United States Department of the Interior

NATIONAL PARK SERVICE
Water Resources Division - PEB
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September 27, 2006

Memorandum

To: Superintendent, Sand Creek Massacre National Historic Site

Through: Bill Jackson, Chief, Water Resources Division (WRD); and Mark Flora, Chief, Planning and Evaluation Branch, Water Resources Division (WRD)

From: Jim Tilmant, Fisheries Biologist (WRD); David Vana-Miller, Fisheries Biologist (WRD); and Kevin Noon, PhD, Wetland Scientist (WRD)

Subject: Trip Report. Sand Creek Massacre National Historic Site, March 14, 2006

PURPOSE: A trip was made to Sand Creek Massacre National Historic Site by three Water Resource Division staff on March 14, 2006, in response to the park's request for technical assistance in evaluating what fish species may be present within several small ponds located



Photo 1. Big Sandy Creek channel Sample Site #5 at County Road W. Superintendent Alexa Roberts providing oversight from the truck: "Move it, there will be no loafing at my park."

along the Big Sandy Creek drainage and one of its tributaries. The park was particularly interested in whether the Arkansas darter (*Etheostoma cragini*), a species of special concern, occurs within the park. The trip was made to sample for fish in the open waters of the park in order to document fish species present.

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David Vana-Miller, Hydrologist, Water Resources Division
Kevin Noon, Wetlands Scientist, Water Resources Division
Alexa Roberts, Superintendent, SAND
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BACKGROUND: It is important to know if the Arkansas darter occurs within SAND. Populations of this fish are known to occur only as isolated colonies within specialized habitat and it is susceptible to extirpation by drought, ground water loss, or private and municipal development. Because of its specialized habitat conditions, the Arkansas darter has received numerous listings and designations of concern from conservations organizations. The U.S. Fish and Wildlife Service classified the species as a candidate for Endangered Species Act protection with a listing priority number of 11. The Arkansas Natural Heritage Program ranks the Arkansas darter as "critically imperiled." The Colorado, Kansas, and Oklahoma Natural Heritage Programs rank it as imperiled, and the Missouri Natural Heritage Program ranks it as "vulnerable." The American Fisheries Society designated the status of this species as "Special Concern" in 1989. Nature Serve, a leading conservation organization that focuses on documenting species distribution and status, has categorized the Arkansas darter as vulnerable to extirpation globally with a rank of G3, and further categorized it as imperiled in Colorado and Kansas (rank of S2).

The Arkansas darter prefers small, permanent flowing springs and spring run tributaries, and is usually found in association with aquatic vegetation, especially watercress, stonewort, or filamentous green algae, over a substrate of gravel, sand and silt (Miller 1984). However, it has also been documented in several turbid streams with sand and mud bottoms, away from any nearby springs, an adaptation that may allow it to survive droughts (Miller 1984). Big Sandy Creek and one small tributary within SAND support several small ponds and perennial stream reaches that contain habitat suitable for the Arkansas darter.

Dave Vana-Miller found Big Sandy Creek to be one of two major population centers for the Arkansas darter within Colorado (Miller 1984). Vana-Miller reported finding the Arkansas darter at eight locations within the Big Sandy Creek watershed and, although most of the locations cited are in Lincoln and El Paso counties well above SAND, one location is downstream near were Big Sandy Creek joins the Arkansas River. Vana-Miller did not sample within the area now designated as Sand Creek Massacre National Historic Site during his 1979-1981 study. Based on the fact that the wetlands at SAND are spring fed on sandy substrate, appear to provide suitable Arkansas darter habitat, and that this darter is known to inhabit sites both upstream and downstream of SAND within this drainage, it seems reasonable that the Arkansas darter may occur within the park.

METHODS: Five locations were sampled within the Park. Sample site locations are shown on the aerial photograph appended (Photo 4.). Sampling gear used consisted of a 25 foot hand pulled beach seine with rigid pole supports at each end, a Smith-Root Model 15-C Backpack Electrofisher, and/or hand held dip nets. Both seine and electrofisher sampling methods were used when there was sufficient open water to allow use of the beach seine, otherwise only the electrofisher was used. At one station, we were able to use only dip nets. The backpack electrofisher was used at varying voltages and currents and run along shoreline habitats and into all areas accessible by wading. The person electrofishing was accompanied by a dip-netter to capture any stunned fish that became visible to the sampling crew (see Photo 5.). Fish captured were identified by the electrofishing crew and either released or placed into a bottle containing alcohol as voucher specimens. Seine hauls were complete by 2 people walking the seine through a portion of the water body with the seine stretched open, while working the weighted, leading edged of the seine along the bottom. Periodically the seine would be raised and all vegetative material and organisms captured remove. Again, all fish captured were identified to species and either immediately released or collected as a voucher specimen if not already obtained. Once the seine was cleaned, it would be redeployed and seining continued from that location onward. This was repeated until either all, or a representative sample, of the water body being sampled was covered.

At each sampling location, water quality parameters of conductivity, temperature and salinity were recorded using a YSI Model 30 Handheld Salinity, Conductivity, and Temperature System. The approximate area of open water was measured using a hand held tape to record average length and width of the pool. Maximum pool depth was determined using a marked survey pole that was placed on the bottom and held vertically up through the water column then read at the water surface to the nearest tenth foot.

FINDINGS: At the time of our survey, Big Sandy Creek was not running any surface water and consisted of only a couple of pools of open water above the point where a small spring creek enters the mainstem (see Photo 4.). This is believed to be the typical situation as Big Sandy Creek is an intermittent plans stream where most flow is subterranean, except during heavy rainfall events or in areas where the surface relief allows permanent surface flow over short distances. The tributary spring creek sampled consisted of a single elongated open water pool approximately one half mile downstream from its upper most source with a small amount of continuous surface flow out of this pool, down to its junction with Big Sandy Creek, and continuing down stream from this junction to a moderately large pond at the park boundary and crossing of County Road W. Sampling was conducted in all places where there was sufficient surface water to allow sampling gear to be used. This included the two small open pools within Big Sandy Creek above the spring creek, within the elongated pool on the spring creek, in the pool at the junction of the spring creek and Big Sandy Creek, and in the pond at the park boundary (see Photo 4 for locations). Air temperature at the time of sampling was approximately 53 deg. F.

Sample Site #1 - This site is located directly north of the future visitor center house and is approximately 0.25 miles above the junction of the spring creek and Big Sandy Creek (see Photo

4.). Open water at this location consisted of a 141 feet long by 50 feet wide pool with a maximum water depth of 4.0 feet. The pool had a soft mud bottom overlying sand. There was a considerable amount of streaming green filamentous algae within the pool that made seine hauls difficult. It is estimated that aquatic vegetation covered approximately 40 percent of the water area. The site may have been excavated to provide water for cattle at some time in the past. The site is in a fairly open setting with riparian vegetation consisting mostly of switch grass and sedges, overlain by large amounts of loose Russian thistle (tumbleweed) (Photo 5.).



Photo 2. Aquatic Insects at Sample Site #1

Water temperature at this site was 11.5 C, salinity 2.7 ppt, and water conductivity very low (5100 microSiemens/cc). Water clarity was very good. Both seining and electrofishing was conducted in attempts to capture fish, however, no fish were captured at this site through sampling, and no fish were observed. Aquatic insect abundance appeared to be high but species diversity low (Photo 2.). A single species of small mollusk was observed to inhabit this pool and seemed fairly abundant.

Sample Site #2 - This site is located where Big Sand Creek runs through a stand of bottomland cottonwoods, approximately 2.0 miles upstream of Site #1 (see Photo 4) and consisted of a drying pool approximately 65 feet long and 35 feet wide. The pool was choked with Russian thistle and aquatic vegetation (Photo 6) with very little "open" water. The bottom was very soft due to a heavy accumulation of decaying vegetation and maximum depth could not be determined, however it is not thought to have exceeded 5 feet. Water clarity was moderate to poor. Nutrient loading was obviously very high with a strong smell of hydrogen-sulfide. This Site is surrounded by cottonwoods and receives significant pressure from deer browsing and loafing.

Water temperature was measured to be 13.6 C, salinity at 3.4 ppt, and water conductivity at 6270 microSiemens/cc. Approximately 90% of the water surface was covered by aquatic or displace terrestrial vegetation. Fish sampling was limited to dip netting as neither the seine nor the electofisher could be use effectively at this site. No fish were caught nor were any observed visually.

Sample Site #3 - Sample Site #3 is located at the junction of the spring creek and the main stem of Big Sandy Creek in an open prairie setting (see Photo 4). The site is just downstream of a breech the spring creek made through a large levee that was place along Big Sandy Creek in the early 1900's at this location. The levee is visible on Photo #4. The sampling site consists of a

fairly large, but shallow (2.5 ft. maximum depth) pool of open water (103 ft. long x 50 ft. wide) that is fed continuously by a small amount of flow from the Spring Creek (Photo 7). There was a distinct large "wind row" of decaying Russian thistle near the west side of this pond that may have been contributing a substantial amount of nutrient input to the pond. Water clarity within the pond was moderately good. Bottom sediments were fairly firm and made up of sand overlain by detritus material. Surface water flow from this site moves downstream through what appeared to be a continuous emergent marsh of cattail, sedges, prairie grasses and tumble weed to the large open pool sampled at Site #5 (approximately one-half mile downstream).

Water temperature was measured at 10.5 deg. C, salinity at 1.9 ppt, and water conductivity at 3551 microSiemens/cc. Only about 20% of the water surface was covered by aquatic or displaced terrestrial vegetation. Both seining and electrofishing were used at this site in an attempt to capture any fish that may be present. No fish were caught in our sampling gear and no fish were observed in the water.

Sample Site #4 - This site is located about half way down the spring creek from the upper most headwater spring and approximately one-half mile above its junction with Big Sandy Creek (see Photo 4). The site is right at the eastern park boundary and was accessed by traveling up a farm road east of the park off County road W and crossing through a fence onto park property. It consisted of a relatively deep pool (3+ foot depth) that is approximately 175 ft. long x 25 ft. wide. There are relatively steep sloping banks on the two lateral sides of the pool and the pool was filled with aquatic vegetation overlain by displaced terrestrial tumble weed throughout its middle areas (Photo 8). Sufficient open water for sampling was only available around the outer edges of the pool and fish could easily escape sampling by moving into the deeper aquatic vegetation choked areas of the pool. The size and depth of this pool suggests that it seldom (if ever) dries out and there may be spring flow into the creek at this location.

Water temperature was measured at 11.0 deg. C, salinity at 1.7 ppt, and water conductivity at 3248 microSiemens/cc. Water clarity was very good. Both seining and electrofishing were used to sample fish. A high abundance of fish were observed within the water and captured with the sampling gear, but fish capture consisted of only one species, that being the Plains killifish (*Fundulus zebrinus*). (See adjacent photo). It is possible other species were present within the dense vegetation in the deeper portions of the pool, as we feel that our sampling gear was not sufficient to sample this habitat, however within the shallower open portions of the pool, species diversity seem to be limited to this single species.



Photo 3. Plains Killifish at Sample Site #4

Sample Site #5 - This site is located on the southern edge of the park at the point where Big Sandy Creek crosses under County road W (see Photo 4). This was the largest and deepest open

water pool sampled (estimated to be approximately 60 ft. in circular diameter) and appeared to be perennial in nature (Photo 1). The deep water extends upstream for an undetermined distance into a dense stand of emergent cattail marsh, which may have secluded habitat for fish that we could not sample. We were unable to measure the maximum depth of this pool, but it is believed to have exceeded 5 ft. Site 5 appears to have been excavated (perhaps periodically) to provide water for fire trucks. Unlike other pools sampled, the pool at this site did not contain a large amount of aquatic or displaced terrestrial vegetation within the water column. Water clarity was very good.

Water temperature at the site was 7.5 deg.C, salinity was 3.2 ppt, and water conductivity was 5950 microSiemens/cc. Due to the depth of the pool and limited access to open water areas, we were only able to sample this site with the electrofisher. No fish were captured and none were observed within the water column despite considerable efforts to observe any fish that might be present.

DISCUSSION: Overall sampling results were discouraging and probably not truly representative of the actual extent of the park's fish fauna. It is not at all clear why only one species of fish was caught at only one location among those sampled. It seems reasonable that fish may not exist in the upper most two sampling sites on Big Sandy Creek, as these sites may be intermittent in supporting open water habitat and may only temporarily hold fish following flooding and transport from other locations. It appeared that it has been a considerable amount of time since either of these two upper sites had been inundated with new flood waters. However, it is surprising that fish were not observed nor captured within the two lower sites on Big Sandy Creek, as these sites appeared to be more perennial in nature and had direct continuous water connection to the site on the spring creek, which did contain fish. It is possible that during winter months, fish retreat from the pools on Big Sandy Creek and occupy only spring feed areas where water temperatures remain above freezing. If so, it is likely that fish would move back in and occupy pools on Big Sandy Creek later in the summer wherever they were able to do so. Because of this, we feel sampling should be repeated at some time during the summer to better determine the actual extent and diversity of fish fauna present within the park, or to verify the lack of existence of fish within the locations we sampled on Big Sandy Creek.

Until additional summer sampling efforts can be made, we do not feel comfortable saying that the Arkansas darter definitely does not occur within the park. We did not find this species in our sampling, but the lack of any fish observed at the lower Big Sandy sites, together with the lack of ability to fully sample the deeper water at the spring creek site, makes us feel that it is still possible that the Arkansas darter may occupy one or more of the open water pools during the summer months. We recommend that the park undertake additional sampling during the summer months (July or August) to gain a better overall (year-around) perspective on its fish fauna and particularly to determine whether the Arkansas darter (and/or other species) may be present at that time of year.

REFERENCE: Miller, D.L. 1984. Distribution, abundance, and habitat of the Arkansas Darter *Etheostoma cragini* (Percidae) in Colorado. The Southwest Naturalist 29(4):496-499.

If you have any questions regarding this report please call Jim Tilmant (970) 225-3547, Dave Vana-Miller ((303) 969-2813, or Kevin Noon at (303) 969-2815.

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PHOTO'S

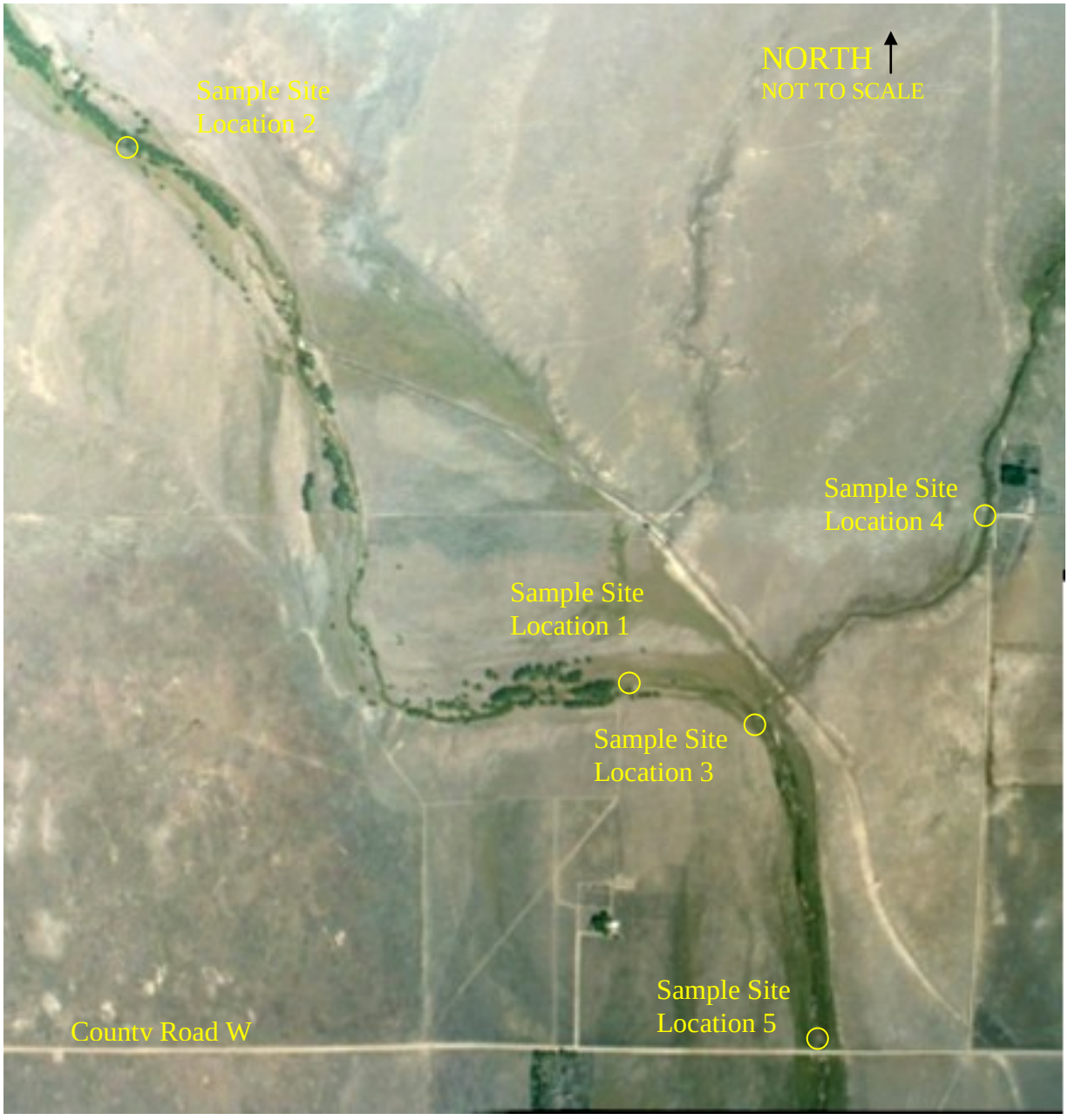


Photo 4. Sample Site Locations along Big Sandy Creek and a spring creek tributary (upper right), 3-14-06 Fish Survey at Sand Creek Massacre National Historic Site.



Photo 5. Sample Site Location #1, Big Sandy Creek, SAND



Photo 6. Sample Site Location #2, Big Sandy Creek, SAND.



Photo 7. Sample Site Location #3, Big Sandy Creek, SAND



Photo 8. Sample Site Location #4, Spring Creek, SAND