Portland Water District
Sebago Lake Watershed Monitoring Programs
Tributary Biological Monitoring

Presenting results from 1989 to 2014

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Introduction;

Sebago Lake is the primary drinking water supply for nearly 200,000 people in 11 Greater Portland communities. Lake water was first delivered to Portland in 1869, from an intake located in the southernmost part of the lake, referred to as Lower Bay. In 1908, the Portland Water District was chartered by the Maine Legislature to provide water services to the cities of Portland and South Portland. The water system has gradually expanded to include 11 cities and town in Greater Portland. Since its inception, the District has actively monitoring and working to protect Sebago Lake.

In 1993, the District was granted a waiver to the filtration requirements of the federal Safe Drinking Water Act (SDWA) based in part on the purity of the water and the effectiveness of watershed protection efforts. This waiver agreement requires ongoing monitoring of lake water quality. The District maintains more than 10 monitoring and surveillance programs throughout the watershed and lake. In general, as one moves closer to the intakes, more samples are collected and tested for more parameters.

This report summarizes results of the Tributary Biological Monitoring program.

Methods

The Portland Water District utilizes the sampling methods outlined in the Maine Department of Environmental Protection's manual *Methods for Biological Sampling and Analysis of Maine's Streams and Rivers*. Rock filled substrate bags are placed in the tributary streams during low flow late summer conditions. Site locations are chosen with the following attributes; representative habitat of the stream, riffle/run stream section, substrate must be submerged the entire sampling period, while avoiding; Atypical influences such as bridges or culverts, bank effects (sample middle 50% of stream) and avoiding backwater eddies. Rock bags are submerged in streams for 28 days. Insects and detritus material are collected and preserved with 70% ethanol and stored in air tight containers and refrigerated for later sorting. Insects are sorted from detritus, preserved in 70% ethanol and shipped to a professional aquatic taxonomist for species identification.

Results and Discussion

Because stream conditions change rapidly and depend on numerous factors (rainfall amounts, storm water runoff, active construction projects etc...) it can be difficult to assess stream health based on intermittent sampling of traditional water quality parameters. However, by sampling the biological community of insects, one can asses stream conditions over the entire water dependent portion of their life cycle. Insects have specific adaptations and pollution tolerance thresholds of the streams they inhabit. If sensitive organisms are found, one can be reasonably sure that the stream is healthy. If these sensitive organisms are absent and only pollution tolerant organisms are found, one can be sure that the stream is being negatively impacted.

The Maine DEP has developed a tiered aquatic life standard to quantify biological community and ultimately watershed health. Live specimens are collected; each individual insect is counted and identified to species. These data are entered into a complex statistical model to produce a "water quality class." This class (or score) represents how well the biological community compares to biological communities in natural watersheds. The scores from the statistical model (from natural to polluted) are Class A, Class B, Class, C and non attainment (N/A). Class A probabilities greater than 0.6 are given a class A final determination. However, DEP can use best professional judgment based on factors not considered by the model.

The PWD has sampled the Crooked River at various locations, the Muddy River and the Northwest River since 2001. The Maine DEP sampled the Crooked River at Edes Falls in 1989 and Rt. 118 in 1991.

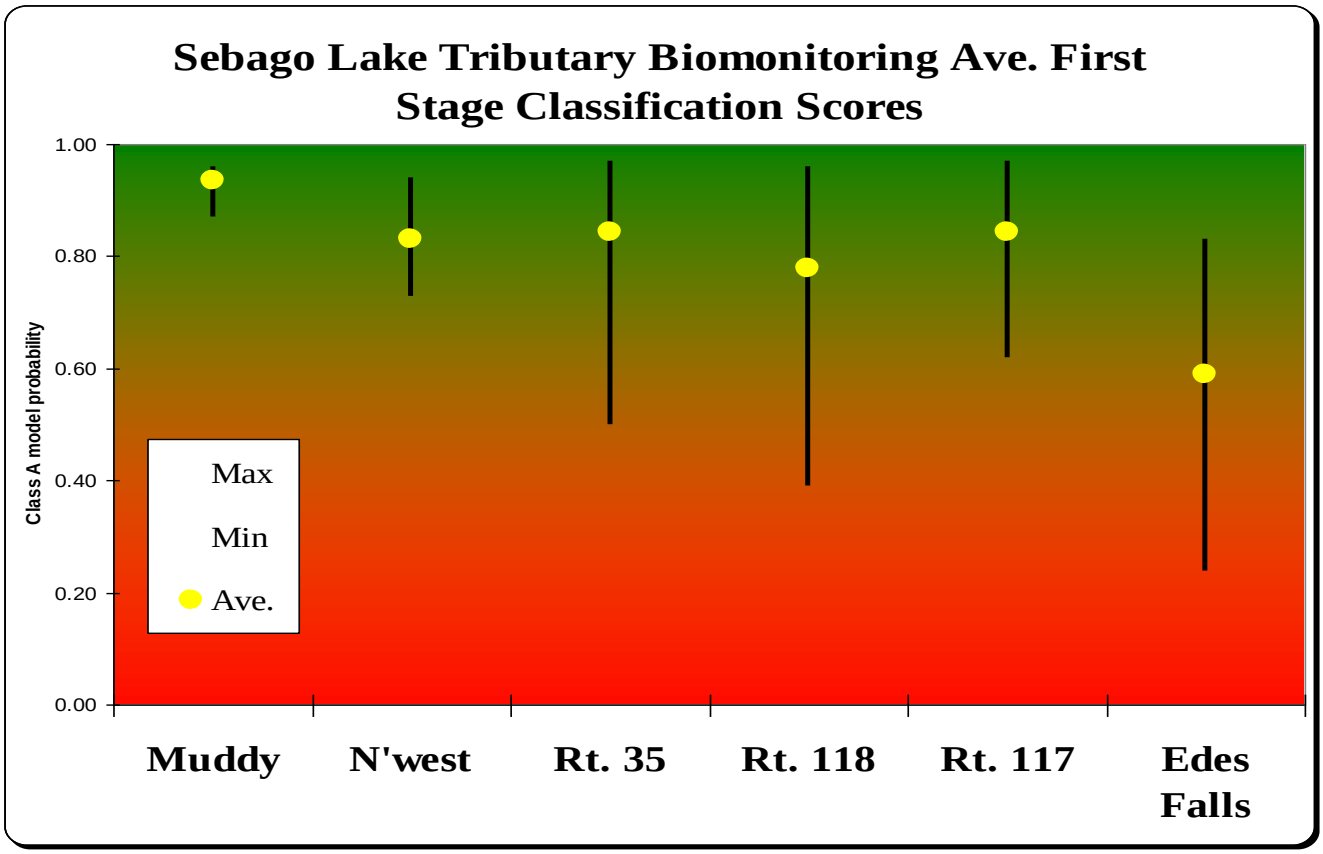
Results from the Muddy River and the Northwest River have shown a high diversity of insects with relatively low abundance of individuals. Average Class A probabilities have been > 80%. This indicates very healthy watershed conditions.

Class A Example from Muddy River 2001
Sample shows a biologically diverse assemblage of insects with a variety of functional feeding groups. Class A indicator species (stoneflies, caddisflies & mayflies) dominate with low total abundance. Class A probability score 1.00.

Results from the Crooked River have show an increase in abundance and a decrease in diversity from the northern to southern portion of the watershed. Average Class A probabilities are 0.81 at Rt. 35 (the most northern portion of the watershed) to 0.59 at Edes falls (the most southern portion of the watershed). This indicates nutrient enrichment in the system as the river nears Sebago Lake.

Enrichment is an excess of nutrients (generally phosphorous or nitrogen) that causes an increase in the abundance and a loss of diversity in the insect community. Enrichment often sounds like an improvement, but is actually a sign of pollution.

Class B Example from Edes Falls 2005
Sample shows enriched conditions with low biological diversity and a dominance of filter feeders. Class B indicator species (Midges) dominate with high total abundance. Class A probability score 0.38.



Min, max, mean of all data collected in the Sebago Lake Watershed.

Crooked River

Edes Falls:

Edes falls	Abundance	First Stage model	Final determination
1989	1017	0.35	A
2001	568	0.72	A
2003	976	0.43	A
2004	477	0.78	A
2005	1408	0.24	B
2006	512	0.75	A
2007	669	0.68	A
2008	359	0.83	A
2009	857	0.53	A
2010	2080	0.56	A
2011	618	0.67	A
2012	307	0.77	A
2013	262	0.80	A
2014	496	0.80	A

Twin Bridges:

Rt. 117	Abundance	First Stage model	Final determination
2003	488	0.62	A
2004	172	0.81	A
2005	137	0.84	A
2006	492	0.97	A
2007	553	0.86	A
2008	113	0.90	A
2009	170	0.91	A
2010	491	0.67	A
2011	242	0.82	A
2012	102	0.96	A
2013	310	0.88	A
2014	174	0.74	A

Waterford (Rt 118):

Rt. 118	Abundance	First Stage model	Final determination
1991	401	0.77	A
2004	186	0.96	A
2005	125	0.86	A
2006	741	0.88	A
2007	761	0.79	A
2008	300	0.80	A
2009	679	0.39	A
2010	719	0.62	A
2011	274	0.85	A
2012	184	0.84	A
2013	265	0.82	A
2014	365	0.73	A

Rt. 35:

Rt. 35	Abundance	First Stage model	Final determination
2003	129	0.90	A
2004	137	0.95	A
2005	253	0.87	A
2006	392	0.90	A
2007	290	0.97	A
2008	414	0.82	A
2009	994	0.50	A
2010	545	0.65	A
2011	376	0.74	A
2012	185	0.95	A
2013	177	0.74	A
2014	190	0.56	A

Muddy River

Muddy	Abundance	First Stage model	Final determination
2001	70	0.95	A
2004	87	0.96	A
2005	112	0.89	A
2006	196	0.96	A
2007	103	0.96	A
2008	58	0.95	A
2009	190	0.87	A
2010	62	0.90	A
2011	109	0.92	A
2012	49	0.94	A
2013	151	0.73	A
2014	49	0.97	A

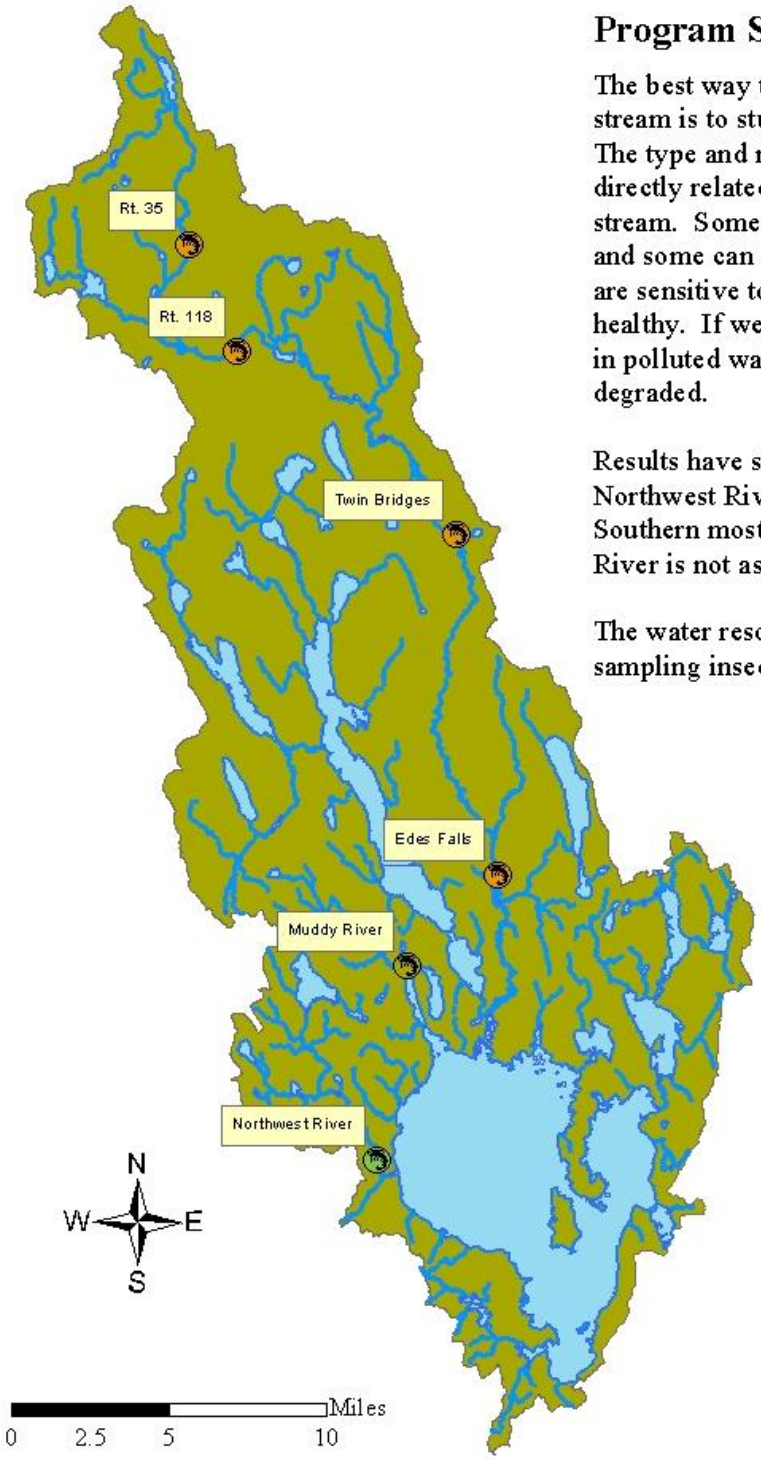
Northwest

Northwest	Abundance	First Stage model	Final determination
2001	81	0.86	A
2004	305	0.73	A
2005	299	0.77	A
2006	158	0.94	A
2007	133	0.93	A
2008	178	0.75	A
2009	200	0.83	A
2010	41	0.91	A
2011	140	0.80	A
2012	124	0.84	A
2013	372	0.63	A
2014	175	0.77	A

Conclusion

The Muddy River and Northwest River watersheds show no signs of degradation as reflected in the biological community of aquatic insects. The species and the number of individuals match the model for an unimpaired watershed. These sites have excellent water quality. However, some locations on the Crooked River are showing signs of nutrient enrichment due to the type and the total number of species found. This enrichment tends to increase from north to south along the river. The relatively numerous individual insects with filter feeding strategies found in the Crooked River are less desirable than relatively few predatory feeding insects as found in the Muddy River and the Northwest River. All sample sites have been rated Class A, except Edes falls on the Crooked River was rated Class B in 2005.

Sebago Lake Watershed Biological Monitoring Program



Program Summary

The best way to measure the health of a stream is to study the bugs that live there. The type and number of insects found are directly related to the water quality of the stream. Some bugs can tolerate pollution and some can not. If we find insects that are sensitive to pollution, the stream is healthy. If we only find bugs that can live in polluted water, then the stream is degraded.

Results have shown the Muddy River and Northwest River are very healthy. The Southern most portion of the Crooked River is not as healthy as the Northern part.

The water resource specialists will begin sampling insects in late August.