Water Quality in Wassataquoik Stream

February 2019

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Introduction

Despite the restoration efforts of numerous groups since the 1970s, the population size of Atlantic salmon (*Salmo salar*) has remained low (USASAC 2018). On the Penobscot River, access has been improved by removing two major dams and constructing a bypass around a third (PRRT 2018), but three main stem dams remain between Wassataquoik Stream and the ocean. For thirty years, the Maine Department of Marine Resources (MDMR) has been stocking juvenile salmon in Wassataquoik Stream, a major tributary to the East Branch Penobscot River, but productivity remains lower than expected. This stream has extensive spawning and rearing habitat of good quality, however the watershed is likely oligotrophic, as are many waters in Baxter State Park. This study investigated the hypothesis that water quality in Wassataquoik Stream exceeds stress thresholds or contains levels of nutrients too low for salmon growth.

Methods

Study Location

Wassataquoik Stream has a large, undeveloped watershed of 293 km^2, with all but 5% conserved land, including Baxter State Park in the headwaters, Katahdin Woods and Waters National Monument, and Maine Bureau of Parks and Lands (MBPL). The stream is Maine Statutory Class AA, and its tributaries are mostly Class A. The area has a history of industrial logging. The bedrock geology in the study area is predominantly granite with some volcanics near the confluence with the East Branch Penobscot River (MGS 2018). Surficial geology is primarily till with glaciofluvial deposits (sand, gravel, silt), eskers and other moraines in the vicinity. In 2018, 755 adults returned to the Penobscot River watershed, and only 16 of those were recorded at the uppermost main stem dam (MDMR 2018). The median relative abundance of parr in Wassataquoik Stream for 2006-2012 was 0.83 CPUE (based on MDMR data), which is low compared to the median of 2.61 CPUE for the Penobscot River in 2017 (USASAC 2018).

In this 2018 study, two locations in Wassataquoik Stream and one in Katahdin Brook were monitored for water quality (Fig. 1). Results were compared with data collected in 2018 by DEP's Biomonitoring Unit in the West Branch of the Sheepscot River, a class AA waterbody with a 131 km^2 primarily natural watershed (19% human altered or developed; MDEP 2018). The West Branch has high salmon productivity (P. Christman, pers. comm.).

Sampling Methods

At each sample location in Wassataquoik Stream, continuous monitoring devices were deployed June 6, 2018. Sondes were deployed as in Zimmermann (2018a). Hourly measurements of temperature, specific conductance, pH, and dissolved oxygen (DO) were collected using YSI 6000 EDS sondes. Sondes were cleaned and calibrated every four weeks until retrieval on October 25, 2018. Continuous data were corrected as needed based on quality control procedures as described in MDEP (2016). Grab samples for calcium, dissolved organic carbon (DOC), aluminum species, acid neutralization capacity (ANC), closed-cell pH, total phosphorus, total Kjeldahl nitrogen, and nitrate + nitrite as nitrogen were collected in June, August, and October from each sample location, following the methods in Zimmermann (2018a). In addition, discrete data were collected each month in Katahdin Brook with a Eureka Manta2 Sub2 sonde. DEP's Biomonitoring program deployed a continuous temperature logger in the West Branch Sheepscot River, a productive salmon stream used for comparison with Wassataquoik Stream.

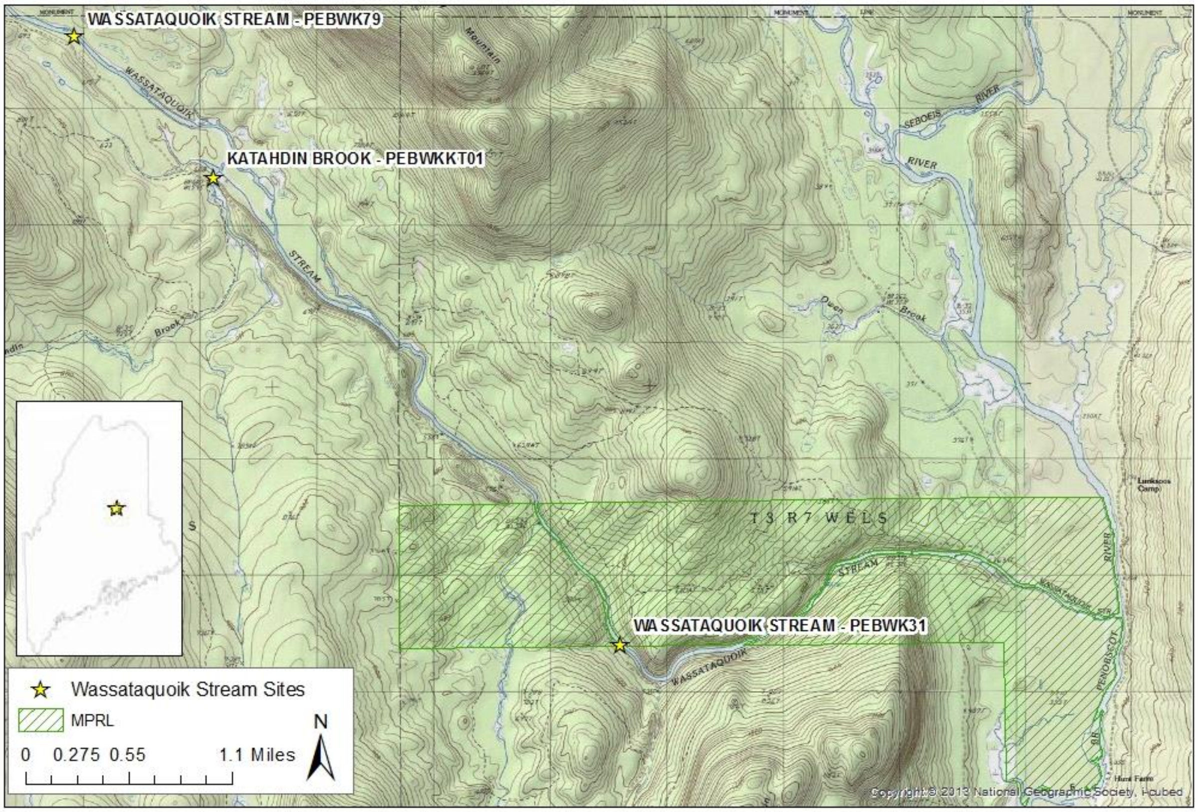

Figure 1. Map of the three study sites on Wassataquoik Stream. The upstream reach is within Katahdin Woods and Waters National Monument, and the downstream site, PEBWK31, is within a Maine Bureau of Parks and Lands (MBPL) parcel.

<u>Macroinvertebrates</u>

Rock bags were deployed at the upstream site in July and retrieved in August, following the sampling and analysis methods in MDEP (2014). MDEP's Biomonitoring program collected rock bag data during the same time period in the West Branch Sheepscot River near Weeks Mills, in the town of China.

Results and Discussion

<u>Weather</u>

Northern and Eastern Maine experienced a cold, dry spring followed by a much warmer than average summer, with record warm overnight lows (NOAA 2018). The dry summer was punctuated by heavy rain events.

<u>pH</u>

The minimum state water quality criterion for the protection of aquatic life, pH 6.0, was met for 85% and 90% of the study duration at the upstream and downstream sites, respectively (Fig. 2; 38 MRS Section 464.4.A.5). The pH was on average 0.2 units higher upstream compared to downstream. The threshold of 5.4, above which no adverse impacts to salmon are expected (Haines et al. 1990; Stanley and Trial 1995), was crossed only 0.4% of the study period, following a significant rain event in early October of more than 25 mm. Organic acids from leaf

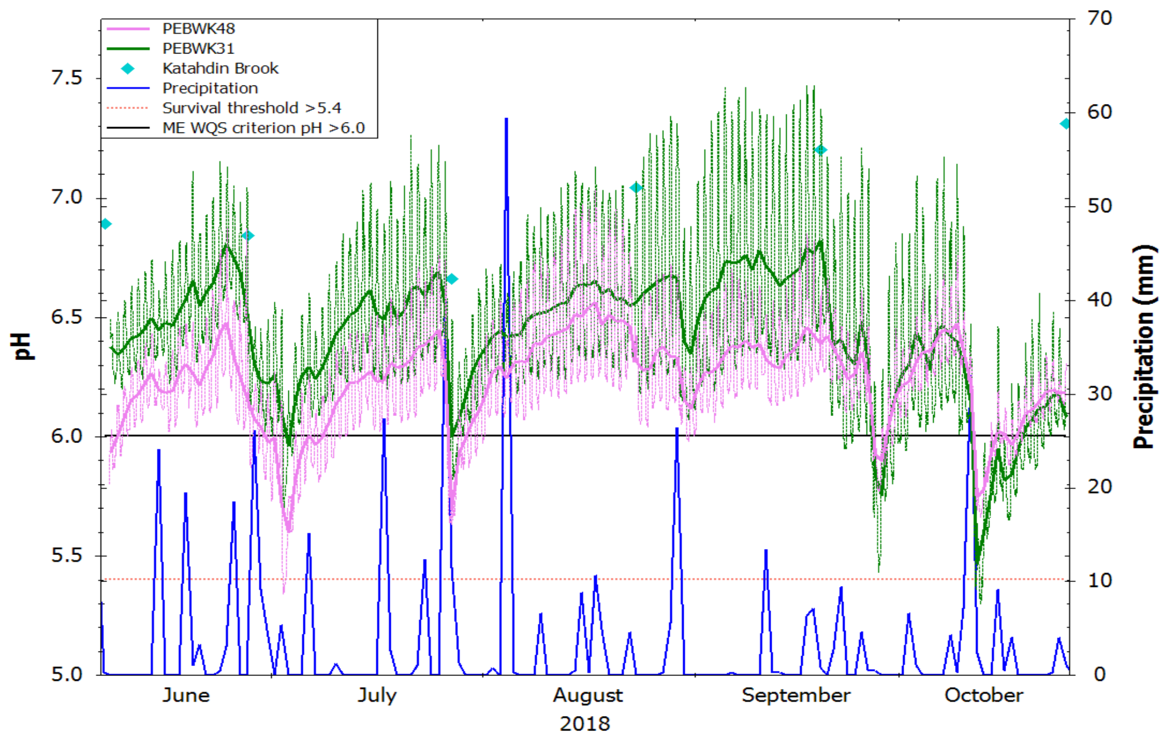

Figure 2. Hourly pH and local rainfall. Rainfall data from Weather Underground station KMESHERM2.

drop may have further contributed to the low pH values. The depression lasted 11 hours, and reached a minimum pH of 5.3 at the downstream site. The mean diel range in pH for both sites was 0.58 ± 0.26, with the maximum diel range of 1.2 occurring in September at the downstream site. At both sites, rain events resulted in episodic acidity. pH refugia may be available in tributaries, such as Katahdin Brook, where the mean pH was 6.99 ± 0.2. Tributary data were not collected during pH depressions caused by rainfall, however it is expected pH would remain higher than the main stem based on the relatively high mean value observed. In comparison, summer base flow pH in the West Branch Sheepscot River is on average 7.3 ± 0.3, similar to the 7.1 ± 0.2 observed in 2017 in the East Branch Penobscot River (Zimmermann 2018b). Episodic acidity in Wassataquoik Stream is not expected to cause lasting adverse impacts to salmon due to the short duration of the pH depressions, and the proximity to the threshold for harm of 5.4.

Stream Temperature

The two Wassataquoik study sites had very similar temperature records. Combining both sites, temperatures were above the threshold for optimal growth of 20°C for 28% of the study duration (Fig. 3; USEPA 1986). The stress threshold of 22.5°C, when salmon stop feeding, was exceeded only 8% of the time (Elliott and Hurley 1997; Stanley and Trial 1995). Similar exceedances of 22.5°C were observed at a site 3 km further downstream in 2006 and in the East Branch Penobscot in 2017 (MDEP 2018; Zimmermann 2018b). Data collected from 2006-2009 by MDMR at nearby sites show cooler summer temperatures, with exceedances of 22.5°C ranging from 1.1% in 2009 to 5.8% in 2007 (SHEDS 2018). In the current study, the maximum temperature for salmon survival of 27°C was never exceeded. Thermal stress is likely during the warmest months (July to August), when temperatures remained above 22.5°C for 8 hours on

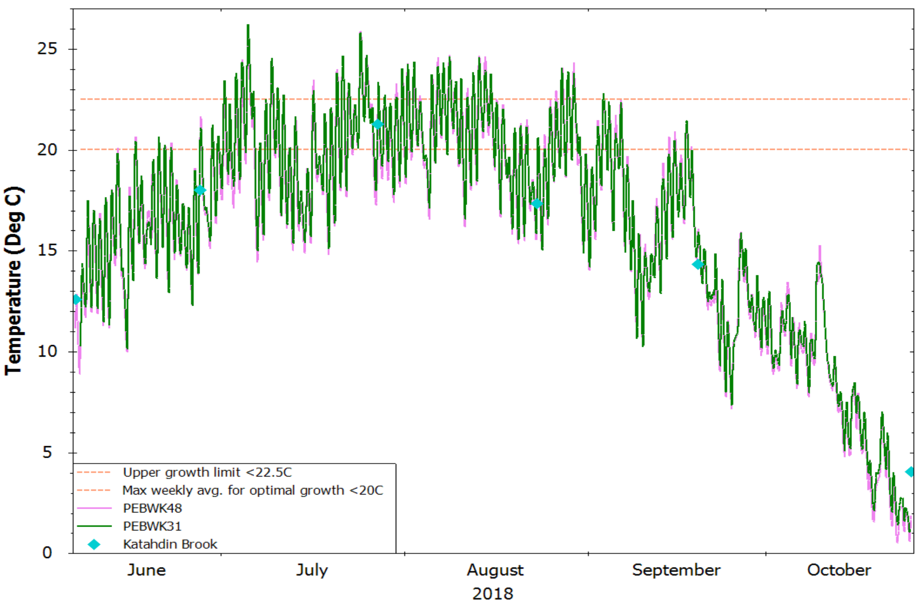

Figure 3. Hourly temperature.

average, with a maximum duration of 18 hours. Mean diel fluctuations were 4.15 ± 1.72°C, which may provide daily thermal refugia for salmon. In addition, minor tributaries in the study reach, such as Katahdin Brook (mean 14.6 ± 6℃), could act as cold water refugia for small numbers of fish. In comparison with the West Branch Sheepscot River, water temperatures were similar, however the survival threshold of 27°C was exceeded 0.8% of the time, with an average duration of 2.8 hours per exceedance event (MDEP 2018). Exceedances above 22.5°C lasted on average 3.3 hours longer in the West Branch, but greater diel fluctuations (5.6 ± 2.7°C) suggest the possibility of nightly temperature refugia (MDEP 2018). In both waterbodies, high temperatures are likely to cause some sublethal stress and reduced growth in salmon during the warmest months of July and August.

Dissolved Oxygen (DO)

DO levels were within a healthy range for fish and aquatic life, and remained well above the Maine Water Quality Standard minimum criterion value of 7 mg/L, which is also the preferred threshold for salmon (38 MRS Section 465.2.B; Stanley and Trial 1995). Mean DO for the study period was 9.8 ± 1.3 mg/L across all sites, reaching a minimum of 7.86 mg/L, which was similar to observations in the West Branch Sheepscot River and the East Branch Penobscot River (MDEP 2018; Zimmermann 2018b). No adverse impacts due to DO are expected.

Specific Conductance

Hourly specific conductance was very similar at all study sites, with an overall mean of 17.4 ± 3.4 µS/cm. Similar specific conductance has been observed at other Wassataquoik Stream sites, as well as the East Branch Penobscot River (MDEP 2018; Zimmermann 2018b). Specific conductance in the West Branch Sheepscot River is much higher (133.7 ± 25.6 µS/cm), likely due to the numerous road crossings and human disturbance in the watershed (MDEP 2018). Rain events did not have a significant impact on specific conductance in Wassataquoik Stream, except for one storm in early October which resulted in a small decrease of 4 µS/cm. No adverse impacts due to specific conductance are expected.

Acid Neutralization Capacity (ANC)

ANC was higher by about 25 μeq/L at the downstream site (137.3 ± 14.5 μeq/L, 6.9 mg/L alkalinity) compared with the upstream site (111.7 ± 11.2 μeq/L, 5.6 mg/L alkalinity). Values at both sites were well above the threshold of acid sensitivity of 50 μeq/L (Driscoll et al. 2001), and the Norwegian 20-30 μeq/L critical limits for salmon (Baker et al. 1990; Lien et al. 1996; Kroglund et al. 2002). Higher ANC gives greater buffering capacity and correlates with higher pH (lower acidity), as seen at the study sites. ANC was lowest during high flow events, likely because of acidic rain. ANC was significantly higher in the study area than at sites further upstream in Baxter State Park, which were close to the threshold of 50 μeq/L (MDEP 2018). In Wassataquoik Stream, buffering capacity increases from the headwaters to downstream. Alkalinity values were below EPA's recommended ambient water quality criteria (AWQC) of 20 mg/L, however this threshold does not apply where values are naturally lower (USEPA 1986). Given the relatively undeveloped and protected nature of the watershed, low alkalinity is likely of natural and not anthropogenic origin. Based on ANC values, Wassataquoik Stream has a moderate buffering capacity.

<u>Calcium</u>

Calcium buffers the detrimental impacts of exchangeable aluminum (Alx) by increasing the efficiency of ion regulation (Baldigo and Murdoch 2007; MacDonald et al. 1980). At the downstream site, calcium (2.16 ± 0.15 mg/L) was slightly above the survival threshold for salmon of 2 mg/L (Baker et al. 1990; Baldigo and Murdoch 2007) but below the suggested threshold of 4 mg/L to prevent deformities (M. Whiting pers. comm.). Summer base flow calcium at the upstream site was slightly lower (1.73 ± 0.15 mg/L) and below both thresholds. In comparison, sites further upstream in Baxter State Park were well below the survival threshold (0.7-0.99 mg/L; MDEP 2018). No calcium data have been collected in the West Branch Sheepscot River. In comparison, the East Branch Penobscot River had higher calcium values (3.7 mg/L; Zimmermann 2018b). Due to the low calcium values and the nearly circumneutral pH values, calcium is not likely providing any buffering of Alx in the study reach (Baker et al. 1990; Wood et al. 1990).

<u>Aluminum</u>

Total aluminum was variable, ranging from 50.6 ± 20.1 μg/L at the downstream site to 58.2 ± 37.1 μg/L at the upstream site. Total aluminum was well below the Maine AWQC maximum of 750 μg/L in all samples MDEP CMR Chapter 584). Aluminum was also well below EPA's site-specific maximum criteria, which ranged from 400-740 μg/L depending on DOC, total hardness, and pH (USEPA 2018). The solubility (and therefore toxicity) of aluminum increases as pH becomes more acidic or basic (beyond pH 6-8; USEPA 2018), and toxicity also depends on the relative dominance of exchangeable aluminum (Lacroix and Kan 1986). Exchangeable aluminum (Alx, calculated as dissolved aluminum minus organically complexed aluminum) was very low at both sites during summer base flow (8 ± 11 and 10 ± 6 μg/L at the downstream and upstream sites, respectively), representing approximately 12% of the aluminum species present, however the percentage almost doubled (23%) in the June sample. These aluminum values are similar to data from other cool ecosystems underlain by a range of geological types (Haines et al. 1990), including the East Branch Penobscot (Zimmermann 2018b). The dominant fraction of aluminum was organic aluminum, as in Nova Scotian and Eastern Maine streams, which helps prevent major changes in aluminum speciation (Lacroix and Kan 1986; Zimmermann 2018a). For protection of aquatic life, including macroinvertebrates, the

European Inland Fisheries Advisory Commission (EIFAC) recommends that exchangeable aluminum should not exceed 0.015 mg/L at pH 5.0-6.0, even for short durations (Howells et al. 1990 as cited in Dennis and Clair 2012; Kroglund and Staurnes 1999; McCormick et al. 2009). This threshold was exceeded in June at both sites, but pH remained well above 6, suggesting that the risk of sublethal stress due to Alx is minimal.

Dissolved Organic Carbon (DOC)

DOC has been shown to be a strong determinant of fish mortality (for brook trout, Baldigo and Murdoch 2007) and can be used as an indicator of organic acidity to determine the role of anthropogenic activity in acidic streams (Monteith et al. 2007; Schiff et al. 1998 as cited in Clair and Hindar 2005). DOC was 3.2 ± 0.6 mg/L at each Wassataquoik site, compared with 6.2 ± 2.5 mg/L in the West Branch Sheepscot River (MDEP 2018) and 6.35 mg/L in the East Branch Penobscot River (Zimmermann 2018b). Wassataquoik Stream is very clear, with very low organic content and high pH, indicating a well-buffered system. Above pH 5.5, and at DOC concentrations greater than 2.0-5.0 mg/L, DOC can buffer against the toxic impacts of exchangeable aluminum, by binding the aluminum into inert organic complexes (Baldigo and Murdoch 2007; Kroglund et al. 2008; Tipping et al. 1991). While some buffering may occur in the West Branch Sheepscot River, it is unlikely that DOC contributes much to the buffering capacity in Wassataquoik Stream due to the low values.

Nutrients

Nitrogen levels were very low, with biologically available nitrogen (nitrate + nitrite) below the detection limit of 0.015 mg/L in half the samples collected, and total Kjeldahl nitrogen (TKN) below the detection limit of 0.11 mg/L in all but one of the samples. State-wide, non-detects of TKN in surface waters occur approximately 9% of the time, indicating that TKN is very low in Wassataquoik Stream (MDEP 2018). When detected, mean biologically available nitrogen for both sites combined was 0.023 ± 0.006 mg/L, TKN was 0.19 mg/L (only detected at the downstream site), and total phosphorus was 14.5 ± 0.005 μg/L. No significant trends were observed across the sampling season, however nitrate + nitrite was higher in the fall following leaf drop. Nutrient levels at sites near the headwaters of Wassataquoik Stream were lower than the study area detections (MDEP 2018). Nitrogen levels in the West Branch Sheepscot River were twice as high as the Wassataquoik sites, likely due to land use patterns including more development and agriculture (MDEP 2018). Nutrients in the Wassataquoik, although low, were typical of natural, undisturbed streams in Maine.

Macroinvertebrates

The water quality of Wassataquoik Stream supports a robust macroinvertebrate community that attains Maine's highest aquatic life water quality classification (Appendix I, Davies et al. 2016). Total mean abundance was high (636) and generic richness was 43. More than half the generic richness was represented by EPT taxa (mayflies, stoneflies, and caddisflies; 62.8%), as was observed at a site 3 km downstream from the study area in 2006 (MDEP 2018). The dominant taxa were filter-feeding caddisflies (41%), in particular the genus *Hydropsyche*, as observed in prior sampling of Wassataquoik Stream (MDEP 2018), and midges (14%). The macroinvertebrate assemblage contains a good variety of sensitive taxa (mayflies and stoneflies) and is typical of clear, oligotrophic, large river systems. The overall abundance is similar to observations in the West Branch Sheepscot River, despite higher nitrogen values in the

Sheepscot Watershed (MDEP 2018). Salmon are thought to be opportunistic feeders, changing their diet to the most abundant prey available, which often includes the larvae of mayflies, chironomids, caddisflies, blackflies, stoneflies, annelids, and mollusks (Scott and Crossman 1973 as cited in Stanley and Trial 1995). Given the high abundance, macroinvertebrates are not likely a limiting factor in salmon productivity in Wassataquoik Stream.

Conclusion

Wassataquoik Stream has good water quality for salmon growth and development, similar to the East Branch Penobscot River. Episodic pH depressions are of short duration and likely do not have a significant impact on salmon growth. Wassataquoik Stream has low to moderate buffering capacity, with moderate ANC and low calcium, however pH remains mostly circumneutral, and aluminum toxicity is not likely. Warm water temperatures throughout most of the summer could lead to sub-lethal stress or avoidance behavior in salmon. The most sensitive life stages of salmon (from hatch to swim up and smolts) are not present in this reach during most of the temperature maxima. However, sub-lethal stresses, such as thermal stress, are additive and can cause detrimental impacts to growth and survival. In a similar waterbody, the West Branch Sheepscot River, temperatures are a little warmer and nitrogen levels are twice as high, potentially allowing for greater salmon productivity. However, the high abundance of macroinvertebrates in Wassataquoik Stream suggest nutrients are not a limiting factor.

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Appendix I – Biomonitoring Key Report

Maine Department of Environmental Protection
Biological Monitoring Program
Aquatic Life Classification Attainment Report

Station Information

Station Number: S-1148
Waterbody: Wassataquoik Stream - Station 1148
Town: T03 R08 Wels
Directions: 1 MILE UPSTREAM FROM KATAHDIN BROOK

River Basin: Penobscot
HUC8 Name: East Branch Penobscot
Latitude: 45 56 37.68 N
Longitude: 68 43 46.51 W
Stream Order: 4

Sample Information

Log Number: 2691
Subsample Factor: X4
Type of Sample: ROCK BAG
Replicates: 3
Date Deployed: 7/27/2018
Date Retrieved: 8/23/2018

Classification Attainment

Statutory Class: AA
Model Result with P≥0.6: A
Date Last Calculated: 11/28/2018
Final Determination: A
Reason for Determination: Model
Comments:
Date: 11/28/2018

Model Probabilities

First Stage Model

Class A	0.54	Class C	0.01
Class B	0.45	NA	0.00

C or Better Model

Class A, B, or C	1.00
Non-Attainment	0.00

B or Better Model

Class A or B	1.00
Class C or Non-Attainment	0.00

A Model

Class A	1.00
Class B or C or Non-Attainment	0.00

Model Variables

01 Total Mean Abundance	636.00
02 Generic Richness	43.00
03 Plecoptera Mean Abundance	18.67
04 Ephemeroptera Mean Abundance	136.00
05 Shannon-Wiener Generic Diversity	3.76
06 Hilsenhoff Biotic Index	4.09
07 Relative Abundance - Chironomidae	0.21
08 Relative Generic Richness Diptera	0.30
09 *Hydropsyche* Abundance	221.05
11 *Cheumatopsyche* Abundance	4.28
12 EPT Generic Richness/ Diptera Generic Richness	2.08
13 Relative Abundance - Oligochaeta	0.00
15 Perlidae Mean Abundance (Family Functional Group)	12.00
16 Tanypodinae Mean Abundance (Family Functional Group)	1.35
17 Chironomini Abundance (Family Functional Group)	12.12
18 Relative Abundance Ephemeroptera	0.21
19 EPT Generic Richness	27.00
21 Sum of Abundances: *Dicrotendipes, Micropsectra, Parachironomus, Helobdella*	0.00
23 Relative Generic Richness- Plecoptera	0.09
25 Sum of Abundances: *Cheumatopsyche, Cricotopus, Tanytarsus, Ablabesmyia*	93.16
26 Sum of Abundances: *Acroneuria, Maccaffertium, Stenonema*	12.71
28 EP Generic Richness/14	1.21
30 Presence of Class A Indicator Taxa/7	0.71

Five Most Dominant Taxa

Rank	Taxon Name	Percent
1	*Hydropsyche*	34.76
2	*Cricotopus*	13.97
3	*Acerpenna*	7.96
4	*Brachycentrus*	6.29
5	*Hemerodromia*	3.98

Maine Department of Environmental Protection
Biological Monitoring Program
Aquatic Life Classification Attainment Report

Station Number: **S-1148**	Town:	T03 R08 Wels	Date Deployed: 7/27/2018
Log Number: **2691**	Waterbody:	Wassataquoik Stream - Station 1148	Date Retrieved: 8/23/2018

Sample Collection and Processing Information

Sampling Organization: BIOMONITORING UNIT

Taxonomist: MICHAEL WINNELL

Waterbody Information - Deployment		Waterbody Information - Retrieval	
Temperature:	19.36 deg C	Temperature:	15.96 deg C
Dissolved Oxygen:	9.2 mg/l	Dissolved Oxygen:	9.75 mg/l
Dissolved Oxygen Saturation:	99.3 %	Dissolved Oxygen Saturation:	101 %
Specific Conductance:	14 uS/cm	Specific Conductance:	17 uS/cm
Velocity:		Velocity:	
pH:	5.98	pH:	6.6
Wetted Width:	30 m	Wetted Width:	26 m
Bankfull Width:	42 m	Bankfull Width:	42 m
Depth:	61 cm	Depth:	28 cm

Water Chemistry

Summary of Habitat Characteristics

Landuse Name	Canopy Cover	Terrain	
Upland Hardwood	Open	Mountainous	
Potential Stressor	**Location**	**Substrate**	
	Pristine Landscape	Boulder	30 %
		Gravel	13 %
		Rubble/Cobble	55 %
		Sand	2 %

Landcover Summary - 2004 Data

Sample Comments

Station Number: S-1148 Waterbody: Wassataquoik Stream - Station 1148 Town: T03 R08 Wels

Log Number: 2691 Subsample Factor: X4 Replicates: 3 Calculated: 11/28/2018

Taxon	Maine Taxonomic Code	Count (Mean of Samplers) Actual	Count (Mean of Samplers) Adjusted	Hilsenhoff Biotic Index	Functional Feeding Group	Relative Abundance % Actual	Relative Abundance % Adjusted
Pteronarcys	09020205023		2.67	0	SH		0.4
Pteronarcys biloba	09020205023061	2.67			--	0.4	
Perlodidae	09020207	4.00	4.00		--	0.6	0.6
Perlidae	09020209	8.00			--	1.3	
Acroneuria	09020209042		8.00	0	PR		1.3
Acroneuria abnormis	09020209042121	2.67		0	PR	0.4	
Paragnetina	09020209049		4.00	1	PR		0.6
Paragnetina immarginata	09020209049149	1.33			--	0.2	
Baetidae	09020401	12.00			--	1.9	
Baetis	09020401001	6.67	21.47	4	CG	1.0	3.4
Baetis flavistriga	09020401001004	1.33			--	0.2	
Baetis intercalaris	09020401001008	6.67			--	1.0	
Baetis pluto	09020401001009	4.00			--	0.6	
Acerpenna	09020401007	2.67	50.60	5	CG	0.4	8.0
Acerpenna macdunnoughi	09020401007001	25.33			--	4.0	
Acerpenna pygmaea	09020401007011	16.00			--	2.5	
Plauditus	09020401012	16.00	18.40		CG	2.5	2.9
Iswaeon	09020401015	1.33	1.53		--	0.2	0.2
Heptageniidae	09020402	4.00			--	0.6	
Epeorus	09020402009	12.00	15.69	0	SC	1.9	2.5
Epeorus vitreus	09020402009033	1.33			--	0.2	
Leucrocuta	09020402011	2.67	3.14	1	SC	0.4	0.5
Rhithrogena	09020402013	2.67	3.14	0	SC	0.4	0.5
Maccaffertium	09020402015	2.67	4.71	4	SC	0.4	0.7
Maccaffertium luteum	09020402015049	1.33			--	0.2	
Isonychia	09020404018	1.33	1.33	2	CF	0.2	0.2
Leptophlebiidae	09020406	4.00	4.00		--	0.6	0.6
Ephemerellidae	09020410	4.00			--	0.6	
Ephemerella	09020410035	2.67	4.67	1	CG	0.4	0.7
Serratella	09020410037		4.67	2	CG		0.7
Serratella deficiens (Teloganopsis deficiens)	09020410037121	1.33			--	0.2	
Serratella serratoides	09020410037124	1.33			--	0.2	
Tricorythodes	09020411038	2.67	2.67	4	CG	0.4	0.4
Dolophilodes	09020601001		2.67	0	CF		0.4
Dolophilodes distincta	09020601001001	2.67			--	0.4	
Neureclipsis	09020603008	12.00	12.00	7	CF	1.9	1.9
Hydropsychidae	09020604	14.67			--	2.3	

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Cheumatopsyche	09020604015	4.00	4.28	5	CF	0.6	0.7
Hydropsyche	09020604016	164.00	221.05	4	CF	25.8	34.8
Hydropsyche morosa	09020604016030	4.00			--	0.6	
Hydropsyche sparna	09020604016032	38.67			--	6.1	
Rhyacophila	09020605019	1.33	1.33	2	PR	0.2	0.2
Glossosoma	09020606020	8.00	8.00	0	SC	1.3	1.3
Hydroptila	09020607026	6.67	6.67	6	P	1.0	1.0
Oxyethira	09020607028	4.00	4.00	3	P	0.6	0.6
Brachycentrus	09020609043		40.00	0	CF		6.3
Brachycentrus appalachia	09020609043096	40.00			--	6.3	
Lepidostoma	09020611064	1.33	1.33	1	SH	0.2	0.2
Chironomidae	09021011	1.33			--	0.2	
Rheopelopia	09021011017		1.35		PR		0.2
Rheopelopia acra group	09021011017036	1.33			--	0.2	
Corynoneura	09021011036	1.33	1.35	7	CG	0.2	0.2
Cricotopus	09021011037		88.88	7	SH		14.0
Cricotopus bicinctus	09021011037057	73.33			--	11.5	
Cricotopus trifascia	09021011037070	14.67			--	2.3	
Eukiefferiella	09021011041		1.35	8	CG		0.2
Eukiefferiella devonica group	09021011041083	1.33			CG	0.2	
Orthocladius	09021011050	1.33	1.35	6	CG	0.2	0.2
Parametriocnemus	09021011053	1.33	1.35	5	CG	0.2	0.2
Psectrocladius	09021011056			8	CG		
Rheocricotopus	09021011057		4.04	6	CG		0.6
Rheocricotopus robacki	09021011057105	4.00			--	0.6	
Thienemanniella	09021011062	1.33	4.04	6	CG	0.2	0.6
Thienemanniella xena	09021011062110	2.67			--	0.4	
Tvetenia	09021011065		10.77	5	CG		1.7
Tvetenia vitracies	09021011065113	9.33			--	1.5	
Tvetenia paucunca	09021011065114	1.33			--	0.2	
Rheotanytarsus	09021011072	1.33	8.08	6	CF	0.2	1.3
Rheotanytarsus exiguus group	09021011072127	5.33			CF	0.8	
Rheotanytarsus pellucidus	09021011072128	1.33			CF	0.2	
Tanytarsus	09021011076			6	CF		
Polypedilum	09021011102	1.33	12.12	6	SH	0.2	1.9
Polypedilum aviceps	09021011102181	9.33			--	1.5	
Polypedilum flavum	09021011102182	1.33			--	0.2	
Simulium	09021012047		9.33	4	CF		1.5

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Simulium tuberosum	09021012047067	9.33			--	1.5	
Hemerodromia	09021016057	25.33	25.33	3	PR	4.0	4.0
Dubiraphia	09021113064		1.33	6	--		0.2
Dubiraphia minima	09021113064036	1.33			--	0.2	
Promoresia	09021113069		8.00		--		1.3
Promoresia tardella	09021113069052	8.00			--	1.3	
Stenelmis	09021113070		1.33	5	SC		0.2
Stenelmis crenata	09021113070055	1.33			--	0.2	