



St. Croix International Waterway Commission



Final Report

March 20, 2020

Anadromous Fish Counts at Milltown Dam Project 2019

International Joint Commission & International St. Croix River Watershed Board
(P2000076)

New Brunswick Wildlife Trust Fund (F309-143)

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SUPPORTING ALEWIFE RESTORATION IN THE ST. CROIX WATERSHED ANADROMOUS FISH COUNTS AT MILLTOWN DAM PROJECT

Anadromous Fish Counts at Milltown Dam Project Overview:

3-Year Project (2018, 2019, 2020)

This project will enumerate all anadromous fish entering the St. Croix River at the lowermost (Milltown) dam. The project forms the basis for measuring progress of current international efforts to restore sea-run alewife, blueback herring and American shad to the watershed, as well as plays an important role in supporting and validating recent alewife population dynamics models being developed to support alewife restoration planning.

Process:

The Milltown research trap is operated for an 8 to 12-week period each year to record the run of alewives (or gaspereau) and closely related blueback herring, collectively called river herring. Other fish entering the trap are also documented.

The research trap and fishway will be opened and activated by NB Power in April each year and the trap will be monitored by daily. The trap was emptied each morning and fish will be hand counted until the run exceeded 1000 fish recorded per hour; at such point, the fish trap will be left open and the fish will be counted on ten-minute intervals each half hour during times of heavy run and the trap will be closed each evening.

Weekly trap reports were issued Thursdays following the final trap check each Wednesday evening.

The project will provide these counts and other biological data to agencies, legislators, and involved parties to support evolving restoration plans.

Key Contacts:

International Joint Commission and the International St. Croix River Watershed Board

Project Authority: Robert Phillips, IJC
Agency Representative: Pierre-Yves Caux, IJC
Sean Ledwin, St. Croix Board Member,
US. Director of Sea Run Fisheries & Habitat Division
Jessie Davies, St. Croix Board Member, Canada

New Brunswick Wildlife Trust Fund

Project Authority: Claire Caron, New Brunswick Wildlife Council

NB Power, Milltown Dam

Site Contact: Jeff Babcock

Funding:

Budgeted Costs	2018	IJC-IWI	\$31,180 CND, plus In-Kind
	2019	IJC-IWI	\$21,900 CND, plus In-Kind
	2020	IJC-IWI	\$21,900 CND, plus In-Kind

Notes:

1. Additional Expense 2018: Fish Counter was purchased instead of borrowed from the Sipayik Environmental Department. The intent was used in conjunction with video counting and hand counting to establish the most effective way to conduct the counts.
2. In 2019, additional funding was identified as being required with the anticipated increase in the fish to be counted. The New Brunswick Wildlife Trust Fund provided an additional \$6,000 CND.
3. In 2020, in response to the fish count again doubling to approximately 1,000,000 and with the decommissioning of the dam, the anticipated budget for 2020 will be \$33,000.



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Items	Details	2018-2020 Budgeted Cost (\$CND)	2018 Actual Costs (\$CND)	2019 Actual Costs (\$CND)	2020 Budgeted Cost (\$CND)
Personnel	Program Administration/Management, Biologists, Technicians	\$53,140	\$15,973.95	\$25,936.55	\$30,000
Equipment	Maintenance/replacement/modification of equipment purchased in 2018, general parts/materials	\$18,110	\$12,233.68	\$33.38	\$2,000
Travel & Meetings	Meetings with US and Canadian agencies, Passamaquoddy Tribe (Sipayik Environmental Department), Peskotomuhkati Nation, etc.	\$1,500	\$32.48	\$1,331.36	\$1,500
General Office		\$1,200	\$286.49	\$728.72	\$500
Total		\$73,950	\$28,450.32	\$28,030.01	\$33,000
IJC-IWI Funded			\$21,380.00	\$21,900	
NBWTF Funded				\$6,000	
SCIWC Funded			\$7,070.32	\$130.01	

Names of Partners

Annual Estimated In-Kind (non-monetary) Contributions – CDN or US \$*

Fisheries and Oceans Canada	\$1,300 CND – in-kind; operating approval, technical advice, license
US Fish and Wildlife Service	\$7,000 USD – in-kind; technical advice
Maine Dept. of Marine Resources	\$2,445 USD– in-kind; fish scale reading and interpretation, technical advice
Passamaquoddy Tribe - Sipayik Environmental Department / Peskotomuhkati Nation	\$500 USD – in-kind; tube counter and related equipment assistance with set-up, technical advice
NB Power	This one is a little harder to quantify in a dollar amount – in-kind; Safety training, 24/7 site access, utilities, staff assistance, location for research building, use of tools/equipment

2019 Activities & Deliverables:

Activity	Description
1. Weekly Reports	Weekly reports on fish count and environmental conditions to the International St. Croix River Watershed Board and the IJC Project Authority, and NB Wildlife Trust Fund.
2. Season- End Report	To include the information on the total fish count, individual species counts, preliminary interpretation, and long-term data summaries to the ISCRWB, ICJ and NBWTF.
3. Public Communication	Send communications to the public to raise awareness and promote the project and its results. Includes social media, bulk emails and weekly updates Creating and maintaining a section of the SCIWC website, under `What We Do`, as section called `Scientific Data Collection Programs`, in which collected data is made available for public use. Develop a community engagement plan to promote the work being done in the St. Croix Watershed. Will include the following.



4. Final Report

- a. Overview of the project
- b. Results for 2019 and comparison to previous years
- c. Details on the count methods used
 - i. ID and overview of each method used
 - ii. Rational for method used
 - iii. Methodology & protocols
 - iv. Design & specifications of alternative / prototype method tested
 - v. Comparison between the results in methods
 - vi. Evaluation of successes, challenges and lessons learned
 - vii. Suggestions and rationale for modification to methods used or for alternative methods to test in the future
- d. Spreadsheets of collected data
- e. Potential applicability of methods used to other locations
- f. Recommendations for fish counts 2020
- g. Images and data visualization
- h. Copy of the community engagement plan

5. Forwarding Reports to Other Stakeholders: As per consultation with IJC, ISCRWB and NBWTF.

Results for 2019 and Discussions:

Summary

Anadromous fish are fish that migrate up rivers from the sea to spawn and include species such as salmon and river herring. Anadromous fish herring have been entering the St. Croix River and pass through up to the four (4) dam systems, equipped with fish passageways, to reach their spawning habitat. The first dam in the fish upstream passage is the Milltown Hydro Power Station (Milltown Dam), then the Woodland Pulp (Woodland Dam), followed by Grand Falls Dam and ending at Vanceboro Dam.

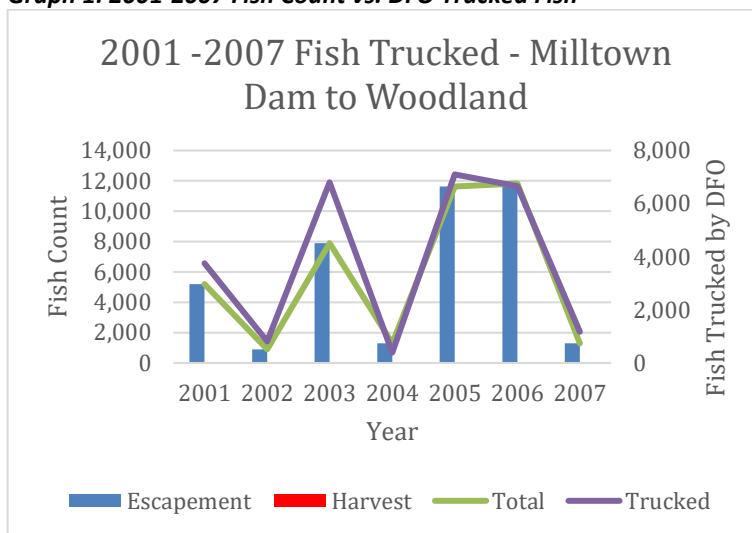
Fish passage in the St. Croix River was limited during the period of 1995 – 2013 when the upstream fishways at two dams, Woodland and Grand Falls, were blocked and prevented passage of the spawning river herring. The Woodland Dam fishway barrier was removed in 2008 and the Grand Falls Dam fishway barrier was removed in 2013, allowing river herring access the upper watershed.

In response to the decrease in anadromous fish noted in the St. Croix River, in 2001 the Department of Fisheries & Oceans Canada began to truck a portion of the spawning run from Milltown to Woodland Flowage.

Table 1: Fish Count Trucked by DFO to Woodland

Year	Total Fish Count Milltown Dam	No of river herring transported by truck to Woodland:
2001	5,202	3,756
2002	900	807
2003	7,901	6,805
2004	1,299	392
2005	11,632	7,100
2006	11,829	6,653
2007	1,294	1,169
Total	40,057	26,682

Graph 1: 2001-2007 Fish Count vs. DFO Trucked Fish





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The fish count process has been underway at a research trap at the NB Power Milltown Hydro Power Station (Milltown Dam) fishway. 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). The SCIWC has worked closely with NB Power, who has provided annual safety training and access to the facilities to conduct the counts.

Beginning in 1981 the fish count has been completed as follows:

1981 1990 - Department of Fisheries & Oceans Canada (DFO)
1991 – 2011 - St. Croix International Waterway Commission
2012 – 2014 - Atlantic Salmon Federation (2012-2014)
2015 – 2019 - St. Croix International Waterway Commission

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 [alewives or gaspereau (*Alosa pseudoharengus*) and blueback herring (*Alosa aestivalis*)]. Beginning in 2007 and continuing to the present, the counting facility was operational from May - July and primarily focused on documenting the annual river herring run.

As in prior years, in 2019 the St. Croix International Waterway Commission operated the Milltown research trap and collected relevant data under agreements, licenses and partnerships with Canadian Department of Fisheries & Oceans, NB Power, US Fish & Wildlife Service (USFWS), the International Joint Commission (IJC), Atlantic Salmon Federation, Maine Department of Marine Resources (DMR), and Sipayik Environmental Department. These partnerships were essential to the successful completion of the fish count process.

2019 Milltown Fishway Trap Operation & Methodology

On April 15, 2019, the staff at NB Power prepared and activated the Milltown fishway and the research trap was activated on May 1, 2019, allowing staff of the SCIWC to enter the facility and collect the fish passage data. The fish count was conducted from May 1 – July 21, until such time as it was presumed end of the river herring run and the research trap was lifted out of the fishway. The fish run is considered to end when there are three consecutive days with no fish in the fish trap. NB Power continues to operate the fishway until mid-November, as required by federal agreement, but with no further fish observed and counted.

In 2018, NB Power purchased and installed the Gas Infusion System (GIS) and in 2019 the GIS was operated throughout the season. The maintenance, operation and security of the GIS was conducted by the staff of NB Power. The goal of the GIS is to supersaturate the water with oxygen, and to see if this supersaturated water would help in attracting river herring up the fish ladder. As this is a new technology to the SCIWC, in July the staff of the Commission arranged a Gas Infusion System (GIS) Information Session at the Huntsman Marine Science Centre, hosted by Dr. Mike Beatie, followed by a tour of Huntsman Ocean Sciences by Chris Bridger.

At the peak of the fish run, staff of SCIWC were present at the research trap from as early as 7 am AST to 10:30 pm AST. This was possible through the recruiting of University of Maine and University of New Brunswick students in the Biology, Forestry, and Environmental Management programs. These employees assisted our Lead Biologist in ensuring the research trap was adequately staffed to collect the data. After mandatory safety training, the staff were required to record all fish species captured in the trap and had access to the research hut provided by NB Power for our exclusive use.

During the start of the monitoring season, spring river flows exceeded 10,000 cubic feet per second (cfs) and hit a peak of 13,100 on May 1. Due to the configuration of the Milltown dam and fishway, river flows greater than 5000 cfs significantly limit attraction and effective operation of the fishway. River flows remained above 5000 cfs until May 10, when the flow had dropped to 4070 cfs. During the first 9 days, high water levels caused the lower portion of the fishway to be submerged and created a large amount of turbulence, preventing any fishway attraction. The hydroelectric turbine adjacent to the fishway was turned off during the fish run, from 8 am AST to 8 pm AST, to prevent turbulence which could confuse the fish during their migration upriver.

The fish count was conducted using two methods: hand counting and clicker counting. Until the run increased to several thousand a day, all fish entering the research trap were individually hand netted and counted to ensure a complete record before they were released upstream. When the number of fish reached 5000 or more a day the trap was left open and fish entering the research trap were counted using clickers as they passed over a white board installed in the fish way. This method of counting was conducted in 10-minute intervals, every 30 minutes, and the total number of fish was extrapolated by multiplying the 10-minute count by 3 and results recorded.



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2019 Results

2019 registered a dramatic increase in the number of river herring counted at the Milltown Dam, and included the identification of several other species as well. Below is a summary of the species counted and the corresponding counts from 2017 – 2019.

Table 2 Fish Species Identified at Milltown

Species	Scientific Name	2017 Apr 26 – Jul 21	2018 May 8 - Jul 16	2019 May 1 – Jul 21
River herring: alewife & blueback	<i>Alosa pseudoharengus</i> & <i>A. aestivalis</i>	157,750	270,659	480,500
American Eel	<i>Anguilla rostrata</i>	5		4
American shad	<i>Alosa sapidissima</i>	56	255	29
Brook trout	<i>Salvelinus fontinalis</i>	2	3	5
Common shiner	<i>Luxilus cornutus</i>	2	1	
Fallfish	<i>Semotilus corporalis</i>		2	1
Golden shiner	<i>Notemigonus crysoleucas</i>	3		
Lamprey	<i>Petromyzon marinus</i>	8		
Pumpkinseed sunfish	<i>Lepomis gibbosus</i>			1
Rainbow smelt	<i>Osmerus mordax</i>	1		
Smallmouth bass	<i>Micropterus dolomieu</i>	45	23	6
Sunfish	<i>Lepomis auratus</i>	1		
White sucker	<i>Catostomus commersonii</i>	94	87	43
Total		157,967	271,030	480,589
	% Increase from prior year		71.5% ↑	77.3% ↑

River Herring

The 2019 run of 486,500 river herring was the largest seen since 1996 (645,978).

The first river herring was recorded in the trap on May 6, 2019. The first strong run with over 1000 fish was on May 26 (23,818 fish). The fish run remained strong until late June, with the largest run taking place on June 4 when 73,291 fish were recorded in a single day.

A total of 486,500 river herring were recorded at the Milltown trap in 2019, a large increase (77.3%) from the 270,659 recorded in 2018, which represented an increase (71.5%) from the 157,750-river herring counted in 2017. The table below demonstrates the decade average of river herring counted and can be noted that the 10-yr average is still significantly lower when compared to the 1981-1990 average count.

Table 3: 10-Yr Comparison of Average Fish Counted/Decade

Decade	Decade Average Count	Inc / Dec from 81-90	Inc / Dec from Prior Decade
1981 to 1990	1,097,275	--	--
1991 to 2000	279,533	-74.5% ↓	-74.5% ↓
2001 to 2010	12,191	-98.9% ↓	-95.6% ↓
2011 to 2019 (9 years)	127,414	-88.4% ↓	+945.1% ↑

Other species

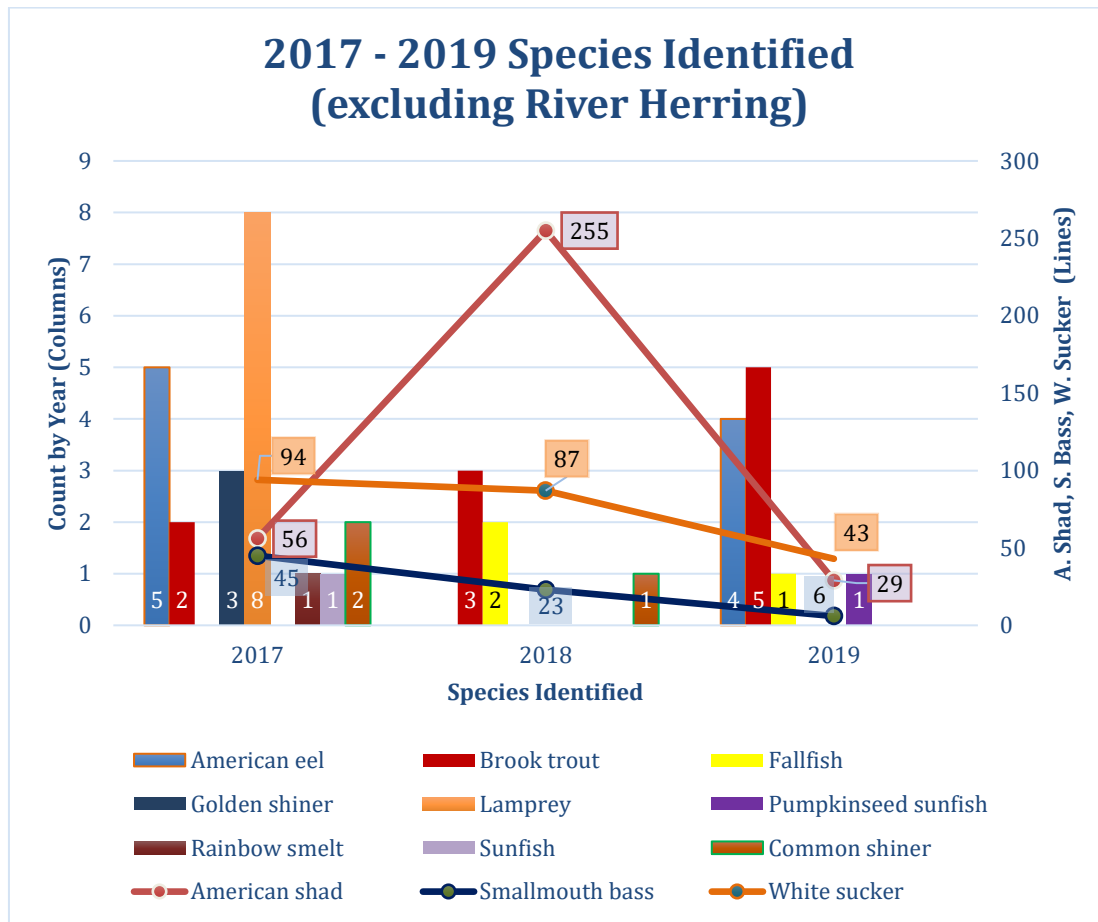
Other fish captured in the Milltown trap during the monitoring period are counted and immediately released upstream, unharmed, unless fisheries agencies specify their removal as exotics.

In 2019, five freshwater fish species were recorded in small numbers; these are all assumed to have passed over the dam spillway or through open gates and returned up the fish ladder after encountering brackish water. One catadromous species (American eel) and one other anadromous species (American shad) were also recorded.



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Graph 2 Species Identified



American shad

29 American shad (*Alosa sapidissima*) were seen and recorded in 2019. On days in which the fish run exceeded 5000 fish the trap was left open and fish were counted in ten-minute intervals every half hour between 0700h and the end of the daily run, with the total number of river herring extrapolated from these observations. Only shad that were seen passing through the fishway were counted, so it is assumed more than 29 shad passed through the fishway in 2019. There were 255 shad in 2018, and 56 shad in 2017. No shad were recorded in 2016. In 2015 eleven shad were recorded in the fish trap after appearing in the St. Croix for the first time since 1999.

American eel

The St. Croix supports an active American eel (*Anguilla rostrata*) population and significant commercial fishery for juvenile eels on the Maine shore. Four American eels were recorded during the 2019 fish count. No American eels were recorded in the trap in 2018.

Inbound juvenile eels (elvers) can pass through the research trap's 1-inch mesh unimpeded and are therefore rarely recorded.

Atlantic salmon

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

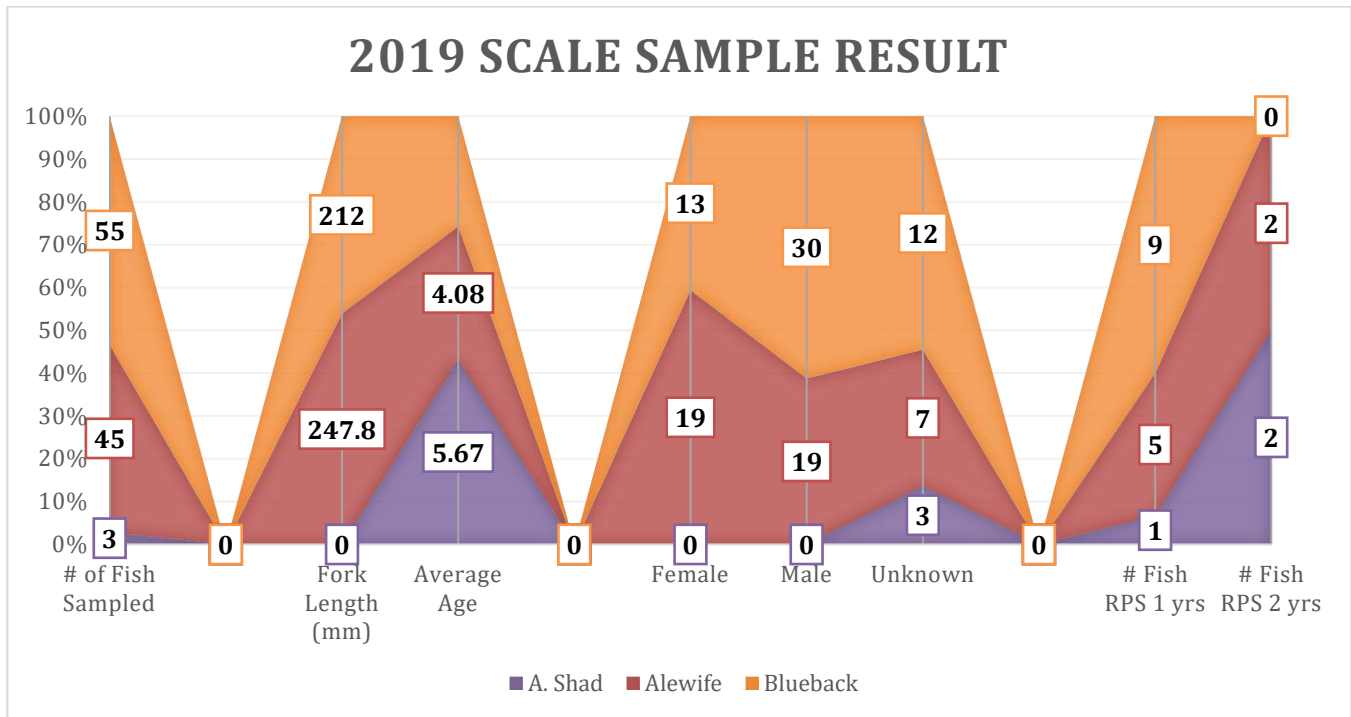
Additional studies

Scale Studies

100 river herring and three (3) American shad were sampled by SCIWC staff for the purpose of scale aging by Maine DMR. Most scales were taken from live samples. More than half of the fish sampled were blueback herring. Repeat spawning rates and age structure were on the low side compared to adjacent commercial and non-commercial runs.



Graph 3: Scale Sampling



Moving Forward

2020 is expected to experience the continued increase in fish count as has been experienced since 2017. Click and hand counting will continue, with the fish trap being monitored regularly, with increased hours during the peak run. Rebecca Goreham, BSc, Lead Biologist, will continue to oversee the project and will be assisted this year by a Student in Environmental Studies or Marine Biology to assist with the scheduling, reporting and fish count.

2020 Options:

Video Counting - Consultation with a SimCorp, Sweeney International Marine Corp., the equipment required to effectively count fish passing through the fish trap would be too large for the space and they are expensive.

Tube Counter - With approval from DFO and NB Power, we intend to install the tube counter demonstrated at the Une 2019 IJC-IWI meeting to test while the fish count is low, to ensure the safety and freedom of fish passage.

Other Studies

PIT Tagging - The Passamaquoddy Sipayik Environmental Department had previously been PIT Tagging fish at the dam and had readers installed to track the fish that were passing through the dam. Their funding ceased and they were not able to continue the project last year. We propose to continue in their absence, as we have the staff already trained and the Peskotomuhkati Nation will loan us the readers.

Electrofishing and e-DNA Testing - As a means to identify the other species in the river, in addition to the visual identification.

Scale Sampling - Expand the current process of scale sampling to include other species that the river herring and limited American Shad. We propose to work with PROFESSORS from UNB in conjunction with his current studies.

Employment Enrichment - we have contacted various groups and have already identified a few that that agree to providing our students with activities to enrich and enhance their employment with SCIWC in topics relevant to their area of study. Moosehorn National Wildlife Refuge, Peskotomuhkati Nation and Passamaquoddy Tribe, and SIMCorp have agreed to allow our students to participate, as appropriate, in the various projects they will undertake in 2020. Other opportunities for training and development include tours of laboratories for demonstrations and lectures on the process conducted, participation in the testing of the scale samples, NB Power Milltown Dam Decommissioning Project and the remodeling of the fish ladder, and working with UNB Professor Kurt Samways with his scale sampling



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and testing, as they relate to his Bay of Fundy Salmon Recovery Project and Salmon Restoration outside of the Bay of Fundy.

Data Bank of Historical Documents and Maps – the SCIWC has a collection of historical studies and documents collected and organized since our inception in 1986. This includes an original hard cover copy of the IJC 1918 Annual Report and various other studies, texts and reports. Additionally, we have over 600 maps that have been in storage at our St. Croix office that represent period from the 1950 – 1990s and for various counties in New Brunswick. These maps have been looked at by local historians, a professional archivist and a local service commission. Based on their initial assessment, we have been advised that the maps, although may have little monetary value, have the potential to provide some historical environmental context, especially as it relates to forestry. In order to assess the value of the contents of our library and map collection, the process of cataloguing the 1000+ documents/texts and 600+ maps must first be undertaken, with the end goal of making these documents available to the public.

Youth Engagement Program Development – We have staff and Commissioners that are very interested in developing a Youth Engagement Program that can be provided to the middle school students in Charlotte County, like the programs in Calais, ME for all grade 5 students. In 2019, we worked with The Washington County Community College and former teacher, Donna Muir to discuss the project and have identified staff hires and an initial process to develop the program. The program would introduce students to various aspects of the St. Croix River, including water quality sampling, outdoor adventures, and events like a nature scavenger hunt.

Public information

In addition to the weekly email distribution of a Milltown River Herring Count newsletter to 130 individuals and organizations, the SCIWC has undertaken to develop a community engagement culture within the organization. This includes staff accessing relevant training and development opportunities, attending social events, participation in industry activities, and meeting stakeholders. The foundation of this process began with the hiring process. To follow we are proud to introduce you to our staff, the hiring process and a brief list of the activities attended.

This past year and continuing into 2020, concentrated efforts were made to update our website (which was launched in March 2020) and engage in the social media arena with updates in Facebook, Twitter and Instagram. Staff championed each venue and kept the pages active during the summer.

Our People

2019 was a pivotal year for the St. Croix International Waterway Commission, its board and staff. Previous Executive Directors managed the administration and conducted the field work and it was recognized that additional personnel and skill sets were required. In November 2018, a new Executive Director was hired with an administrative and risk management background. The primary focus for 2019 was to ensure that each of the various programs were successfully implemented and the first step in this was hiring competent, eager and committed individuals focused on achieving the desired results. This required increasing our seasonal staffing from 8 to 11 employees.

In building the Management Team, a Program Coordinator, Gloria Tinker, was hired to assist the Executive Director in the day-to-day management of staff and programs. Current employees accepted leadership roles as Lead Biologist, Rebecca Goreham, and Heritage River Recreation Supervisor, Gareth Whittingham. These were new positions for each of these team members and their first leadership role.

The additional staff were recruitment from the following regional educational facilities:

1. University of Maine and Machias Campus, Wildlife and Marine Biology Department
2. University of New Brunswick
 - a. Environmental Management Department, and
 - b. Forestry Science Department
 - c. Washington County Community College, Business Management.
 - d. Calais High School and St. Stephen High School

In addition to our two Park Hosts for the Heritage River Recreation Program that returned for their third year with the SCIWC, we were fortunate and successful in hiring from the schools above.

Allow me to introduce you to the 2019 SCIWC Staff that participated in your project (in alphabetical order) with the short bios they provided. They each deserve a great deal of praise and respect for their efforts and willingness to assist in the various programs, thereby making 2019 a successful year:



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- **Cameron Solda**, Field Technician & Heritage River Recreation Staff.

"I was born in Hamilton, Ontario, but I spent all my summers in Southwestern NB fishing, kayaking, and enjoying the outdoors.

I am studying water sciences at UNB Fredericton, Environmental Management and this Fall 2019 I will be in my fourth year. With my degree I aspire to work with fish and preserve their habitats.

I have been involved with many maintenance projects along the St. Croix River such as Fish Count at Milltown dam, tagging fish at Moosehorn, and paddling the river weekly to maintain the sites. My favorite part of was assisting with the fish projects SCIWC is a part of. This was a great experience and I gained a plethora of skills and knowledge."

- **Dylan Eggleton**, Field Technician & Heritage River Recreation Staff

"I was originally born and raised in Stoney Creek, Ontario. Grew up with a passion for the outdoors, camping, fishing, and being outside are some of my favorite past times. I later moved to NB to pursue a career and life in the woods of NB, a place I've wanted to call home since a young age.

I have received my diploma as a forestry technician from Fleming College in Lindsay, Ontario. I am currently finishing my Bachelor of Science in Forestry and will be graduating in December 2019.

I have had the pleasure acting as a steward of the St. Croix River. Preserving the cultural heritage, recreational values, and environmental values has been a great joy."

- **Elizabeth Hyslop, BBA, FCIP**, Executive Director

"Prior to moving from Saint John to St. Stephen and accepting this position in November 2018, I had a dynamic prosperous 25-year career in insurance and risk management. The experience in finance, risk mitigation, administration and human resources, combined with a long history of social engagement and volunteering, have proved to be a great asset in my position with the SCIWC. I have had tremendous support from the Board of Directors, our Program Funders and our staff as I settled into and defined my role. Unlike the staff, I did not grow up in the outdoors It has been an absolute pleasure to learn and grow in this organization."

- **Emily Ruttan**, Field Technician & Heritage River Recreation Staff

"I was born and raised in Saint John, NB. I grew up spending a lot of my childhood on the shores of the Bay of Fundy and along the St. John River, and fell in love with water. I am currently a student at UNB Fredericton majoring in water management.

My time at the St. Croix International Waterway Commission has introduced me to the beauty of the St. Croix Watershed from the St. Croix River to Spednic and East Grand Lake. This has also given me an opportunity to be a part of a historic Alewife count at the Milltown Dam. Working here has also given me the chance to explore Maine and New Brunswick and they have to offer. "

- **Gareth Whittingham, BA**, Heritage River Recreation Supervisor

I was born and raised in St. Stephen, NB. My parents ran the Loon Bay Lodge for numerous years which allowed me to grow up paddling the St. Croix River. I spent many hours on the river and continue to do so even now by working for St. Croix International Waterway Commission.

I graduated from St. Stephen High School in 2008. I then choose to attend St. Francis Xavier University and took Human Kinetics for three years and graduated from the University of New Brunswick with my Bachelor of Arts in Psychology.

I have been with SCIWC for six years with this last year becoming the Heritage River Supervisor. I have also assisted with other programs such as the Fish Count. Working for SCIWC has allowed me to continue paddling the river I grew up on, as well as gaining experience in leadership roles and assisting in other interesting programs.

- **Gloria Tinker**, Program Coordinator

"I was born and raised in California and have now lived in the East Coast for 9 years as of 2020. Since moving I have learned to truly enjoy the outdoors and embrace the beauty around me, which is why SCIWC is such a great fit.

In 2019 I obtained my Associated Degree in Business Management from Washington County Community College where I obtained much reignition for my academics. I was inducted into the Phi Theta Kappa Honor Society, became part of the All-Star ME Academic Team, and was a strong leader within my two years at WCCC. I am currently continuing my



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journey to obtain my bachelor's degree from University of ME of Augusta in Business Administration with a minor in Accounting.

Being part of St. Croix International Waterway has given me the opportunity to gain hands on training in my field while also allowing me to enjoy the beautiful St. Croix River and its surroundings. SCIWC has offered not just professional growth, but personal as well."

- **Isaiah Chevrier**, Anadromous Fish Tagging Technician

"I grew up in Eastport, ME. I grew up fishing and hunting within the area with my grandfather which turned into a big part of my life and helped steer me into my field of studies. I am currently attending school at the University of Maine in Machias for Wildlife and Marine Biology. I will be completing my program in 2020 and hopefully gain a position in this field.

I am very grateful to have gotten to work at St. Croix International Waterway Commission over the summer because it pertained perfectly to my major as well as expanded my knowledge. I was able to gain additional hands on training by being allowed to work the fish count and PIT tagging which I had never done before. Working for SCIWC was a very worthwhile experience"

- **Rebecca Goreham, BSc**, Lead Biologist

"I grew up in the small fishing village of Woods Harbour Nova Scotia and have a lifelong passion for nature. I have dedicated my life to learning as much as possible about the natural world, beginning with receiving my BSc in biology from Saint Mary's University in Halifax NS. In 2009 I moved to Charlotte County and have worked on various projects at DFO, Huntsman, and SCIWC. I'm especially fond of birds, fish, insects, and spiders."

- **Xochitlquetzal Rodriquez**, Heritage River Recreation Staff

"Since I have found my interest in Marine Biology, I am going to the University of Maine Machias (2019-2020) to take their four-year Marine Biology program. I have recently graduated from High School, so this will be my first year in University and I am beyond excited to start this new chapter in my life.

Working with SCIWC has been amazing. Since I have worked with this organization, I have learned to canoe, take water samples, gather fishing data, tag birds and learn to better communicate with people. SCIWC is an amazing summer job, you learn how to do amazing things. Not only does this job teach you how to do things, but your co-workers also teach you things along the way."

Social Engagement

2019 has been a very busy year for our executive director and staff. To promote the activities of the SCIWC, we concentrated on finding ways each month to interact with others in our communities and bring awareness to the organization and its funders. In addition to the various activities and events attended, the Executive Director has become a board member of the St. Stephen Area Chamber of Commerce and a member of the WCCC Adventure Recreation and Tourism Advisory Committee.

To follow is a snapshot of the community engagement activities we attended or participated in during 2019.



St. Croix International Waterway Commission

Table 4: Community Engagement Activities

January	Executive Director accepted as Board Member for the St. Stephen Area Chamber of Commerce (St. Stephen, NB)
February	Eastern Charlotte Waterway Coffee Meeting to discuss joint interests (Calais, ME) Water to Web Workshop, Water Quality Data Management Protocols (Fredericton, NB)
March	2019 Maine Sustainability & Water 2-Day Conference (Augusta, ME) - Attended and made a presentation on our data collection at the Milltown Dam Annual meeting with the St. Croix Stewardship Foundation on the Heritage River Recreation Program (Bangor, ME)
April	Meeting with Department of Energy & Resource Development on the Heritage River Recreation Program (Fredericton, NB)
May	WCCC Adventure Recreation and Tourism Advisory Committee Mtg (Calais, ME) St. Stephen Area Chamber of Commerce - Board Meeting (St. Stephen, NB)
June	IJC - IWI Partners Meeting (St. Stephen, NB) WorkSafe NB 1/2 Day Information Session (St. Stephen, NB) St. Stephen Area Chamber of Commerce - Board Meeting (St. Stephen, NB)
July	Meet Your Neighbor Men's Club meeting on Project Grand Falls (Calais, ME)
August	International Homecoming Festival 2019 (Calais & St. Stephen) - Summer students were members of the Organization Committee for the Hands Across the Border Opening Ceremony, Organized & delivered kid's event - the St. Croix Little Detectives Scavenger Hunt, entered a float in the parade and our 2 members of the Organizing Committee lead the parade. The Passamaquoddy Canoe "Morning Salute" (St. Croix Island) Southwest NB Service Commission discussion on recreation opportunities in the region (St. Stephen, NB)
September	Saint John River 2-Day Summit: Celebrating the International Year of the Salmon (Sussex, NB) St. Stephen Business Improvement Area Inc. Annual Meeting (St. Stephen, NB) Breakfast with Premier Hon. Blaine Higgs & Caucus. Topic: Setting Priorities (St. Stephen, NB) Presentation on 'What is the SCIWC' to the St. Stephen Rotary Club by staff (St. Stephen, NB)
October	Environmental Trust Fund Information Session (Fredericton, NB) Eco Canada, Environmental Professionals Networking Event (Halifax, NS) Maine Revenue Services Tax Symposium (Bangor, ME) St. Stephen Area Chamber of Commerce Annual Business Gala (St. Stephen, NB)
November	St. Stephen Area Chamber of Commerce - Board Meeting (St. Stephen, NB)
December	St. Croix Valley Chamber of Commerce Annual Meeting & Awards Event (Calais, ME) International St. Croix River Watershed Board Meeting (Bangor, ME) Christmas Business Networking Mixer (St. Stephen Area Chamber of Commerce) (St. Stephen, NB)



St. Croix International Waterway Commission

St. Croix International Waterway Commission Additional Projects:

Water Quality Monitoring Project

In 2019, the St. Croix International Waterway Commission (SCIWC) received funding from the New Brunswick Environmental Trust Fund (ETF) to conduct water quality monitoring in the St. Croix Watershed, and from the Atlantic Water Network to upload our water quality dataset, and they loaned and calibrated the equipment utilized in the project.

Sampling was conducted following the Province of NB Department of Environment and Local Government Guidelines for River Sample Collection and Lab Submissions for Watershed Groups in NB. Samples were submitted to RPC Fredericton. In 2017, 35 samples were collected, 20 in 2018, and we exceeded our 2019 goal of 35 samples collected by collecting 43 samples from the predesignated sample list. The collection period in 2019 was increased to June to October.

Sampling conducted using a Professional Plus series YSI borrowed from Atlantic Water Network's equipment bank to collect measurements of pH, conductivity, temperature, dissolved oxygen (DO), total dissolved solids (TDS) and salinity.

Surface water samples were also collected and analyzed at the RPC lab in Fredericton for surface water chemistry, surface water metals, total suspended solids, and *E. coli*.

Results were posted in the www.atlanticdatastream.ca, thereby making our dataset available to the public.

Sample results were compared to the Canadian Council of Ministers of the Environment (CCME) www.ccme.ca Canadian Environmental Quality Guidelines (CEQG) for the protection of Aquatic Life. To follow is a sample of the data collected.

Table 5: Water Quality 2019 Sampled Sites

Site Name	Latitude	Longitude	Sampled Date
Monument Brook 2	45.86461	-67.78998	3-Jul-19
Monument Brook 1A	45.85179	-67.78936	3-Jul-19
Mouth of Monument Brook	45.83331	-67.76533	3-Jul-19
Canoose Stream	45.37498	-67.38769	20-Aug-19
Forest City	45.66575	-67.73325	30-Sep-19
Diggity Stream	45.6175	-67.42683	25-Jul-19
Dennis Stream	45.1927	-67.25813	16-Jul-19
Dennis Stream 2	45.20901	-67.26204	25-Jun-19
Dennis Stream 3	45.29275	-67.27201	25-Jun-19
Billy Weston Brook 1C	45.20488	-67.27175	16-Oct-19
Billy Weston Brook 1A	45.20336	-67.27588	5-Sep-19
Billy Weston Brook 1B	45.204	-67.27301	5-Sep-19
Elm Street Nature Trail	45.20267	-67.28635	16-Jul-19
Tan House	45.19216	-67.26926	12-Jun-19
Scott Brook	45.48986	-67.50251	17-Jun-19
Gleasons Point	45.33981	-67.43366	20-Aug-19
Mohannes Stream	45.1598	-67.33851	10-Jul-19
Upper Mills Road	45.13366	-67.32258	10-Jul-19
Woodland Dam	45.15482	-67.39282	2-Oct-19
Vanceboro Dam/Bridge	45.56844	-67.42872	25-Jul-19
Waweig	45.24985	-67.1331	17-Jun-19
Pout Brook	45.24425	-67.15408	17-Jun-19
Pottery Creek	45.07869	-67.06964	12-Jun-19
Goldsmith Brook	45.20316	-67.12258	24-Jul-19
Milltown Boat launch	45.16978	-67.29886	10-Jul-19
Milltown Boat launch	45.16978	-67.29886	12-Jun-19
Milltown Boat launch	45.16978	-67.29886	5-Sep-19
Milltown Boat launch	45.16978	-67.29886	30-Sep-19
Oak Bay Campground	45.22794	-67.18784	25-Jun-19
Hays Brook	45.84023	-67.73961	9-Oct-19
Todds Point	45.17269	-67.16133	24-Jul-19
Goldsmith Stream 1	45.20525	-67.1393	24-Jul-19
East Grand Lake	45.7157	-67.80356	14-Aug-19
East Grand Border Bridge	45.81633	-67.78042	14-Aug-19
East Grand Border Bridge	45.81633	-67.78042	16-Sep-19
New Canoose Site	45.37406	-67.35906	20-Aug-19
Trout Brook	45.83117	-67.72563	16-Sep-19
Mud Lake Falls	45.6878	-67.72672	30-Sep-19
Woodland 2	45.16678	-67.40494	2-Oct-19
Woodland	45.1629	-67.40578	2-Oct-19
Meadow Brook	45.18699	-67.20426	16-Jul-19
St. Stephen Wharf	45.19171	-67.27608	16-Oct-19
East Grand Stn 3	45.681268	-	14-Aug-19
		67.784598	



St. Croix International Waterway Commission

Table 7: Water Quality 2019 CCME Water Quality

Calculator

Site Name	Site Code	WQI Category
Billy Weston Brook	SC-BILL1A	FAIR
Billy Weston Brook	SC-BILL1B	FAIR
Billy Weston Brook	SC-BILL1C	FAIR
Canoose Stream	SC-CAN2A	GOOD
Canoose Stream	SC-CAN2B	GOOD
Dennis Stream	SC-DEN1	FAIR
Dennis Stream	SC-DEN2	GOOD
Dennis Stream	SC-DEN5	FAIR
Diggity Stream	SC-DIG1	GOOD
East Grand Border Bridge	SC-EGB2	GOOD
East Grand Lake	SC-STN1	GOOD
East Grand Lake	SC-STN3	GOOD
Elm Street Nature Park	SC-BILLELM	FAIR
Forrest City	SC-FC1	EXCELLENT
Gleasons Point	SC-GLEAS	GOOD
Goldsmith Brook	SC-GOLD1	FAIR
Goldsmith Stream	SC-GOLDA1	GOOD
Hays Brook	SC-HAYS	FAIR
Meadow Brook	SC-MEAD	MARGINAL
Milltown Boat Launch	SC-RMTB	FAIR
Mohannes Stream	SC-MOH1	MARGINAL
Monument Brook	SC-MON1	GOOD
Monument Brook	SC-MON1A	GOOD
Monument Brook	SC-MON2	GOOD
Mud Lake Falls	SC-MUD	GOOD
Oak Bay Campground	SC-PARK1	MARGINAL
Pottery Brook	SC-POT1	GOOD
Pout Brook	SC-POUT	FAIR
Scott Brook	SC-RBEAC	GOOD
St Stephen Wharf	SC-WHARF	GOOD
Tanhouse	SC-TAN2	POOR
Todds Point	SC-TODD	POOR
Trout Brook	SC-TROUT	FAIR
Upper Mills Road	SC-MILLS	GOOD
Vanceboro Dam	SC-RVB	GOOD
Waweig	SC-WAW3	GOOD
Woodland Dam	SC-RWOOD	EXCELLENT
Woodland Flowage	SC-WLSTN1	GOOD
Woodland Flowage	SC-WLSTN2	GOOD

Table 6: Water Quality 2019 E. Coli Analysis

Site Name	Date Sampled	E. coli MPN/100mL
Billy Weston Brook	5/Sep/19	193.5
Billy Weston Brook	5/Sep/19	214.3
Billy Weston Brook	16/Oct/19	59.4
Canoose Stream	20/Aug/19	36.4
Canoose Stream	20/Aug/19	70.3
Dennis Stream	25/Jun/19	20.1
Dennis Stream	25/Jun/19	18.5
Dennis Stream	16/Jul/19	52
Diggity Stream	25/Jul/19	14.2
East Grand Border Bridge	16/Sep/19	32.7
East Grand Lake	14/Aug/19	<1
East Grand Lake	14/Aug/19	<1
Elm Street Nature Park	16/Jul/19	50.4
Forest City	30/Sep/19	5.2
Gleasons Point	20/Aug/19	20.3
Goldsmiths Brook	24/Jul/19	5.2
Goldsmiths Stream	24/Jul/19	7.5
Hays Brook	9/Oct/19	148.3
Meadow Brook	16/Jul/19	35.9
Milltown Boat Launch	12/Jun/19	28.5
Milltown Boat Launch	10/Jul/19	30.1
Milltown Boat Launch	5/Sep/19	10.7
Milltown Boat Launch	30/Sep/19	27.5
Mohannes Stream	10/Jul/19	13.4
Monument Brook	3/Jul/19	51.2
Monument Brook	3/Jul/19	23.1
Monument Brook	3/Jul/19	12.2
Mud Lake Stream	30/Sep/19	2
Oak Bay Campground	25/Jun/19	5.2
Pottery Brook	12/Jun/19	238.2
Pout Brook	17/Jun/19	35.9
Scotts Brook	17/Jun/19	4.1
St Stephen Wharf	16/Oct/19	9.8
Tanhouse	12/Jun/19	2,419.60
Todds Point	24/Jul/19	<1
Trout Brook	16/Sep/19	14.6
Upper Mills	10/Jul/19	44.3
Vanceboro Dam	25/Jul/19	5.2
Waweig	17/Jun/19	23.1
Woodland Dam	2/Oct/19	7.4
Woodland Flowage	2/Oct/19	4.1
Woodland Flowage	2/Oct/19	4.1

Table 8: Water Quality 2019 Summary of Parameters

Parameter	Guideline
Aluminum (Al)	< 0.1 mg/L
Ammonia (NH3)	<0.1 mg/L
Arsenic (As)	0.05 mg/L
Cadmium (Cd)	0.000017 mg/L
Calcium (Ca)	up to 100 mg/L
Carbon, Total Organic	1 - 30 mg/L
Chloride (Cl)	< 10mg/L
Chromium (Cr)	0.0089 mg/L
Conductivity (Cond)	10 - 50 uS/cm
Copper (Cu)	< 0.05 mg/L
Fluoride (F)	0 - 2 mg/L
Iron (Fe)	< 0.5 mg/L
Lead (Pb)	0.007 mg/L
Magnesium (Mg)	1 - 100 mg/L
Manganese (Mn)	>0.2 mg/L
Nickel (Ni)	0.025 mg/L
Nitrogen, total Kjeldahl (TKN)	0.1 - 0.5 mg/L

Water Quality 2019 Summary of Parameters Continued

Parameter	Guideline
Oxygen, dissolved (DO)	4 - 10ppm
pH	4 - 9 with 6.0 - 7.5 being the most common in this region
Phosphorus	≤ 0.01 mg/L
Potassium (K)	<10 mg/L, sometimes as high as 20 mg/L
Sodium (Na)	1 - 100,000 mg/L
Total Suspended Solids (TSS)	≤ 25 mg/L
Sulphate (SO4)	5 - 5000 mg/L
Temperature (Temp)	Summer range of 18 - 25°C is common for local surface waters
E. coli	For swimming, a mean of <200MPN for 5 samples, and <400MPN for any one sample



St. Croix International Waterway Commission

USFWS Assessment of Alewife and Blueback Herring Spawning Migration at MNWR

USFWS (United States Fisheries & Wildlife Services) contracted the SCIWC to assess the integrity of the newly renovated fish passages located in MNWR (Moosehorn National Wildlife Refuge) and was related to the IJC-IWI fish count at Milltown Dam.

In 2017 the fish passage structures at Poople, Steeppass, Vose and Denil in Moosehorn National Wildlife Refuge (MNWR), Washington County, Maine were improved, and the St. Croix International Waterway Commission (SCIWC) was contracted (F18AC00020) to implement PIT tag technology to test the efficiency of the new fish passage structures. PIT Tags, Passive Integrated Transponder, are small radio transponders that contain a specific code and can automatically be detected through the antenna and reader systems installed at the fish ways.

The SCIWC and MNWR, in conjunction with US Fish and Wildlife Service (USFWS) worked together to assess upstream and downstream (postspawning) movements of river herring within the Magalloway Stream in Moosehorn NWR, evaluated river herring movements between potential migratory barriers by recording the percentage of fish arriving at each structure, and assessed passage performance of the potential barriers and lastly, to investigate the effects of environmental conditions (temperature flow, etc.) on movements and passage performance.

This investigation follows a significant population increase in river herring recorded at the research trap at Milltown Dam in St. Stephen New Brunswick. This population increase has been a result of restoration efforts on both sides of the border, which includes the opening of fishways at the dams in Woodland (2008) and Grand Falls (2013), allowing river herring to once again return to their spawning grounds.

Plans for 2018 were to tag 400 fish, but due to delays in getting the fyke net on site, only 27 fish received PIT tags. Tagging efforts ceased on June 28, after the water temperature exceeded 19 degrees Celsius and fish were showing signs of stress. The fyke net was removed from the water on June 29, 2019.

In 2019, the fish were tagged at the Denil fish ladder and released (See Photo 3). 465 river herring were tagged with 23mm HDX PIT tags and released between the dates of May 31 and June 7, 2019 with help from Moosehorn staff and interns. Fish were netted, measured, sexed, and a small incision was placed slightly above the pelvic fin between two ribs. PIT tags were inserted through the incision into the intraperitoneal area.

Summary Project Results

Measurements & Sex of the 492 River Herring Tagged in 2018-2019

Sex of Fish Tagged

- 262 (53.25%) of the fish were females,
- 226 (45.93%) of the fish were males, and
- 4 (0.81%) were undetermined.

Average Length

The average length the river herring tagged was 244.78 mm (9.66 inches),

- Females average length was 262.00 mm (9.80 inches),
- Males average length was 241.07 mm (9.49 inches),
- Undetermined average length was 246.33 mm (9.7 inches).

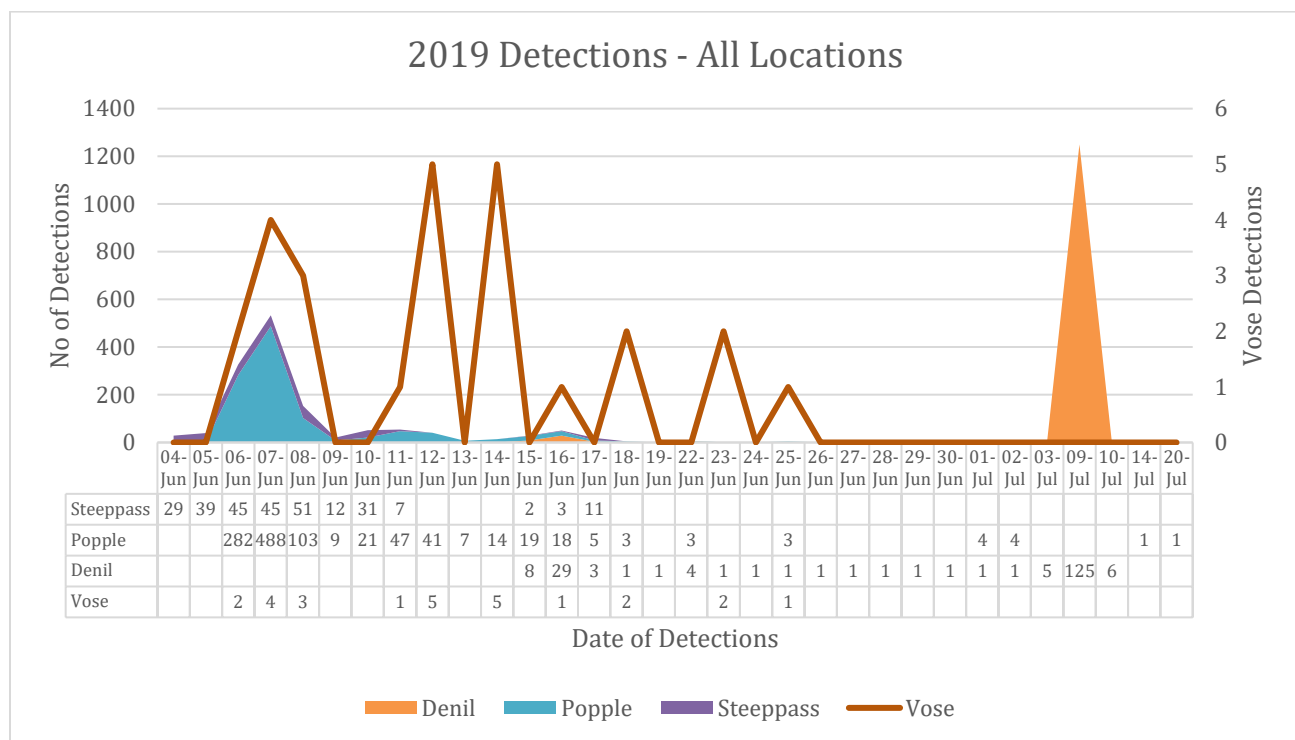
Of the 27 fish tagged in 2018 and the ~700 fish tagged by the Sipayik Environmental Department, five (5) fish were detected passing through antennas at the Denil fishway, and four (4) made it to the Alaskan Steeppass. No fish were detected at Vose or Popple Pond in 2018. This is likely a combination of having few fish tagged, and the fish that were tagged not making it to Vose or Popple.

Of the **465** fish tagged in 2019, we recorded 199 incidents of fish passing the through the antenna (42.8%).



St. Croix International Waterway Commission

Graph 4 Detections of PIT Tagged Fish



Acknowledgements

The St. Croix International Waterway Commission gratefully acknowledges financial support for the 2019 Milltown research program from the International Joint Commission (IJC) and International St. Croix Watershed Initiative (IWI), United States Fish and Wildlife Service (USFWS), Maine's Department of Marine Resources (MDMR). The SCIWC would also like to acknowledge New Brunswick Power (NB Power) and the Department of Fisheries and Oceans (DFO) for their cooperation on this project.

We would also like to acknowledge financial support for this Moosehorn Fish Tagging Program from the United States Department of the Interior, Fish & Wildlife Service; and the staff of the Moosehorn National Wildlife Refuge staff, the Peskotomuhkati Nation, the Atlantic Salmon Federation, and the Sipayik Environmental Department, Passamaquoddy Nation for their willingness to share information and provide guidance. The program financial costs were mitigated thanks to the equipment loaned to the St Croix International Waterway Commission by the Peskotomuhkati Nation and Atlantic Salmon Federation.

Thank you to Cameron, Dale, Dylan, Emily, Gareth, Gloria, Isaiah, Pat, Rebecca and Xochitl for working so tirelessly. To the Commissioners and Liaison's for all their support and guidance.

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Photo Gallery

The cliché is that a picture is worth a thousand words and we are including several pictures of our 2019 season to share with you the those that made this season. It was a season of exploration and growth for each of the individuals that participated.



Photo 1 International Homecoming Festival - Opening Ceremonies

Front - Left to Right: Emily, Gloria, Rebecca, Xochitl

Back – Left to Right: Cameron, Isaiah, Dylan, Gareth, Elizabeth



St. Croix International Waterway Commission

Photo Gallery: Anadromous Fish Count



Photo 2 NB Power Barbeque Hosted for the SCIWC Staff



Photo 3 Hand Counted Fish in the Research Trap



Photo 4 Clicker Counting Fish in the Research Trap



Photo 5: Fish swimming past the whiteboard



Photo 6 Attempting to install video counter



Photo 7 Hand Counting Fish



Photo 8 Cameron, A man that loves fish!



Photo 9 Fashion 101 for Fish Counting



Photo 10 Geared up & ready for her first count (Research Hut at Milltown)



St. Croix International Waterway Commission

Dam)



Photo 11 Demo of Fish Counter



Photo 12 Research Hut – Krew Bringing Supper for the last shift, Dylan, Cameron, Emily & Isaiah

Photo Gallery: Moosehorn National Wildlife Refuge



Photo 13 SCIWC & MNWR Tagging Fish, Ray Brown, Isaiah, Cameron, Rebecca & Intern



Photo 14 PIT Tagging Fish at MNWR



Photo 15 MNWR & SCIWC to Participate in the Goose Banding



Photo 16 Trapping geese



Photo 17 Xochitl of SCIWC Banding her Goose



Photo 18 Xochitl of SCIWC Holding her Banded Goose

Photo Gallery: Social Engagement



Photo 19 St. Stephen Area Chamber of Commerce AGM; Elizabeth, Rebecca & David



St. Croix International Waterway Commission



*Photo 20 Silver Sponsor St. Stephen
Area Chamber of Commerce AGM*



Photo 21 SCIWC Staff Leading the International Festival Parade – Isaiah & Dylan



*Photo 22 Hands Across the Boarder,
Cameron, Emily, Gareth & Rebecca*



Photo 23 Parade Float, Cameron & Gareth



*Photo 24 International Festival
SCIWC Little Detectives Scavenger
Hunt, Rebecca & Isaiah*



Photo 25 Registration Wəlastəkw - Saint John River Summit 2019



Photo 26 Wəlastəkw - Saint John
River Summit 2019, Gloria & Rebecca



Photo 27 River Summit 2019 Picnic



*Photo 28 Wəlastəkw - Saint John
River Summit 2019 Traditional
Welcome*

Photo Gallery: Krew Equipment Testing Day



Photo 29 Rebecca & Elizabeth on equipment testing day



Photo 30 Emily & Xochitl at Little Falls



St. Croix International Waterway Commission



Photo 31 Gareth & Cameron loading the trailer



Photo 32 Dylan, Pat and Emily

Photo Gallery: Staff Conquering Fears

We worked to provide staff with activities that enriched their experience and pushed them out of their comfort zone a little. Gareth, Gloria & Rebecca are new to Public Speaking & Team Leading.



Photo 33 Presentation to Rotarians



Photo 34 Gloria, Gareth and Rebecca

Gloria also conquered her greatest fear of water and canoed the River!!

At the end of the season, Gloria & Rebecca said it was time for me to face my biggest fear - SNAKES! (Thanks to Harper's Exotic Animals & Pet Supply).



Photo 35 Gloria has a lizard & would've stayed all day



Photo 36 Rebecca LOVES snakes

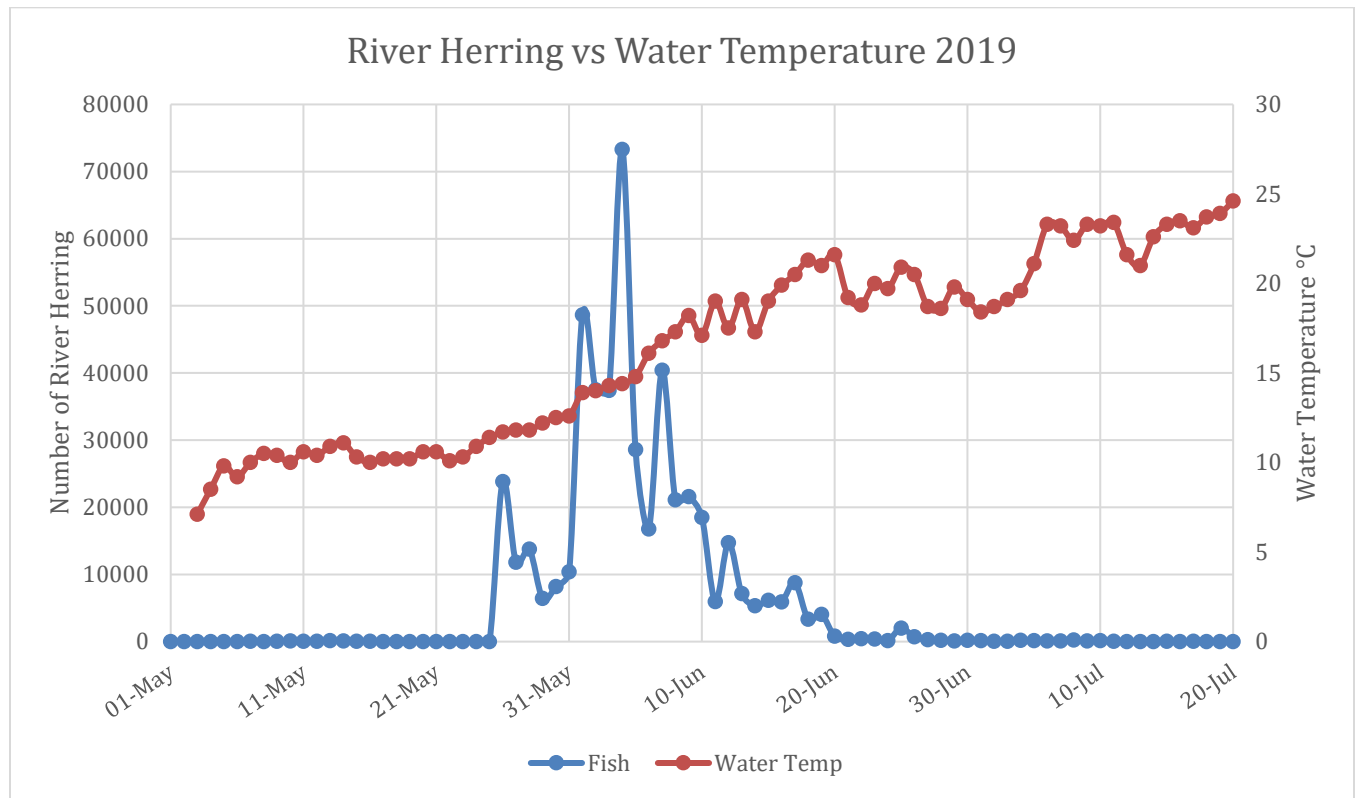


Photo 37 ABSOLUTELY TERRIFIED AND SCREAMING IN MY HEAD

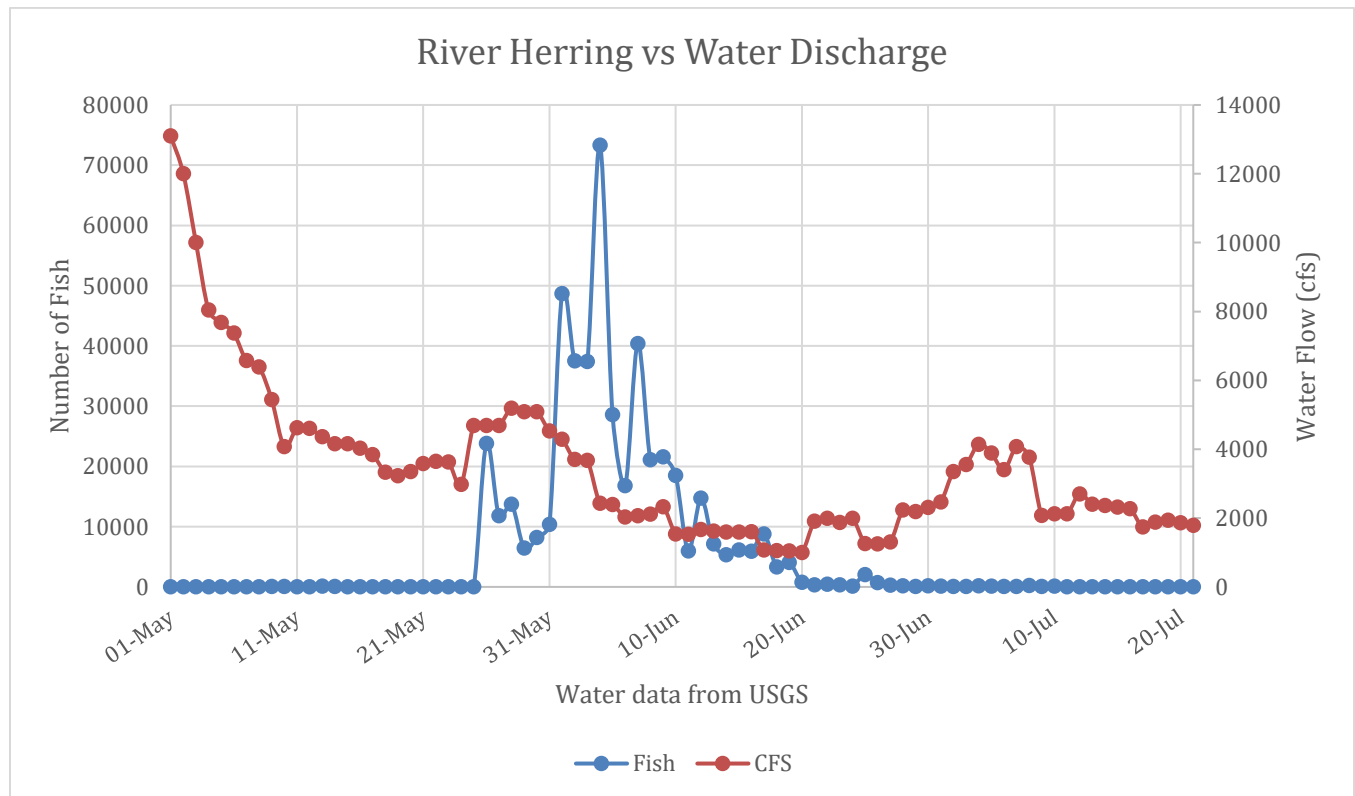


Appendix – Tables and Graphs

Graph 5: Water Temperature



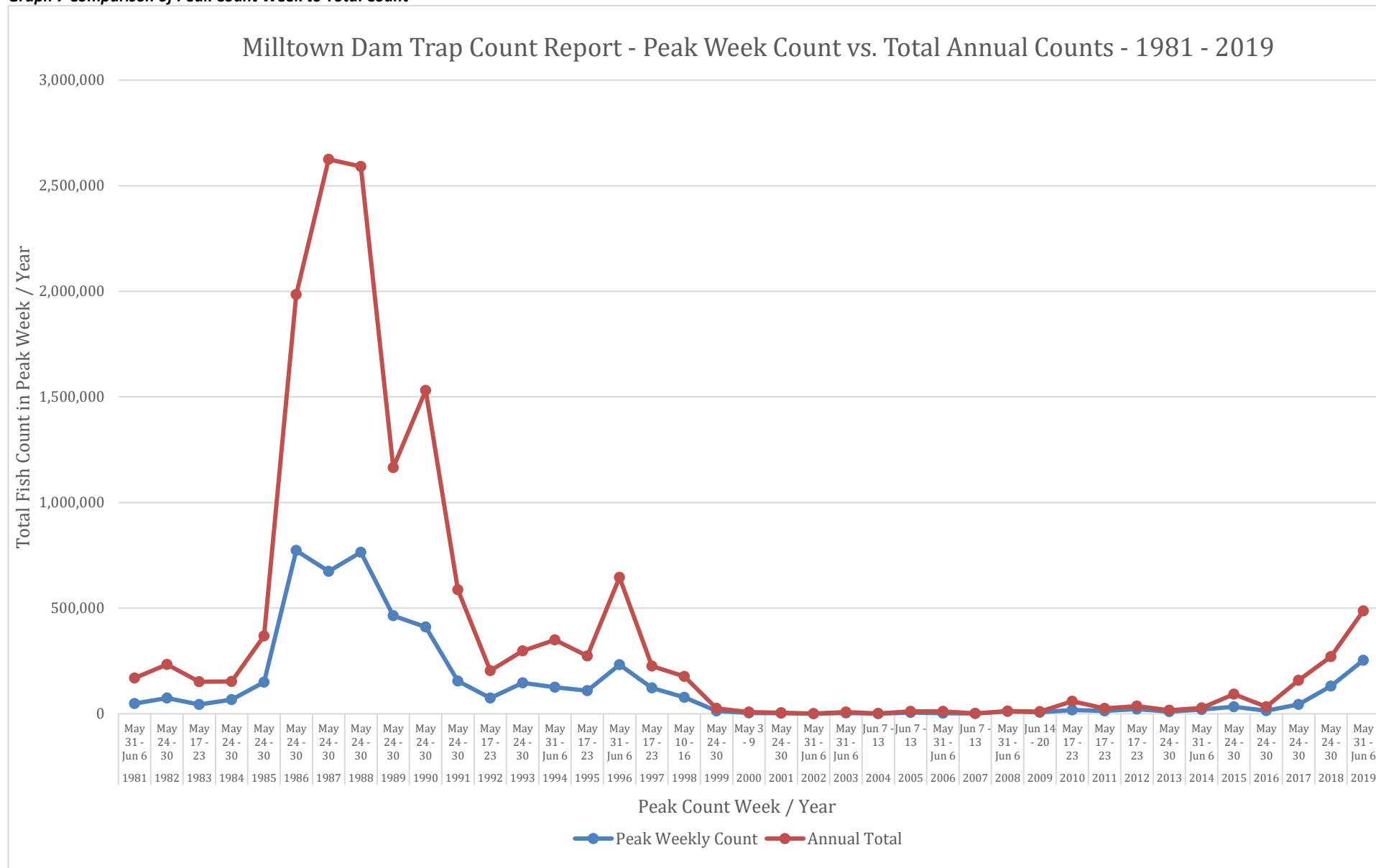
Graph 6: Water Discharge





St. Croix International Waterway Commission

Graph 7 Comparison of Peak Count Week to Total Count





St. Croix International Waterway Commission

Table 9: Summary of Fish Count Weekly Totals – 1981 - 2019

Year	Apr 30–May 2	May 3 - 9	May 10 - 16	May 17 - 23	May 24 - 30	May 31-Jun 6	Jun 7 - 13	Jun 14 - 20	Jun 21 - 27	Jun 28-Jul 4	Jul 5 - 11	Jul 12 - 18	Jul 19 - 25	Jul 26- Later	Annual Total
1981		--	7,510	47,450	47,770	48,310	16,000	1,760	790	30					169,620
1982			32,160	64,120	74,800	56,930	4,610	250	210	20	1	1			233,102
1983			16,970	44,050	33,760	20,770	35,650	620			130		2		151,952
1984			6,000	40,300	67,100	26,200	13,300								152,900
1985				70,000	149,890	96,740	26,900	21,040	1,060	3,270					368,900
1986	5,460	16,410	75,150	429,400	772,800	628,300	57,200								1,984,720
1987		9,400	171,500	559,500	674,700	645,300	480,400	83,900							2,624,700
1988		24,410	468,750	760,280	764,990	370,750	187,800	13,770							2,590,750
1989				200,610	464,390	424,550	63,940	11,370							1,164,860
1990		29,690	305,370	319,380	411,090	141,490	132,030								1,531,250
1991		170	14,740	133,820	154,560	51,110	4,010								586,910
1992			8,910	74,120	45,520	24,780	50,420								203,750
1993				12,000	146,600	102,800	2,260	26,060							297,720
1994				94,304	99,150	125,900	15,400								350,154
1995			5,898	109,388	99,847	50,946									274,079
1996		2,814	11,178	202,188	188,538	231,870	9,390								645,978
1997				122,478	93,000	4,091	5,951							1	225,521
1998			77,394	25,705	71,534	2,684									177,317
1999			195	5,933	13,615	5,476	108								25,327
2000		3,966	142	2,011	377	2,067	6								8,569
2001			160	505	2,625	1,735	123	54							5,202
2002		2	6	23	325	494	35	15							900
2003			3	603	2,115	3,163	999	1,018							7,901
2004							951	108	79	150	11				1,299
2005				2	20	5,277	6,220	113							11,632
2006		18	577	3,111	3,155	2,540	1,096	1,227	105						11,829
2007					2		1,225	66	1						1,294
2008			4	33	119	11,797	61	23	221	3					12,261
2009			1	12	3,740	42	2	6,627	26						10,450
2010			9,748	17,731	17,008	8,520	4,700	1,126	255	45	9	3			59,145
2011			1,657	13,053	1,227	7,750	1,387	50	10	7	1				25,142
2012		993	343	22,260	11,190	1,175	197	10							36,168
2013		342	362	178	10,542	5,107	37	83	23	3					16,677
2014			7	16	29	19,971	6,775	95	143	267	9				27,312
2015			16	126	32,637	16,875	27,150	11,871	3,817	816	161	34			93,503
2016			125	269	14,304	12,781	3,038	2,000	471	27	1				33,016
2017			369	29,946	44,110	42,406	27,681	8,790	3,787	571	69	21			157,750
2018		5	13,028	43,260	130,538	43,657	29,292	7,804	2,163	821	86	5			270,659
2019		60	417	13	63,941	252,631	129,387	34,221	4,220	809	743	58			486,500

Note: Items in RED represent Peak Count.

Items in Yellow represent Lowest count Peak Weeks (4) May 17 – Jun 13

Max Weekly Count

	5,460	29,690	468,750	760,280	772,800	645,300	480,400	83,900	4,220	3,270	743	58	2	1	
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Avg Weekly Count

	5,460	6,791	39,635	93,194	123,991	94,513	36,371	8,669	1,022	326	111	20	2	1	373,965
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Weeks Fish Counted (Out of 38)

	1	13	31	37	38	37	37	27	17	21	11	6	1	1	
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Table 10: Total Count of Alewife - by week - 1981 to Present - Milltown Fishway Research Trap

YEARS >>>	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Apr 30 - May 2	--	0	0	0	0	5,460	0	0	0	0
May 3 - May 9	--	0	0	0	0	16,410	9,400	24,410	0	29,690
May 10 - May 16	7,510	32,160	16,970	6,000	0	75,150	171,500	468,750	0	305,370
May 17 - May 23	47,450	64,120	44,050	40,300	70,000	429,400	559,500	760,280	200,610	319,380
May 24 - May 30	47,770	74,800	33,760	67,100	149,890	772,800	674,700	764,990	464,390	411,090
May 31 - Jun 6	48,310	56,930	20,770	26,200	96,740	628,300	645,300	370,750	424,550	141,490
Jun 7 - Jun 13	16,000	4,610	35,650	13,300	26,900	57,200	480,400	187,800	63,940	132,030
Jun 14 - Jun 20	1,760	250	620	0	21,040	0	83,900	13,770	11,370	0
Jun 21 - Jun 27	790	210	0	0	1,060	0	0	0	0	0
Jun 28 - Jul 4	30	20	0	0	3,270	0	0	0	0	0
Jul 5 - Jul 11	0	1	130	0	0	0	0	0	0	0
Jul 12 - Jul 18	0	1	0	0	0	0	0	0	0	0
Jul 19 - Jul 25	0	0	2	0	0	0	0	0	0	0
Jul 26 - later			0	0	0	0	0	0	0	0
Escapement	169,620	233,102	151,952	152,900	368,900	1,984,720	2,624,700	2,590,750	1,164,860	1,339,050
Harvest	0	0	0	0	0	0	0	0	0	192,200
Total	169,620	233,102	151,952	152,900	368,900	1,984,720	2,624,700	2,590,750	1,164,860	1,531,250

YEARS >>>	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Apr 30 - May 2	0	0	0	0	0	0	0	0	0	0
May 3 - May 9	170	0	0	0	0	2,814	0	0	0	3,966
May 10 - May 16	14,740	8,910	0	0	5,898	11,178	0	77,394	195	142
May 17 - May 23	133,820	74,120	12,000	94,304	109,388	202,188	122,478	25,705	5,933	2,011
May 24 - May 30	154,560	45,520	146,600	99,150	99,847	188,538	93,000	71,534	13,615	377
May 31 - Jun 6	51,110	24,780	102,800	125,900	50,946	231,870	4,091	2,684	5,476	2,067
Jun 7 - Jun 13	4,010	50,420	2,260	15,400	0	9,390	5,951	0	108	6
Jun 14 - Jun 20	0	0	26,060	0	0	0	0	0	0	0
Jun 21 - Jun 27	0	0	0	0	0	0	0	0	0	0
Jun 28 - Jul 4	0	0	0	0	0	0	0	0	0	0
Jul 5 - Jul 11	0	0	0	0	0	0	0	0	0	0
Jul 12 - Jul 18	0	0	0	0	0	0	0	0	0	0
Jul 19 - Jul 25	0	0	0	0	0	0	0	0	0	0
Jul 26 - later	0	0	0	0	0	0	1	0	0	0
Escapement	358,410	203,750	289,720	334,754	266,079	645,978	225,521	177,317	25,327	8,569
Harvest	228,500	0	8,000	15,400	8,000	0	0	0	0	0
Total	586,910	203,750	297,720	350,154	274,079	645,978	225,521	177,317	25,327	8,569



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YEARS >>>	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Apr 30 - May 2	0	0	0	0	0	0	--	--	--	--
May 3 - May 9	0	2	0	0	0	18	0	0	0	0
May 10 - May 16	160	6	3	0	0	577	0	4	1	9,748
May 17 - May 23	505	23	603	0	2	3,111	0	33	12	17,731
May 24 - May 30	2,625	325	2,115	0	20	3,155	2	119	3,740	17,008
May 31 - Jun 6	1,735	494	3,163	0	5,277	2,540	0	11,797	42	8,520
Jun 7 - Jun 13	123	35	999	951	6,220	1,096	1,225	61	2	4,700
Jun 14 - Jun 20	54	15	1,018	108	113	1,227	66	23	6,627	1,126
Jun 21 - Jun 27	0	0	0	79	0	105	1	221	26	255
Jun 28 - Jul 4	0	0	--	150	--	--	--	3	0	45
Jul 5 - Jul 11	0	0	--	11	--	--	--	--	--	9
Jul 12 - Jul 18	0	0	--	0	--	--	--	--	--	3
Jul 19 - Jul 25	0	0	--	0	--	--	--	--	--	--
Jul 26 - later	0	0	--	0	--	--	--	--	--	--
Escapement	5,202	900	7,901	1,299	11,632	11,829	1,294	12,261	10,450	59,145
Harvest	0	0	0	0	0	0	0	0	0	0
Total	5,202	900	7,901	1,299	11,632	11,829	1,294	12,261	10,450	59,145

YEARS >>>	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Apr 30 - May 2	--	--	--	--	0	0	0	0	--	--
May 3 - May 9	0	993	342	0	0	0	0	5	60	--
May 10 - May 16	1,657	343	362	7	16	125	369	13,028	417	--
May 17 - May 23	13,053	22,260	178	16	126	269	29,946	43,260	13	--
May 24 - May 30	1,227	11,190	10,542	29	32,637	14,304	44,110	130,538	63,941	--
May 31 - Jun 6	7,750	1,175	5,107	19,971	16,875	12,781	42,406	43,657	252,631	--
Jun 7 - Jun 13	1,387	197	37	6,775	27,150	3,038	27,681	29,292	129,387	--
Jun 14 - Jun 20	50	10	83	95	11,871	2,000	8,790	7,804	34,221	--
Jun 21 - Jun 27	10	0	23	143	3,817	471	3,787	2,163	4,220	--
Jun 28 - Jul 4	7	--	3	267	816	27	571	821	809	--
Jul 5 - Jul 11	1	--	--	9	161	1	69	86	743	--
Jul 12 - Jul 18	--	--	--	--	34	--	21	5	58	--
Jul 19 - Jul 25	--	--	--	--	--	--	0	0	0	--
Jul 26 - later	--	--	--	--	--	--	--	--	--	--
Escapement	25,142	36,168	16,677	27,312	93,503	33,016	157,750	270,659	486,500	0
Harvest	0	0	0	0	0	0	0	0	0	0
Total	25,142	36,168	16,677	27,312	93,503	33,016	157,750	270,659	486,500	0



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- Note 1.** **Sources:** Fisheries & Oceans Canada (1981-1990), Atlantic Salmon Federation (2012-2014), St. Croix International Waterway Commission (1991-2011, 2015-present).
- Note 2.** **Items in bold = 7-day peak.**
- Note 3.** **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 4.** **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 and 2016; 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
- Note 5.** **Correction of 1994, 1995 and 2010 counts.** In 2016, errors in the day counts for these three years was discovered and corrected. This increased earlier reported totals for 1995 and 2010 and decreased 1994.



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Table 11: 2019 Scale Sample Results

Notes: Fork Length in millimetres (Mean FL used because it was not recorded), RPS = number of years the fish previously spawned, Weight in grams.

Species	Fork Length	Age	RPS	Weight	Sex
Alewif19-001	250	4		222	Male
Alewif19-002	270	4			Male
Alewif19-003	243	5	1	203	Female
Alewif19-004	240	4			Female
Alewif19-005	255	4			Female
Alewif19-006	255	4		214	Unknown
Alewif19-007	270	5	2	250	Female
Alewif19-008	248	5	1	225	Female
Alewif19-009	260	5	1		Male
Alewif19-010	259	4			Female
Alewif19-011	268	5	1		Female
Alewif19-012	260	4			Female
Alewif19-013	256	4			Male
Alewif19-014	250	4		241	Female
Alewif19-015	240	4		193	Male
Alewif19-016	240	4		241	Male
Alewif19-017	254	4			Male
Alewif19-018	253	4			Female
Alewif19-019	260	4			Female
Alewif19-020	255	4			Female
Alewif19-021	256	4			Female
Alewif19-022	250	4			Male
Alewif19-023	238	4			Unknown
Alewif19-024	275	5			Unknown
Alewif19-025	230	4	1		Male
Alewif19-026	244	4			Female
Alewif19-027	262	4			Female
Alewif19-028	218	3			Male

Alewif19-029	227	4			Male
Alewif19-030	245	4			Unknown
Alewif19-031	225	3			Male
Alewif19-032	248	4			Female
Alewif19-033	260	6	2		Male
Alewif19-034	235	4			Male
Alewif19-035	266	4			Unknown
Alewif19-036	240	4			Female
Alewif19-037	223	4			Male
Alewif19-038	243	4			Unknown
Alewif19-039	241	4			Unknown
Alewif19-040	263	4			Male
Alewif19-041	244	4			Female
Alewif19-042	260	4			Male
Alewif19-043	210	3			Male
Alewif19-044	230	3			Male
Alewif19-045	232	4			Female
American Shad19-001		6	2		Unknown
American Shad19-002		6	2		Unknown
American Shad19-003		5	1		Unknown
Blueback Herring19-001	232	4	1	145	Male
Blueback Herring19-002	210	3			Male
Blueback Herring19-003	210	3			Male
Blueback Herring19-004	210	3			Male
Blueback Herring19-005	207	3			Male
Blueback Herring19-006	218	3			Male
Blueback Herring19-007	230	4			Male
Blueback Herring19-008	206	3		104	Unknown
Blueback Herring19-009	200	3			Male
Blueback Herring19-010	198	3			Female
Blueback Herring19-011	203	4			Female
Blueback Herring19-012	191	3			Male
Blueback Herring19-013	220	4			Female
Blueback Herring19-014	199	4	1		Male



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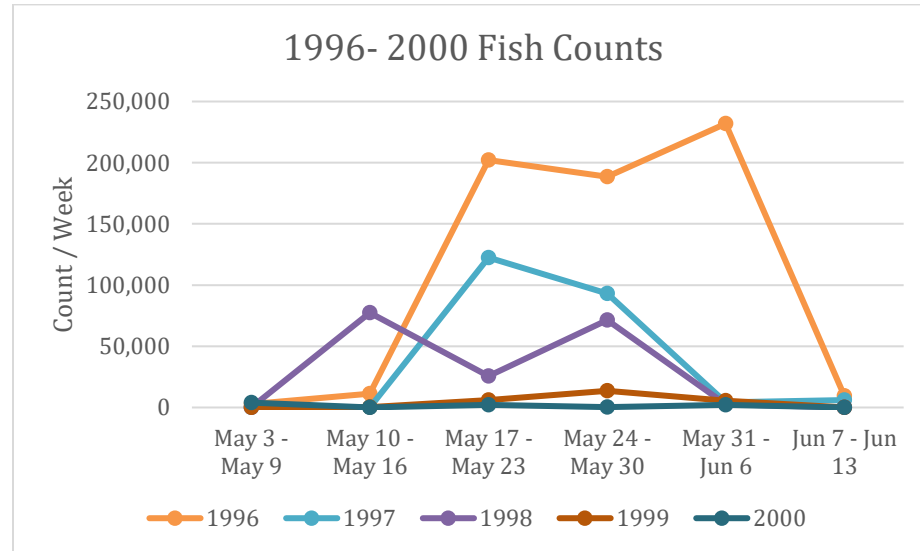
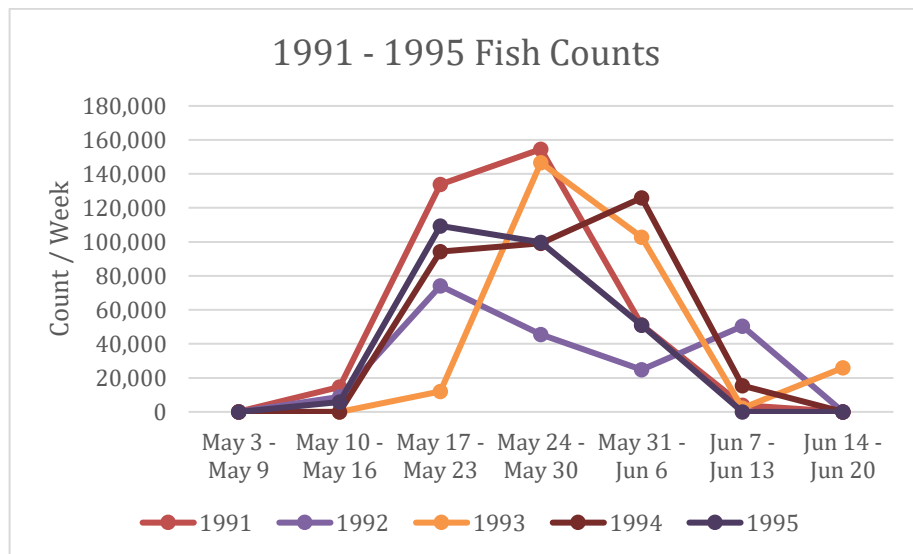
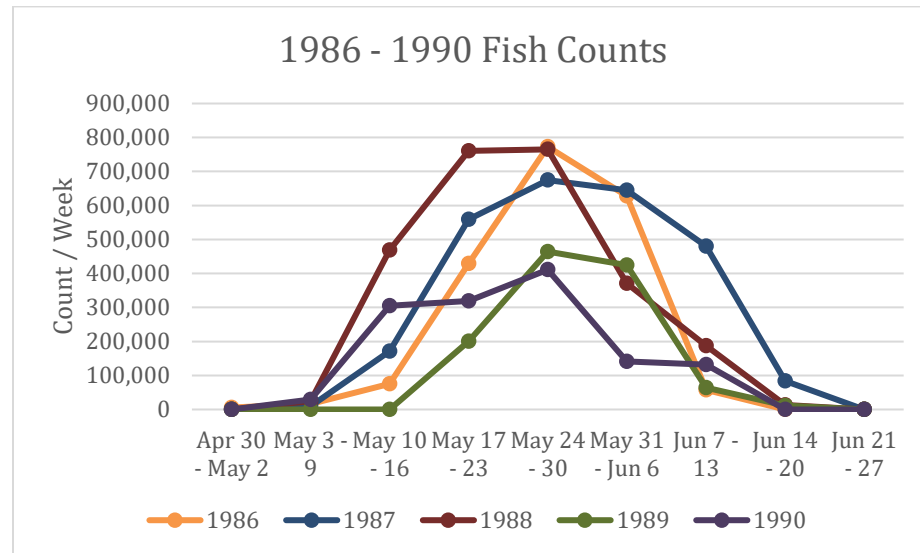
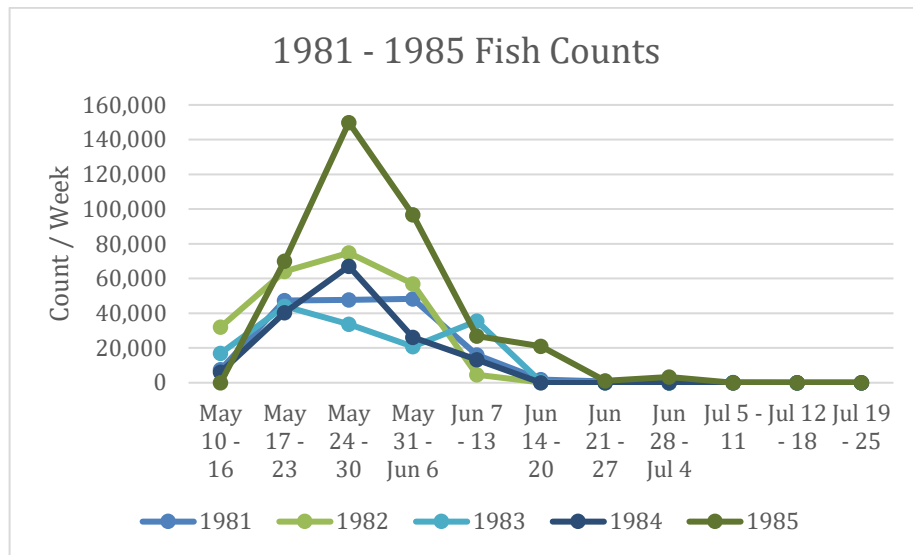
Blueback Herring19-015	228	4	1	Male
Blueback Herring19-016	212	4		Unknown
Blueback Herring19-017	228	4		Female
Blueback Herring19-018	210	3		Unknown
Blueback Herring19-019	212	3		Unknown
Blueback Herring19-020	212	4		Unknown
Blueback Herring19-021	212	3		Unknown
Blueback Herring19-022	228	4	1	119 Male
Blueback Herring19-023	220	3		126 Female
Blueback Herring19-024	208	4	1	111 Female
Blueback Herring19-025	213	4		117 Male
Blueback Herring19-026	205	3		106 Female
Blueback Herring19-027	220	4	1	123 Male
Blueback Herring19-028	206	3		107 Male
Blueback Herring19-029	204	3		91 Male
Blueback Herring19-030	220	4		121 Male
Blueback Herring19-031	210	3		98 Male
Blueback Herring19-032	220	3		112 Unknown
Blueback Herring19-033	200	3		Male
Blueback Herring19-034	214	3		Male
Blueback Herring19-035	235	4		Female
Blueback Herring19-036	220	4	1	Male
Blueback Herring19-037	197	3		Female
Blueback Herring19-038	180	3		Unknown
Blueback Herring19-039	195	3		Unknown
Blueback Herring19-040	222	4	1	Unknown
Blueback Herring19-041	225	4		Unknown
Blueback Herring19-042	220	3		Male
Blueback Herring19-043	200	3		Male
Blueback Herring19-044	240	3		Male
Blueback Herring19-045	208	4	1	Male
Blueback Herring19-046	201	3		Male
Blueback Herring19-047	205	3		Female
Blueback Herring19-048	230	4		Female

Blueback Herring19-049	203	3		Female
Blueback Herring19-050	210	3		Male
Blueback Herring19-051	215	3		Unknown
Blueback Herring19-052	200	3		Male
Blueback Herring19-053	201	3		Male
Blueback Herring19-054	234	4		Female
Blueback Herring19-055	203	3		Male



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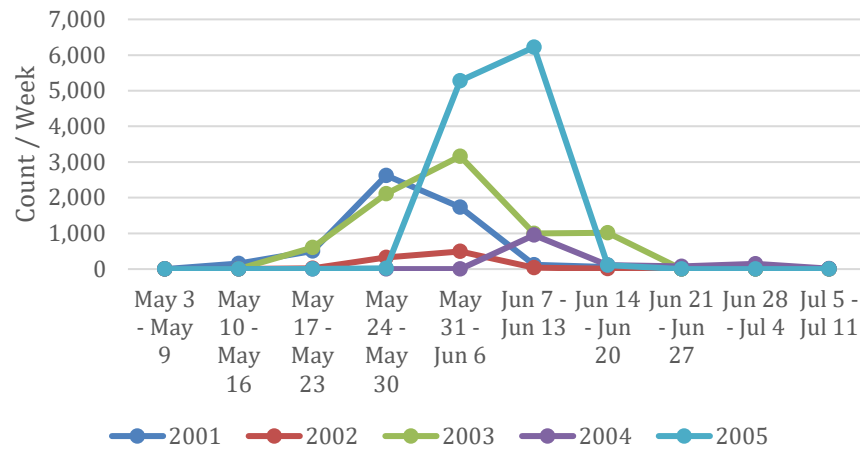
Graph 8: Fish Counts 1981 -2019, 5 Year Increments



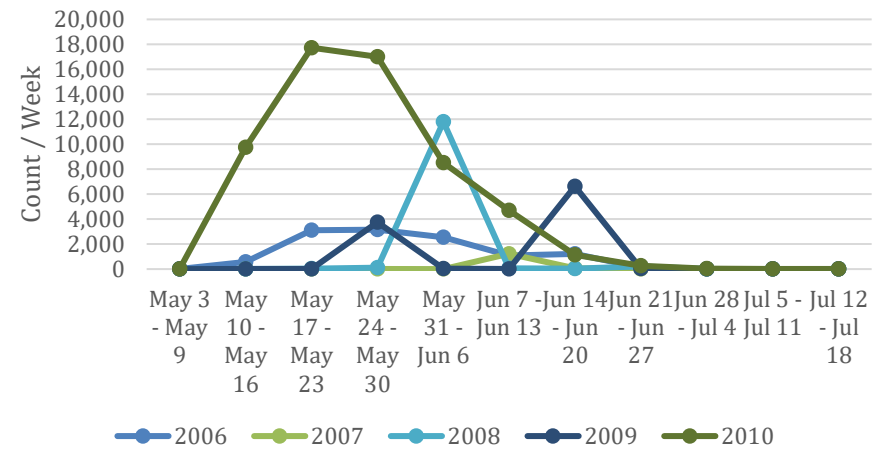


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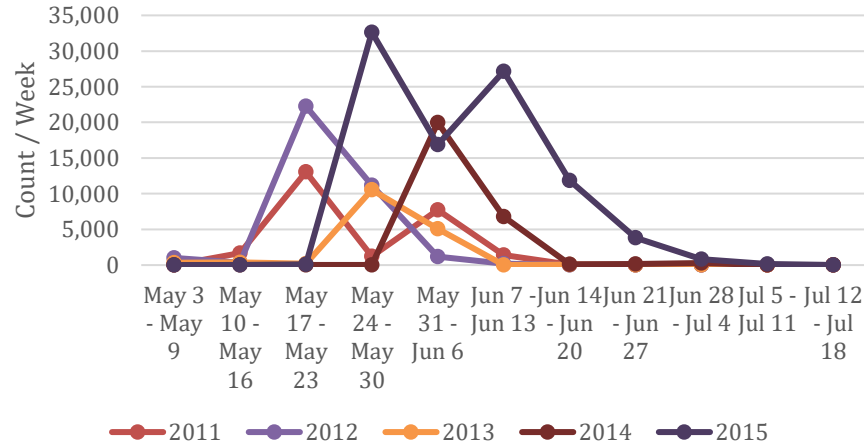
2001 - 2005 Fish Counts



2006 - 2010 Fish Counts



2011 - 2015 Fish Counts



2016 - 2019 Fish Counts

