Water Quality in Seboeis River

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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 Seboeis River, a major tributary to the East Branch Penobscot River, and the ocean. The Maine Department of Marine Resources (MDMR) stopped stocking juvenile salmon in Seboeis River in 2014 due to low parr production. This stream has spawning and rearing habitat of good quality, however the watershed is likely oligotrophic, as are many nearby waters. This study investigated the hypothesis that water quality in Seboeis River exceeds stress thresholds or contains levels of nutrients too low for salmon growth.

Methods

Study Location

Seboeis River has a large, undeveloped watershed of 705 km^2, with 15% conserved land, including Katahdin Woods and Waters National Monument, Seboeis River Gorge Preserve, and Maine Bureau of Parks and Land (MBPL). The river is Maine Statutory Class AA, and its tributaries are Class A. The area has a history of industrial logging. The bedrock geology in the study area is predominantly marine sandstone and slate with some volcanics in the center of the watershed, and a small amount of granite (MGS 2019). Surficial geology is primarily till with some glaciofluvial deposits and eskers. In 2019, 1,196 adult salmon returned to the Penobscot River watershed (MDMR 2019). The median relative abundance of parr in Seboeis River for 2009-2012 was 0.21 catch per unit effort (CPUE; based on MDMR data), which is very low compared to the median of 2.61 CPUE for the Penobscot River in 2017, and 0.83 CPUE for Wassataquoik Stream (2006-2012), another major tributary of the East Branch Penobscot River (USASAC 2018). Three locations in Seboeis River were monitored for water quality (Fig. 1): PEBSB174 upstream of Grand Matagamon Rd, PEBSB107 at Philpot snowmobile bridge, and PEN22 at the Sherman Lumber Rd. Results were compared with data collected in 2019 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 2020). The West Branch has high salmon productivity (P. Christman, pers. comm.).

Sampling Methods

At the two upstream sample locations in Seboeis River, continuous monitoring devices were deployed May 29, 2019, as in Zimmermann (2018a). Measurements of temperature, specific conductance, pH, and dissolved oxygen (DO) were collected every 30 minutes using YSI 6000 EDS sondes. Sondes were cleaned and calibrated every four weeks until retrieval on October 22, 2019. 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), and closed-cell pH, were collected in June, August, and October from each sample location, following the methods in Zimmermann (2018a). Grab samples for total phosphorus, total Kjeldahl nitrogen, and nitrate + nitrite as nitrogen were also collected in August. In addition, discrete data were collected each month at the downstream sample location with a Eureka Manta2 Sub2 sonde. DEP's Biomonitoring program deployed a continuous temperature logger in the West Branch Sheepscot River.

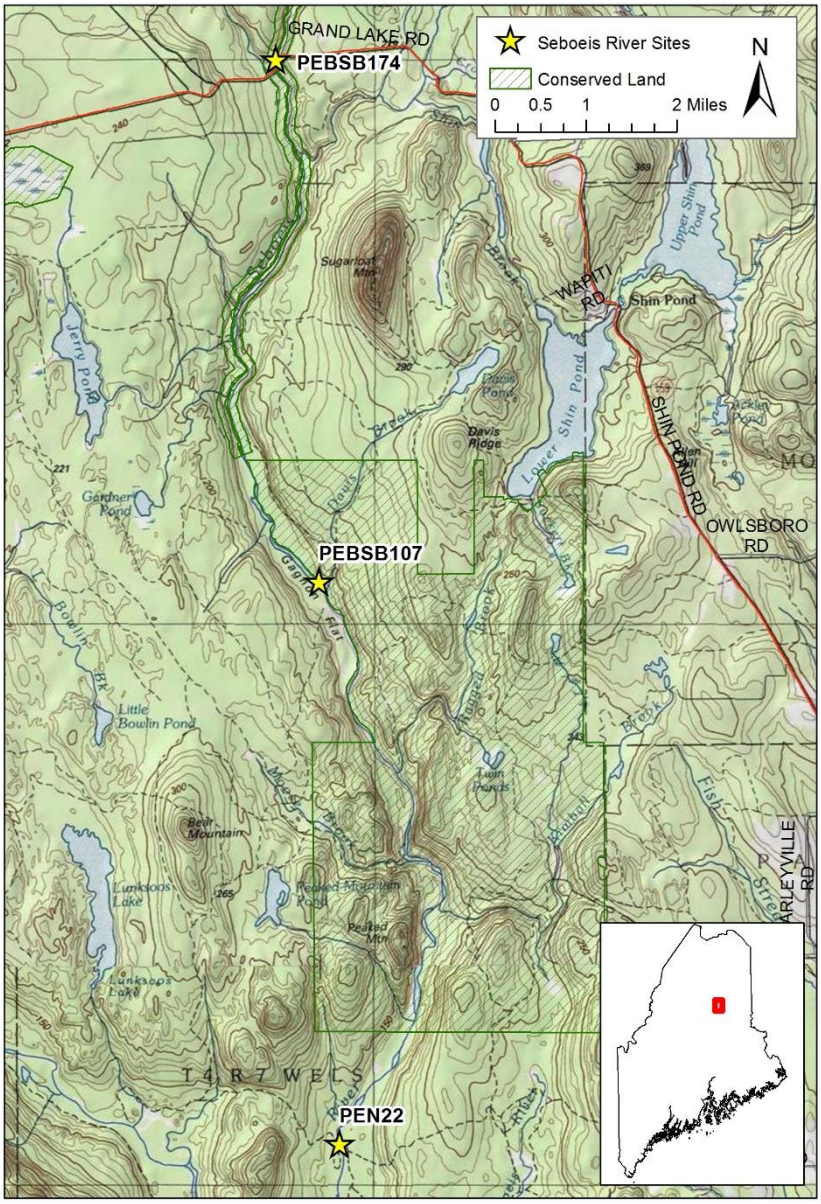

Figure 1. Map of the three study sites on Seboeis River. Sondes were deployed at the two upstream sites.

Macroinvertebrates

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

Weather

Northern and Eastern Maine experienced a cold, record-setting wet spring, following a winter with deep and persistent snow pack (NOAA 2019a). The summer had above average temperatures and precipitation (NOAA 2019b).

pH

Seboeis River water quality stayed above the minimum state water quality criterion for the protection of aquatic life, pH 6.0, for the study duration (Fig. 2; 38 MRS Section 464.4.A.5). Mean pH was 7.43 ± 0.23 across all Seboeis River sites, and the pH was on average 0.2 units higher upstream compared to downstream. The minimum pH value observed was 1.5 units above the stress threshold of 5.4, above which no adverse impacts to salmon are expected (Haines et al. 1990; Stanley and Trial 1995). The mean diel range in pH was 0.5 units, with the largest fluctuations (up to 1 unit) occurring at the upstream site. Rain events did not have a significant impact on pH. In comparison, summer base flow pH in the West Branch Sheepscot River was on average 7.6 ± 0.4, similar to the 7.1 ± 0.2 observed in 2017 in the East Branch Penobscot River

(Zimmermann 2018b), and much higher than the 6.33 ± 0.33 observed in Wassataquoik Stream in 2019 (Zimmermann 2019). No negative impacts to salmon are expected from pH in Seboeis River.

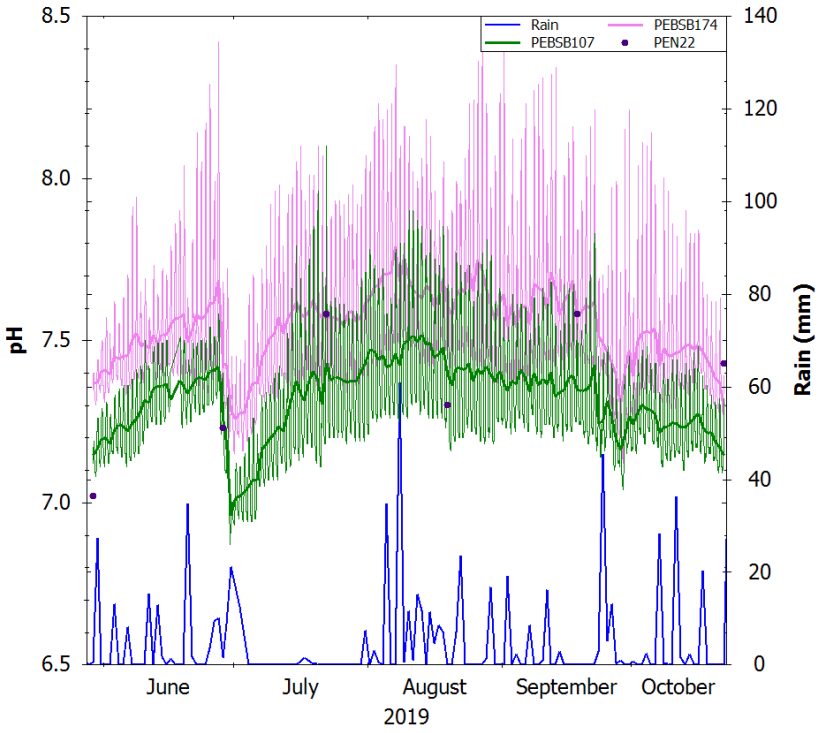

Figure 2. Continuous pH and local rainfall. Rainfall data from Weather Underground station KMESILVE1.

Stream Temperature

Temperature was similar at all Seboeis River study sites, remaining above the threshold for optimal growth of 20°C for 30% of the study duration (Fig. 3; USEPA 1986). The stress threshold of 22.5°C, when salmon stop feeding, was exceeded only 14% of the time (Elliott and Hurley 1997; Stanley and Trial 1995). Stream temperatures were warmer in 2019 compared with prior observations 2006-2018 in nearby systems (East Branch Penobscot, Wassataquoik Stream) and at other sites in Seboeis River, where temperatures exceeded 22.5°C around 11% of the time (MDEP 2020; SHEDS 2019; Zimmermann 2018b; Zimmermann 2019). The maximum temperature for salmon survival of 27°C was exceeded for <0.1% of the study duration, mostly at site PEBSB107 (Fig. 1), with average duration of 2.7 hours and a maximum exceedance of almost 16 hours. Thermal stress is likely during the warmest months (July to August), when temperatures

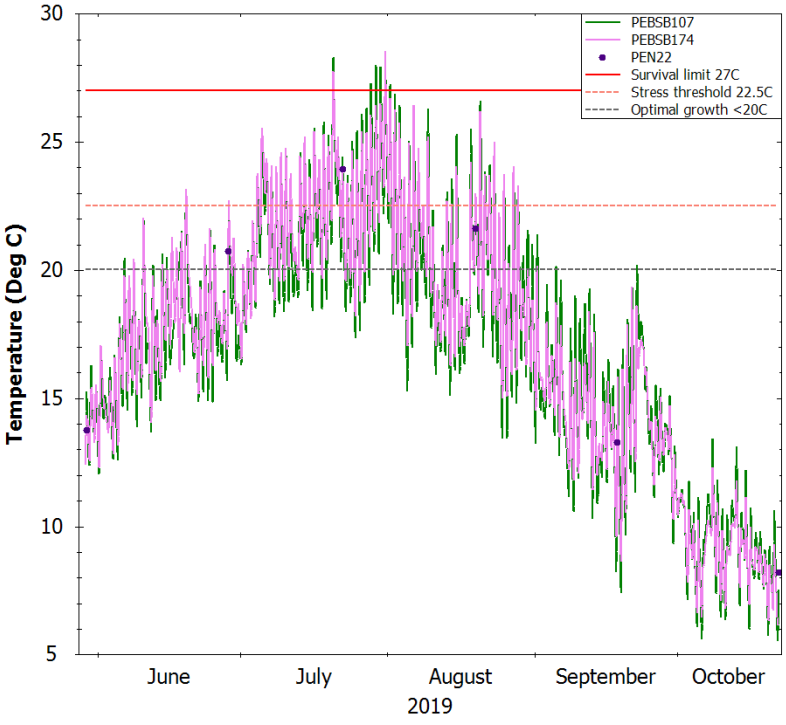

Figure 3. Continuous temperature, May through October.

remained above 22.5°C for 10 hours on average, with a maximum duration of 2.6 days at the upstream site (PEBSB174) and 1.3 days at the downstream sonde site (PEBSB107), similar to observations in the East Branch Penobscot River in 2017 (Zimmermann 2018b). Mean diel fluctuations were 4.15 ± 1.75°C, which may provide daily thermal refugia for salmon. In addition, minor tributaries in the study reach could act as cold water refugia for small numbers of fish. In comparison, exceedances above 22.5°C lasted on average 3 hours shorter in the West Branch Sheepscot River, with similar diel fluctuations (6.1 ± 2.1°C; MDEP 2020). In both Seboeis River and the West Branch Sheepscot River, high temperatures are likely to cause some sublethal stress and reduced growth in salmon during the warmest months of July and August, however nightly temperature refugia may help mitigate the impacts.

Dissolved Oxygen (DO)

DO levels were within a healthy range for fish and aquatic life and remained 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 9.7 ± 1.1 mg/L across all Seboeis River sites, reaching a minimum of 7.3 mg/L, which was slightly higher than observations in the West Branch Sheepscot River, and similar to the East Branch Penobscot River and Wassataquoik Stream (MDEP 2020; Zimmermann 2018b). No adverse impacts due to DO are expected.

Specific Conductance

Specific conductance was very similar at all Seboeis River study sites, with an overall mean of 49 ± 8 µS/cm, which is twice as high as observations in Wassataquoik Stream and the East Branch Penobscot (Zimmermann 2018b; Zimmermann 2019). Specific conductance in the West Branch Sheepscot River is twice as high as in Seboeis River (101 ± 2 µS/cm), likely due to the numerous road crossings and human disturbance in the watershed (MDEP 2020). No adverse impacts due to specific conductance are expected.

Acid Neutralization Capacity (ANC)

ANC was higher by about 41 µeq/L at the upstream Seboeis River site (429.43 ± 85.8 µeq/L, 21.4 mg/L alkalinity) compared with the two downstream Seboeis River sites (388.0 ± 65.0 µeq/L, 19.4 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. Alkalinity values were very close to EPA's recommended ambient water quality criteria (AWQC) of 20 mg/L; USEPA 1986). Based on ANC values, Seboeis River has a strong buffering capacity, that decreases slightly from upstream to downstream.

Calcium

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 all Seboeis River sites, calcium levels (6.6 ± 1.0 mg/L) were above both the suggested threshold of 4 mg/L to prevent deformities (M. Whiting pers. comm.) and the survival threshold for salmon of 2 mg/L (Baker et al. 1990; Baldigo and Murdoch 2007). No calcium data have been collected in the West Branch Sheepscot River. In comparison, both Wassataquoik Stream and East Branch

Penobscot River had much lower calcium values, near or below the stress thresholds (1.9 and 3.7 mg/L, respectively; Zimmermann 2018b; Zimmermann 2019). In Seboeis River, calcium is available to buffer against exchangeable aluminum as necessary.

Aluminum

Total aluminum was variable, averaging 34.0 ± 21.5 µg/L across all Seboeis River sites, with values slightly higher upstream. 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 (CMC), which ranged from 1400-2000 µg/L depending on DOC, total hardness, and pH at each sample site (USEPA 2018). The solubility (and therefore toxicity) of aluminum increases as pH becomes more acidic or basic (beyond pH 6-8; USEPA 2018). Seboeis River pH infrequently exceeded this range, indicating that aluminum solubility is low. Aluminum 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 all sites (2 ± 1 µg//L), representing approximately 5% of the aluminum species present, lower than both Wassataquoik Stream (12%) and East Branch Penobscot (26%; Zimmermann 2018b, 2019). 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 never exceeded in Seboeis River, and pH remained well above 6, suggesting no risk of sublethal stress due to Alx.

Dissolved Organic Carbon (DOC)

DOC has been shown to be a strong determinant of fish mortality (for brook trout, Baldigo and Murdoch 2007) due to its buffering capacity 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 7.1 ± 1.7 mg/L averaged across all Seboeis River sites, with the furthest downstream site having lowest DOC (6.5 ± 2.1 mg/L). The DOC in Seboeis River was similar to the West Branch Sheepscot River and East Branch Penobscot River (MDEP 2020; Zimmermann 2018b). In comparison, the clear waters of Wassataquoik Stream had half the DOC value of these other rivers (3.2 ± 0.6 mg/L; Zimmermann 2019). 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). Some buffering capacity is available in Seboeis River, however aluminum levels suggest there is currently no buffering need.

Nutrients

Biologically available nitrogen (nitrate + nitrite) was below the detection limit of 0.025 mg/L at the downstream Seboeis River site. Mean biologically available nitrogen for the remaining two Seboeis River sites combined was 0.047 ± 0.013 mg/L, TKN was 0.39 ± 0.040 mg/L, and total phosphorus was 6.33 ± 1.53 µg/L. Nitrogen values were twice as high as

observations in Wassataquoik Stream, an oligotrophic system (Zimmermann 2019). Biologically available nitrogen levels in the West Branch Sheepscot River were twice as high as in Seboeis River, and phosphorus was more than three times as high, likely due to land use patterns including more development and agriculture (MDEP 2020). Nutrients in Seboeis River were typical of natural, undisturbed streams in Maine.

Macroinvertebrates

The water quality of Seboeis River 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 comparable with other Class A waterbodies in the state (169) and generic richness was 49. EPT taxa (mayflies, stoneflies, and caddisflies) represented 38% of the community. The dominant taxa were mayflies (*Tricorythodes* and *Maccaffertium*), a midge (*Microtendipes*), and a snail (*Amnicola*), however all four only represented 37% of the community. This is quite different from the dominant (41%) filter-feeding caddisflies observed in Wassataquoik Stream in 2018, but the lack of one really dominant taxon in 2019 is indicative of a more balanced community, as evidenced by the high Shannon-Wiener diversity index (4.72 compared with 3.76 in Wassataquoik Stream). The macroinvertebrate assemblage contains a good variety of sensitive taxa and is typical of clear, oligotrophic-mesotrphic, large river systems. The overall abundance in Seboeis River is similar to observations in the West Branch Sheepscot River, despite higher nitrogen values in the Sheepscot Watershed (MDEP 2020). 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). Macroinvertebrates are not likely a limiting factor in salmon productivity in Seboeis River.

Conclusion

The water quality in Seboeis River was good for salmon growth and development and was comparable to the two other nearby systems studied recently (Wassataquoik Stream in 2018 and upper East Branch Penobscot River in 2017). Watersheds range in size from Wassataquoik Stream (~300 km^2) to the upper East Branch Penobscot River (~1500 km^2). Bedrock is predominantly marine sandstone and slate with volcanics, except for the Wassataquoik Stream watershed which is predominantly granite. There were differences in rainfall (and therefore flow) between the three study years, with 2018 being the driest year (~500 mm of rain) and 2019 the wettest year (~700 mm of rain). Despite these differences, all three river systems have similar water quality. All experience episodic pH depressions, but these are often of short duration and likely do not have a significant impact on salmon growth due to the overall high pH and the buffering capacity (based on ANC and calcium). Wassataquoik Stream has the lowest buffering capacity and pH values almost one unit lower than the other two study systems, suggesting that sub-lethal stress may occur at times. In all three systems, high summer water temperatures 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 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. The highest summer temperatures were observed in Seboeis River, despite the colder, wetter weather in 2019. Dissolved oxygen levels are good in all systems, and exchangeable aluminum concentrations are low. Nitrogen and phosphorus levels are typical of natural, undisturbed Maine streams (no data were collected in the Upper East

Branch Penobscot River). Wassataquoik Stream has the lowest nutrient values, however the highest macroinvertebrate abundance of the three systems, indicating nutrients are not a limiting factor. In the West Branch Sheepscot River, temperatures are warmer than the three Penobscot study systems, and nutrient levels are similar to Seboeis River. In the study watersheds, nutrients do not appear to be limiting macroinvertebrate abundances. Water temperature may be the most stressful aspect of water quality for salmon growth

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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-737**
Waterbody: Seboeis River - Station 737
Town: T06 R07 Wels
Directions: UPSTREAM OF GRAND LAKE RD, ~45M UPSTREAM OF SAWTELLE BROOK

River Basin: Penobscot
HUC8 Name: East Branch Penobscot
Latitude: 46 8 39.04 N
Longitude: 68 38 1.89 W
Stream Order: 3

Sample Information

Log Number: **2765** Type of Sample: ROCK BAG Date Deployed: 7/22/2019
Subsample Factor: X1 Replicates: 3 Date Retrieved: 8/19/2019

Classification Attainment

Statutory Class: **AA** **Final Determination:** **A** Date: 1/9/2020
Model Result with P≥0.6: A **Reason for Determination:** **Model**
Date Last Calculated: 1/2/2020 Comments:

Model Probabilities

First Stage Model			
Class A	0.88	Class C	0.00
Class B	0.12	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	169.33
02 Generic Richness	49.00
03 Plecoptera Mean Abundance	8.33
04 Ephemeroptera Mean Abundance	64.67
05 Shannon-Wiener Generic Diversity	4.72
06 Hilsenhoff Biotic Index	3.97
07 Relative Abundance - Chironomidae	0.20
08 Relative Generic Richness Diptera	0.27
09 *Hydropsyche* Abundance	0.00
11 *Cheumatopsyche* Abundance	0.00
12 EPT Generic Richness/ Diptera Generic Richness	1.85
13 Relative Abundance - Oligochaeta	0.00
15 Perlidae Mean Abundance (Family Functional Group)	8.00
16 Tanypodinae Mean Abundance (Family Functional Group)	2.04
17 Chironomini Abundance (Family Functional Group)	21.25
18 Relative Abundance Ephemeroptera	0.38
19 EPT Generic Richness	24.00
21 Sum of Abundances: *Dicrotendipes, Micropsectra, Parachironomus, Helobdella*	0.00
23 Relative Generic Richness- Plecoptera	0.04
25 Sum of Abundances: *Cheumatopsyche, Cricotopus, Tanytarsus, Ablabesmyia*	6.95
26 Sum of Abundances: *Acroneuria, Maccaffertium, Stenonema*	21.51
28 EP Generic Richness/14	1.14
30 Presence of Class A Indicator Taxa/7	0.29

Five Most Dominant Taxa

Rank	Taxon Name	Percent
1	*Tricorythodes*	11.81
2	*Microtendipes*	9.66
3	*Maccaffertium*	7.98
4	*Amnicola*	7.68
5	*Acroneuria*	4.72
6	*Acerpenna*	4.72

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

Station Number: S-737 Town: T06 R07 Wels Date Deployed: 7/22/2019
Log Number: 2765 Waterbody: Seboeis River - Station 737 Date Retrieved: 8/19/2019

Sample Collection and Processing Information

Sampling Organization: BIOMONITORING UNIT

Taxonomist: MICHAEL COLE

Waterbody Information - Deployment			Waterbody Information - Retrieval		
Temperature:	21.9	deg C	Temperature:	20.29	deg C
Dissolved Oxygen:	8.89	mg/l	Dissolved Oxygen:	8.72	mg/l
Dissolved Oxygen Saturation:	101.4	%	Dissolved Oxygen Saturation:	97.1	%
Specific Conductance:	46	uS/cm	Specific Conductance:	59.1	uS/cm
Velocity:			Velocity:	1.5	cm/s
pH:	7.65		pH:	7.47	
Wetted Width:	29	m	Wetted Width:	25	m
Bankfull Width:	32	m	Bankfull Width:	32	m
Depth:	51	cm	Depth:	44	cm

Water Chemistry

Summary of Habitat Characteristics

Landuse Name	Canopy Cover	Terrain
Upland Conifer	Open	Hilly
Upland Hardwood		

Potential Stressor	Location	Substrate	
	Above Road Crossing	Boulder	5 %
		Gravel	15 %
		Rubble/Cobble	80 %

Landcover Summary - 2004 Data

Total Area (ac)	44356	High Int. Dev. %	0.0	Water %	8.9	Non-vegetated %	0.1
		Med Int. Dev. %	0.0	Wetland %	9.4	Tilled Agriculture %	0.0
		Low Int. Dev. %	0.6	Upland Woody %	80.9	Grassland %	0.0
		Development %	0.6	Natural %	90.4	Human Altered %	0.7
						Impervious %	0.0
Total Land (ac)	40394	High Int. Dev. %	0.0	Water %	N/A	Non-vegetated %	N/A
		Med Int. Dev. %	0.0	Wetland %	10.4	Tilled Agriculture %	0.0
		Low Int. Dev. %	0.6	Upland Woody %	88.8	Grassland %	0.0
		Development %	0.6	Natural %	99.2	Human Altered %	0.8
						Impervious %	0.0

Sample Comments

CREEK CHUBS PRESENT AT SHORELINE. SPARSE AQUATIC VEGETATION DISPERSED BETWEEN COBBLE & BOULDERS.

Station Number: S-737 Waterbody: Seboeis River - Station 737 Town: T06 R07 Wels

Log Number: 2765 Subsample Factor: X1 Replicates: 3 Calculated: 1/2/2020

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		0.33	0	SH		0.2
Pteronarcys biloba	09020205023061	0.33			--	0.2	
Acroneuria	09020209042		8.00	0	PR		4.7
Acroneuria lycorias	09020209042125	8.00			--	4.7	
Boyeria	09020301004		4.67	2	PR		2.8
Boyeria grafiana	09020301004011	4.33			--	2.6	
Boyeria vinosa	09020301004012	0.33			--	0.2	
Gomphidae	09020302	1.67	1.67		--	1.0	1.0
Calopteryx	09020307043	0.67	0.67	5	PR	0.4	0.4
Argia	09020309048	0.33	0.33	7	PR	0.2	0.2
Baetis	09020401001		0.33	4	CG		0.2
Baetis flavistriga	09020401001004	0.33			--	0.2	
Acerpenna	09020401007		8.00	5	CG		4.7
Acerpenna macdunnoughi	09020401007001	1.00			--	0.6	
Acerpenna pygmaea	09020401007011	7.00			--	4.1	
Labiobaetis	09020401009	0.33	0.33		--	0.2	0.2
Procloeon	09020401010	1.67	1.67		CG	1.0	1.0
Plauditus	09020401012	0.33	0.33		CG	0.2	0.2
Iswaeon	09020401015		0.67		--		0.4
Iswaeon anoka	09020401015001	0.67			--	0.4	
Anafroptilum (Centroptilum)	09020401016	1.67	1.67	2	CG	1.0	1.0
Neocloeon (Centroptilum)	09020401017	0.67	0.67	2	CG	0.4	0.4
Heptageniidae	09020402	0.33			--	0.2	
Leucrocuta	09020402011	7.00	7.09	1	SC	4.1	4.2
Stenacron	09020402014	4.67	4.73	7	SC	2.8	2.8
Maccaffertium	09020402015	4.33	13.51	4	SC	2.6	8.0
Maccaffertium vicarium	09020402015055	9.00			--	5.3	
Paraleptophlebia	09020406026	5.33	5.33	1	CG	3.1	3.1
Ephemerella	09020410035	0.33	0.33	1	CG	0.2	0.2
Tricorythodes	09020411038	20.00	20.00	4	CG	11.8	11.8
Polycentropodidae	09020603	0.67	0.67		--	0.4	0.4
Neureclipsis	09020603008	7.67	7.67	7	CF	4.5	4.5
Hydroptilidae	09020607				--		
Oxyethira	09020607028			3	P		
Brachycentrus	09020609043		2.67	0	CF		1.6
Brachycentrus appalachia	09020609043096	2.67			--	1.6	
Pycnopsyche	09020610049	1.33	1.33	4	SH	0.8	0.8

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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
Lepidostoma	09020611064	7.33	7.33	1	SH	4.3	4.3
Helicopsyche	09020616070		4.33	3	SC		2.6
Helicopsyche borealis	09020616070137	4.33			--	2.6	
Mystacides	09020618075		1.00	4	CG		0.6
Mystacides sepulchralis	09020618075147	1.00			--	0.6	
Oecetis	09020618078	0.33	0.67	8	PR	0.2	0.4
Oecetis avara	09020618078153	0.33			--	0.2	
Chironomidae	09021011	6.33			--	3.7	
Ablabesmyia	09021011001	1.33	1.63	8	PR	0.8	1.0
Thienemannimyia	09021011020		0.41	3	PR		0.2
Thienemannimyia group	09021011020041	0.33			--	0.2	
Cricotopus	09021011037	2.67	4.50	7	SH	1.6	2.7
Cricotopus bicinctus	09021011037057	1.00			--	0.6	
Nanocladius	09021011049	3.00	3.68	3	CG	1.8	2.2
Tvetenia	09021011065		0.82	5	CG		0.5
Tvetenia vitracies	09021011065113	0.67			--	0.4	
Stempellinella	09021011074	1.00	1.23	2	--	0.6	0.7
Tanytarsus	09021011076	0.67	0.82	6	CF	0.4	0.5
Pseudochironomus	09021011078	0.33	0.41	5	CG	0.2	0.2
Lauterborniella	09021011092		0.41		CG		0.2
Lauterborniella agrayloides	09021011092001	0.33			--	0.2	
Microtendipes	09021011094		16.35	6	CF		9.7
Microtendipes rydalensis group	09021011094168	13.33			--	7.9	
Phaenopsectra	09021011101	0.67	0.82	7	SC	0.4	0.5
Polypedilum	09021011102		3.27	6	SH		1.9
Polypedilum aviceps	09021011102181	2.33			--	1.4	
Polypedilum flavum	09021011102182	0.33			--	0.2	
Atherix	09021015055	0.33	0.33	2	PR	0.2	0.2
Psephenus	09021108058		4.00	4	SC		2.4
Psephenus herricki	09021108058028	4.00			--	2.4	
Dubiraphia	09021113064	4.67	4.67	6	--	2.8	2.8
Macronychus	09021113065		0.33	4	--		0.2
Macronychus glabratus	09021113065040	0.33			--	0.2	
Promoresia	09021113069		1.67		--		1.0
Promoresia elegans	09021113069051	1.67			--	1.0	
Stenelmis	09021113070	1.33	1.33	5	SC	0.8	0.8
Amnicola	10010104013	13.00	13.00		SC	7.7	7.7

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Taxon	Maine Taxonomic Code	Count (Mean of Samplers)		Hilsenhoff Biotic Index	Functional Feeding Group	Relative Abundance %	
		Actual	Adjusted			Actual	Adjusted
Physa	10010202027	3.33	3.33		SC	2.0	2.0
Gyraulus	10010203029	0.33	0.33		SC	0.2	0.2