Vermont Fish and Wildlife Department
Annual Report

State: Vermont **Project No**.: F-35-R-13

Grant Title: Lake Champlain Fisheries Restoration and Management

Study No. IV **Study Title:** Salmonid Management

Period Covered: July 1, 2010 to June 30, 2011

Summary of Activity:

Fall electrofishing surveys of selected Lake Champlain tributaries and near-shore areas yielded collections of 796 landlocked Atlantic salmon, 581 lake trout, 42 steelhead rainbow trout and 30 brown trout. A total of 98 spawning adult Sebago strain salmon collected by electrofishing were transferred to the Ed Weed Fish Culture Station for gamete collection; virtually all other fish collected were released alive.

Sea lamprey wounding rates on lake trout in the index 533-633 mm TL class declined from 55 wounds per 100 fish in 2009 to 40 wounds per 100 fish in 2010. Wounding rates on 432-533 mm TL salmon decreased over the same period, from 31 to 15 wounds per 100 fish in the Main Lake basin, and from 38 to 22 wounds per 100 fish in pooled Inland Sea-Malletts Bay samples. The wounding rate for Main Lake salmon met the program objective for the first time in 2010. Wounding rates for lake trout and Inland Sea-Malletts Bay salmon remain higher than the program objectives.

The proportion of smaller lake trout (533-633 mm TL) in spawning population samples increased in 2010, following over ten years of steady decline. This may indicate that sea-lamprey-induced mortality of younger, more vulnerable lake trout is beginning to decline.

Two trapnets were set and tended from November 10-12, 2010 in Hatchery Cove near the mouth of Hatchery Brook at the Ed Weed Fish Culture Station to evaluate an alternative technique for capturing lake trout and landlocked Atlantic salmon returning to the Hatchery Cove area for spawning. A total of 989 lake trout and 56 salmon were captured over four trap-nights. The trapnetting coincided with lake trout electrofishing in the same area; a length frequency comparison of lake trout collected by both methods showed that electrofishing selected for larger fish than did trapnetting.

The Winooski One fish lift operated for 58 days in the fall, 2010 and 44 days in the spring, 2011. A total of 130 adult landlocked Atlantic salmon and 61 steelhead rainbow trout were collected and tagged during the fall and 37 steelhead were collected in the spring**.** The threat of viral hemorrhagic septicemia has curtailed the movement of fish upstream at this time.

A total of 33,330 landlocked Atlantic salmon fingerlings were stocked in the Winooski River in the fall, 2010 and 31,710 salmon smolts in spring, 2011. In addition to the smolt stocking, the Huntington River was stocked with approximately 110,000 salmon fry in May, 2011.

Salmon parr were found at both Huntington River index stations sampled in the early fall of 2010. Density of YOY salmon found in the Huntington River was 3.3 fish per salmon unit. Rainbow trout made up the majority (77%) of the trout collected during surveys.

A rotary screw trap was fished in the Huntington River in April and May, 2011 to capture out-migrating salmon smolts. Record precipitation and high flow events resulted in an abbreviated trapping season. A total of 50 smolts were captured.

A total of 137 spawning adult Sebago strain salmon (67 males and 70 females) collected in fall assessment sampling were transferred to the Ed Weed Fish Culture Station for gamete collection; this included 98 from electrofishing and another 39 collected at the Winooski One fish lift; virtually all other fish collected were released alive.

Details on these activities are reported below.

This project was made possible by fishing license sales and matching Dingell-Johnson/Wallop-Breaux funds, available through the Federal Aid in Sport Fish Restoration Act; and was conducted in partnership with staff from the US Fish and Wildlife Service working under the Lake Champlain Special Designation Act.

Fall Electrofishing Surveys

Background

Lake Champlain salmonids are sampled annually in fall electrofishing surveys to assess population structure and response to sea lamprey control (F-35-R, Study VIII), and provide gametes for landlocked Atlantic salmon culture. In October and November 2010, lake trout, landlocked Atlantic salmon, steelhead rainbow trout and brown trout were sampled in the Lamoille River and Sandbar Causeway Bridge in the Inland Sea/Malletts Bay basins, and Main Lake basin locations including Hatchery Brook (Ed Weed Fish Culture Station discharge stream) and adjacent lake shore, the Boquet River, and the nearshore areas of Whallon Bay, and Willsboro Bay (Figure 1). The Whallon Bay, Willsboro Bay, and Boquet River sampling was conducted in cooperation with the New York State Department of Environmental Conservation and the U.S. Fish and Wildlife Service. Sex/maturity, total length, fin clips and sea lamprey attack data were recorded for all fish collected, and subsamples were weighed. Scale samples were collected from salmon, steelhead and brown trout for future age determination. Virtually all fish collected were released alive aside from a portion of the salmon transferred to Ed Weed for culture purposes.

Salmonid Collections

A total of 786 salmon were collected from all locations and 580 lake trout were collected from the lakeshore areas; one additional lake trout was collected in the Lamoille River. A total of 42 steelhead were collected from Hatchery Brook, Lamoille River, Otter Creek, Whallon Bay and Willsboro Bay, while 30 brown trout were collected from Hatchery Brook, Whallon Bay and Willsboro Bay. A summary of the salmonids collected is presented in Table 1. Nine of the lake trout collected (1.5 percent) were not marked with a fin clip. This proportion of unmarked lake trout is within normal hatchery fin clipping error rates.

A total of 98 spawning adult Sebago strain salmon collected from hatchery brook (53 females and 45 males) were held as broodstock at the Ed Weed Fish Culture Station, Grand Isle, VT. The Sebago strain was identified by fin clips; Sebago smolts stocked prior to 2008 were marked an Adipose-Right Ventral fin clip. The fin clip was changed to Right Ventral beginning with smolts stocked in 2008.

Sea Lamprey Wounding Rates

Sea lamprey attacks on salmonids were categorized using the standard classification system from Ebener, et al. (2006). Stage A1 (fresh wounds) and A2-A3 (healing wounds) were used in the wounding rate calculations. Sea lamprey control and salmonid restoration objectives include wounding rate targets of 25 wounds per 100 lake trout in the 533-633 mm TL size class, and 15 wounds per 100 salmon in the 432-533 mm TL size class (USFWS et al. 2001). The wounding rate calculations include pooled data from lake trout and salmon collected in all fall assessments (electrofishing, trapnetting and Winooski River fish lift). Wounding rates both species showed marked declines in 2010, and the lakewide salmon wounding rate met the program objective for

the first time (Figure 2). The lake trout wounding rate of 40 wounds per 100 fish is down from 55 wounds per 100 fish in 2009; and the larger size classes showed a similar trend (Figure 3). A comparison of lamprey wounds on Main Lake and Inland Sea-Malletts Bay salmon wounding shows a continued trend of higher wounding rates in the pooled Inland Sea-Malletts Bay samples (Figure 4).

Lake Trout Size Structure

Length frequency metrics indicate continuing maturation of the lake trout population. Prior to 2005, 10 percent 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 percent of the sample in 2010 (Figure 5). There was a corresponding steady decline in the proportion of lake trout in the 533-633mm TL class, from a high of 42 percent of the sample in 1997 to 12 percent in 2009; however, an increase to 16% of the sample was observed in this size class 2010 (Figure 5). The approximately 55% reduction annual lake trout stocking that began in 1995 explains much of the decline in the 533-633mm size class, but the long term trend indicates that changes in sea lamprey-induced mortality inferred from wounding rate trends may also be a contributing factor.

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Ebener, M.P., E.L. King, Jr., and T.A. Edsall. 2006. Application of a dichotomous key to the classification of sea lamprey attack marks on Great Lakes fish. Great Lakes Fisheries Commission Misc. Publication 2006-02. Ann Arbor, MI. 21pp.

U. S. Fish and Wildlife Service, Vermont Department of Fish and Wildlife, and New York State Department of Environmental Conservation. 2001. A long-term program of sea lamprey control in Lake Champlain. Final Supplemental Environmental Impact Statement FES# 01-27. Lake Champlain Fish and Wildlife Management Cooperative. 356 pp. plus appendices.

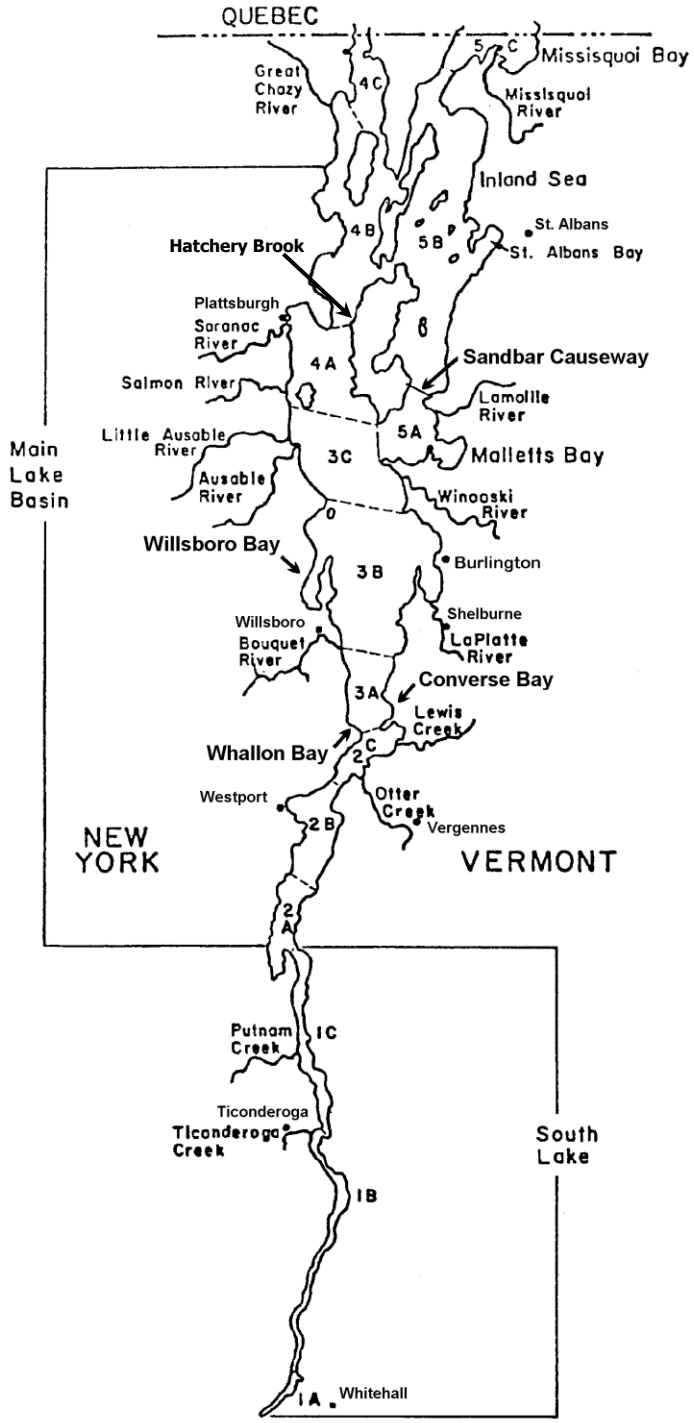

Figure 1. Lake Champlain, showing major lake basins and management zones, tributaries and salmonid sampling areas.

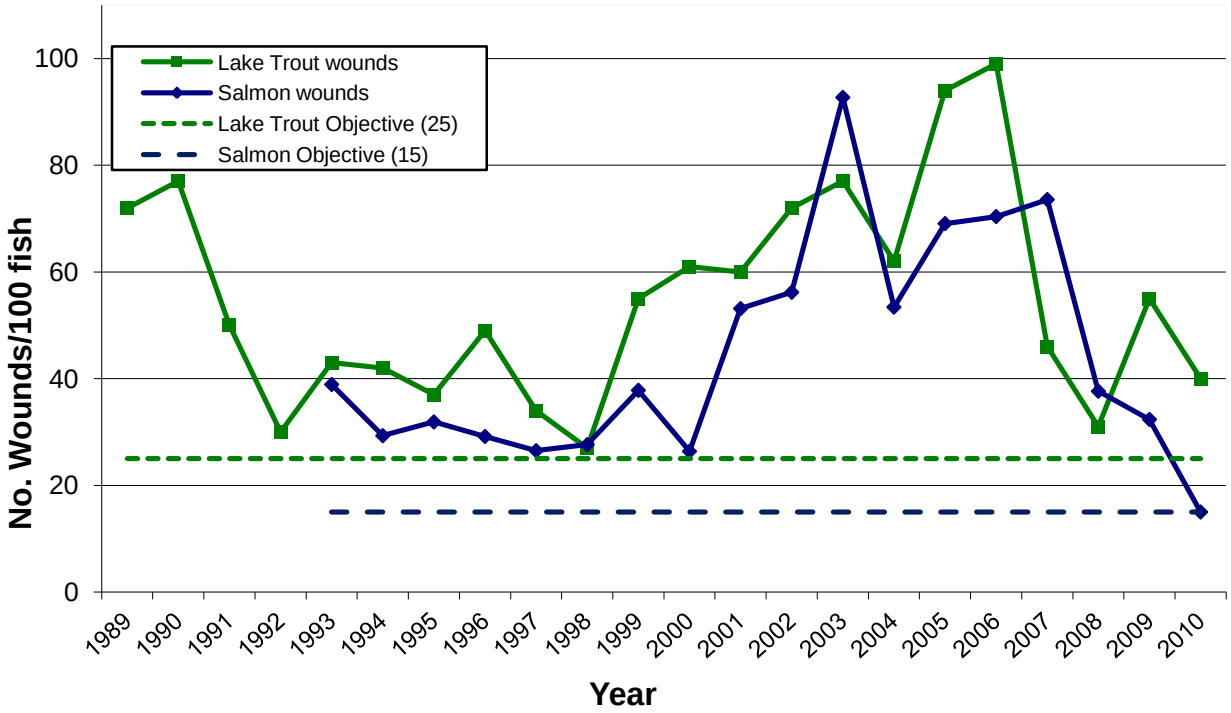

Figure 2. Sea lamprey wounding rates on 533-633 mm TL lake trout and 432-533 mm TL landlocked Atlantic salmon from Lake Champlain, 1989-2010.

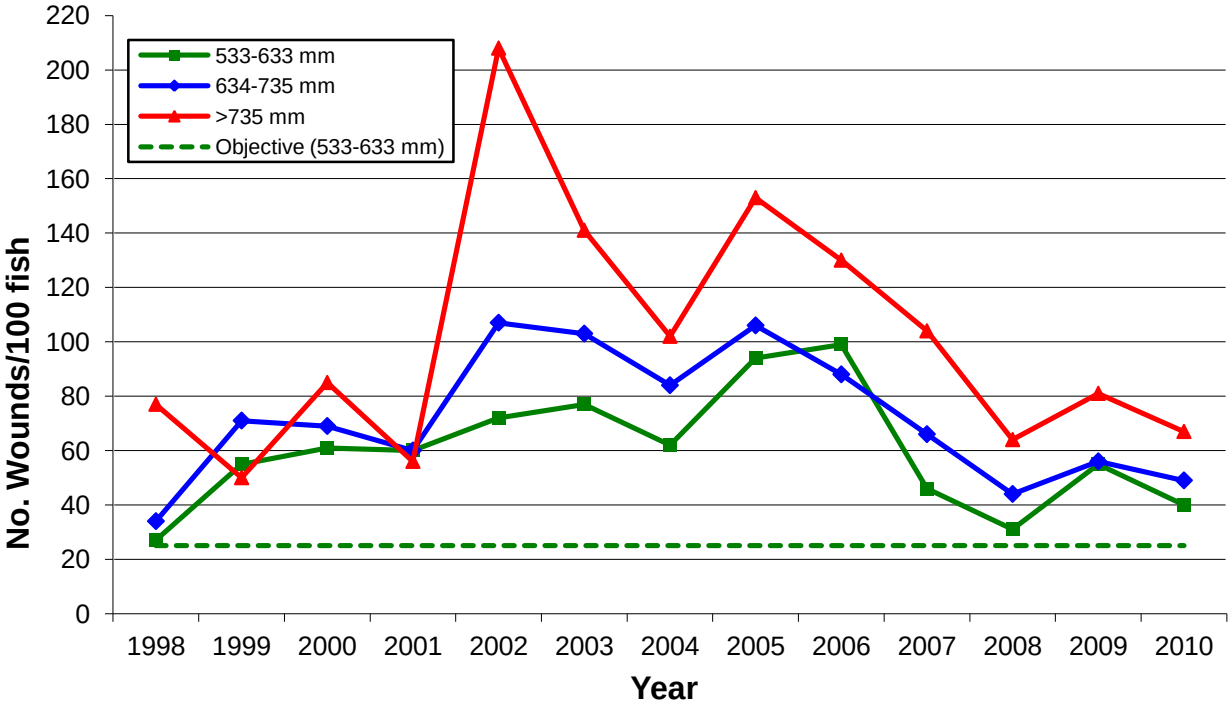

Figure 3. Sea lamprey wounding rates on three length classes of lake trout from Lake Champlain, 1998-2010.

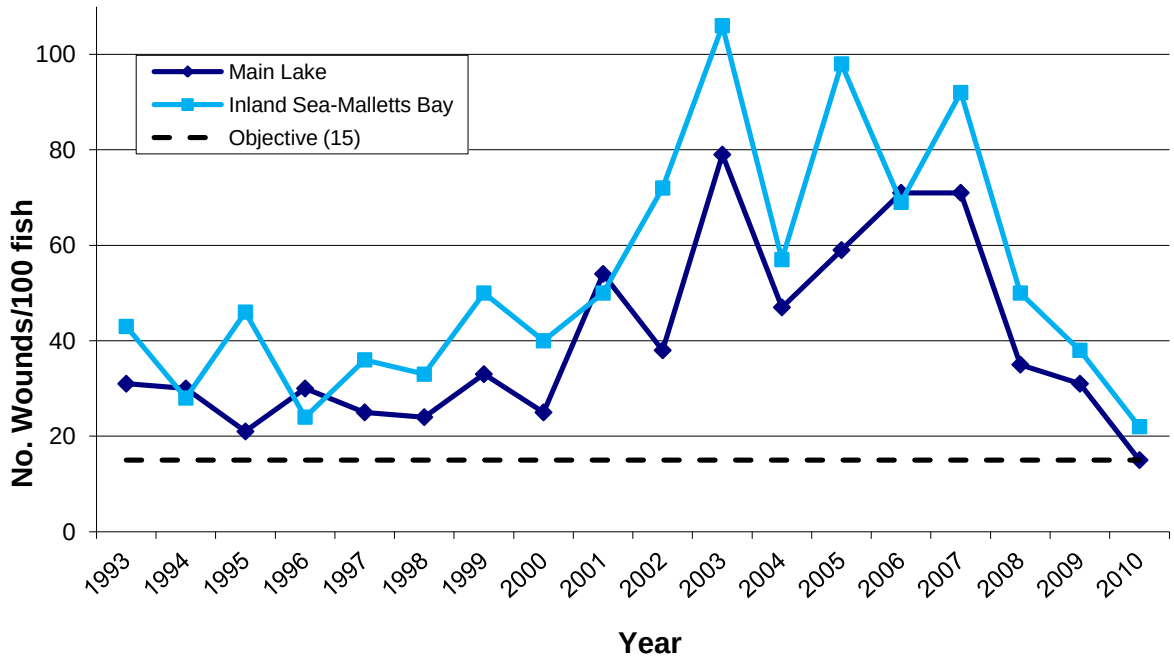

Figure 4. Sea lamprey wounding rates on 432-533 mm TL landlocked Atlantic salmon from the Main Lake and Inland Sea/Malletts Bay basins of Lake Champlain, 1993-2010.

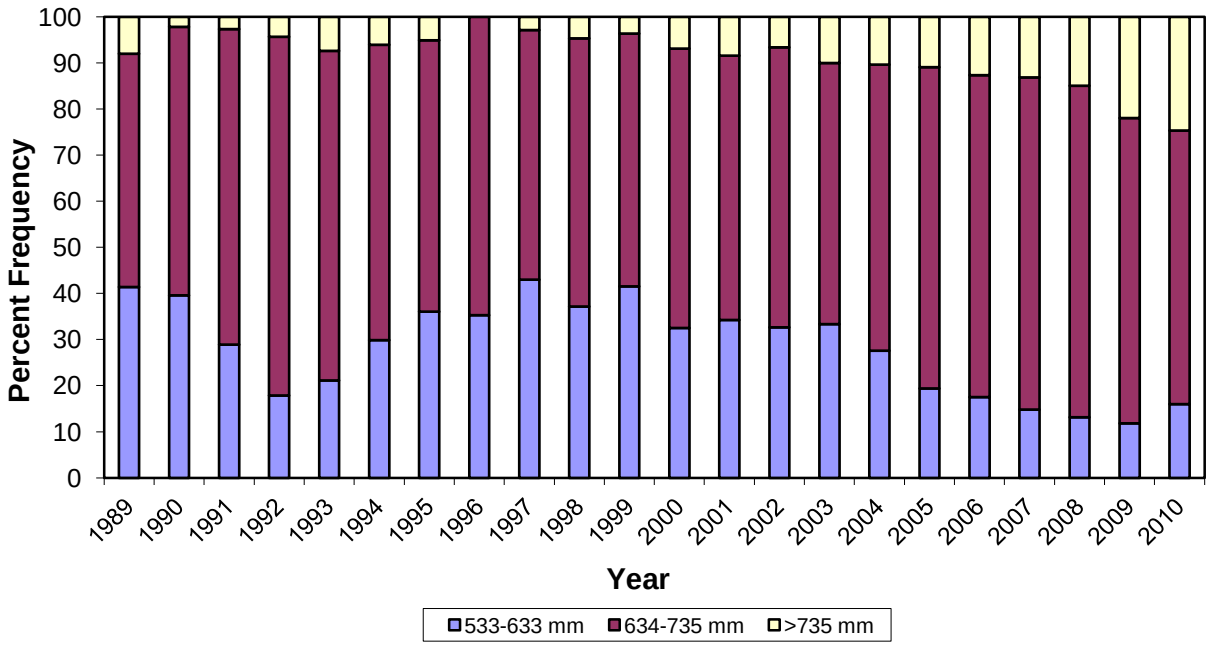

Figure 5. Percent frequency of three length classes of lake trout sampled in Lake Champlain by fall electrofishing, 1989-2010.

Table 1. Cooperative Lake Champlain salmonid sampling results in fall 2010. Average total length (TL) is in mm.

Species/Area	Sampling Period (No. Days Sampled)	Number Collected	Males Ave. TL (n)	Females Ave. TL (n)	Juvenile or unknown Ave. TL (n)
Landlocked Atlantic salmon					
Lamoille River	Oct. 8 - Nov. 11 (8)	43	513 (21)	527 (21)	360 (1)
Sandbar Causeway	Oct. 4 - Nov. 11 (7)	3	593 (2)	482 (1)	-
Hatchery Brook	Oct. 8 - Nov. 11 (11)	350	519 (169)	523 (179)	431 (2)
Missisquoi River	Oct. 12-22 (2)	1	-	547 (1)	-
Otter Creek	Oct. 10 (1)	0	-	-	-
Whallon Bay	Oct. 27 - Nov. 15 (6)	58	549 (4)	-	494 (54)
Boquet River	Nov. 3-9 (2)	64	566 (38)	546 (26)	-
Willsboro Bay	Oct. 26 - Nov. 3 (5)	289	628 (4)	504 (1)	430 (284)
	Total	796			
Lake trout					
Hatchery Cove/Breakwater	Nov. 11 (1)	241	703 (150)	719 (88)	706 (3)
Willsboro Bay	Oct 26-28 (2)	77	647 (36)	714 (37)	576 (4)
Lamoille River	Oct. 8 - Nov. 11 (8)	1	-	-	-
Whallon Bay	Nov. 2 (1)	262	660 (136)	702 (123)	597 (3)
	Total	581			
Steelhead					
Lamoille River	Oct. 8 - Nov. 11 (8)	1	-	-	418 (1)
Sandbar Causeway	Oct. 4 - Nov. 11 (7)	0	-	-	-
Hatchery Brook	Oct. 8 - Nov. 11 (11)	30	459 (8)	453 (2)	454 (20)
Missisquoi River	Oct. 12-22 (2)	0	-	-	
Otter Creek	Oct. 10 (1)	1	-	-	463 (1)
Whallon Bay	Oct. 27 - Nov. 15 (6)	6	-	-	509 (6)
Boquet River	Nov. 3-9 (2)	0			
Willsboro Bay	Oct. 26 - Nov. 3 (5)	4	-	462 (1)	425 (3)
	Total	42			
Brown trout					
Lamoille River	Oct. 8 - Nov. 11 (8)	0	-	-	-
Sandbar Causeway	Oct. 4 - Nov. 11 (7)	0	-	-	-
Hatchery Brook	Oct. 8 - Nov. 11 (11)	18	472 (7)	500 (7)	500 (4)
Missisquoi River	Oct. 12-22 (2)	0	-	-	-
Otter Creek	Oct. 10 (1)	0	-	-	-
Whallon Bay	Oct. 27 - Nov. 15 (6)	4	-	-	405 (4)
Boquet River	Nov. 3-9 (2)	0	-	-	-
Willsboro Bay	Oct. 26 - Nov. 3 (5)	8	517 (2)	-	387 (6)
	Total	30			

Winooski River Fish Lift and Salmon Investigations

Introduction

On November 3, 1988 the City of Burlington Electric Department and the Winooski One Partnership was issued a Federal Energy Regulatory Commission (FERC) License to construct, operate, and maintain the Chase Mill Hydroelectric Project No. 2756. This hydroelectric facility is located on the Winooski River at the Winooski Falls in the City of Winooski, Vermont, approximately 18.4 kilometers (km) upstream of Lake Champlain (Figure 1). This facility has three large generating units with a capacity of producing 7.5 megawatts.

The installation and operation of a fish passage facility was a requirement of licensing. FERC license article 408 states "The licensee, after consultation with the Vermont Department of Fish and Wildlife (VTDFW) and the U.S. Fish and Wildlife Service shall develop plans for a trap and truck facility immediately downstream of the project dam to ensure upstream fish passage past the project dam". Winooski One is also required to operate in an "instantaneous run-of-river mode" (article 405) which provides protection of fish downstream of the dam.

The Winooski One project is the first upstream barrier on the Winooski River. Two more hydroelectric facilities owned by the Green Mountain Power Corporation, Gorge #18, 1.4 km upstream of Winooski One, and Essex #19, 3.7 km upstream, are additional barriers to fish migration. Favorable salmonid habitat is accessible upstream of Essex #19 dam for approximately 33.6 km to Green Mountain Power's Bolton Falls dam.

The Winooski One fish lift 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 lift has enabled migrating Lake Champlain landlocked Atlantic salmon and steelhead rainbow trout access to critical spawning and nursery habitat above the Winooski One hydroelectric station. The goals of the project are:

1. To create a quality stream fishery for lake-run steelhead rainbow trout and landlocked Atlantic salmon in the Winooski River.

2. To encourage natural reproduction of Lake Champlain landlocked Atlantic salmon and steelhead rainbow trout in the Winooski River watershed.

Viral Hemorrhagic Septicemia

Viral hemorrhagic septicemia (VHS) is considered to be one of the most serious fish diseases in freshwater environments in Europe and now, in North America. Outbreaks of the VHS virus can result in severe fish mortality events in aquaculture as well as in wild populations. The VHS virus is readily transmissible to fish of all ages, and survivors of infection can be lifelong carriers. The virus is shed from infected fish in urine, feces, and reproductive fluids and transmission can occur through water or direct contact.

VHS has recently been confirmed in the Great Lakes following several large fish mortality events, and has spread to several inland lakes in New York State. At least 37 fish species have been documented to carry the virus, including such recreationally important species as walleye, yellow perch, smallmouth bass, northern pike and muskellunge, and virtually all species of trout and salmon. In response to the rapid spread of VHS, the US Department of Agriculture's Animal and Plant Health Inspection Service (APHIS) issued a Federal Order restricting the importation of fish and bait from two Canadian provinces into the United States and the interstate movement from eight states bordering the Great Lakes. Similar measures have been taken by the states of New York and Vermont to prevent the spread of VHS including new importation rules and regulations on the personal and commercial collection and movement of baitfish.

Since Lake Champlain has a high probability of being infected with VHS, the Vermont Department of Fish and Wildlife is evaluating and considering modification where necessary, certain fishery management practices including stocking and fish passage to minimize the risk to wild fish populations. To this end, upstream movement of salmon and steelhead collected the Winooski One fish passage facility was suspended in 2008. The fish lift, however, will continue to operate since it has become an important fish population assessment tool (e.g., relative abundance, size, age, and lamprey wounding data), as well as a source of salmon brood stock for the Lake Champlain culture program. Downstream passage facilities will also continue to operate as salmon parr still exist in the Winooski watershed as the result of fry stocking. This change of operating procedure will be re-evaluated on an annual basis.

Fish Lift Monitoring

Objective: To move migratory landlocked Atlantic salmon and steelhead rainbow trout above the first three dams on the Winooski River.

Procedures

The fish lift was scheduled to operate in the spring (March 15 – May 15) and in the fall (September 15 – November 15). Power company personnel activated the lift 1-3 times a day (0800 hr, 1300 hr, and 1600 hr). Lift frequency was determined based on the numbers of fish being lifted. Lifted fish were emptied into a sorting tank where targeted species were separated from the other catch. A daily log was kept of the number of lifts, time, species numbers, flows, water temperature, and general weather.

Targeted species were saved for processing by state or federal biologists while other catch was released back downstream. Biological data recorded from fish collected include length, weight, sex (when possible), scales for age analysis, fin erosion and sea lamprey attacks. Fish were tagged with a serially numbered floy-type tag (yellow for salmon, red for steelhead) under the dorsal fin to determine movements and contribution to the fishery, and the release site recorded.

In addition to the biological information collected at the lift, an hourly flow history was provided by United States Geological Survey as well as the power company for the fish lift period. Hourly temperature data at the lift was collected using Stowaway Miniature Temperature

Loggers (Onset Instruments, Pocasset, MA), Model WTA08, Optic StowAway Temp. Temperature loggers were programmed to record every hour.

Findings

Fall lift season

The fish lift operated continuously from September 15 thru November 12, 2010 (Figure 2). The fish hopper was lifted 125 times in 58 days of operation. A total of 130 adult salmon were recorded (Table 1). Many salmon were captured more than once (see Fish Lift Efficiency Assessment).

There were 66 male, 63 female and 1 sex not-determined salmon processed at the lift. Ninety-six salmon aged had spent one year in the lake (1-lake-year). Mean lengths of male and female 1-lake-year salmon were 580 and 551 millimeters (mm), respectively (Table 2). Thirteen salmon were two-lake-year fish with a mean length of 615 mm for males (10 fish) and 632 mm for females (3 fish). Additionally, one 255 mm smolt was also trapped. Forty-three salmon (26 male, 17 female) were transported to the Ed Weed fish culture station. These fish were utilized for brood stock.

In addition to the salmon, 61 steelhead, and 5 lake trout were lifted in the fall, 2010 (Table 1). Most of the steelhead (57) were 1-lake-year fish and averaged 440 mm (Table 2).

Spring lift season

The fish lift operated from March 17 thru May 19, 2011. The fish hopper was lifted 97 times in 44 days of operation. Unusually high flows (i.e. floods) reduced operating days from possible 62 days (March 15 – May 15); 53 days is about the average number of operating days.

Thirty-seven (37) adult steelhead rainbow trout were trapped (Table 1). Seventeen of the steelhead had been previously lifted in the fall, 2010. Several fish were re-captured during the season. All the steelhead lifted were male; 34 fish were lake-age 2 and one fish was lake-age 1. Mean length and weight of the 2-year old steelhead were 466 mm and 1119 gm, respectively. These fish were slightly larger then steelhead lifted in the fall, 2010.

In addition to the steelhead, 2 lake trout, 2 walleye and an adult sea lamprey were captured.

Lamprey wounding rates

The goal of the Lake Champlain sea lamprey control program is to achieve or surpass the fish population, recreational fishery and economic benefits realized during the 1990-97 experimental sea lamprey control program (Fisheries Technical Committee 2001). To this end, a lamprey wounding rate objective of 15 wounds per 100 fish was established for landlocked salmon in the 432-533 mm length class. In 2010, 20 salmon fell within this length class with a

calculated lamprey wounding rate of 45 wounds per 100 fish (Table 3). This is a substantial decrease – almost a 50% reduction- from previous years.

Fish Lift Efficiency Assessment

Objective: To evaluate landlocked Atlantic salmon and steelhead rainbow trout movement and trapping efficiencies from fish tagged below the dam.

Procedures

Steelhead and salmon were captured below the Winooski One dam, tagged, and released. The ratio of the number of tagged fish recaptured in the trap to the total number of fish lifted would be a measure of the effectiveness of the fish trapping system. Sampling was conducted during the spring and fall lift seasons below the Winooski One dam using an electrofishing boat equipped with a Coffelt VVP-15 pulsator unit set on DC-pulse output.

Findings

No electrofishing for salmon or steelhead below the Winooski One dam was conducted in the fall of 2010 or the spring of 2011. However, during the fall 2010 lift season many of the tagged salmon that were released below the lift were recaptured. Two hundred and twenty-one salmon (221) were released below the dam (including recaptures) and 46 recaptures (12 salmon were recaptured multiple times) were recorded or 21 percent of released fish.

Evaluation of Fry and Smolt Stocking

Objective: To establish runs of adult landlocked Atlantic salmon and steelhead rainbow trout that will provide a stream fishery as well as encourage natural reproduction.

Procedures

A total of 31,710 Sebago strain salmon smolts were stocked in the Winooski River in spring 2011, (Table 4). The salmon had mean lengths ranging from 178 - 205 mm and were reared at the Ed Weed Fish Culture Station in Grand Isle, Vermont. All the salmon stocked received a right ventral fin clip (RV) before stocking at the dam or at the fishing access near the mouth on March 23 and 24.

In fall 2010, 33,330 fingerling salmon were stocked in the main stem Winooski from Richmond, Vermont upstream. These fish came from the Eisenhower National Fish Hatchery and averaged 114 mm total length. This stocking replaces past fry stocking of the Winooski River. It is hoped that these larger fish will have better survival.

In addition to the salmon smolt and fingerling stocking, the Huntington River was stocked with approximately 110,000 salmon fry in May, 2011 (see Winooski River Tributary Salmonid Assessment).

A total of 20,876 Chambers Creek strain steelhead were stocked in the Winooski River in 2011. These fish came from the Ed Weed Fish Culture Station. Half of the fish were stocked below the fish lift while the other half was released at the fishing access near the mouth. The fish were stocked on March 23 and 24 (Table 5).

The success of the salmon fry, and smolt stocking is assessed by the subsequent adult returns to the Winooski River trap. Returning salmon were identified as being fry, fingerling or smolt stocked by fin clips. Salmon stocked as smolts through 2007 have adipose and right ventral (ADRV) fin clips; in 2008 the smolt fin clip changed to RV. Beginning in 2007, salmon parr were collected from several areas on the Huntington River and fin clipped. Salmon parr (young-of-year) were collected by electrofishing, anesthetized, total length measured and the left ventral (LV) fin removed. Prior to 2007, salmon parr were tagged with magnetized metal nose tags and adults were scanned for the tags at the lift.

Findings

Twice as many RV clipped adult salmon returned to the trap as did non-clips (84 vs. 46). The majority of both the clipped and non-clipped salmon were lake-age 1 fish but a large number of returning clipped salmon were lake-age 0 fish (Table 6). No lake-age 0 non-clipped salmon were recorded. The proportion of non-clipped to clipped fish increased from 2009 to 2010 but the 2009 sample was small (Figure 3).

In 2008, 430 parr were marked with LV fin clips; these salmon would have been expected to out-migrate as 1 or 2-year old smolts and return as adults a year later in the fall of 2010 or 2011; no LV clipped adult salmon were observed in 2010. A total of 827 salmon parr were collected in 2009 and fin clipped in the Huntington River. These fish had a mean length of 101 mm (SD = 12) and are expected to return as adults in 2011 or 2012. In 2010 a total of 372 salmon parr were collected and fin clipped in the Huntington River. These fish had a mean length of 84 mm (SD = 9) and are expected to return as adults in 2012 or 2013.

Winooski River and Tributary Habitat Assessment

Objective: To assess present salmonid habitat within the Winooski River watershed.

Procedures

No habitat assessment was conducted in 2010. However, temperature data was collected for the Winooski and Huntington Rivers, and Mill, Duck and Ridley Brooks using temperature loggers from Onset Instruments, (Pocasset, MA); model HOBO Water Temp Pro v2. Temperature loggers were programmed to record every hour.

Findings

Table 7 depicts water temperature measurements for the Winooski River and its tributaries. Mean water temperatures during the months of May through mid-October ranged

from 11 to 22 degrees °C. The highest maximum measured water temperature was 29 °C measured in the Huntington River in July.

Winooski River Tributary Salmonid Assessment

Objective: To assess present natural reproduction of resident salmonids, survival of stocked salmon fry and spawning success of lifted adult salmonids.

Procedures

Salmon fry stocking

Stocked salmon fry originated from eggs of Sebago strain salmon and were incubated at the Eisenhower National Fish Hatchery. Fry were transported from the hatchery in fine mesh cages stacked in a large insulated tank mounted on a pickup equipped with oxygen. Once on site, the correct amount of fry was determined by weight and acclimated to stream water temperature before hand planted into suitable habitat in the Huntington River. Target stocking density was 46 fry per salmon habitat unit.

Salmon parr sampling

The subsequent status of juvenile salmon stocked as fry and other salmonid populations were evaluated during August and September, 2010. Salmon and trout were sampled on the Huntington River and Mill, Preston, Pinneo and Ridley Brooks.

Sampling accessibility and general habitat characteristics determined site selection. Tributary stations varied in length from approximately 100 to 175 meters. Sampling was accomplished by electrofishing with a Georator Corporation portable electric generator at 500 volts or ABP-2 backpack electrofishing unit (Univ. of Wisconsin, Engineering Technical Services, Madison, WI).

Population size was estimated using a maximum weighted likelihood modification of the Zippin removal method (Carl and Strub 1978). Multiple sampling runs (usually 3) were conducted at each station until the last run collected no more than 20 percent of the total trout collected in the previous runs. This ensured that allowable coefficient of variation values resulted from calculated population estimates.

Captured salmon and trout were identified, measured, weighed. A scale sample was taken from some salmon. Scale samples from these and salmon captured in the out-migration study (see Salmon Smolt Out-Migration below) as well as length-frequency analysis were used to assign ages to salmon. Young-of-year fish were weighed collectively.

Findings

Salmon fry stocking

The total number of salmon fry stocked into the Winooski watershed in 2011 was about 110,360. All the fry were put into 18.3 kilometers the Huntington River (figure 1). These fry averaged 25 mm in length and were stocked at an average density of 42 fish per salmon unit. Three of the 26 stocking sections (or approximately 2 km) received no fry.

Salmon parr sampling

Salmon stocked prior to 2011 were found at both index stations sampled on the Huntington River early fall of 2010. Unfortunately sampling equipment failure prevented adequate sampling to calculate a population and subsequent density estimates in the lower index station. Mean total lengths at the time of sampling for the young-of-year (YOY) and age 1+ salmon was 83 mm and 155 mm, respectively. Density of YOY salmon found in the Huntington River at the upper sampling location was 3.3 fish per salmon unit (Table 8). Survival estimates for salmon fry stocked in 2009 and 2010 are presented in Table 9.

A total of 384 trout were collected during the 2010 tributary sampling effort. Table 10 and 11 summarizes YOY mean lengths, population estimates and biomass for the Winooski River tributaries sampled in 2010. Rainbow trout made up 77 percent of the trout collected in the 5 tributaries sampled with the majority of those being YOY (97 %) (Figure 4). Figure 5 illustrates the variability of YOY rainbow trout population estimates over time for three tributaries sampled. Population trends appear similar among the three streams. Similar population trends among the streams for rainbow trout in the 100-152 mm length class (age 1+) can also be discerned (Figure 6).

Salmon Smolt Out-Migration

Objective: (1) describe timing and rates of migration, (2) assessing in-river migration factors, (3) evaluating inter-year variability in magnitude of out-migration.

Procedures

In spring 2004, the first attempt at capturing salmon smolts stocked as fry out-migrating to Lake Champlain was conducted utilizing a rotary screw trap. This trap was placed in the lower Huntington River, performed well and a total of 57 salmon were captured. The trap was again deployed in 2005 and 2006. In 2007 a new trap was purchased from E.G. Solutions of Corvallis, Oregon. The new trap has a larger fish capturing cone (2.4 meters diameter vs. 1.8 meters).

The rotary screw trap was deployed in the Huntington River at river kilometer 0.5. The trap consists of two 8-meter floating pontoons between which a revolving mesh–covered cone is suspended. The large end of the cone (2.4 m diameter) is facing upstream and an internal screw built into the cones center axel rotates the cone as the water current exerts pressure on it. Downstream migrating fish that enter the cone are passed to the end of the cone and collected in a live box. The trap was tied to the shore and positioned in the upstream end of a pool at the end of a shallow riffle that funneled much of the flow into the cone.

Discharge in the Huntington River was monitored daily with a staff gauge placed near the trap location. Stream temperature was monitored using Stowaway Miniature Temperature Logger (Onset Instruments, Pocasset, MA), Model Hobo U22 Water Temp Pro v2. The temperature logger was programmed to record every hour.

The trap was checked at least once per day in the morning. Captured salmon were measured for total length, weighed and a scale sample taken for age verification. Salmon were marked by injecting a small amount of non-toxic acrylic paint in-between two of the anal fin rays to help identify potential re-captures. After processing, salmon were placed in a cage 400 meters upstream and held from 8-24 hours before being released in order to estimate trap efficiency (see below).

Rotary screw traps sample only a portion of the cross-sectional area of the stream. For this reason, numbers of migrants were estimated by the trap-efficiency method. Trap efficiency was calculated by releasing marked salmon upstream of the trap. The estimated numbers of migrants was calculated by the following formula:

Efficiency = Recaptured marked salmon / Marked fish released

The total number of fish migrating past the trap site was then estimated by:

Number of fish = unmarked fish caught / Efficiency

Findings

The trap was deployed on April 19 but high flows prevented fishing until May 9. The unusual wet spring plagued trapping efforts throughout April and May finally culminating in the loss of the trap in late May during a flash flood. The trap was recovered at the Essex 19 hydro-electric facility 25+ kilometers downstream. The trap fished only 10 days until it was lost during the night of May 26-27. Precipitation for the this trapping period measured 12.11 inches as recorded in Burlington, VT (www.weather.gov/climate); total rainfall for April and May was 7.88 inches (5.0 in. above normal) and 8.67 (5.35 in. above normal), respectively.

A total of 50 salmon smolts were captured in 2011 (not including recaptures). Calculation of trap efficiency and subsequent estimation of out-migration numbers were not possible due to abbreviated trapping season. Table 12 compares the spring 2011 trapping efforts to previous years.

Age structure of trapped smolts was split evenly between age 1 (23 fish) and age 2 (26 fish) with only one age 3 smolt trapped (figure 7). Mean length for trapped salmon was: age 1 - 126 mm (SD = 8), age 2 – 163 mm (SD = 19), and age 3 – 214 mm.

Angler Exploitation

Objective: To estimate angler fishing effort and catch of returning salmonids.

Procedures

Angler exploitation was measured by angler tag returns and volunteer reporting on angler creel survey forms posted at the Winooski One fish lift.

Findings

Four anglers reported having caught steelhead in the fall 2010 or spring 2011 that had been tagged at the Winooski One fish lift. Six steelhead were caught below the lift in or near the Salmon Hole and one fish was caught on Lake Champlain. Four fish were caught during the fall and 3 caught in the spring. No tagged salmon were reported during the period.

There were 26 entries in the volunteer angler survey forms between September 17 and November 6, 2010. Based on information provided by anglers it took approximately 3.5 hours of fishing effort to catch either a salmon or steelhead during this period. Nine salmon and 14 steelhead trout were caught in 80 hours of fishing effort reported below Winooski One dam. Four of the salmon caught were reported as "smolts no fin clips" or "10 inches" both indicating small fish. Only 2 salmon were harvested while 12 of the 14 steelhead were kept by anglers.

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Date: November 30, 2011

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Zydlewski, G. B., A. Haro, and S. D. McCormick. 2005. Evidence for cumulative temperature as an initiating and terminating factor in downstream migratory behavior of Atlantic salmon (Salmo salar) smolts. Canadian Journal of Fisheries and Aquatic Sciences 62:68-78.

Table 1. Summary of landlocked Atlantic salmon and rainbow steelhead trout lifted at the Winooski One fish passage facility, 1993 – spring 2011.

Year	Spring		Fall	
	Steelhead	Salmon	Salmon	Steelhead
1993	NA	0	36	7
1994	179	0	32	15
1995	38	0	12	9
1996	45	0	11	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	3	0	10	1
2005	4	0	15	5
2006	2	2	23	7
2007	0	0	35	2
2008	6	1	26	0
2009	1	0	38	26
2010	13	3	130	61
2011	37	0	na	na

Table 2. Summary of mean total lengths of landlocked Atlantic salmon and Steelhead rainbow trout collected at the Winooski One fish passage facility, fall 2010. All lengths in millimeters ± one standard deviation. Number of fish in parenthesis.

Sex	**Lake Age 0**	**Lake Age I+**	**Lake Age 2+**	**Total**
Landlocked Atlantic Salmon				
Male	396 ± 18 (17)	580 ± 42 (38)	615 ± 24 (10)	65
Female	---	551 ± 34 (58)	632 ± 90 (3)	61
Total	17	96	13	126
Steelhead Rainbow Trout				
na	385 (1)	440 ± 26 (57)	---	58

Table 3. Summary of sea lamprey attacks on Landlocked Atlantic salmon in the 432-533 mm length class lifted at the Winooski One fish lift, 1993 - 2010.

Year	Number of Salmon	Fresh wounds	Healing wounds	Scars	Total wounds	Wounds/ 100 fish
1993	14	0	4	9	4	28.6
1994	10	0	3	7	3	30.0
1995	3	0	0	4	0	0
1996	6	0	0	2	0	0
1997	112	4	21	30	25	22.3
1998	15	0	1	5	1	6.7
1999	14	3	7	9	10	71.4
2000	6	0	4	3	4	66.7
2001	4	1	2	2	3	75.0
2002	7	0	3	10	3	42.8
2003	3	2	3	8	5	166.6
2004	4	0	0	6	0	0
2005	7	7	4	9	11	157.1
2006	16	4	18	29	22	137.5
2007	10	2	5	13	7	70.0
2008	11	0	9	12	9	81.8
2009	12	0	10	14	10	83.3
2010	20	1	8	15	9	45.0

Table 4. Summary of recent landlocked Atlantic salmon smolt stocking in the Winooski River, 2004– 2011. Stockings are typically split between the boat access near the river mouth and below the Winooski One dam. Strain: Mag = Lake Memphremagog, Vermont; Seb = Sebago.

Year stocked	Stocking location	Number stocked	Size (mm)	Strain	Total stocked
2004	W. One W. One W. One Mouth	10,721 14,650 7,113 7,300	157 178 147 178	Mag Seb Seb Seb	39,784
2005	W. One Mouth Mouth	16,359 4,617 8,104	203 216 190	Seb Seb Seb	29,080
2006	W. One Mouth	26,046 3,954	196-239 251	Seb Seb	30,000
2007	W. One Mouth	9,865 13,290	219 219	Seb Seb	23,155
2008	W. One Mouth	33,689 26,302	178-203	Seb	59,991
2009	W. One Mouth	15,706 17,040	155 - 171	Seb	32,290
2010	W. One Mouth	15,466 15,703	178 - 192	Seb	31,169
2011	W. One Mouth	15700 16010	178 - 203	Seb	31,710

Table 5. Summary of recent steelhead rainbow trout smolt stocking in the Winooski River, 2004 – 2011. Strain: C = Chambers Creek.

Year stocked	Stocking location	Number stocked	Size (mm)	Strain
2004	Mouth	24,000	178	C
2005	Mouth W. One	12,000 8,000	183 188	C
2006	Mouth W. One	10,000 10,000	183 183	C
2007	Mouth W. One	9,000 9,000	179 179	C
2008	No steelhead stocked in 2008			
2009	Mouth W. One	10,000 10,000	211	C
2010	Mouth W. One	10,410 10,270	203	C
2011	Mouth W. One	11,876 9,000	203	C

Table 6. Comparison of aged returning fin clipped and non-clipped landlocked Atlantic salmon lifted at the Winooski One fish passage facility, 2009 and 2010.

Age	RV clipped Salmon		Non-Clipped Salmon	
	2009	2010	2009	2010
0	0	17	0	0
1	29	56	6	40
2	2	9	1	4
Total	**31**	**82**	**7**	**44**

Table 7. Summary of average water temperature measurements on the Winooski River and its tributaries in 2010. Temperature measurements are in Celsius with maximum temperatures in parentheses. Measurements from May 1 – October 14, 2010.

River	**May**	**June**	**July**	**August**	**September**	**October**
Huntington – 5.3 km	13 (26)	16 (24)	21 (29)	20 (28)	17 (28)	9 (17)
Mill Brook	13 (23)	16 (22)	20 (27)	19 (23)	16 (24)	10 (17)
Duck Brook	12 (19)	14 (18)	18 (22)	16 (20)	14 (21)	10 (16)
Winooski River - Jonesville	14 (24)	18 (24)	22 (28)	21 (26)	18 (27)	12 (17)
Ridley Brook	11 (18)	14 (18)	18 (21)	16 (20)	14 (20)	10 (16)

Table 8. Population estimates (with standard error) and calculated densities by age class for landlocked Atlantic salmon collected in the Huntington River in 2010.

Tributary	Age group	Sample Size	Population Estimate	Density (no./unit)	95% C.I.
Huntington 0.9	0+ 1+	11 1	nd	nd	
Huntington 7.7	0+ 1+	54 8	55 ± 1.6 8	3.3 0.5	3.2 – 3.4 0.5 – 0.5

Table 9. Population densities and survival estimates by age groups for the 2009 and 2010 age class of landlocked Atlantic salmon in the Huntington River.

Tributary	Density (no./salmon unit)			Survival (percent)			Fry/0+ Surival 95% C.I.
	Fry	0+	1+	Fry/0+	0+/1+	Fry/1+	
2009 Year Class							
Huntington 0.9	118	3.2	nd	2.7	nd	nd	2.2 – 3.3
Huntington 7.7 km	32	5.2	0.5	16.2	9.6	1.6	13.4 – 20.0
2010 Year Class							
Huntington 0.9	35	nd	nd	nd	nd	nd	nd
Huntington 7.7 km	35	3.3	na	9.4	na	na	9.1 – 9.7

Table 10. Summary of mean total lengths of young-of-year trout collected in Winooski River tributaries in 2010. All lengths in millimeters ± one standard deviation.

Tributary	Date	Rainbow trout	Brown trout	Brook trout
Mill Brook	9/2	80.6 ± 8.3 n = 82	84.3 ± 4.8 n = 12	78.0 n = 1
Huntington 7.7 km	8/31	---	77.0 ± 6.1 n = 3	95.0 n = 1
Huntington 0.9 km	8/25	76.3 ± 7.1 n = 37	76.9 ± 7.1 n = 7	---
Preston Brook	9/1	72.4 ± 7.0 n = 55	80.3 ± 7.6 n = 7	69.3 ± 3.1 n = 10
Ridley Brook	9/1	66.8 ± 8.5 n = 116	78.2 ± 6.9 n =6	63.7 ± 2.4 n = 12
Pinneo Brook	9/2	65.2 ± 7.4 n = 33	---	64.8 ± 8.0 n = 25

Table 11. Population estimates for salmon and trout collected in Winooski River tributaries in 2010.

LEGEND

Stream – Name of tributary; may be followed by river kilometer from mouth of stream
Elev. – Elevation (feet)
Date – Day, month
Len. – Survey section length (feet)
Wth – Average stream width (feet)

Species –
RBT = Rainbow trout
BNT = Brown trout
BKT = Brook trout
LLS = Landlocked Atlantic salmon

Class – Size/age class
YOY – young-of-year
<6 – yearling or older trout measuring less than 6.0 inches total length
6-9.9 - yearling or older trout measuring between 6.0 and 9.9 inches total length
10 - yearling or older trout measuring between 10.0 and 11.9 inches total length
12+ - yearling or older trout measuring greater than 11.9 inches total length
1+ and 2+ - Salmon age class

Num – Number of fish collected
Est. – Population estimate
UpCi/LoCi – Upper and Lower 95% confidence interval expressed as a percentage of the population estimate

Popmi – Population estimate expressed as number per mile
Popkm - Population estimate expressed as number per kilometer

MnWt – Mean weight of fish (grams)
Lbac – Estimated pounds per acre
Kghec – Estimated kilograms per hectare

Table 11. Population estimates for salmon and trout collected in Winooski River tributaries in 2010

Stream	Elev.	Date	Len	Width	Species	Class	Num	Est.	LOCI	UPCI	Popmi	Popkm	Mn Wt	Lbac	Kghec
Huntington River 7.7	590	31-Aug	480	37.9	LLS	YOY	54	55	1.8	5.7	605	376	5.5	1.59	1.78
						1+	8	8	0.0	0.0	88	55	36.1	1.53	1.71
							62				693	431		3.12	3.49
					RBT	12+	2	2	0.0	0.0	29	18	344.5	8.90	9.98
					BNT	YOY	3	3	0.0	0.0	43	27	3.7	0.14	0.16
						6-10	1	1	0.0	0.0	14	9	48.0	0.62	0.70
							4				57	36		0.76	0.86
					TOTALS		**68**				**779**	**485**		**12.78**	**14.33**
Mill Brook	300	2-Sep	316	24.8	RBT	YOY	82	84	2.4	5.2	1404	872	5.1	5.28	5.92
						<6	1	1	0.0	143.8	17	10	31.0	0.38	0.43
						6-10	1	1	0.0	0.0	17	10	45.0	0.55	0.62
							84				1438	892		6.21	6.97
					BNT	YOY	12	12	0.0	15.4	201	125	5.5	0.81	0.91
						6-10	1	1	0.0	0.0	17	10	76.0	0.93	1.04
							13				218	135		1.74	1.95
					BKT	YOY	1	1			17	10	8.0	0.04	0.04
					TOTALS		**98**				**1673**	**1037**		**7.99**	**8.96**
Pinneo Brook	370	2-Sep	371	8.8	RBT	YOY	33	33	0.0	4.0	470	292	2.8	2.73	3.07
					BKT	YOY	25	27	7.4	20.1	384	239	2.8	2.25	2.53
						<6	5	5	0.0	0.0	71	44	17.0	2.50	2.80
							30				455	283		4.75	5.33
					TOTALS		**63**				**925**	**575**		**7.48**	**8.40**

Table 11. (continued)

Stream	Elev.	Date	Len	Width	Species	Class	Num	Est.	LOCI	UPCI	Popmi	Popkm	Mn Wt	Lbac	Kghec
Preston Brook	365	1-Sep	342	16	RBT	YOY	55	62	11.3	17.8	957	595	3.5	3.80	4.26
						<6	2	2	0.0	0.0	31	19	21.5	0.75	0.85
							57				988	614		4.55	5.11
					BNT	YOY	7	7	0.0	24.3	108	67	5.0	0.61	0.69
						<6	1	1	0.0	0.0	15	10	17.0	0.30	0.33
							8				123	77		0.91	1.02
					BKT	YOY	10	10	0.0	16.8	154	96	3.8	0.67	0.75
						<6	4	4	0.0	0.0	62	38	8.0	0.56	0.63
							14				216	134		1.23	1.38
					TOTALS		**79**				**1327**	**825**		**6.69**	**7.51**
Ridley Brook	360	1-Sep	368	20.2	RBT	YOY	116	120	3.3	5.0	1722	1070	2.9	4.51	5.06
						<6	2	2	0.0	101.7	29	18	19.5	0.50	0.56
						6-10	1	1	0	0	14	9	37.0	0.48	0.54
							119				1765	1097		5.49	6.16
					BNT	YOY	6	6	0.0	45.1	86	53	4.3	0.34	0.38
					BKT	YOY	12	12	0.0	19.1	172	107	2.4	0.37	0.42
						<6	1	1	0.0	0.0	14	9	29.0	0.37	0.42
							13				186	116		0.74	0.84
					TOTALS		**138**				**2037**	**1266**		**6.57**	**7.38**

Table 12. Summary of out-migrating smolt trapping on the Huntington River, 2004 – 2011.

Year	Start Date	End date	Days Fished	Number new , unmarked Trapped	Number Marked and released[1]	Number Recaptured	Estimate	Trap style[2]
2011	May 9	May 26	10	43	na	2	na	New
2010	April 19	June 1	41	205	214	16	1,783	New
2009	April 16	June 12	52	76	88	16	418	New
2008	April 24	June 13	49	360	412	66	2,247	New
2007	May 1	June 15	44	288	276	19	4,184	New
2006	April 11	June 9	49	60	39	0	Nd	Old
2005	April 14	June 9	49	126	135[3]	6	2,835	Old
2004	May 6	June 4	25	57	0	na	na	Old

1 Includes recaptured smolts released again.
2 The old trap had a 1.8 meter diameter; the new trap has a 2.4 m diameter.
3 Includes 35 hatchery smolts.

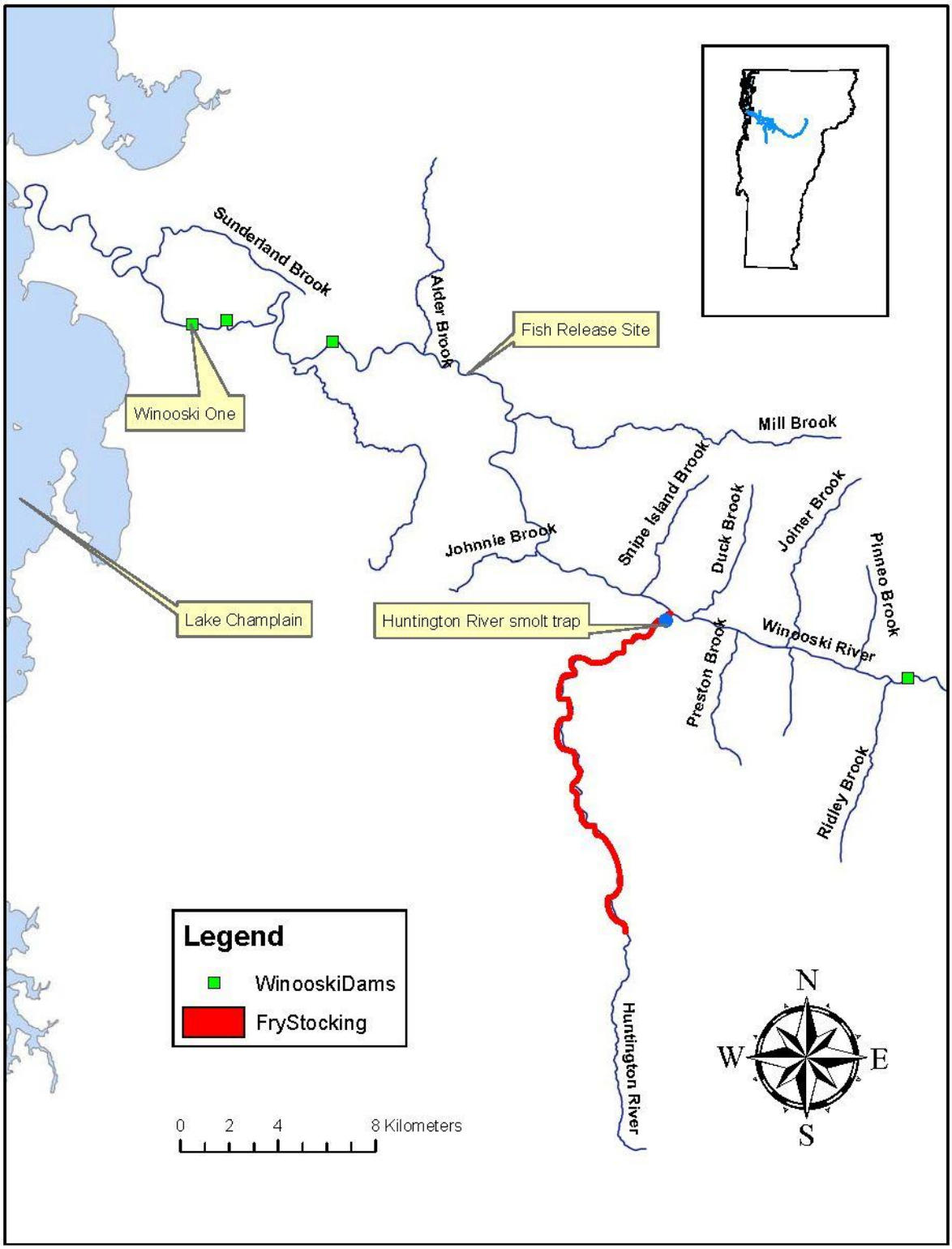


Figure 1. Map of lower Winooski River drainage showing Winooski One Dam, the fish release site, named tributaries, and fry stocking areas.

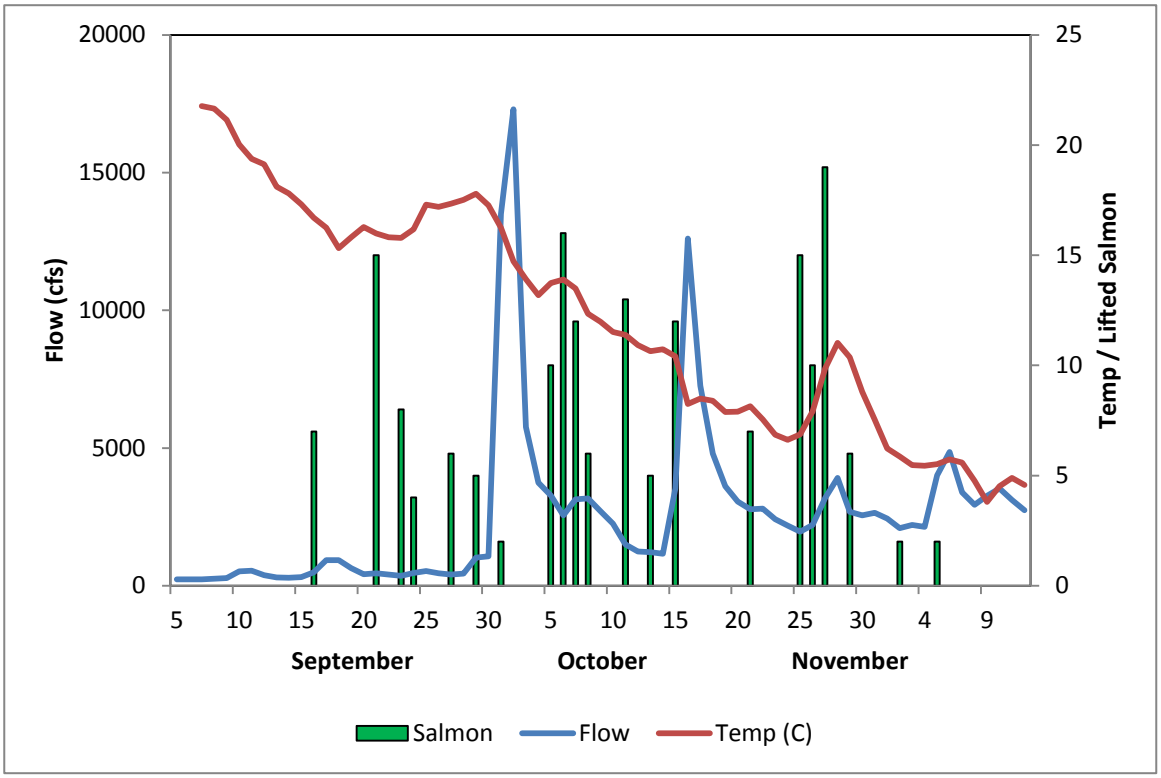


Figure 2. Comparison of 2010 fall river flows (cubic feet per second), mean water temperatures (Celsius) and numbers of salmon processed by date at the Winooski One fish facility.

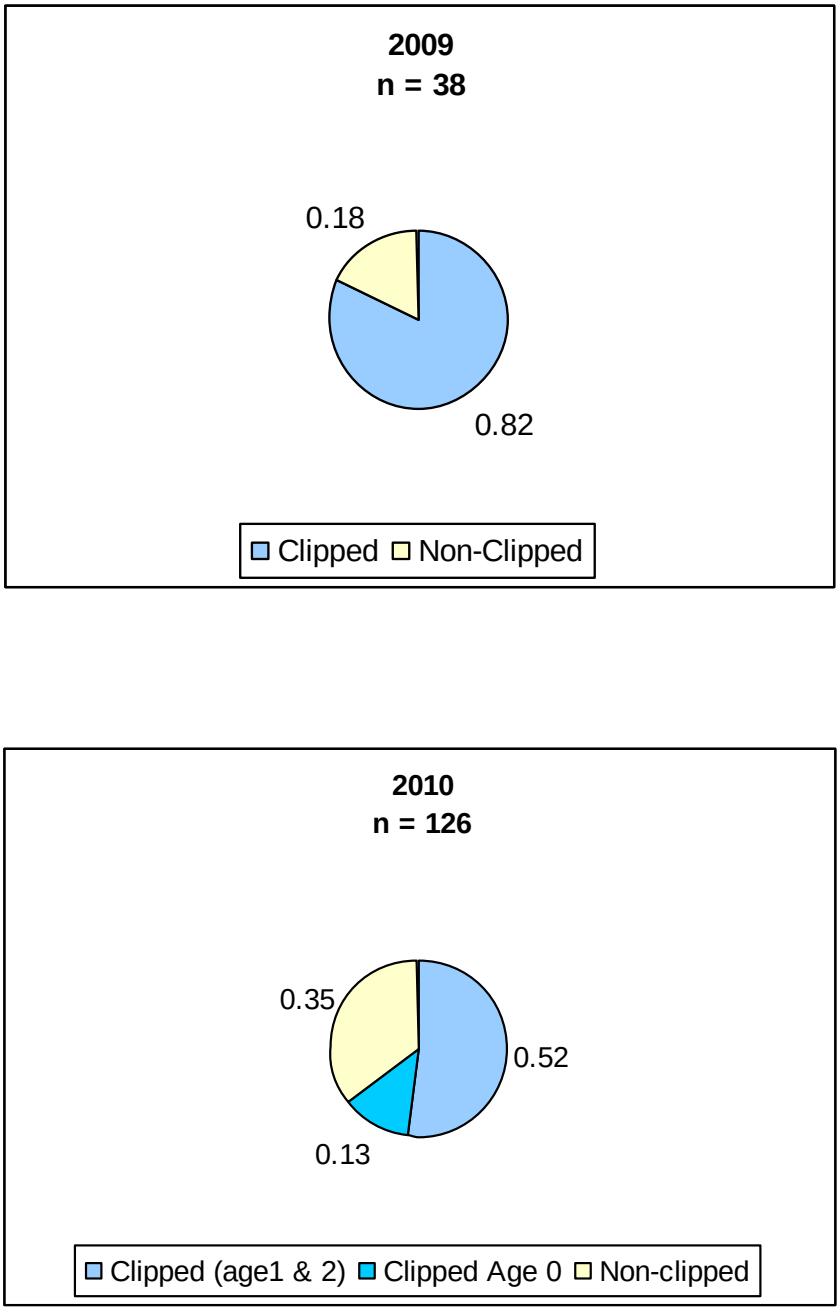
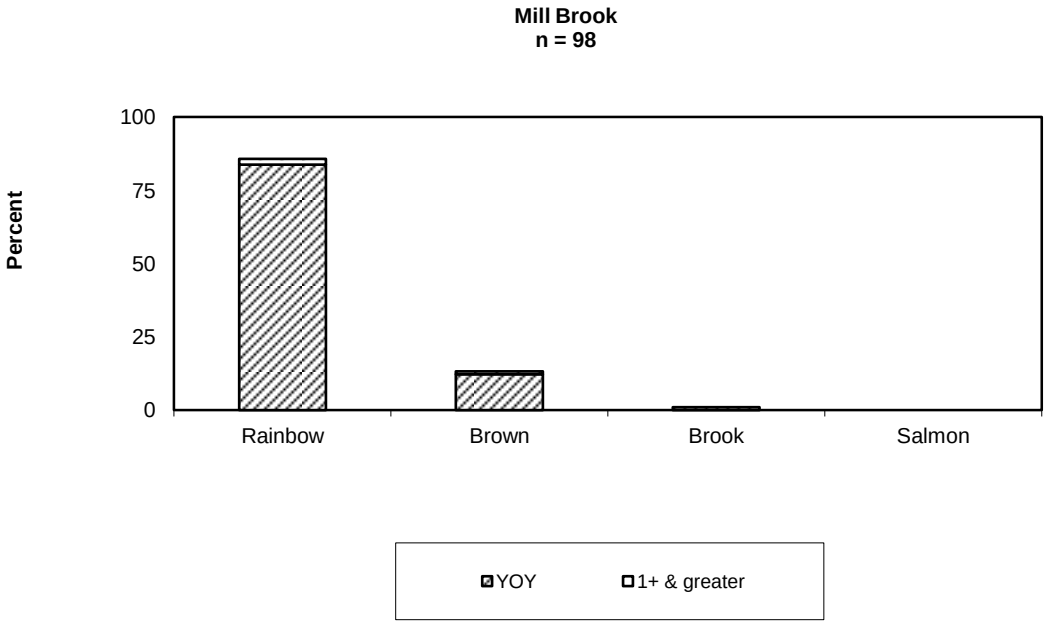


Figure 3. Comparison of percent composition of clipped and non-clipped salmon collected at the Winooski One lift in the fall of 2009 and 2010.



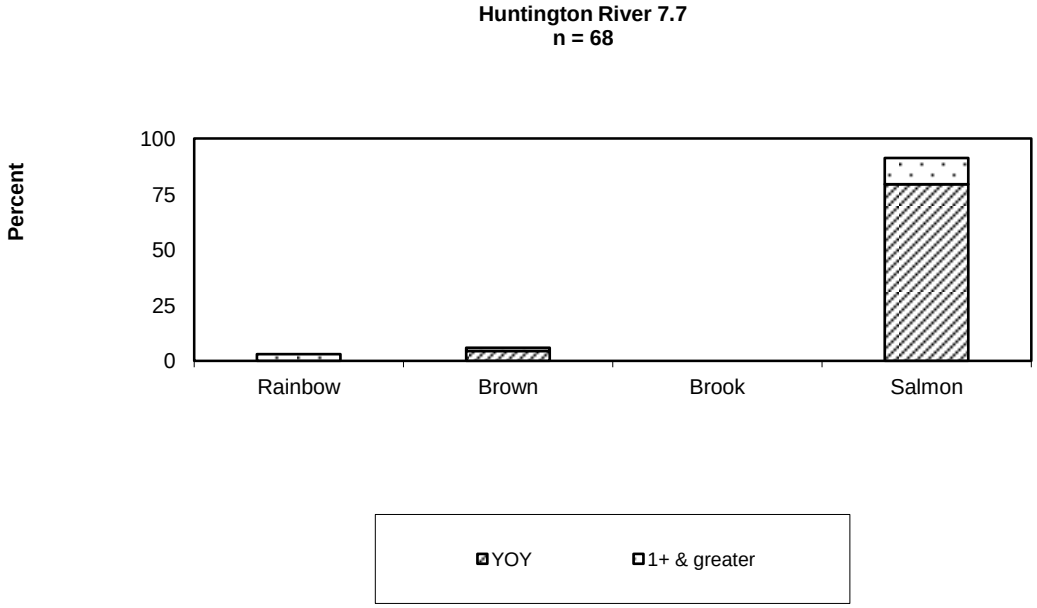
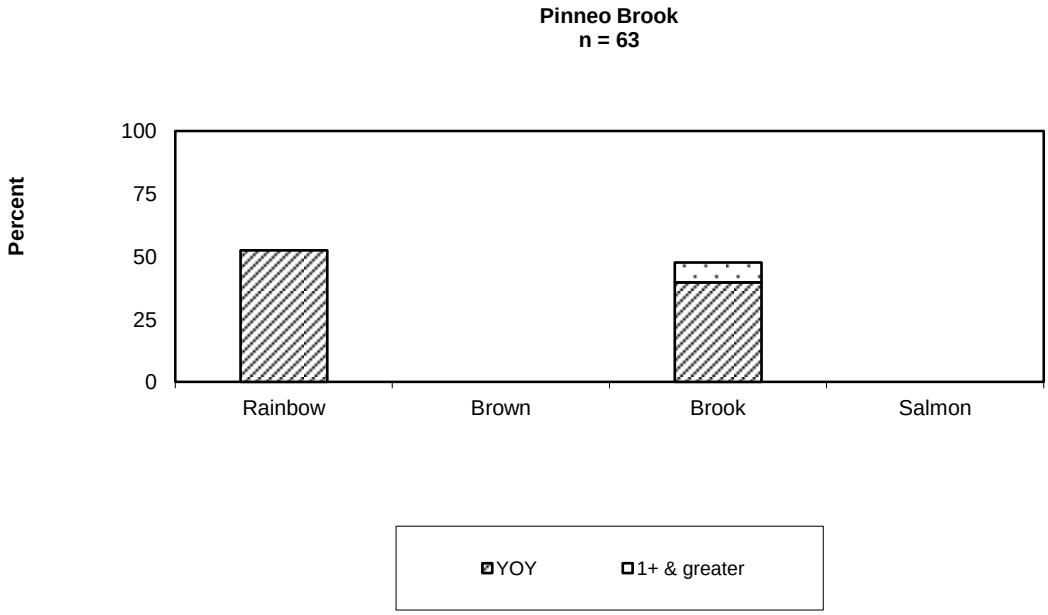


Figure 4. Percent composition of trout and salmon collected by site in 2010.



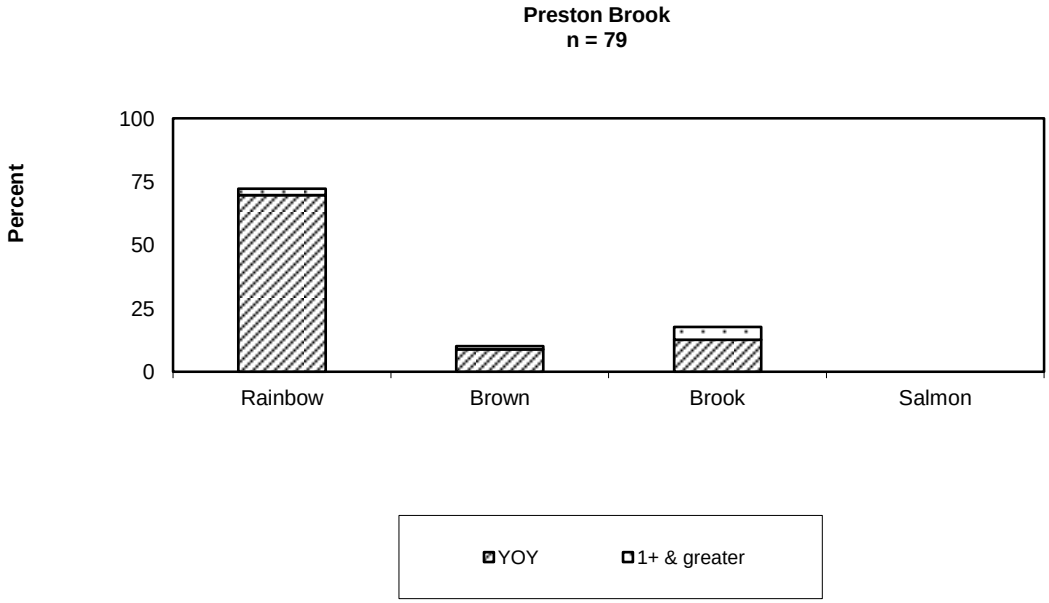


Figure 4. Continued.

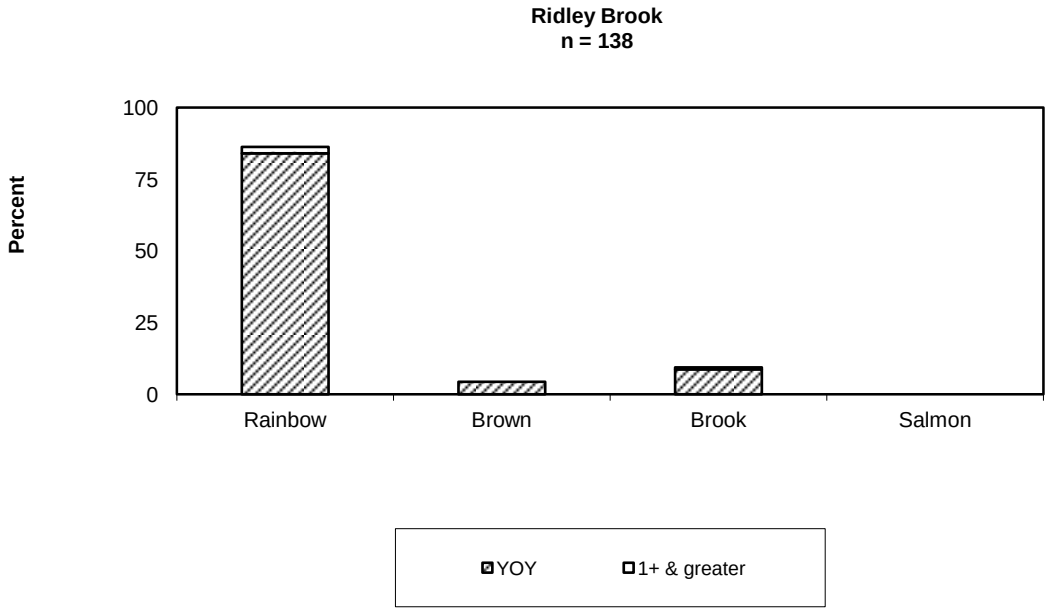


Figure 4. Continued.

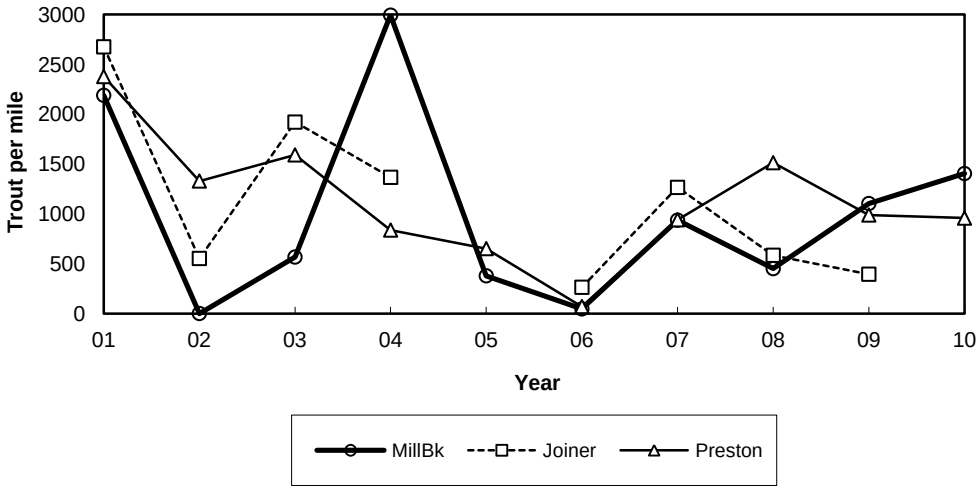


Figure 5. Estimated number per mile of young-of-year rainbow trout for Mill, Joiner, and Preston Book, 2001 – 2010.

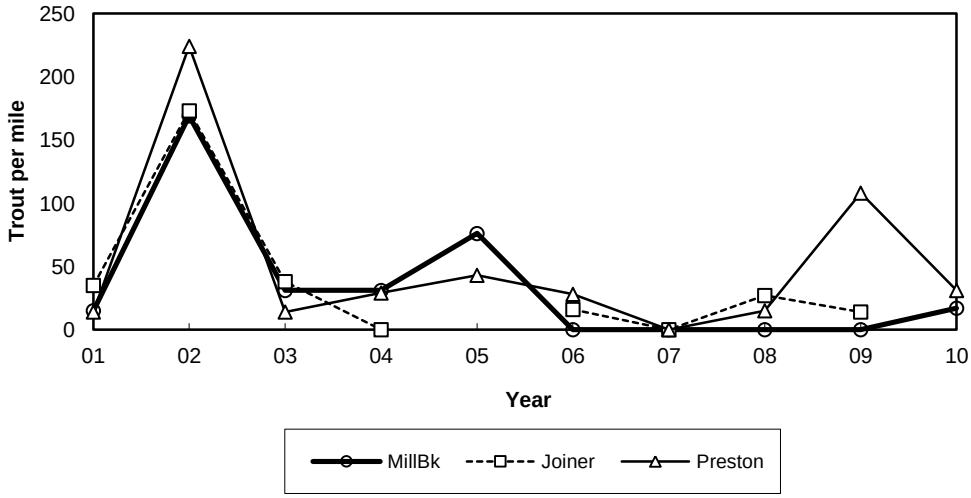


Figure 6. Estimated number per mile of the 100-152 mm length class (age 1+) rainbow trout for Mill, Joiner, and Preston Book, 2001 – 2010.

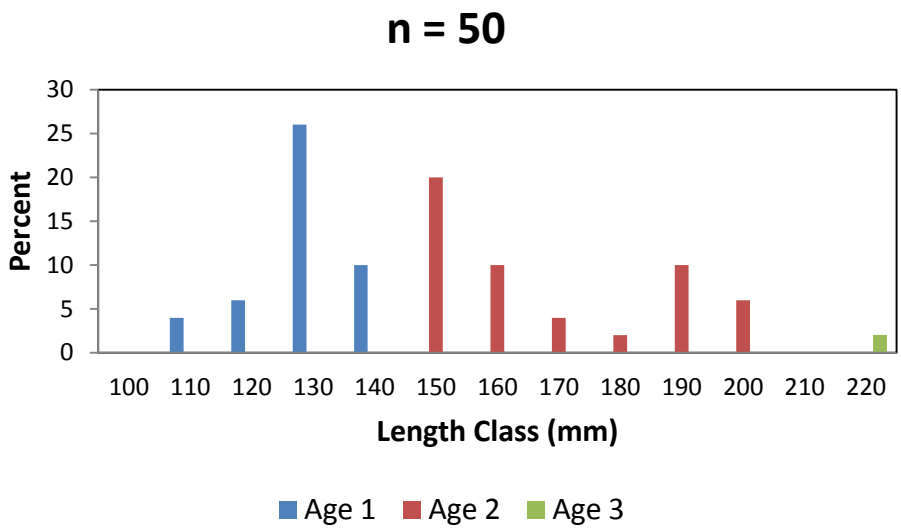


Figure 7. Length/age frequency graph expressed as a percent of landlocked Atlantic salmon smolts trapped in the Huntington River, 2011.

Lake Trout Trapnet Survey – Hatchery Cove & Button Bay

Hatchery Cove Trapnetting:

Two trapnets were set in Hatchery Cove near the Ed Weed Fish Culture Station to evaluate an alternative technique for capturing lake trout and landlocked Atlantic salmon returning to the Hatchery Cove area for spawning. Electrofishing is currently used to capture most salmonids for the Lake Champlain Salmonid restoration evaluation.

Trapnets were set in two locations in Hatchery Cove on Tuesday, 11/09/10, and pulled on Friday, 11/12/10 (Figure 1). The trapnet crib measured 6’ × 6’ × 11’4” and was made of 380-18 black knotted polypropylene twine. Mesh size measured 1 ¾-inch stretched. The trapnet had 2 attached 6’ × 25’ wings set on a 45° angle to the lead line. The lead line was 6’ × 150’ long with 2 ½-inch stretched mesh made from twine of the same type and weight as the rest of the trapnet. One trapnet was set just north of Hatchery Brook and the other trapnet was set north of the first net near the water intake for the hatchery.

A boat was left at the site, which reduced the time required to monitor the net. The boat was locked with a chain to a large cable on shore beneath the street light at the end of the ferry dock. The trap was emptied each day. Three people were usually involved with emptying the net, processing the fish, and transporting fish.

Lake trout and landlocked Atlantic salmon were measured for total length, examined for fin clips and sea lamprey wounds, sexed, marked with a lower caudal fin punch and released. Sea lamprey were measured for total length and destroyed. Non-target species were counted and released. Twenty lake trout pairs were spawned for a study of thiamine levels by researchers at the University of Vermont.

Figure 1. Locations of trapnets set in Hatchery Cove in 2010. Hatchery Brook is to the right of Trapnet #1.

Results:

Two trapnets were set the first day of sampling but too many fish were caught for three people to process during the day. For the remainder of the sampling both nests were left in the water but the entrance to one net was closed each day. We alternated the net that was fished each day. All fish from the first net checked on day 1 were measured but fish from the second net were just counted, marked with a lower caudal finclip and released. Lamprey were not processed on the first day but were for the remainder of the sampling. Water temperature was 48.2 F during the sampling period.

Catch:

A total of 989 lake trout were captured during the 3 nights of sampling in 2010 (Table 1). Eighteen lake trout were recaptured. One lake trout was captured that had been collected by electrofishing at night earlier in the week. The average lake trout catch rate was 247 lake trout per overnight trapnet set.

A total of 792 lake trout were measured, the remainder of the lake trout that were caught but not measured were recaptures or were from the second net checked on the first day of sampling. These fish were counted, marked, and released. The average total lengths (TL) of male and female lake trout were 26.9 and 28.0 inches respectively with males ranging in length from 20.1 to 32.4 inches and females ranging in length from 22.1 to 33.9 inches (Figure 2).

No fin clips were seen on 14 of the 792 lake trout examined for marks. The most common finclip seen on lake trout was a Right Pectoral (RP) clip (Table 2).

Of the 345 female lake trout processed, 63 (18%) were spent, 152 (44%) were running ripe, and 130 (79%) were green.

Forty lake trout were spawned to monitor thiamine levels in lake trout eggs. A sample of unfertilized eggs was collected from 20 females to determine thiamine levels. A small number of eggs from each female were fertilized. These eggs were brought to the University of Vermont where they were to be reared to hatching to see if fry exhibited symptoms of Early Mortality Syndrome caused by a diet high in alewives. All of these eggs died before hatching. Twenty of the lake trout that were spawned were killed for disease testing.

Nets were set about 2 weeks later in the year than they were set in 2009. Catch rate was substantially higher in 2010, 247 lake trout per set versus 86 in 2009. Average lengths of male and female lake trout were larger in 2010 with males averaging 24.9” in 2009 versus 26.0” in 2010 and females averaging 26.3” and 28.0” in 2009 and 2010.

A total of 56 landlocked Atlantic salmon were captured in 2010. Twenty one salmon were measured and the remainder were marked and released on the first day of sampling. Right Ventral (RV) finclips were found on 19 of the 21 salmon examined for marks. The other 2 salmon were unmarked. The average total length (TL) of male landlocked Atlantic salmon was 19.8 inches with males ranging in length from 15.4 to 24.2 inches (Figure 4). Female salmon averaged 20.7 inches TL and ranged in length from 17.7 to 23.0 inches (Figure 5).

Lamprey numbers and sizes were not recorded on the first day of sampling. Twenty four sea lamprey, ranging in size from 13.9 to 20.9 inches TL, were captured on the next 2 days of sampling (Table 1). All sea lamprey were killed.

Table 1. Number of fish caught each day in trapnets set at Hatchery Cove, Lake Champlain, 2010

Date	Lake Trout	Salmon	Lamprey
11/10/10	467	38	NA
11/11/10	273 (11 recaps)	3	13
11/12/10	249 (7 recaps)	15	11
Totals	**989**	**56**	**24**

Table 2: Fin clips observed on salmonids collected in trapnets set in Hatchery Cove, 2010 (N = sample size).

Species	N	Fin Clip Observed										
		None	AD	RV	LV	RP	LP	AD/ RV	AD/ RP	AD/ LV	LV/ RP	RV/ LV
Landlocked Atlantic Salmon	21	2		19								
Lake Trout	792	14	106	166	71	309	117	1	1	4	2	1

Wounding Rates

A total of 127 lake trout were captured that fell within the 533mm-633mm total length (TL) slot size used for the sea lamprey wounding rate assessment. The lamprey wounding rate for lake trout with fresh (A1) and healing (A2 & A3) wounds was 31 wounds per 100 fish (Table 3). Lamprey wounding rates in the two larger size ranges were higher, 44 and 56 wounds per 100 fish respectively (Table 3).

A total of 11 landlocked Atlantic salmon were measured that fell within the 432mm-533mm slot size used for the sea lamprey wounding rate assessment. The lamprey wounding rate for salmon with fresh (A1) and healing (A2 & A3) wounds was 0 wounds per 100 fish (Table 3).

Table 3. Lamprey wounding rates (A1, A2 & A3) on three length classes of lake trout and landlocked Atlantic salmon, collected in Hatchery Cove, Lake Champlain, November, 2010 (N = sample size).

Lake Trout			Landlocked Atlantic Salmon		
Length Categories	N	Wounds /100 fish	Length Categories	N	Wounds /100 fish
533 – 633mm	127	31	432 – 533mm	11	0
634 – 735mm	459	44	534 – 634mm	8	25
> 735mm	202	56	635 – 736mm	0	NA

Trapnetting and electrofishing catch comparison:

A comparison of the length frequency distributions of lake trout collected by trapnetting and electrofishing in 2009 indicated that larger fish were collected by electrofishing (Figures 6 & 8). Trapnetting occurred 2 weeks earlier than electrofishing in 2009.

The 2010 trapnetting occurred during the same week that electrofishing occurred. The length frequency distributions of lake trout captured by electrofishing and trapnetting were more similar to one another than the 2009 sampling. However it still appears that the electrofishing in 2010 captured a few larger fish than were collected in trapnets (Figures 7 & 9).

Summary:

Hatchery Cove is an excellent site for collecting salmonid with trapnets. Large numbers of salmon and lake trout, attracted by the Ed Weed Fish Culture Station outflow, congregate in this location and are easily captured. The depth of the cove (approximately 8' maximum) allowed the trapnet to fish effectively by covering most of the water column. The site is well-protected from the wind and a boat can be left on site which reduces daily travel time as well as increasing the number of days that can be sampled due to weather conditions. Fishing more than one net per day may require more than 3 people to process the fish.

Button Bay trapnetting:

Two trapnets were set at two locations on Button Bay Island on November 1, 2010 and pulled on November 3 (Figure 10). Only 3 lake trout were captured at this site in two days of sampling. All were spent females. No landlocked salmon were captured.

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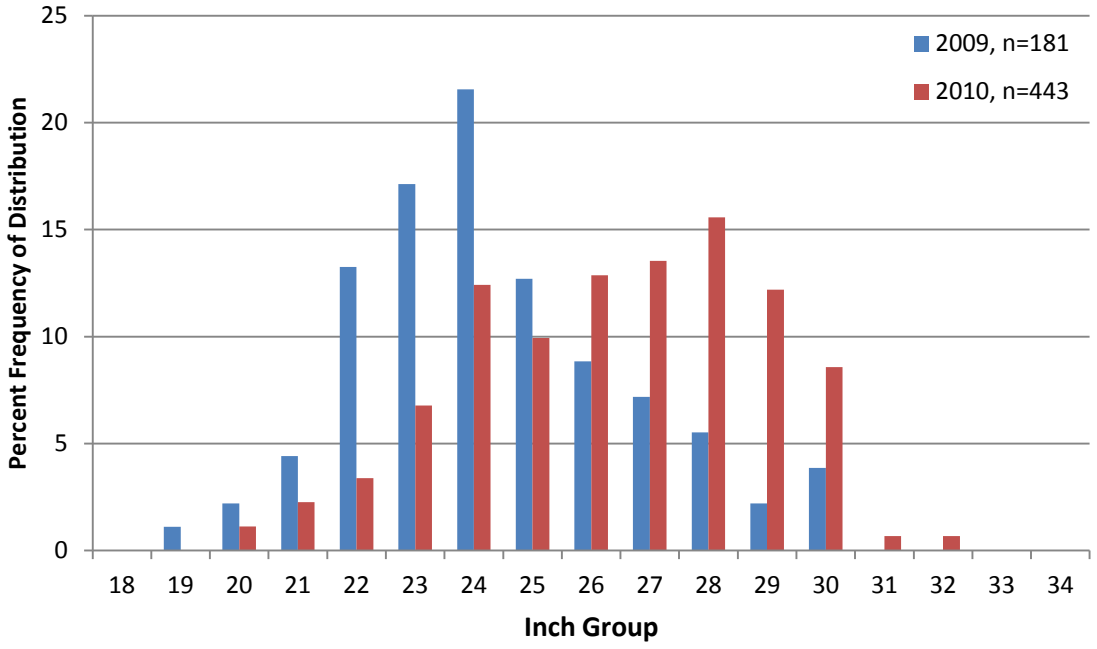

Figure 2: Length distribution of male lake trout captured in Hatchery Cove by trapnetting, 2009 and 2010.

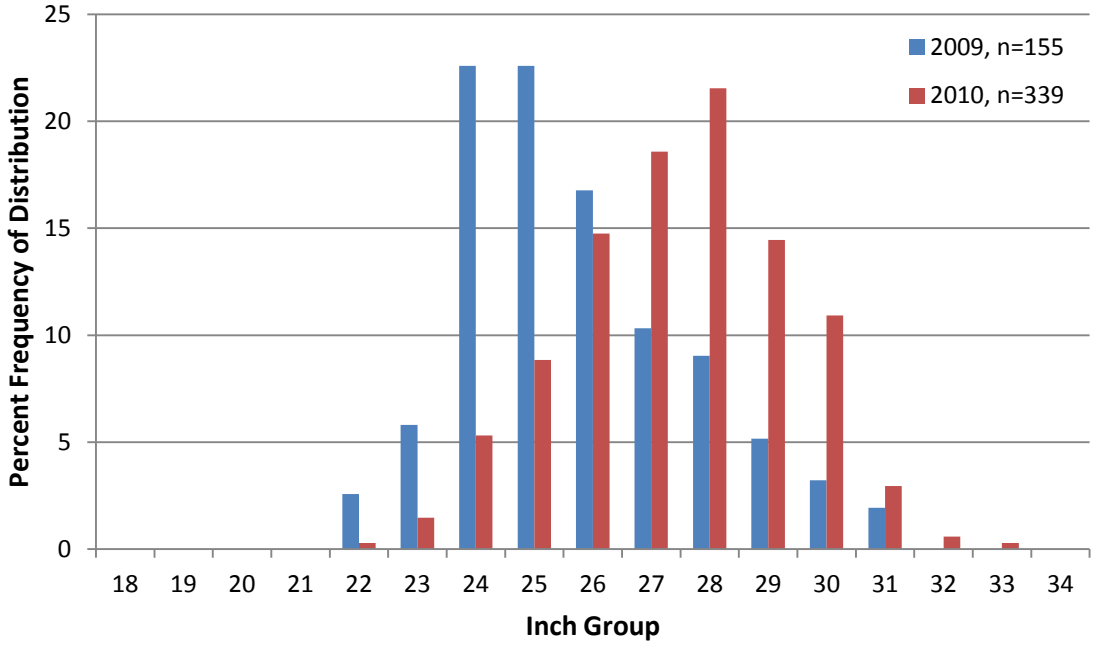

Figure 3: Length distribution of female lake trout captured in Hatchery Cove by trapnetting, 2009 and 2010.

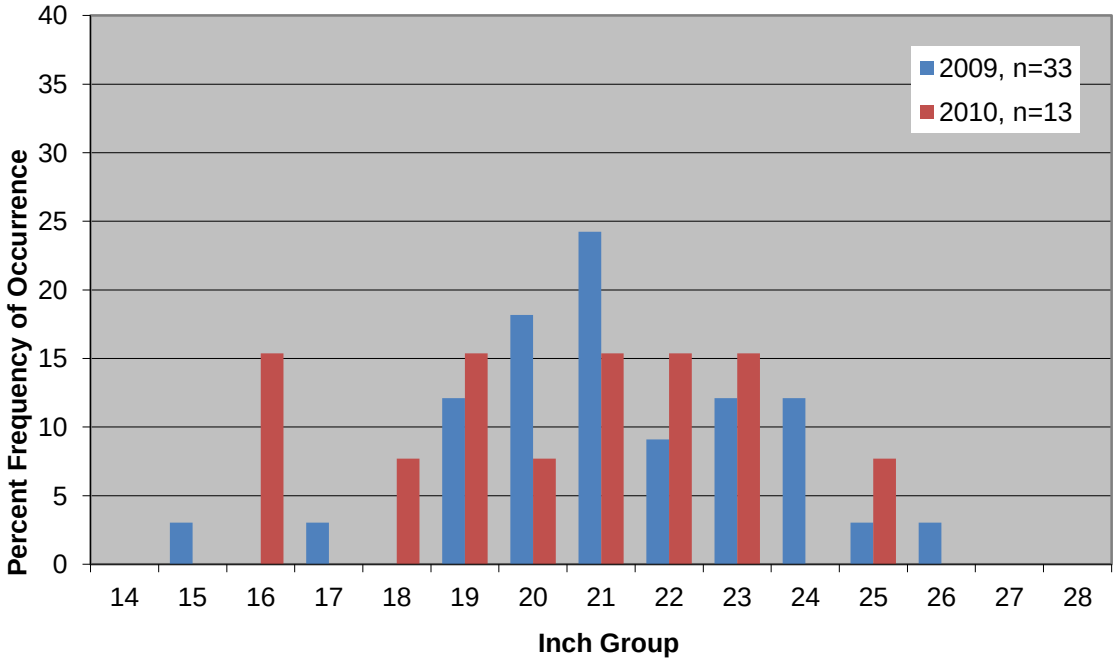

Figure 4: Length distribution of male landlocked Atlantic salmon captured in trapnets, Hatchery Cove, 2009 and 2010.

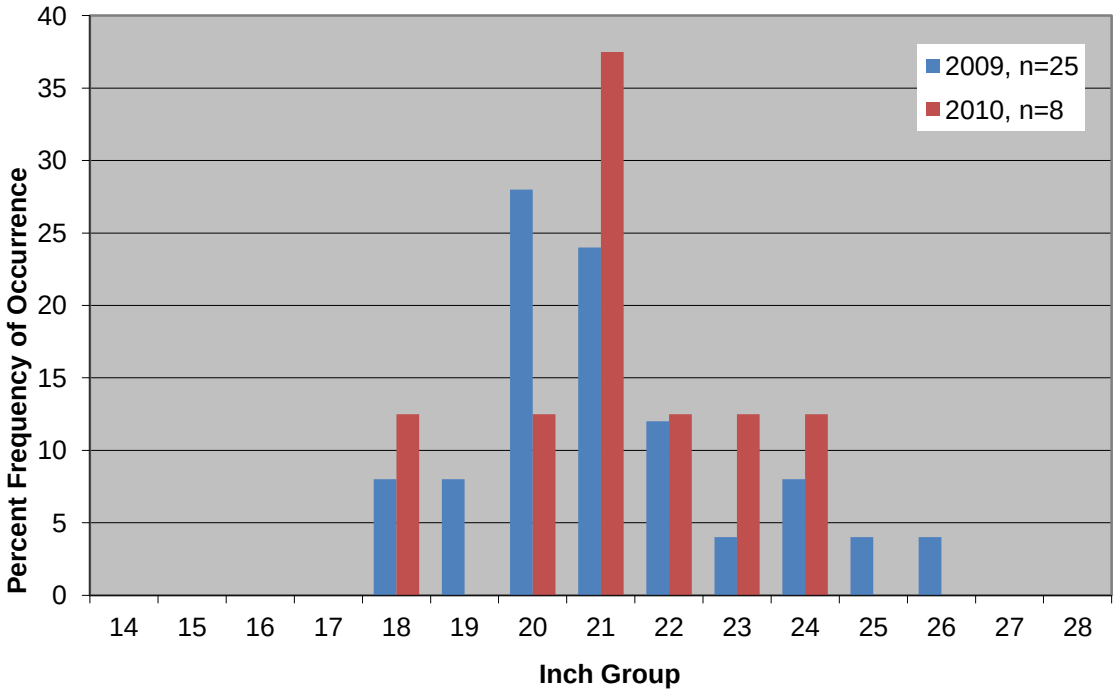

Figure 5: Length distribution of female landlocked Atlantic salmon captured in trapnets, Hatchery Covet, 2009 and 2010.

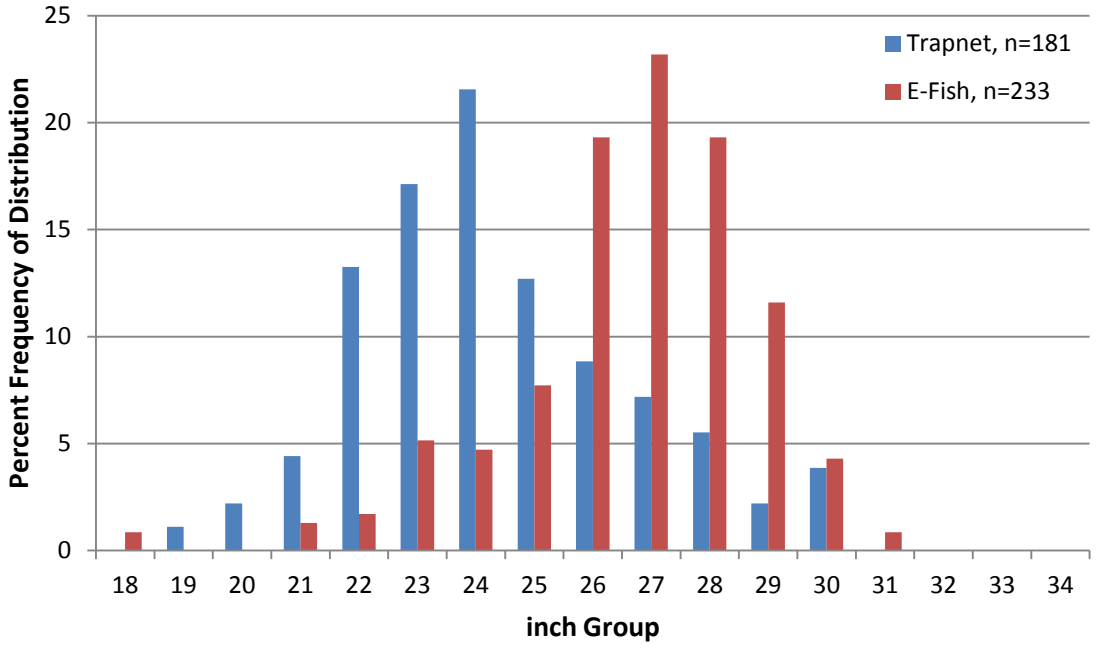

Figure 6: Length distribution of male lake trout captured by trapnetting (October 27-30) and electrofishing (November 11), Hatchery Cove, 2009.

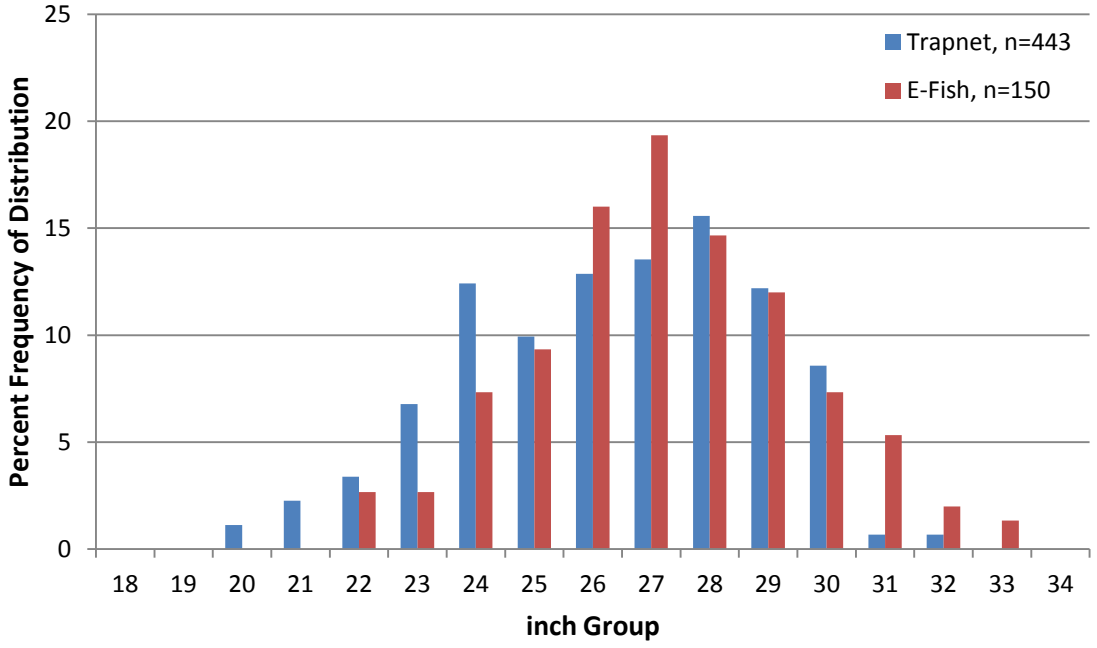

Figure 7: Length distribution of male lake trout captured by trapnetting (November 10-12) and electrofishing (November 11), Hatchery Cove, 2010.

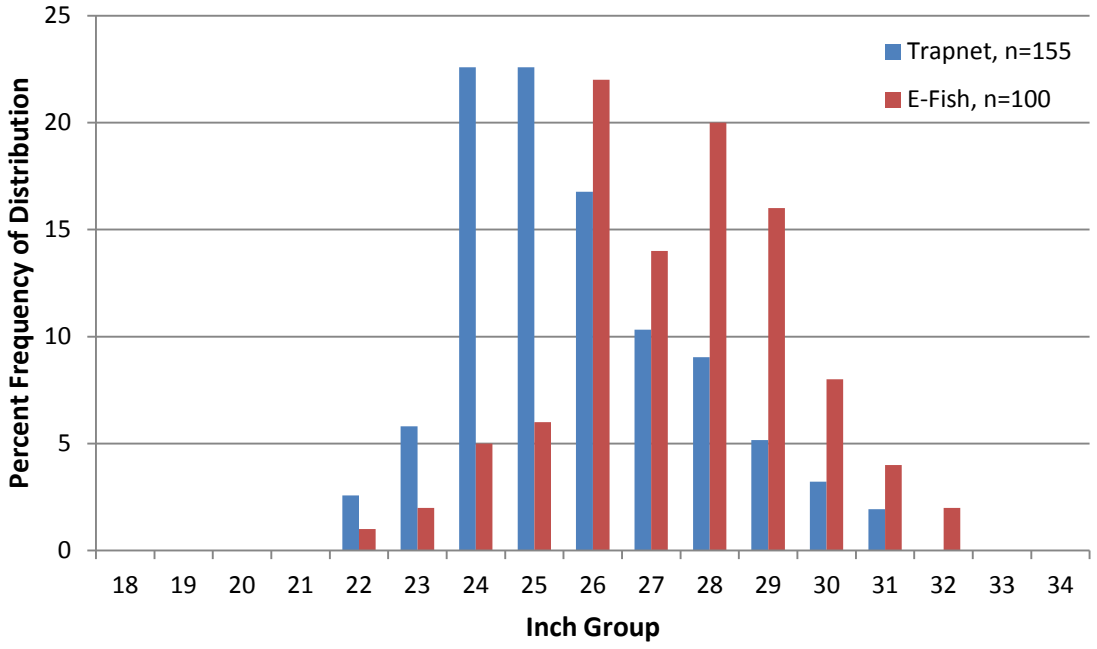

Figure 8: Length distribution of female lake trout captured by trapnetting (October 27-30) and electrofishing (November 11), Hatchery Cove, 2009.

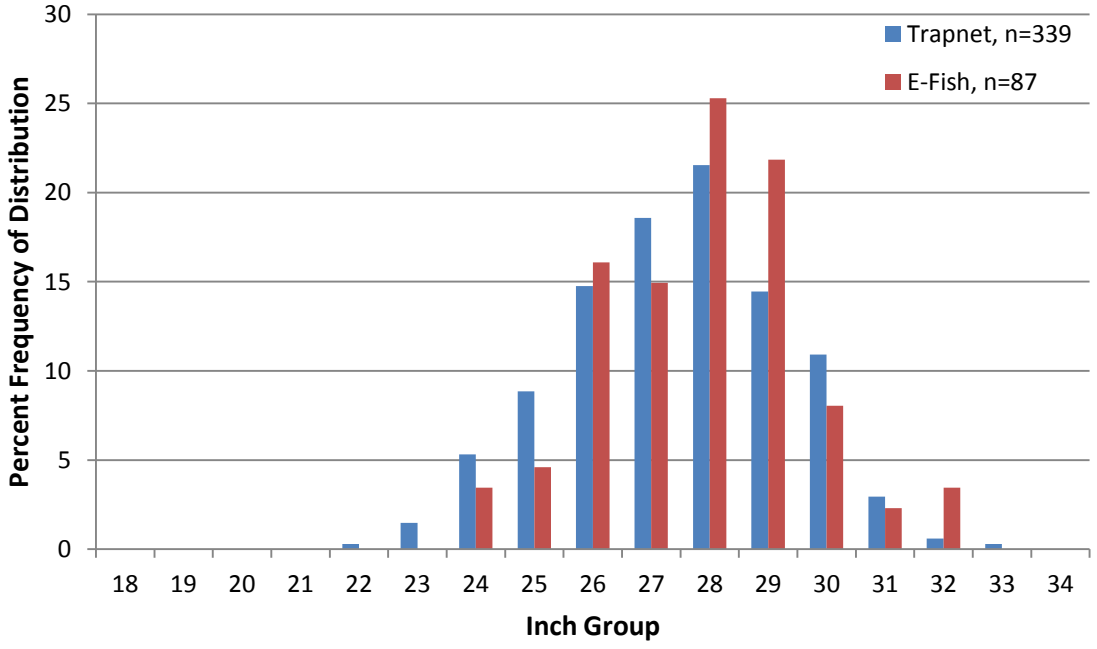

Figure 9: Length distribution of female lake trout captured by trapnetting (November 10-12) and electrofishing (November 11), Hatchery Cove, 2010.

Figure 10: Location of trapnets set off Button Bay Island, 2010.