk of injury to visitors by hardening the riding surface, or tread, at those points. They have installed nine hardened crossings so far and have 250 more that need to be done.

Small and medium stream crossings

Park staff chose the method of mitigating the crossings, or fords, based on the size of the stream. For small and medium-sized streams, park staff places preformed concrete planks (each 8 feet [2.4 m] long, 16 inches [0.4 m] wide, and 6 inches [0.15 m] thick) along the crossing areas using a front-end loader and hand labor. The park biologist examines the stream prior to plank placement to ensure that no organisms will be crushed under the planks. These are placed across the creek, parallel to the bank, eliminating contact of horse hooves with the creek substrate, and level with the creek bottom so that the water will flow freely over the hardened surface. The top edge of the plank is beveled to a 45-degree angle to prevent erosion at the base of the plank. A cable runs through a hole in each plank on the upstream side and is attached to an anchor on each side of the crossing. The cable system is submerged and buried to prevent user injury.

At the streambanks, resource managers engineer approaches to the stream crossings to be durable in flood events, provide good traction, and require low maintenance. Treadways are excavated for the width of the trail; a sub-base of large rock is placed in the bottom and covered with a filter fabric blanket. Next, a layer of smaller rock is placed over it and another blanket spread on top of that. The final layer is the tread-



way material. In some situations where traffic is heavy, staff uses three layers of blanket to hold the sub-base material together. This last situation occurs when using interlocking concrete blocks (designed for erosion control). After the third blanket layer is put down and the treadway is as level as possible, staff places concrete blocks on top and fills in the spaces and voids with an inert material derived from burned shales called "red-dog."

These improvements make ford approaches easy to see for both humans and horses. Often when horses first notice that they must cross a creek, they become nervous and defecate. Horse manure accumulates in and near stream crossings, resulting in degradation to aquatic resources and water quality. However, trails that can be clearly identified by horses help relax the animal and reduce manure in sensitive aquatic environments. Mountain bikers and hikers are also able to cross streams more easily and with less indecision about location of the correct route. An added benefit is safer driving conditions across the creek for authorized vehicles because the hardened surface provides a smoother treadway for the tires. Life expectancy of the trail improvements is more than 50 years. All trails and fords could potentially receive this treatment, and the corresponding streams would benefit.



Resource managers designed and installed trail crossings at Big South Fork for potentially heavy river flows (above) and light to medium stream flows (right and previous page). The designs increase horse and human safety, reduce animal stress, improve water quality, and protect freshwater mussels and other sensitive species.



Large-river crossings

Two of three large river crossings that exist in the park occur within a 12-mile (19 km) reach that provides habitat for endangered species, including 10 mussel species and 3 federally listed fish species. The U.S. Fish and Wildlife Service, in an informal consultation, expressed concerns about the concrete plank technique working in large rivers. Water depths at the crossings vary from 3 inches [7.5 cm] during low flow to 40 feet [12 m] during a severe flood. The power of the water flow and the debris it carries can be tremendous. Therefore, anchoring the planks would be problematic, and any failure could result in harm to the habitat. Park staff prepared a biological assessment to review alternative methods at the Station Camp crossing. The environmentally preferred alternative was to mark the corridor with native sandstone rocks that were slablike in profile.

First, resource managers inspected the surface of the trail crossing for endangered species and found none. The trail substrate was composed of 2 inches (0.8 cm) of sand over solid bedrock. Native mussels avoid the large-river crossings because the

Slabs . . . provide habitat for mussels and fish while serving as an effective method for trail delineation.

sediment is not deep enough for stable burrowing in the event of high river flows. Slab rocks used to mark the trail corridor at Station Camp crossing weighed from 900 to 3,000 pounds (409–1,363 kg) and measured 3 feet (1 m) wide by 6 feet (2 m) long on average. Rocks ranged from 6 to 10 inches (0.15 to 0.26 m) thick, and 22 of them were used to mark the crossing. Workers placed rocks on each side of the 10-foot (3 m) corridor to delineate the trail. The mussel's life cycle includes a host fish to which young mussels are attached temporarily. Host fish frequently hide under slab rocks, and when the young mussels fall off the fish they remain under these rocks. The slabs therefore provide habitat

for mussels and fish while serving as an effective method for trail delineation.

Improvements noted

The trail corridor is now marked with slab rocks, and trail users and horses have a clear and visible pathway. (When the river is flooded and the rocks are not visible, it is not safe to cross.) Staff has installed signs providing instructions to users to stay inside the corridor, and so far the system is working well.

Monitoring has documented a drastic reduction in the number of mussels crushed by users and decreases in horse manure at the stream approaches. Treated streams are no longer turbid because users are now crossing at the fords. This technique of stream protection is likely to work well in other parks with streams forded by visitors.

About the authors

Steve Bakaletz is a biologist and **Wallace Linder** is trail foreman with Big South Fork National River and Recreation Area. The authors can be reached at steve_bakaletz@nps.gov and wally_linder@nps.gov, respectively.