

Historical and Current
Distribution and Abundance of the Anadromous Alewife
(*Alosa pseudoharengus*) in the St Croix River

A Report to the State of Maine
Atlantic Salmon Commission
161 Capitol Street
172 State House Station, Augusta, Maine 04333-0172

- Lewis N. Flagg
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Introduction: The St Croix River is the largest river between the Penobscot and St John watersheds. The river drains an area of 1635 square miles of which approximately 625 square miles of the river's basin is in New Brunswick and 1010 square miles is in Maine. The east branch of the St Croix forms the easterly boundary of the Atlantic seaboard between the US and Canada. Historically, the St Croix river was noted for its large runs of anadromous fish, particularly Atlantic salmon, American shad, and alewife. Due to the international boundary formed by the St Croix river, the freshwater and anadromous fish resources of the main stem and East Branch are interjurisdictional resources under the joint management of state and federal US and provincial and federal Canadian fishery agencies (St Croix River Steering Committee). The St Croix River Steering Committee was established for the purpose of seeking mutual agreement on a course of action to rebuild the depleted fish stocks and for management strategies as the fisheries develop. A long term management plan was developed by the Steering Committee in 1988 and a subsequent five year management plan was developed in 1993. Due to continued fishway closures at Woodland and Grand Falls since 1995, the 1993 plan was never fully implemented.

Overview: The upstream migration limit for anadromous species, particularly alewives (Gaspereaux) has been a center of controversy since the 1980's when anadromous alewives were perceived to be the cause of substantial declines in smallmouth bass in the upper St Croix river. Prior to 1980, an old, inefficient, and limited capacity fishway at Milltown (constructed in 1960) allowed only limited passage of anadromous fish. Construction of a new fishway at Milltown in 1980, coupled with state of the art fishways constructed in 1964 at Woodland and Grand Falls, allowed alewives virtually unimpeded access nearly to the headwaters of the St Croix. Limited numbers of alewives had ascended the river above Woodland and Grand Falls as early as 1965 because juvenile alewives were observed passing into the turbines at the Grand Falls powerhouse in the summer of that year by Fletcher (1965). By the mid to late 1980's, smallmouth bass in Spednic Lake had apparently declined substantially. Following complaints of poor smallmouth bass fishing from local guides and sporting camps on Spednic Lake, the MDIF&W undertook a cooperative study with the New Brunswick DNR. After 10 years of investigative work at Spednic lake, that study concluded that the large influx from a natural run of alewives through the Vanceboro Dam fishway, coupled with a lake drawdown of 9-14 feet, resulted in the young bass fry becoming unprotected by the rocky shoreline habitat and forced to compete for food and habitat with young perch and alewife fry. The combination of the loss of protective habitat, through water drawdown, coupled with the excessive competition from other fish fry, was believed to have caused poor bass fry survival over several successive years. In response to the smallmouth bass decline, the St Croix River Steering committee agreed to block the Vanceboro fishway during the alewife run and requested that Georgia Pacific Company (Vanceboro Dam owner) revise its water management plan on the St Croix watershed to

minimize the impacts of water drawdown on young bass. The Vanceboro fishway has been closed to alewife passage since 1988 with the exception of some limited passage in 1991 when the fishway was not closed soon enough to prevent some limited alewife escapement. In spite of this proactive effort, in 1995 the Maine Legislature passed L.D. 520, An Act to Stop the Alewives Restoration Program on the St Croix River, which resulted in unilateral closure of the Woodland and Grand falls fishways to the passage of alewives. This action, which was opposed by the fishery agencies of the state of Maine and Canada, caused the alewife run to decline from 2,600,000 in 1987 to 900 fish in 2002. The Milltown Dam, owned by the New Brunswick Electric Power Commission and with a fishway and powerhouse located on the Canadian side of the river, was not subject to the Maine Legislature's action. Alewives have continued to be released above the Milltown dam up to the present time. Because of recent dramatic declines in adult alewife returns, DFO Canada has been trucking alewives from the Milltown fishway to the Woodland impoundment since 2001. This has caused the alewife run to rebound from 900 adult returns in 2002 to about 12,000 in 2006.

Smallmouth bass sportfishing guides and upriver camp owners allege that anadromous alewives historically had no access to the waters of the upper St Croix because of a natural falls (Salmon Falls) located at the head of tide. It is the purpose of this report to examine the history of early settlement of the area, archaeological information and historical fisheries records to determine the distribution and relative abundance of anadromous alewives in the St Croix watershed.

Historical Status of Anadromous Fish Runs.

There are numerous references to the abundance of anadromous salmon, shad and alewife in the St Croix river. The first report (1867) of the Commissioners of Fisheries of the state of Maine had this to say about the St Croix River: "The St Croix was formerly very productive of salmon, shad, and alewives. Perley (1852), in his report of the fisheries of New Brunswick, states that the average catch of salmon at Salmon Falls, in Calais, was 18,000 annually. Gaspereaux, (alewives) came in such numbers that it supposed they could never be destroyed. The number of shad were almost incredible. The fisheries did not diminish up to 1825. Until that time there were fishways; but in that year the Union dam was built without a fishway, and the fisheries instantly fell off. We have the testimony of Mr. Ferdinand Tinker of Milltown, to the abundance of fish up to 1825. Perley says the whole number of salmon taken in 1851 was 200. Since that time they have remained the same until 1866, when 300 were caught. In 1867 there was a still further increase. Mr Treat of Eastport attributes this late increase of salmon to the influence of Porter's stream, a tributary on the New Brunswick side of the river, to which they sometimes have access at the breeding season."

Atkins (1887) reported: "The St Croix is remarkable, even among the rivers of Maine, for the great extent of the lake surface among its tributaries. **These lakes afford breeding ground for great numbers of alewives,** and, in the main river and its branches, here the salmon and there the shad found their favorite haunts. The exact limit of the upward migration of all these species is very naturally unknown with any degree of exactness, the entire upper portions of the basin being wilderness till long after the occupation of the lower banks and the erection of artificial obstructions; **but the fact of their existence in great numbers in the river shows they must have passed the only serious obstacle to their ascent, the natural fall at Salmon Falls near the head of tide**

and found their breeding ground in the upper waters. From the early settlement of the country until 1825, there was annually a great abundance of salmon shad and alewives. Vessels from Rhode Island, from 100 to 150 tons berthen, followed the fishing business on the river and were never known to leave without full cargoes. There were also several seines belonging to the inhabitants, which were worked in the tideway of the river, the owners of which put up annually 1,500 to 2,000 barrels of alewives for exportation. At the same time shad were caught in great numbers, often more than a hundred of them being caught in a small net in a single night.”

The St Croix River once supported large runs of anadromous species that ascended the river system nearly to its headwaters (Havey 1963). Keith Havey was the IF&W Regional fishery biologist for eastern Maine from the early 1950' to the 1980's.

In the late 1700's, mill dams were built throughout the lower St Croix watershed, impounding tidal areas, streams, and sections of the mainstem between Baring/Upper Mills and Milltown. Fletcher (1982) reported that the early dams only partially blocked the river. They were built out from either shore obliquely upstream and did not meet at the center of the river, the opening serving as fish passage and as a vent for excess flows. While water ran around the open end of these dams, the retained water served as a log holding pond and insured a head of water to power the mills on shore. Fletcher also reported that the natural ledge barrier at Salmon Falls and the rapids at Milltown may have been a barrier to the anadromous fish runs at various water stages, particularly at low water flows. He further acknowledges that the construction of the Union Dam in 1825 in Calais brought the taking of great quantities of salmon, shad, and gaspereau (alewives) to an end. This tidewater structure had no fishway. It is quite apparent that the lack of a fishway at the Union Dam virtually destroyed the anadromous fish runs of the St Croix. Fletcher surmised that the rapids immediately upstream of the Milltown dam and the rapids at Baring would be difficult for fish to pass at many water levels **but at high flows, migratory fish would probably pass these areas successfully.**

Alewife Life History and Fisheries

The Maine Commissioners of Fisheries report of 1867 makes the following observations about alewives: “ The fishermen distinguish three separate schools or runs of different sizes of fish. The main body does not appear until late in May or in some rivers in June. Of the first run on the East Machias, 370 fill a barrel, of the second run, 400, of the third run, 600.” **(It takes 120 alewives to fill a bushel, making a barrel of alewives equivalent to three bushels. If 2000 barrels were put up annually, this represents a minimum of 720,000 individual fish).**

Collette and MacPhee (2002) Fishes of the Gulf of Maine 3rd edition provides the following description of alewife spawning habitat: “Alewives usually spawn in quiet waters of coves and ponds, including those behind barrier beaches (if there are openings to the sea, natural or artificial) and in sluggish sections of streams above the head of tide (Smith 1907; Belding 1921; Bigelow and Schroeder 1953; Marcy 1976B). Where further upstream migration is barred by dams, alewife will spawn in shore-bank eddies or deep pools (Loesch and Lund 1977).

During their spawning migration, alewife are much more successful than American shad in navigating fishways of suitable design. They do not generally jump over obstructions although they easily negotiate white water in rapids and fishways. Negotiating swift water apparently does not stress them because increases in blood lactic

acid levels were not very great when tested during spawning runs in a fishway in the Gaspereaux river, N.S. (Dominy 1973).

Adult alewives move up our rivers in May and June on spawning runs. They spawn mostly in lakes, but may choose slow-moving streams. The eggs are broadcast and there is no parental care. The young hatch in just a few days and spend part of their first summer in the waters in which they hatched, moving down to the sea between July and December of that first year. After three to five years they return to their home rivers to produce their own young. (Havey 1963)

Most alewife are believed to return to spawn in their stream of origin (Bigelow and Schroeder 1953; Loesch 1987). This theory is supported by meristic data (Messieh 1977), by establishment or reestablishment of spawning runs by stocking gravid adults (Belding 1920, 1921; Bigelow and Schroeder 1953; Havey 1961) and by olfaction experiments (Thunberg 1971).

Alewife production in Maine is based on a production potential of 117.5 –235 adult returns per surface acre of spawning habitat. These very conservative production figures are derived as follows: Long term annual yield of alewives from the Damariscotta and St George Rivers (early 1950's to early 1980's) was 190 and 270 pounds per acre respectively. These figures do not include spawning escapement which is assumed to be 15%, based on a one-day weekly closed period which was in effect at that time. More recently, harvests of alewives have dropped dramatically to between 50 to 100 pounds per acre. The average alewife weighs about 0.5 pounds, which translates to 100-200 adults per acre yield. If 15% (a minimal % since current weekly closures have been increased from 24 to 72 hours) is added to this yield to account for spawning escapement, the production potential is 117.5 –235 returning adult fish per acre of spawning habitat. The following table shows the distribution of habitat and potential alewife production in the St Croix River drainage.(Acreages obtained from Five Year (1993-1997) Operational plan for the development and Management of the Diadromous Fishes of the St Croix River.)

Table 1

St Croix River Alewife Habitat/Production Above Milltown

River Reach	Acreage	% of Total Habitat	Production @117.5	Production @ 235
Milltown to Woodland	131	0.1	15392	30,784
Woodland to Grand Falls	1174	1.1	137,945	275,890
Grand Falls Flowage	27,142	27.3	3,189,185	6,378,370
Spednic Lake and above	36,209	36.5	4,254,557	8,509,114
West Grand lake and above	34,549	34.8	4,059,507	8,119,015
TOTAL	99,205	100.0	11,783,486	23,566,974

Alewife habitat below Woodland represents only 0.1 % of the production potential of the drainage. There is virtually no alewife spawning habitat below the Milltown Dam (Lee Sochasky, personal communication), certainly no where near the habitat that exists between Milltown and Woodland. If we accept the theory that alewives never ascended above Salmon Falls where was the habitat that produced harvests in excess of 700,000 adults per year prior to 1825? Even the

area from Salmon Falls (Milltown) to Woodland only provides a potential production of 15,000 fish. Moreover, the number returning in recent years as a result of stocking the Woodland impoundment is only about 12,000 fish annually). If production is doubled to replicate alewife yields in the 1950's-1980's, the production is only 30,000 fish. Therefore alewives would have to have ascended above Grand Falls to produce runs of the magnitude mentioned in historical literature. Further evidence of alewife migration above Salmon Falls is provided by the following:

Petition of Joseph Whitney et. al. for Removal of Obstructions in the St Croix River for the Passage of Fish, December 3, 1822

“To the Honorable Senate & House of representatives of the state of Maine: We the undersigned, citizens of said state, respectfully represent that previous to existing obstructions, by mills and mill dams, on the St Croix or Schoodic River, great quantities of Salmon, Shad, and Alewives annually passed up and returned down said river to the great benefit and advantage of the community generally; and in an especial manner of the new settlements in the eastern part of the state— That said obstructions have rendered it almost impossible for the Shad and Alewives to pass above the town of Calais; **whereas they used to pass from eighty to an hundred miles above; and they are now almost totally excluded from said River.**

That it is confidently believed that if suitable fish ways should be provided and also suitable regulations for the taking of fish on said river, it would, as formerly, be abundantly supplied with fish and all the privileges and advantages of the proprietors of the mills and mill dams on said River remain unimpaired--

Wherefore, we pray, that such fishways and such regulations concerning the taking of fish on so much of said river and its branches as be within this state as may be deemed necessary to restore to its citizens their ancient privileges in this respect, may be provided by the Honourable House of representatives and as in duty bound we will ever pray. Joseph Whitney, Anson G. Chandler, Enoch Darling, William Smith, Andrew Tracy, Samuel Perkins, James Stuart, and John Harvey.

Not only did the petitioners believe that alewives ascended the river above Salmon Falls before the dams were built, but they also acknowledged that the alewife, shad, and salmon runs were depleted. as a result of the dams with no fish passages. **If alewives never went above Salmon Falls, why did the run decline coincident with dam construction without fish passages?**

Table 2
Adult Alewife Returns at Milltown 1981-2006

Year	Returns at Milltown	Significant events
1981	169,620	New pool & weir fishway at Milltown
1982	233,102	
1983	151,952	
1984	152,900	
1985	368,900	
1986	1,984,720	
1987	2,624,700	
1988	2,590,750	Spednic Fishway closed to alewife
1989	1,164,860	
1990	1,531,250	Grand falls Fishway blocked Limited alewife escapes into Spednic
1991	586,910	
1992	203,750	Limited escapes above Grand falls
1993	297,720	Grand falls Fishway blocked
1994	378,330	Grand falls Fishway blocked
1995	223,133	Woodland & Grand Falls Fwys blocked
1996	645,978	
1997	225,521	
1998	173,318	
1999	25,327	
2000	8,569	
2001	5,202	Woodland headpond stocked
2002	900	Woodland headpond stocked
2003	7,901	Woodland headpond stocked
2004	1,299	Woodland headpond stocked
2005	11,632	Woodland headpond stocked
2006	11,829	Woodland headpond stocked

Table 2 represents recent counts of adult alewife returns to the Milltown fishway. The majority of adults in the spawning run return after four to five years at sea. The 1988 closure of the Spednic lake fishway reduced the adult return from 2,590,750 in 1988 to 203,750 in 1992; a ten fold reduction in the run over a span of four years. The 1990 closure of the Grand falls fishway resulted in a five fold reduction in adult returns in 1994. The 1995 closure of the Woodland and Grand falls fishways in 1995 reduced the adult return from 223,133 in 1995 to 25,327 in 1999; an additional ten fold reduction over a four year period. The run further

diminished to 900 returns in 2002 due to lack of access to alewife spawning habitat. Adult returns have increased only because DFO has been stocking the 1174 acre Woodland impoundment since 2001. **These data demonstrate conclusively that there is little habitat for alewife production below Salmon Falls and therefore alewives had to ascend the river above Salmon Falls and Grand falls to produce the historically abundant alewife run in the St Croix river.**

Recent information received from Dr Arthur Spiess, Senior Archaeologist with the Maine Historic Preservation Commission, further demonstrates that alewives have been present in the upper portion of the St Croix watershed for at least 4000 plus or minus 100 years. (See attachment A letter to Dr Spiess from Lewis Flagg and Attachment B response from Dr Spiess.). Following is a summary of Dr Spiess' report:

“The Mud Lake stream site (BkDw 5) is located at the confluence of Mud lake Stream and Spednic Lake on the New Brunswick side. Excavated in 1983/4, the **archaeologists recovered 17 alewife bones** (representing multiple individual alewives-Dr Spiess personal communication 25May 07) from a hearth and/or a garbage pit (Figure 21). Charcoal from the pit was radiocarbon dated to 4000 plus or minus 100 years. **As for specific identifications of animal bone, there are a few specialists who are quite good at the task, and we (I am included) use comparative collections as much as possible. When a bone is identified as “alewife” it is specifically differentiated from the larger shad on size.** Native Americans of eastern Maine and western New Brunswick moved seasonally to be near food sources. The food animal bone, plant and shellfish remains (with one exception) from their sites seems appropriate to the local ecology. They did maintain long-distance trade networks, trading rocks, furs, and other high-value commodities. We do not have any evidence of trade in food stuffs. The one exception to the “food animal bone locally caught rule seems to be movement of bone that was used for tools and/or attached to pelts (such as in the form of medicine bags). the only fish bone that was used as a tool, and therefore moved across some distance, was swordfish sword. **In short, we conclude that food was gathered within perhaps ½ day travel maximum, and often much less, from a camp site.** (½ day travel by canoe is estimated by archaeologists to be no more than 10 miles. The distance from Calais or Meddybemps Lake to the Mud Lake site is between 60 and 65 miles so there is virtually no likelihood that alewives were carried to the Mud lake site from other known alewife sites.)**We know from ethnographic records that camps were often made at good fishing locations, and the archeological record seems to support this pattern. In summary, the Mud Lake Stream site provided evidence of alewife above the head of tide on the St Croix 4000 years ago.”**

It should be noted that Mud Lake Falls was reported by Mike Smith, IF&W biologist, to be impassable to anadromous alewives. Therefore, this was a logical place for native Americans to harvest alewives since they would naturally be backed up below the falls as is the case today when alewives encounter artificial and natural obstructions to passage.

Summary and Conclusions

Therefore, I conclude that anadromous alewives historically ascended above Salmon Falls and Grand Falls based on the following evidence:

1. There is not enough habitat below Salmon Falls and Grand falls to produce the historically large runs of alewives that were commercially exploited in the lower river. (See Table 1.)
2. Historical reports link the decline of alewives, shad, and salmon to the construction of dams at Salmon Falls and other sites on the lower river. If alewives never ascended the river above Salmon Falls, why did the alewife run decline dramatically coincident with dam construction on the lower river? I conclude that alewives did ascend the river above Salmon Falls and the decline in abundance of alewives, along with salmon and shad, was directly related to loss of access to upriver spawning and nursery habitat
3. Since 1990 and 1995, when alewives were denied access to habitat above Grand Falls and Woodland respectively, adult returns declined dramatically from 2,600,000 adults to 900 and has shown no appreciable recovery up to the present. The habitat below Grand falls (Milltown and Woodland flowages) is producing a run of only about 12,000 adult alewives or approximately the number projected by DMR's low range estimate in Table 1 for the river below Woodland.
4. Archeological findings at the Mud Lake Stream site provide evidence of alewife above head of tide on the St Croix 4000 years ago. This was long before any fish passage modifications may have been made at Salmon Falls by European colonists. The Mud Lake site is 65 miles upstream of head of tide and the same distance from Meddybemps Lake and more than 65 miles upstream of the Devil's Head site in the St Croix estuary, other known sites of alewife bones. These sites are much more than a ½ day travel maximum between where food was harvested and where it was consumed by native Americans. Therefore, I conclude that the alewives at the Mud Lake stream site were caught in Mud Lake stream or the immediate vicinity and therefore successfully passed upstream above Salmon Falls and Grand Falls.

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