LAKE CHAMPLAIN FISH AND WILDLIFE MANAGEMENT COOPERATIVE

FISHERIES TECHNICAL COMMITTEE

2020 ANNUAL REPORT

Approved at Lake Champlain Fish and Wildlife Management Meeting

July 14, 2021

University of Vermont researchers bottom trawling from the RV Melosira to collect juvenile lake trout (left) and several age classes of wild juvenile lake trout (right) collected in the main lake, Lake Champlain (Photo credit UVM).

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Executive Summary

Restoration efforts for native salmonids continued to be the primary focus of the Lake Champlain Fisheries Technical Committee (FTC) in 2020. Landlocked Atlantic salmon (salmon) and lake trout were focal species accounting for 68% of 519,171 smolts/yearlings stocked into the lake and tributaries. Highlights from native salmonid management include:

- Eleven of 16 established fisheries indicators met target goals.
- Sampling for juvenile lake trout continued to identify wild lake trout ranging from YOY (young of year) to three years old; sampling targeting larger lake trout found 25% of age 4+ were wild.
- Sea lamprey wounding rates for salmon and lake trout in the main lake remained above target levels. The wounding rate on Inland Sea-Mallett's Bay salmon was below the objective of 15.
- Salmon returns were lower at the Hatchery Brook trap and at the Winooski fish left than in 2019. Returns at the Lamoille River were also lower; however, sampling effort was reduced due to COVID-19. The Missisquoi River and Otter Creek were not sampled in 2020.
- Condition factor of salmon was lower in 2020 than in previous years. Condition factor of lake trout remained high.
- Lake trout stocking was recommended to be reduced by 33% starting in 2022; NYSDEC will discontinue stocking

There were four lampricide treatments conducted in the Basin during 2020. Due to COVID-19, no trapping of adult sea lamprey occurred in the Lake Champlain Basin in 2020. Due to the closure of the US – Canada Border sea lamprey larval surveys were not done in the Pike River or Morpion Stream in Quebec in 2020. Sea lamprey salmon wounding rates decreased to 17.1, but it is still above the target of 15 wounds per 100 fish. Wounding rates on lake trout decreased from 57.4 in 2019 to 40.8 in 2020; the rate is still well above the target of 25 wounds per 100 fish.

In 2020, a fish kill occurred on northern Lake Champlain. The report from Quebec MFFP states that the cause of the mortality episode is uncertain. Changes in the environment (especially in the temperature of the water) may have caused direct mortality and/or promoted the development of fatal bacterial infections.

Monitoring efforts continued for American eel, muskellunge, bass, walleye, and yellow perch.

NYSDEC is placing the sauger restoration plan on hold while focusing efforts on other major projects within the Lake Champlain watershed. When time permits, the proposed plan will be revisited.

Research efforts in the lake and tributaries included: using acoustic telemetry and sonar methods to monitor lake sturgeon movement patterns, parentage-based tagging of Atlantic Salmon, and characterizing evolutionary potential of salmon to respond to thiamine deficiency.

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Introduction

Management of the fishery resources of Lake Champlain is coordinated by the Lake Champlain Fisheries Technical Committee (FTC), which is a workgroup of the Lake Champlain Fish and Wildlife Management Cooperative. Members and advisors of the FTC include staff from Vermont Fish and Wildlife Department (VTFWD), New York State Department of Environmental Conservation (NYSDEC), U.S. Fish and Wildlife Service (USFWS), University of Vermont (UVM), Vermont Cooperative Fish and Wildlife Research Unit (VTCFWRU), Quebec Ministry of Forestry, Wildlife and Parks (MFFP), Lake Champlain Sea Grant, and other universities.

This report briefly summarizes fisheries management and research activities carried out on Lake Champlain and its tributaries during 2020. The names of project leaders are listed after section headings and their affiliation can be found on the FTC Membership list at the end of this document (Appendix 1).

Salmonids

Salmonid Assessment Program for Lake Champlain (Salmonid Working Group)

A workgroup of the Lake Champlain FTC was established in 2014 with the goal of maintaining balanced and robust fish populations that provide a fishery for salmonids. The working group has five objectives: (1) evaluate status of salmonid populations; (2) evaluate the salmonid fishery; (3) evaluate salmonid hatchery production; (4) evaluate fish health status and impact of aquatic nuisance species; and (5) identify potential management actions.

The working group reviewed relevant fisheries indicators that are part of annual monitoring efforts (Fisheries Technical Committee 2019). A suite of indicators was identified to monitor salmon and lake trout fisheries and restoration of natural populations. The period from 2011 to 2017 was identified as the "desired state" for salmon and lake trout in Lake Champlain. This time period was selected based on the effectiveness of sea lamprey control efforts, stability and quality of the fishery, and evidence of natural reproduction for both species. In an effort to maintain the desired state, target goals were developed for all indicators. Thresholds for target goals were set at 25th and 75th percentile bounds for indicators over the seven-year desired state period. These target goals may change if there are long-term changes to the Lake Champlain fishery, but will not be adjusted annually.

In 2020, five of the 16 indicators fell out-of-bounds of the established thresholds (Table 1 and 2). Due to COVID-19 walleye sampling in 2020 was limited and no information was collected on walleye condition factor. Pre-stock smolt percentage was slightly lower than target level. Median condition factor of lake age-0 salmon was 1.2 and slightly above the upper threshold of 1.19. Median total length of lake age-1 salmon was 574 mm (22.6 inches) and slightly above the upper threshold of 567 mm. Two indicators – sea lamprey wounding for both salmon and lake trout – were above target thresholds for the fourth year in a row. Salmon wounding rate declined to 16.3 wounds per 100 fish from 19.5 observed in 2019 but was still above the target level of 15 wounds per 100 fish. The lake trout wounding rate of 40.8 wounds per 100 fish is still well above the target of 25.

The FTC is in the process of exploring additional indicators of salmonid status. These include additional sampling to estimate abundance of wild lake trout, evaluating methods to characterize forage fish abundance, exploring alternative measures of sea lamprey impacts on salmonids and options to tag / mark all stocked salmonids. In addition, adaptive management experiments are underway to improve survival of salmon smolts stocked in the lake and increase adult returns to rivers; these studies include evaluating alternative stocking methods and performance of a low thiamine tolerant broodstock.

Table 1. Indicators and their thresholds for annually evaluating the state of landlocked Atlantic salmon, lake trout, walleye, and fish health in Lake Champlain. The median is the middle value of all values calculated. Condition factor describes the relative "plumpness" or "fatness" based on fish length and weight.

Species and Indicators	Thresholds or desired ranges	2020 Value	n
Landlocked Atlantic Salmon			
Pre-stock smolt size percentage > 150 mm	≥90 %	88.0 %	2,600
Median Condition Factor – Lake Age 0	1.00 – 1.19	1.20	35
Median Condition Factor – Lake Age 1	0.86 – 1.01	0.97	107
Median Total Length – Lake Age 0	390 – 427 mm	414 mm	35
Median Total Length – Lake Age 1	494 – 562 mm	574 mm	176
Sea Lamprey Wounding Rate (lake-wide)	<15 wounds per 100	16.3	147
Median Weight of top 10 salmon from Lake Champlain International Fishing Derby	2.86 – 3.68 kg	3.16 kg	10
Median Condition Factor from Lake Champlain International Fishing Derby	1.01 – 1.22	1.15	46
Lake Trout			
Median Condition factor - Males	0.84 – 0.94	0.89	589
Sea Lamprey Wounding Rate (main lake)	<25 wounds per 100	40.8	169
Wild Lake Trout - Proportion Unclipped	≥15 %	10.1 %	139
Median weight top 10 Lake Trout from Lake Champlain International Fishing Derby	5.65 – 6.42 kg	6.25 kg	10
Median Condition Factor from Lake Champlain International Fishing Derby	0.93 – 1.09	1.00	171
Salmonid Stocking			
Number of salmonids stocked annually	512,000	519,171	
Landlocked Atlantic salmon	304,000	296,824	
Lake trout	82,000	85,429	
Steelhead trout	58,000	60,700	
Brown trout	68,000	76,218	
Walleye			
Median Condition Factor walleye Males 350.5 – 475 mm	0.90 – 0.98	NS	NS
Health Testing Results	Detection of new disease	No detection	860

Table 2. Indicators for annually evaluating the status of landlocked Atlantic salmon, lake trout, and walleye, and fish health in Lake Champlain. Condition factor describes the relative "plumpness" or "fatness" based on fish length and weight. Status colors: Green: Within desired ranges or threshold targets; Yellow: Outside targets; direction of yellow arrow indicates if above or below the threshold; Red: Outside targets for three consecutive years.

Species and Indicators	**2018 Status**	**2019 Status**	**2020 Status**	**2020 Value**
Landlocked Atlantic Salmon				
Pre-stock smolt size percentage	Yellow ↓	Green	Yellow ↓	88.0 %
Median Condition Factor – Lake Age 0	Green	Green	Yellow ↑	1.20
Median Condition Factor – Lake Age 1	Green	Green	Green	0.96
Median Total Length – Lake Age 0	Green	Yellow ↑	Green	414 mm
Median Total Length – Lake Age 1	Green	Green	Yellow ↑	574 mm
Sea Lamprey Wounding (lake-wide)	Yellow ↑	Red	Red	16.3
Median Weight of top 10 salmon in Lake Champlain Inter. Derby	Green	Yellow ↓	Green	3.2 kg
Median Condition Factor salmon in Lake Champlain Inter. Derby	Green	Green	Green	1.15
Lake Trout				
Median Condition Factor - Males	Green	Green	Green	0.89
Sea Lamprey Wounding (Main-lake)	Yellow ↑	Red	Red	40.8
Wild Lake Trout - Proportion Unclipped	Green	Green	Green	10.1 %
Median Weight of top 10 lake trout in Lake Champlain Inter. Derby	Green	Green	Green	6.25 kg
Median Condition Factor lake trout in Lake Champlain Inter. Derby	Green	Green	Green	1.00
Salmonid Stocking				
Number of salmonids stocked annually	Yellow ↓	Red	Green	519,171
Walleye				
Walleye Median Condition Factor (Males 350 –475 mm)	Green	Green	NS	NS
Other				
Fish Health Testing Results	Yellow ↑	Green	Green	ND

Stocking Reduction for Lake Trout (Salmonid Working Group)

The Salmonid Working Group recommended a reduction in Lake Trout stocking for Lake Champlain in 2020 to be implemented starting in 2022. This recommendation was approved by the FTC Management Committee (FTC 2020a, Appendix 2).

Excerpt from the Recommendation:

Rationale

One of the Salmonid Indicators for lake trout (FTC 2020b), as well as an action identified in the Strategic Plan (Hurst et al. 2020), is a reduction in stocking based on the percentage unclipped fish in the fall spawning assessment. If the proportion of naturally produced spawners (i.e., unclipped fish) in age 4 and 5 year classes is greater than or equal to 15% then a 25% reduction in stocking is recommended; if the proportion unclipped is greater than 25% then a 50% reduction is recommended (Lake Champlain Fisheries Technical Committee 2020). While the proportion of unclipped lake trout in the fall spawning assessments is still low, the numbers of unclipped fish in both the juvenile assessments and the summer 2020 gillnet assessment indicates wild lake trout are increasing in abundance and may be just starting to recruit to the spawning population. Because only two locations are sampled each fall, it is unknown if wild fish are spawning elsewhere. We observed more wild fish in the fall 2020 assessments.

Using the summer 2020 gillnetting data (see Appendix 2) and applying the results to the spawning assessment indicators, as described above, at a minimum, **35% of fish in the age-4 and age-5 year classes were unclipped, which would lead to a 50% reduction in stocking based on the indicators and the strategic plan**. While the spawning assessment indicator has not been met yet, the juvenile and gillnetting assessments are strong enough to justify making a change now. During discussions among a subset of the Salmonid Working Group regarding lake trout, an opportunity was identified to eliminate NYSDEC lake trout stocking beginning in 2022. This represents 33% of the total lake trout stocked and all agreed would be a good starting point. Some unknowns with this approach are the lack of understanding of how the NY and VT stockings may differ in overall survival rates and movement patterns within the lake. However, just cutting NY fish but keeping VT stocking steady helps create a good study to assess contribution from VT. All agreed this could be a good opportunity for both management and research goals.

Recommendation

Based on the background and rationale provided, it is recommended to reduce lake trout stocking by 33%. This can be accomplished most efficiently by eliminating the NY portion of lake trout stocking, beginning in 2022 and continuing indefinitely. New York will resume stocking if recruitment indices indicate increased stocking is necessary to sustain the fishery. As part of this recommendation, we assume stocking numbers of other salmonids will remain within their target numbers (i.e., no increase to make up for reduced lake trout stocking). It is recommended that population assessments continue to monitor the impact of the stocking reduction.

Stocking Summary (Shanahan, Balk)

Salmonid stockings in Lake Champlain during 2020 included approximately: 297,000 landlocked Atlantic salmon (smolt equivalents); 61,000 steelhead (smolt equivalents); 85,000 lake trout; and 76,000 brown trout (Table 3). The list includes landlocked Atlantic salmon and steelhead that were stocked in the tributaries to the lake. Also listed in Table 3 are the stocking targets for each species. Stocking numbers are presented as “stocking equivalents.” Salmonids are stocked at varying sizes, from recently hatched fry that spend two years in the tributaries before migrating to the lake, to smolts and yearlings that are ready to begin life in the lake at the time of stocking. The numbers stocked are adjusted to stocking (smolt/yearling) equivalents to better represent the effective numbers stocked.

Table 3. Numbers (in smolt equivalents) of salmonids stocked in Lake Champlain during 2020, and stocking targets for the lake.

Species	Main Lake		Mallett's Bay/Inland Sea		Total number stocked in 2020
	Target	2020	Target	2020	
Landlocked salmon	227,000	220,312	77,000	76,512	296,824
Lake trout	82,000	85,429	0	0	85,429
Steelhead	53,000	55,700	5,000	5,000	60,700
Brown trout	38,000	47,718	30,000	28,500	76,218
Total	400,000	409,159	112,000	110,012	519,171

Pre-stocking Landlocked Salmon Assessments (Pientka)

To undergo the parr to smolt transformation a fish is typically greater than or equal to 150 mm total length. In spring 2020, over 99% and 85% of fish exceeded the 150 mm size threshold for Ed Weed Fish Culture Station (FCS) and New York's Adirondack hatchery, respectively. Eisenhower NFH percentage was lower at only 68.7% exceeding that threshold (Table 4).

Table 4. Pre-stocking assessment of yearling landlocked Atlantic salmon stocked in Lake Champlain. Total number of yearling salmon stocked and the number that reached the viable smolt size (greater than or equal to 150 mm total length) are reported for stocking years from 2012-2020.

Hatchery (agency)	Year	Mean Size (mm)	Numbered Sampled	% Viable Smolts	Total Stocked	Viable Smolts Stocked
Adirondack (NYSDEC)	2012	150	400	54.8	45,000	24,638
	2013	163	400	83.0	45,000	37,350
	2014	174	399	90.0	49,260	44,322
	2015	175	300	92.3	45,000	41,550
	2016	180	400	93.8	45,000	42,188
	2017	167	400	85.8	45,000	38,610
	2018	172	400	90.3	45,000	40,635
	2019	183	100	94.0	12,730	11,966
	2020	**167**	**200**	**85.5**	**45,000**	**38,475**
Ed Weed FCS (VTFWD)	2012	196	999	99.7	155,289	154,823
	2013	191	1,100	99.6	165,459	164,857
	2014	188	999	99.2	146,290	145,119
	2015	181	1,000	95.3	163,827	156,127
	2016	177	1,000	96.4	149,419	144,040
	2017	190	1,100	99.7	160,028	159,548
	2018	191	900	99.7	139,128	138,711
	2019	181	900	99.7	139,411	138,993
	2020	**182**	**900**	**99.7**	**158,663**	**158,187**
Eisenhower (USFWS)	2012	188	900	96.8	104,706	101,332
	2013	206	1,100	98.8	69,992	69,165
	2014	170	1,000	84.8	76,160	64,584
	2015	163	1,300	82.7	102,430	84,702
	2016	155	1,223	66.6	102,697	68,353
	2017	161	1,800	80.7	113,947	91,955
	2018	153	1,431	67.1	85,510	57,377
	2019	165	1,100	91.7	69,651	63,870
	2020	**158**	**1,500**	**68.7**	**90,835**	**62,404**
Overall	2012	185	2,299	92.1	304,995	280,792
	2013	193	2,600	96.8	280,451	271,372
	2014	178	2,398	93.5	271,710	254,024
	2015	171	2,600	90.7	311,257	282,379
	2016	167	2,623	85.7	297,116	254,580
	2017	171	3,300	91.0	318,975	290,113
	2018	168	2,731	87.8	269,638	236,723
	2019	173	2,100	96.9	221,792	214,829
	2020	**167**	**2,600**	**88.0**	**294,498**	**259,066**

Fish Passage (Simard)

Winooski One Dam Fish Lift – In 2020, a total of 13 steelhead and 38 landlocked Atlantic salmon were trapped at the Winooski One fish passage facility in the spring and fall, respectively (Figure 1). Of the salmon lifted, 16 were female and 22 were male. Fin clips and scales were used to age 34 of the lifted salmon. Of those, 29 (85%) were lake age-1 and five (15%) were lake age-2. One additional steelhead was lifted during the fall season. Steelhead were released directly above the Winooski One dam while salmon were transported above the next two dams and released in the Winooski River in Richmond.

Overall, spring steelhead return rates remained very low. Approximately 20,000 steelhead are stocked into the Winooski River each year. However, other than three slightly higher return years in 2011, 2013, and 2015, no more than 23 steelhead have returned to the lift in a given year since 2000 with most years not exceeding 15 fish. Landlocked Atlantic salmon return rates also continued to drop to the lowest level since 2009, down from a peak return of 189 adults observed in 2011. Alternative landlocked Atlantic salmon smolt stocking strategies will begin in the Winooski River in 2021 in an attempt to increase return rates.

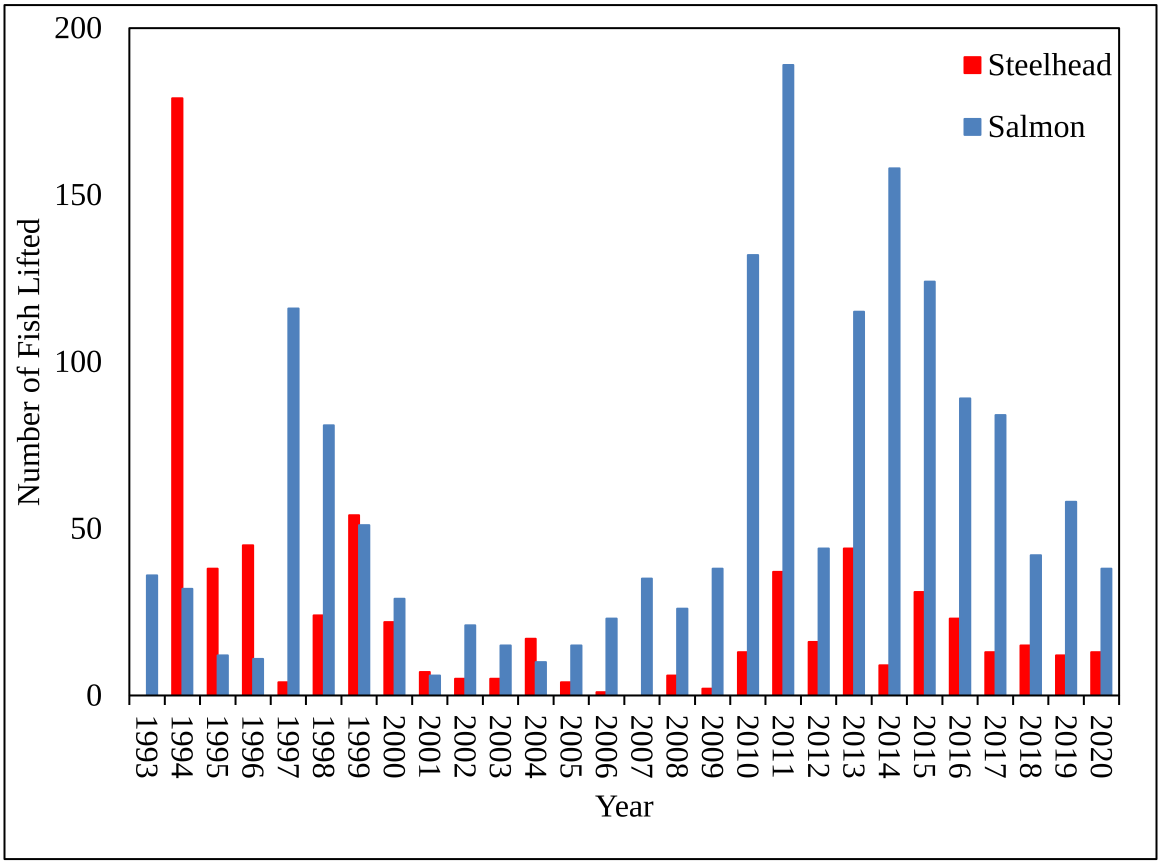

Figure 1: Number of steelhead trout (spring season) and landlocked Atlantic salmon (fall season) lifted at the Winooski One fish passage facility, 1993-2020.

Downstream Passage at Winooski River Essex 19 Dam (Ardren, Simard)

The USFWS and VTFWD continued consulting with Green Mountain Power and its consultant, Kleinschmidt Associates regarding the Federal Energy Regulatory Commission license for Essex 19 Dam that expires in 2025. Downstream passage effectiveness studies are planned for smolts in spring of 2021 and adults in fall of 2021. The smolt study also will evaluate route passage and survival at the other two downstream dams, Gorge Dam and Winooski One Dam.

Radio Telemetry of Trap and Trucked Salmon in the Winooski River

(Withers, Heim, Simard, Scarfo, Ardren)

During 2020, the USFWS in cooperation with USGS and VTFWD conducted the third year of a radio telemetry study monitoring movements of adult Atlantic salmon trapped at the Winooski One Dam and transported upstream above three dams into suitable spawning habitat. Goals of this study are to: 1) determine the percentage of salmon that fallback over Essex 19 dam before spawning, and 2) characterize behavior, habitat use, and movement of Atlantic salmon between Essex 19 Dam and Bolton Dam. Thirty-eight salmon were radio tagged in the fall of 2020 and their movements were continuously monitored at 14 stationary radio telemetry receivers deployed between the river mouth and Bolton Dam. Weekly mobile tracking surveys also were conducted. The 14 fixed radio telemetry receivers provided excellent temporal resolution of fish movements, while mobile tracking has provided high spatial resolution.

Three of the 38 trap and trucked salmon (8%) were classified as "fallback" salmon that moved downstream of Essex 19 dam prior to spawning. These fallback salmon are not able to migrate back upstream to suitable spawning habitat without passing two additional dams and being recaptured at the Winooski One dam fish lift. Four salmon migrated out of the spawning reach shortly after spawning. The majority of the salmon (n = 31) did not migrate out of the spawning reach (i.e., upstream of Essex 19 Dam) and remained in the Winooski River as of December 31, 2020. Mobile tracking indicated many of these 31 salmon were still alive and overwintering in the river. Monitoring is in place to determine what portion of these fish migrate downriver to Lake Champlain in the spring and summer of 2021. A report summarizing all three years of this study will be completed in 2021.

In fall of 2020, USFWS and VTFWD began a study with Green Mountain Power to assess downstream passage of adult salmon at Essex 19 Dam (Figure 2). The goal of this work is to monitor fallback rate and downstream passage at Essex 19 dam (timing, route selection, and survival). USFWS and VTFWD were responsible for tagging and transporting fish and Green Mountain Power was responsible for hiring a consultant to monitor passage at Essex 19 dam from September 2021 – June 2022. This project is associated with the FERC relicensing process for Essex 19 Dam.

Figure 2. Radio tagging Atlantic salmon (left image), Sigma Eight Inc. radio telemetry transmitter (center image), and Sigma Eight Inc. radio telemetry receiver in the Winooski River.

Boquet River Atlantic Salmon Redd, Juvenile, and Habitat Surveys

(Withers, Heim, Balk, Ardren)

<u>Redd and Wild Fry Surveys (Withers, Balk, Scarfo, Ross, Ardren)</u>

In fall of 2020 a total of 182 salmon redds were observed in the Boquet River below the Willsboro Cascade (n=126) and in the North Branch of the Boquet River (n=56). This is a dramatic increase from the 4 redds observed in 2019. No wild fry were observed in 2020 snorkeling surveys in the North Branch. The absence of wild fry in 2020 is likely explained by the large flooding event that occurred in late October of 2019 and scoured out redds that fall.

Broodstock outplanting (Ardren, Balk, Heim)
Limited wild fry production over the past five years in the North Branch has prompted NYSDEC and USFWS to consider additional ways to assist salmon recolonization in this protected spawning and rearing habitat. The USFWS and NYSDEC started a pilot project in 2020 to outplant adult broodstock into high quality spawning habitat within the North Branch. Goals for this project are to: 1) increase the number of redds in the North Branch and 2) improve wild fry production in the North Branch. In mid-October 2020 a total of 197 adult broodstock from the Low Thiamine Tolerant broodstock at White River NFH were released in the upper portion of the North Branch. Following the release of broodstock, redd surveys were conducted between mid-October and early-December. Several of the broodstock were observed within the North Branch during redd surveys. Broodstock remained near release locations for roughly a week before beginning to disperse. Dispersal appeared to be generally downstream of the release locations with the majority remaining within the upper reaches of the North Branch. There were 56 redds observed in the North Branch of the Boquet River, and it is likely that these were produced mainly by the adult outplants (rather than wild fish, that had passed upstream past the cascades). Fry sampling in 2021 and genetic analysis will be used to determine the origin of any fry produced by redds in the North Branch. A small number of broodstock were captured by anglers (n = 5) below the Willsboro cascades.

A radio telemetry project at Willsboro Cascade indicated a low upstream passage rate in 2020 suggesting the majority of the 52 redds observed in the North Branch were produced by outplanted broodstock. While, the 119 redds observed below the Willsboro Cascade were likely produced by smolt-stocked salmon returning from the lake. Genetic samples were collected from all outplanted broodstock so if wild fry are collected in 2021 surveys it will be possible to determine if they were parented by broodstock or smolt-stocked parents.

Radio Telemetry and Fish Passage at Willsboro Cascades (Withers, Balk, Scarfo, Ross, Ardren)
Landlocked Atlantic salmon have successfully migrated above the Willsboro Cascades and produced wild fry in the North Branch following the removal of the Willsboro Dam in 2015. However, the majority of redds documented since the dam removal occur downstream of the Willsboro Cascades suggesting the cascade is a partial barrier to upstream migration of Atlantic salmon. During the fall of 2020, the USFWS in collaboration with USGS and NYSDEC conducted a radio telemetry study to examine upstream passage efficiency of adult Atlantic salmon at the Willsboro Cascade (Figure 3). Radio telemetry receivers were deployed throughout the Boquet River ranging from the river mouth to Wadhams Dam as well as throughout the North Branch (from the confluence with the mainstem to the former Crowningshield Dam). Thirty adult Atlantic salmon were captured with a fyke downstream of the cascades and radio tagged between September 15th and October 31st. Tagged salmon were released at their capture site and their movements were monitored on the radio telemetry receivers from the time of their release through January 14th.

Preliminary results found only three percent of radio tagged Atlantic salmon (1 of 30) were able to ascend the Willsboro cascades demonstrating the cascades had significant impacts on upstream migration of Atlantic salmon. These results suggest additional work is needed to evaluate use of temporary baffles to add in upstream migration above the cascades. The USFWS, NYSDEC, and USGS will be using this telemetry information to inform a fish passage evaluation by an engineer during the summer of 2021. The goal is to determine if improved use of temporary baffles can be effective for improving upstream salmon passage while continuing to restrict the passage of sea lamprey. Atlantic salmon restoration in the Boquet River may be restricted until upstream passage is improved allowing salmon to access to spawning and rearing habitat in the North Branch. The spawning and juvenile rearing habitat below the Willsboro Cascade is low quality and acts a reproductive “sink” for salmon in the Boquet River.

Figure 3. Willsboro cascades (left image), Sigma Eight Inc. stationary radio telemetry receiver (center image), and radio tagged Atlantic salmon (right image) in the Boquet River.

Spring and Fall Nearshore and Tributary Assessments (Pientka, Smith)

Annual fall boat electrofishing surveys for salmonids were conducted in larger Vermont tributaries and nearshore areas in New York. A fish trap was operated at Hatchery Brook (Ed Weed FCS discharge stream) during spring and fall to capture returning salmonids in spawning runs. A trap net was deployed in Hatchery Cove to collect spawning lake trout. These sampling efforts allow for the collection of biological data including total length, weight, sex, and age information as well as lamprey wounding data. Salmonids collected in Vermont tributaries were tagged with serially numbered Floy anchor tags prior to release. The data are utilized in hatchery product and fishery evaluations, and to monitor sea lamprey control progress through time. Numbers of fish reported below do not include same-year recaptures.

The focus of fall nearshore salmonid sampling was on traditional sites in Willsboro and Whallon bays. Sampling took place throughout most of November in 2020. Catches in the Whallon Bay and Willsboro Bay areas consisted of 328 lake trout and 164 salmon. Whallon and Willsboro bay salmon catches were on par with recent years. In 2020, a large portion of the salmon catch was made up of fish larger than 600 mm (Figure 4). These larger older fish were largely missing from the catch in 2018.

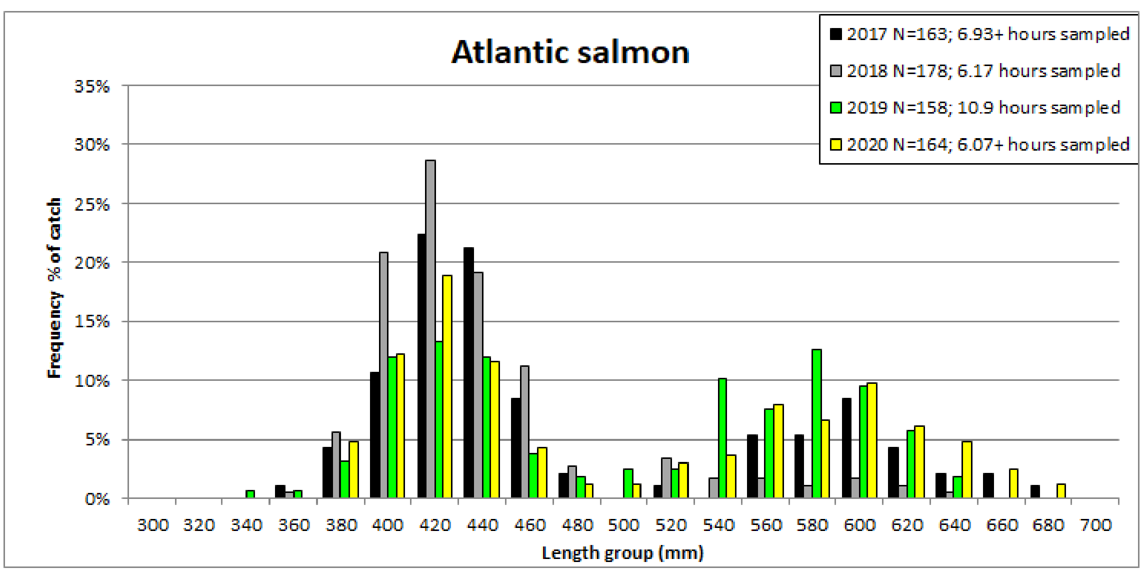

Figure 4. Length frequency distributions of landlocked Atlantic salmon collected from Willsboro and Whallon bays by electrofishing, 2017-2020.

In 2020, the Hatchery Brook trap was operated March 15-May 15, and September 15-November 15. Fifteen steelhead were captured and processed in Hatchery Brook during the spring season. In the fall, 353 salmon, 13 brown trout, and 5 steelhead were captured in the trap and processed.

Electrofishing yielded collections of 55 salmon in three trips to the Lamoille River, no sampling occurred at Otter Creek, and only a single trip occurred on Missisquoi River. Numbers of salmon collected in the fall 2020 tributary runs were good for Hatchery Brook and Lamoille River, but they started late. Limited sampling occurred on other rivers due to COVID-19.

A total of 157 adult salmon pairs were spawned at Ed Weed FCS. Ninety-one of the males, and 27 of the females spawned were lethally sampled for disease testing. Five female salmon died during the process, and the remainder were released alive in Lake Champlain.

Length frequency distributions of Hatchery Brook and Lamoille River salmon appeared to have more larger fish compared to previous years. Hatchery Brook peaked at 550 mm and Lamoille at 525 mm (Figure 5). Age distributions of salmon from these two sites are generally similar to past years. Lake age 1 made up a high percentage of the catch, but in 2020 Lake age 2 were just under 20 percent of the catch (Figure 6).

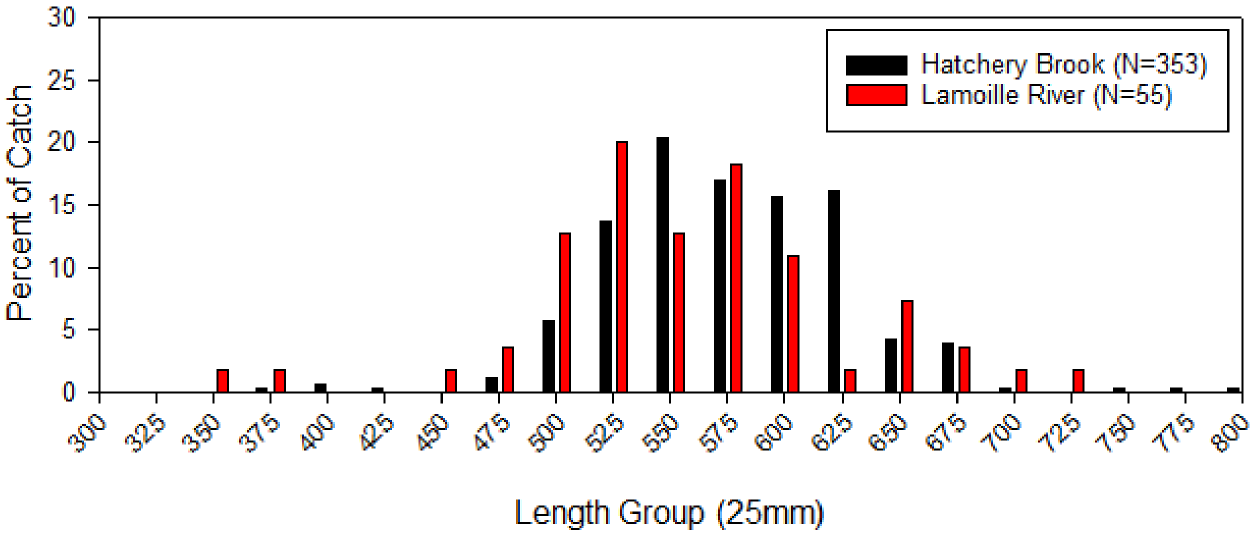

Figure 5. Length frequency distributions of landlocked Atlantic salmon collected from fall spawning runs in Hatchery Brook and Lamoille River in 2020.

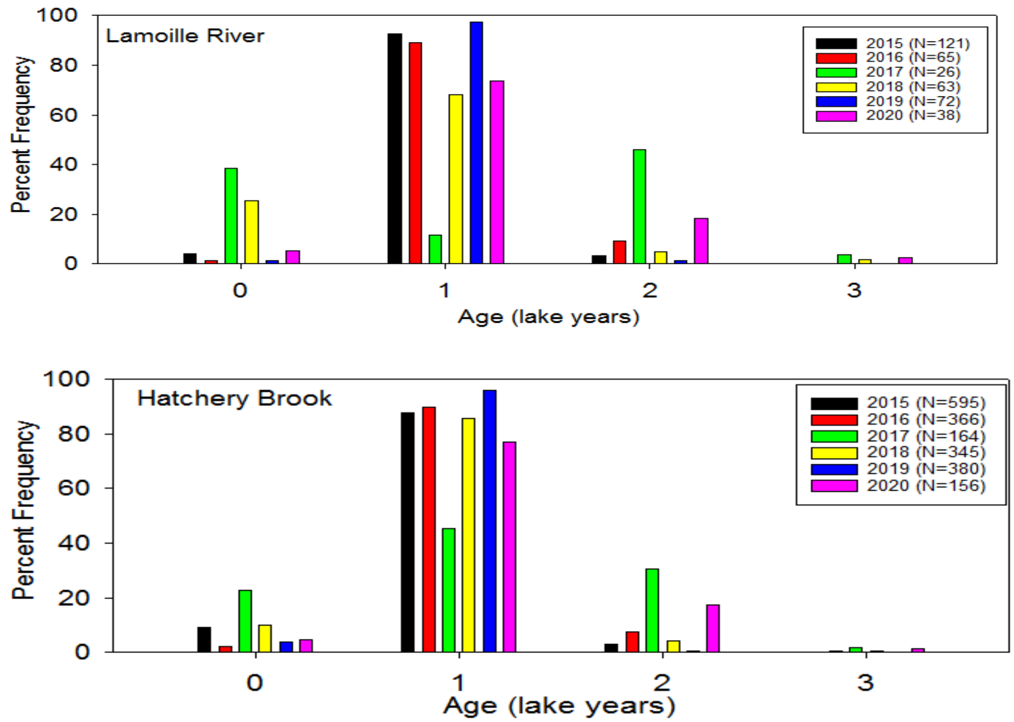

Figure 6. Age distributions (lake years) of landlocked Atlantic salmon from Lamoille River and Hatchery Brook, 2015-2020.

A trap net was deployed in Hatchery Cove for two overnight sets in early November to sample the lake trout spawning concentration; it yielded 576 lake trout. Length frequency distributions of male and female lake trout collected by trap net in Hatchery Cove and by electrofishing in Whallon Bay are presented in Figure 7.

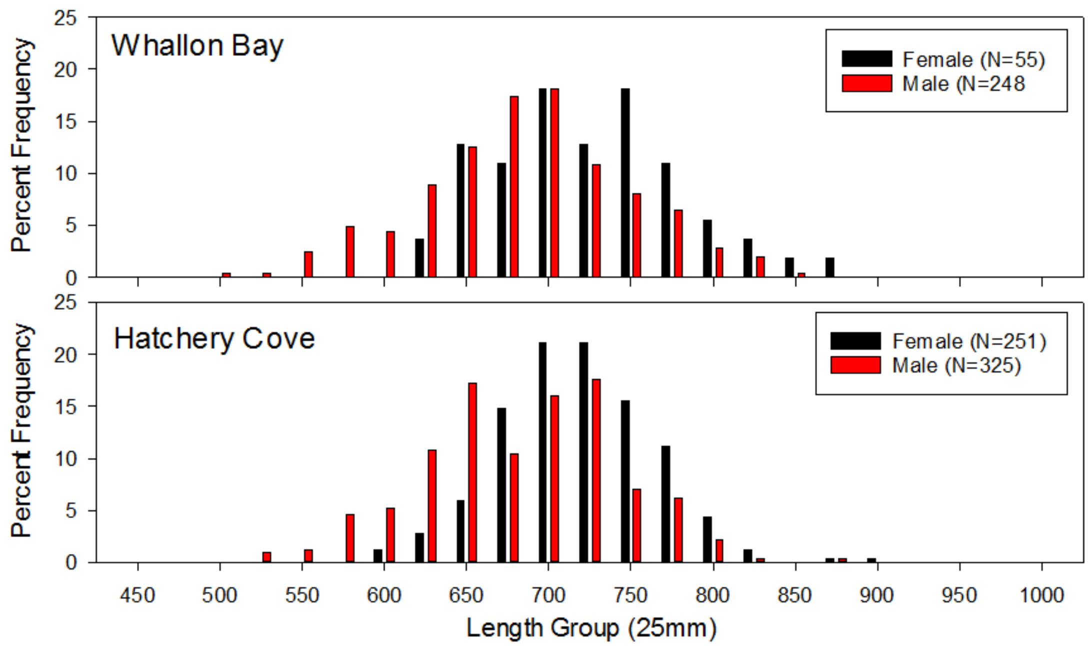

Figure 7. Length frequency distributions of male and female lake trout collected by trap net in Hatchery Cove and by electrofishing in Whallon Bay, November 2020.

Sea Lamprey

Larval Assessment

Pre-treatment (Allaire)

Streams are typically surveyed the year prior to a scheduled lampricide treatment to determine if a treatment is warranted. No lampricide treatments are scheduled in the Lake Champlain Basin in 2021, so no pre-treatment surveys were conducted in 2020.

Post-treatment (Allaire)

Post-treatment larval surveys were conducted in Vermont and New York tributaries that were treated with lampricide in the fall of 2019. This included Hoisington Brook (NY), Mill Brook (NY), Putnam Creek (NY), Mt. Hope Brook (NY), Poultney River (NY/VT), Hubbardton River (VT), and Lewis Creek (VT). Compared to pre-treatment larval surveys, post-treatment larval surveys showed that lampricide treatments had been successful (≥ 95%) at reducing sea lamprey larval densities in Hoisington Brook (100%), Poultney River (99.0%), and the Hubbardton River (100%) and only slightly less effective in Mill Brook (94.4%) and Mt. Hope Brook (92.5%). Lampricide treatments were less effective than desired in Putnam Creek (74.8%), and Lewis Creek (72.1%). In those rivers that received a less than effective treatment, staff will review treatment data and discuss ways to improve treatment strategies for future treatments.

Deltas (Allaire)

Delta surveys are typically conducted the same year as a scheduled delta treatment to limit the time for larvae to relocate between surveys and treatments. No delta treatments were scheduled in the fall of 2020. With no travel to Canada in 2020 we had some time available in our field schedule. We spent 2 days on the Winooski Delta and 2 days on the Lamoille delta targeting areas where we thought we might find sea lamprey larvae. No sea lamprey larvae were detected during these exploratory surveys.

Detection (Allaire)

In 2020, staff visited 34 tributaries in Vermont and New York at 56 locations that historically have been either "negative" for the presence of sea lamprey larvae or where sea lamprey larvae may have previously been found at densities that did not warrant control efforts.

No new sea lamprey larval populations were found. In the Mettawee River, La Chute River, and Indian Brook only *Ichthyomyzon sp.* (silver or northern brook) larvae were found. In the Missisquoi River above Swanton Dam only American brook lamprey larvae were found.

We have found sea lamprey larvae in Youngman Brook in the past, but at very low densities. A detection survey in Youngman Brook in 2016 did not detect any sea lamprey larvae. During our detection survey in Youngman Brook in 2020 we collected 106 sea lamprey larvae in $30m^2$ of larval habitat. We determined that a full Quantitative Assessment Sampling (QAS) survey was needed. During the full QAS survey we collected an additional 316 sea lamprey larvae. The largest sea lamprey larvae that was collected was 95mm and likely 2+ years old. We are currently investigating the possibility of trapping adults in Youngman Brook to address this recent surge in the larval population in the brook.

Other (Allaire)

Due to the closure of the US – Canada Border sea lamprey larval surveys were not done in the Pike River or Morpion Stream in Quebec in 2020. These tributaries had been surveyed annually since 2014 to monitor changes in larval densities and determine the effectiveness of the Morpion Barrier. While it is unfortunate that we were not able to operate the barrier in 2020, it will provide a year with no control to our data set.

Lamprey larval surveys are done periodically in Mallett's Creek and Mullen Brook where trapping is the selected control strategy. Sea lamprey larval density in Mullen Brook was slightly lower than previous surveys, while the sea lamprey larval density in Mallett's Creek had dropped by nearly 90% from a larval survey conducted there in 2015.

Trapping and Barriers (Allaire)

Due to COVID-19, no trapping of adult sea lamprey occurred in the Lake Champlain Basin in 2020. We are hopeful that we will be able to resume our trapping operations in the spring of 2021. Work continues to progress on the Great Chazy River dam repair project and the LaPlatte River barrier installation project. Both projects are expected to be completed by the end of 2021 and reduce the length of river accessible to lamprey by more than half in both cases.

Lampricide Control (Smith)

Lampricide treatments were completed on four tributaries in 2020 (Table 5). Control status of Lake Champlain tributaries is presented in Appendix 3. A treatment history and schedule of future treatments is presented in Appendix 4.

Table 5. Summary of 2020 lampricide applications in tributaries to Lake Champlain.

Stream	Date treated	Discharge (CFS)	TFM (lbs. active ingredient)	Length treated (miles)
Winooski River	10/2/20	1,000	3,790	10.5
LaPlatte River	10/14/20	5	74	3.5
Missisquoi River	10/20/20	1,800	5,681	7.8
Lamoille River	10/27/20	1,100	4,367	6.0
		Totals:	**13,912**	**27.8**

Wounding Rates (Pientka, Smith)

The objective of the sea lamprey control program is to achieve and maintain wounding rates at or below 25 wounds per 100 lake trout, 15 wounds per 100 landlocked Atlantic salmon (salmon), and two wounds per 100 walleye.

Sea lamprey wounding rates calculated for 533-633 mm TL lake trout collected in fall 2020 decreased to 40.8 wounds per 100 fish (n=169), which remains well above the program objective (Figure 8). The 2020 wounding rate estimate for salmon in the 432-533 TL interval also decreased slightly to 17.1 wounds per 100 fish (n=23), (Figure 8).

The wounding rate on salmon was under 20, similar to most years since 2010 (Figure 8). The wounding rate on lake trout in 2020 remains above our management target. The wounding rate index as a metric to gauge sea lamprey abundance has received increased scrutiny in recent years in the Great Lakes and Lake Champlain. The number of different variables that affect the index are difficult to individually quantify and can lead to misleading interpretations. This issue has led to investigations into new approaches in the Great Lakes that more accurately measure sea lamprey abundance. We are coordinating with our partners there and are in the process of developing a new adult assessment metric that will better inform us on the response of the lamprey population to our control efforts.

The sea lamprey wounding rate assessment for walleye (534 - 634 mm TL) was planned for the Poultney River in 2020. Due to COVID-19 restrictions, the assessment was not completed.

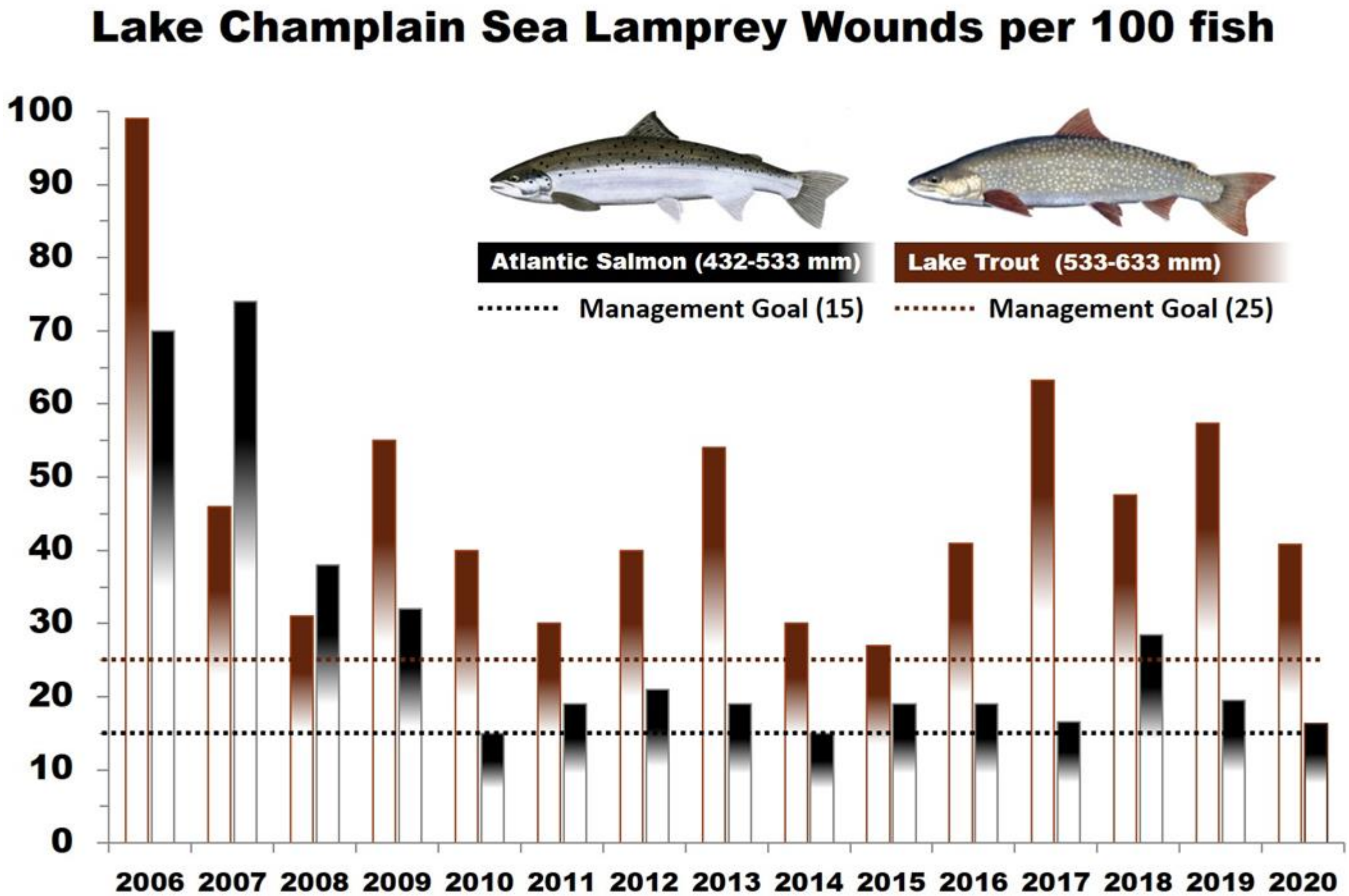

Figure 8. Type A1-A3 sea lamprey wounds (fresh and healing) per 100 lake trout (533-633 mm TL) and per 100 salmon (432-533 mm TL) from fall sampling.

Percidae

Yellow Perch (Pientka)

Experimental gillnets are set overnight at multiple locations in Vermont annually, to monitor the Lake Champlain fish community. While these nets are not specifically targeting yellow perch, they do provide insight into relative abundance of yellow perch. In 2020, the sampling occurred between July 5th and July 13th. Due to COVID-19 issues no sampling occurred in Missisquoi Bay in 2020.

Yellow perch catch per overnight set (CPUE) in 2020 were compared to the multiyear average CPUE for 2009 to 2019. Yellow perch CPUE in Mallett's Bay was slightly lower than the multiyear average. This was the second year in a row below the multiyear average. Shelburne Bay and St. Albans CPUE in 2020 were above the multiyear average. CPUE in 2020 for St. Albans was almost double that of the multiyear average (Figure 10). Sampling will continue in 2021.

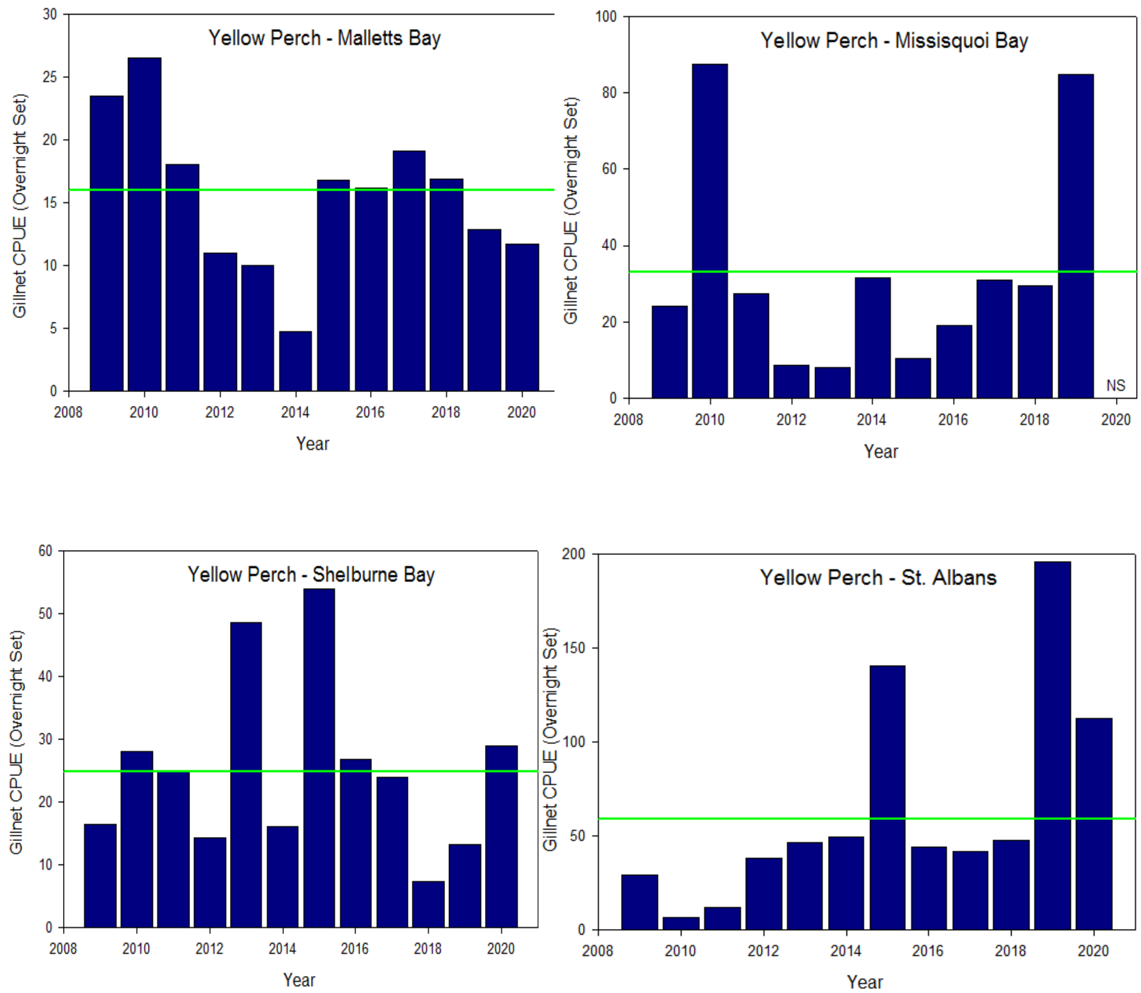

Figure 9. Yellow Perch CPUE for 2009-2020 at four Lake Champlain locations (note different y-axis scale). NS=not sampled. Green line represents the multiyear average CPUE for 2009 to 2019.

Walleye (Pientka, Good)

Walleye management activities in 2020 on Lake Champlain included monitoring adult walleye returning to spawn in the Poultney River (VT). The Poultney River spawning stock was used for collection of brood stock for the fish culture and stocking program, and evaluation of the contribution of stocked walleye to spawning populations. Because of field work and crew size restrictions imposed due to the COVID-19 pandemic, regular data collection activities did not occur. Field efforts focused only on collecting enough ripe male and female walleye to provide gametes for walleye culture and stocking needs in 2020.

One hundred and eighty-nine walleye (158 males, 31 females) were collected from the Poultney River. Sixteen pairs were spawned resulting in 2.23 million eggs. Eggs were hatched at the Ed Weed FCS in Vermont. Fingerlings were reared in the intensive culture system located at the Ed Weed FCS and in one pond managed by the Lake Champlain Walleye Association. All fry and fingerlings were marked with oxytetracycline (OTC) prior to stocking. Fifty-one age-3 males were collected for evaluation of the contribution of stocked fish to the spawning run in the Poultney River. All 3-year-old males collected were found to be of hatchery origin, as indicated by the presence of the OTC marks on the otoliths.

Sauger (Fiorentino)

NYSDEC is assessing options for sauger restoration in Lake Champlain and has drafted a Lake Champlain Sauger Restoration Plan. The plan has been reviewed by the FTC sauger working group and was presented to the full FTC in July 2019 for final input. A major component of the plan is establishing a sauger hatchery program to restore the species to Lake Champlain with a focus on the South Lake region. The plan suggested using broodstock from the upper Mississippi River. The sauger restoration plan is current on hold while NYSDEC is focusing on other major projects within the Lake Champlain watershed. When time permits the proposed plan will be revisited.

Centrarchids

Largemouth and Smallmouth Bass (Good, Pientka)

Angling for largemouth and smallmouth bass in Lake Champlain continues to be highly popular. The lake is widely considered to be one of the top 5 bass fishing destinations in the country, and it attracts and supports a high level of recreational and tournament-oriented fishing pressure. In 2020, Vermont issued 152 permits for bass tournaments on Lake Champlain, up from 127 the previous year. Due to COVID-19 restrictions, 22 of those tournaments were canceled. Data from professional bass fishing tournaments can serve as a valuable proxy for and an indicator of fishing quality, because professional anglers, as a group, are highly adept at maximizing the catch potential waterbodies support. Of the two major U.S. professional bass fishing tournament series, only B.A.S.S. held an event on the lake in 2020. Tournament results since 1997 indicate that bass fishing quality, reported as the average weight of daily 5-fish limits for the Top 10 finishing anglers, have remained consistent over time (Figure 11). In 2020, the highest average daily weight was observed since these data have been tracked.

Due to COVID-19, no electrofishing surveys were conducted on Vermont waters of Lake Champlain in 2020.

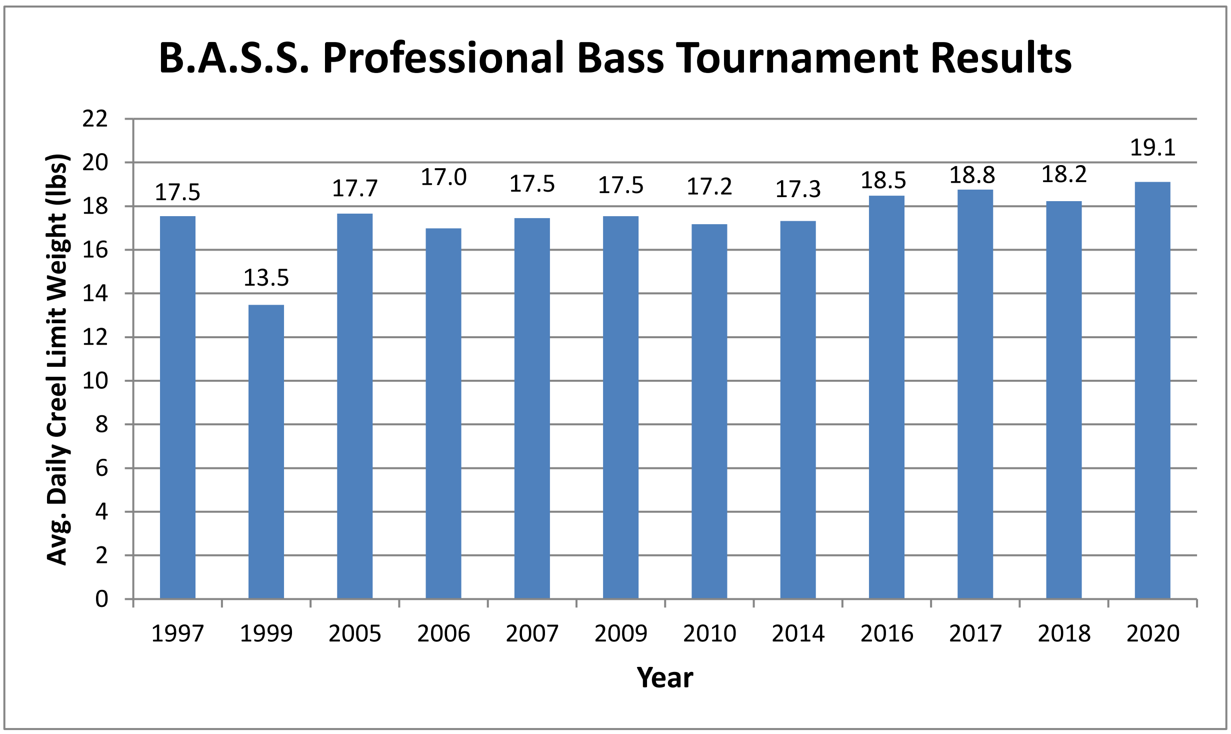

Figure 10. Average daily creel limit weights for the Top 10 anglers each year for B.A.S.S. Professional-level bass tournament series held on Lake Champlain since 1997 (note: x-axis is for years recorded and is not consecutive).

Esocids

Muskellunge (Good, Pientka, Balk)

No muskellunge stocking activities were conducted by NYSDEC in 2020.

No muskellunge stocking activities were conducted by VTFWD in the Missisquoi River and Missisquoi Bay in 2020 due to the unavailability of surplus fish from NYSDEC's Chautauqua Hatchery. Previous year's stocking numbers are provided in Table 6.

Table 6. Muskellunge stocking numbers for Lake Champlain, 2008-2020.

Date	Total Number Received	Total Wt. (lbs.)	Avg. Length (Inches)	Numbers Stocked by Location	
				Lower Missisquoi River & Bay	Above Swanton Dam
8/19/2008	250	4.35	6.10	250	0
8/19/2009	10,000	174.00	5.04	10,000	0
2010	0			0	0
8/18/2011	5,150	95.50	5.00	5,150	0
8/21/2012	8,800	185.00	5.36	8,800	0
8/26/2013	7,580	155.00	5.32	4,580	3,000
8/27/2014	7,000	137.00	5.24	5,000	2,000
8/25/2015	5,540	85.00	4.83	3,540	2,000
8/22/2016	6,300	128.00	5.31	3,800	2,500
8/21/2017	4,340	74.00	5.00	2,340	2,000
2018	0			0	0
2019	0			0	0
2020	0			0	0
TOTAL	**54,960**			**43,460**	**11,500**

In a non-stocking year, fall sampling for juveniles provides an opportunity to document any natural reproduction that may be occurring now that multiple age classes of mature stocked fish are present in the system. The upper and lower Missisquoi River was boat electrofished in November 2020. Unfortunately, due to extremely low water levels in the river, no suitable juvenile habitat was found, and no juvenile muskellunge were collected above or below the Swanton dam. However, two adult muskellunge were collected in the lower river (Dead Creek) measuring 470 mm and 794 mm in total length, and several others were observed but not collected.

Anecdotal information from angler catches also continues to indicate that stocked muskellunge are surviving and growing well.

Anguillids

American Eel Sampling (Pientka)

No sampling was done in 2020.

Acipenseridae

Lake Sturgeon (Murphy, Simard)

Due in part to COVID-19 restrictions, no new sampling or tagging of lake sturgeon was conducted in 2020. Staff revisited past data and work to prioritize future management activities and sampling efforts. Public outreach at fishing areas along spawning tributaries also continued to inform anglers of the presence of lake sturgeon, the endangered status of the species, and proper handling techniques if a lake sturgeon is caught.

Recreational Fishery Monitoring

Angler Surveys (Pientka, Balk)

No angler surveys were conducted by NYSDEC or VTFWD in 2020.

Fish Health (Jones, Balk, Garceau)

Walleye Fish Health Inspection: Adult walleye broodstock were collected from the Poultney River and transferred to a bio-secure isolation station at the Ed Weed FCS. Eggs were water-hardened in a 50-ppm iodine solution for 30 minutes and then placed in a quarantine unit until associated fish health inspection laboratory work was completed. On March 30 & 31, 2020, 32 gamete contributing adults (16 female/16 male) were lethally sampled and tested for viral and bacterial fish pathogens of concern to include: IPN, IHN, VHS, OMV, AS and BR (Table 7. All fish sampled tested negative (Table 7). Both Lymphocystis (virus) and Walleye Dermal Sarcoma (virus) were presumptively identified on the skin. Muscle tissue was visually examined for the *Heterosporis sp*. parasite which was not observed.

Table 7. Summary of pathogen abbreviations.

Pathogen	Abbreviation	Pathogen	Abbreviation
Infectious Pancreatic Necrosis	IPN	Spring Viremia Carp Virus	SVCV
Infectious Hematopoietic Necrosis	IHN	Furunculosis	AS
Viral Hemorrhagic Septicemia	VHS	Enteric Redmouth Disease	YR
Largemouth Bass Virus	LMB	Oncorhynchus Masou Virus	OMV
Renibacterium salmoninarum	BKD	Aquareovirus A	AQ
Epizootic Epitheliotropic Disease Virus	EEDV	Namaycush Herpesvirus	NamHV

Wild Landlocked Atlantic Salmon Inspection: Sebago strain landlocked Atlantic salmon, originating from Lake Champlain, were captured from the Ed Weed FCS discharge stream (Hatchery Brook), and used as an egg source. Eggs were water hardened in iodine at 50-ppm concentration for 30 minutes. Fertilized eggs were held in a bio-secured isolation area until associated fish health inspection laboratory work was completed. From November 6, 2020 through November 16, 2020, a total of 206 salmon (156 male and 5 female) were lethally sampled for viral and bacterial pathogens of concern (IPN, IHN, VHS, OMV, BKD, ER, AS, and AQ) (Table 8). In addition, non-lethal, ovarian fluid samples were collected from 156 females and tested for IPN, IHN, VHS, OMV, BKD, and AQ (Table 8). All fish sampled tested negative (Table 8). The internal Cestode "*Diphyllobothrium dendriticium*" was documented from the gastrointestinal tract. This parasite has been documented consistently when testing salmon from Lake Champlain.

Wild lake Trout originating from Lake Champlain were captured from d Hatchery Cove and used as an egg source for the Ed Weed FCS as part of a pilot study. Eggs were water hardened in iodine at 50-ppm concentration for 30 minutes. Fertilized eggs were held in a bio-secured isolation area until associated fish health inspection laboratory work was completed. On November 9, 2020, a total of 48 lake trout (24 male and 24 female) were lethally sampled for viral and bacterial pathogens of concern (IPN, IHN, VHS, OMV, BKD, ER, AS, EEDV, and NamHV – see Table 8. In addition, ovarian fluid samples were collected from 48 females and tested for IPN, IHN, VHS, OMV, BKD, EEDV and NamHV. Both EEDV and NamHV were detected in 23 adult fish (Table 8). Due to the high incidence of both viruses, and as a safeguard approach to rearing production lake trout at the Ed Weed FCS, additional testing of lake trout embryos and fry was planned prior to moving fingerlings into the main raceway production area. On December 14, 2020, 360 eggs tested negative for both viruses. On February 10, 2021, 60 sac-fry tested negative for both viruses. Two additional fry tests will be conducted prior to fry being moved to the main production raceways.

Table 8. Summary of Disease Testing in Lake Champlain Feral Broodstock

Date	Sp.	# Test	IPN	IHN	VHS	LMB	BKD	SVCV	AS	YR	OMV	AQ	EEDV	NamHV
3/30/20 & 3/31/20	WAL	32 lethal	NEG	NEG	NEG	N/A	N/A	N/A	NEG	NEG	NEG	N/A	N/A	N/A
11/6/20 to 11/16/20	LAS	206 lethal	NEG	NEG	NEG	N/A	NEG	N/A	NEG	NEG	NEG	NEG	N/A	N/A
11/6/20 to 11/16/20	LAS	156 O/F	NEG	NEG	NEG	N/A	NEG	N/A	N/A	N/A	NEG	NEG	N/A	N/A
11/9/20	LAT	48 lethal	NEG	NEG	NEG	N/A	NEG	N/A	NEG	NEG	NEG	NEG	POS	POS
11/9/20	LAT	24 O/F	NEG	NEG	NEG	N/A	NEG	N/A	N/A	N/A	NEG	N/A	POS	POS
12/14/20	LAT	360 Egg lethal	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NEG	NEG
2/10/21	LAT	40 Fry lethal	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NEG	NEG

Species Key: WAL – Walleye LAS - Landlocked Atlantic Salmon LAT- Lake Trout
Results: POS - Positive **NEG** – Negative **N/A** – Not Tested For **O/F :** Nonlethal Ovarian fluid

Vermont Wild Fish Health Testing: One Lake Champlain location was sampled in 2020 and samples were forwarded to the USFWS Lamar Fish Health Center to be included in the USFWS's Natural Fish Population Survey. On June 1, 2020, samples were collected from Lake Champlain (Dillenbeck Bay) located in Alburg, VT. Testing was conducted on three fish species for a total of 100 fish sampled; species included: largemouth bass (24), yellow perch (50) and brown bullhead (26). Pathogens tested for included: VHS, IHN, IPN, LMBV, SVCV, AS, and YR (Table 9). None of the major pathogens tested for were detected. In addition to the pathogens previously mentioned, a significant bacterial infection of *Aeromonas sobria* and *Aeromonas hydrophila* was documented in yellow perch. Additionally, in yellow perch, muscle tissue was visually examined for the *Heterosporis sp*. parasite which was not observed. Common parasites detected in yellow perch included blackspot and redworm. Yellow grub was detected in largemouth bass.

Table 9. Summary of Lake Champlain Disease Testing for USFWS's Natural Fish Population Survey

Date	Location	Sp.	# Test	IPN	IHN	VHS	LMB	BKD	SVCV	AS	YR	OMV
6/1/2020	Dillenbeck Bay	YP	50	NEG	NEG	NEG	NEG	N/A	NEG	NEG	NEG	N/A
6/1/2020	Dillenbeck Bay	LMB	24	NEG	NEG	NEG	NEG	N/A	NEG	NEG	NEG	N/A
6/1/2020	Dillenbeck Bay	BB	26	NEG	NEG	NEG	NEG	N/A	NEG	NEG	NEG	N/A

Species Key: YP - Yellow Perch LMB - Largemouth Bass BB - Brown Bullhead
Results: (+/-) **N/A** – Not Tested For

NY salmonid fish health testing: Salmonids were collected by USFWS from Willsboro Bay in the fall of 2020. Samples were transferred to NYSDEC staff and delivered to the NYS fish health testing lab. Results will be available in a few months.

Fish Kill – Northern Champlain – June 2020

Beginning in early June 2020 and continuing through early July 2020 a large fish kill was observed in both the U.S. and Quebec portion (Near Venise-en-Québec) of Missisquoi Bay and extended south to St. Albans Bay, VT. Both VTFWD and MFFP investigated and documented the following species to be involved: yellow perch, rock bass, pumpkinseed, white perch, largemouth bass, smallmouth bass, northern pike, brown bullhead, golden shiner, white sucker, tench, and common carp.

Early attempts to collect freshly dead or moribund fish in Vermont failed due to the rapid decomposition of the fish due to warm water conditions. To address the rapid decomposition, in late June MFFP collected live fish samples in the areas where dead fish were observed using short duration gillnet sets. These fish samples were submitted to the Université de Montréal for testing. The final report listed multiple conditions including: multifocal integumentary hemorrhages on the skin and fins (75% of fish sampled), multifocal hemorrhages on kidney and muscle (55% of fish sampled), multifocal Trematode metacercariae (45% of fish sampled), dermatitis and erosive skin lesions (bacterial origin, *Aeromonas hydrophila;* 25% of fish sampled), organic infection of bacterial origin with Gram-negative bacilli (20% of fish sampled), and Branchial parasitism (copepods, monogenic Trematode; 20% of fish sampled). It was also reported that macroscopic and histopathological examinations as well as additional tests (bacteriology, biology molecular for viral research) failed to identify a significant cause in twenty of the one hundred and four fish submitted. In conclusion the report mentions that the cause is uncertain but that changes in the environment (especially in the temperature of the water) may have caused direct mortality and/or promoted the development of fatal bacterial infections. The many lesions of parasitic origin are expected in wild freshwater fish and considered to have little impact on the health of the fish submitted.

As a follow-up to the large fish kill previously described, in early July, VTFWD randomly collected approximately 50 yellow perch and 1 brown bullhead from Lapans Bay and St. Albans Bay. External lesions were noted on the skin and gills from 5 perch and the single bullhead. From 3 perch and 1 bullhead, both kidney and lesions were inoculated onto TSA and TYES media for bacterial growth. All 4 lesions grew bacteria, although none of the kidneys produced bacterial growth. Using standard tube culture and the API 20E testing system, *Aeromonas sobria* was documented. Additionally, *Flavobacterium columnare (*Columnaris disease*)* was observed and cultured from perch/bullhead lesions and perch gill tissue. All perch were tested for viral pathogens on 2 cell lines (CHSE and EPC) producing Negative results. No parasites were detected in the 50 perch examined. Although not conclusive evidence on what was responsible for the previous fish kill in this general area, both bacterial species are well known to produce fish mortality in many fish species, particularly under stressful conditions such as high-water temperatures. It was interesting to note that in early June 2020, as a part of the USFWS's Wild Fish Health Survey, VTFWD submitted fish tissues to the Lamar Fish Health Center, Lamar, PA. Two bacterial species (*Aeromonas hydrophilia and Aeromonas sobria*) were recovered from asymptomatic yellow perch and largemouth bass. Twenty of the 50 yellow perch had *Aeromonas hydrophilia* and 6 out of 50 had *Aeromonas sobria.* Water temperature was documented to be 60 F.

In conclusion, both VTFWD and MFFP, were unable to establish the direct cause of this fish kill but both organizations strongly feel that the warm water temperatures during this timeframe was the major stressor leading to this large fish kill.

Research

Development of methods to assess lake sturgeon populations in Lake Champlain (Lisa K. Izzo[1], Donna L. Parrish[2,1], Gayle Barbin Zydlewski[3], and J. Ellen Marsden[4], Affiliations: Vermont Coop Unit[1], USGS[2], Maine Sea Grant[3], UVM[4])

In 2020, the Vermont Cooperative Fish & Wildlife Research Unit (VTCFWRU) wrapped up field work on the lake sturgeon project and finalized many pieces of analysis. The project had three main goals: (1) to investigate movements and habitat use of lake sturgeon in the Lake Champlain basin, (2) to develop a method to estimate lake sturgeon abundance using SONAR technology, and (3) to test an alternative method for ageing lake sturgeon.

For the first goal, a total of 29 juvenile (453–874 mm TL) lake sturgeon from the Winooski River population were tagged between 2017 and 2019. We compared data from tagged juveniles to data from adult lake sturgeon that had been tagged by VTFWD and found that juvenile home ranges were the same as adult home ranges in spring and summer, but were larger than adult home ranges in winter. Juveniles and adults overlapped in shallow (< 10 m) water on the Winooski River Delta in the summer and fall. In winter and spring, juveniles moved to deep-water sites (> 25 m), while adults remained in shallow water near the mouth of the Winooski River. We also used acoustic telemetry to describe adult lake sturgeon movement patterns during the spawning period and to investigate environmental drivers of these movements in the Winooski River. River discharge, temperature, the lagged effect of temperature, and time of day were significant factors in describing upstream movements. Adult lake sturgeon displayed general movement patterns that included a single run upstream, upstream and downstream movements throughout the river, or multiple runs made up the entire length of the spawning tributary to the spawning site. An understanding of movements during the spawning period was key to the method we developed to estimate abundance.

To estimate abundance, we used acoustic telemetry data from adult lake sturgeon to estimate observation probability of the SONAR and the probability that a lake sturgeon had been seen previously during the season. Using a Bayesian integrated model, we combined these parameters with counts from a dual-frequency identification sonar (DIDSON) to estimate the following abundances: 110 (47 – 229 CI) in 2017, 133 (79 – 242 CI) in 2018, and 99 (51 – 220 CI). The results of this work represent the first estimate of abundance for spawning lake sturgeon in a Lake Champlain tributary.

Lastly, we investigated the second marginal pectoral fin ray as an alternative, less invasive method for ageing lake sturgeon. By looking at the variability of age estimates between different readers and fin structures, we found that the second fin ray is not a viable substitute for ageing adult lake sturgeon but may provide some utility to age juvenile lake sturgeon.

Parentage Based Tagging of Atlantic Salmon in Lake Champlain (Heim, Ardren)

In 2020, the USFWS in cooperation with NYSDEC and VTFWD were working to develop a parentage-based tagging (PBT) program with a goal of maintaining a healthy Atlantic salmon population in Lake Champlain and its tributaries that supports a quality recreational fishery while striving to increase the number of wild fish in the fishery. All Atlantic salmon produced at White River NFH for the 2020 – 2024 year classes will be PBT. In 2020, 18 PBT were developed. Ten of the PBT groups are being reared to smolts at DD Eisenhower National Fish Hatchery and stocked into three rivers in 2022. Eight PBT groups are being reared at Adirondack Hatchery and will be released as unfed fry in three rivers in spring 2021.

Genetic Potential for Tolerance to Low Thiamine in Landlocked Atlantic Salmon (Harder, Christie - Purdue University; Ardren - USFWS)

Adaptive genetic potential of landlocked Atlantic salmon to respond to thiamine deficiency was evaluated using gene expression analysis of salmon collected at Hatchery Brook and spawned and reared at White River NFH. Among-family differences in survival under low thiamine conditions was evaluated. A wide variation in survival of families was observed and family survival was linked to differences in gene expression patterns. Based on these results, the authors concluded that landlocked Atlantic salmon in Lake Champlain have genetic variation needed for adaptation to low thiamine conditions. Follow up studies are underway to evaluate the survival and reproductive success of fry and smolts stocked into Lake Champlain from the Low Thiamine Tolerant and Maximum Genetic Diversity broodstocks at White River NFH developed in parallel with this study. The first fry from these broodstocks were stocked into Lake Champlain rivers in spring of 2021. The first smolts from these broodstocks will be stocked in spring of 2022.

Lake Trout Population Dynamics (J. Ellen Marsden, Benjamin Marcy-Quay, UVM)

Continued recruitment of wild lake trout in Lake Champlain may necessitate future adjustments to management and stocking strategies. Our objective is to inform these decisions by improving the understanding of the relative performance (growth and survival) of the two stocking strategies used by New York and Vermont, as well as the parental population underlying recruitment. To accomplish this, we are designing a next-generation genetic panel that will allow us to determine the origin of stocked fish and the size and structure of the parental population contributing to wild recruitment.

Lake Trout Recruitment (J. Ellen Marsden, Matt Futia, UVM)

Ongoing assessment of wild lake trout (*Salvelinus namaycush*) recruitment was limited in 2020 by the COVID-19 pandemic, although there was increased effort to collect older individuals (total length > 400 mm) with gill nets and angling. A total of 208 trawls was conducted between July and October 2020. The overall percentage of wild juvenile lake trout (total length < 400 mm) collected was 33.8% (n = 195). Wild juveniles represented 15.8% of 19 juveniles in the north region, 46.8% of 111 juveniles in the central region, and 15.2% of 92 juveniles in the south region of the Main Lake. These percentages are similar to the data from 405 bottom trawls conducted during the comparable period in 2019 with the exception of the north region, which had few juvenile lake trout in 2019 (north: 75.0%, n = 4; central: 54.8%, n = 332; south: 14.5%, n = 69). In older age classes (> 400 mm), wild lake trout represented 25.7% of 106 fish caught.

Lake Champlain food web model (Jason D. Stockwell, J. Ellen Marsden, and Rosalie Bruel, UVM)

Lake Champlain has experienced several important ecological events over the last few decades, including invasion of species at low and higher trophic levels and in the last few years, lake trout (*Salvelinus namaycush*) natural recruitment has suddenly “turned on” after more than four decades of stocking. Understanding how changes in the structure of the food web impact the ecosystem as a whole requires an ecosystem-based approach. We used long-term datasets (>25 years) on limnological variables (VTDEC long-term monitoring) and fishes (VTFWD annual surveys of forage fish, nearshore fish community, lake trout spawners, larval and adult sea lamprey, and stocking rates of Atlantic salmon (*Salmo salar*), lake trout, and walleye (*Sander vitreus*)). Our objective is to retrospectively examine the impacts of exotic species invasions in Lake Champlain, and to prospectively test management-relevant hypotheses. In this initial phase of the food web model development, we focused on modeling three periods: before alewife (*Alosa pseudoharengus*) invasion (2000-2002), after alewife invasion (2008-2010), and after the first sign of lake trout natural recruitment was observed (2018-2020). The model indicates that the trophic carrying capacity of Lake Champlain was not fully used in the early 2000s, which allowed alewife to invade without impacting its potential native competitor, rainbow smelt (*Osmerus mordax*). Balancing the model also reveals knowledge gaps, such as survival of stocked predators and abundance of non-stocked predators, that may be key for designing ecosystem-based management approaches.

Lake Champlain forage fish/carbon project (Jason D. Stockwell, J. Ellen Marsden, Ariana M. Chiapella, UVM)

Quagga mussels (*Dreissena bugensis*) are a clear and imminent danger to the ecology of Lake Champlain. In the Great Lakes, the invasive quagga mussel has dramatically shifted system production from pelagic to benthic habitats with negative consequences on resource availability for pelagic-dependent trophic levels. Quagga mussels could have the same effects in Lake Champlain when they invade. If quagga mussels induce a shift from pelagic to benthic primary production in the lake, then pelagic-dependent forage fishes such as alewife (*Alosa pseudoharengus*) and rainbow smelt (*Osmerus mordax*), and ultimately lake trout (*Salvelinus namaycush*) and Atlantic salmon (*Salmo salar*), could be negatively impacted. The objective of our project is to understand the carbon (i.e., energy) pathways of Lake Champlain's forage fish community, so that we can anticipate the potential effects of quagga mussels on the lake's fishery. We have sampled the main components of the forage fish food web (phytoplankton, detritus, zooplankton, benthic invertebrates, *Mysis*, alewife, rainbow smelt, and slimy sculpin) and analyzed their stable nitrogen and carbon isotopes to determine trophic position and foraging habitat. We also analyzed a subset of samples for fatty acids and deuterium of fatty acids. We are using these data to delineate the primary basal energy resources that support the forage fish community (and ultimately lake trout) in Lake Champlain using Bayesian MixSIAR models. We will identify any vulnerable trophic connections, and the consequent risk quagga mussels pose to the forage fish community. In conjunction with the Lake Champlain food web model, this project will inform how certain management and/or stocking decisions may impact the stability of the forage fish community

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Appendix

Appendix 1. Members and Advisors of the Lake Champlain Fish and Wildlife Management Cooperative, Fisheries Technical Committee

U.S. Fish and Wildlife Service:
W. Ardren , B. Young, B.J. Allaire, Essex Junction, VT
S. Smith – Liaison to NYSDEC – Essex Junction, VT
H. Bouchard – North Chittenden, VT

Vermont Fish and Wildlife Department:
B. Pientka, L. Simard - Essex Junction, VT
M. Murphy, S. Good – Rutland, VT
K. Kelsey – Grande Isle, VT

New York State Department of Environmental Conservation:
R. Fiorentino, T. Shanahan, N. Balk (FTC Chair), – Ray Brook, NY

University of Vermont:
J.E. Marsden – Burlington, VT

Vermont Cooperative Fish and Wildlife Research Unit (USGS):
D. Parrish – Burlington, VT

Lake Champlain Sea Grant:
M. Malchoff – Plattsburgh, NY

Appendix 2. Stocking reduction for Lake Trout.

Lake Champlain Lake Trout Stocking Reduction Recommendation
Lake Champlain Fisheries Technical Committee - Salmonid Assessment Working Group
November 12, 2020
Approved by Lake Champlain Fish and Wildlife Management Cooperative - Management Committee November 24, 2020

Background

Lake Champlain supported indigenous populations of lake trout *Salvelinus namaycush* during its early settlement. Lake trout were rapidly depleted as development in the area progressed during the 1800s. In the late 1950s and early 1960s, New York and Vermont began stocking lake trout, producing a limited fishery. In 1973, the Vermont Fish and Game Department (now Fish and Wildlife Department), New York State Department of Environmental Conservation (NYSDEC), and the U.S. Fish & Wildlife Service (USFWS) formed the Lake Champlain Fish and Wildlife Management Cooperative. A major goal of this cooperative is to develop and maintain a salmonid fishery focusing on restoration of landlocked Atlantic salmon *Salmo salar* and lake trout, and stocking steelhead trout *Oncorhynchus mykiss* and brown trout *Salmo trutta* to diversify fishing opportunities. The States of Vermont and New York and the USFWS annually stock approximately 82,000 yearling lake trout in Lake Champlain. All stocked lake trout receive a fin clip following a five-fin rotation. Evaluating progress of the program is important to guide future salmonid management actions and research priorities.

One of the salmonid indicators includes an annual assessment of the proportion of wild lake trout in fall spawning assessments (Lake Champlain Fisheries Technical Committee 2020). An increase in wild lake trout may require management changes to stocking rates or harvest regulations without similar trends being apparent in other indicators because lake trout are long lived and the impacts of natural recruitment by lake trout are unknown. Assessment of wild lake trout contribution to the Lake Champlain lake trout population is done by examining the proportion of unclipped to clipped lake trout less than 660 mm total length and with fin-clips corresponding to age 4 or 5 (first ages of recruitment to the fall spawning population) captured in fall sampling which has been conducted for the past 20 years at Gordon Landing, VT and Whallon Bay, NY (Lake Champlain Fisheries Technical Committee 2020). Sampling at these sites has found a low percentage of unclipped fish through 2019, which would indicate minimal natural reproduction or recruitment to spawning age (Table 1). The percent unclipped are well within the potential clipping error.

Table 1. Count of clipped, unclipped, and total lake trout <660 mm and percentage of unclipped lake trout collected during fall spawning assessments

Year	**Number Lake Trout Collected**			**Percent Unclipped**
	Clipped <660 mm	**Unclipped <660 mm**	**Total <660 mm**	
2011	137	3	140	2.1
2012	128	4	132	3.0
2013	52	3	55	5.5
2014	305	7	312	2.2
2015	328	5	333	1.5
2016	144	0	144	0.0
2017	91	4	95	4.2
2018	75	4	79	5.0
2019	51	2	53	3.8

Sampling for juvenile lake trout outside the spawning assessment has documented slightly different results (Table 2). Starting in 2015, a high percentage of unclipped juvenile lake trout (age 0-3) were collected during bottom trawl sampling by University of Vermont researchers. Wild juveniles had not been documented in the lake since the stocking of yearling lake trout began in 1972. While the percentage of unclipped adult lake trout in spawning surveys exceeded 10% in the 1990s and 2000 (likely due to two years of unmarked stockings), this has been at or below 2% since 2002 indicating recruitment of wild lake trout has not occurred in the recent past (Marsden et al. 2018). Sampling to date has documented eight year classes of unclipped juveniles; therefore, it would be expected that wild lake trout of spawning age (6 or 7) should be appearing in the annual spawning surveys.

Table 2. Proportion of wild juveniles in bottom trawling 2015-2019 (from Ellen Marsden).

Year	**Number collected (Ages 0 to 3)**	**Percent No Clip**
2015	263	27.8
2016	1332	31.2
2017	946	55.9
2018	1474	65.7
2019	740	50.4

While the juvenile assessments have been showing a higher percentage of unclipped lake trout this only represented ages 0-3. During summer 2020, an additional survey was conducted to assess the percentage of unclipped lake trout in the subadult to adult age classes to investigate why the two assessment methods (spawning vs juvenile) had such different unclipped percentages. Two potential reasons for this are high mortality between ages 4 and 6 or wild lake trout are spawning at locations other than Gordon Landing and Whallon Bay and are not being observed in annual sampling. Sampling in 2020 focused on the south, central, and north sections of the main lake with a target of 100 lake trout per section. Sampling occurred in late June and July and resulted in 339 lake trout collected with 32 of those unclipped (9.4%) with a higher percentage unclipped in the north and central sections compared to the south (Table 3). In addition, the percentage of lake trout with no clip was higher for smaller individuals compared to larger ones indicating these fish may be just entering the spawning population. If the catch data from the summer gillnetting was applied to the spawning assessment indicator (<660 mm total length) the overall percentage of unclipped fish is 34.8 or 43.6, depending on which fin clip rotation is used for age 4 and age 5 (either 2019 age 4 and 5 or 2020 age 4 and 5, respectively).

Table 3. Summary of lake trout collected in summer 2020 with gillnets by total length and lake section.

Length (mm)	Section	Number Collected	Number No Clip	Number with Clip	% No Clip
250-350	North	11	2	9	18.18
351-450	North	11	1	10	9.09
451-550	North	10	5	5	50.00
551-650	North	19	4	15	21.05
651-750	North	51	1	50	1.96
751-850	North	16	0	16	0.00
All	**North**	**118**	**13**	**105**	**11.02**
250-350	Central	1	1	0	100.00
351-450	Central	4	1	3	25.00
451-550	Central	6	2	4	33.33
551-650	Central	25	1	24	4.00
651-750	Central	54	6	48	11.11
751-850	Central	21	1	20	4.76
All	**Central**	**111**	**12**	**99**	**10.81**
250-350	South	7	0	7	0.00
351-450	South	5	3	2	60.00
451-550	South	10	3	7	30.00
551-650	South	26	1	25	3.85
651-750	South	44	0	44	0.00
751-850	South	18	0	18	0.00
All	**South**	**110**	**7**	**103**	**6.36**

Rationale
One of the Salmonid Indicators for lake trout (FTC 2020), as well as an action identified in the Strategic Plan (Hurst et al. 2020), is a reduction in stocking based on the percentage unclipped fish in the fall spawning assessment. If the proportion of naturally produced spawners (i.e., unclipped fish) in age 4 and 5 year classes (is greater than or equal to 15% then a 25% reduction in stocking is recommended; if the proportion unclipped is greater than 25% then a 50% reduction is recommended (Lake Champlain Fisheries Technical Committee 2020). While the proportion of unclipped lake trout in the fall spawning assessments is still low, the numbers of unclipped fish in both the juvenile assessments and the summer 2020 gillnet assessment indicates wild lake trout are increasing in abundance and may be just starting to recruit to the spawning population. Because only two locations are sampled each fall, it is unknown if wild fish are spawning elsewhere or if we can anticipate seeing more wild fish in our fall 2020 assessments. Using the summer 2020 gillnetting data and applying the results to the spawning assessment indicators, as described above, at a minimum, 35% of fish in the age 4 and 5 year classes were unclipped, which would lead to a 50% reduction in stocking based on the indicators and the strategic plan. While the spawning assessment indicator has not been met yet, the juvenile and gillnetting assessments are strong enough to justify making a change now.

During discussions among a subset of the Salmonid Working Group regarding lake trout an opportunity to eliminate New York DEC lake trout stocking beginning in 2022 was identified. This represents 33% of the total lake trout stocked and all agreed would be a good starting point. Some unknowns with this approach are the lack of understanding of how the NY and VT stockings may differ in overall survival rates and movement patterns within the lake. However, just cutting NY fish but keeping VT stocking steady helps create a good study to assess contribution from VT. All agreed this could be a good opportunity for both management and research goals.

Recommendation

Based on the background and rationale provided, it is recommended to reduce lake trout stocking by 33%. This can be accomplished most efficiently by eliminating the NY portion of lake trout stocking beginning in 2022 and continuing indefinitely. New York will resume stocking if recruitment indices indicate increased stocking is necessary to sustain the fishery. As part of this recommendation, we assume stocking numbers of other salmonids will remain within their target numbers (i.e., no increase to make up for reduced lake trout stocking). It is recommended that population assessments continue to monitor the impact of the stocking reduction.

Assessment

If stocking reductions are implemented in 2022, it is important that we continue to monitor the population response. A reduction in stocked lake trout may allow more wild fish to recruit and survive the first year. Lake trout will continue to be sampled by fall spawning surveys and the summer gillnetting will continue to assess overall contribution of unclipped fish to the population. In addition, additional spawning bed surveys may be evaluated at other locations in the lake, such as Arnold Bay or Burlington Harbor, to determine if unclipped lake trout may be spawning elsewhere. UVM researchers will continue juvenile assessments to document the percentage of wild fish among juvenile lake trout as part of their forage fish survey, although funding for this study has only been provided through the next two years. It will be important to discuss how juvenile lake trout sampling continues in the future, the spatial and temporal level of assessment, as well as funding. Genetic analysis has been proposed to determine if there is a difference between the NY and VT stocked lake trout and if so potentially determine whether parentage of wild fish is of NY or VT origin. This would help determine if there are concerns with eliminating stocking from NY.

Finally, a plan should be developed for announcing the proposed stocking reduction recommendation to the public. The development of the plan should include members from all the agencies. Outreach to anglers and the general public will need to convey a consistent message and explain that a reduction in stocking is a success story. We need to explain that there are a lot more fish out there that we didn't put in the lake and there is a limit on the food available to feed these predators. We also need to be clear that we will continue to monitor the population response and may make additional reductions depending on what we see.

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Marsden, J.E., C.L. Kozel, and B.D. Chipman. 2018. Recruitment of lake trout in Lake Champlain. J. Great Lakes Res. 44:166-173.

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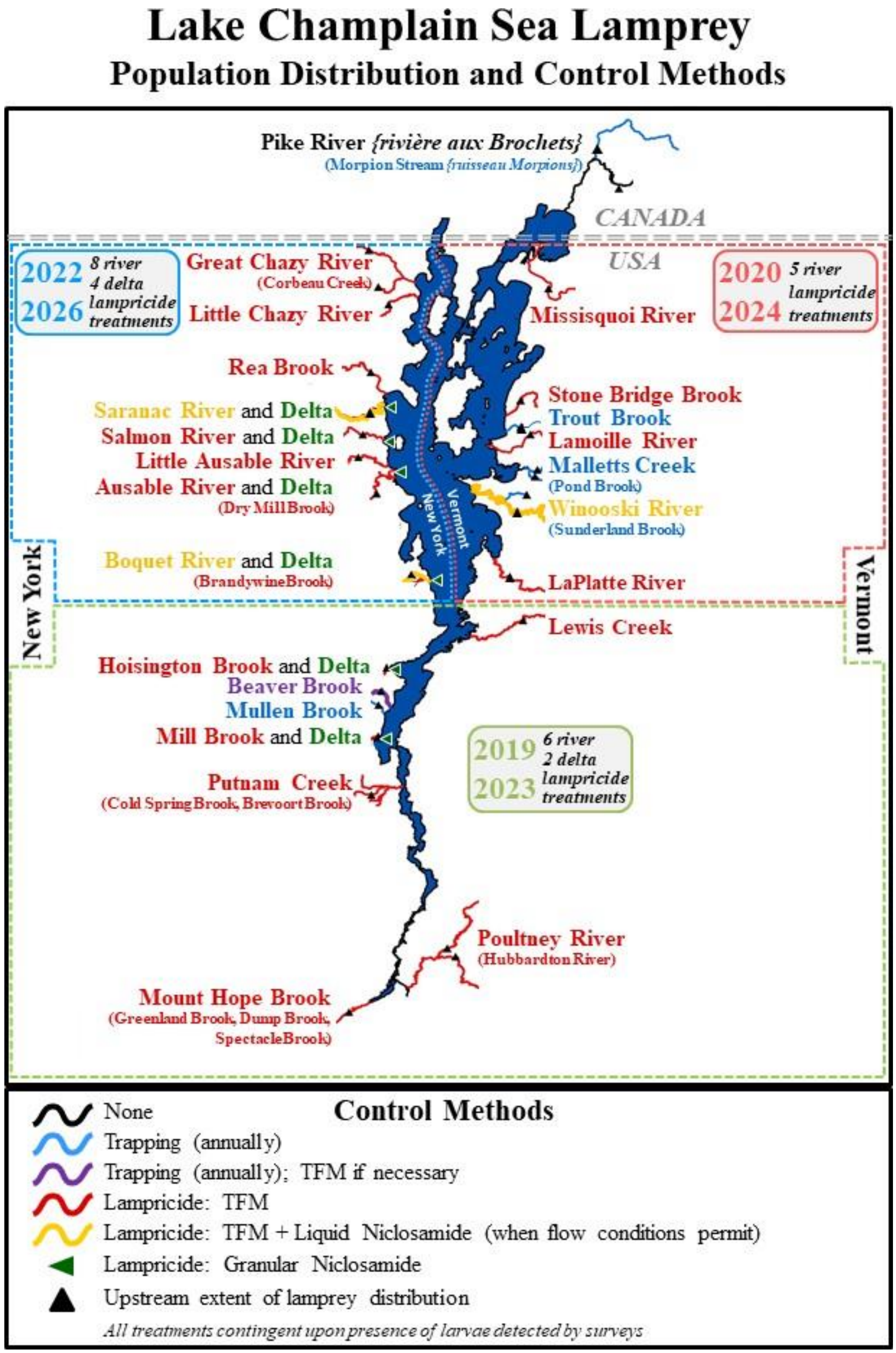
NYSDEC: Nicole Balk, Rob Fiorentino, Tom Shanahan
VTFWD: Kevin Kelsey, Margaret Murphy, Bernie Pientka, Lee Simard
UVM: Ellen Marsden, Matt Futia (Grad Student), Ben Marcy-Quay (Post-Doc)
USGS Co-op Unit: Donna Parrish

Management Committee Members:

USFWS: Andrew Milliken
NYSDEC: Steve Hurst
VTFWD: Eric Palmer

Appendix 3. Map of Lake Champlain tributaries with lamprey populations and the site-specific methods used to control them.



Appendix 4. Schedule of completed and projected Lake Champlain lampricide treatments. The "T" denotes completed TFM-only treatments, "B" denotes completed Granular Bayluscide delta treatments, "C" denotes completed TFM + 1% Niclosamide treatments, and "P" denotes pending treatments. Treatment histories from the experimental control program (1990-2000) and the long-term program from 2001-2009 are available in earlier annual reports. The geographic reorganization plan was completed in 2017 resulting in the temporal and geographical alignment of treatments in the Lake Champlain Basin and a new cycle of treatments in 3 out of every 4 years.

			10	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
New York	**WEST**	Great Chazy River			T		T				T				P	
		Little Chazy River									T				P	
		Rea Brook									T				P	
		Saranac River				C					C				P	
		Saranac Delta			B		T				B				P	
		Salmon River	T				T				T				P	
		Salmon Delta					B				B				P	
		Little Ausable River	T				T				T				P	
		Ausable Delta Complex		B			B				B				P	
		Ausable River	T				T	T			T				P	
		Boquet River		C			C				C				P	
		Boquet Delta					B								P	
	SOUTH	Hoisington Brook										T				P
		Beaver Brook							T							P
		Mill Brook			T							T				P
		Mill Delta			B											P
		Putnam Creek	T			T			T			T				P
		Mt. Hope Brook			T			T				T				P
- -- -		Poultney/Hubbardton rivers		T				T				T				P
		Lewis Creek	T				T	T				T				P
Vermont	**EAST**	LaPlatte River							T				T			
		Winooski River			T			T					T			
		Stonebridge Brook				T			T							
		Lamoille River				T							T			
		Missisquoi River			T								T			

Appendix 5. Copy of the PDF report from the Veterinary Hospital of Université de Montréal regarding the fish kill last June in Missisquoi Bay.

RAPPORT DE NÉCROPSIE

RÉSEAU CANADIEN POUR LA SANTÉ DE LA FAUNE

CQSAS

CENTRE RÉGIONAL DU QUÉBEC
Faculté de médecine vétérinaire
Université de Montréal
3200, rue Sicotte, Saint-Hyacinthe, QC, J2S 2M2
Téléphone: 450-773-8521 Poste 8346
Télécopieur: 450-778-8116
Courriel: quebec@cwhc-rcsf.ca

Date de génération du rapport: 2020-07-28

No de pathologie: P1762-20

Information disponible pour les spécimens

Code d'évènement: CWHC.207607

Spécimens:
Barbotte brune (*Ameiurus nebulosus*)
Achigan à petite bouche (*Micropterus dolomieu*)
Crapet de roche (*Ambloplites rupestris*)
Méné jaune (*Notemigonus crysoleucas*)
Meunier noir (*Catostomus commersoni*)
Tanche (*Tinca tinca*)
Carpe (*Cyprinus carpio*)
Grand brochet (*Esox lucius*)
Perchaude (*Perca flavescens*)
Crapet soleil (*Lepomis gibbosus*)
Gaspareau (*Alosa pseudoharengus*)
Baret (*Morone americana*)

Endroit:

Venise-en-Québec
Québec

Latitude: 45.08
Longitude: -73.14

Trouvé / soumis par

Soumis par :

Guillaume Lemieux
Direction de la protection de la faune - Longueuil
201, Place Charles-Lemoyne 2ième étage
Longueuil, Québec, J4K 2T5
Téléphone: (450) 928-7608

Information disponible pour l'évènement

Un épisode de mortalité massive de poissons a été signalé au MFFP aux alentours du 2020-06-17 sur le Lac Champlain au niveau de la Baie Missisquoi, près de Venise-en-Québec. Plusieurs milliers de poissons d'espèces différentes ont été retrouvés morts sur les berges du lac. Le MFFP fût dépêché sur les lieux afin de récolter des poissons au filet maillant le 2020-06-25. Une centaine de poissons ont été soumis moribonds ou morts au CQSAS le 2020-06-25.

Diagnostic et interprétation

Diagnostic final généraux :

- Cause de l'épisode de mortalité incertaine, conditions environnementales à considérer
- Hémorragies tégumentaires multifocales (peau, nageoires; 15/20 poissons nécropsiés – 75%)
- Hémorragies organiques multifocales (majoritairement rein, muscle; 55%)
- Métacercaires de trématodes multifocalement (peu significatif majoritairement; 45%)
- Dermatite et lésions cutanées érosives (origine bactérienne, Aeromonas hydrophila; 25%)
- Infection organique d'origine bactérienne à bacilles Gram négatif (signification incertaine; 20%)
- Parasitisme branchial (copépodes, monogènes; peu significatif; 20%)
- Parasitisme intestinal (cestodes, trématodes; signification incertaine; 5%).

Diagnostics finaux individuels :

Barbotte brune
- Hémorragies tégumentaires et organiques multifocales.