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2015 Milltown Fishway Research Trap Report
St. Croix River, New Brunswick and Maine

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Summary

Anadromous fish inbound to spawn in the St. Croix River have been counted at a research trap at the Milltown dam fishway since 1981. The dam is located at the head-of-tide on this international boundary water between Maine and New Brunswick, and is owned by the New Brunswick Power Corporation (NB Power). The fishway and research trap are on the Canadian side of the river and are under the jurisdiction of Canada's Department of Fisheries & Oceans (DFO).

From 1981 to 2006, the counting facility was operated seasonally for up to seven months each year to document all inbound fish but notably Atlantic salmon (*Salmo salar*) and river herring (these being alewives or gaspereau (*Alosa pseudoharengus*) and blueback herring (*Alosa aestivalis*). Since 2007, a reduced operation in May-July has focused primarily on documenting the annual river herring run.

In 2015, the St. Croix International Waterway Commission operated the Milltown research trap and collected relevant data under agreements and/or partnerships with DFO, NB Power, the U.S. Fish & Wildlife Service (USFWS), the International Joint Commission (IJC), the Atlantic Salmon Federation and the Maine Department of Marine Resources (DMR).

The research trap was activated on April 30 and all fish were counted individually until July 18, when the trap was lifted at the presumed end of the river herring run. After July 18, NB Power continues to operate the fishway until mid-November, as required by federal agreement, but with no fish count. All fish species captured in the trap in 2015 are recorded in Table 1.

Three notable findings in 2015:

1. The three dam hydroelectric turbines adjacent to the fishway were off-line for refurbishment for the entire counting period. This created unique flow conditions above and below the fishway that may have influenced fish passage.
2. A total of 93,503 river herring were recorded at the Milltown trap in 2015. This was the highest return since 1998 and six-fold the average run of the last 15 years. A very high proportion was four year-old fish returning for the first time.
3. Eleven American shad (*Alosa sapidissima*) were also recorded, the first time this historic species has been documented in the St. Croix River since 1999.

In addition to the counting operation, Milltown fisheries staff supplied a sample of 60 alewives for a USFWS fish health study and 29 alewives for a tagging study to track spawners in the St. Croix watershed.

Table 1. Counts of inbound fish at the Milltown fishway research trap, St. Croix River, April 30- July 18, 2015.

Species	2015 trap count
River herring: alewife (*Alosa pseudoharengus*) and blueback herring (*Alosa aestivalis*)	93,501
American shad (*Alosa sapidissima*)	11
American eel *(Anguilla rostrata)*	2
Sea lamprey (*Petromyzon marinus)*	1
White sucker (*Catostomus commersonii)*	27
Smallmouth bass *(Micropterus dolomieu)*	29
Brook trout *(Salvelinus fontinalis)*	9
Common shiner (*Luxilus cornutus*)	2

Milltown fishway operation and trap counts

The Milltown fishway was activated for the season on April 15. The research trap at the top of the fishway was activated on April 30 and monitored until July 18 when it was lifted for the year at the presumed end of the river herring run. All fish entering the trap were hand netted and individually counted to ensure a complete record.

Since 2005, DFO had permitted a delay in annual fishway activation until the first week of May, recognizing that spring river flows greater than 5000 cubic feet per second (cfs) prior to this time significantly limit any attraction to, or effective operation of, the fishway. This variation was not available in 2015. River flows remained above 5000 cfs from early April until May 2 and it unlikely that any fish ascended the fishway prior to the research trap's activation. The first fish was recorded on May 7.

Specific to 2015, the three hydropower turbines adjacent to the fishway were off-line for refurbishment for the entire monitoring period. This created unique conditions below and above the fishway that have not occurred in the 32 year period of trap record (fish counts began in 1981 with the opening of the present fishway).

With no inflow or outflow at these turbines in 2015,

- Below the dam, there was a roughly 30m diameter area of slack water immediately adjacent to the fishway that formed a holding pool where incoming fish were observed to actively school and stage prior to entering the fishway.
- The sole discharge on this side of the river was now the fishway outfall. In recent years, the efficacy of the fishway attraction flow relative to adjacent turbine outflows has been a concern and has been under study. These conflicting conditions were not present in 2015: fish were observed to quickly locate and enter the fishway.
- At the top of the fishway there was an observable delay in fish exiting the fishway channel. The lack of current to the turbines eliminated the sensory clues that fish usually rely on to recognize and follow their upstream migration path. This was noted but could not be mitigated and is a situation that will not reoccur.

After the fisheries research trap was lifted on July 18, NB Power continues to operate the fishway as specified by DFO, without fish counts, until mid-November.

River herring

Table 2 summarizes river herring returns to the St. Croix River from 1981 to 2015. This indicates that the 2015 return of 93,503 river herring was the highest since 1998 and six-fold the average run of the last 15 years.

Typically, the majority of river herring entered the river in short, intense bursts: 51% of run passed through the fishway on portions of four days (May 28-29, June 4 and 12). Table 3 summarizes the run distribution.

Table 3. Percent of St. Croix river herring run recorded at the Milltown research trap in 2015, by date.

10%	25%	50%	75%	90%	100%
May 28	May 29	June 5	June 12	June 15	July 18

A total of 94 river herring were lethally sampled for fork length, body weight, gonad weight, sexual maturity stage, scale age and previous spawning record. Of these, 87 were alewives (Table 4a) and nine were blueback herring (Table 4b). These tables and Table 5 offer a general indication of species composition and select other characteristics of the 2015 river herring run. Of note:

- Based solely on the small sample, it appears that the historic blueback herring component of the St. Croix river herring run may be recovering. This is the third consecutive year that blueback herring have been recorded in the Milltown sample, after more than a decade of absence, and now in larger

Table 2. St. Croix River ME/NB alewife/gaspereau/blueback herring spawning runs, 1981- present **(bold = 7-day peak)** **FINAL at July 19, 2015**

Sources: Fisheries & Oceans Canada (1981-1990), St. Croix International Waterway Commission (1991-2011, 2015), Atlantic Salmon Federation (2012-2014).

YEARS >>>	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
April 30-May2	--	0	0	0	0	5460	0	0	0	0	0	0	0	0	0	0	0	0
May 3-9	--	0	0	0	0	16410	9400	24410	0	29690	170	0	0	0	0	2814	0	0
May 10-16	7510	32160	16970	6000	0	75150	171500	468750	0	305370	14740	8910	0	0	5898	11178	0	**77394**
May 17-23	47450	64120	**44050**	40300	70000	429400	559500	760280	200610	319380	133820	**74120**	12000	102210	**109388**	202188	**122478**	25705
May 24-30	47770	**74800**	33760	**67100**	**149890**	**772800**	**674700**	**764990**	**464390**	**411090**	**154560**	45520	**146600**	116020	99847	188538	93000	71534
May 31- June 6	**48310**	56930	20770	26200	96740	628300	645300	370750	424550	141490	51110	24780	102800	**144700**	0	**231870**	4091	2684
June 7-13	16000	4610	35650	13300	26900	57200	480400	187800	63940	132030	4010	50420	2260	0	0	9390	5951	0
June 14-20	1760	250	620	0	21040	0	83900	13770	11370	0	0	0	26060	0	0	0	0	0
June 21-27	790	210	0	0	1060	0	0	0	0	0	0	0	0	0	0	0	0	0
June 28 - July 4	30	20	0	0	3270	0	0	0	0	0	0	0	0	0	0	0	0	0
July 5-11	0	1	130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
July 12-18	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
July 19-25	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
July 26 - later			0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Escapement	169620	233102	151952	152900	368900	1984720	2624700	2590750	1164860	1339050	358410	203750	289720	362930	215133	645978	225521	177317
Harvest	0	0	0	0	0	0	0	0	0	192200	228500	0	8000	15400	8000	0	0	0
TOTAL RUN	169620	233102	151952	152900	368900	1984720	2624700	2590750	1164860	1531250	586910	203750	297720	378330	223133	645978	225521	177317

YEARS >>>	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
April 30-May2	0	0	0	0	0	0	0	0	--	--	--	--	--	--	--	--	0
May 3-9	0	**3966**	0	2	0	0	0	18	0	0	0	0	0	993	342	0	0
May 10-16	195	142	160	6	3	0	0	577	0	4	1	9748	1657	343	362	7	16
May 17-23	5933	2011	505	23	603	0	2	3111	0	33	12	**17731**	**13053**	**22260**	178	16	126
May 24-30	**13615**	377	**2625**	325	2115	0	20	**3155**	2	119	3740	17008	1227	11190	**10542**	29	**32637**
May 31- June 6	5476	2067	1735	**494**	**3163**	0	5277	2540	0	**11797**	42	8520	7750	1175	5107	**19971**	16875
June 7-13	108	6	123	35	999	**951**	**6220**	1096	**1225**	61	2	4446	1387	197	37	6775	27150
June 14-20	0	0	54	15	1018	108	113	1227	66	23	**6627**	1126	50	10	83	95	11871
June 21-27	0	0	0	0	0	79	0	105	1	221	26	140	10	0	23	143	3817
June 28 - July 4	0	0	0	0	--	150	--	--	--	3	0	45	7	--	3	267	816
July 5-11	0	0	0	0	--	11	--	--	--	--	--	9	1	--	--	9	161
July 12-18	0	0	0	0	--	0	--	--	--	--	--	3	--	--	--	--	34
July 19-25	0	0	0	0	--	0	--	--	--	--	--	--	--	--	--	--	--
July 26 - later	0	0	0	0	--	0	--	--	--	--	--	--	--	--	--	--	--
Escapement	25327	8569	5202	900	7901	1299	11632	11829	1294	12261	10450	58776	25142	36168	16677	27312	93503
Harvest	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL RUN	25327	8569	5202	900	7901	1299	11632	11829	1294	12261	10450	58776	25142	36168	16677	27312	93503
		8569	5202	900	7901	1299	11632	11829	1294	12261	10450	58776	25142	36168	16677	27312	235412

Note 1. Enumeration. Prior to 1999, river herring were enumerated by counting all fish for 10min/hr and multiplying by 6 to yield an hourly total, for each hour the fishway was open. In 1999 and 2000, "light" run periods were enumerated by shutting off the fishway exit for 4 hour intervals and then individually counting all fish in the trap, while "heavy" run periods were enumerated as in previous years. Since 2001. all fish have been counted individually.

Note 2. Upstream passage. Beginning in 1995, the State of Maine blocked the upstream fishways at Woodland and Grand Falls to spawning river herring. In 2001, Fisheries & Oceans Canada began to truck a portion of the spawning run from Milltown to Woodland Flowage. Number of river herring transported to Woodland: 2001 (3756), 2002 (807), 2003 (6805), 2004 (392), 2005 (7100), 2006 (6653), 2007 (1169). In 2008, Maine removed the Woodland fishway barrier, allowing river herring direct access to Woodland Flowage, and Fisheries & Oceans discontinued its trucking operation. In 2013, Maine removed the Grand Falls fishway barrier, allowing river herring access the upper watershed.

Note 3. Duration of count. Monitoring was discontinued on June 27 in 2006, 2007 and 2012; on July 3 in 2008; July 4 in 2009 and 2013; July 8 in 2014; July 11 in 2011; July 18 in 2015 and July 19 in 2010 at the presumed end of each year's run. Any fish entering the river after these dates were not recorded

Table 4a. 2015 St. Croix adult alewife/gaspereau field data (St. Croix International Waterway Commission). Final at August 17, 2015

Sites listed by River km: Milltown fishway 2.26. Maturity (sex) stage is 1-7 Nikolsky index. Scale aging by Maine Department of Marine Resources.

Date yyyy/mm/dd	Site River km	Fish #	FL (mm)	WT (g)	Sex	Gonad Wt (g)	Sex Stage	Scale sample	Scale Age	Prev Spawn #	Comment	Disposal if not on site
2015/05/12	2.26	SCR-15-001	279	288.5	F	19.9	3	Y	6	2	sacrifice	
2015/05/19	2.26	SCR-15-002	245	183.4	M	10.9	3	Y	4	1	sacrifice	
2015/05/28	2.26	SCR-15-003	255	213.9	F	18.3	3	Y	4	0	sacrifice	
2015/05/28	2.26	SCR-15-004	239	196.0	M	10.4	3	Y	5	1	sacrifice	
2015/05/28	2.26	SCR-15-005	247	202.2	M	10.7	3	Y	4	0	mortality	
2015/05/28	2.26	SCR-15-006	260	237.0	M	15.6	3	Y	5	2	sacrifice	
2015/05/28	2.26	SCR-15-007	243	192.0	M	9.2	3	Y	5	1	sacrifice	
2015/05/28	2.26	SCR-15-008	248	211.4	F	22.2	3	Y	4	0	sacrifice	
2015/05/28	2.26	SCR-15-009	249	202.7	F	17.5	3	Y	4	0	sacrifice	
2015/05/28	2.26	SCR-15-010	263	228.1	M	10.7	3	Y	7	2	sacrifice	
2015/05/28	2.26	SCR-15-011	243	170.8	F	12.4	3	Y	4	0	mortality	
2015/05/28	2.26	SCR-14-012	260	225.7	F	15.3	3	Y	4	0	sacrifice	
2015/05/28	2.26	SCR-15-013	240	196.3	M	11.5	3	Y	4	0	sacrifice	
2015/05/28	2.26	SCR-15-014	256	219.1	F	20.5	3	Y	4	0	sacrifice	
2015/05/28	2.26	SCR-15-015	249	196.2	M	8.2	3	Y	4	1	sacrifice	
2015/05/28	2.26	SCR-15-016	258	209.0	M	11.3	3	Y	4	1	sacrifice	
2015/05/28	2.26	SCR-15-017	241	137.2	M	8.3	3	Y	4	0	sacrifice	
2015/05/29	2.26	SCR-15-018	247	163.4	M	7.5	3	Y	4	0	mortality	
2015/05/29	2.26	SCR-15-019	292	302.6	F	29.9	3	Y	6	2	sacrifice	
2015/05/29	2.26	SCR-15-020	245	189.5	M	12.0	3	Y	4	0	sacrifice	
2015/06/03	2.26	SCR-15-022	238	178.7	F	22.0	3	Y	4	0	sacrifice	
2015/06/03	2.26	SCR-15-023	251	190.4	M	11.8	4	Y	4	0	sacrifice	
2015/06/03	2.26	SCR-15-024	272	264.2	F	32.9	3	Y	5	0	sacrifice	
2015/06/03	2.26	SCR-15-025	252	188.7	M	7.0	3	Y	4	0	sacrifice	
2015/06/03	2.26	SCR-15-026	250	214.6	F	20.6	3	Y	4	0	sacrifice	
2015/06/05	2.26	SCR-15-027	249	192.0	M	8.4	3	Y	4	0	mortality	
2015/06/05	2.26	SCR-15-028	242	177.3	M	8.0	3	Y	4	0	mortality	
2015/06/05	2.26	SCR-15-029	250	211.2	F	16.6	3	Y	4	0	sacrifice	
2015/06/05	2.26	SCR-15-030	242	193.2	M	10.6	3	Y	4	0	sacrifice	
2015/06/05	2.26	SCR-15-031	238	185.4	M	13.4	3	Y	4	0	sacrifice	
2015/06/05	2.26	SCR-15-032	223	162.6	F	16.7	3	Y	4	0	sacrifice	
2015/06/05	2.26	SCR-15-033	243	206.8	F	18.1	3	Y	4	0	sacrifice	
2015/06/05	2.26	SCR-15-034	230	150.4	F	11.8	3	Y	3	0	sacrifice	
2015/06/05	2.26	SCR-15-035	253	208.6	F	21.8	4	Y	4	0	sacrifice	
2015/06/05	2.26	SCR-15-036	228	146.6	M	8.0	3	Y	4	0	sacrifice	
2015/06/05	2.26	SCR-15-037	229	145.4	M	6.3	3	Y	4	0	sacrifice	
2015/06/05	2.26	SCR-15-038	235	154.8	M	8.4	3	Y	4	0	sacrifice	
2015/06/05	2.26	SCR-15-039	262	251.3	F	31.1	4	Y	4	0	sacrifice	
2015/06/05	2.26	SCR-15-040	257	218.5	M	13.6	3	Y	4	0	sacrifice	
2015/06/05	2.26	SCR-15-041	249	202.3	M	10.4	4	Y	4	0	sacrifice	
2015/06/05	2.26	SCR-15-042	224	141.2	M	6.4	3	Y	3	0	sacrifice	
2015/06/05	2.26	SCR-15-043	231	158.2	M	9.3	4	Y	4	0	sacrifice	
2015/06/08	2.26	SCR-15-045	254	192.2	M	6.9	3	Y	4	0	sacrifice	
2015/06/08	2.26	SCR-15-047	250	221.7	F	24.1	3	Y	4	0	sacrifice	
2015/06/08	2.26	SCR-15-049	244	209.1	F	18.6	3	Y	4	0	sacrifice	
2015/06/08	2.26	SCR-15-050	251	189.2	F	19.1	4	Y	4	0	sacrifice	
2015/06/11	2.26	SCR-15-051	237	153.4	M	6.7	3	Y	4	0	sacrifice	
2015/06/11	2.26	SCR-15-052	246	212.1	F	22.8	3	Y	4	0	sacrifice	
2015/06/12	2.26	SCR-15-053	244	185.8	M	7.8	4	Y	4	0	sacrifice	
2015/06/12	2.26	SCR-15-056	242	202.8	F	20.4	3	Y	4	0	sacrifice	
2015/06/12	2.26	SCR-15-057	226	159.9	M	7.8	3	Y	3	0	mortality	
2015/06/12	2.26	SCR-15-058	251	228.5	F	22.1	4	Y	4	0	sacrifice	
2015/06/12	2.26	SCR-15-059	243	220.9	F	27.2	3	Y	4	0	sacrifice	
2015/06/12	2.26	SCR-15-060	263	276.3	F	25.1	3	Y	4	0	sacrifice	
2015/06/12	2.26	SCR-15-061	266	257.5	F	25.2	4	Y	4	0	sacrifice	
2015/06/12	2.26	SCR-15-062	252	232.4	M	13.7	4	Y	4	0	sacrifice	
2015/06/12	2.26	SCR-15-063	245	215.3	F	18.3	3	Y	4	0	sacrifice	
2015/06/12	2.26	SCR-15-064	248	188.3	F	20.3	3	Y	4	0	sacrifice	
2015/06/12	2.26	SCR-15-065	244	200.2	F	21.9	4	Y	4	0	sacrifice	
2015/06/12	2.26	SCR-15-066	259	227.6	F	21.6	3	Y	4	0	sacrifice	
2015/06/12	2.26	SCR-15-067	233	154.3	M	5.3	3	Y	4	0	sacrifice	
2015/06/12	2.26	SCR-15-068	245	213.9	F	21.5	4	Y	4	0	sacrifice	
2015/06/12	2.26	SCR-15-069	238	167.2	M	10.5	4	Y	4	0	sacrifice	
2015/06/12	2.26	SCR-15-070	225	167.9	M	9.3	4	Y	4	0	sacrifice	
2015/06/14	2.26	SCR-15-071	258	227.0	F	20.7	4	Y	4	0	sacrifice	
2015/06/14	2.26	SCR-15-072	244	228.9	M	12.1	4	Y	5	1	sacrifice	
2015/06/14	2.26	SCR-15-073	259	236.0	F	17.5	3	Y	4	0	sacrifice	
2015/06/14	2.26	SCR-15-074	253	231.2	F	26.1	4	Y	4	0	sacrifice	
2015/06/14	2.26	SCR-15-075	245	196.5	M	9.7	3	Y	4	0	sacrifice	
2015/06/14	2.26	SCR-15-076	248	203.0	F	21.2	4	Y	4	0	sacrifice	
2015/06/14	2.26	SCR-15-077	254	217.9	F	32.8	4	Y	4	0	sacrifice	
2015/06/17	2.26	SCR-15-079	243	180.2	F	19.1	4	Y	4	0	sacrifice	
2015/06/17	2.26	SCR-15-080	232	161.0	M	8.1	3	Y	4	0	sacrifice	
2015/06/17	2.26	SCR-15-081	265	266.0	F	19.8	3	Y	4	0	sacrifice	

2015/06/17	2.26	SCR-15-082	247	207.3	F	22.7	4	Y	4	0	sacrifice	
2015/06/18	2.26	SCR-15-083	256	253.8	F	24.5	3	Y	4	0	sacrifice	
2015/06/18	2.26	SCR-15-084	234	182.5	F	19.8	4	Y	4	0	sacrifice	
2015/06/18	2.26	SCR-15-085	232	148.2	F	11.3	3	Y	4	0	sacrifice	
2015/06/18	2.26	SCR-15-086	248	202.0	F	17.4	3	Y	4	0	sacrifice	
2015/06/24	2.26	SCR-15-087	240	178.2	F	18.8	4	Y	4	0	sacrifice	
2015/06/24	2.26	SCR-15-088	240	184.1	M	9.2	4	Y	4	0	sacrifice	
2015/06/27	2.26	SCR-15-089	249	202.6	F	22.1	4	Y	4	0	sacrifice	
2015/06/27	2.26	SCR-15-090	246	204.4	M	9.6	4	Y	4	0	sacrifice	
2015/06/27	2.26	SCR-15-091	271	246.7	F	25.3	4	Y	5	1	sacrifice	
2015/06/27	2.26	SCR-15-092	240	179.4	F	17.3	4	Y	4	0	sacrifice	
2015/06/27	2.26	SCR-15-093	224	154.0	F	14.8	4	Y	3	0	sacrifice	
2015/07/04	2.26	SCR-15-094	226	153.0	M	9.3	3	Y	4	0	sacrifice	

Table 4b. 2015 St. Croix adult blueback herring field data (St. Croix International Waterway Commission). Final at August 17, 2015

Date yyyy/mm/dd	Site River km	Fish #	FL (mm)	WT (g)	Sex	Gonad Wt (g)	Sex Stage	Scale sample	Scale Age	Prev Spawn (#)	Comment	Disposal if not on site
2015/06/03	2.26	SCR-15-021	228	137.0	M	8.4	3	Y	--	--	sacrifice	
2015/06/08	2.26	SCR-15-044	216	125.9	M	10.4	3	Y	3	0	sacrifice	
2015/06/08	2.26	SCR-15-046	215	133.2	F	19.8	3	Y	4	1	sacrifice	
2015/06/08	2.26	SCR-15-048	229	158.7	F	18.8	3	Y	4	0	sacrifice	
2015/06/12	2.26	SCR-15-054	208	118.5	F	11.5	3	Y	3	0	sacrifice	
2015/06/12	2.26	SCR-15-055	216	129.5	M	14.5	4	Y	4	1	sacrifice	
2015/06/14	2.26	SCR-15-078	211	109.5	F	11.7	4	Y	3	0	sacrifice	

Table 4c. 2015 St. Croix American shad field data (St. Croix International Waterway Commission). Final at August 17, 2015

Note: Three shad entered the trap prior to June 13 and were recorded but not sampled. All subsequent fish were sampled for length and scales.

Date yyyy/mm/dd	Site River km	Fish #	FL (mm)	WT (g)	Sex	Gonad Wt (g)	Sex Stage	Scale sample	Scale Age	Prev Spawn (#)	Comment	Disposal if not on site
2015/06/13	2.26	SCR-15-S01	460					Y	5	0	live sample	release
2015/06/14	2.26	SCR-15-S02	461	1034.7	F	130.9	3	Y	5	0	mortality	
2015/06/14	2.26	SCR-15-S03	416					Y	5	1	live sample	release
2015/06/17	2.26	SCR-15-S04	415					Y	5	1	live sample	release
2015/06/17	2.26	SCR-15-S05	416					Y	5	1	live sample	release
2015/06/25	2.26	SCR-15-S06	446					Y	5	2	live sample	release
2015/06/26	2.26	SCR-15-S07	439					Y	5	0	live sample	release
2015/06/27	2.26	SCR-15-S08	418					Y	5	1	live sample	release

Table 5. Summary of St. Croix Milltown trap alewife data. Sources: Fisheries & Oceans Canada (1981-2000), St. Croix International Waterway Commission (2001-2011, 2015), Atlantic Salmon Federation (2012-2014).

at August 17, 2015

Year	Escapmt + harvest at Milltown	Escapmt at Milltown	Escapmt at Woodland	Escapmt at Grand Falls	Sample size (for age)	Age distribution from scale data												Sample repeat spawners		Sample Mean Wt (g)	Sample Mean FL (mm)	Notes
						Age 3		Age 4		Age 5		Age 6		Age 7		Age 8		Age 9						
						#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%			
1981		169620	Yes	Yes																		new Milltown fishway opened
1982		233102	Yes	Yes	350	0	0	32	9.1	110	31.4	40	11.4	71	20.3	75	21.4	22	6.3	244	70	373	307	
1983		151952	Yes	Yes																				
1984		152900	78000	65000																				
1985		368900	93000	87000																				
1986		1984720	1300000	625000																				
1987		2624700	930000	800000																				Vanceboro fishway part-closed
1988		2590750	1004200	Yes																				Vanceboro fishway closed
1989		1164860	Yes	Yes																				
1990	1531250	1339050	Yes	Yes	298	2	0.7	45	15.1	91	30.5	106	35.6	52	17.4	2	0.7	0	0	138	46	228	214	
1991	586910	358410	Yes	No	101	0	0	10	10	12	12	60	59	14	14	5	5	0	0	86	85	294	280	Grand Falls fishway closed
1992		203750	Yes	No	503	4	0.8	240	47.7	149	29.6	74	14.7	29	5.8	7	1.4	0	0	151	30	225	263	
1993	297720	289720	Yes	No	78	0	0	8	16.3	49	62.8	18	23.1	3	3.8	0	0	0	0	38	49	234	263	
1994	378330	362930	Yes	No																				
1995	223133	215133	No	No																				Woodland fishway closed
1996		645978	No	No																				
1997		225521	No	No																				
1998		177317	No	No																				
1999		25327	No	No																				
2000		8569	No	No																				
2001		5202	3756	No	85	0	0	62	72.9	19	22.4	3	3.5	1	1.2	0	0	0	0	22	26	204	247	Woodland Flowage stocked
2002		900	807	No	26	0	0	12	46	13	50	1	4	0	0	0	0	0	0	6	23	241	290	
2003		7901	6805	No	56	1	1.8	28	50	25	44.6	2	3.6	0	0	0	0	0	0	13	23	231	259	
2004		1299	392	No	149	3	1.0	38	25.5	87	58.4	21	14.1	0	0	0	0	0	0	51	34	201	251	
2005		11632	7100	No	120	0	0	61	64	28	29	7	7	0	0	0	0	0	0			204	258	
2006		11829	6653	No	65	4	6.2	47	72.3	14	21.5	0	0	0	0	0	0	0	0			210	247	
2007		1294	1169	No	88	0	0	24	27	50	57	13	15	0	0	0	0	0	0			206	240	
2008		12261	Yes	No	60	0	0	14	23	32	53	11	18	3	5	0	0	0	0			156	229	Woodland fishway opened
2009		10450	Yes	No	80	0	0	66	78	15	19	3	4	0	0	0	0	0	0	11	14	172	238	
2010		58776	Yes	No	151	2	1.3	69	46	76	50	2	1.3	1	0.7	1	0.7	0	0	42	28	204	247	
2011		25142	Yes	No	51	1	2.0	32	62.7	11	21.57	7	13.7	0	0	0	0	0	0	16	31	207	250	
2012		36168	Yes	No	61	1	1.6	31	50.8	20	32.79	7	11.5	7	11.5	2	3.3	0	0	21	34	224	254	
2013		16677	Yes	Yes	26	2	7.7	14	53.8	8	30.77	1	3.8	1	3.8	0	0	0	0	10	37	201	249	Grand Falls fishway opened
2014		27312	Yes	Yes	69	12	17.4	40	58	12	17.4	5	7.2	0	0	0	0	0	0	16	23	191	242	
2015		93503	Yes	Yes	87	2	5	74	85	6	7	2	2	1	1.0	0	0	0	0	11	13	200	247	

Notes:
1) Monitoring of escapement at dams was subject to variable methodologies; consult original documents.
2) Escapement recorded at Woodland in 2001-2007 was from stocking; the State of Maine controlled fishway was closed to alewives during this period.
3) Alewife access to Spednic Lake (Vanceboro fishway) was available through 1986, partially available in 1987 and fully blocked beginning in 1988. It is now open.
4) Grand Falls fishway was blocked to alewives in 1991; both Grand Falls and Woodland were blocked beginning in 1995. Fisheries & Oceans Canada trucked part of the alewife run to Woodland in 2001-2007 (see Note 2).
5) Woodland fishway was re-opened to alewives in 2008 and Grand Falls fishway re-opened in 2013.
6) Sample sizes for mean weight and fork length and for scale age may differ: not all fish are sampled for all parameters. See annual trap reports for details.

numbers. This suggests that blueback herring have continued to comprise a portion of the St. Croix river herring run over the long term, generally undetected in the small Milltown sample size.

- St. Croix river herring typically spawn first at Age 4 or Age 5 and a high return of progeny from the large (58,776) spawning run in 2010 was anticipated this year. This does not appear to have been the case. While variable sampling methodologies and small sample sizes do not support statistical analyses, limited sampling data (Table 5) suggest that most of this year's fish were four-year-old offspring of the much smaller (25,142 fish) spawning run of 2011. A full 85% of this year's sampled alewives were progeny of the 2011 run and nearly all (82%) were first time spawners. This would be consistent with the higher than usual number of Age 3 alewives observed in 2014. It will be useful to see if this year class leads to a strong showing of Age 5 fish in 2016.

American shad

American shad (*Alosa sapidissima*) were recorded at the Milltown research trap for the first time since 1999. While this species was present in large numbers in the St. Croix historically, only four shad have entered the river in the last 24 years.

The first three shad entered the trap late on June 12, amid a strong run of river herring, and were counted and released. On scattered dates to June 27, nine additional shad entered the trap for a total of 11 fish. One of these died in the trap and was sampled for fork length, body weight, gonad weight, sexual maturity stage, scale age and previous spawning record. The remaining fish were live sampled for fork length and scales (to provide age and previous spawning record) and released. Table 4c contains these sampling data.

Literature suggests that up to 3% of American shad may stray from their home river and there is a strong possibility that the fish that entered the St. Croix in 2015 were from the large shad populations of the Saint John River or Annapolis River further up the Bay of Fundy. Rivers nearer to the St. Croix that once had historic shad runs are not known to have current populations.

The St. Croix does have spawning habitat to support this species. It will be interesting to see if additional shad enter the river in the coming years.

American eel

The St. Croix supports an active American eel (*Anguilla rostrata*) population and significant commercial fishery for juvenile eels on the Maine shore.

Inbound juvenile eels (elvers) can pass through the research trap's 1-inch mesh unimpeded and are therefore rarely recorded. However on June 16, the fishway was drained for four hours to allow for head pond maintenance and large numbers of elvers were observed on the still-wetted floors of the fishway pools prior to the fishway being reflooded. Additionally, two adult eels were recorded in the trap in 2015.

Sea lamprey

One sea lamprey (*Petromyzon marinus)* was recorded at the trap, on June 18. This was attached to an inbound river herring.

Atlantic salmon

Wild Atlantic salmon (*Salmo salar*) have not been recorded at the Milltown trap since 2006.

Freshwater species

Other fish encountered in the Milltown trap during the monitoring period are counted and immediately released upstream, unharmed, unless fisheries agencies specify their removal as exotics.

In 2015, four freshwater fish species were recorded in small numbers (Table 1). These were all assumed to have passed over the dam spillway or through open gates and returned up the fish ladder after encountering brackish water.

Additional studies

Fish health testing

On request, the Commission collected 60 river herring from the Milltown trap on June 1 and express shipped these to the U.S. Fish & Wildlife Service's Northeast Fish Health Center in Lamar, PA for fish health testing.

The USFWS conducted standardized tests for seven major pathogens: furunculosis, Enteric Red Mouth Disease (ERM), Infectious Hematopoetic Necrosis (IHN), Infectious Pancreatic Necrosis (IPN), Infectious Salmon Anemia (ISA), *Oncorhynchus masou* virus (OMV) and Viral Hemorrhagic Septicemia (VHS). No bacterial or viral pathogens were detected in any of the fish sampled.

River herring tracking studies

Two complementary studies are being conducted in 2015 to track river herring on their spawning migration into and out of the St. Croix watershed.

In an extension of a 2014 study, on June 6-9 the Atlantic Salmon Federation implanted 29 river herring taken from the Milltown research trap with acoustic tags and released these 1km upstream. ASF subsequently tracked their movements with receivers located throughout the watershed and in the upper estuary into mid-August.

On June 5, the Pleasant Point Passamaquoddy Tribe Environmental Department implanted 30 river herring collected immediately below the Milltown fishway with acoustic tags and released these on site. The fish were subsequently tracked by the ASF receivers and additional receivers beyond the St. Croix estuary and into the Bay of Fundy.

The findings of these studies are in the very preliminary stages of analysis but it does appear that, similar to 2014, one of the tagged fish migrated upstream into Grand Falls Flowage, roughly 30 km above head-of-tide.

Additional information will be available from the Atlantic Salmon Federation and the Pleasant Point Passamaquoddy Tribe Environmental Department at a later date.

Public information

Weekly reports of the Milltown river herring count were issued to 94 individuals and organizations by email and to others by phone, from mid May to early July. Additional requests for general or technical information on St. Croix river herring were answered on a regular basis.

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