



Water Quality Monitoring in Big Hole National Battlefield (BIHO)

Importance

Freshwater habitats are diverse and productive ecosystems, providing habitat for aquatic plant, invertebrate, and vertebrate species including many fishes and birds. Rivers and streams are intimately connected to riparian zones, providing habitat for many specialist species. Additionally, most upland animals rely on aquatic habitats to one degree or another.

Water resources in the semi-arid west have been strongly affected by human activity, and many Upper Columbia Basin Network (UCBN) streams and rivers are listed by states as impaired for one or more parameters. Most UCBN waterbodies and many aquatic resources, such as migratory fish, are strongly influenced by activities in the larger watersheds outside park boundaries. Understanding the current status of freshwater ecosystems will help guide management and restoration efforts and provide insight into ecosystem change in a landscape with shifting climate and dynamic human influences.



North Fork Big Hole River water quality monitoring station, August 2012.

Status of the North Fork (NF) Big Hole River

Threats to water resources in BIHO have been listed as: flow impairment, mining, agriculture, and stormwater runoff (Garrett et al. 2007). In 2012, NF Big Hole River was listed as a category 4A or impaired water according to the state of MT. Meaning that sufficient data shows that the stream is failing to achieve compliance with applicable water quality standards (i.e., nonsupport or partial support of beneficial uses). Designated state beneficial uses include agricultural, aquatic life, drinking water, and primary contact recreation. Of which, aquatic life and primary contact recreation uses were partially supported.

In 2012 the UCBN monitored 5 core water chemistry parameters in this river including: dissolved oxygen, pH, specific conductance, temperature, and turbidity. Each parameter was evaluated hourly between the months of June and October using a continuous water quality monitor. In addition, aquatic macroinvertebrates were collected according to United States Forest Service (USFS) - PACFISH/INFISH Biological Opinion Effectiveness Monitoring Program protocol. For more on macroinvertebrates please see the integrated water quality annual report for BIHO on the UCBN website listed below.

- Water temperature exceeded the threshold to protect against stress or lethal conditions for imperiled arctic grayling (18 °C) during 1.2% of observations. These data suggest that reduced streamflow and stream shading may be contributing to high water temperatures. Note that the segment of NF Big Hole River in the park may serve as potential habitat for arctic grayling. Recent grayling observations are from near the confluence with the Big Hole River.
- During the time period in which there are “early life stage” fishes present in the river, minimum daily dissolved oxygen levels consistently (100% of observations) fell below the criteria of 8.0 mg/l and were likely attributable to elevated water temperatures and reduced streamflow. The early life stage dissolved oxygen criteria is applicable July 16th to September 30th.

UCBN water quality monitoring is conducted on a 3 year rotating panel. The NF Big Hole River will be sampled for water chemistry and macroinvertebrates again in 2015. The following table is a summary of findings from 2012 monitoring along with state regulatory thresholds and other criteria for this river.

North Fork Big Hole River Water Chemistry Summary 2012

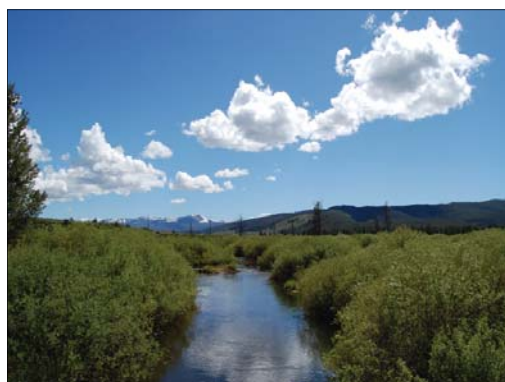
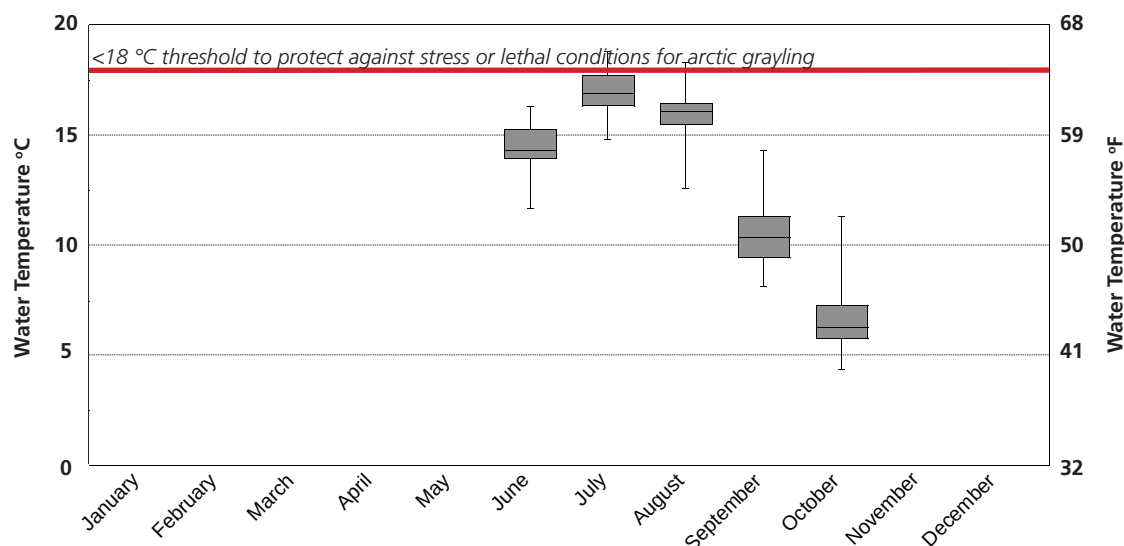
Measure	Current Condition (June-October, 2012)	State DEQ Thresholds ^a	% Exceedance ^c
Temperature (*MDMT, **MDAT)	*MDMT=18.78 °C **MDAT=17.24 °C	“A 1 °F [0.56 °C] maximum increase above naturally occurring water temperature is allowed” <18 °C threshold to protect against stress or lethal conditions for arctic grayling ^b	-- 1.2%
Specific Conductance (mean)	57.8 µS/cm	N/A	N/A
Dissolved Oxygen (mean daily min)	6.38 mg/l	Daily minimum > 8.0 mg/l; 7-d mean > 9.5 mg/l (Early life stage - applicable 16 July to 30 Sept.)	100% 100%
pH (mean daily max)	7.30 pH Units	6.5-8.5; < 0.5 unit human induced change;	0%
pH (mean daily min)	7.15 pH Units	Maintain > 7.0 if naturally > 7.0	0%
Turbidity (mean daily max)	2.46 NTU	“No increase above natural turbidity is allowed”	--

*MDMT – Maximum Daily Maximum Temperature, **MDAT – Maximum Daily Average Temperature, ^a Montana Department of Environmental Quality water quality standards for North Fork Big Hole River planning area. ^b BIHO preferred temperature threshold. ^c Proportion of samples above water quality standard.



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North Fork Big Hole River, Daily Maximum Water Temperature, June-October 2012



North Fork Big Hole River June 2012



North Fork Big Hole River September 2012



North Fork Big Hole River October 2012

North Fork Big Hole River, Daily Minimum Dissolved Oxygen, June-October 2012

