LAKE CHAMPLAIN FISH AND WILDLIFE MANAGEMENT COOPERATIVE

FISHERIES TECHNICAL COMMITTEE
ANNUAL REPORT
2011

Executive Summary

Salmonid restoration efforts continued to be the primary focus of the Lake Champlain Fisheries Technical Committee in 2011. Stocking targets for salmonids were achieved and a pre-stocking landlocked Atlantic salmon[1] assessment program was initiated. Sea lamprey wounding rates for landlocked Atlantic salmon, lake trout, and walleye have declined to rates below what was achieved during the experimental program. The declining wounding rates correlate with increased survival and condition of landlocked Atlantic salmon in Lake Champlain. As an example, the Winooski River trap and truck facility observed an all-time record landlocked Atlantic salmon capture rate in 2011. Additionally, salmon entries from the Lake Champlain International Fishing derby indicate that the average size of entered salmon has increased. The derby also established a new record in 2011 for landlocked Atlantic salmon of 11.42 pounds.

Lampricide treatments were successfully completed on the Ausable/Little Ausable delta, Boquet River, and Poultney and Hubbardton Rivers. The Boquet River treatment was the first combination niclosamide/TFM treatment ever completed in the Lake Champlain Basin.

Members of the Fisheries Technical Committee continued working on a wide variety of projects including development of an intensive culture system for rearing walleye fingerlings, monitoring sea lamprey, forage fish, bass, walleye, yellow perch, and northern pike populations. Research efforts included determining the sensitivity of stonecats to lampricides, investigation of thiaminase levels in alewives, studying the microchemistry of sea lamprey statoliths and experimentation with fish rearing practices and stocking strategies to enhance salmon survival and adult returns to spawning tributaries.

Introduction

Management of the fishery resources of Lake Champlain is coordinated by the Lake Champlain Fisheries Technical Committee, which is a workgroup of the Lake Champlain Fish and Wildlife Management Cooperative. Members and advisors of the Fisheries Technical Committee includes staff from the Vermont Department of Fish and Wildlife (VTDFW), New York State Department of Environmental Conservation (NYSDEC), US Fish and Wildlife Service (USFWS), University of Vermont, Vermont Cooperative Fish and Wildlife Research Unit, Quebec Ministry of Natural Resources, Sea Grant, and other universities.

[1] Throughout this report the terms “landlocked salmon,” “Atlantic salmon,” and “salmon” refer to landlocked Atlantic salmon.

This report briefly summarizes fisheries management and research activities carried out on Lake Champlain during 2011. The names of Project Leaders are listed after section headings and their affiliation can be found on the Fisheries Technical Committee Membership list at the end of this document. More details on specific projects can be obtained by contacting project leaders.

SALMONIDS

Stocking Summary (Zollweg-Horan, Chipman)

Salmonid stockings in Lake Champlain during 2011 included about: 314,000 landlocked Atlantic salmon (smolt equivalents); 53,000 steelhead (smolt equivalents); 86,000 lake trout; and 59,000 brown trout (Table 1). The list includes landlocked Atlantic salmon and steelhead that were stocked in the tributaries to the lake. Also listed in Table 1 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 emigrating 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. The number of landlocked Atlantic salmon stocked in 2011 was increased to balance the decreased number of steelhead available.

Table 1. Numbers (in stocking equivalents) of salmonids stocked in Lake Champlain during 2011, and stocking targets for the lake.

	Main Lake		Malletts Bay/Inland Sea		Total number stocked in 2011
Species	Target	2011	Target	2011	
Landlocked salmon	207,000	235,521	60,000	78,143	313,664
Lake trout	82,000	85,989	0		85,989
Steelhead	73,000	48,143	12,000	5,000	53,143
Brown trout	38,000	29,408	40,000	29,501	58,909
Total	400,000	399,061	112,000	112,644	511,705

Stocking Evaluation (Staats)

A landlocked Atlantic salmon stocking evaluation continued in the Winooski River drainage. A total of 31,710 landlocked Atlantic salmon smolts were stocked in the lower Winooski River in 2011. In addition to the smolt stocking, the upper Winooski River (above the first 3 dams but below Bolton Dam) was stocked with approximately 38,800, 4.5-inch fingerlings.

The Huntington River was also stocked with approximately 110,000 salmon fry in May, 2011. Out-migrating salmon smolts from previous fry stockings were assessed using a rotary screw trap which was fished at the mouth of the Huntington River from April into June, 2011. Record precipitation and high flow events resulted in an abbreviated trapping season and only 50 smolts were captured.

Fish Passage (Staats, Smith)

Sixty-nine adult landlocked Atlantic salmon were trapped at the Willsboro fish ladder on the Boquet River in September and October of 2011. This was the largest number of salmon collected at the ladder since 1998. All fish were measured and released upstream of the dam.

A total of 189 adult landlocked Atlantic salmon and 18 steelhead rainbow trout were trapped at the Winooski One fish passage facility in the fall 2011 while 37 steelhead were processed in the spring**.** All lifted fish were tagged and released downstream except for 30 salmon which were transported to the Ed Weed Fish Culture Station (FCS) for fall egg-take. The threat of viral hemorrhagic septicemia has curtailed the movement of fish upstream of the Winooski One Dam at this time.

Spring and Fall Nearshore and Tributary Assessments **(Chipman, Smith)**

Spring and fall boat electrofishing surveys for salmonids are conducted annually. This sampling allows for the collection of biological data including total length (TL), sex and age information as well as lamprey wounding data. The data are utilized in hatchery product/strain evaluations and to monitor sea lamprey control progress through time.

No springtime electrofishing was conducted in 2011 due to record high lake levels and high tributary discharge.

Fall near-shore salmon catches (~200) in the Whallon Bay and Willsboro Bay areas continued to be dominated by young salmon in 2011. The presence of older, larger salmon in the nearshore sample combined with increased collections in the tributaries indicates salmon survival continues to improve.

In fall 2011 410 returning salmon were collected from Hatchery Brook (Ed Weed Fish Culture Station discharge stream), including 123 adult Sebago-strain salmon that were retained for use as broodstock at Ed Weed FCS. Many additional salmon were observed in Hatchery Brook but not collected. Ninety salmon were collected in the Lamoille River, including 7 adult Sebago-strain salmon that were retained for broodstock at Ed Weed; and 19 salmon were collected at the Sandbar Causeway Bridge. Numbers of salmon collected from the Lamoille River and Sandbar locations increased substantially from 2010, when 43 and three salmon, respectively, were collected with similar sampling effort. Limited sampling was conducted in two other Vermont rivers; one salmon was collected from Otter Creek and none were observed in the Missisquoi River.

Fall electrofishing was also conducted on the Boquet River below the Willsboro fish ladder. Twenty-one spawning condition salmon were collected, measured, and released in 20 minutes of electrofishing effort. River conditions proved very difficult for sampling and limited sampling effort.

Fall nearshore electrofishing at Whallon Bay and the Grand Isle Ferry breakwater yielded collections of 342 and 102 lake trout, respectively, in one night of sampling at each location. Another 49 lake trout were collected in Willsboro Bay. Length frequency metrics indicate continuing maturation of the lake trout spawning population. Prior to 2005, 10% or less of lake trout sampled were greater than 735mm TL, a size at which sea lamprey parasitism has little effect on survival. The proportion of lake trout greater than 735mm TL has steadily grown to about 25% of the sample since 2005 (Figure 1). There was a corresponding steady decline in the proportion of fish in the 533-633mm TL class from 1997 through 2009; however, the 533-

633mm TL class proportionally increased in 2010 and again in 2011 (Figure 1). The approximately 55% reduction in annual lake trout stocking that began in 1995 explains much of the decline in the 533-633mm size class, but the magnitude of this effect has progressively decreased as surviving lake trout stocked prior to 1995 have become increasingly rare in the population, and are nearly nonexistent in recent years. Thus, reduced sea lamprey-induced mortality inferred from wounding rates may be largely responsible for the increasing trend in smaller lake trout in the spawning population since 2009 (Figure 1). Sea lamprey wounding data are described in further detail in the lamprey section on pages 8 and 9.

The second year of experimental trap netting was conducted at the Grand Isle site in 2011 to evaluate an alternative lake trout sampling technique. Two trap nets were deployed from the shore over the same night that electrofishing was conducted at the breakwater and were tended the next morning. The trap nets captured 131 lake trout and 104 salmon.

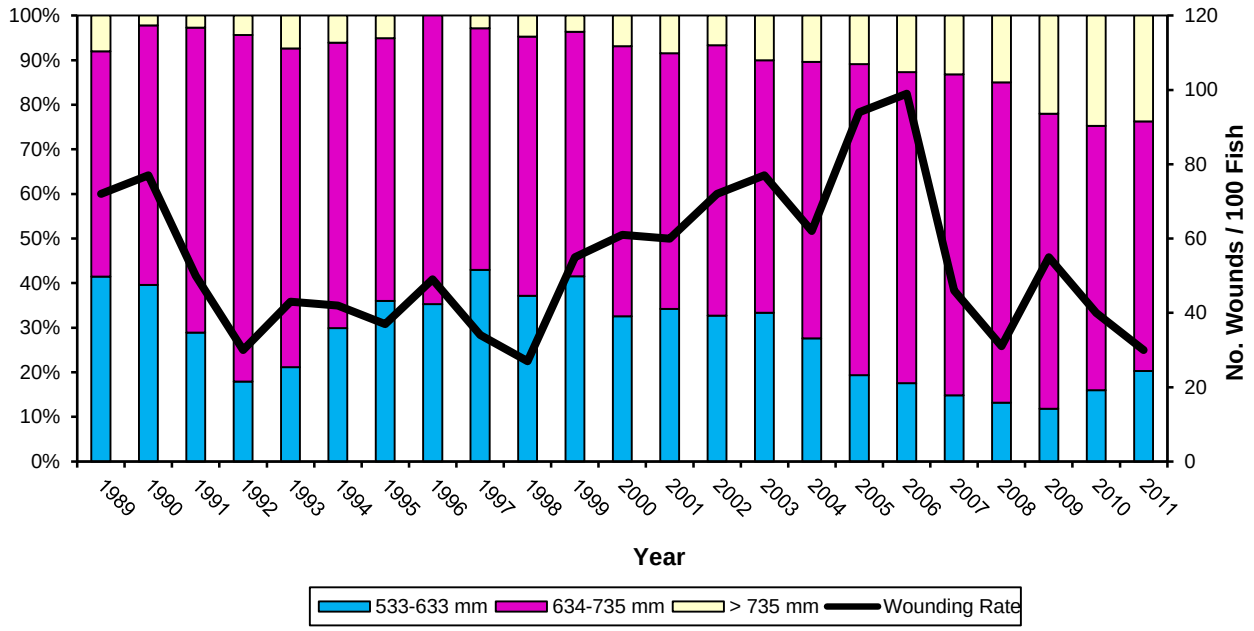


Figure 1. Percent frequency of three length classes of lake trout sampled in the Main Lake basin by fall electrofishing, 1989-2011 (left axis), with sea lamprey wounding rate trend on 533-633 mm lake trout (right axis).

Pre-stocking Landlocked Salmon Assessments (Ardren)

In the spring of 2011, landlocked salmon yearlings from Eisenhower National Fish Hatchery, Ed Weed Fish Culture Station, and Adirondack Fish Hatchery were assessed to establish a long-term monitoring database that will allow managers to better understand the percentage of stocked fish that are viable smolts. Many hatchery programs that rear one year old smolts have developed a size threshold for classifying a stocked fish as a smolt. Fish that do not reach this size threshold remain as parr and will not undergo the parr-smolt transformation that year. Biologists working with Connecticut River salmon have established a smolt threshold of greater than or equal to 150 mm total length. Our first year of data collection revealed almost all yearlings released from Ed Weed and Eisenhower hatcheries exceeded the 150mm size threshold (Figure 2). However, over 75% of yearlings reared at Adirondack hatchery did not exceed 150mm, indicating they were stocked as parr not smolts (Figure 2). The small size of fish at Adirondack is not likely to be representative of normal fish production at this hatchery. The small size distribution was likely caused by the use of substandard fish feed with poor

nutrient content.

We are in the process of establishing a new biologically based smolt size threshold for landlocked salmon reared in Lake Champlain hatcheries. Data on length, weight, silvering, darkening of fin margins, abdomen hardening, changes in body shape, fin condition, and physiology are being collected and examined. Having more accurate estimates of the percentage of stocked fish that are viable smolts will be useful for setting stocking rates and evaluating adult return rates to the fishery and rivers. A better understanding of the timing for parr-smolt transformation at each hatchery will also help establish optimal release times for stocking.

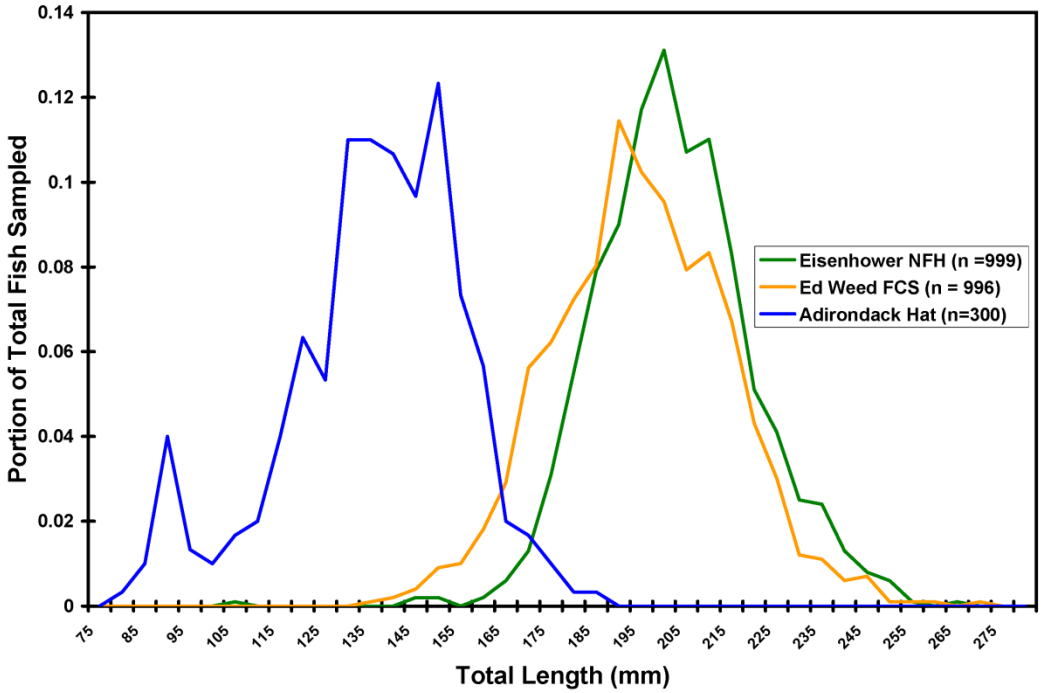


Figure 2. Length distribution of yearling landlocked Atlantic salmon stocked into the Lake Champlain Basin from three hatcheries during the spring of 2011.

SEA LAMPREY

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.

Stream quantitative assessment sampling (QAS) (Bouffard)

Quantitative assessment surveys were conducted on four streams (Great Chazy, Winooski, and Missisquoi Rivers and Mill Brook) in preparation for scheduled lampricide treatments in the fall of 2012 and on two streams (Mount Hope Brook and Putnam Creek) in preparation for potential treatments in the fall of 2011(Table 2).

Table 2. Results of quantitative assessment surveys conducted in 2011.

Stream	Population Estimate-Ammocoetes	Population Estimate-Transformers
Great Chazy River	42,955	0
Winooski River	79,462	0
Missisquoi River	408,283	0
Mill Brook	939	0
Putnam Creek	12,501	0
Mount Hope Brook	34,812	0

Detection Sampling (Bouffard)

In 2011, presence absence surveys were conducted in the northern Vermont quadrant. Sea lamprey were collected from one site in Potash Brook in S. Burlington, VT. Sea lamprey presence was also confirmed in Youngman Brook in Highgate, VT.

Delta assessment (Bouffard)

Beginning in 2011 the timing of deepwater surveys has been adjusted to reduce the amount of time and redistribution of larvae between delta surveys and treatments. Following the extreme flooding that occurred during the spring of 2011 it was decided that in order to accurately define the spatial distribution of sea lamprey on the Ausable and Little Ausable Deltas the survey of 2010 needed to be repeated. The survey area was extended based on the 2010 adaptive sampling approach which in effect reduced the amount of effort and increased the geographic scope as compared to the 2010 survey. Distributions of sea lamprey had indeed shifted over the course of the intervening year and the treatment was planned based on the new information collected during the 2011 survey. From this point forward, surveys of lentic populations of sea lamprey larvae will occur during the summer immediately preceding the scheduled lampricide treatment.

Ausable / Little Ausable River- Sampling on the Ausable and Little Ausable River deltas was repeated in 2011 following the spring floods of 2011 in an effort to delineate the infested area of the delta and plan for a fall lampricide treatment. The survey area was expanded to include lamprey infested areas discovered during the adaptive sampling effort of 2010, specifically the slope of the delta between 20 and 80 feet deep.

Salmon River- Sampling on the Salmon River was incomplete following the 2010 field season due to the proximity of the marina to the south of the river mouth. Sampling was completed in 2011 before the marina was in full operation. No sea lamprey larvae were collected from either the 2010 or 2011 sampling efforts.

Mullen Brook- Limited sampling during 2010 on the Mullen Brook delta found several sea and American brook lamprey to the north of the stream mouth. Additional sampling was conducted in 2011 throughout the entire delta area. No lamprey larvae were collected during the 2011 sampling effort.

Control (Smith, Chipman, Zollweg-Horan)

Lampricides - Lampricide treatments were successfully completed on the Ausable/Little Ausable delta, Boquet River, and Poultney and Hubbardton rivers (Table 3). The Boquet River treatment was the first combination niclosamide/TFM treatment ever completed in the Lake

Champlain Basin. The combination of the two chemicals allowed for substantial cost savings to the program. Control status of Lake Champlain tributaries is presented in Appendix 1. A treatment history and schedule of future treatments is presented in Appendix 2.

Table 3. Summary of 2011 lampricide applications in tributaries and deltas of Lake Champlain.

Stream or delta	Date treated	Flow (CFS)	TFM (lbs. active ingredient)	Miles treated	Bayluscide (lbs active ingredient)	Acres treated
Ausable/Little Ausable Delta	Sept 14	-	-	-	896	179
Boquet River	Sept 22	245	1,143	2.6	12	-
Poultney River	Sept 28	135	1,230	10.6	-	-
Hubbardton River	Sept 28	21	238	1.2	-	-
	Totals:	**2,611**	**14.4**	**908**	**179**	

Trapping and Barriers **(Bouffard, Young)**

Sea lamprey spawning runs were monitored in eight streams during the spring of 2011 (Table 4) using portable assessment traps, pots, and permanent trapping facilities. Spring floods and high lake levels caused some difficulty for trapping operations during the spring of 2011. Three trap sites (Trout Brook, Malletts Creek, and Mullen Brook) had to be abandoned due to high lake levels. An alternate site for a trap was found on Mullen Brook just upstream of the abandoned site. In Malletts Creek and Trout Brook where alternate sites were unavailable pots baited with male sea lamprey were used as an alternative to traps. The events of the spring of 2011 illustrate the difficulty in using mechanical methods to control sea lamprey.

Baited pots were deployed above trap sites on Stone Bridge Brook, Pond Brook, and Mullen Brook to capture sea lamprey which had escaped above the trap. In all three cases the pots were set at the upstream barrier to migration (i.e. waterfalls). Pots were also deployed in the LaPlatte River for the first time. We will continue to use pots in areas where we are unable to deploy traps as well as above traps to gauge the amount of escapement past trap sites.

Table 4. Results of migratory phase sea lamprey trapping 2011. Dates of trap removal on Trout Brook and Malletts Creek indicate when trapping was abandoned due to high water.

Stream	Date Trap Set	Date Trap Removed	% Days Trap Operational	Number Lamprey (Trap)	Number Lamprey (Pots)	% Change from 2010
Beaver Brook	4/4/2011	6/16/2011	86.3%	351	NA	2825%
Trout Brook	4/7/2011	4/27/2011	47.8%	2	19	-63%
Stonebridge Brook	4/7/2011	6/23/2011	68.8%	191	6	18%
Malletts Creek	4/19/2011	5/2/2011	53.8%	16	11	-90%
Great Chazy River	4/23/2011	6/16/2011	83.3%	681	NA	59%
Pond Brook	4/15/2011	6/20/2011	89.4%	49	0	158%
LaPlatte River (Pots)	5/26/2011	6/23/2011	NA	NA	7	NA
Mullen Brook	4/6/2011	7/6/2011	81.3%	146	0	317%

Expectations were high in 2011 that the Morpion barrier would be built. In June, the USFWS met with the Municipal council in Notre Dame de Stanbridge and signed a Memorandum of

Agreement that spelled out the terms and conditions of ownership, leases, and payments. With that in place, the project went out for bid, 3 times, to an increasingly wide geographic pool of potential bidders. From all three requests for bids, only one contractor submitted a bid and that was for 3 times the price estimate that our engineer had calculated. The bid was refused and has led to discussions with the Quebec Ministry of Natural Resources. Their interest in the project remains high and they will be working to assist us in obtaining more acceptable bids. With funding, permits, engineered plans, leases, and agreements all in place, we are waiting for an acceptable bid on the project so that construction can begin.

Wounding Rates (Chipman, Smith)

Sea Lamprey wounding rates calculated for both lake trout and salmon collected in 2011 were within 5 wounds per 100 fish of their respective program objectives for the first year in the history of the program (Figures 2 and 3). The lake trout wounding rate declined to 30 wounds per 100 fish, from 40 in 2010. Wounds on Main Lake salmon increased slightly to 19 wounds per 100 fish, after meeting the program objective (15 wounds per 100 fish) in 2010 (Table 5). However, wounds on Inland Sea and Malletts Bay salmon declined to 14 wounds per 100 fish (Table 5).

Sea lamprey wounding rates for walleye (TL 534 to 634 mm) collected in 2011 from the Poultney and Lamoille rivers were 0 and 5 wounds per 100 fish, respectively. This is the first time the Cooperative's lamprey wounding objective for walleye of 2 wounds per 100 walleye has been achieved on any river. Wounding rates on the Lamoille River population continue to exceed program objectives.

Table 5. Sea lamprey wounding rates on Lake Champlain lake trout and salmon during 2011, compared with pre-control and eight-year experimental control program results.

	Number of type A1-A3 lamprey wounds per 100 fish			
	Objective	Pre-control	Experimental control	2011
Lake trout[a] (Main Lake)	25	55	38	30
Salmon[b] (Main Lake)	15	51	27	19
Salmon[b] (Malletts Bay-Inland Sea)	15	37	40	14

[a] Lake trout in the 533-633 mm (21.0-24.9 inches) length interval. For lake trout, pre-control included 1982 - 92, while experimental control includes 1993 - 97.

[b] Salmon in the 432-533 mm (17.0-21.0 inches) length interval. For salmon, pre-control included 1985 - 92, while experimental control includes 1993 - 98.

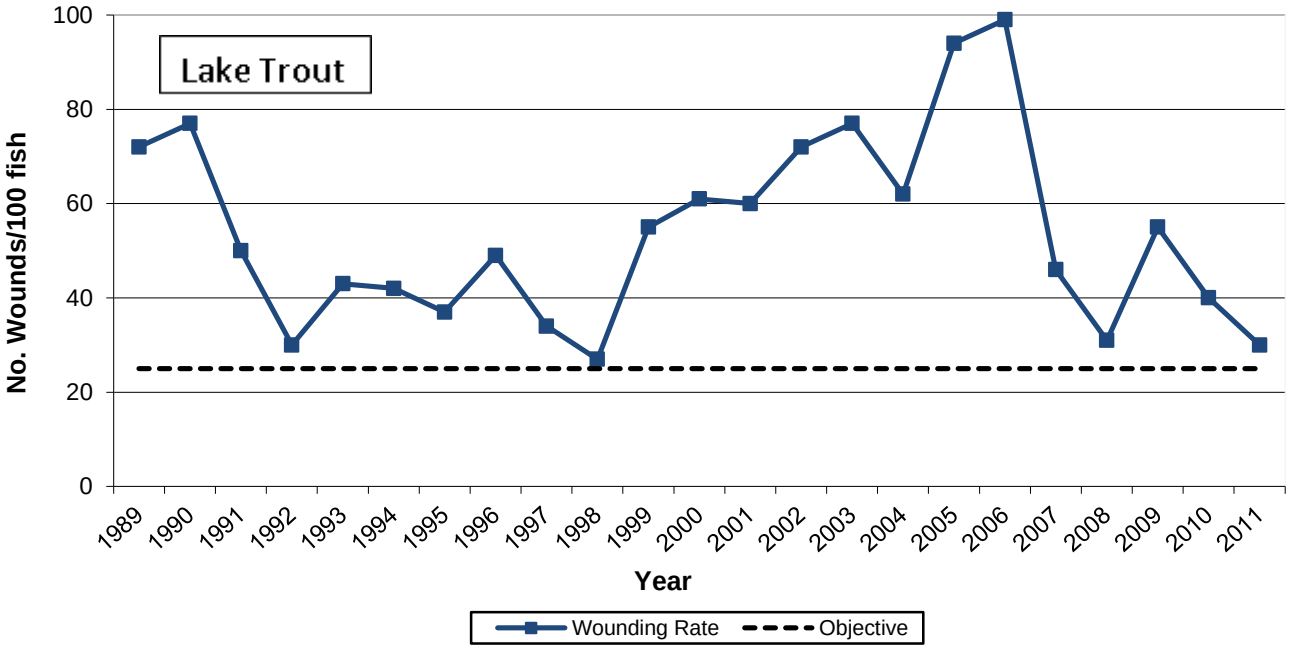


Figure 2. Type A1-A3 sea lamprey wounds (fresh and healing) per 100 lake trout (533-633 mm total length) sampled in the Main Lake basin by fall electrofishing, 1989-2011. For reference, the target wounding rate of 25 wounds per 100 fish is also presented (dashed line).

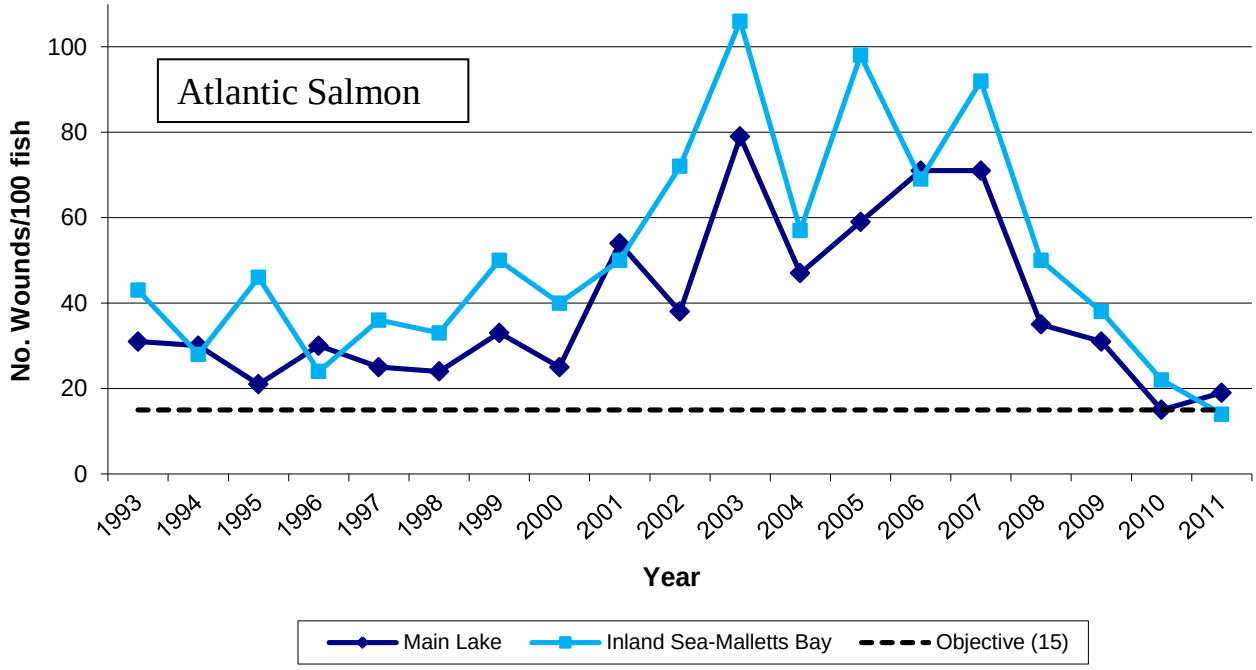


Figure 3. Type A1-A3 sea lamprey wounds (fresh and healing) per 100 salmon (432-533 mm total length) sampled by fall electrofishing in the Main Lake (also includes fishways on the Winooski and Boquet rivers) and Inland Sea-Malletts Bay basins, 1993-2011. For reference, the target wounding rate of 15 wounds per 100 fish is also presented (dashed line).

FORAGE FISH (Pientka, Staats)

SMELT

Nineteen midwater trawls for rainbow smelt were conducted in late summer, 2011 (Table 6). Mean catch per 55 minute trawl (CPUE) at all stations was below 100 fish per trawl (Figure 4). Only at the Malletts Bay station did the CPUE increase slightly from 2010, but it was still well below historical levels.

Table 6. Mean catch per 55 minute trawl (CPUE with 95% confidence interval) of rainbow smelt in 2011 and comparison to pre- (1990-2004) and post-alewife invasion mean CPUE (2005-2011).

Station	Number of trawls	CPUE	Pre-Alewife Mean	Post-Alewife Mean	N years
Main Lake					
Barber Point	4	66 ± 7	206	342	18
Juniper Island	4	67 ± 40	180	159	22
Valcour Island	3	71 ±35	423	117	12
Malletts Bay					
Malletts Bay	4	61 ± 28	1124	595	22
Inland Sea					
Northeast Arm	4	37 ± 13	1363	272	22

ALEWIFE

Alewives were first discovered in Lake Champlain in 2004 and their numbers have increased since. A sampling program is being developed to monitor their abundance and population characteristics. Since 2008, floating gill nets have been utilized to collect alewife samples for age and growth analysis. In 2011, both young-of-year and older alewife were collected at all sampling stations.

Hydroacoustics – Hydroacoustics assessment of Northeast Arm, Malletts Bay and Main Lake was conducted between August 3 and August 23, 2011 following the same procedures as prior years. The 2011 assessment transects covered 10 nautical miles in the Northeast Arm, 11.5 nautical miles in Malletts Bay and 54 nautical miles in the Main Lake. Three additional transects were not completed due to high winds and waves. Along with the acoustic transects, targeted trawls were performed to confirm species compositions. In 2011, 11 tucker and 8 midwater trawls were performed. Processing of the acoustic data is currently ongoing.

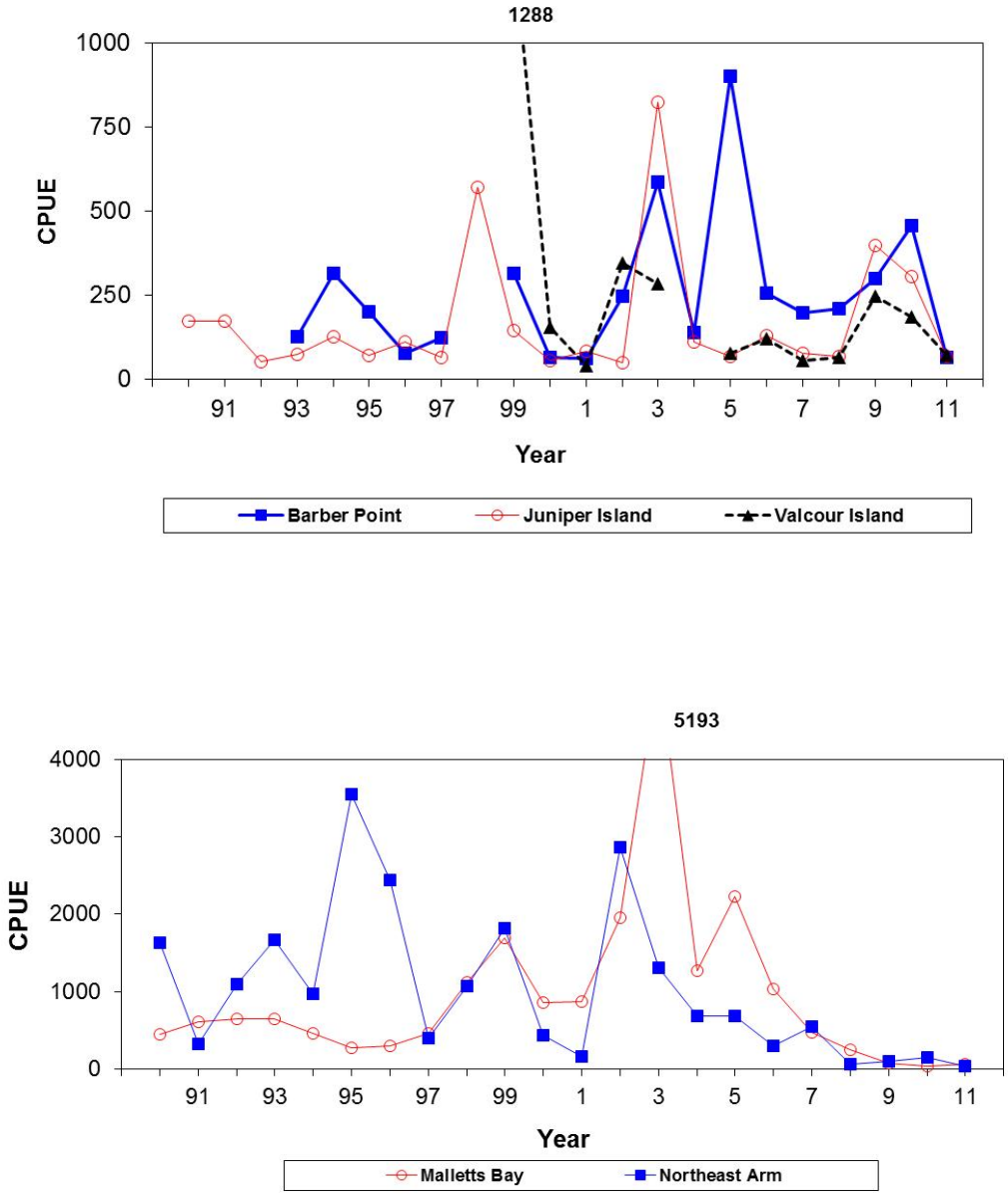


Figure 4. Mean catch per 55-minute trawl for smelt in Lake Champlain.

PERCIDS

YELLOW PERCH (Pientka)

Experimental gillnets are set overnight at multiple locations in order to monitor the Lake Champlain fish community. While these nets are not specifically targeting yellow perch they do give insight into relative abundance. The gillnets consist of 125ft of experimental netting ranging from 25.4 mm (1 inch) to 76.2 mm (3 inch) stretched mesh and are set on the bottom following a depth contour. The nets are fished overnight (roughly 24 hrs). In 2011, the sampling occurred between June 29th and July 19th. Yellow perch catch per overnight set (CPUE) at both Shelburne Bay and Malletts Bay appear to be similar for all three years (Figure 5). Missisquoi Bay catch was higher in 2010 then 2009 or 2011 and St. Albans Bay was lower in 2010 than 2009 but increased in 2011. Sampling will continue in 2012.

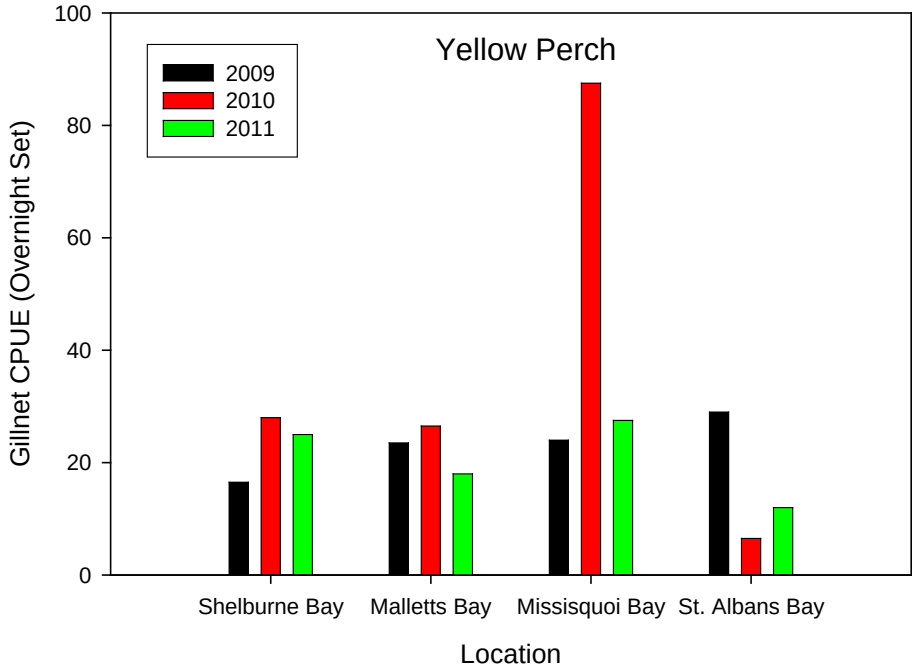


Figure 5. Yellow Perch CPUE for 2009, 2010, 2011 at four Lake Champlain Locations.

WALLEYE (MacKenzie, Zollweg-Horan, Fiorentino, Smith)

Walleye management activities on Lake Champlain in 2011 included the collection of brood stock from the Poultney River and South Bay, evaluation of the contribution of stocked walleye to the spawning run in the Poultney River and assessment of the spawning run in the Lamoille River.

In 2011, 3 million eggs were collected from 25 pairs of walleye collected from the Poultney River. All adults used for spawning were sacrificed for disease testing because of concerns over Viral Hemorrhagic Septicemia. Eggs were hatched at the Ed Weed Fish Culture Station (FCS) in Vermont. Fingerlings were reared in a new intensive culture system located at the Ed Weed FCS and in 4 ponds managed by the Lake Champlain Walleye Association. There were 524,000 fry, 29,000 advanced fry, and 75,000 fingerlings stocked into the lower Poultney River, southern basin of Lake Champlain and lower Otter Creek. All fry, advanced fry and fingerlings were marked with OTC prior to stocking.

An additional 1,250,000 eggs were collected from nine walleye collected from the South Bay, NY, spawning stock and reared in a portable hatchery managed by the Lake Champlain Walleye Association in Whitehall, New York. Unfortunately, due to flooding at the hatchery, there were no surviving fry and no fish stocked back into South Bay in 2011.

Otoliths were collected from 33 age 3 fish to evaluate the contribution of stocked fish to the Poultney River. Stocked fish comprised 70% of the age 3 walleye collected from the 2011 Poultney River spawning run.

Sampling efforts for sauger were expanded to five additional trap net sites and three electrofishing transects in South Bay and at the confluence with the Poultney River. Sampling occurred during the two weeks following walleye spawning. No sauger were captured. A New York State Sauger Management Plan has been drafted. In 2012, sauger surveillance efforts will concentrate on the Head of Lake at Whitehall.

LARGEMOUTH AND SMALLMOUTH BASS (Good, Pientka, Zollweg-Horan)

Angling for largemouth and smallmouth bass in Lake Champlain continues to increase in popularity. The lake is frequently named as one of the top 5 bass fishing destinations in the United States by numerous popular national fishing magazines. It not only attracts and supports a high level of recreational fishing pressure, but multiple professional bass fishing tournament trails have added Lake Champlain as an annual stop. Results indicate that tournament catches have remained very consistent since the first professional tournament was held on Lake Champlain in 1997 (Figure 6).

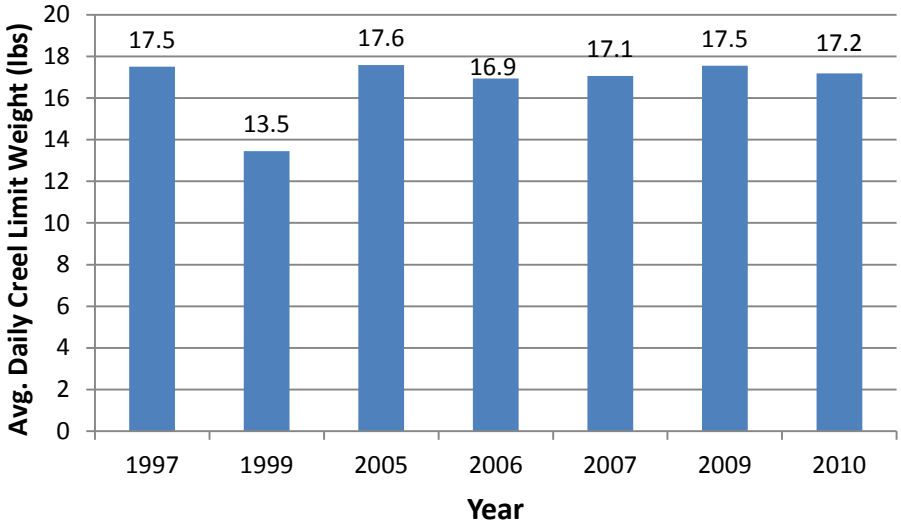


Figure 6. Average daily creel limit weights for the Top 10 anglers from each of the 8 professional-level Bassmaster tournaments held on Lake Champlain since 1997.

Electrofishing surveys at sampling stations on the South Lake captured 511 largemouth bass and 123 smallmouth bass in 2011. Largemouth bass ranged in size from 1.5 to 20.6 inches total length and smallmouth bass ranged in size from 4.0 to 18.5 inches total length. It should be noted that following record lake levels in the spring of 2011, the waters of southern Lake

Champlain were extremely turbid, even into the summer, and may have affected bass sampling efficiency due to decreased water clarity.

ESOCIDS **(Good, Pientka)**

NORTHERN PIKE

In 2011, trapnets were set at the mouth of potential northern pike spawning marshes so as to intercept fish moving into the marsh to spawn or exiting the marsh after spawning was completed. A total of 78 northern pike were collected at southern Champlain sites and 141 northern pike were collected from Carmen's Marsh in the north end of Lake Champlain. The total numbers of pike caught and numbers of pike caught per net day (CPUE) are reported in Table 7.

Table 7. Summary of ice-out trapnet effort and northern pike catches at southern and northern Lake Champlain sampling sites, 2009 through 2011.

Year	Trapnet Effort (hr)	Trapnet Effort (d)	# Northern Pike		CPUE (net days)
			M	F	
2009	378.9	16	42	99	8.8
2010	458.7	19	156	288	23.4
2011	162.0	7	19	59	11.1
2011 (north)		6	34	107	23.5

Sea lamprey wounding rates calculated for northern pike collected in 2011 from northern and southern populations were 6 and 13 A1 – A3 wounds per 100 pike greater than 610 mm total length (Table 8).

Table 8. Lamprey wounding rates (A1 – A3 wounds) for northern pike (>=610mm TL) sampled collected from southern and northern Lake Champlain populations.

Southern Lake Champlain				
Year	# NP	# >=610mm	#A1, A2, A3	Wounds/100
2009	141	97	8	8
2010	444	247	26	11
2011	78	53	3	6

Northern Lake Champlain				
	# NP	# >=610mm	#A1, A2, A3	Wounds/100
2005	88	24	2	8
2010	281	54	6	11
2011	141	75	10	13

MUSKELLUNGE

In 2011, VTDFW stocked 5,150 muskellunge into the lower Missisquoi River and areas of Missisquoi Bay, including Campbell's Bay (Table 9). The muskellunge were provided by NYSDEC's Chautauqua Lake Hatchery.

Table 9. Muskellunge stocking numbers for Lake Champlain, 2008-2010.

Date	Strain	Source	Number Received	Avg. Length (Inches)	Total Wt. (Lbs)	Life Stage	Stocking Location
2008	Chautauqua	NYDEC	250	6.1	4.35	Summer Fingerling	Missisquoi River & Bay
2009	Chautauqua	NYDEC	10,000	5.04	174	Summer Fingerling	Missisquoi River & Bay
2010	--	NYDEC	0	--	--	--	--
2011	Chautauqua	NYDEC	5,150	5.0	95.5	Summer Fingerling	Missisquoi River & Bay

AMERICAN EEL (Staats, Good)

In 1997, an eel ladder was constructed at the dam in Chambly and in 2001 a fish ladder and an eel ladder were built at the St Ours dam. Faune Québec, in cooperation with a commercial fishermen union and Hydro-Québec, initiated a ten-year eel stocking program in 2005 in the Richelieu River to further enhance eel recruitment. From 2005 to 2008 an average of about 692,000 elvers (young eels about 50-60 mm in length) were transferred annually from the Atlantic Coast (Nova Scotia, Canada) and stocked into the Richelieu River (Table 10). In order to monitor the success of these stocking efforts and new passage facilities, Québec asked members of Fisheries Technical Committee to monitor eel in Lake Champlain.

No targeted eel sampling was conducted in 2011. Targeted sampling is planned for 2012. Eel continue to make up of a portion of the by-catch collected during other sampling activities (i.e. bass and salmonid sampling, lamprey trapping). American eels collected during bass sampling in 2011 were provided to researchers at the Université of Laval that are investigating the use of microelements in otoliths to determine if the technique can be used to identify specific eel stocks.

Table 10. Summary of American eel stocking in the upper Richelieu River and comparison of 2007 and 2010 eel sampling efforts in Lake Champlain.

Year	Number of glass eels stocked	Number of eels collected			
		Keeler Bay	Paradise Bay	Converse Bay	Grand Isle shoreline
2005	600,000				
2006	1,000,000				
2007	425,500	0	0	0	1
2008	746,000				
2009	0				
2010	0	1	1	25	14

RESEARCH

Stonecat Bioassays (Calloway)

The USFWS completed a series of 3 stonecat bioassays this past summer and fall in order to quantify the sensitivity of stonecats to TFM during a lampricide treatment. We collected 600+ stonecats from the Great Chazy River in New York immediately downstream of the Frog Farm Dam in Perry's Mill, NY. The bioassays were conducted in the NYSDEC Mobile Toxicology lab with 10 stonecats and 10 sea lamprey in each of 9 chambers that were exposed to a series of differing TFM concentrations. The results showed that stonecats have a greater level of resiliency to TFM than sea lamprey. The mean No Observed Effect Concentration of the 3 tests for stonecats was 1.1 times the 9-hour sea lamprey 99.9% minimum lethal concentration (MLC). The mean Lowest Observed Effect Concentration of the 3 tests for stonecats was 1.4 times the 9-hour sea lamprey MLC. The mean Maximum Allowable Toxicant Concentration of the 3 tests for stonecats was 1.2 times the 9-hour sea lamprey MLC.

Alewife thiaminase project (Marsden, Ladago)

The objectives of this project are to evaluate changes in alewife thiaminase levels during the initial phases of the alewife invasion, and examine effects of alewife consumption and alewife thiaminase expression on lake trout reproduction in Lake Champlain. Total thiamine levels in lake trout eggs collected in 2010 averaged 4.4±2.8 nmol/g, close to the threshold of severe thiamine deficiency syndrome. Wild lake trout fry produced by the same population of spawners from which the eggs were sample were collected at the Grand Isle ferry breakwall in spring 2011. The fry CPUE was 2.6 fry/trap-day, substantially higher than in three of the previous four years of fry collections. Lake trout and landlocked Atlantic salmon eggs were collected in fall, 2011, from 20 females of each species. A sample of eggs is being analyzed for thiamine content; the remaining eggs are being reared and examined for evidence of thiamine deficiency – lethargic behavior or hyperexcitability, developmental abnormalities, and early mortality. Incidence of thiamine deficiency in each family will be compared with egg thiamine content. In addition, wild lake trout fry will be collected from spawning reefs in Lake Champlain and examined for evidence of thiamine deficiency.

Microchemistry of sea lamprey statoliths (Lochet, Marsden)

Sea lamprey larvae from different streams can be discriminated based on the chemistry of their statoliths, calcified structures located in the inner ear. But statolith chemistry fails to track the natal origin of parasitic juveniles and spawners. This suggests that the process of metamorphosis alters the chemistry of the statolith, a structure that is assumed to be inert. The objective of this study is to test if statolith chemistry is stable during ontogeny, particularly during metamorphosis, which is a drastic transition from larval non-parasitic stage to juvenile-parasitic stage. Any change in statolith chemistry through metamorphosis could potentially affect our ability to properly assign natal origin to post-metamorphic stage. A total of 240 pre- and post-metamorphic lampreys were collected in fall 2010 and 2011 from five Lake Champlain tributaries, one tributary of Lake Huron and one tributary of Lake Michigan. Statolith chemistry was analyzed using LA-ICP-MS and compared between the two stages. The concentration of rubidium, a key element for discriminating among streams, was different between pre- and post-metamorphic larvae. However, the change appears to be systematic, such that the natal stream of juveniles and adults may be identifiable by comparison with

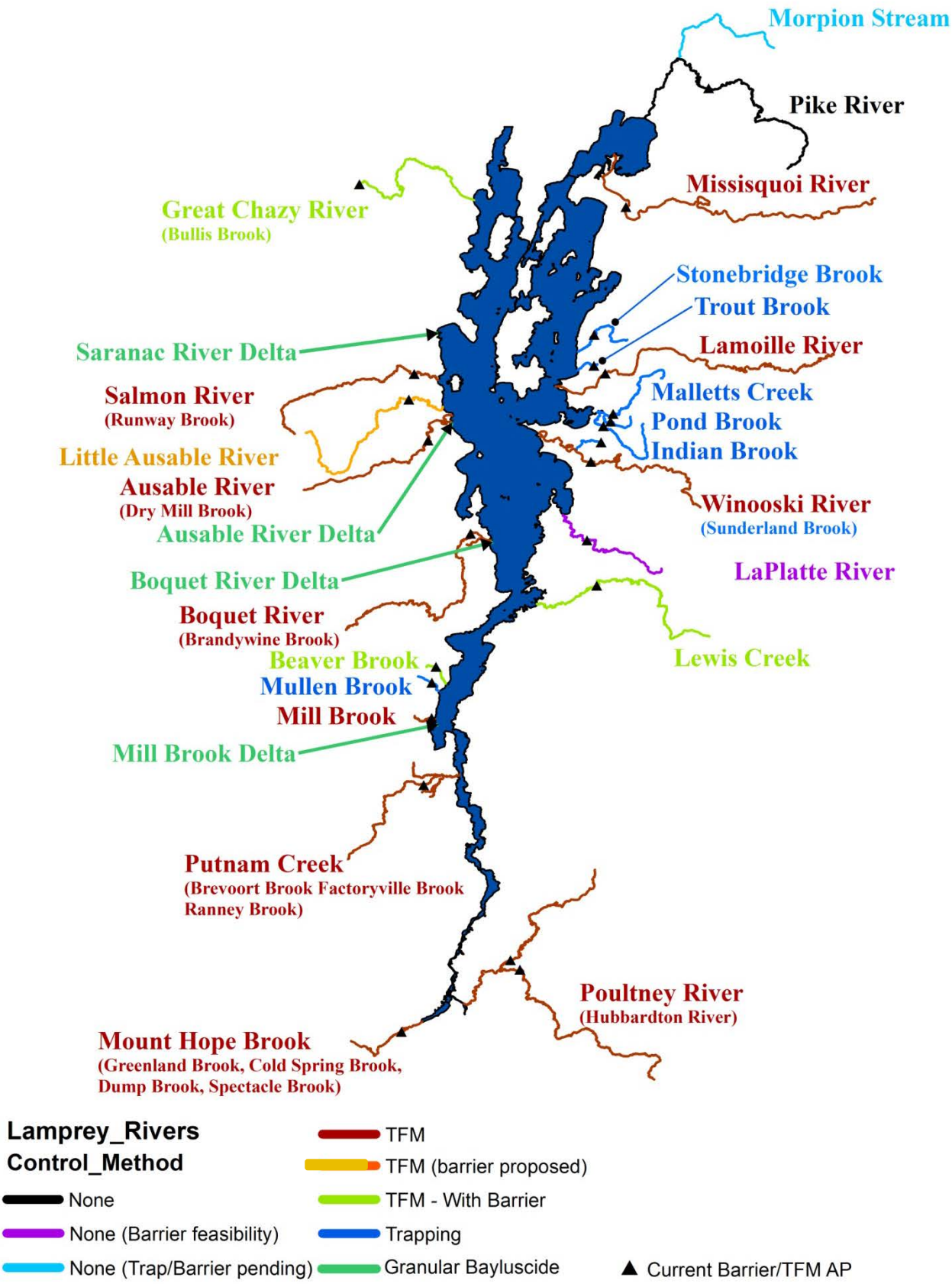
transformer, rather than larval, microchemistry. The continuing project will focus on characterizing microchemistry of transformer sea lamprey from a range of Lake Champlain tributaries.

Champlain Canal sampling (Marsden, Ladago)

Sampling of fish, plants, and molluscs was conducted in the Champlain Canal to describe the diversity and relative abundance of species present, in an effort to predict which taxa are likely to use the canal as a vector for transit between the connected watersheds. Sampling focused on the area around the Dunham Basin, between locks 8 and 9, which separates the Hudson River and Lake Champlain drainages. Gear included seines, gillnets, an ichthyoplankton net, boat electroshocker, and hand nets; collections were also made in lock 8 when the lock was drained for repairs. In prior years, locks 4 and 9 were also sampled. Over the last two years we have collected 39 fish species, 19 mollusks, 12 plants, and 2 crayfish; over half of the fish species were reproducing in the canal. Species lists have been compared with species present in the linked ecosystems to identify any species in transit outside their native range. Habitat data, species abundance, and species' habitat preferences are being used to predict which taxon groups are most likely to use the canal as a vector, and inform future efforts at prevention of further invasions via the canal.

River-run Restoration of Landlocked Salmon (Ardren)

The U.S. Fish and Wildlife Service is leading a large adaptive management experiment focused on restoring and enhancing river-runs of landlocked Atlantic salmon to Lake Champlain. The goals of this program are to: (1) Increase returns of hatchery-origin salmon to rivers; (2) Enhance the tributary fishery for salmon in Lake Champlain; (3) Restore naturally spawning populations of salmon. Lab and field experiments have been initiated in the Winooski River, VT and Boquet River, NY to increase river-runs of hatchery-origin salmon and to monitor success of natural reproduction. Activities include improving quality of hatchery fish by optimizing hatchery culture conditions and modifying stocking strategies to enhance survival and improve imprinting. Improved imprinting of hatchery fish to rivers where they are stocked will result in greater adult returns to those rivers because adult salmon migrate from the lake to rivers they imprinted on as juveniles to reproduce. Additional work has been started to quantify impacts of early mortality syndrome on juvenile salmon, which is caused by salmon feeding on non-native alewife. This adaptive management experiment is done in partnership with Vermont Fish and Wildlife, New York DEC, USGS, Dartmouth College, University of Vermont, Middlebury College, and Lake Champlain International.



Appendix 1: Map of Lake Champlain tributaries included in the sea lamprey control program.

Appendix 2: Schedule of completed Lake Champlain lamprey treatments through 2010 and projected treatments for 2011 -2015. The "T" denotes TFM only treatments, "B" denotes Granular Bayluscide, "C" denotes TFM + 1% Niclosamide and "P" denotes proposed treatments.

	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
Great Chazy River			T				T				T				T				T				P			
Saranac River			T																							
Saranac Delta		B				B									B				B				P			
Salmon River	T				T				T				T				T				T				P	
Salmon Delta		B				B																			P	
Little Ausable River	T				T				T				T				T				T				P	
Little Ausable Delta		B																				B			P	
Ausable River	T				T					T			T				T	T			T				P	
Ausable Delta		B				B								B				B				B			P	
Boquet River	T				T					T				T				T				C			P	
Boquet Delta		B				B																	P		P	
Beaver Brook	T								T					T				T								
Mill Brook																			T				P			
Mill Delta																			B				P			P
Putnam Creek	T				T				T				T				T				T			P		P
Mt. Hope Brook (incl. tribs)		T				T				T					T				T				P			p
Poultney & Hubbardton rivers			T				T											T				T				P
Lewis Creek	T				T								T				T				T				P	
Winooski River															T				T				P			
Trout Brook						T																				
Stonebridge Brook		T																								
Lamoille River																				T				P		
Missisquoi River																			T				P			

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