



Breaching of the Edwards Dam, July 1, 1999

The Kennebec River is the third largest river in Maine consolidating the flows from many large lakes in north-central Maine, then flowing south through agricultural areas and small towns and cities of the central part of the state to merge with the Androscoggin River at Merrymeeting Bay.

Introduction

Geography

The Kennebec River originates at Moosehead Lake flowing 145 miles to Merrymeeting Bay where it joins the Androscoggin River, then to the Atlantic Ocean at Phippsburg and Georgetown. The upper Kennebec flows from Moosehead Lake about 4 miles before reaching Indian Pond, the first of many impoundments. Flowing out of Indian Pond through Harris Dam, a major hydroelectric station, it passes through the Kennebec gorge then runs south draining into Wyman Lake, and through Wyman Dam, another large hydroelectric impoundment. From there it passes through urban and industrial areas of Madison, Skowhegan, Waterville-Winslow, and, with the

removal of the Edwards Dam in Augusta in July, 1999, the Kennebec head of tide now occurs between Augusta and Sidney. The river eventually empties into Merrymeeting Bay in Richmond. Six major tributaries enter the river: the Moose River is the major tributary of Moosehead Lake, Dead River, Sandy River, Sebasticook River, Messalonskee Stream and Cobbosseecontee Stream. The basin covers approximately 5,893 square miles with approximately 3,850 miles of rivers and streams.

Basin Summary Statistics	
Biomonitoring Activities in the Basin	Period of Record: 1983-1997 Waterbodies Sampled: 19 Established Stations: 55 Number of Sampling Events: 85
Wastewater Discharges	Six paper mills (two recently closed, three discharge waste through municipal treatment facilities), one tannery, two textile mills (both recently closed), eighteen municipal waste treatment facilities
Other Sources	Agricultural activity; urban non-point sources, combined sewer overflow (CSO's), eutrophic lakes, fish hatcheries, contamination from hazardous waste areas
Flow Regulation	31 dams . 21 FERC licensed hydro-projects.
Quality	Overall quality is good and improving

Drainage area	Average Annual Discharge
Kennebec Basin: 5,893 mi ²	At North Sidney 9,015 cfs
Sandy R. 516 mi ²	Sandy R. @ Mercer 976 cfs
Sebasticook R. 572 mi ²	Sebasticook R. @ Pittsfield 962 cfs

Overview of Biological Monitoring Activities

Considerable biomonitoring activity began in the Kennebec basin during the first years of the Biomonitoring Program and over half of all the stations in the basin were established in 1983. Basin-wide biological monitoring was last conducted in 1997. General water quality in the basin is good with 35 stations (64%) presently attaining their statutory classification and 6 stations (11%) have communities representative of standards higher than their statutory classification (Basin Table 4 p. 142; Basin Map 4, p. 164 and 165). Among these sites with higher classed communities are Wilson Stream in Wilton, West Branch

Sebasticook River at Pittsfield and the Kennebec River at Benton. These are all Class C segments, attaining Class B aquatic life standards, that might be considered for upgrade after review of other water quality data. The East Branch Sebasticook River at Corinna (Station 194) has a long history of water quality problems and, in 1997, attained Class C standards for only the second time since 1983, due to closure of a woolen mill (see Case Study 5). A number of smaller waterbodies sampled in 1997 for the first time including Cobbossee Stream in Gardiner, Mill Stream in Norridgewock, Cold Stream in Skowhegan and Outlet Stream in Vassalboro. Many other nonattainment waters are associated with hydroelectric impoundments such as the Kennebec River at Bingham below Wyman Dam (Station 165), Kennebec River at Norridgewock above the Weston Dam (Station 174), and the Kennebec River at Augusta above the former Edwards Dam (Station 29). See the special discussion on hydropower effects on riverine aquatic life in Part I Chapter 1, page 16.

Historical Perspective

The Kennebec basin has shared some of the same water quality history as many other waters in the state. Dams were constructed in the 19th and early 20th century and were followed with settlement and industrialization in the basin. Until the late 1970s, the Kennebec had many notable water quality problems. Most towns and industries did not provide treatment of their wastes. A now closed pulp and paper mill in Winslow dumped wastes, in the 1970's, reportedly equivalent to the raw sewage of two million people. This pollution left the lower river chronically anoxic during the summer with fish kills commonly occurring. Additionally, the river was used as the primary means to bring pulp logs to the mills and for wood storage, thus leaving the river inaccessible for other uses and leaving substantial bark and wood deposits on the bottom. While the effects of the pulp and paper industry were severe, many other industries contributed wastes sufficient to cause additional problems particularly on the smaller tributaries. The worst of these included tanneries on the West Branch Sebasticook River and Wilson Stream, textile mills on the East Branch Sebasticook River and Messalonskee Stream, dairy and potato processing on the East Branch Sebasticook River and poultry processing plants on the Kennebec River. Water quality in the basin is also stressed by a number of eutrophic lakes that affect downstream waters.

Many events in the 1970s and early 1980s resulted in substantial water quality improvements, especially implementation of the Clean Water Act. The pulp mill in Winslow closed and a new pulp and paper facility was built 10 miles upriver with modern waste treatment in 1978. Pulpwood drives were terminated on the river in 1976. The poultry industry collapsed in the late 1970s resulting in the closure of those plants. One of the tanneries and the dairy and potato processors have gone out of business. Waste treatment facility construction was completed in the

basin by 1985 for all significant towns and industries. In the last five years, other industries have closed including two paper mills and both textile mills.

Current Status and Issues

The upstream portion of the Kennebec as well as many of the major tributaries (Dead, Carrabassett, Sandy) are classified A and AA. Water quality in these segments is good and supports high quality aquatic communities. Problems have been detected associated with the many hydropower facilities that affect the habitat quality of the river downstream of the impoundments (see Part I Chapter 1 discussion on hydropower). This is particularly true at sites used for peaking power (e.g. Wyman dam) or where flows are highly variable. The river below Wyman dam (Station 165) was found to be nonattainment of the lowest state standards for aquatic life presumably due to extreme flow manipulation that causes daily flooding, followed by dewatering, of a significant portion of the channel, precluding establishment of a persistent aquatic community. Populations of invertebrates are uncharacteristically low for a lake outlet location such as this. The benthic community lacks the filter-feeding organisms that would typically be associated with locations downstream of lakes. Information from the Biomonitoring Program has been used to recommend new operating limits at this site through the relicensing process for this dam (Section 401 water quality certification).

Downriver, the classification of the mainstem changes to Class B from Anson-Madison all the way to tidewater except for a segment from Skowhegan to Waterville below a large pulp and paper mill that is Class C. The river attains classification except for two impounded segments at Norridgewock and the lower portion of the Edwards impoundment (both are nonattainment presumably due to habitat effects of the impoundments). Repeated sampling at Station 29 above the Edwards dam has been consistently in nonattainment since 1985. The Legislature has recently raised the classification of the lower Edwards impoundment from Class C to B in anticipation of the improved habitat that will occur because the dam has been removed.

Tributaries of the Kennebec are variable in quality. While remaining water quality impacts on the mainstem are associated with habitat modifications or other water quality factors associated with hydropower dams, many documented effects on the tributaries are associated with wastewater discharges and other contamination sources in these smaller receiving waters. The Sebec River and Messalonskee Stream are both eutrophic as a result of municipal and industrial wastes and nonpoint source pollution going to those waters. The effects are most pronounced in the impounded parts of those waters.

Future Needs

A number of management changes are occurring in the Kennebec basin that require follow-up monitoring to measure aquatic life response. These include the re-licensing of several hydropower dams that will impose new flow regimes for these facilities to enhance the quality of downstream aquatic life. Improved treatment and restoration of the East Branch Sebasticook River, recently designated a federal Superfund site, should also provide an opportunity to demonstrate aquatic life response to water quality improvements (see Case Study 5). The removal of the Edwards dam in Augusta provides a unique opportunity to assess the revival of a river that has been altered by impoundment for over 160 years. The Department is presently engaged in a study with researchers from Clarkson University to follow the changes that will occur in the lower Kennebec following the breach of the dam. Interest in the lower river may also push interest to better understand and assess the tidal freshwater segment below Augusta.

CASE STUDY 5

Long Term monitoring of a toxic point source, East Branch Sebasticook River

In 1983, as the biomonitoring program was first being designed and organized, the Department selected the East Branch Sebasticook River (Class C) at Corinna as a waterbody for study. The Department has repeated annual biological monitoring in this segment for 9 of the years from 1983-1997. This river segment had been the focus of considerable attention for many years due to persistent water quality problems associated with municipal and industrial discharges. The Town of Corinna had constructed a treatment plant in 1969 to treat wastes from the town and a woolen mill. Additionally, untreated domestic sewage was discharged from the Town of Dexter about 7 miles upriver until 1985. The river also receives runoff from numerous farms in the watershed and the Town of Corinna has five combined sewer overflows that deliver stormwater and wastewater to the river during runoff events. Habitat of the river has been critically altered as it passes under the mill and through the town. More recently, it has been discovered that a significant pool of dichlorobenzene and other chemicals used by the woolen mill had been dumped at the mill site and could be found in very high concentrations in the hyporheic zone of the river and presumably enters the surface water during certain flow conditions.

In 1981, the Department had issued a new wastewater license to the treatment facility that presumably would correct the water quality problems in this segment. The license incorporated discharge limits for all known contaminants based on EPA's water quality criteria. Biological monitoring in 1983 found a seriously degraded aquatic community (total of 11 organisms, 4 Diptera taxa). The initial concern was that at low flow, chlorine from the disinfection process might be having this extreme effect, however a trial where chlorine was removed from the process did not yield any improvement (total of 15 organisms, 7 Diptera or non-insect taxa). The new license obviously was not working. The toxic effect of the chemicals from the mill was too complex and could not be regulated adequately in the current license to protect the aquatic life in the river.

Over the years, a number of improvements were made at the mill and at the treatment facility to lessen the toxicity problems. The community responded with incremental improvements (Figures 15, 16 for Station 20). Despite recruitment of organisms and taxa, the community structure and function remained poor and was assessed as non-attainment until 1993, when it attained Class C for the first time. At that time, the mill was operating sporadically until November, 1996 when it permanently shut down. Biological monitoring found non-attainment conditions again in 1994 and then attainment of Class C in 1997 following the closure of the mill. Until 1989, the community was dominated by Diptera larvae and non-insect (snails, leeches). In 1989, significant numbers of filter-feeding Hydropsychidae were collected, an important feeding function that had been lacking in the stream. In 1992, the community began to have some less tolerant organisms such as Ephemeroptera collected, although Plecoptera, a very intolerant group, has never been collected at the site. During the same period of study, Station 90 located below the mill but above the treatment outfall has consistently maintained a Class C community. This segment is affected by all the aforementioned sources of contaminants except the treatment plant outfall. In 1999 the Eastland Woolen mill site in Corinna was designated a federal Superfund site. A number of management actions have been initiated for the East Branch since the closure of the mill, including remediation of the hazardous waste site at the mill (including proposed relocation of the stream bed away from the contaminant source area), removal and treatment of the combined sewer overflows, and redirection of the wastewater treatment plant effluent to a land disposal site.

The Corinna case was particularly important in the evolution of Maine's biological monitoring program. It became the leading example, presented to the Legislature in 1986, why the state needed to have biologically based water quality standards and criteria. The complexities of water quality management in waters like the East Branch required the state to have tools that could integrate and express the effects of multiple stressors on the aquatic community, something that cannot be efficiently accomplished through narrowly focused management tools like wastewater discharge licensing.



Corinna Sewer District outfall, E. Br. Sebasticook River, about 1980

Fig. 15. Changes in total abundance values in the East Branch of the Sebasticook River (Station 20) from 1983-1997.

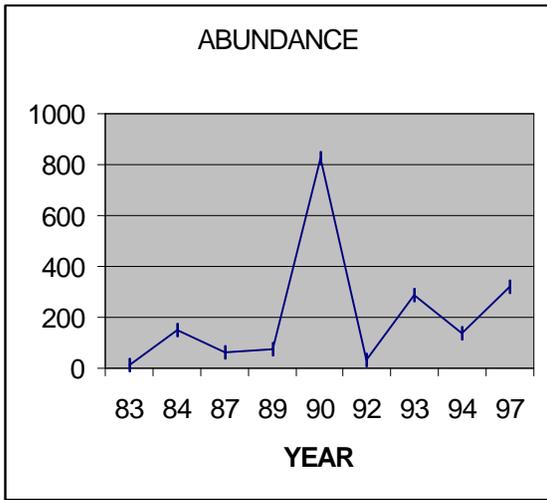


Fig. 16. Changes in richness values in the East Branch of the Sebasticook River from (Station 20) 1983-1997.

