LAKE CHAMPLAIN FISH AND WILDLIFE MANAGEMENT COOPERATIVE

FISHERIES TECHNICAL COMMITTEE
ANNUAL REPORT
2010

Administrative Accomplishments

In addition to the regular and recurring field activities reported in this document, there were three noteworthy accomplishments in 2010.

1) Through negotiations with the Vermont Department of Environmental Conservation, a five-year, multi-stream Aquatic Nuisance Control Permit for Vermont lampricide treatments was granted. The permit is in effect through September 13, 2015 and allows treatments of Lewis Creek, Poultney River, Winooski River and Lamoille River. This is the first Vermont permit that covers more than a single treatment, which will save both the applicant and permitting authority substantial time and resources while maintaining environmental protections. Separate threatened and endangered species permits will continue to be required for individual treatments for the foreseeable future
2) An Addendum to the Cooperative's MOA was established that defined new roles for all three agencies in the Lamprey Control Program. The USFWS was positioned in a leadership role to coordinate both assessment and control functions and coordinate operations with the states.
3) An automated temperature/fire alarm system was installed in the pesticide storage building at the Ed Weed Fish Culture Station, and a Certificate of Occupancy was granted to complete the project. This new building will provide much-needed secure space to store lampricides used in Vermont.

SALMONIDS

Stocking Summary (Zollweg, Chipman)

Salmonid stockings in Lake Champlain during 2010 included about: 345,000 salmon (smolt equivalents); 59,000 steelhead (smolt equivalents); 92,000 lake trout; and 73,000 brown trout (Table 1). The list includes salmon and steelhead that were stocked in the tributaries to the lake. Also listed in Table 5 are the stocking targets for each species. The 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.

Table 1. Numbers (in stocking equivalents[a]) of salmonids stocked in Lake Champlain during 2010, and stocking targets for the lake.

	Main Lake		Malletts Bay/Inland Sea		Total number
Species	Target	2010	Target	2010	stocked in 2010
Salmon	207,000	290,021	77,000	56,613	346,634
Lake trout	82,000	92,122	0		92,122
Steelhead	73,000	54,350	5,000	5,000	59,350
Brown trout	38,000	41,139	30,000	31,776	72,915
Total	400,000	477,632	112,000	93,389	571,021

[a] Salmonids are stocked in a range of sizes which exhibit very different survival rates. The numbers stocked are converted to stocking equivalents based on expected survival rates.

Stocking Evaluation (Staats)

A landlocked salmon stocking evaluation continued in the Winooski River drainage. A total of 31,169 landlocked Atlantic salmon smolts were stocked in the lower Winooski River in 2010. In addition to the smolt stocking, the upper Winooski River (above the first 3 dams but below Bolton Dam) was stocked with approximately 33,000, 4.5-inch fingerlings.

The Huntington River was also stocked with approximately 98,000 salmon fry in May, 2010. The resulting age 0+ salmon parr were found in good numbers later at the two index stations sampled. Out-migrating salmon smolts from previous years fry stockings were assessed using a rotary screw trap which was fished at the mouth of the Huntington River from April into June, 2010. A total of 205 smolts were captured resulting in an estimate of 1,783 salmon smolts passing the trapping site.

Fish Passage (Staats, Smith)

A total of 51 adult landlocked Atlantic salmon and 1 brown trout were trapped at the Willsboro fish ladder on the Boquet River in the fall of 2010. This was the highest number of salmon collected at the ladder since 1998. All fish were measured and released upstream of the dam.

A total of 131 adult landlocked Atlantic salmon and 62 steelhead rainbow trout were trapped at the Winooski One fish passage facility in the fall 2010 while only 13 steelhead and 3 salmon was processed in the spring**.** All lifted fish were tagged and released downstream except for 42 salmon which were transported to the Ed Weed Fish Culture Station for fall egg-take. The threat of viral hemorrhagic septicemia has curtailed the movement of fish upstream 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 length, 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.

Limited springtime electrofishing was conducted in the Saranac and Ausable rivers in 2010. Over 80 salmon were collected from the Saranac River, while only 8 were collected in the Ausable. The majority of the fish were just completing their first year in the lake. These numbers suggest survival for the younger age classes of salmon continues to improve.

Fall near-shore salmon catches in the Whallon Bay and Willsboro Bay areas continued to be dominated by small, young salmon in 2010, suggesting sea lamprey predation may still be impacting the recruitment of salmon older than one lake-year. Beginning in 2008, data began to show an increase in the number of larger, older salmon, with 20% of the 2008 sample greater than 540 mm TL. In 2009, this trend continued with 26% of the near-shore salmon catch being greater than 540mm in length, but the proportion declined to 18% of the 2010 sample. About 50% more salmon smolt equivalents were stocked in 2008 and 2009 than in 2006 and 2007, which may have resulted in a higher proportion of smaller, younger fish in the 2010 sample.

In fall 2010, 350 returning salmon were collected from Hatchery Brook (Ed Weed Fish Culture Station discharge stream), including 98 adult Sebago-strain salmon that were retained for broodstock at Ed Weed. Many additional salmon were observed in Hatchery Brook but not collected. A total of 43 salmon were collected in the Lamoille River, which is in the range of recent years; however, only three salmon were collected at the Sandbar Causeway Bridge, which is the smallest sample ever taken at this location. The Sandbar sample is an anomaly compared to the strong salmon runs in other areas.

Fall electrofishing was also conducted on the Boquet River below the Willsboro fish ladder. Sixty-four spawning condition salmon were collected, measured and released in 47 minutes of electrofishing effort. Electrofishing samples had not been taken in the Boquet for a number of years due to the lack of fish passing the fish ladder.

Fall nearshore electrofishing at Whallon Bay and the Grand Isle Ferry breakwater yielded collections of 261 and 227 lake trout, respectively, in one night of sampling at each location. Another 77 lake trout collected in Willsboro Bay by electrofishing and five lake trout from the Winooski River fish lift were included in the sample. Length frequency metrics indicate continuing maturation of the lake trout 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 has steadily grown since 2005, and amounted to 25% of the sample in 2010 (Figure 1). There was a corresponding steady decline in the proportion of lake trout in the 533-633mm TL class, from a high of 42% of the sample in 1997 to 12% in 2009; however, an increase to 16% of the sample was observed in this size class 2010 (Figure 1). The approximately 55% reduction annual lake trout stocking that began in 1995 explains much of the decline in the 633-633mm size class, but the long term trend indicates that changes in sea lamprey-induced mortality inferred from wounding rates may also be a contributing factor (Figure 1). Sea lamprey wounding data are described in further detail on pages 7 and 8 of the lamprey section.

Experimental trap netting was conducted at the Grand Isle site in 2010 to evaluate an alternative lake trout sampling technique. A trap net was deployed for three nights, overlapping with the night of electrofishing, and was tended daily. A total of 783 lake trout and 21 salmon were captured in this effort.

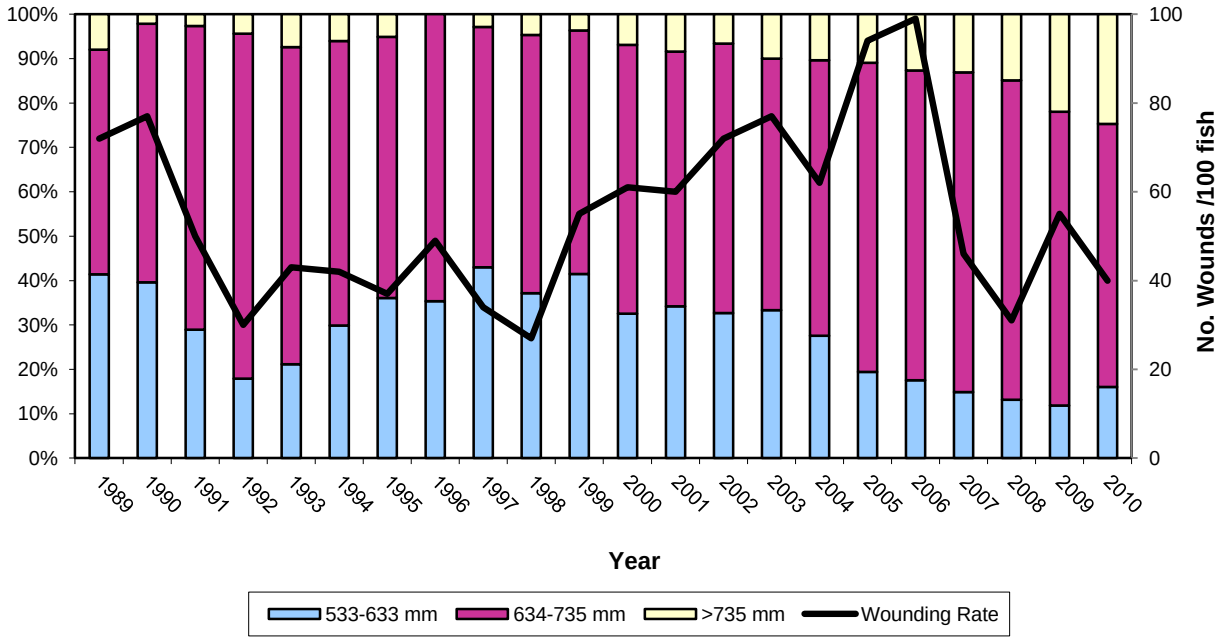


Figure 1. Percent frequency of three length classes of lake trout sampled in the Main Lake basin by fall electrofishing, 1989-2010 (left axis), with sea lamprey wounding rate trend on 533-633 mm lake trout (right axis).

SEA LAMPREY

The objective of the sea lamprey control program is to achieve and maintain wounding rates at or below 25 (ideally 10) wounds per 100 lake trout, 15 (ideally 5) wounds per 100 landlocked Atlantic salmon (salmon), and two (ideally less than one) wounds per 100 walleye.

Stream quantitative assessment sampling (QAS) (Bouffard)

Quantitative assessment surveys were conducted on four streams in preparation for scheduled lampricide treatments in the fall of 2011 (Table 2). A QAS survey was also conducted on Mullen Brook from the mouth to just upstream of the Route 9/22 bridge in Moriah, NY to determine the population of sea lamprey prior to implementation of trapping as a control measure (see trapping section).

Table 2. Results of quantitative assessment surveys conducted in 2010.

Stream and Reach	Population Estimate-Ammocoetes	Population Estimate-Transformers
Boquet River	2,261	0
Beaver Brook	85	0
Poultney River	23,323	0
Hubbardton River	1,141	0
Mullen Brook	4,178	0

Detection Sampling (Bouffard)

In 2010, presence absence surveys were conducted in the northwest quadrant of Lake Champlain. New sea lamprey populations were only collected from one site: Ray Brook, a tributary to Scomotion Creek in Plattsburgh, NY. Additional sampling at other locations in Ray Brook and throughout the Scomotion Creek watershed did not locate any other lamprey.

Delta assessment (Bouffard)

Larval sea lamprey surveys were conducted on the Salmon, Ausable, and Little Ausable River deltas during the summer of 2010 in preparation for Bayluscide treatments scheduled for the fall of 2011. During the survey conducted on the Ausable River, lamprey were collected from depths up to 60 feet and in an area that extends from the northern edge of the Ausable River delta to the southern edge of the Little Ausable River delta. Additional sampling will be conducted early in 2011 to determine the extent of infestation and plan for the fall delta treatment. No larvae were captured during the Salmon River delta survey, however, additional sampling will be conducted immediately north of the river mouth in an effort to determine if the stream lampricide treatment during the fall of 2010 may have moved larvae from the river onto the delta following the summer 2010 survey.

Control

Lampricides (Smith, Chipman, Zollweg)

Lampricide treatments were successfully completed on Putnam Creek, Little Ausable River, Salmon River, Ausable River and Lewis Creek (Table 3). 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 2010 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
Putnam Creek	Sept 14-15	8	310	9.2	-	-
Little Ausable River	Sept 18	31	559	5.3	-	-
Salmon River	Sept 20	24	243	4.0	-	-
Ausable River	Sept 22-23	331	1,267	7.5	-	-
Lewis Creek	Sept 28-29	24	297	9.5	-	-
		Totals:	**2,676**	**35.5**	**-**	**-**

Trapping and Barriers (Bouffard, Young)

Sea lamprey spawning runs were monitored in seven streams during the spring of 2010 (Table 4). Lamprey pots, baited with spermiating males, were deployed above the trap and barrier on Malletts Creek, Colchester, VT to capture sea lamprey that had escaped above the trap and yielded a total of 11 female sea lamprey. This technique will be used at several more trapping locations to determine whether sea lamprey are escaping above the trap site and to further reduce the potential for spawning in streams where traps are deployed.

Table 4. Results of adult sea lamprey trapping, 2010.

Stream	Date Trap Set	Date Trap Pulled	Number of Lamprey 2010	% Change from 2009
Beaver Brook	4/6/2010	6/15/2010	12	-50%
Trout Brook	4/5/2010	6/24/2010	56	4%
Stonebridge Brook	4/5/2010	6/24/2010	167	39%
Malletts Creek	4/6/2010	6/14/2010	280	195%
Great Chazy River	4/20/2010	6/17/2010	429	120%
Pond Brook	4/8/2010	6/9/2010	19	NA
Sunderland Brook	4/5/2010	6/16/2010	22	NA
Mullen Brook	4/12/2010	6/28/2010	35	NA
Total			944	93%

In order to address the escapement of spawning run sea lamprey above the Frog Pond Dam on the Great Chazy River in Champlain, NY, a new lamprey lip was installed in 2009. The screen panels of the trap were also reconfigured to eliminate the possibility of sea lamprey getting under one panel of the trap and moving upstream in 2009 and 2010. If fully effective, the barrier on the Great Chazy River would eliminate access to approximately 13 miles of sea lamprey spawning and larval habitat and the need for lampricide treatments above the barrier. Larval assessments planned for 2011 should indicate whether the modifications to the dam and trapping operations have resolved the escapement problem.

The Morpion Stream lamprey barrier project in Quebec made progress in 2010 by regaining necessary support from the newly elected municipal council and mayor. The ongoing challenges with landowner negotiations were finally resolved with the establishment of a lease. Our engineering firm, Kleinschmidt Assoc., has had to redesign and relocate the barrier 3 times due to land owner disputes. They have completed the 90% phase of the plans and should deliver the finished product in April 2011. Construction is scheduled as of now for August 2011.

Wounding Rates **(Chipman, Smith)**

Lamprey wounding rates on lake trout and salmon declined markedly in 2010 (Figures 2 and 3). The lake trout rate of 40 wounds per 100 fish is still well above the program objective (Table 5), but it is the second lowest observed wounding rate since 1998 (Figure 2). The wounding rate for Main Lake salmon met the program objective (15 wounds per 100 fish) for the first time in 2010 (Table 5). The wounding rate for pooled Inland Sea and Malletts Bay salmon declined at a rate similar to that of Main Lake salmon (Figure 3), but it remains higher than the objective (Table 5).

Sea lamprey wounding rates on walleye collected in 2010 from the Missisquoi River were 4 wounds per 100 fish sampled in the length slot (534 to 634mm). This remains higher than the Cooperative's lamprey wounding objective of 2 wounds per 100 walleye.

Table 5. Sea lamprey wounding rates on Lake Champlain lake trout and salmon during 2010, 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	**Year 2010**
Lake trout[a] (Main Lake)	25	55	38	40
Salmon[b] (Main Lake)	15	51	27	15
Salmon[b] (Malletts Bay-Inland Sea)	15	37	40	22

[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.

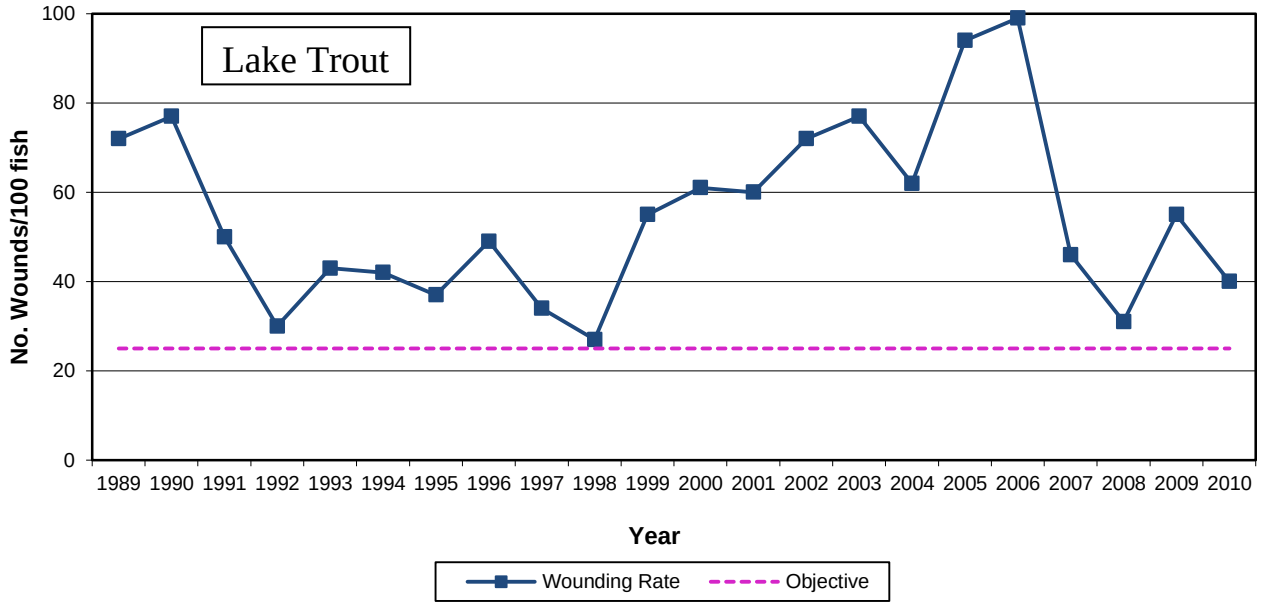


Figure 2. Type A1-A3 sea lamprey wounds (fresh and healing) per 100 lake trout (533-633 mm total length) sampled in the Main Lake basin by fall electrofishing, 1989-2010. For reference, the target wounding rate of 25 wounds per 100 fish is also presented (dashed line).

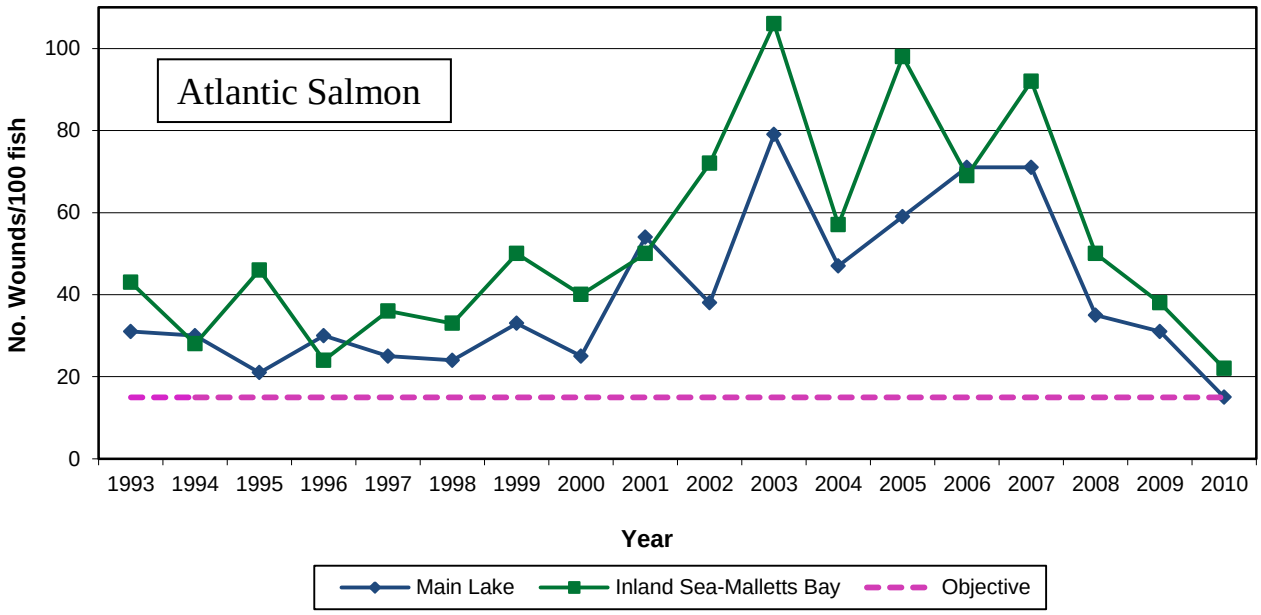


Figure 3. Type A1-A3 sea lamprey wounds (fresh and healing) per 100 salmon (432-533 mm total length) sampled by fall electrofishing in the Main Lake (also includes fishways on the Winooski and Boquet rivers) and Inland Sea-Malletts Bay basins, 1993-2010. For reference, the target wounding rate of 15 wounds per 100 fish is also presented (dashed line).

FORAGE FISH

SMELT

A total of 19 midwater trawls for rainbow smelt were conducted in late summer, 2010 (Table 6). Calculated mean CPUE at the main lake stations was similar to 2009 but continued to decrease in Malletts Bay (Figure 4). At the Northeast Arm station CPUE increased slightly and was dominated by age two smelt (94% of aged sample). The Malletts Bay catch was so low that only 102 smelt were aged (usually 200 fish are aged). Only 15 age 1 smelt were found; one third of the sample were age 2.

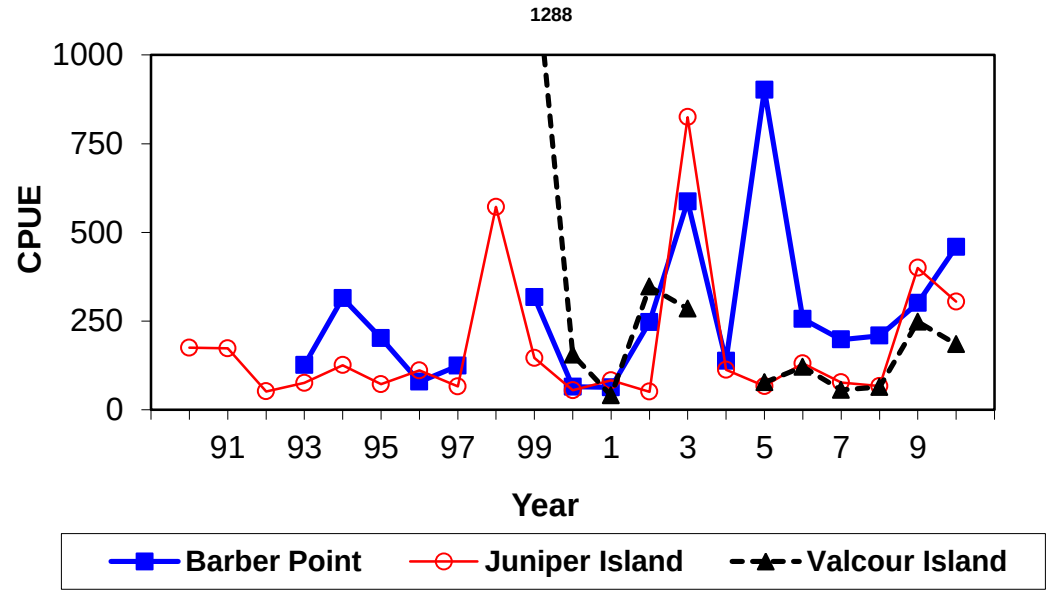
Table 6. Mean catch per 55 minute trawl (CPUE with 95% confidence interval) of rainbow smelt in 2010 and comparison to long-term mean and median CPUE.

Station	Number of trawls	CPUE	Mean	Median	N years
Main Lake					
Barber Point	4	459 ± 147	270	209	17
Juniper Island	4	305 ± 71	178	111	21
Valcour Island	3	185 ±38	261	155	11
Malletts Bay					
Malletts Bay	4	38 ± 10	999	654	21
Inland Sea					
Northeast Arm	4	151 ± 63	1062	693	21

ALEWIFE

Alewife were first discovered in Lake Champlain in 2004 and their numbers have increased since. A sampling program is being developed to monitoring their abundance and population characteristics. Since 2008, floating gill nets have been utilized to collect alewife samples for age and growth analysis. In 2010, 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 18, 2010 following the same procedures as prior years. The assessment transects generally covers around 30 nautical miles in the Northeast Arm, 15 nautical miles in Malletts Bay and just over 100 nautical miles in the Main Lake. Along with the acoustic transect targeted trawls were performed to confirm species compositions. In 2010, 8 tucker and 13 midwater trawls were performed. Processing of the acoustic data is currently ongoing.



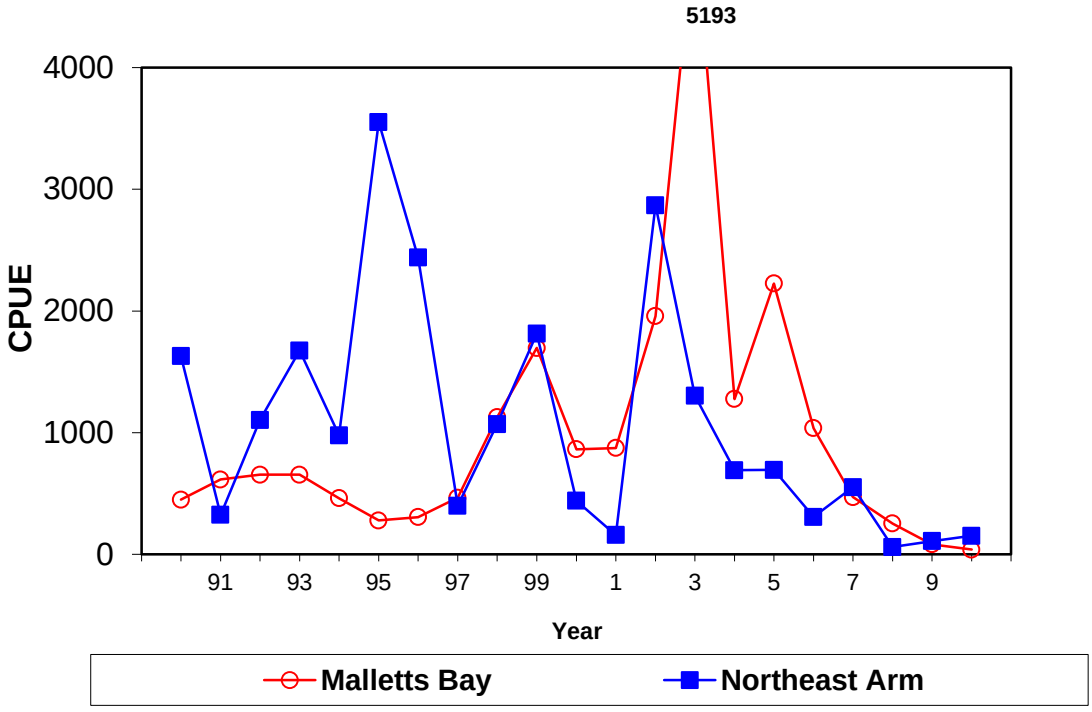


Figure 4. Mean catch per 55-minute trawl for smelt in Lake Champlain.

PERCIDS

YELLOW PERCH (Pientka)

CPUE

Starting in 2009 experimental gillnets were set overnight at multiple locations in order to examine the Lake Champlain fish community. While these nets are not specifically targeting yellow perch they do give insight into relative abundance. The gillnets consisted of 125ft of experimental netting ranging from 25.4 mm (1 inch) stretch to 76.2 mm (3 inch) stretch and were set on the bottom following a depth contour. The nets were fished overnight (roughly 24 hrs). In 2010, the sampling occurred between July 7th and July 15th. Since only two years of data are available, trends are difficult to interpret (Figure 5). Both Shelburne and Malletts Bay CPUE appear to be similar for both years. Missisquoi Bay catch was higher in 2010 then 2009 and St. Albans Bay was lower in 2010 than 2009. Continued years of sampling should help to better evaluate the trends.

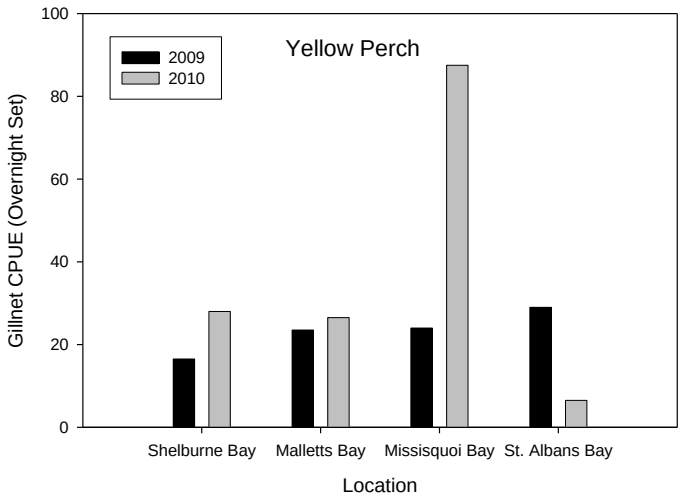


Figure 5. Yellow Perch CPUE for 2009 and 2010 at four Lake Champlain Locations.

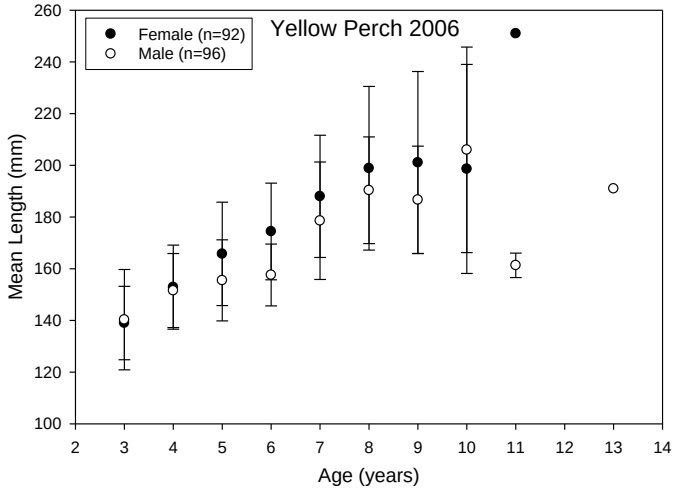


Figure 6. Yellow Perch length at age for bottom trawled yellow perch at all community monitoring station in 2006.

Ageing

As part of the Lake Champlain fish community monitoring, yellow perch from gillnets and bottom trawls had their otoliths removed for aging (Figure 5). Samples from 2006 (bottom trawling) have been aged and the results are presented in Figure 6. Yellow perch were aged between 3 and 13 years old and generally the females were larger for a given age. Samples from additional years continue to be processed.

WALLEYE (MacKenzie, Zollweg, Smith)

Walleye management activities on Lake Champlain included the collection of brood stock from the Missisquoi River, evaluation of the contribution of stocked walleye to the spawning run in the Missisquoi and continuation of the angler diary program.

In 2010, 2.5 million eggs were collected from 26 pairs of walleye collected from the Missisquoi River. All adults used for spawning were sacrificed for disease testing because of concerns over Viral Hemorrhagic Septicemia.

Eggs were hatched at the Bald Hill Fish Culture station in Vermont. Fingerlings were reared in one pond at the Bald Hill FCS. The other two ponds were damaged in the spring and were unusable. Fingerlings were also reared in 4 pond managed by the Lake Champlain Walleye Association. There were 160,000 advanced fry and 81,000 fingerlings stocked into the Missisquoi River and adjoining waters and lower Otter Creek. All fry were marked with OTC and all fingerlings received a second OTC mark before being stocked.

Samples of age 3 walleye were collected for OTC analysis from the Missisquoi River (n = 30) because the river was stocked with OTC-marked fingerlings and fry in 2007. Preliminary results indicate that 70% of the age 3 walleye collected from the 2010 Missisquoi River spawning run were stocked.

An additional 678,000 eggs were collected from 16 walleye collected from the South Bay, New York spawning stock and reared in a portable hatchery managed by the Lake Champlain Walleye Association in Whitehall, New York. An estimated 332,000 unmarked fry were stocked back into South Bay. One 502 mm, female sauger was also collected which has renewed hopes of an extant population in southern Lake Champlain. In, 2011 sampling efforts will be targeted to detect that population. A New York State Sauger Management Plan has been drafted.

LARGEMOUTH AND SMALLMOUTH BASS (Good, Pientka, Zollweg)

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 **7**).

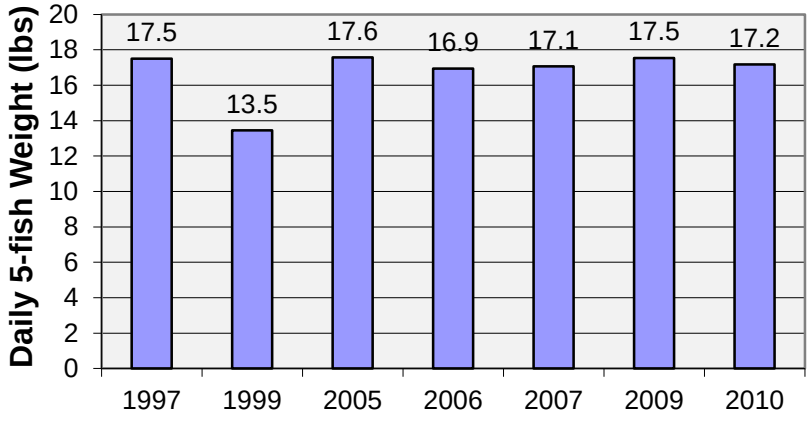


Figure 7. 5-fish daily bag weights averaged for the Top 10 anglers from all 8 professional-level Bassmaster tournaments held on Lake Champlain since 1997.

In 2009, Vermont introduced a new bass tournament reporting program to collect a variety of data (Table 7). Of the 95 tournaments held on Lake Champlain, 70% were headquartered on the Vermont side. However, this only represented 38% of angler participation because New York's tournaments had greater participation.

Table 7. Catch summaries of 2009 bass tournaments held on Lake Champlain that were open to angling in Vermont waters.

	Lake Champlain Bass Tournaments fishing Vermont waters
# of Tournaments	95
# Bass Weighed In	14,884
# Bass Released Alive	14,141
Estimated Initial Mortality Rate	5%
Total lbs Weighed In	37,473 lbs
Avg. Bass Weight	2.52 lbs
Largest Largemouth Bass	6.75 lbs
Largest Smallmouth Bass	5.45 lbs
Anglers weighing in at least 1 bass	87%

In 2010, VTDFW established twenty standardized bass electrofishing stations in southern Lake Champlain between Dresden Narrows and Chimney Point. It is intended that sampling will take place annually in May for smallmouth and in July for largemouth bass. NYSDEC transects were not electrofished in 2010 due to budget constraints. Nighttime electrofishing of the twenty VT stations in 2010 yielded 640 largemouth bass and 112 smallmouth bass (Table 8).

Table 8. Catch-per-Unit Effort estimates for all 20 southern Lake Champlain bass survey stations sampled in 2010. PSD values were 60.1 for largemouth bass and 28.6 for smallmouth bass. RSD_p values were 30.45 for largemouth bass and 10.39 for smallmouth bass.

Hours Shocked	#LMB	# Legal LMB (≥254mm)	#SMB	# Legal SMB (≥254mm)	CPUE LMB	CPUE Legal LMB (≥254mm)	CPUE SMB	CPUE Legal SMB (≥254mm)	CPUE Total Bass	CPUE Total Legal Bass (≥254mm)
7.82	640	308	112	31	81.89	39.41	14.33	3.97	96.21	43.37

ESOCIDS **(Good)**

NORTHERN PIKE

In 2010, the Vermont Fish & Wildlife Department continued collecting length, age and growth information for Lake Champlain's northern pike population. Ice-out trapnet surveys were conducted in the spring of 2010. Trapnets were set at four sites in southern Lake Champlain; Peter's Bay in Benson, East Creek and Larabee's Point in Orwell, and 5-Mile Point in Shoreham March 22 through April 2. 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 459 hours of trapnet sampling effort resulted in the collection of 444 northern pike (288 ♀, 156 ♂), ranging in size from 367mm to 960mm. For aging purposes, 12 female and 21 male northern pike were sacrificed for cleithra removal.

Department staff also attended several Lake Champlain ice fishing derbies in the winter of 2010 to collect cleithral bones from northern pike brought to the weigh-in stations. 43 cleithra were collected from female northern pike ranging in length from 625mm to 1014mm; 3 cleithra were collected from male northern pike ranging from 644mm to 802mm in length.

These data will be used to develop length-frequency distributions, generate age and growth curves, and calculate mortality estimates for northern pike on Lake Champlain.

MUSKELLUNGE

Vermont recently implemented a muskellunge stocking program for the lower Missisquoi River and Missisquoi Bay, with the expectations of eventually restoring a naturally reproducing population and establishing a fishery. The stocking program utilizes surplus summer fingerlings (~6 inches in length) provided by NYDEC's Chautauqua Lake hatchery. The specific numbers of muskellunge provided by NY varies year to year, depending upon the amount of surplus summer fingerlings available after NY stocks their hatchery grow-out ponds, and how many of those fish Vermont decides to take.

In the first year of stocking (2008), only 250 surplus fingerlings were available. These fish were stocked in the lower Missisquoi River. In 2009, Vermont received 10,000 surplus summer-fingerling muskellunge which were stocked into the lower Missisquoi River and into areas of suitable habitat in Missisquoi Bay as far south as the Route 78 bridge. In 2010, due to unexpected levels of hatchery mortality related to poor conversion on a new pellet diet, no surplus fingerlings were available.

AMERICAN EEL (Staats)

American eel *Anguilla rostrata* support important commercial fisheries where populations remain at harvestable levels. However, downward trends in harvest data have raised concern for the population of eel in the United States and Canada. The Richelieu River connects northern Lake Champlain to the St. Lawrence River and supported a commercial eel fishery until it was closed in 1998 because harvest dramatically declined. The rebuilding of two dams on the river has been partly to blame for the decline.

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 9). In order to monitor the success of these stocking efforts and new passage facilities, Québec asked the United States Fish and Wildlife Service's Lake Champlain Fish and Wildlife Resources Office in Essex Junction, Vermont for assistance by conducted eel surveys.

Eel sampling occurred on the nights of July 15 (Paradise and Keeler Bay), July 20 (Converse Bay) and August 18 (Grand Isle) in 2010. One American eel was collected in Paradise and Keeler Bay and one other eel was observed but not captured in Paradise Bay (Table 10). Twenty-five eels were collected from Converse Bay while 20-30 small eels were observed but not captured. These small eels were difficult to net over the rough substrate on which they were found. Fourteen eels were collected along the Grand Isle shoreline and an additional 3-5 small eels missed. Eels collected ranged in size from 282 millimeters (mm) to 672 mm. Mean length was 458 mm (sd = 83) and mean weight was 208 grams (sd = 131). As noted above, many smaller eels were observed but not netted.

Table 10 compares the 2010 and 2007 eel sampling efforts. It would appear that recruitment of eels to the main lake portion of Lake Champlain has been good. However, movement of eel into the Northeast Arm (Keeler and Paradise bay) has been less successful. The Northeast Arm is somewhat isolated from the main lake by highway and old railroad causeways. Access into the Northeast Arm is limited to small openings in these causeways that allow boat traffic to pass. It would be expected that recruitment into this portion of the lake would be less rapid than the main lake. Also of note, the Vermont Department of Fish and Wildlife netted 61 and observed 73 additional eels while sampling bass in southern Lake Champlain (Bridport, Vermont to West Haven, Vermont) in 2010, further suggesting growing eel abundance.

Table 9. Summary of American eel stocking in the upper Richelieu River.

Year	Number of glass eels
2005	600,000
2006	1,000,000
2007	425,500
2008	746,000
2009	0
2010	0

Table 10. Comparison of 2007 and 2010 American eel sampling efforts in Lake Champlain.

Year	Number of eels collected			
	Keeler Bay	Paradise Bay	Converse Bay	Grand Isle shoreline
2007	0	0	0	1
2010	1	1	25	14

RESEARCH

Lake whitefish project (Herbst and Marsden)

A four-year project on lake whitefish was completed. Larval whitefish were abundant in samples throughout much of the main lake, rare in the Inland Sea and south lake, and absent in Missisquoi Bay. Diet varied seasonally; whitefish fed primarily on large numbers of fish eggs in the spring and transitioned to foraging on mysids in the summer and gastropods in the fall and winter. Zebra mussels made up less than one percent of the diet and appeared in less than ten percent of the stomachs analyzed. Biological parameters (size and age structure, sex composition, growth, condition, energy density, and fecundity) of whitefish in Lake Champlain were typical of an unexploited population, with multiple length and age classes represented.

Condition was high and representative of a diet with high energy content. Whitefish in Lake Champlain had similar high energy density to Lake Erie, where whitefish were not negatively impacted by dreissenid invasions, and had greater mean energy density than lakes Michigan, Huron, and Ontario. Metrics of the current whitefish population in the main lake of Lake Champlain are typical of a stable, unexploited population; however, whitefish appear to be are rare or absent in Missisquoi Bay and Larabee's Point, most likely because of habitat degradation. Whitefish in Lake Champlain have not been negatively impacted by the introduction of zebra mussels, probably due to their ability to attain ample energy sources from their diets.

Alewife thiaminase project (Marsden)

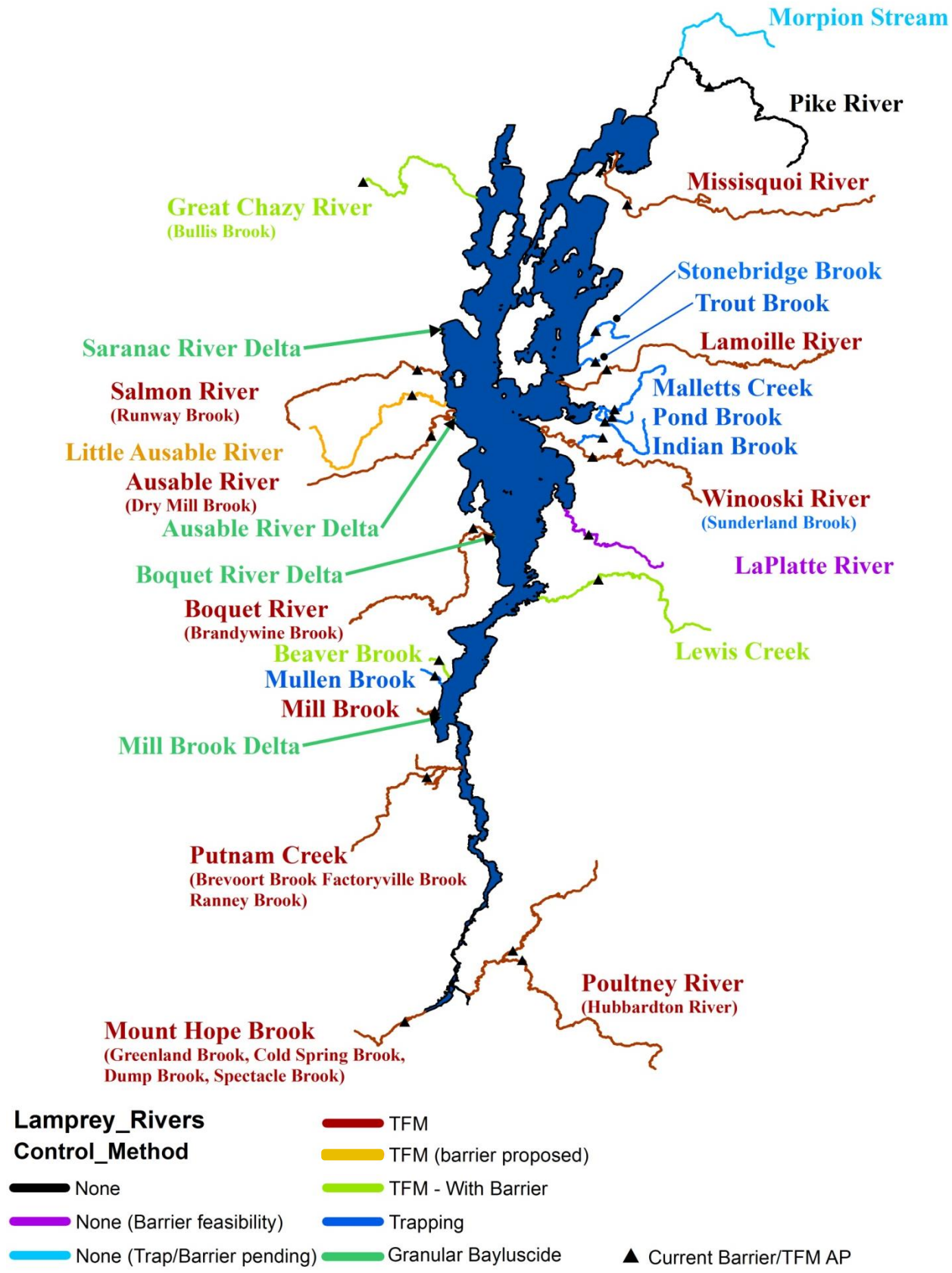
The objectives of this project are to evaluate changes in alewife thiaminase levels during the initial phases of the alewife invasion, and examine effects of alewife consumption and alewife thiaminase expression upon lake trout reproduction in Lake Champlain. Lake trout and Atlantic salmon eggs were collected in fall, 2010; thiamine levels in Atlantic salmon dropped from 3.7±1.2 nmol/g in 2009 to 2.3±0.4; lake trout levels rose slightly from 2.9±1.1 to 4.4±2.8. Smelt and alewife were collected for thiaminase analysis; both contained a wide range of thiaminase among individuals (alewife, 3.2 – 22.9 umol/g/min, smelt 2.3 – 53.5 umol/g/min). Research in the Great Lakes suggests that smelt thiaminase has low activity at the pH present in salmonid stomachs, but this does not entirely explain the apparent absence of thiamine depletion prior to the arrival of alewife, when smelt were the primary forage for salmonids.

Microchemistry of sea lamprey statoliths (Lochet and Marsden)

Aude Lochet, a post-doctoral researcher, has begun to examine changes in sea lamprey statoliths before, during, and after metamorphosis in an effort to learn whether the microchemical signal that identifies the larva's natal stream can be detected in parasites or adults. Larval lamprey were collected from two streams, marked with alizarin red or a stable isotope, and are being reared in the laboratory to monitor changes in the location and ability to detect the marks.

Champlain Canal sampling (Marsden)

Sampling of fish, plants, and molluscs was conducted in the Champlain Canal to describe the diversity and relative abundance of species present and presence of recruits, 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 locks 4 and 9 during winter draw-down for repairs. We collected 25 fish and 18 mollusc species; nine fish species were captured either as larvae, young-of-year, or ripe adults, indicating that they are spawning within the canal. Sampling will resume after ice-out in spring, 2011.



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 -2014

	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
Great Chazy River			X				X				X				X				X				-		
Saranac River			X																						
Saranac Delta		X				X									X				X				-		
Salmon River	X				X				X				X				X				X				-
Salmon Delta		X				X																			
Little Ausable River	X				X				X				X				X				X				-
Little Ausable Delta		X																				-			
Ausable River	X				X					X			X				X	X			X				-
Ausable Delta		X				X								X				X				-			
Boquet River	X				X					X				X				X				-			
Boquet Delta		X				X																			
Beaver Brook	X								X					X				X							
Mill Brook																			X				-		
Mill Delta																			X				-		
Putnam Creek	X				X				X				X				X				X	-			
Mt. Hope Brook (incl. tribs)		X				X				X					X				X			-			
Poultney & Hubbardton rivers			X				X											X				-			
Lewis Creek	X				X								X				X				X				-
Winooski River															X				X				-		
Trout Brook						X																			
Stonebridge Brook		X																							
Lamoille River																				X				-	
Missisquoi River																			X				-		

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