



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 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
September 2015

Status of North Fork Big Hole River in BIHO

Threats to water resources in BIHO have been listed as: flow impairment, mining, agriculture, and stormwater runoff (Garrett et al. 2007). In 2014, North Fork 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 are agricultural, aquatic life, drinking water, and primary contact recreation. Of which, aquatic life and primary contact recreation uses were not supported.

In 2015 the UCBN monitored 5 core water chemistry parameters in the North Fork Big Hole 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 (PIBO-EM) 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 arctic grayling (18 °C) during 3.6% of observations. These data suggest that reduced streamflow and stream shading may be contributing to high water temperatures.
- During the time period in which there are “early life stage” fishes present in the river, minimum daily dissolved oxygen levels consistently (96% 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 North Fork Big Hole River will be sampled for water chemistry and macroinvertebrates again in 2018. The following table is a summary of findings from 2015 monitoring along with state regulatory thresholds and other criteria for the North Fork Big Hole River.

North Fork Big Hole River Water Chemistry Summary 2015

Measure	Current Condition (June-October, 2015)	State DEQ Thresholds ^a	% Exceedance ^c
Temperature (*MDMT, **MDAT)	*MDMT=19.59 °C **MDAT=17.57 °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	-- 3.6%
Specific Conductance (mean)	58.80 µS/cm	N/A	N/A
Dissolved Oxygen (mean daily min)	6.91 mg/L	Daily minimum >8.0 mg/L; 7-d mean >9.5 mg/L (Early life stage - applicable 16 July to 30 Sept.)	96% 100%
pH (mean daily max)	7.34 pH Units	6.5-8.5; <0.5 unit human induced change;	0%
pH (mean daily min)	8.19 pH Units	Maintain >7.0 if naturally >7.0	0%
Turbidity (mean daily max)	7.07 NTU	“No increase above natural turbidity is allowed”	--

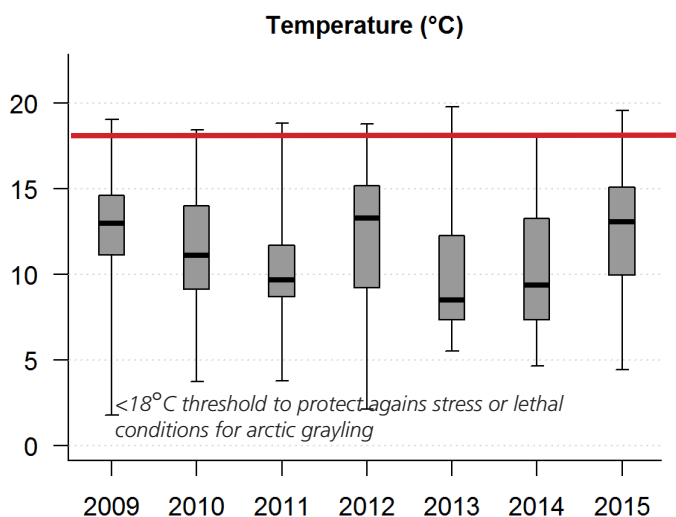
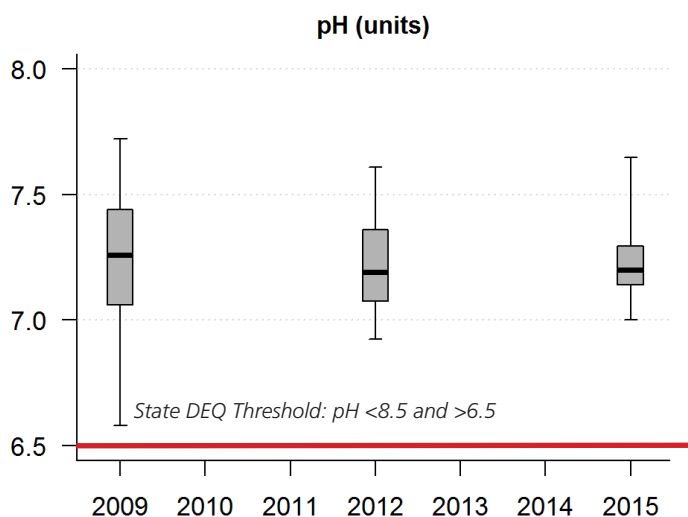
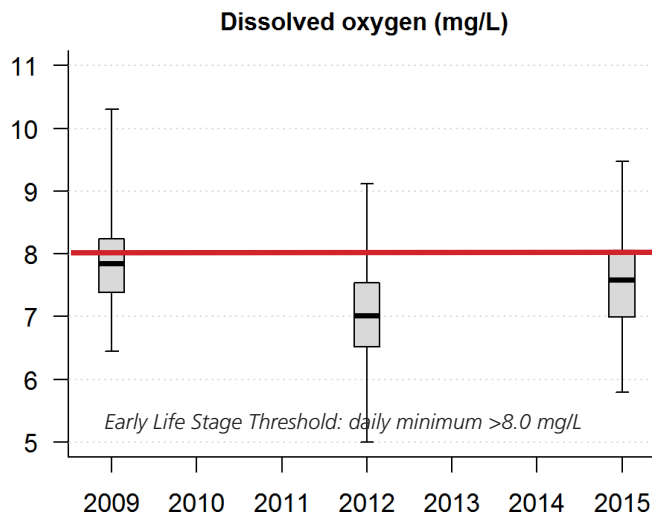
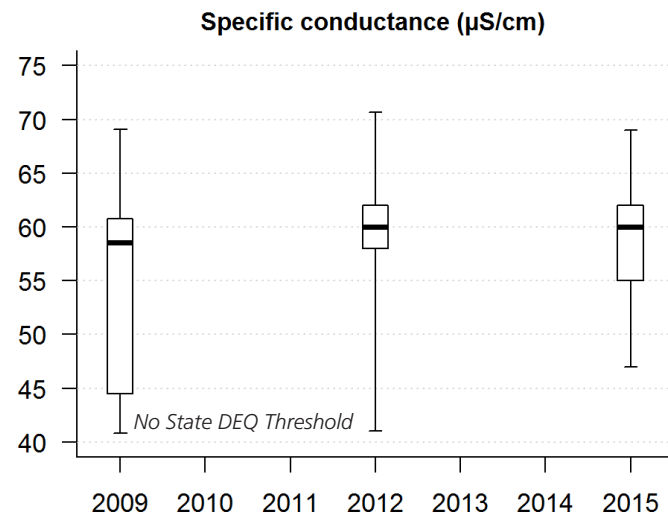
*MDMT – Maximum Daily Maximum Temperature, **MDAT – Maximum Daily Average Temperature, ^a MT DEQ water quality standards for North Fork Big Hole River planning area, ^b BIHO preferred temperature threshold, ^c Proportion of samples above water quality standard.





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North Fork Big Hole River, Water Quality Monitoring Results 2009-2015



Note that box-plot tail ends represent the minimum and maximum values



North Fork Big Hole River
June 2015



North Fork Big Hole River
September 2015



North Fork Big Hole River
October 2015