Year 2000 Progress Report for DEP Water Quality Monitoring Plan

Maine Atlantic Salmon Rivers

Project Objectives:

The DEP has established a water quality monitoring program to see if salmon reproduction or productivity is limited by natural or man-made water quality conditions found in the salmon rivers. Another goal is to establish a water quality baseline, so that environmental trends can be monitored. This project completed its second year in 2000. This is a collaborative effort that involves DEP, the watershed councils, and the University of Maine's George Mitchell Center for Environmental and Watershed Research (formerly the Water Resources Institute). The water quality parameters that are monitored include pH, alkalinity, temperature, conductivity, major nutrients, turbidity and total suspended solids. The presence or absence of insect indicators is also recorded to see if pesticides or non-point source pollutants have impacted aquatic communities. The Pleasant and Narraguagus Rivers were monitored for pesticide residues.

Progress in Year 2000:

In June 2000, the DEP hired a full time biologist to coordinate the water quality research, train volunteers, and maintain the database. Volunteers from the watershed councils collected at least 2 summer baseflow water samples from sample sites on the Dennys, East Machias, Machias, Pleasant, Narraguagus, Ducktrap, and Sheepscot Rivers. The number of sample sites ranged from four (Dennys and Ducktrap Rivers) to eleven (Machias River). This was also the first year that water quality data have been collected from Cove Brook and Tunk Stream. Both Tunk Stream and Cove Brook now have incipient watershed councils with trained water quality volunteers. Three summer baseflow samples were collected in Tunk Stream at four sample sites. Field data (pH, temperature, and dissolved oxygen) were collected from Cove Brook twice this fall. Cove Brook also has four sample sites.

The Year 2000 field season was also the first time that the Maine salmon rivers were sampled during storm events. Stormwater was collected from the Dennys, Pleasant, Narraguagus, Ducktrap, and Sheepscot Rivers, and from Tunk Stream. In addition to field measurements (water temperature, pH and dissolved oxygen), storm samples were analyzed for total suspended solids and turbidity. Summer dryness and sample protocol demands (at least an inch of rain) prevented stormwater sampling on the Machias and East Machias Rivers. Additional storm event samples were taken from the Pleasant and Narraguagus Rivers for pesticide analysis. The Board of Pesticides Control also conducted a study of pesticide contamination of surface and groundwater in the Pleasant and Narraguagus River watersheds.

Significant Findings:

Acid rain and suspended sediments have been identified as two pollutants that might effect salmon productivity. Results so far (see Tables 1-8) suggest that the eight salmon rivers have moderate pH (range 6-7), healthy alkalinity (ANC range 37-874 ueq/L), and no evidence of chronic acidification or other obvious kinds of pollution. While all of the rivers have some agriculture, forestry, road construction and other activities that might contribute to sediment erosion, none of the stormwater samples taken to date indicate a significant amount of sediment transport (total suspended solids ranged from 0-19 mg/L). The issue of sediment transport will be re-examined in the spring of 2001.

The baseflow chemistry for sample years 1999 and 2000 is very similar. The summer of 1999 was fairly dry (i.e., a "moderate drought" based on the Palmer Drought Index, see on-line NOAA weather summaries for Maine), while the summer of 2000 was cool and wet ("wetter than average"). While the data base (Tables 1-8) still do not have about half of the Year 2000 data, the available data suggest that there was a slight dilution of the baseflow chemistry compared to drought years. Preliminary analysis also shows that the baseflow chemistries for some tributaries are very different compared to the river mainstem. For instance, the West Branch of the Narraguagus is more acidic and more humic than the main stem. Aluminum levels are also higher. Rocky Brook, a tributary of the East Machias, is the most acidic of any of our sample sites and has the highest aluminum. Trout Brook on the Sheepscot is more acidic than the main stem, and is more similar to the downeast rivers than it is like the rest of the Sheepscot.

Some of the downeast rivers have a significant amount of aluminum (dissolved aluminum ranged 12-287 ug/L). The highest aluminum values tend to be found in the smaller tributaries, especially those draining boggy areas. Aluminum is found in freshwater in many different forms. Some forms of aluminum are known to be toxic to a wide range of plant and animal species, including salmon. Aluminum may be washed out of forest soils due to natural processes or due to acid rain. At the observed pH ranges in the salmon rivers, aluminum is not thought to be a significant problem for fish health. However, acidic episodes in the Downeast rivers have been documented by other studies. These rivers are most sensitive to acid rain during large storm events or spring melt periods when river chemistry is dominated by precipitation. Brief acidic episodes may lead to conditions where aluminum could be converted to toxic forms.

Stormwater samples from the Pleasant and Narraguagus Rivers were analyzed for a suite of pesticides that are used in the culture of blueberries. These pesticides are Captan, Chorothalonil, Propiconazole, Diuron, Hexazinone/ Hexazinone metabolite B, Terbacil, Azinphos-methyl. Phosmet, Diazinon, Malathion, and Methoxychlor. Only Hexazinone was detected and only in trace amounts (0.54-3.37 parts per billion (ppb)). The highest concentration was found in an irrigation pond that is surrounded by blueberry fields (Ethyl Smith Pond on a tributary to the Narraguagus). The EPA-Health Advisory Level for Hexazinone in drinking water is 400 ppb (EPA. Summer 2000).

So far, there is no clear indication in the insect data that shows that pesticides have effected

invertebrate communities (see Tables 1-8). Virtually all sites that have appropriate bottom substrate (gravel or cobble) have diverse invertebrate assemblages. A few exceptions (e.g., the Crooked River, a tributary of the Machias that drains some blueberry lands) sometimes lack stoneflies or mayflies in spite of having appropriate substrate. This is a topic for further analysis and future field effort.

Also in 2000, the Board of Pesticide Control, Maine Dept. of Agriculture, conducted an independent study of herbicide contamination of salmon rivers and groundwater. This study had two parts, a study of pesticides found in first order streams and springs in the Pleasant and Narraguagus Rivers, and a study of pesticide drift during application on blueberry fields. Tributaries of the Pleasant and Narraguagus Rivers were screened for the same suite of blueberry pesticides (see above). In a report issued in November 2000 (see Appendix 1), the BPC study found only Hexazinone in the Pleasant River (range Not Detected (ND)-1.4 ppb in tributaries and ND-3.08 ppb in springs). Because Hexazinone is water-soluble and is found in higher concentrations in springs, groundwater is thought to be an important source of Hexazinone contamination in surface water.

The same BPC report summarizes the drift studies. Hexazinone and Phosmet were found in tributaries of the Narraguagus (ranging ND-2.65 ppb and ND-0.52 ppb respectively) during pesticide application. The same pesticides were found in drift studies on the Pleasant (ranging ND- 0.97 ppb Hexazinone, and ND-0.10 ppb Phosmet). Drift targets on land detected as much as 21,978 nanograms (ng) /filter (less than 0.01 the application rate recommended for blueberries grown on sandy soils). In general, the greatest concentrations were found on the targets nearest the agricultural fields (within 300 ft). The results of the drift study indicate that pesticide drift is also a significant source of low level stream contamination.

The traces of the herbicide Hexazinone Narraguagus and Pleasant Rivers are well below concentrations that are known to be harmful to aquatic life. Since Phosmet is an organophosphate insecticide, its toxicity is greater. While it is relatively "non-toxic" to mammals and birds, Phosmet is highly toxic to fish and invertebrates. Acute poisoning is expected at 230 ppb for rainbow trout and 5.6 ppb for *Daphnia magna.* This latter concentration is more than 50 times greater than that detected in the Pleasant River. However, due to the sampling intervals (monthly or twice monthly), peak pesticide concentrations could be overlooked. Also, potential reservoirs of pesticides in sediments or in biological tissues may be more important than ambient levels in the water. New evidence from other parts of the country indicate that trace concentrations of some pesticides, or their '"inert ingredients"' that are used as fillers or spreaders, may cause disruption of fish endocrine systems. Thus, even trace amounts in water may be a significant concern. In 1999, the DEP funded a study at the U of Maine to look at potential estrogen disruption or estrogen mimics in blueberry pesticide formulations. The results of this study should be available in 2001.

Plans for Next Year:

To date, the analysis of the Year 2000 water quality samples has not been completed. Tables

1-8 show results for only about half of the samples that were collected this year. A review of the competed data will be necessary before a Year 2001 sample protocol and budget can be completed. However, given the partial analysis above, it is possible to conclude that some goals are close to being achieved while other issues clearly need more attention.
The characterization of the baseflow chemistry of the rivers is fairly complete. The rivers that were added to the sampling program in Year 2000 (Tunk Stream and Cove Brook) are the exception. Some baseflow sampling will be useful next year due to the expected year-to-year variations in weather.

The water quality monitoring program is just beginning to address the influence of storm water on aluminum chemistry and the influence of stormwater on sediment transport. These two issues will be further addressed in the 2001 field season. Aluminum will be fractionated into different components, especially the "exchangeable aluminum" that is most relevant to determining toxicity. Sediment loads are expected to be greater in the "wet seasons" compared to the summer field seasons.

On the advice of the Washington County Soil & Water Conservation District, we plan to make a special effort to study pesticide residues in Mopang Stream next year. Blueberry fields around Mopang are located in soils that are less sandy than those in the Narraguagus/Pleasant River watersheds. We plan to study pesticide residues in stormwater runoff from agricultural soils that are tighter than the Cherryfield/Deblois fields.

In cooperation with the Board of Pesticides Control we hope to conduct more drift studies in 2001. One possible goal will be to document the effectiveness of different forested buffers in minimizing surface water contamination. This might lead to the development of agriculture BMP's that would improve surface water protection during agricultural spraying. Another possible goal would be to use automatic samplers downstream of pesticide spray sites to decrease the sample interval and improve our ability to detect peak concentrations.

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