Fish Inventories in Four Park Units of the Rocky Mountain Network

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INTRODUCTION

The mission of the National Park Service (NPS) is to conserve unimpaired the natural and cultural resources and values of the National Park system for the enjoyment of this and future generations. To complete this mission, the NPS has focused on the need to have more complete and credible scientific information on the status of the natural resources within the Nation's parks. There is little or no data available that documents the fish species present or their relative abundances in some of the smaller park units of the Rocky Mountain Network. Our goal was to provide such information for Florissant Fossil Beds National Monument, Grant-Kohrs Ranch National Historic Site, Great Sand Dunes National Monument and Preserve, and Little Bighorn Battlefield National Monument.

Our specific objectives were to 1) document 90% of the fish species present and their relative abundance in each of the park units; 2) create voucher specimens for species not previously recorded or for known taxa where voucher specimens do not currently exist; and 3) provide data on species of fish present in the four park units to NPS personnel to update NPS databases.

METHODS

The aquatic habitats that were sampled were selected with the assistance of the NPS Project Coordinators at each park unit. At Little Bighorn Battlefield National Monument and Florissant Fossil Beds National Monument all water bodies were sampled. At Grant-Kohrs Ranch National Historic Site, all natural water bodies were sampled, but irrigation ditches were not sampled. At Great Sand Dunes National Monument and Preserve, sites in the Sand Creek basin were sampled. The Medano Creek basin was not sampled because this basin was the site of nonnative fish eradication in 1987, followed by restoration of native Rio Grande cutthroat trout (*Oncorhynchus clarki virginalis*), and Rio Grande suckers (*Catostomus plebeius*) (John Alves, Colorado Division of Wildlife, personal communication). Because Colorado Division of Wildlife (CDOW) monitors fish populations in Medano Creek, we decided under consultation with Fred Bunch, NPS, and John Alves, CDOW, to compile the existing data for this basin rather than sample directly.

We captured fish using backpack electrofishing equipment, seines, and angling equipment. Specific gear types used in each water body are presented in the results for each park unit. Sampled fish were identified to species, counted, and either released at the site of capture or euthanized and preserved in 10% formaldehyde for use as voucher specimens. A subsample of fish of each species was measured to the nearest mm total length (TL). Because Colorado Division of Wildlife prohibited taking voucher specimens of putative Rio Grande cutthroat under our Colorado Scientific Collector's Permit, we took photographs of several cutthroat trout to serve as vouchers. These photographs are archived on the compact disc located in the sleeve on the back cover of this document. We also documented sample sites and representative habitats at all four parks units photographically (Appendix 1, compact disc). A global positioning system (GPS) unit was used to document locations including upstream and downstream benchmarks that delineated stream sample sections and lake and pond sampling sites.

We searched for existing data for the park units in Montana using the Montana Fisheries Information System (MFISH) (http://nris.state.mt.us/scripts/esrimap.dll?name=MFISH&Cmd=INST), an interactive database administered by Montana Fish, Wildlife, and Parks (MFWP), and the Montana Natural Resource Information System (NRIS). We spoke with the CDOW fisheries database manager to determine what fisheries data existed for the Colorado park units.

RESULTS AND DISCUSSION

Florissant Fossil Beds National Monument

We surveyed all the known water bodies on the Monument including seven ponds, one spring, and Grape Creek. The seven ponds were arbitrarily labeled as Ponds A–G. Descriptions of the ponds and their locations are listed below, and latitude and longitude of ponds are listed in Table 1. Fish were sampled using 4.6 or 6.0 x 1.8 m x 5 mm mesh seines. No other fish collection records for the Grape Creek drainage are extant (Harry Vermillion, CDOW Fisheries Database Manager, personal communication).

Grape Creek.—Most of Grape Creek was dry; water was present beginning at the marsh near the Hornbeck Homestead, and continuing downstream to the Monument's north boundary (Table 1). Below the marsh area, Grape Creek was very shallow (~ 5 cm), and about 0.5 m wide, and aquatic macrophytes and filamentous algae were common. We sampled this reach using dip nets; no fish were seen or captured.

A series of beaver ponds is located on Grape Creek about 1 km downstream of the Hornbeck Homestead. We sampled two different areas in these ponds (Table 1). The Upper Beaver Pond was about 100 m long and 10 to 30 m wide. We captured 45 fathead minnows (*Pimephales promelas*) in the Upper Beaver Pond ranging from 26 to 71 mm TL in two seine hauls. The Lower Beaver Pond area (Table 1) was about 50 m long and 10 m wide. We captured 60 fathead minnows ranging from 35 to 65 mm TL and 23 white suckers (*Catostomus commersoni*) ranging from 43 to 99 mm TL in two seine hauls.

Grape Creek Tributary.—We surveyed a tributary to Grape Creek, located east of Teller County Road 1, from the Monument's south boundary to Pond F (Table 1). The upper reach was shallow (1-5 cm deep by 10 cm wide), and was completely dry at Pond F. We sampled the water with dip nets; no fish were seen or captured.

Pond A.—Pond A was located on a small tributary of Grape Creek, about 400 m northwest of the Hornbeck Homestead (Table 1). Pond A was about 20 m by 20 m, with a maximum depth of about 0.8 m. We captured 122 fathead minnows ranging from 35 mm to 78 mm TL in one seine haul.

Pond B.—Pond B was located on a small tributary of Grape Creek, about 100 m east of the Hornbeck Homestead (Table 1). Pond B was about 15 m by 5 m, with a maximum depth of about 0.5 m. No fish were captured, but we captured 3 tiger salamanders (*Ambystoma tigrinum*) ranging from 104 mm to 128 mm TL, with external gills, which indicate that they were either larval stage or the neotenic axolotl form.

Pond C.—Pond C was located near the north Monument boundary, about 750 m southeast of the Florissant Cemetery (Table 1). Pond D was about 40 m by 50 m, with a maximum depth of over 2 m. In three seine hauls, we captured 154 fathead minnows ranging from 35 mm to 69 mm TL and 47 white suckers ranging from 40 mm to 122 mm TL.

Pond D.—Pond D was located near the Cusack Potato Barn (Table 1); it was about 100 m by 40 m, with a maximum depth of 2-3 m. Aquatic macrophytes including duckweed (*Lemna* sp.) and filamentous algae were common. We made 4 seine hauls over a total distance of about 180 m. No fish were captured. We captured two larval or neotenic tiger salamanders of 45 and 125 mm TL.

Pond E.—Pond E was located on Grape Creek, about 300 m upstream of the Lower Twin Rock Road (Table 1). Pond E was about 30 m by 8 m, with a maximum depth of about 0.4 m. We captured 29 fathead minnows ranging from 49 mm to 80 mm TL in one seine haul.

Pond F.—Pond F was located on a tributary of Grape Creek, about 600 m upstream of Lower Twin Rock Road (Table 1). This pond was dry.

Pond G.—Pond G was located near the southern Monument boundary, about 1.5 km west of Teller County Road 1 (Table 1). Pond G was about 30 m by 30 m, with a maximum depth of about 1 m. No fish were captured, but we captured 21 larval or neotenic tiger salamanders ranging from 77 mm to 136 mm TL, and 9 adult tiger salamanders ranging from 128 mm to 145 mm TL in three seine hauls.

Barksdale Spring.—Barksdale Spring was a small (2 m by 2 m, 0.5 m deep) pool located near the Barksdale Picnic area (Table 1). We sampled this pool with a dip net. No fish were seen or captured.

Conclusions for Florissant Fossil Beds.—The fish assemblages in Florissant Fossil Beds are typical of habitats with little perennially flowing water. We collected just fathead minnow and white sucker, both of which are native to Colorado. Fathead minnows are tolerant of extremes in

environmental conditions such as high temperatures and low dissolved oxygen concentrations (Woodling 1985; Bramblett and Fausch 1991a) and are common inhabitants in residual pools of intermittent streams (Cross and Moss 1987; Bramblett and Fausch 1991b). White suckers have generalized habitat requirements (Becker 1983); their habitats in Colorado include lakes, rivers, and perennial and intermittent streams (Woodling 1985; Bramblett and Fausch 1991b). Fathead minnows were more widely distributed at Florissant, whereas white suckers were only captured in the largest pond, and in the most downstream reach of Grape Creek.

Grant-Kohrs Ranch National Historic Site

Clark Fork River.—The Grant-Kohrs National Historic Site contains about 4.8 km of the Clark Fork River, of which we sampled three reaches. Other water bodies sampled included Cottonwood Creek, North Fork Johnson Creek, Johnson Creek, and a beaver pond slough area. Fish were captured using a gasoline generator-powered backpack electrofishing unit, proceeding in an upstream direction. Sites on the Clark Fork River were chosen based on available access points.

The Upper Reach was located near the southern boundary of the Historic Site (Table 1). It was 270 m in length. Stream width was about 8-12 m, depth range was 0.3-1.5 m, substrate ranged from silt to cobble, aquatic macrophytes and filamentous algae were common, and large woody debris was rare.

The Middle Reach was located upstream of the bridge near the ranch buildings (Table 1), and was 300 m in length. Habitat conditions were similar to those described for the Upper Reach, although with slightly less diversity in depths and stream-flow velocities.

The Lower Reach was located towards the northern boundary of the Historic Site, near the Deer Lodge sewage ponds (Table 1), and was 300 m in length. Habitat conditions were similar to those in the Upper and Middle reaches; however, this reach was noticeable shallower and had less diversity in depths, substrates, and stream-flow velocities.

We captured six fish species in the Clark Fork River (Table 2): brown trout (*Salmo trutta*), largescale sucker (*Catostomus macrocheilus*), longnose sucker (*Catostomus catostomus*), mountain whitefish (*Prosopium williamsoni*), redside shiner (*Richardsonius balteatus*), and mottled sculpin (*Cottus bairdi*). Brown trout, largescale sucker, and mottled sculpin were captured in all three reaches. Redside shiners were captured in the Lower and Middle reaches, longnose suckers were captured in the Middle and Upper reaches, and mountain whitefish were captured in the Upper Reach. All of the fish species we captured were native to Montana, except brown trout.

Brown trout were numerically dominant, making up 39, 60, and 62 % of the catch in the Lower, Middle, and Upper reaches, respectively. Brown trout ranged from 73 to 460 mm TL. This range of lengths represents age classes from age-0, up to perhaps six years old (Brown 1971). The numbers and sizes of brown trout are adequate to provide for a quality recreational fishery.

The numbers of fish captured in the three Clark Fork River reaches appeared to correlate with our general visual estimates of habitat diversity. For example, we captured 52 fish in the 270-m Upper Reach where riffle, run and pool habitat provided a diversity of depths, current velocities, and substrates. In contrast, we captured only 23 fish in the 300-m Lower Reach where the habitat was predominantly shallow water with moderate to slow current velocities and little cover for fish.

In addition to the six fish species we captured, the MFISH database lists brook trout (*Salvelinus fontinalis*), bull trout (*Salvelinus confluentus*), rainbow trout (*Oncorhynchus mykiss*), and longnose dace (*Rhinichthys cataractae*) as occurring in the Clark Fork River in Powell County. Brook trout and rainbow trout are listed as rare, and bull trout are listed as an incidental species, so our failure to capture these species is not unexpected. Longnose dace are listed as common in the Clark Fork River, but they are not normally found at MFWP sample sites on this part of the Clark Fork River (Wayne Hadley, MFWP, personal communication).

Cottonwood Creek.—We sampled nearly the entire length of Cottonwood Creek within the Historic Site; the downstream end of the reach began at the irrigation ditch just above the Clark

Fork River and extended 412 m upstream to the eastern boundary fence (Table 1). Cottonwood Creek was 2-4 m wide and the substrate ranged from silt to cobble, with silt predominant. Aquatic macrophytes and filamentous algae were common and there were two small beaver dams on the stream.

We captured brown trout, largescale sucker, longnose sucker, and redside shiner in roughly equal numbers in Cottonwood Creek, as well as a single mottled sculpin (Table 2). Brown trout ranged from 56 to 440 mm TL, although 39 of 44 (89%) brown trout captured were 122 mm or less. The MFISH database listed brook trout and westslope cutthroat trout as common in Cottonwood Creek; however, these species were listed based on professional judgment rather than actual surveys, and it is possible that these two species exist farther upstream in Cottonwood Creek.

Johnson Creek.—We sampled a 135-m reach of Johnson Creek, beginning just upstream of the Clark Fork River and proceeding upstream to the first beaver dam (Table 1). This reach was 1-2 m wide and less than or equal to 0.1 m deep, with almost entirely silt substrate. Aquatic macrophytes were abundant and beaver activity was common. We captured low numbers of brown trout, largescale suckers, and longnose suckers (Table 2). The low numbers of fish captured are likely attributable to the lack of deep water in this reach. The MFISH database does not list any fish distribution data for Johnson Creek.

North Fork Johnson Creek.—We sampled a 200-m reach in the pasture north of the Visitor's Center on North Fork Johnson Creek (Table 1). The reach began just upstream of the railroad tracks and proceeded upstream to the eastern boundary fence. The stream was 0.5 to 1.0 m wide, 0.1 to 0.3 m deep, and substrate was primarily gravel. No fish were seen or captured in this reach. The lack of fish in this reach may be because the habitat is too shallow or flows are too intermittent to support fish populations, or perhaps a barrier prevents fish access from the Clark Fork River. The MFISH database does not list any fish distribution data for North Fork Johnson Creek.

Beaver pond slough.—The beaver pond slough area we sampled was located just west of the road that parallels the railroad tracks, and southeast of the Deer Lodge sewage disposal ponds.

This was a wetland area, with beaver dams creating areas of open water up to about 1.0 m in depth. Substrate was primarily silt and aquatic macrophytes were abundant. We sampled a 300-m long linear ditch portion of this area that was apparently created by excavation for the roadbed immediately east of the wetland. We captured a single longnose sucker (Table 2). The low density of fish in this area may be because of the probable lack of a good connection to the Clark Fork River or other source of colonizing fish. The MFISH database does not list any fish distribution data for this slough.

Conclusions for Grant-Kohrs National Historic Site.—The fish assemblages on the Grant-Kohrs Ranch consist primarily of native species; five of six species captured were native. However, in terms of numbers, the introduced brown trout is the most common species present. The only native salmonid captured was the mountain whitefish; westslope cutthroat trout and bull trout were not captured. The Clark Fork River had the highest fish diversity, followed by Cottonwood Creek, Johnson Creek, and the beaver pond sloughs. The North Fork Johnson Creek had no fish.

Great Sand Dunes National Monument and Preserve

We sampled Upper, Lower, and Little Sand Creek lakes using angling equipment. Sand Creek and Little Sand Creek were sampled using a gasoline generator-powered backpack electrofishing unit, proceeding in an upstream direction.

Upper Sand Creek Lake.—Upper Sand Creek Lake is located at an elevation of 3,580 m (Table 1). Fish were captured using angling equipment. Three people used fly-fishing gear and 3 used spin-fishing gear, and each person fished for a total of 4.25 h. Only two fish were captured; both were cutthroat trout (*O. clarki*), 460 and 470 mm TL. Very few fish were seen swimming in the lake or rising to the surface; however, those that were seen appeared to be about the same size as the two we captured.

There was no flowing inlet stream, and the outlet stream was small (0.5-1.0 m wide), shallow (0.05 –0.1 m deep), and partially blocked by a beaver dam. The gradient in the outlet stream quickly became quite steep (~5 > 10 %). The substrate was primarily large (0.20 – 0.50 m)

angular rock. We observed three small (~ 75 mm) trout in the outlet stream below the lake. About 140 m below the lake, the outlet stream enters a narrow canyon with very steep gradient. We observed two probable fish barriers of up to 2.0 m in height in this area.

Colorado Division of Wildlife fish stocking records (Appendix Table 1) dating back to 1974 indicate that Upper Sand Creek Lake was stocked with small (22–41 mm) cutthroat trout every year or every other year (21 of 28 years). The number of fish stocked ranged from 1,600 to 8,019 per year. From 1974 to 1998 the strain of cutthroat used for stocking was the "Pikes Peak Native," which was a strain of cutthroat trout with about 70 % greenback cutthroat trout (*O. clarki stomias*) and 30 %Yellowstone cutthroat trout (*O. clarki bouvieri*) genes. Beginning in 2000, the "Rio Grande Native" strain was used, which is a composite developed from Rio Grande cutthroat trout captured at three locations within its native range (John Alves, CDOW, personal communication).

Lower Sand Creek Lake.—Lower Sand Creek Lake is at an elevation of 3,496 m (Table 1). Fish were captured using angling equipment. Three people used fly-fishing gear and 3 used spin-fishing gear; each person fished for a total of 2.0 h. We captured 21 cutthroat trout ranging from 245 to 360 mm TL (Table 2). CDOW fish stocking records (Appendix Table 1) dating back to 1974 indicate that Lower Sand Creek Lake underwent a stocking regime similar to that in Upper Sand Creek Lake. However, from 1984 onward Lower Sand Creek Lake received an average of 1,057 more fish per stocking than Upper Sand Creek Lake, which may partially account for our lower angling catch in Upper Sand Creek Lake.

The small, flowing inlet stream located at the south end of the lake was 0.5 to 1.0 m wide, with low current velocity and substrate consisting of sand and silt overlying fine gravel. The inlet stream extended about 100 m upstream until it became very steep (5 to > 10 % slope). No fish were observed in the inlet stream. The outlet stream from Lower Sand Creek Lake was small (1.0 to 1.5 m wide), shallow (0.1 to 0.3 m) and its substrate ranged from small gravel to large, angular rock. We observed many trout in the outlet stream. These fish appeared to represent perhaps three age classes: age-0 (~ 40-50 mm TL), age-1 (~ 100 mm TL), and age-2 (~ 130-140 mm TL).

Little Sand Creek Lake.—We sampled the larger of the two Little Sand Creek lakes, which is at an elevation of 3,654 m (Table 1). One person fished Little Sand Creek Lake for 2.75 h, using fly-fishing gear. Five cutthroat trout ranging from 229 to 419 mm TL were captured. CDOW stocking records (Appendix Table 1) indicate that Little Sand Creek Lake received from 1,040 to 2,405 small (24 – 39 mm) cutthroat trout every year or every other year since 1974. As with Upper and Lower Sand Creek Lakes, the "Pikes Peak Native" strain was stocked until 1998, when the strain was switched to the Rio Grande Native strain of cutthroat trout. No stream flowed into the lake and only a very small trickle of flow exited the lake. The outlet stream flowed beneath the substrate as it exited the lake and the stream's gradient was high (> 10%). No fish were observed in the outlet stream.

Sand Creek.—We sampled three 200-m reaches on Sand Creek (Table 1). The Lower Reach was located about 460 m downstream of the Little Sand Creek mouth. The stream width was 4.0 to 5.0 m, substrate ranged from gravel to boulder, gradient was moderate (~3–5 %), and plunge pool habitat was common. The canopy was partially closed, with riparian alders, and conifers higher up on the stream bank. We captured 57 brook trout and 4 cutthroat trout in the Lower Reach of Sand Creek (Table 2). Brook trout ranged from 101 to 295 mm TL, and cutthroat trout ranged from 185 to 257 mm TL.

The Sand Creek Middle Reach was located at the first trail crossing below the junction of the Music Pass Trail (Table 1). The stream width ranged from 2 to 5 m, fine gravel was abundant, and substrate ranged up to boulder sized. The stream gradient was lower (~2 %) than the Lower Reach and the pools were shallower, with glide habitat more common, and plunge pools less common. The riparian canopy was fairly open, with riparian willows dominating, and few alders or conifers spanning the stream. We captured 43 brook trout and 30 cutthroat trout in the Middle Reach of Sand Creek (Table 2). Brook trout ranged from 47 to 236 mm TL, and cutthroat trout ranged from 58 to 335 mm TL.

The Sand Creek Upper Reach was located at the first trail crossing above the Music Pass Trail. The 200-m reach was centered on a 2.6-m waterfall, located where the hiking-trail crosses the stream. Because of low water conditions, the lower 100 m of this reach was very shallow (< 0.3

m), and 1 to 2 m wide, although the stream channel was about 7 m wide. Substrate was primarily angular cobble and boulder. The only deep area was a 5 x 7 m pool, ranging to 1 m deep, located immediately below the waterfall. The upper 100 m had similar habitat; however, bedrock substrate and shallow pools were more common than below the waterfall. We captured 66 cutthroat trout ranging from 35 to 274 mm TL in the Upper Reach of Sand Creek; no brook trout were captured.

Little Sand Creek.—The Little Sand Creek Reach began at the hiking-trail crossing and extended for 200 m upstream (Table 1). The stream width was 1 to 3 m, the substrate ranged from small gravel to boulder, and the gradient was quite steep, ranging to about 10 %. Plunge pool habitat was common, with depths up to 0.5 m. Large woody debris, primarily aspen logs, was common in the stream. We captured 59 brook trout, ranging from 45 to 262 mm TL (Table 2). No cutthroat trout were captured, although they would seem to have access to this stream because Little Sand Creek flows into Sand Creek between the Lower and Middle Sand Creek reaches, which is a reach occupied by cutthroat trout.

Barrier Reach of Sand Creek.—Because both brook trout and cutthroat trout were captured in the Lower and Middle reaches, and only cutthroat trout were captured in the Upper reach, as well as in the lakes, we searched the area between the Upper and Middle reaches of Sand Creek for a barrier to upstream movement of brook trout (Table 1). This area included a high-gradient canyon-bound reach located between the mouth of the Lower Sand Creek Lake outlet stream and the hiking trail crossing downstream. We searched this area for the fish barrier by visually inspecting pools for the presence of brook trout, and located a bedrock waterfall, about 2.2 m high with brook trout and cutthroat trout downstream, and only cutthroat trout above. We electrofished for about 200 m upstream of this waterfall, capturing about 50 cutthroat trout and no brook trout.

The distribution of cutthroat and brook trout in the Sand Creek basin indicates that nonnative brook trout were introduced into lower reaches of Sand Creek. Brook trout then colonized the lower part of the basin; the upstream limit of their distribution in Sand Creek was identified through our survey (Table 1). No brook trout were captured above this barrier site. In contrast,

cutthroat trout were captured in all sampled areas of Sand Creek, as well as Upper, Lower, and Little Sand Creek lakes.

The Rio Grande cutthroat trout is the subspecies of cutthroat trout native to the Rio Grande Basin (Behnke 1992). The pre-Columbian distribution of Rio Grande cutthroat trout in the Sand Creek basin is not known, but because Sand Creek flows into the closed basin of the San Luis Valley, it is possible that these waters were barren of fish until they were stocked (John Alves, CDOW, personal communication). In any event, it is apparent that brook trout were stocked into lower Sand Creek at some point, and stocking of cutthroat trout by CDOW in Upper, Lower, and Little Sand Creek lakes has resulted in their occurrence in waters below these lakes. The occurrence of cutthroat trout both above and below barriers such as the 2.6-m high waterfall in the Sand Creek Upper Reach and the 2.2-m high waterfall in the barrier reach, together with a sharply demarcated upper end of brook trout distribution are consistent with a "brook trout from below, cutthroat trout from the lakes" hypothesis. Because both Pikes Peak and Rio Grande strains of cutthroat trout were stocked in the lakes, the cutthroat that now occur in Sand Creek are likely to contain genes from the two strains, as well as possibly genes of the original resident cutthroat trout in Sand Creek, if any were present before stocking.

Summary of information for Medano Creek.—John Alves of CDOW supplied us with unpublished file data for the Medano Creek basin (Appendix 2). Medano Creek begins at Medano Lake and extends downstream about 21 km, where the flow disappears into the sand dunes on the Monument. In 1985, the brook trout population in the Medano Creek basin was chemically reclaimed, and Rio Grande cutthroat trout from Osier, Placer, and West Indian creeks were introduced in 1987. Subsequent fish surveys in 1989, 1997, and 1998 found no brook trout and indicated that the cutthroat trout population was increasing, reaching biomass densities of 44, 66, and 102 kg/ha, respectively. The overall population estimate for Rio Grande cutthroat trout in Medano Creek was 24,500 individuals, of multiple age classes in 1998. The Hudson Branch of Medano Creek was surveyed in 1999, and Rio Grande cutthroat trout of several year classes were captured; biomass was estimated at 85 kg/ha. In Little Medano Creek, five small Rio Grande cutthroat trout were captured in a 1990 survey, indicating successful reproduction.

Thus, the Rio Grande cutthroat trout population in Medano Creek basin is considered by CDOW to be secure and expanding.

In 1996 and 1997, 200 Rio Grande suckers were transplanted into Medano Creek from Rio Tusas, New Mexico. Subsequent surveys were conducted in 1998, 1999, and 2000. Eleven mature Rio Grande suckers were captured in the1998 CDOW fish survey. No reproduction was documented, despite the presence of sexually mature suckers and optimal water temperatures (10˚ C to 15˚ C). Low numbers of Rio Grande suckers were captured in surveys in 1999. Reproduction was documented in 2000, when 34 suckers less than 76 mm were captured. However, adult suckers remained rare.

Conclusions for Great Sand Dunes National Monument and Preserve.—The current fish assemblages in the Sand Creek basin are the result of fish stocking superimposed on whatever native fish populations may have occurred prior to stocking. Cutthroat trout occur in the lakes, and most downstream stream reaches, and brook trout occur only in the lower portion of the basin. These fisheries provide for recreational fishing opportunities, but because nonnative strains of cutthroat trout and the nonnative brook trout have been stocked, we suspect that the value of these fisheries in conserving native biodiversity is minor. In Medano Creek, the native strain of Rio Grande cutthroat trout is secure and expanding, and although Rio Grande suckers have been introduced and their reproduction has been documented, overall numbers remain low.

Little Bighorn Battlefield National Monument

Little Bighorn River.—The Little Bighorn River forms the western boundary of the Little Bighorn Battlefield National Monument, and is the only body of water on the park unit. The Monument is about 1.6 km wide from north to south, but the Little Bighorn River boundary is probably 3 times this length because of stream meanders. We sampled 3 reaches on the Little Bighorn River (Table 1); each was 300 m long. Fish were captured using a 9.1 x 1.8 m x 5 mm mesh bag seine fished in a downstream direction.

The Upper Reach was located near the southern Monument boundary. Habitat in the Upper Reach was fairly shallow (0.1-1.0 m), and consisted primarily of riffle and run habitat types, with areas of shallow pool; stream width was about 10 to 15 m. Substrate was primarily fine gravel to cobble. The Middle Reach was located about midway between the northern and southern Monument boundaries. Habitat in the Middle Reach included pools up to about 1.5 m deep, short riffles, and run habitat. Stream width was 10 to 15 m, and substrate ranged from silt to cobble. The Lower Reach was located near the northern Monument boundary, and was primarily run and pool habitat, with one short (about 20 m) riffle. Depths ranged to about 2.0 m, stream width was 15-20 m, and substrates ranged from silt to cobble.

We captured 10 species of fish in the Little Bighorn River (Table 2). Five species were Cyprinids (Minnow Family): brassy minnow (*Hybognathus hankinsoni*), common carp (*Cyprinus carpio*), fathead minnow, flathead chub (*Platygobio gracilis*), and longnose dace. Four species were Catostomids (Sucker Family): mountain sucker (*Catostomus platyrhynchus*), river carpsucker (*Carpoides carpio*), shorthead redhorse (*Moxostoma macrolepidotum*), and white sucker. One species was an Ictalurid (Catfish Family), the channel catfish (*Ictalurus punctatus*). All are native to Montana, except common carp. We captured all 10 species in the Lower and Middle reaches. Channel catfish, common carp, and white suckers were not captured in the Upper Reach perhaps because this reach lacked the deeper pool habitat that occurred in the Middle and Lower reaches.

We captured a total of 1,826 individual fish, of which 1,812 (99 %) were native species. The only nonnative species captured was common carp. The species in order of abundance summed for all three reaches were: flathead chub (29%), shorthead redhorse (19% of catch), fathead minnow (19%), longnose dace (12%), mountain sucker (7%), brassy minnow (7%), channel catfish (4%), white sucker (2%), common carp (1%), and river carpsucker (< 1%). Channel catfish ranged up to 575 mm TL. The abundant native fish populations and the presence of large predators indicate a healthy stream ecosystem.

The MFISH data base lists the following species, which we did not capture, as being present in the vicinity of the Monument: brown trout, longnose sucker, rainbow trout, mountain whitefish,

and smallmouth bass. Of these, we would only expect longnose sucker and smallmouth bass to possibly occur in the Monument reach of the Little Bighorn River. The others are cold-water species that probably occur farther upstream. Smallmouth bass, brown trout and rainbow trout are not native species, and thus do not increase native biodiversity. Only 2 of 10 species that we captured, channel catfish and mountain sucker, were listed in the MFISH database. However, the MFISH records for the Little Bighorn River were based on professional judgment and extrapolation from other surveys rather than actual surveys on the river.

Conclusions for Little Bighorn Battlefield National Monument.—The fish assemblage in the Little Bighorn River consisted primarily of native species, which was indicative of a healthy stream ecosystem. The fairly high diversity (nine native fish species) also represents considerable native biodiversity conservation value.

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Table 1. Locations of sample sites for fish surveys in four National Park Service units, August and September 2002.

Site description	Latitude (N)	Longitude (W)
Florissant Fossil Beds National Monument		
Grape Creek, dry reach across from Visitor's Center	38.91291	105.27570
Grape Creek, start of water below Hornbeck	38.92494	105.28454
Grape Creek, Upper Beaver Pond	38.93426	105.29080
Grape Creek, Lower Beaver Pond	38.93652	105.29628
Grape Creek tributary, upstream end of survey	38.88858	105.26591
Grape Creek tributary, channel mostly dry below here	38.89117	105.26591
Grape Creek tributary, downstream end of survey	38.89824	105.26627
Pond A	38.92870	105.28590
Pond B	38.92700	105.27967
Pond C	38.92852	105.26749
Pond D	38.91081	105.26374
Pond E	38.90402	105.25930
Pond F	38.89824	105.26627
Pond G	38.89314	105.28867
Barksdale Spring	38.91165	105.25555
Grant-Kohrs National Historic Site		
Clark Fork Lower Reach, downstream end	46.42551	112.74456
Clark Fork Lower Reach, upstream end	46.42419	112.74501
Clark Fork Middle Reach, downstream end	46.40878	112.74585
Clark Fork Middle Reach, upstream end	46.40708	112.74533
Clark Fork Upper Reach, downstream end	46.40507	112.74443
Clark Fork Upper Reach, upstream end	46.40312	112.74432
Cottonwood Creek, downstream end	46.40361	112.74353
Cottonwood Creek, upstream end	46.40256	112.73884
Johnson Creek	46.40976	112.74368
N. Fork Johnson Creek, downstream end	46.40734	112.73735
N. Fork Johnson Creek, upstream end	46.40725	112.73524
Beaver pond slough, downstream end	46.42268	112.73701
Beaver pond slough, upstream end	46.42001	112.73757
Great Sand Dunes National Monument and Preserve		
Upper Sand Creek Lake	37.94193	105.53876
Lower Sand Creek Lake	37.92990	105.53016
Little Sand Creek Lake (larger of the two)	37.90300	105.52790
Sand Creek Upper Reach	37.93581	105.52443
Sand Creek Middle Reach	37.91837	105.50472
Sand Creek Lower Reach	37.88575	105.50722
Sand Creek, fish barrier	37.92199	105.50836
Little Sand Creek	37.88902	105.50249

Table 1, continued. Locations of sample sites for fish surveys in four National Park Service units, August and September 2002.

Site description	Latitude (N)	Longitude (W)
Little Bighorn Battlefield National Monument		
Little Bighorn River Lower Reach, downstream end	45.56665	107.44647
Little Bighorn River Lower Reach, upstream end	45.56530	107.44505
Little Bighorn River Middle Reach, downstream end	45.56369	107.43579
Little Bighorn River Middle Reach, upstream end	45.56185	107.43481
Little Bighorn River Upper Reach, downstream end	45.55811	107.42955
Little Bighorn River Upper Reach, upstream end	45.55621	107.42805

Table 2. Fish and salamanders captured in four National Park Service units, August and September 2002.

Site	Species	Number captured (% of catch)	Mean total length in mm (SD, N)	Range, total length in mm
		Florissant Fossil Beds National Monument		
Grape Creek Upper Beaver Pond	fathead minnow	45 (100)	41 (14, 22)	26-71
Grape Creek Lower Beaver Pond	fathead minnow	60 (72)	47 (10, 20)	30-65
	white sucker	23 (28)	63 (14, 20)	43-99
	total	83		
Pond A	fathead minnow	122 (100)	60 (12, 20)	35-78
Pond B	tiger salamander larvae	3 (100)	120 (14, 3)	104-128
Pond C	fathead minnow	154 (77)	48 (9, 20)	35-69
	white sucker	47 (23)	62 (33, 20)	37-122
	total	201		
Pond D	tiger salamander larvae	2 (100)	86 (56, 2)	46-125
Pond E	fathead minnow	29 (100)	68 (8, 29)	49-83
Pond F	no fish or salamanders			

Table 2, continued. Fish and salamanders captured in four National Park Service units, August and September 2002.

Site	Species	Number captured (% of catch)	Mean total length in mm (SD, N)	Range, total length in mm
Pond G	tiger salamander adults	9 (30)	139 (5, 9)	128-145
	tiger salamander larvae	21 (70)	116 (16, 21)	77-136
	total	30		
Barksdale Spring	no fish			
Total Florissant		515		
	Grant-Kohrs National Historic Site			
Beaver pond slough	longnose sucker	1 (100)		110
Lower Clark Fork	brown trout	9 (39)	146 (111, 9)	95-440
	largescale sucker	1 (4)		48
	redside shiner	7 (30)	58 (15, 7)	40-88
	mottled sculpin	6 (26)	95 (20, 6)	60-115
	total	23		
Middle Clark Fork	brown trout	23 (60)	177 (115, 23)	82-460
	largescale sucker	5 (13)	95 (63, 5)	47-202
	longnose sucker	5 (13)	149 (52, 5)	110-240
	redside shiner	3 (8)	88 (21, 3)	64-104
	mottled sculpin	2 (5)	85 (35, 2)	60-109
	total	38		

Table 2, continued. Fish and salamanders captured in four National Park Service units, August and September 2002.

Site	Species	Number captured (% of catch)	Mean total length in mm (SD, N)	Range, total length in mm
Upper Clark Fork	brown trout	32 (62)	195 (132, 32)	73-435
	largescale sucker	10 (19)	126 (65, 10)	45-213
	longnose sucker	2 (4)	220 (0, 2)	220-220
	mountain whitefish	5 (10)	268 (102, 5)	93-340
	mottled sculpin	3 (6)	110 (14, 3)	94-120
	total	52	185 (118, 52)	45-435
Cottonwood Creek	brown trout	45 (22)	97 (16, 20)	56-440
	largescale sucker	53 (26)	70 (22, 14)	48-275
	longnose sucker	48 (24)	82 (19, 8)	60-294
	redside shiner	57 (28)	57 (6, 36)	45-105
	mottled sculpin	1 (< 1)		97
	total	204		
Johnson Creek	brown trout	1 (17)		80
	largescale sucker	2 (33)	69 (16, 2)	57-80
	longnose sucker	3 (50)	109 (10, 3)	100-120
	total	6		
North Fork Johnson Creek	no fish			
Total Grant-Kohrs		324		

Table 2, continued. Fish and salamanders captured in four National Park Service units, August and September 2002.

Site	Species	Number captured (% of catch)	Mean total length in mm (SD, N)	Range, total length in mm
		Great Sand Dunes National Monument and Preserve		
Upper Sand Creek Lake	cutthroat trout	2 (100)	465 (7, 2)	460-470
Lower Sand Creek Lake	cutthroat trout	21 (100)	313 (27, 21)	245-360
Little Sand Creek Lake	cutthroat trout	5 (100)	345 (79, 5)	229-419
Lower Sand Creek	brook trout	57 (93)	192 (41, 57)	101-295
	cutthroat trout	4 (7)	227 (33, 4)	185-257
	total	61	194 (41, 61)	101-295
Middle Sand Creek	brook trout	43	186 (57, 43)	47-236
	cutthroat trout	30	196 (61, 30)	58-335
	total	73	181 (60, 73)	47-335
Upper Sand Creek	cutthroat trout	66 (100)	124 (57, 66)	35-274
Little Sand Creek	brook trout	59 (100)	162 (48, 59)	45-262
Total Great Sand Dunes		287		

Table 2, continued. Fish and salamanders captured in four National Park Service units, August and September 2002.

Site	Species	Number captured (% of catch)	Mean total length in mm (SD, N)	Range, total length in mm
	Little Bighorn National Battlefield			
Little Bighorn River Lower Reach	brassy minnow	1 (< 1)		62
	channel catfish	46 (8)	229 (131, 25)	108-575
	common carp	5 (< 1)	165 (56, 5)	70-215
	fathead minnow	45 (8)	60 (6, 21)	45-68
	flathead chub	209 (36)	87 (27, 23)	45-140
	longnose dace	67 (12)	62 (6, 20)	55-80
	mountain sucker	54 (9)	113 (25, 23)	55-173
	river carpsucker	7 (1)	150 (41, 7)	110-232
	shorthead redhorse	122 (21)	236 (94, 22)	102-358
	white sucker	18 (3)	133 (26, 18)	63-171
	total	574		
Little Bighorn River Middle Reach	brassy minnow	116 (11)	64 (7, 22)	55-85
	channel catfish	28 (3)	240 (98, 18)	114-500
	common carp	9 (< 1)	323 (176, 7)	160-570
	fathead minnow	242 (24)	55 (7, 21)	37-65
	flathead chub	292 (29)	82 (23, 23)	55-115
	longnose dace	21 (2)	46 (10, 9)	35-69
	mountain sucker	60 (6)	61 (24, 17)	40-122
	river carpsucker	1 (< 1)		54
	shorthead redhorse	227 (22)	158 (70, 21)	100-335

Table 2, continued. Fish and salamanders captured in four National Park Service units, August and September 2002.

Site	Species	Number captured (% of catch)	Mean total length in mm (SD, N)	Range, total length in mm
	white sucker	20 (2)	216 (86, 10)	137-355
	total	1,016		
Little Bighorn River Upper Reach	brassy minnow	2 (<1)	47 (0, 2)	47
	fathead minnow	56 (24)	45 (10, 21)	28-65
	flathead chub	25 (11)	52 (13, 21)	35-100
	longnose dace	130 (55)	42 (7, 20)	30-57
	mountain sucker	18 (8)	44 (4, 18)	37-52
	river carpsucker	1 (< 1)		147
	shorthead redhorse	4 (2)	167 (59, 4)	103-235
	total	236		
Total Little Bighorn		1,826		
Grand Total		2,952		

Appendix 1. Photographs of sampling sites in four National Park Service units, August and September 2002.

Photo 1. Upper Beaver Pond, Grape Creek, Florissant Fossil Beds National Monument, Colorado.

Photo 2. Lower Beaver Pond, Grape Creek, Florissant Fossil Beds National Monument, Colorado.

Photo 3. Pond A, Florissant Fossil Beds National Monument, Colorado.

Photo 4. Pond B, Florissant Fossil Beds National Monument, Colorado.

Photo 5. Pond C, Florissant Fossil Beds National Monument, Colorado.

Photo 6. Pond D, Florissant Fossil Beds National Monument, Colorado.

Photo 7. Pond E, Florissant Fossil Beds National Monument, Colorado.

Photo 8. Pond F, Florissant Fossil Beds National Monument, Colorado.

Photo 9. Pond G, Florissant Fossil Beds National Monument, Colorado.

Photo 10. Barksdale Spring, Florissant Fossil Beds National Monument, Colorado.

Photo 11. Clark Fork River, Upper Reach, Grant-Kohrs National Historic Site, Montana.

Photo 12. Clark Fork River, Middle Reach, Grant-Kohrs National Historic Site, Montana.

Photo 13. Clark Fork River, Lower Reach, Grant-Kohrs National Historic Site, Montana.

Photo 14. Cottonwood Creek, Grant-Kohrs National Historic Site, Montana.

Photo 15. Johnson Creek, Grant-Kohrs National Historic Site, Montana.

Photo 16. North Fork Johnson Creek, Grant-Kohrs National Historic Site, Montana.

Photo 17. Beaver pond slough, Grant-Kohrs National Historic Site, Montana.

Photo 18. Upper Sand Creek Lake, Great Sand Dunes National Monument and Preserve, Colorado.

Photo 19. Outlet stream, Upper Sand Creek Lake, Great Sand Dunes National Monument and Preserve, Colorado.

Photo 20. Lower Sand Creek Lake, Great Sand Dunes National Monument and Preserve, Colorado.

Photo 21. Outlet stream, Lower Sand Creek Lake, Great Sand Dunes National Monument and Preserve, Colorado.

Photo 22. Inlet stream, Lower Sand Creek Lake, Great Sand Dunes National Monument and Preserve, Colorado.

Photo 23. Little Sand Creek Lake, Great Sand Dunes National Monument and Preserve, Colorado.

Photo 24. Sand Creek, Lower Reach, Great Sand Dunes National Monument and Preserve, Colorado.

Photo 25. Sand Creek, Middle Reach, Great Sand Dunes National Monument and Preserve, Colorado.

Photo 26. Sand Creek, Upper Reach, Great Sand Dunes National Monument and Preserve, Colorado.

Photo 27. Sand Creek, Upper Reach, Great Sand Dunes National Monument and Preserve, Colorado.

Photo 28. Little Sand Creek, Great Sand Dunes National Monument and Preserve, Colorado.

Photo 29. Upstream barrier to brook trout distribution, Sand Creek, Great Sand Dunes National Monument and Preserve, Colorado.

Photo 30. Upper Reach, Little Bighorn River, Little Bighorn Battlefield National Monument, Montana.

Photo 31. Middle Reach, Little Bighorn River, Little Bighorn Battlefield National Monument, Montana.

Photo 32. Lower Reach, Little Bighorn River, Little Bighorn Battlefield National Monument, Montana.

Appendix 2. Colorado Division of Wildlife fish stocking and survey data for Great Sand Dunes National Monument and Preserve, Colorado.

Appendix Table 1. Summary of fish stocking records from Colorado Division of Wildlife for Upper, Lower, and Little Sand Creek lakes, Great Sand Dunes National Monument and Preserve, Colorado.

Year	Strain of cutthroat trout stocked	Number of fish stocked	Average size (mm)	Number of fish per pound
		Upper Sand Creek Lake		
1974	Pikes Peak native	3,600	41	600
1976	Pikes Peak native	2,400	41	600
1978	Pikes Peak native	1,600	38	800
1980	Pikes Peak native	5,250	29	1,750
1982	Pikes Peak native	5,500	33	1,100
1984	Pikes Peak native	8,019	28	1,909
1985	Pikes Peak native	3,900	22	3,900
1986	Pikes Peak native	4,002	25	2,354
1987	Pikes Peak native	4,000	28	1,826
1988	Pikes Peak native	4,000	26	2,286
1989	Pikes Peak native	4,004	34	1,021
1990	Pikes Peak native	4,011	28	1,840
1991	Pikes Peak native	4,008	31	842
1992	Pikes Peak native	4,000	30	1,575
1993	Pikes Peak native	4,001	34	1,056
1994	Pikes Peak native	3,996	33	1,145
1996	Pikes Peak native	3,998	33	1,120
1998	Rio Grande native	3,365	38	2,064
2000	Rio Grande native	3,468	36	1,000
2001	Rio Grande native	4,281	30	1,461
2002	Rio Grande native	4,278	25	2,428
		Lower Sand Creek Lake		
1974	Pikes Peak native	3,600	41	600
1976	Pikes Peak native	2,400	41	600
1978	Pikes Peak native	1,600	38	800
1980	Pikes Peak native	5,250	29	1,750
1982	Pikes Peak native	4,400	33	1,100
1984	Pikes Peak native	10,080	28	1,800
1985	Pikes Peak native	4,940	25	2,470
1986	Pikes Peak native	5,002	25	2,382
1987	Pikes Peak native	5,000	28	1,825
1988	Pikes Peak native	5,000	26	2,283
1989	Pikes Peak native	4,995	34	1,021
1990	Pikes Peak native	5,005	28	1,840
1991	Pikes Peak native	5,010	31	842
1992	Pikes Peak native	4,993	30	1,575
1993	Pikes Peak native	5,004	34	1,056
1994	Pikes Peak native	5,004	33	1,145

Appendix Table 1, continued. Summary of fish stocking records from Colorado Division of Wildlife for Upper, Lower, and Little Sand Creek lakes, Great Sand Dunes National Monument and Preserve, Colorado.

Year	Strain of cutthroat trout stocked	Number of fish stocked	Average size (mm)	Number of fish per pound
1996	Pikes Peak native	4,995	33	1,120
1998	Rio Grande native	3,004	38	2,064
2000	Rio Grande native	3,642	36	1,000
2001	Rio Grande native	6,282	30	1,461
2002	Rio Grande native	6,279	25	2,428
		Little Sand Creek Lake		
1974	Pikes Peak native	1,800	39	600
1976	Pikes Peak native	1,800	39	600
1980	Pikes Peak native	1,750	28	1,750
1982	Pikes Peak native	2,200	32	1,100
1984	Pikes Peak native	2,405	27	1,850
1985	Pikes Peak native	1,170	25	2,340
1986	Pikes Peak native	1,203	25	2,406
1987	Pikes Peak native	1,200	29	1,412
1988	Pikes Peak native	1,200	25	2,264
1989	Pikes Peak native	1,205	33	1,021
1990	Pikes Peak native	1,214	27	1,839
1991	Pikes Peak native	1,204	30	842
1992	Pikes Peak native	1,200	29	1,575
1993	Pikes Peak native	1,203	33	1,056
1994	Pikes Peak native	1,202	32	1,145
1996	Pikes Peak native	1,198	32	1,120
1998	Rio Grande native	1,587	37	2,064
2000	Rio Grande native	1,040	34	1,000
2001	Rio Grande native	1,256	29	1,461
2002	Rio Grande native	1,260	25	2,428