Management of Fishery Resources and Sea Lamprey in Lake Champlain, 2004

Annual Report from the Lake Champlain Fisheries Technical Committee

Prepared by the Fisheries Technical Committee of the
Lake Champlain Fish and Wildlife Management Cooperative

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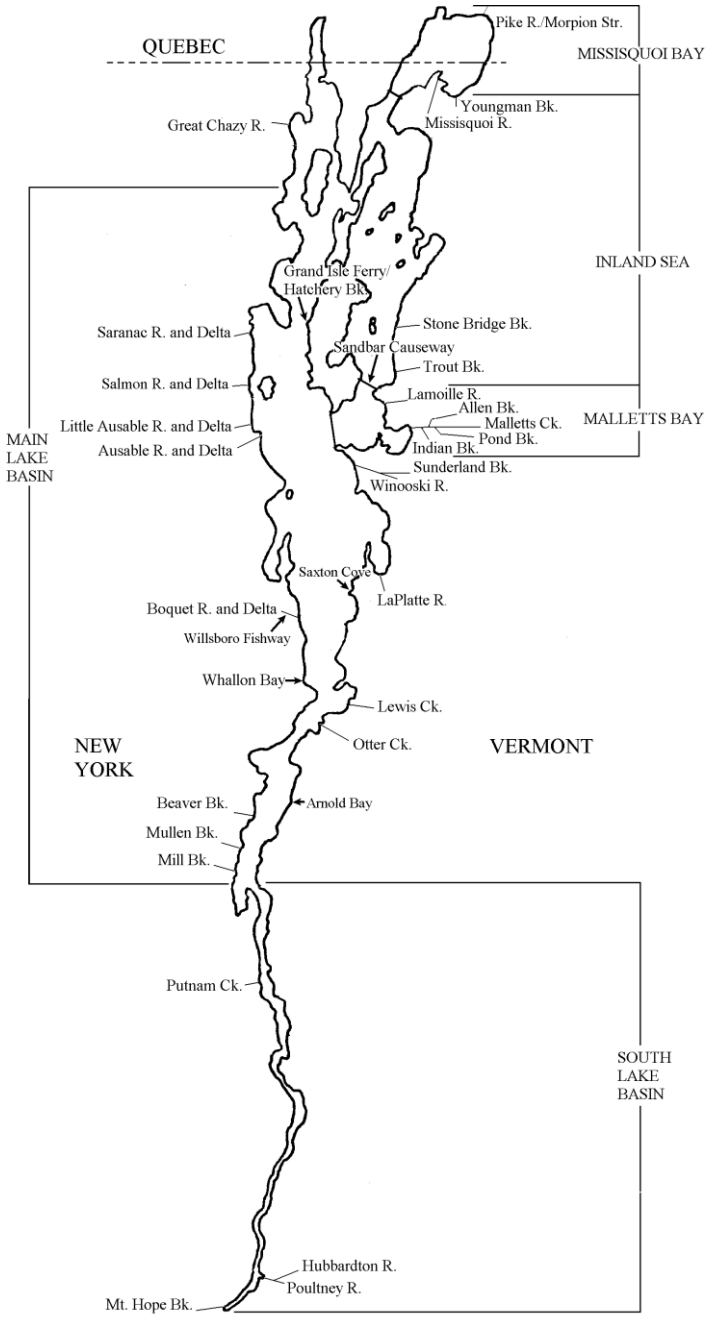
Executive Summary

The Lake Champlain Fisheries Technical Committee manages and conducts research on the fish resources of Lake Champlain. The Committee promotes a unified approach for the conservation of those resources. This report summarizes activities of the Committee in 2004.

A primary focus of the Fisheries Technical Committee has been to reestablish populations of the native landlocked Atlantic salmon and lake trout. Management of sea lamprey in Lake Champlain has become a major activity necessary to achieve those objectives. Three rivers and one delta were treated with lampricides in 2004. All of the treatments were successful at killing larval sea lamprey while having minimal nontarget impacts. One planned stream treatment in NY was canceled because of high flows. A planned stream treatment in VT was canceled because of delays in obtaining the necessary state permits. During their spawning run, sea lamprey were trapped on nine streams. Quantitative sampling was conducted to estimate abundances of larval and transformer stage sea lamprey of three tributaries, and qualitative sampling to define areas requiring treatment were conducted on two deltas. Ongoing research will assess sea lamprey movements within the lake, and the relative contributions of several rivers to the population of adult lamprey in the lake. A sea lamprey life history model is in the process of being developed. The model will help identify future research needs and the relative effectiveness of various approaches to control. A control alternatives working group is investigating alternatives to lampricides as possible lamprey control procedures.

Salmonid management included stocking about 268,000 landlocked Atlantic salmon, 86,000 lake trout, 81,000 steelhead and 68,000 brown trout. Salmonid abundances were monitored through spring and fall near shore electrofishing, collections at the Willsboro Fishway and Winooski River Fish Lift, and an angler diary cooperator program. Natural reproduction by lake trout is the subject of a research project being conducted by the University of Vermont. Providing fish passage for salmon runs is an ongoing activity. A study to compare returns from three strains of salmon was begun with the stocking of differentially fin-clipped study fish in spring, 2003. Attack rates on lake trout and salmon in 2004 were generally higher than attack rates prior to the eight-year experimental sea lamprey control program, but lower than 2003. Sampling of salmon and lake trout by the Committee indicated that abundances of those species were relatively low, likely an indication of sea lamprey induced mortality. Completion of the Final Supplemental Environmental Impact Statement on long-term sea lamprey control in 2001 allowed a long-term control program to begin in 2002. Expectations are that the renewed control effort will yield improvements in the salmonid populations, as well as walleye, lake sturgeon and other fish populations over the next few years.

Figure 1. Map of Lake Champlain showing relevant tributaries and other fishery survey locations.



Introduction

This report summarizes activities conducted by the Lake Champlain Fisheries Technical Committee during 2004. A major focus of the Technical Committee has been to reestablish the native landlocked Atlantic salmon and lake trout populations in Lake Champlain. In addition, effort has been directed towards management of walleye, lake sturgeon, smelt and other species. Related activities include fish stocking, control of sea lamprey, research into sea lamprey biology in Lake Champlain, and studies of potential nontarget impacts from lamprey control.

The Lake Champlain Fisheries Technical Committee is part of the Lake Champlain Fish and Wildlife Management Cooperative (Cooperative). The Cooperative and the Fisheries Technical Committee were established in 1973 to promote "a unified approach for the protection and management of the fish and wildlife resources of interstate significance in Lake Champlain" (Lake Champlain Fish and Wildlife Policy Committee, 1977). The Fisheries Technical Committee includes representatives of the US Fish and Wildlife Service (USFWS), the Vermont Department of Fish and Wildlife (VTDFW), the New York State Department of Environmental Conservation (NYSDEC), the University of Vermont, and the Vermont Cooperative Fish and Wildlife Research Unit. In addition, representatives from the Province of Quebec, Sea Grant, and other universities are frequently involved in Technical Committee activities.

The organizations making up the Technical Committee obviously have a broad spectrum of management, regulatory, and research responsibilities. This document primarily discusses activities conducted cooperatively between the organization's members and/or activities that involve resources held in common across the lake's political boundaries.

Refer to the map of Lake Champlain (Figure 1) for locations of tributaries and other areas referred to in this report.

Fish Community Objectives

Objectives for the Technical Committee were initially developed in the 1977 document: "A Strategic Plan for Development of Salmonid Fisheries in Lake Champlain." That plan established a goal of developing and maintaining a diverse salmonid fishery to supplement existing fisheries. Program objectives included:

- *Re-establish a lake trout fishery by 1985 that will annually provide at least 45,000 additional man-days of fishing with an approximate yield of 18,000 lake trout averaging 5 pounds each.*

- *Re-establish a landlocked Atlantic salmon fishery by 1985 that will annually provide at least 41,000 additional man-days of fishing with an approximate yield of 12,200 Atlantic salmon averaging 4 pounds each.*

- *Establish a "steelhead" rainbow trout fishery by 1985 that will annually provide at least 31,000 additional man-days of fishing with an approximate yield of 6,100 steelhead averaging 4 pounds each*.

- *Maintain the rainbow smelt fishery at a level that will annually average at least 25,000 man-days of fishing with an approximate annual yield of 100,000 pounds*.

Subsequent work by the Cooperative concluded that the abundance of sea lamprey was a primary factor preventing achievement of the salmonid management objectives. Those findings were reviewed in the Final Environmental Impact Statement: "Use of Lampricides in a Temporary Program of Sea Lamprey Control in Lake Champlain with an Assessment of Effects on Certain Fish Populations and Sportfisheries." That document established the following objectives:

- *Achieve an abrupt and substantial reduction in the abundance of parasitic stage sea lampreys for 8 years with 2 complete treatments of important ammocoete-producing areas*.

- *Monitor and assess the effects of the sea lamprey reduction on the characteristics of certain fish populations, the sportfishery, and the area's economy*.

- *Upon completion of this program, formulate long-range policy and management strategies for minimizing the effects of sea lamprey in Lake Champlain*.

The eight-year experimental sea lamprey control program that was conducted in the 1990's determined that sea lamprey control yielded substantial biological, economic, and recreational benefits. During this period the Cooperative conducted 24 stream treatments with the lampricide TFM, and 9 delta treatments with the lampricide Bayluscide. A favorable benefit:cost ratio of nearly 3.5:1 was estimated for the experimental program (Fisheries Technical Committee 1999).

The eight-year program lead to the Cooperative completing in 2001 the Final Supplemental Environmental Impact Statement (FSEIS): "A long-term Program of Sea Lamprey Control in Lake Champlain." The FSEIS includes objectives and strategies for the lamprey control portion of the Cooperative's activities. While the eight-year control program focused on the use of lampricides, the long-term sea lamprey control program incorporates a variety of techniques including barriers to spawning migrations, trapping migrating adults, and lampricides to control larval lamprey infestations.

Over time the Cooperative members have devoted considerable effort towards protecting and improving Lake Champlain's walleye population. Stocking, monitoring the spawning runs, and monitoring lamprey impacts on walleye are primary areas of focus. Lamprey attack rates on

walleye suggest that, similar to salmonids, sea lamprey control may be an important strategy for improving the walleye resource. Walleye and salmonids also share the smelt forage base. Therefore, the smelt studies conducted by members of the Committee relate to the smelt's role as the primary forage for walleye and salmonids, in addition to sustaining a fishery directed specifically for smelt.

The Cooperative has pursued the above goals and objectives in a manner that is consistent with principles of ecosystem management:

- Management restores functions within the ecosystem that have been lost. Deep water, pelagic habitat accounts for roughly half of the lake's surface area. Lake trout and salmon were apparently the top piscivores in that portion of the lake. With their demise, neither native nor nonnative fishes filled that pelagic piscivore function. Another ecosystem function that is being restored is that of salmon runs in the lake's tributaries. Early records indicate that salmon were exceptionally abundant during the spawning runs. Due to the early loss of salmon, the broad implications of those runs to the basin's ecosystem are not known. However, salmon runs elsewhere provide important forage for fish eating mammals and birds.

- Management also reestablishes native components (native species) of the ecosystem that have been lost. Independent of their ecological function, reestablishing salmon and lake trout represents a restoration of native components of the ecosystem. Salmon and lake trout were historically found in the pelagic habitat of the lake and, in the case of salmon, in many of the tributaries. Adult salmon are present in tributaries during the fall spawning runs, and immature salmon are there throughout the year. An example that illustrates the distinction between function and components is the use of Pacific salmon in the Great Lakes: Pacific salmon are not a native component of the Great Lakes ecosystems, but they have been very effective at restoring the function of pelagic predator.

- The Cooperative stocks two nonnative species: steelhead (rainbow trout) and brown trout. Based on experience in the basin and elsewhere, neither species is likely to reach nuisance levels or be disruptive to the lake's ecosystem. Both species provide valuable diversification to angling opportunities in the lake and tributaries. In a lake and watershed with many significant ecological changes brought by humans, the non-disruptive nature of those stockings, combined with their recreational and economic value, makes their continued stocking appropriate.

- Key components of the ecosystem are monitored for potential impacts from management actions. The primary forage, smelt, is monitored for potential changes in abundance resulting from increased predation. Walleye, the primary competitor with salmon and lake trout, is also being monitored.

- Lastly, impacts of the sea lamprey control treatments on nontarget species are considered via toxicity tests, on-site observations during the treatments, and other studies. Results are used to develop effective treatment methodologies while minimizing potential nontarget impacts to the greatest extent possible.

By reestablishing native components, and by restoring functions of the historic Lake Champlain ecosystem, salmonid management by the Technical Committee is an excellent example of ecosystem management.

Sea Lamprey Management and Assessment

The Cooperative's current objectives for sea lamprey control in Lake Champlain, as established in the FSEIS for the long-term control program, include:

- *Achieve and maintain lamprey wounding rates at or below:*
  25 wounds per 100 lake trout (ideally 10 wounds per 100 lake trout);
  15 wounds per 100 landlocked salmon (ideally 5 wounds per 100 salmon);
  2 wounds per 100 walleye (ideally less than 1 wound per 100 walleye).

- *Attain target wounding rates within five years of full implementation of the long-term control program.*

Presently, sea lamprey control in the Lake Champlain Basin is achieved through the use of lampricides, barriers, and trapping. Ongoing efforts monitor the status of various life stages of sea lamprey to better direct those control efforts. Lastly, research efforts are being pursued to assess potential new control methodologies.

Lampricide Control

- TFM lampricide treatments were successfully completed on three streams (Great Chazy River and Mount Hope Brook in New York and the Winooski River in Vermont) and one delta (Saranac River delta) during 2004 (Table 1).

- Several treatment delays were necessary on the Saranac River delta due to weather and the City of Plattsburgh's "Battle of Plattsburgh" reenactment.

- Toxicity tests were conducted on each of the streams prior to beginning TFM applications.

- Observations following the 2004 TFM and Bayluscide applications indicate they were largely effective at killing ammocoetes (larval stage sea lamprey), yet caused minimal

nontarget mortalities. However, there was mortality exceeding 50 individuals of four nontarget species on the Great Chazy River, requiring filing an adverse effects report with the USFWS.

- A list of past and projected future stream treatments is provided in Appendix 1.

Table 1: Summary of lampricide applications in tributaries and deltas of Lake Champlain during 2004.

Stream or delta	Date treated	Flow (CFS)	TFM (lbs active ingredient)	Miles treated	Bayluscide (lbs formulation)	Acres treated
Saranac River delta	Sept 14–18	-	-	-	1241.6	248
Great Chazy River	Sept 25-28	83.0	1268.8	14.5	-	-
Mount Hope Brook	Oct 12	8.3	79.3	1.5	-	-
Winooski River	Oct 20	630.0	4,560.0	11.0	-	-
		Totals:	5,908.1	27.0	1241.6	248

Toxicity Studies

- Lampricide toxicity testing, essential for obtaining necessary treatment permits, was completed on one-year-old mudpuppies in 2004.

- NYSDEC tested the mudpuppies at the Rome Laboratory and found them to be relatively sensitive to TFM, with significant mortality observed at or above the MLC (sea lamprey minimum lethal concentration).

- Permission to collect Eastern sand darters in potential donor rivers in NY to conduct a TFM/Niclosamide toxicity study was denied. This species, classified as Threatened by NY and VT, was tested previously with TFM alone and found to be very tolerant of TFM.

- High flows and scheduling difficulties forced the postponement of collections of other non-target species needed for testing with the TFM/Niclosamide combination.

Trapping and Barriers

- Traps were used to collect migratory-phase sea lamprey in nine streams during the spring of 2004 (Table 2).

- On eight of those streams trapping was implemented as the primary method of control. Trapping has been implemented as a control technique in small streams where trapping efficiency is thought to be high, and where suitable trapping sites exist downstream of spawning habitat.

- In the Great Chazy River, trapping is part of an integrated approach to controlling sea lamprey that includes lampricide treatments and a barrier with a trapping facility.

- Trapping was implemented for the first time in Beaver Brook in Westport, NY. Beaver Brook is a small tributary which is difficult to treat with lampricides. If trapping there proves to be effective at controlling larval sea lamprey populations, it would eliminate the need for conducting lampricide treatments in the future.

- Two traps were set in Stone Bridge Brook to determine the blocking efficiency of our trapping operations. The blocking efficiency of the lower trap was estimated to be 97.5%, based on the number of sea lamprey captured at the upper trap. The blocking effectiveness for the two traps in combination was estimated to be 99.9%.

- Larval assessment surveys are planned for 2005 in trapping streams to determine the effectiveness of traps at controlling larval populations of sea lamprey.

Table 2. Number of migratory-phase sea lamprey captured during 2004 in Lake Champlain tributaries where traps were deployed.

Stream	Number of migratory-phase sea lamprey captured
Great Chazy River	832
Beaver Brook	137
Trout Brook	192
Stone Bridge Brook	82
Malletts Creek	271
Indian Brook	0
Pond Brook	15
Sunderland Brook	15
Youngman Brook	0

Sea Lamprey Control in the Pike River System

The Pike River System in Quebec, including its major tributary, Morpion Stream, is one of the most important untreated sea lamprey producers in the Lake Champlain Basin. Surveys conducted in 1999 estimated a larval sea lamprey population of approximately 136,000. Surveys conducted in 2004 estimated the larval population of approximately 179,000. It is believed that the majority of sea lamprey reproduction in the Pike River system occurs in Morpion Stream. The Lake Champlain Fish and Wildlife Management Cooperative is pursuing the construction of a seasonal variable-crest weir in Morpion Stream to prevent migrating sea lamprey from reaching the spawning areas.

- In 2002 the U.S. Fish and Wildlife Service contacted the Quebec Ministry of the Environment to initiate the planning and permitting process.

- In 2003 the Cooperative secured funding through the Lake Champlain Basin Program and began technical evaluation of a low-head weir for Morpion Stream. This included the collection of field data for modeling of stream flows, design work, siting, and cost estimates.

- Surveys conducted in 2004 indicate that sea lamprey population levels in the Pike River and Morpion Stream continue to increase. Surveys also confirmed that migrating sea lamprey are able to bypass the dam on the Pike River in Notre-Dame-de-Stanbridge. Two sea lamprey ammocoetes were observed in the section of river between Notre-Dame-de-Stanbridge and the next dam in the town of Bedford.

- The Quebec Department of Wildlife and Parks is planning modifications to the dam in Notre-Dame-de-Stanbridge to incorporate fish passage. This may provide the Cooperative with an opportunity to address the sea lamprey passage issue.

- In 2004 the U.S. Fish and Wildlife Service completed the hydrologic modeling, siting analysis, two alternative weir designs, and cost estimates and is prepared to submit a final report to the Lake Champlain Basin Program for approval.

- This report will serve as the foundation for the submittal of necessary permits to the Quebec Ministry of the Environment.

- Current Plans are to fund the remainder of the project using Federal appropriations made to the Cooperative during 2004. This includes contracting a Quebec consultant to shepherd permits through the appropriate Canadian Federal and Provincial agencies and construction costs.

- It is hoped that construction can commence during the summer of 2006. Under this scenario, Morpion Stream will continue to produce parasitic phase sea lamprey through 2010, due to the sea lamprey life cycle.

Sea Lamprey Tagging Project

- NO UPDATE

Alternative Control: Alternatives Workgroup

The Final Supplemental Environmental Impact Statement for long-term sea lamprey control recommends "deferment of lampricide treatment of the Poultney River for five years after [program] initiation to fully assess potential alternatives to lampricides and the effects of the proposed sea lamprey control program on wounding rates." This provides an opportunity to investigate potential alternative control techniques, while currently feasible control activities are implemented elsewhere in the Champlain Basin. An "Alternatives Workgroup" was formed to evaluate sea lamprey control methodologies that do not involve the use of lampricides. The workgroup consists of 30 members from 16 governmental and non-governmental organizations, including representatives from: the U.S. Fish and Wildlife Service; the Vermont Department of Fish and Wildlife; the New York State Department of Environmental Conservation; the Lake Champlain Walleye Association; the Vermont BASS Federation; charter captains; the Lake Champlain Committee; and The Nature Conservancy. The USFWS, as chair of the Alternatives Workgroup for the Cooperative, is chartering the Workgroup as a Federal advisory committee under the Federal Advisory Committee Act (FACA). Chartering the Workgroup under FACA provides an opportunity for stakeholders to give policy and technical advice to the Cooperative about sea lamprey control techniques that may provide useful alternatives to lampricides. Following our June 2003 meeting, meetings were postponed until the Workgroup was formally chartered under FACA. The USFWS expects to charter the workgroup through the Department of Interior in early 2005.

- Members of the Workgroup helped leverage over $200,000 of funding for a variety of alternatives-related projects. Grants for alternative control research includes: a total of $62,000 from the Lake Champlain Basin Program, $46,000 from The Nature Conservancy, $84,000 from Lake Champlain Sea Grant, $10,000 from the Lake Champlain Ecosystem Team, and $57,000 from USFWS and Biological Resources Division Science Support Partnership Program.

- A sea lamprey life-history model to incorporate all life stages of the sea lamprey life cycle is being developed by Dr. Ellen Marsden and graduate student, Eric Howe, at the University of Vermont. Impacts of various management options (i.e., lampricide, angler impact, nest dismantling, and adult trapping) can be incorporated into the model to estimate the relative effect each respective management tool may have on the overall growth rate of the population.

- Validation of micro-elemental analysis of statoliths as a tool for tracking stream origins of sea lamprey builds on ongoing research being conducted by Dr. Ellen Marsden and colleagues in which sea lamprey are being tagged as transformers and recaptured as

parasites in Lake Champlain. Once the micro-chemistry of sea lamprey statoliths (lamprey ear bones) is worked out, it is hoped that the method can be used to identify stream of origin of parasites. This method has great potential to reduce the use of lampricides by identifying the streams or deltas that are the major contributors to the parasitic population. In this way, managers will be able to focus control efforts on those streams that have the greatest impact on fish populations, while reducing or even eliminating control activities on others.

- A radio-telemetry project was funded by The Nature Conservancy and is being conducted by Dr. Donna Parrish from the Vermont Cooperative Fish and Wildlife Research Unit and graduate student David Hitchcock. This project will assess whether an engineered sea lamprey trap may be feasible in the Poultney River as part of a control strategy for this river. Effective sea lamprey trapping on the Poultney River would require that sea lamprey migrate to Carvers Falls before falling back to their primary spawning area just downstream from the falls.

- As identified above, the sea lamprey life history model is currently under development by researchers at UVM that will allow managers to estimate the impacts of control options targeted at different life stages of sea lamprey. Survival rates estimated for various life stages can significantly impact the model output. An important gap in our knowledge of sea lamprey life history is the survival rates of eggs incubated within the nests constructed by lamprey and the survival rates of eggs that are swept from the nest during spawning. The Nature Conservancy provided funding to Dr. Ellen Marsden and research assistant Steve Smith to begin assessing egg survival in 2004. The Lake Champlain Basin Program provided second-year funding ($29,500) for 2005 work activities.

- Dr. Donna Parrish and graduate student David Hitchcock with the assistance of Dr. Brad Young and Wayne Bouffard investigated the effectiveness of “sex pheromone” attractants to attract spawning-phase female lamprey into traps. Sex pheromone is a bile acid secreted by spermiating male sea lamprey to attract a mate. The researchers hope to demonstrate that trapping efficiency can be improved through the use of pheromone-baited traps.

- Wayne Laroche, currently Commissioner of the Vermont Fish and Wildlife Department, Craig Martin, and retired Middlebury professor, Dr. Pete Wimmer, finalized a Lake Champlain Basin Program report titled: “Exploratory study of dismantling sea lamprey nests to reduce egg and larvae production in two Lake Champlain Basin tributaries.” The study provided parameter estimates for the sea lamprey life-history model for management actions targeting sea lamprey egg and larval survival. It was recommended that population sensitivity and elasticity analyses be conducted with the life-history model to determine what effect, if any, nest raking might have on population growth of sea lamprey. Additional experimental application of nest dismantlement within the Basin should be based upon the modeling results and 1) whether eggs deposited outside of lamprey nests survive and contribute to parasitic production, 2) its integration into a suite

of alternative control methods targeting multiple life stages, 3) its application in small to mid-sized streams where nests can be found and their numbers managed, and 4) where stream-specific evaluations suggest minimal non-target impacts.

Sea Lamprey Assessment

Sea lamprey assessment activities include monitoring several stages of the sea lamprey life cycle. Abundances of the larval (ammocoete) and transformer stages are estimated using quantitative assessment sampling (QAS) techniques in wadeable stream sections, and deepwater electrofishing surveys in delta areas. The data from those two techniques help the Committee prioritize lamprey treatments on streams and deltas. Lastly, monitoring sea lamprey attack rates on salmonids and walleye yields an indication of impacts of the parasitic stage (attack rates are discussed elsewhere in this document).

Sea Lamprey Assessment - ammocoetes and transformers in tributaries

- QAS surveys were conducted on three tributaries during the summer of 2004. The Pike River and Morpion Stream were surveyed to determine the status of sea lamprey populations and provide information regarding the potential impacts a barrier would have on the Pike River system's sea lamprey population (Table 5).

- During surveys on the Pike River, sea lamprey ammocoetes were discovered above the dam in the town of Notre-Dame-de-Stanbridge.

- A QAS survey was also conducted on the Winooski River to fulfill a requirement of the Vermont Aquatic Nuisance Species Control permit issued for the 2004 lampricide treatment. Due to high water conditions during the survey, access to appropriate sea lamprey habitat was not possible. Therefore, the accuracy of the estimates of the sea lamprey and American brook lamprey populations were compromised. The under-estimation of the larval and transformer populations was evidenced by the mortality surveys conducted following the lampricide treatment of the Winooski River.

- Index surveys were conducted on Lewis Creek to fulfill a requirement for the Vermont Aquatic Nuisance Species Control permit issued prior to the 2002 lampricide treatment.

- Presence/absence surveys were conducted in 26 New York tributaries to Lake Champlain. Most of these streams had not been surveyed for over 10 years. Sea lamprey ammocoetes were found in two streams; Silver Stream, which flows into the lake near Snug Harbor and Corbeau Creek a tributary of the lower Great Chazy River.

Table 5. Summary of larval sea lamprey surveys conducted on Lake Champlain tributaries

during 2004.

Tributary and reach	Year last assessed	Estimated 2004 larval population	Estimated Transformer Production 2004
Pike River Reach 2	2000	38,951	708
Morpion Stream	2000	139,809	2,772
Winooski River Reach 5	2002	2,378	0

Sea Lamprey Assessment - ammocoetes and transformers on deltas

- Deepwater electrofishing surveys for sea lamprey larvae were completed on the Boquet and Saranac River Deltas. Surveys indicated the main larval sea lamprey concentration off the Boquet River mouth was largely eliminated by the previous fall's river treatment with TFM, thus eliminating the need for a Bayluscide treatment. Saranac River Delta sampling was conducted to further delineate the extent of sea lamprey distributions. The resulting distribution area was mapped using Geographical Information System (GIS) and Global Positioning System (GPS) equipment. Sea lamprey were found beyond the potential treatment area identified in the original permit application, and a permit modification was obtained to allow for the expanded treatment zone.

Forage Fish Assessment

Rainbow smelt are the primary food for walleye and salmonids, and also comprise an important winter sport fishery in Lake Champlain. Predation on rainbow smelt is likely to increase as sea lamprey control yields increased survival of salmonids. Therefore, a program was initiated in 1990 to monitor rainbow smelt stocks annually in several areas of the lake.

During the March 2004 meeting of the Lake Champlain Fisheries Technical Committee on forage fish, improvements to the forage fish assessment program were discussed. Modifications to the sampling design focused on the need to measure young-of-year smelt abundance and reducing the sampling variability through the use of new hydroacoustic techniques. From these discussion and recent research by Vermont Cooperative Fish and Wildlife Research Unit and Cornell University a new sampling design has been proposed but it needs to be evaluated and implemented.

The new sampling design focuses on increased use of hydroacoustics and reduced effort in trawling. Hydroacoustics uses sonar (sound waves) to estimate the numbers of fish in a given area that are then verified for identification by limited collections (i.e. trawling). The use of acoustics in forage fish assessment has been extensively studied and has become an accepted monitoring method in the Great Lakes.

- A total of 16 midwater trawls were taken between August 2 and August 9, 2004. Two stations are sampled in the main lake portion of Lake Champlain; one in the Northeast Arm (Inland Sea); and one in the outer Malletts Bay.

- Calculated mean catch-per-unit-efforts (CPUE; number of smelt captured per 55 minute trawl) in 2004 were substantially lower at all stations. The greatest decline in catch occurred in the Northeast Arm where the number of smelt per trawl declined 53 percent. However, the low catch numbers are similar to other low-catch years. Figures 2-3 compare CPUE over time at the four stations.

Figure 2. Mean catch-per-unit-effort (CPUE) for the main lake stations Barber Point and Juniper Island, 1990 – 2004.

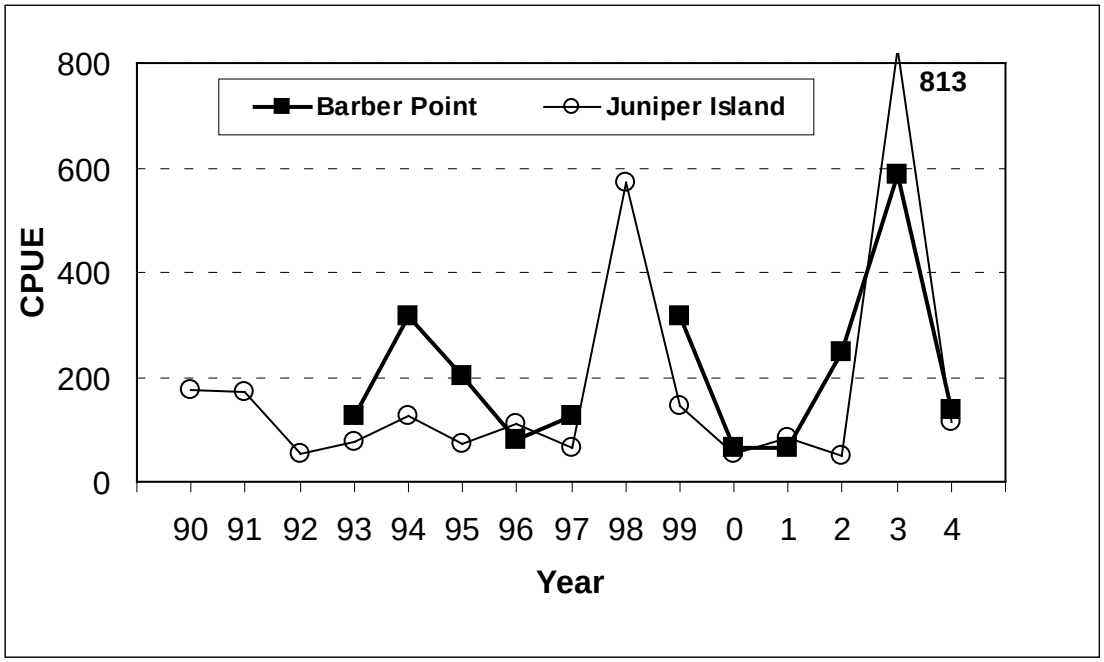
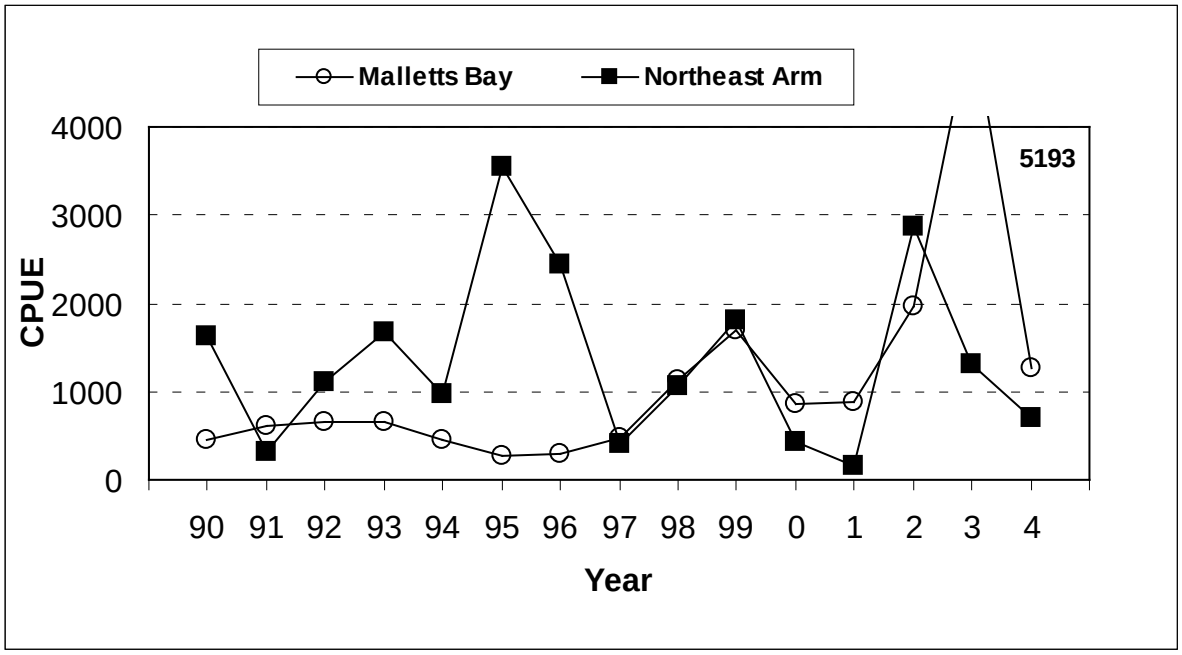


Figure 3. Mean catch-per-unit-effort (CPUE) for the Malletts Bay station and the Northeast Arm (Inland Sea), 1990 – 2004.



- This was the first year that we attempted to increase hydroacoustic sampling. Before sampling could occur we had to borrow some needed equipment. We are extremely grateful to the following organizations for allowing us to borrow the needed items: Cornell University, acoustic system; University of Vermont, tucker trawl; Vermont Cooperative Fish and Wildlife Research Unit, temperature profiler.

- A total of 21 acoustic transects (48 nautical miles), 5 tucker trawls and 5 targeted mid water trawls were completed in 2004. Sampling occurred in Malletts Bay, Inland Sea and Southern Main Lake. Additional sampling was proposed in the Main Lake but none was completed because of weather and equipment issues. The data have yet to be processed. We have made progress in acquiring our own sampling equipment. Consequently we will have more flexibility to deal with weather-caused scheduling changes.

Salmonid Management

Salmonid management activities include stocking of landlocked salmon, lake trout, steelhead, and brown trout. On certain rivers, fish passage is being developed at dams to facilitate spawning migrations of migratory species. A variety of sampling procedures are conducted to monitor the status of the salmonid populations, including evaluations of potential natural reproduction.

Salmonid Stocking Summary

- Salmonid stockings in Lake Champlain during 2004 included about: 268,000 landlocked Atlantic salmon (smolt equivalents); 86,000 lake trout; 81,000 steelhead (smolt equivalents); and 68,000 brown trout (Table 7). The list includes landlocked Atlantic salmon and steelhead that were stocked in the tributaries to the lake. Also listed in Table 7 are the stocking targets for each species. The stocking numbers are presented as "stocking equivalents." Salmonids are stocked at widely 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 equivalents to better represent the effective numbers stocked.

Table 7. Numbers (in stocking equivalents [a]) of salmonids stocked in Lake Champlain during 2004, and stocking targets for the lake.

Species	Main Lake		Malletts Bay/Inland Sea		Total number stocked in 2004
	Target	2004 stocking	Target	2004 stocking	
Landlocked salmon	207,000	220,164	60,000	48,189	268,353
Lake trout	82,000	85,700	0	0	85,700
Steelhead	73,000	70,978	12,000	9,810	80,788
Brown trout	38,000	47,804	40,000	20,004	67,808
Total	400,000	426,650	112,000	80,007	504,653

[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.

Salmon Fry Stocking Evaluations

- Landlocked salmon fry were stocked in several tributaries to Lake Champlain during 2004. Subsequent electrofishing surveys assessed survival rates in the Lamoille and

Winooski Watersheds.

- The lower Winooski River, including the Huntington River and Mill Brook was planted with approximately 150,750 fry in 2004. At the time of stocking, fry mean length ranged from 28 to 50 mm total length. The larger fry were planted in the main stem of the Winooski River in an effort to increase survival. The Browns River, a tributary of the Lamoille River was stocked with 27,000 fry.

- Survival estimates of fry through their first summer were highest in Mill Brook and the Huntington River at 41 and 54 percent, respectively. Survival estimates on the Browns River were lower at two stations sampled (7 and 22%). Mean lengths of 0+ and 1+ parr ranged from 84 – 92 mm and 140 – 163 mm, respectively.

- The first attempt at capturing salmon smolts planted as fry out-migrating to Lake Champlain was attempted by utilizing a rotary screw fish trap. This trap was borrowed from the U.S. Forest Service's Green Mountain National Forest Region and fished from early May into June as a pilot study to determine the feasibility of utilizing this technique in the Huntington River. The rotary screw trap was deployed on May 6, 2004 and fished for 25 days until June 4. A total of 57 salmon parr were captured. Analysis of scale samples determined that all but one smolt were 2-years old with a mean length of 141 mm (sd = 1.4). These fish would have originated from the 2002 stocking of 27,500 fry in the Huntington. The other salmon was 207 mm and 3-years old. The trap performed well and will be deployed again in 2005.

- A landlocked salmon parr tagging project was initiated this year in the Winooski River watershed in an attempt to evaluate the success of fry stocking. The 63-161mm (2.5 – 6.3 inch) parr are being tagged in the nose with magnetized wire tags that can be detected by means of a portable sampling detector. The parr will eventually out-migrate to Lake Champlain, mature and return to the Winooski River. These adult salmon must be lifted at the Winooski Dam fish passage facility to complete their journey. At the lift, the salmon will be checked for the presence of the tag. This project will provide information about the effectiveness of stocking fry and its contribution to the number of adults returning.

Sea Lamprey Attack Rates on Salmonids

- Wounding rates on lake trout and salmon were high during 2004. Table 8 shows that for the size classes selected for monitoring, 2004 wounding rates were much higher than the wounding objectives. Lake trout wounding rates were even higher than prior to the experimental control program.

Table 8. Wounding rates on Lake Champlain lake trout and salmon sampled in the main lake during 2004.

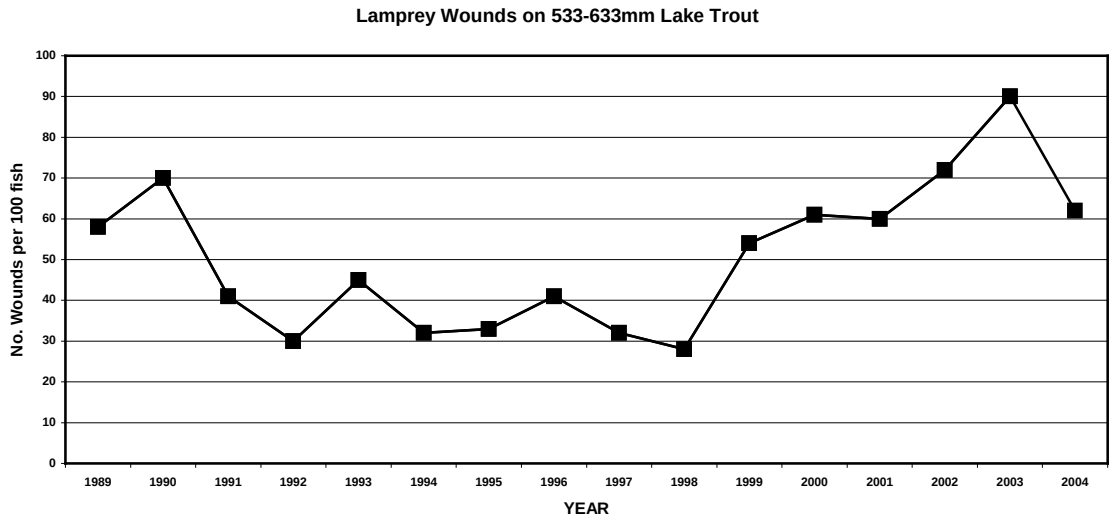
Species	Number of lamprey wounds per 100 fish			
	Objective	Pre-control	Eight-year control	2004
Lake trout[a]	25	55	38	62
Landlocked salmon[b]	15	51	22	45

[a] Lake trout in the 533-633 mm (21.0-24.9 inches) length interval.
For lake trout, pre-control included 1982 - 92, while eight-year 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 eight-year control includes 1993 - 98.

- Annual wounding rates for lake trout from 1989 through 2004 show a substantial reduction in wounding during the experimental control program, a rebound from 1999 through 2003, and a drop in 2004 (Figure 4).

Figure 4. Sea lamprey wounds (fresh and healing) per 100 lake trout, 533-633 millimeters total length, sampled in the main lake by electrofishing, 1989-2004.



- A similar pattern of high wounding rates occurred for three size classes of salmon returning to the Willsboro Fishway, Lamoille River, Sandbar Causeway, Winooski River

Fish Lift and Hatchery Brook (Table 9). Wounding rates for the intermediate size class in 2004 are roughly as high as wounding rates for the period before control began.

Table 9. Sea lamprey wounding rates by size group for adult landlocked Atlantic salmon captured at various locations during various phases of sea lamprey control. There is a time lag of 1-2 years before treatments conducted for the long-term control program could have influenced wounding rates.

	PRE-CONTROL (1985 –1992)		EXPERIMENTAL CONTROL (1993 – 1998)		INTERIM CONTROL (1999 – 2002)		2004	
LOCATION/ SIZE GROUP (mm)	N	Wounds per 100 salmon	N	Wounds per 100 salmon	N	Wounds per 100 salmon	N	Wounds per 100 salmon
Willsboro Fishway								
432-533	43	51	101	22	34	65	0	-
534-634	80	73	157	44	46	80	6	67
635-736	32	156	30	40	12	12	6	50
Lamoille River								
432-533	200	32	335	43	81	56	ND	ND
534-634	116	83	237	58	26	69	ND	ND
635-736	31	77	44	82	6	33	ND	ND
Sandbar Causeway								
432-533	191	42	241	37	50	60	ND	ND
534-634	114	59	156	69	18	89	ND	ND
635-736	47	104	29	84	3	67	ND	ND
Winooski River Fish Lift								
432-533	n/a	-	160	21	31	64	ND	ND
534-634	n/a	-	165	28	46	63	ND	ND
635-736	n/a	-	18	61	9	278	ND	ND
Hatchery Brook								
432-533	n/a	-	196	33	416	35	ND	ND

534-634	n/a	-	100	45	254	68	ND	ND
635-736	n/a	-	20	85	34	65	ND	ND

The major lamprey producing tributaries (excluding delta areas) in New York were treated during the interim control period, yet wounding rates increased to pre-control levels. Density compensatory mechanisms, and/or increased lamprey production from deltas or other locations are likely explanations for that trend. Regardless of the cause, the trend demonstrates that control must be expanded substantially from just the New York tributaries to achieve the desired benefits to the salmonid resources.

Fish Passage

Winooski River Fish Lift

The Winooski One hydroelectric station in Winooski, Vermont, is the first upstream barrier on the Winooski River. More than 33 kilometers of suitable salmonid habitat exist upstream of the dam. The Winooski One fish "trap and truck" project has allowed fisheries managers the opportunity to restore wild migratory salmonid populations and fisheries in the lower Winooski River that have been restricted by barriers built on the river. The goals of the project are: To create quality stream fisheries for lake-run steelhead rainbow trout and landlocked Atlantic salmon in the Winooski River; and to encourage natural reproduction of Lake Champlain landlocked Atlantic salmon and steelhead rainbow trout in the Winooski River watershed.

- The fish lift operated from March 15 thru May 15 and from September 15 thru November 12, 2004. Only 3 steelhead were lifted in the spring and 10 salmon and 1 steelhead were recorded in the fall (Table 10). Of the salmon processed in the fall, four were male and four female. All but one salmon aged had spent one year in the lake. The remaining salmon (a female) was a two lake-year salmon. Mean lengths of one lake-year salmon were 548 (sd = 50) and 545 (sd=17) millimeters for male and female salmon, respectively. The 2-year-old female salmon mean length was 665 mm.

Table 10. Summary of landlocked Atlantic salmon and rainbow steelhead trout lifted at the Winooski One fish passage facility, 1993-2004.

Year	SPRING		FALL	
	Salmon	Steelhead	Salmon	Steelhead
1993	NA	0	36	7

1994	179	0	32	15
1995	38	0	12	9
1996	45	0	45	3
1997	8	0	115	24
1998	23	0	85	80
1999	54	0	53	13
2000	22	0	29	3
2001	7	0	6	0
2002	5	1	21	3
2003	4	2	14	3
2004	0	3	10	1

Willsboro Fishway

The Willsboro Fishway is located on the Boquet River in the Town of Willsboro, Essex County, New York. The fishway provides fish passage upstream, over the most downstream dam on the Boquet River.

- Twelve adult salmon and one rainbow trout were collected in the Willsboro Fishway during 2004.

Imperial Mill Dam fish passage

The Imperial Mill dam is located on the Saranac River in the City of Plattsburgh, Clinton County, New York. The dam is located approximately 5.3 km from the river mouth, and is the first upstream barrier to fish passage on the Saranac River. Efforts continued to develop fish passage at the Imperial Mill Dam.

- Dam safety deficiencies were identified and must be corrected prior to, or concurrent with, installation of fish passage. Lowering the elevation of the dam crest would be the least expensive option for correcting the deficiencies.

- A sediment survey of the Imperial Mill Dam reservoir was conducted in 2004. The sediment study will help predict potential impacts from lowering the crest elevation or dam removal.

- Conceptual agreement was reached with the former owner of the dam to lower the crest. However, the mill and dam were sold in 2003 and the mill was converted into an

industrial park with multiple tenants. The new owner has expressed an interest in maintaining the present crest elevation to generate hydropower to supply the industrial park tenants with electricity. Discussions were initiated, and will continue, with the new owner to reach a mutually agreeable solution to the dam's deficiencies and potential fish passage.

Spring and Fall Salmonid Assessments

Spring and fall boat electrofishing surveys for salmonids are conducted annually in addition to the sampling discussed above on the Boquet and Winooski fish passage facilities. 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.

- NO UPDATE ON NON-LAKE TROUT

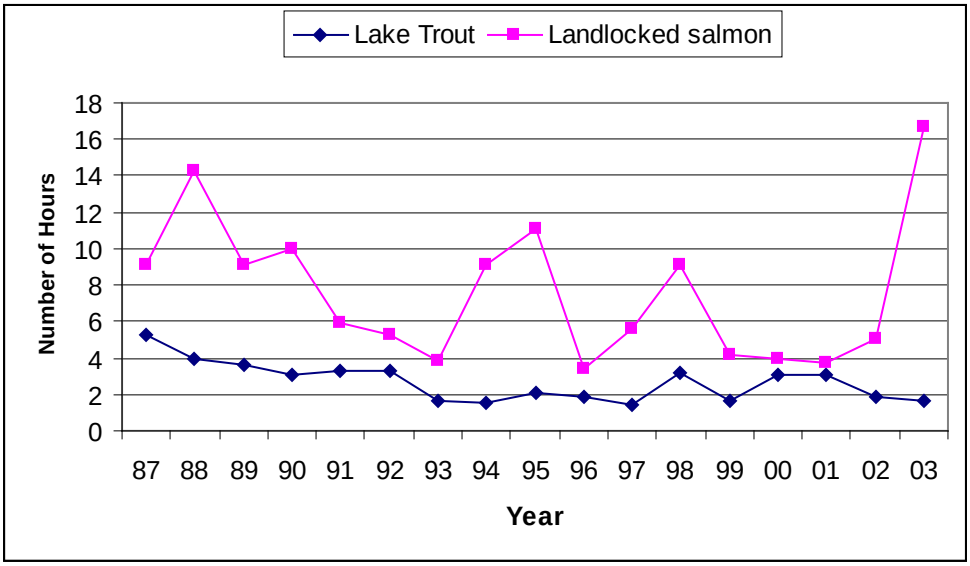
- A total of 117 lake trout collected by Vermont and New York electrofishing were within the slot size (432-533 mm) selected for evaluation of lamprey wounding rates.

Lake Champlain Salmonid Angler Diary Program

- During the 2003 open-water fishing season, 34 cooperators recorded information from 448 fishing trips.

- For lake fishermen, the catch rate for lake trout anglers was 0.59 legal-sized lake trout per hour, and 0.06 legal-sized landlocked salmon per hour for landlocked salmon anglers (Figure 6).

Figure 6. Main lake catch rates (hours of fishing per fish) for legal-sized lake trout and landlocked salmon, 1987 - 2003.

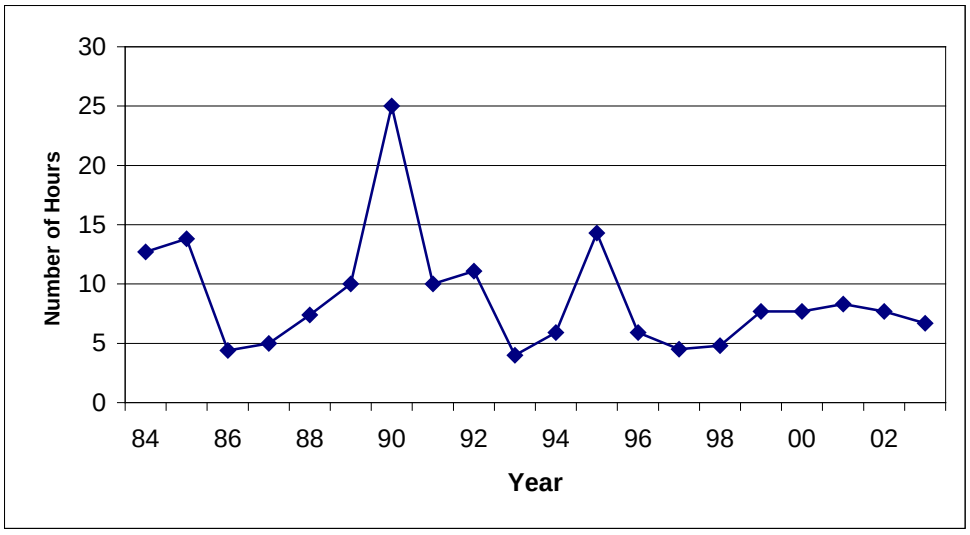


- Catch rates for legal-sized lake trout (≥ 15") improved slightly in 2003, however, catch rates for landlocked salmon decreased substantially from 2002.

- Cooperators reported only three lake-caught brown trout and four steelhead, and no lake trips targeting these two species were made during 2003.

- In contrast to lake fishing for landlocked salmon, tributary fishing improved slightly in 2003 from 2002 (Figure 7). In 2003 it took slightly under 7 hours to catch a legal-sized landlocked salmon. Cooperators reported catching 97 landlocked salmon, the vast majority of which were legal-sized (≥ 15").

Figure 7. Tributary catch rates (hours of fishing per fish) for legal-sized landlocked salmon for the years 1984 through 2003. These include trips where salmon alone or in combination with another salmonid were listed as the angler's target.



- Cooperators also reported catching 3 brown trout and 34 steelhead during fishing trips on tributaries.

Lake Champlain Landlocked Atlantic Salmon Strain Evaluation

The Cooperative initiated a landlocked Atlantic salmon strain evaluation in 2002. The study will assess the relative performance of Sebago, Memphremagog, and Little Clear (Adirondack) strain salmon. The Memphremagog, and Little Clear strains are both primarily West Grand Lake progeny and have a long stocking history in Lake Champlain. Sebago strain salmon have been stocked in Lake Champlain in recent years, and monitoring at the Ed Weed Fish Culture Station discharge stream indicates favorable returns from those stockings. In their native lakes, West Grand Lake salmon tend to utilize the outlet for spawning, while Sebago Lake salmon orientate to the inlet. Limited evidence indicates some salmon have out-migrated from Lake Champlain to the St Lawrence River. Such behavioral differences, or other differences between strains, could result in one strain yielding better returns in Lake Champlain than the others. Expectations are to raise 15,000 yearlings of each strain for each year of the study. Prior to stocking, each strain will receive a different mark for future identification. Initial stockings occurred in spring 2003 with evaluations beginning that fall using river mouth and stream electrofishing techniques. Relative returns to the sample, sea lamprey wounding, and biological data will be collected for strain comparisons. The strain stockings will occur for at least three brood years and their performance will be evaluated through 2007.

- NO UPDATE

Walleye, Sturgeon, Alewives, Cormorants, and Mudpuppies

Walleye Spawning Run Assessments

- Walleye spawning runs were monitored in 2 tributaries of Lake Champlain during the spring of 2004 (Table 11). Adult populations are sampled to determine lamprey wounding rates, collect eggs for the fish culture program and to provide population indices (e.g. length distribution, age structure, etc.). Wounding rates are summarized in Table 11.

Table 11. Numbers of walleye sampled, and sea lamprey wounding rates for walleye collected in four tributaries to Lake Champlain, 2004.

River	Total Walleye Sampled [a]	Total in 534-634 Length class	Fresh Wounds	Healing Wounds	Wounds per 100 walleye
Missisquoi	282	ND	ND	ND	ND
Winooski	1007	ND	ND	ND	ND

[a] Not including same-year recaptures.

South Bay Walleye/Sauger Sampling

- In early April trap netting was undertaken in South Bay to collect walleye eggs for the Lake Champlain Walleye Association and to assess the walleye and sauger populations. A total of 24 overnight Oneida trap net sets yielded catches of 26 fish species. A total of 149 walleye were sampled but no sauger were captured. Walleye eggs were provided to the Lake Champlain Walleye Association for rearing to the fry stage.

- The netting failed to capture a single sauger, and walleye numbers were low compared to similar trap netting conducted during the 1980s. The reasons for the decline in the catch of these two species are unknown, but recent South Bay surveys have produced high numbers of white perch and white crappie. Enquiries to Lake Champlain biologists and anglers also suggest sauger catches have been dwindling. Further investigations might explain whether the increase of non-native white perch and white crappie could be factors in the apparent decline of walleye and sauger.

Walleye Stocking

Recent stocking efforts began in 1986 in cooperation with the Lake Champlain Walleye Association. Eggs were collected from the spawning run in South Bay, NY, reared at the Essex County Hatchery in Crown Point, NY and stocked in the South Lake. In 1988, the Salisbury Fish Culture facility in Salisbury, VT began rearing eggs collected from the Poultney River. In 1991, walleye fish culture efforts were moved to the Bald Hill Fish Culture Station in Newark, VT. Annual stocking ranged from 1 to 4 million fry and 12.5 to 70 thousand fingerlings prior to the completion of the Lake Champlain Walleye Restoration Plan adopted by the Vermont Department of Fish & Wildlife in 1999. The restoration plan objective is to collect 12 million eggs and produce 8 million fry for Lake Champlain, annually. Since 1999, 9 to 12.5 million eggs have been collected annually resulting in 6.1 to 8.3 million fry and 45 to 95 thousand fingerlings being stocked into Lake Champlain each year.

- In 2004, 8.2 million Winooski strain fry were stocked into the Winooski River and adjoining lake areas, 450,000 Missisquoi strain fry hatched at the LCWA portable hatchery in Swanton were stocked into Missisquoi Bay, and 780,000 fry hatched at the LCWA portable hatchery in Whitehall were released into South Bay.

Walleye Stocking Evaluation

A priority need identified in the Walleye Restoration Plan was to evaluate the contribution of stocked fry and fingerlings to the Lake Champlain walleye population. Experimentation with OTC marking techniques began in 1998. The OTC technique involves exposing fry or fingerlings to oxytetracycline prior to stocking. The exposure leaves a permanent mark in bony tissue that fluoresces under ultraviolet light and allows identification of stocked walleye years after stocking. OTC techniques were developed by 2000 that allowed the mass marking of all fry and fingerlings stocked into Lake Champlain.

- In 2004, a sample of 18 young walleye was collected from the Missisquoi River. Thirty-nine percent of these fish had been marked with OTC. Fish stocked as fry (17%) and fingerlings (27%) were collected.

Sturgeon

Lake Champlain once supported a small commercial fishery for lake sturgeon that harvested from 50 to 200 fish annually in the late 1800's and early 1900's. Annual harvest declined rapidly in the late 1940's, and the fishery was closed in 1967. Lake sturgeon are currently listed as endangered by the state of Vermont. In 1994, a study of the feasibility of restoring lake sturgeon to Lake Champlain concluded that suitable sturgeon habitat still exists in Lake Champlain but that the likelihood of achieving restoration through the natural reproduction of existing sturgeon populations was small. After reviewing the study, biologists from the Vermont Department of Fish & Wildlife, USFWS, and the Cooperative Fish & Wildlife Research Unit at the University of Vermont recommended that a survey of the existing adult

population be conducted before deciding whether or not sturgeon needed to be stocked from other lakes into Lake Champlain. Sampling would focus in tributaries near historic spawning locations to determine if adult sturgeon were still present and their relative abundance. The Missisquoi, Lamoille, and Winooski Rivers, and Otter Creek are the four tributaries where sturgeon spawning activity had been noted in the past.

Gillnets were used to sample for adult sturgeon during the spawning runs in the Lamoille and Winooski rivers from 1998 thru 2002. Three to eleven individual sturgeon were captured each year. The total number of individual sturgeon captured and tagged during the 5 years of gillnetting is 15 in the Winooski and 9 in the Lamoille. Several sturgeon have been captured in more than one year and more than once in a year. Two adult sturgeon were captured in 2003. These fish were caught while electrofishing for walleye in the Winooski River.

In addition to the sturgeon captured in the Lamoille and Winooski rivers, a large dead sturgeon was found in Otter Creek in June, 2000. Sampling with gillnets by the USFWS near spawning sites on the Missisquoi River in 2001 and 2003 was unsuccessful.

Sturgeon ranged in size from 965 to 1,854 mm (38 to 73 inches), weighing from 11 to 72 pounds. All captured sturgeon were identified as males with the exception of two small sturgeon that could not be sexed. One young sturgeon (7 inches or 170 mm TL) was caught in the Winooski River during August, 2001. Lake sturgeon were weighed, tagged with PIT tags (small metal tags placed under the skin, just behind the skull) and measured for fork and total length. A small section of the first pectoral spine was removed from the left pectoral fin for aging and tissue samples were collected and archived for future genetic analysis.

In 2004, biologists expanded their search for sturgeon eggs to all four rivers where sturgeon spawning was historically documented. Vermont Department of Fish & Wildlife staff sampled the Lamoille and Winooski rivers and Otter Creek. USFWS staff sampled the Missisquoi River.

- Thirty-six egg mats were placed in the Winooski River on May 6, 2004. Twelve mats were set in Otter Creek on May 7, and 21 mats were set in the Lamoille River on May 11. The number of mats set in each river varied due to flow conditions.

- Mats were removed from the Winooski River on June 8. An adult sturgeon was seen on the spawning grounds in shallow water on May 17. Sturgeon eggs were collected on June 1 (n = 183) and June 3 (n = 3).

- Egg mats were removed from Otter Creek on June 4. One sturgeon prolarvae was collected on May 28.

- Egg mats were removed from the Lamoille River on June 8. No sturgeon eggs were collected.

- Twenty-six sturgeon eggs were collected in the Missisquoi River by the USFWS on May 27.

- Four drift nets were set in the Winooski River on June 14 to sample for larval lake sturgeon drifting from the spawning areas. The driftnets had 1 meter diameter openings and were 3 meter long constructed with 1/16" knotless nylon netting. In four nights of netting, a total of 80 sturgeon larvae were collected.

Alewives

Alewives are not native to the Lake Champlain Basin. Their potential establishment in Lake Champlain could have serious ecological impacts. Alewives were discovered in Lake St. Catherine, Vermont (a tributary to Lake Champlain) in July 1997. It is thought that the Lake St. Catherine population was established through a purposeful, illegal stocking. The existence of alewives in Lake St. Catherine is of great concern because of their potential to spread to, and impact, Lake Champlain and other area lakes. Alewives may spread unassisted to Lake Champlain via Lake St. Catherine's outlet that flows to the Mettawee River, and eventually into the southern end of Lake Champlain. To date, larval alewives have been collected immediately below the Lake St. Catherine dam in Mill Brook, but not further downstream.

As a result of the threat from alewives, various alternatives to manage alewives in Lake St. Catherine were investigated: 1) Public Education & Outreach, 2) Population Reduction, 3) Containment, and 4) Eradication/Reclamation. While drawbacks are present in all alternatives, some are more problematic than others and reduce the viability of those alternatives.

Unfortunately, there is no straightforward answer to the current alewife problem. It is very rare when an invasive exotic species can be eradicated. More often than not, managers must find ways to cope with the invasive species. Alewives could be re-introduced illegally to Lake St. Catherine or any other lake in Vermont in the future. In addition, it is quite possible that alewives may eventually migrate to Lake Champlain via the Hudson River and Champlain Barge Canal, as have blueback herring, gizzard shad, and a host of other recent Lake Champlain fish invaders.

Through the selection of Alternative #1, Public Education and Outreach, the Vermont Department of Fish & Wildlife will continue their efforts to prevent the further movement of alewives through increased public education, and the adoption of pertinent regulations. The Vermont Department of Fish & Wildlife will also continue to search for new alternatives to control or eradicate alewives.

- In late 2003, the Fisheries Technical Committee recommended revisiting the chemical treatment alternative and that a tour of Lake St. Catherine by reclamation experts be arranged. In 2004 Robert Spateholts was contracted to make a site visit and prepare a report on the technical feasibility of alewife eradication in Lake St. Catherine. Mr.

Spateholts, who has extensive reclamation experience, concluded that eradication of alewives from Lake St. Catherine with rotenone could be technically accomplished with a high probability of success.

- In July 2004 during routine bottom trawling, VTDFW staff collected a single alewife from the La Motte Passage area of Lake Champlain. Additional targeted sampling in the area failed to capture additional alewives.

- Sampling plans to check for alewife presence in Lake Champlain during 2005 were prepared by USFWS and VTDFW staff.

Cormorant Research

- NO UPDATE

Mudpuppy Surveys

Potential impacts of lampricide treatments on mudpuppies have been raised as a concern, particularly in the Vermont tributaries to Lake Champlain. Therefore, substantial efforts have been directed to better understand the distribution and status of mudpuppies in the tributaries of the lake. The mudpuppy is a type of salamander that breathes via gills throughout its life cycle. Mudpuppies are relatively sensitive to TFM, but otherwise are very difficult to sample. Therefore, much of what is known about mudpuppy distributions has resulted from the TFM treatments themselves. Where we have treated with TFM we have a good idea of whether mudpuppies are present. Where we have not treated, we know very little about their abundances.

In April 2002, the U.S. Fish and Wildlife Service, in partnership with Vermont Department of Fish and Wildlife, developed a work plan to sample mudpuppy (*Necturus maculosus*) in tributaries of Lake Champlain. The focus of the plan was to develop a reliable method to monitor mudpuppy communities. Sampling prior to 2004 was conducted at several locations resulting in only 4 mudpuppy captured in 2003 and one in 2002.

- In 2004 sampling for mudpuppies primarily focused on the Winooski River because of the scheduled fall sea lamprey control treatment. Cylindrical minnow traps made of the standard metal mesh material were used but had been modified by enlarging the diameter of the entrance holes. Frozen and live spottail shiners, *Notropis hudsonius* were used as bait.

- In addition to the trapping efforts, mudpuppies were searched for by snorkeling in the Winooski River in the area of the Salmon Hole that is located below the first dam. Snorkeling was conducted at night. Mudpuppies were also searched for by flipping stones while wading in the Lamoille River.

- Trapping: A total trapping effort of 3,700 trap-hours have been expended in 2004 in an attempt to capture mudpuppy. Fifty-eight percent of the effort (2,164 hours) was spent in the Winooski River. Four locations in the Northfield/Berlin, Vermont area were also trapped including the inlet of Berlin Pond and in the Dog River. No mudpuppies were trapped in 2004. Nontarget catch included rock bass (7 captured), tessellated darter (4), logperch (4), yellow perch (3), Stickleback (1) and crayfish (58).

- Snorkeling: Twelve people participated in four hours of snorkeling on the night of August 12, 2004 in the Winooski River. No mudpuppies were observed.

- An additional 6 man-hours were expended flipping stones in search of mudpuppies in the Lamoille River near Fairfax, VT with none found.

Champlain Canal Barrier

Researchers from the University of Vermont, Plattsburgh State University, Lake Champlain Sea Grant, Vermont Department of Environmental Conservation and the Lake Champlain Basin Program initiated a cost-benefit analysis and feasibility study of potential Champlain Canal barrier options. The purpose of a barrier would be to prevent the introduction of nuisance aquatic species into Lake Champlain via the Champlain-Hudson canal. In 2002, Lake Champlain Sea Grant convened a workshop to identify stakeholders' concerns relative to this issue. Project staff are now attempting to integrate such concerns with ecological and economic impact findings, in hopes of listing several management alternatives. A summary document and associated public workshops are being planned for 2004.

- NO UPDATE

Prospects for 2005

The management and research activities discussed above will generally continue in 2005. Expectations are that the impacts of sea lamprey will begin to decline with the renewal of treatments in Vermont and treatments of lamprey producing delta areas in New York. Over the long-term, research activities will assist in improving and refining the management of the lake's aquatic resources. A brief synopsis of expectations for 2005 include:

Vermont Senator Leahy and other area congressional representatives secured a congressional appropriation for sea lamprey control on Lake Champlain. The new congressional appropriation will allow the program to continue for several more years.

- No treatments are scheduled for 2005.

- Sea lamprey trapping will continue on selected streams during 2005

- No streams are currently scheduled for treatment during 2005. Quantitative Assessment Sampling (QAS) of larval abundances may be conducted on several streams to determine the need for future treatments and monitor populations being controlled through trapping.

- Conduct surveys on the Saranac and Boquet River deltas to gain information on the distribution and status of their respective larval sea lamprey populations, relative to their planned treatments in 2004.

- Additional surveys will be conducted to gain information on the distribution and status of brook lamprey populations in the Lake Champlain Basin and throughout Vermont.

- NYSDEC and the USGS Upper Midwest Environmental Sciences Center at LaCrosse, Wisconsin will conduct several toxicity tests to evaluate impacts of TFM/Niclosamide combination treatments to nontarget organisms. Combination treatments offer the potential to reduce the cost of treatments and possibly reduce nontarget impacts. However, toxicity tests must be conducted on several species before permits will be issued for combination treatments. Species to be tested include: quillback (a species of sucker); yearling mudpuppies; pocketbook and fluted shell mussels; American brook lamprey; eastern sand darter; and channel darter. Collecting test animals, conducting the tests, and analyzing the results make these activities a substantial commitment of staff and time.

- Pursue required permits and funding for a barrier for Morpion Stream in Quebec.

- Pursue New York and Vermont permits and permit modifications as needed for lamprey control activities. In New York, lampricide treatments require Wetlands permits from the NYSDEC and the Adirondack Park Agency. In addition, pesticides permits are required from the DEC. Current permits are good thru 2009. In Vermont, Aquatic Nuisance Control and Endangered and Threatened Species permits are required prior to conducting lamprey treatments. For both states the permitting process has required a substantial commitment of staff time.

- The Cooperative and the Alternatives Workgroup will continue to evaluate potential alternatives to lampricides. Staff maintain communication with the Great Lakes Fishery Commission on related research conducted by that organization.

- Continue activities related to sea lamprey assessment, salmonid assessment and sea lamprey/salmonid interactions. Procedures will be similar to those described above for 2004.

- Continue to update the 1977 document "A Strategic Plan for the Development of Salmonid Fisheries in Lake Champlain" to better reflect the multi-species work pursued by the Cooperative.

- Continue research into cormorant diets and population dynamics.

- Conduct walleye and sauger spawning run assessments, walleye egg collection, walleye stocking (including marked fingerlings and marked and unmarked fry), and walleye stocking evaluations.

- Complete summary documents and associated public workshops regarding feasibility and effects of Champlain Canal barrier options.

References:

Fisheries Technical Committee. 1999. Comprehensive Evaluation of an EightYear Program of Sea Lamprey Control in Lake Champlain. Lake Champlain Fish and Wildlife Management Cooperative. 209 pp.

Fisheries Technical Committee. 2001. A Long-term Program of Sea Lamprey Control in Lake Champlain, Final Supplemental Environmental Impact Statement. Lake Champlain Fish and Wildlife Management Cooperative. 358 pp.

Lake Champlain Fish and Wildlife Policy Committee. 1977. A Strategic Plan for Development of Salmonid Fisheries in Lake Champlain. NYS Department of Environmental Conservation 20pp.

Appendix 1: Schedule of completed Lake Champlain lamprey treatments through 2004, and projected treatments for 2005 and beyond.

1990: Salmon River
Little Ausable River
Ausable River (and Dry Mill Brook)
Boquet River
Beaver Brook
Putnam Creek
Lewis Creek

1991: Mount Hope Brook (and Greenland Brook)
Stone Bridge Brook
Ausable Delta
Saranac Delta
Little Ausable Delta
Salmon Delta
Boquet Delta

1992: Great Chazy River
Saranac River
Poultney River
Hubbardton River

1993: no treatments

1994: Salmon River
Little Ausable River
Ausable River (and Dry Mill)
Boquet River
Putnam Creek
Lewis Creek

1995: Mount Hope Brook (and Greenland)
Trout Brook
Ausable Delta
Salmon Delta
Boquet Delta
Saranac Delta

1996: Great Chazy River
Poultney River
Hubbardton River

1997: no treatments

1998: Little Ausable River
Salmon River
Putnam Creek
Beaver Brook

1999: Mount Hope Brook (and Greenland)
Boquet River
Ausable River (and Dry Mill)

2000: Great Chazy

2001: no treatments

2002: Little Ausable River
Ausable River (and Dry Mill)
Salmon River
Putnam Creek
Beaver Brook - postponed
Lewis Creek

2003: Mount hope Brook – postponed
Beaver Brook
Boquet River
Ausable Delta
Salmon Delta - no treatment required
Little Ausable Delta - no treatment required
Winooski River - postponed

2004: Great Chazy River
Saranac Delta
Boquet Delta – no treatment required
Mount Hope Brook
Winooski River

2005: no treatments

2006: Little Ausable River
Ausable River (and Dry Mill)
Salmon River
Putnam Creek
Lewis Creek

2007: Beaver Brook
Boquet River
Ausable Delta
Little Ausable Delta
Salmon Delta
Poultney River[1]
Hubbardton River[1]

2008: Great Chazy River
Mount Hope Brook
Saranac Delta
Boquet Delta
Winooski River

2009: no treatments

2010 and beyond: Repeat the cycle listed above for 2006 through 2009. Other rivers such as the Pike and Missisquoi may be added at any time as appropriate.

[1] If program wounding rate objectives are not met and no feasible control alternatives exist.

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