

CHEMICAL AND BIOTIC SURVEY OF SALT WASH
Arches National Park, August 13-15, 1988
Prepared By: Nathan Webb

INTRODUCTION

Salt Wash is a fourth order intermittent stream draining the northeastern quarter of Arches National Park. Throughout the wash's drainage it is fed by springs that sustain perennial reaches, Freshwater Spring and Wall Spring. Salt Wash becomes a perennial stream once below Wall Spring and flows into the Colorado River (Fig. 1).

On October 6-7, 1979 Bio/West personnel qualitatively surveyed the fish, algae, aquatic invertebrates, and the basic water chemistry of Salt Wash and Fresh Water Canyon (Selby and Holden, 1979). On August 13-15, 1988 National Park Service Resource Management Volunteer, Nathan Webb, resurveyed, using the same methods as Bio/West's survey. This report finalizes the 1988 findings and compares them to that of Bio/West 1979.

STUDY SITES

In 1988 ten sites were surveyed in Salt Wash: 1) Approximately 500 feet upstream from the Wolfe Ranch footbridge UTM 4289N 628E; 2) the northern and; 3) southern most pools (pool number 1A and 2A respectively) of an unnamed spring/ground seep upstream from Wall Spring, both UTM 4286N 628E; 4) Wall Spring pool on 8/13/88; 5) Wall Spring pool on 8/14/88 UTM 8285N 628E; 6) the northern and; 7) southern most pools (pool number 1B and 2B respectively) of a second unnamed spring flowing into Salt Wash upstream from Salt Spring UTM 4284N 629E; 8) Salt Wash approximately 300 feet upstream from Salt Spring UTM 4284N 629E; 9) Salt Spring UTM 4284N 629E; 10) Salt Wash approximately 300 feet upstream from its mouth at the Colorado River UTM 4282N 630E (Figures 1 and 2)

Site 1, upstream from Wolfe Ranch, is highly vegetated series of pools and streams. The substrate here was primarily sand, including the banks.

Site 2 and 3 the unnamed spring upstream from Wall Spring, could be recognized as a ground seep. It originates in the bed of Salt Wash, flows some 1500 feet as a series of ripples and pools, and then is soaked up by the Salt Wash bed. Both pools at this site were sand bottom and bank near large sandstone rocks.

Wall Spring is the origin of the perennial Salt Wash stream where water flows heavily from a crack in the rock face approximately ten feet above the streambed. Approximately twenty feet downstream from the spring, a pool has been formed on sand and bedrock substrate. Vegetation in and around the pool is limited. This site receives little direct sunlight in contrast to the other sampling sites which are sunlit the majority of the summer day. Therefore sampling was done during shaded and unshaded hours to detect changes in DO, pH, and temperature.

Downstream ^{from} a wall spring is the second unnamed spring, sites 6 and 7. This spring, a tributary to Salt Wash, consisted of two pools approximately fifty feet apart. The bottoms and banks of both pools are sand. Only pool 2B is vegetated and has an outlet.

The eighth study site is a highly vegetated area of Salt Wash. Emergent plants and a substrate of cobble stones and boulders characterizes this site.

Salt Spring is a large pool formed by boulders and a shale cliff. This spring has no nearby vegetation.

The last site studies is Salt Wash approximately 300 feet upstream from the mouth of the Colorado River. This site is composed of sand, gravel and boulders.

MATERIALS AND METHODS

The basic chemical analysis was performed using a Hydrolab 4000. This determined temperature, pH, dissolved oxygen, and conductivity. A high range chloride ion test was performed using a Hach alkalinity chloride and hardness test kit.

The fish were identified by streamside observation and collected using a scoop net. To positively identify the fish a dichotomous key of Utah's fishes was used (Sigler and Miller 1963). A freshwater dichotomous key (Klots, 1966) was used to identify aquatic plants and algae.

The identification of aquatic invertebrates was performed using a dichotomous key of arthropods (Borror et. al. 1981).

RESULTS

Water Quality: The basic water chemistry parameters are presented in Table 1. Note. Averages have been calculated. These are for convenience and have limited statistical meanings.

Fish: The following four species of fish were observed:

Plains killifish (Fundulus lansae), Redside shiner (Notropis lutrensis), Speckled dace (Rhinichthys osculus) and Fathead minnow (Pimephales promelas). The dace is the only native species. Relative abundance is indicated in Table 2.

Algae and Other Aquatic Plants: The algae, Characeae (stoneworts), occurs at the site near Wolfe Ranch as a dense bottom mat.

Filamentous green algae, Spirogyra, was observed at the Wolfe Ranch site and the tree sites between Wall and Salt Springs. At the site above Salt Spring the Spirogyra was extremely abundant as it formed a very dense algae mat, everywhere!

Throughout Salt Wash and its tributaries the rush, Juncus, was observed on the banks and in the water. Phragmites communis occurs everywhere except Salt Spring, and Salt Wash near the Colorado River.

Aquatic Insects: Qualitative observation of aquatic and aquatic related insects were made at every site. The most obvious families encounters are listed in Table 3.

Terrestrial Fauna: ID of tracks and observance of Great Blue Heron.

DISCUSSION

Chemistry: The water quality parameters between the August 1988 and October 1979 findings are not statistically comparable to one another because of temporal and spatial differences and data size. However these parameters define a general range specific to month and place, averages allow speculation about differences.

Note the average temperatures of Salt Wash were 16.2°C in October 1979 and 25.3°C in August 1988. This difference is most likely due to shading effects and season.

The average pH of Salt Wash in 1979 was found as 8.5, slightly alkaline. In 1988 the wash's average pH was found as 6.9, slightly acidic. The difference in pH may be caused by a combination of sampling variation, seasonal, or environmental changes.

The average dissolved oxygen difference between 1979 and 1988 was of the same magnitude, 7.6 mg/L as opposed to 6.9 mg/L. Note - a very small data base. These figures may be due to algae mats, phytoplankton, biological and chemical oxygen demand, all relative to the seasonal or environmental changes or both.

The chloride parameters of Salt Wash were found to have been the same average magnitude in 1979 as 1988, approximately 1750 mg/L. The importance of the chloride parameter lies not in comparison between the surveys but in the parameters comparison to sea water, which is 2182 mg/L. The Salt Wash figure is roughly 80% that of sea water. Recommended levels of chloride for consumption are: for humans, >250 mg/L unsatisfactory drinking; >400 mg/L, harmful to some fish; 1500 mg/L, not yet detrimental to stock and wildlife (Ricketts and Kunkle 1984). Also interesting was that the 1988 surveyor of Salt Wash consumed solely this water for three days without seemingly any detrimental effects.

The conductivity of the Salt Wash indicated a high concentration of dissolved ions. Distilled water has a conductivity of about 1 umho/cm. Normal natural waters range from 20-1500 umho/cm (Boyd 1979). The averages of the 1979 and 1988 surveys were 2581 umho/cm and 5665 umho/cm respectively. Even without the use of statistical analysis it is clear that more investigation into Salt Wash's conductivity could be fruitful.

Fish: In both 1979 and 1988 the plains killifish was found as the most abundant fish. The speckled dace and fathead minnow were also found by both surveys. However, only the 1988 survey observed the redbase shiner.

The redbase shiner has been known in Utah's Colorado River Drainage since 1934 (Sigler et al 1963), but never in the Salt Wash. In view of the already said chemical make-up, this fish may have entered Salt Wash via the Colorado River by allowance of some chemical difference. As a new pioneering species and a prey of trout fish, investigation of minnows dispersal may be of interest.

There may have been a systematic bias concerning the observation of Salt Wash's fish population. The methods of 1979 seine netting (Paul Holden) may have been more effective at capturing all fish than simple scoop netting. This may have been the reason that the flannel mouth sucker was never encountered in the 1988 survey.

Algae and Other Aquatic Plants: Both surveys observed spirogyra and characeae in Salt Wash. The 1988 survey did not find Cladophora and Potamogeton, algae and pond weed. This was due to limited field reference.

Aquatic Insects: The invertebrate populations were seen to qualitatively differ between the two surveys. This was expected due to seasonal differences. Life cycles may have not been completed, thus obscuring the 1979 and 1988 observations.

Terrestrial Fauna: The mega fauna observed in the Salt Wash 1988 survey were tracks of raccoon, squirrel, deer and a sighting of the Great Blue Heron. The presence and abundance of these animals indicated that Salt Wash can and will support a thriving riparian food chain despite chemical and seasonal harshness.

LITERATURE SITED

Borror, Donald J., Dwight M. DeLong, and Charles A. Triplehorn. 1981. Introduction to the Study of Insects, fifth edition. CBS College Publishing.

Boyd, Claude E. 1979. Water Quality in Warmwater Fish Ponds. Auburn University, Auburn, Alabama.

Holden, Paul. 1988. Phone conversation regarding method.

Klots, Elsie B. 1966. Freshwater Life G. P. Putnam's Sons. New York, NY 10016

Ricketts, T.S. Kunkle, and M. Flora. 1984. A Resource Managers Guide to Water Quality Criteria. Training document of NPS water.

Selby, Douglas A. and Paul B. Holden. 1979. Survey of Fish, Invertebrates and Algae in Salt Wash, Arches National Park. Bio/West, Logan, Utah.

Sigler, William and Robert Miller. 1963. Fishes of Utah. Utah State Department of Fish and Game. Salt Lake City, Utah.

Table 1. Water Quality Parameters of Salt Wash, Arches National Park, August 13, 1988

	Upstream of Wolfe Ranch	Pool 1A	Pool 2A	Wall Spring	Wall Spring	Pool 1B	Pool 2B	Salt Wash 300 ft. from Spring	Salt Spring	Salt Wash 300 ft. from Colo. Riv.
<u>Date</u>	8/15/88	8/13/88	8/13/88	8/13/88	8/14/88	8/14/88	8/14/88	8/14/88	8/14/88	8/14/88
<u>Temp</u> (°C)	22.5	21.1	26.0	20.1	16.3	29.9	28.3	29.4	29.2	30.2
<u>pH</u>	7.0	5.3	5.6	6.3	7.1	7.9	7.5	7.9	7.4	6.9
<u>D.O.</u> (mg/L)	8.9			7.3	6.3			6.7	6.2	6.2
<u>Cl⁻</u> mg/L=ppm	--	1696.8	1848.3	1605.9	--	1939.2	1212.0	1818.0	1818.0	2181.6
<u>Con.</u> (umho/cm)	3820	5200	5960	5010	5140	6470	6150	5990	6270	6640

Table 2. Summary of fish identified at indicated sites of the Salt Wash in Arches National Park, August 13-15, 1988
(Species listed in descending order from most abundant to least abundant)

[illegible]

Table 3. Summary of Invertebrates identified at indicated sites of Salt Wash, Arches National Park, August 13-15, 1988

Order Family	Upstream From Wolfe Ranch	Pool 1A	Pool 2	Wall Spring	Wall Spring	Pool 1B	Pool 2B	Salt Wash 300 ft. from Salt Spring	Salt Spring	Salt Wash 300 ft. from Co. R.
Coleoptera Dytiseidae	--	--	--	--	--	X	X	--	--	--
Unk.	X	X	--	--	--	X	X	--	--	--
Diptera Chironomidae (flies)	--	--	--	X	--	--	--	--	--	--
Tabanidae (horse, deer)	X	--	--	X	--	--	--	--	--	--
Ephemeroptera Bactidae	X	--	--	--	--	--	--	--	--	--
Gastropoda	--	--	--	--	--	X	X	--	--	--
Hemiptera Gerridae	X	X	X	X	X	X	X	X	X	X
Hydrachnida (water mite)	--	--	--	--	--	X	X	--	--	--
Odonata Coenagrionidae (dragon)	X	X	X	X	X	X	X	--	--	X
Libellulidae (damselfly)	X	X	X	X	X	X	X	--	--	X
Ostracoda	X	--	--	--	--	--	--	--	--	--
Trichoptera (Caddisflies)	--	--	X	--	--	--	--	--	--	--
Arachnida Theridionidae	--	--	--	--	--	--	--	X	--	--