Vermont Fish and Wildlife Department
Annual Report

State: Vermont **Project No**.: F-35-R-12

Grant Title: Lake Champlain Fisheries Restoration and Management

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

Period Covered: July 1, 2009 to June 30, 2010

Summary of Activity:

Fall electrofishing surveys of selected Lake Champlain tributaries and nearshore areas yielded collections of 932 landlocked Atlantic salmon, 749 lake trout, 28 steelhead rainbow trout and 24 brown trout. A total of 384 spawning adult Sebago strain salmon collected 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 increased from 31 wounds per 100 fish in 2008 to 55 wounds per 100 fish in 2009. However, wounding rates on 432-533 mm TL salmon decreased over the same period: from 35 to 31 wounds per 100 fish in the Main Lake basin, and from 50 to 38 wounds per 100 fish in pooled Inland Sea-Malletts Bay samples.

A trapnet was set and tended from October 26-30, 2009 in Hatchery Cove near the Ed Weed Fish Culture Station to evaluate an alternative technique for capturing lake trout and salmon returning to the Hatchery Cove area for spawning. A total of 342 lake trout, 59 salmon, two steelhead, and one brown trout were captured over four trap-nights; 47 of the lake trout and 56 of the salmon were transferred to the Ed Weed Fish Culture Station for gamete collection.

Winooski River Fish Passage and Landlocked Atlantic Salmon Stocking Evaluations

The Winooski One fish passage facility operated for 59 days in the fall, 2009 and 61 days in the spring, 2010. Thirty-eight landlocked Atlantic salmon and 26 steelhead rainbow trout were lifted and tagged during the fall and 13 steelhead were lifted in the spring**.** The threat of viral hemorrhagic septicemia has curtailed the movement of fish upstream at this time.

A total of 30,000 landlocked Atlantic salmon fingerlings were stocked in the Winooski River in the fall, 2009 and 31,169 salmon smolts in spring, 2010. In addition to the smolt stocking, the Huntington River was stocked with approximately 98,000 salmon fry in May, 2010.

Salmon parr were found in 4 of the 8 tributaries sampled in the early fall of 2009. Density of YOY salmon found in the Huntington River ranged from 3.2 to 5.2 fish per salmon unit. Rainbow trout made up the majority (70%) of the trout collected during surveys.

A rotary screw trap was fished in the Huntington River from April to June, 2010 to capture out-migrating salmon smolts. A total of 205 smolts were captured resulting in an estimate of 1,783 salmon smolts passing the trapping site.

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

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 and lake trout culture. In September through November 2009, 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 (Grand Isle) and adjacent lake shore, and the nearshore areas of Converse Bay, Whallon Bay, NY, and Willsboro Bay, NY (Figure 1). The Whallon Bay and Willsboro Bay 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 and 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 and 384 transferred to the

A total of 932 salmon were collected at all locations and 749 lake trout were collected at the four lakeshore areas; 28 steelhead were collected from Hatchery Brook and Willsboro Bay, while 25 brown trout were collected from Hatchery Brook, Whallon Bay and Willsboro Bay. A summary of trout and salmon sampling data is presented in Table 1. Nine of the lake trout collected (1.2%) were not marked with a fin clip. This proportion of unmarked lake trout is within normal hatchery fin clipping error rates.

A total of 384 spawning adult Sebago strain salmon collected (186 females and 190 males and 8 sex undetermined) were held as boodstock for spawning at the Ed Weed Fish Culture Station, Grand Isle, VT; 316 (82%) of these salmon were collected from Hatchery Brook, while 45 (12%)and 23 (6%) were collected from the Sandbar Causeway and Lamoille River, respectively. Sebago salmon 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 size class, and 15 wounds per 100 salmon in the 432-533 mm TL size class. Wounding on 533-633 mm TL lake trout increased to 55 wounds per 100 fish in 2009, and the larger size classes showed a similar trend (Figure 2). In contrast, the Main Lake salmon wounding rate declined slightly to 31 wounds per 100 fish (Figure 3). Wounding rates on Inland Sea/Malletts Bay salmon also declined but they remain higher than for Main Lake salmon (Figure 4).

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References

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.

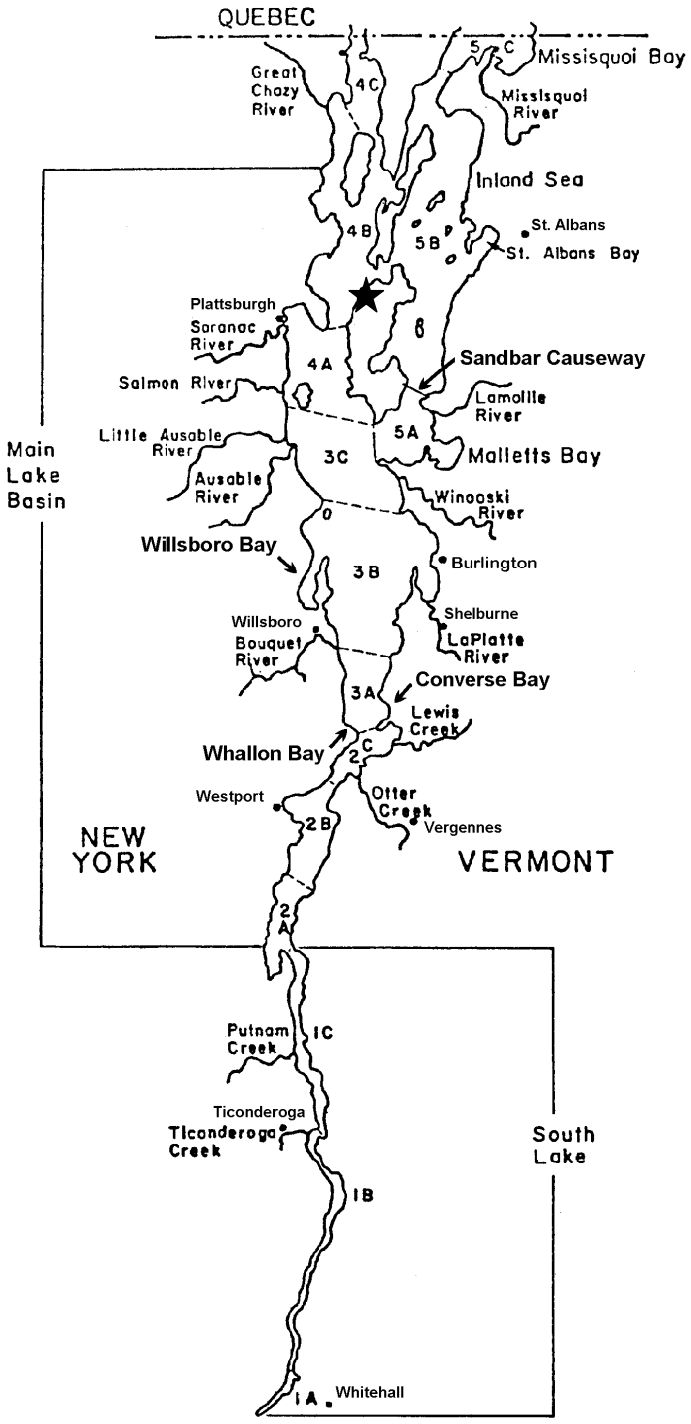

Figure 1. Lake Champlain, showing major lake basins and management zones, tributaries and salmonid sampling areas (★is the location of Hatchery Brook and ferry breakwater, Grand Isle).

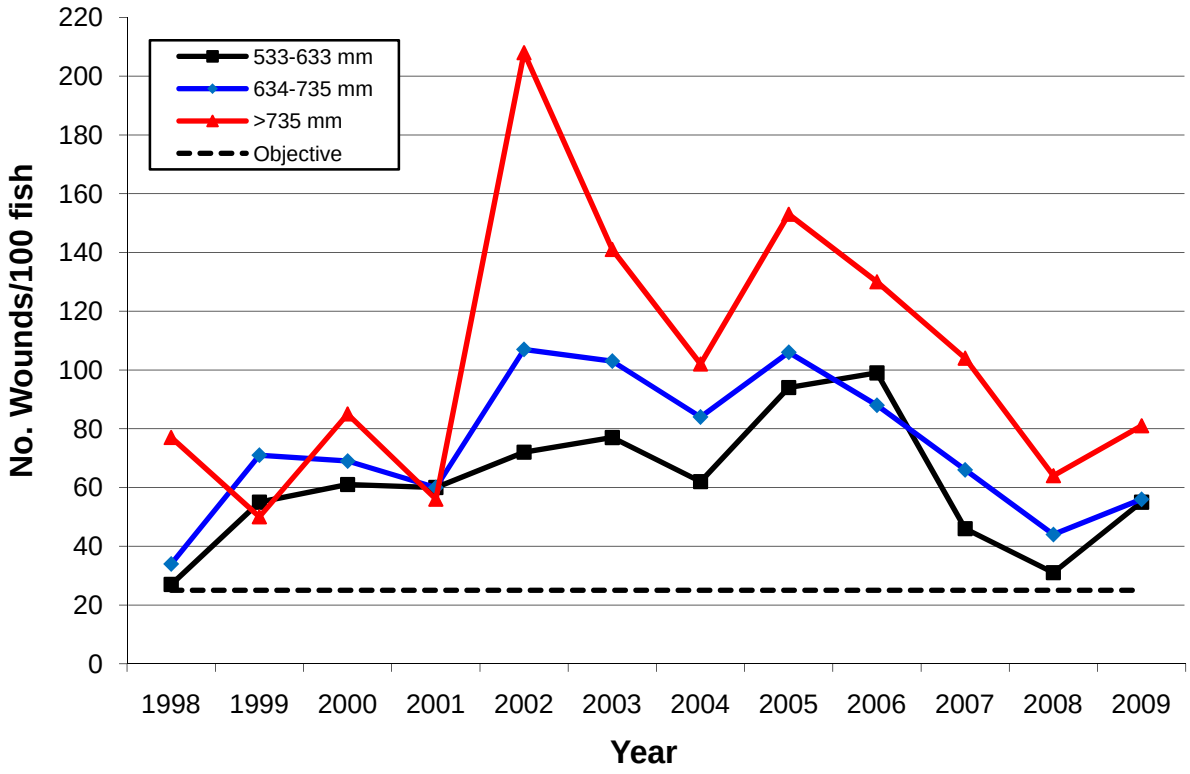

Figure 2. Lamprey wounding rates on three length classes of lake trout from Lake Champlain, 1998-2009.

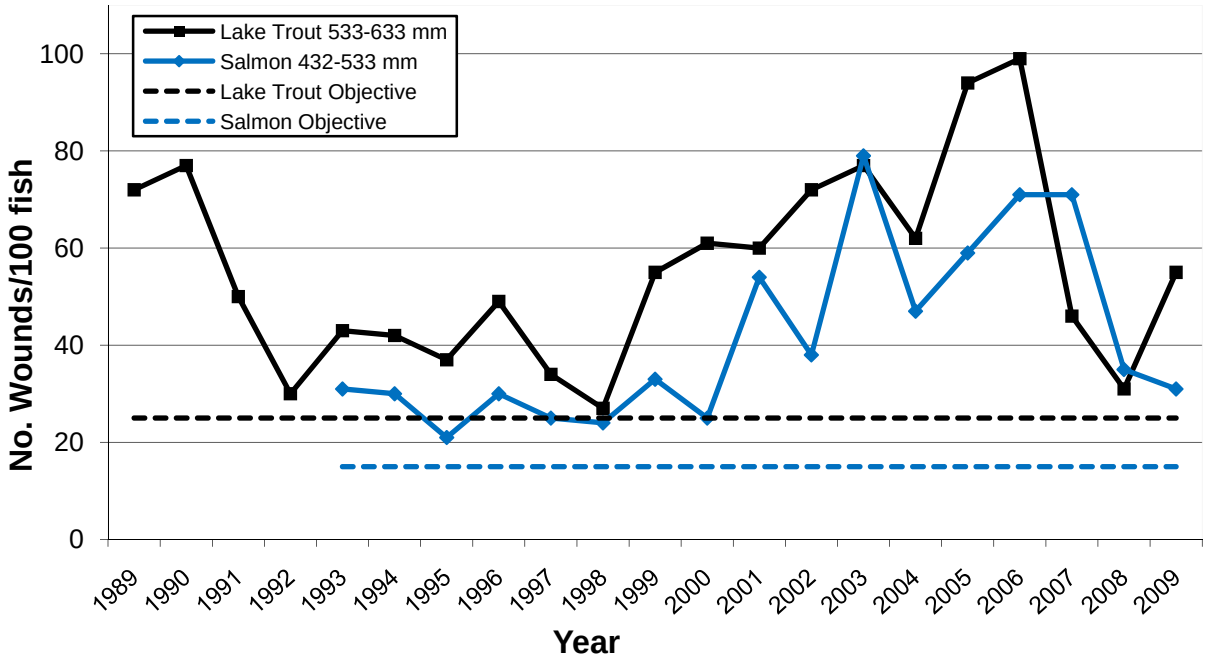

Figure 3. Lamprey wounding rates on 533-633 mm TL lake trout and 432-533 mm TL landlocked Atlantic salmon from the Main Lake basin of Lake Champlain, 1989-2009.

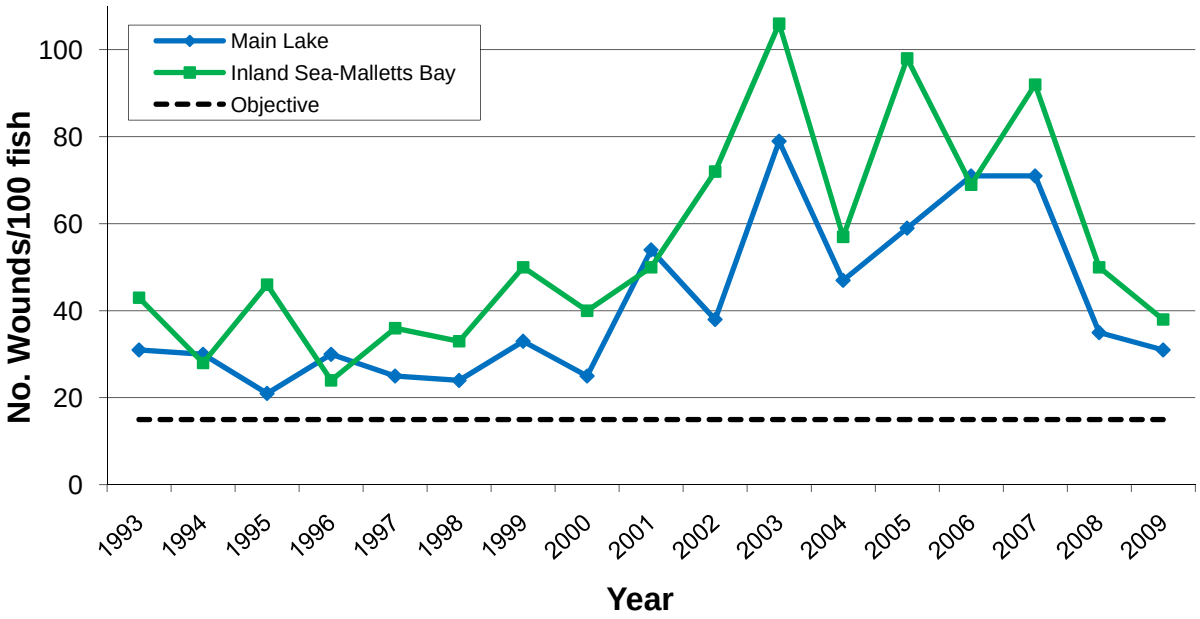

Figure 4. Lamprey wounding rates on 432-533 mm TL landlocked Atlantic salmon from the Main Lake and Inland Sea/Malletts Bay basins of Lake Champlain, 1993-2009.

Table 1. Lake Champlain salmonid sampling results in fall 2009. 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. 5 - Nov. 9 (8)	62	529 (28)	518 (34)	-
Sandbar Causeway	Oct. 7 - Nov. 9 (10)	95	516 (25)	514 (69)	-
Grand Isle/Hatchery Brook	Sep. 22 - Nov. 20 (24)	498	529 (108)	519 (79)	-
Converse Bay	Nov. 8 (1)	5	-	-	414 (5)
Whallon Bay	Oct. 27 - Nov. 17 (7)	149	537 (2)	-	479 (147)
Willsboro Bay	Oct. 21 - Nov. 9 (3)	123	490 (2)	-	430 (119)
	Total	932			
Lake Trout					
Grand Isle	Nov. 11 (1)	335	692 (233)	708 (100)	555 (2)
Converse Bay	Nov. 8 (1)	2	740 (1)	740 (1)	
Willsboro Bay	Oct 21 – Nov. 9 (3)	34	669 (13)	705 (17)	618 (4)
Whallon Bay	Oct. 27 - Nov. 17 (7)	378	690 (229)	706 (140)	625 (9)
	Total	749			
Steelhead					
Grand Isle-Hatchery Brook	Sep. 22 - Nov. 12 (21)	25	-	-	416 (25)
Willsboro Bay	Oct. 30 - Nov. 11 (2)	3	-	-	460 (3)
	Total	28			
Brown trout					
Grand Isle-Hatchery Brook	Sep. 22 - Nov. 12 (21)	20	438 (6)	400 (10)	385 (4)
Willsboro Bay	Oct. 21 - Nov. 9 (3)	2	-	-	377 (2)
Whallon Bay	Oct. 27 - Nov. 17 (7)	3	-	561 (7)	440 (3)
	Total	25			

Hatchery Cove Trapnet Survey

A single trapnet was 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.

A trapnet was set in Hatchery Cove on Monday, 10/26/09, and pulled on Friday, 10/30/09 (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 leadline. The leadline 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. The trapnet leadline was tied to a tree on the shoreline just north of Hatchery Brook and the full length was deployed perpendicular to shore in a westward direction (Figure 1). A jon 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 by hatchery staff. Three people were usually involved with emptying the net, processing the fish, and transporting fish to the hatchery.

Non-target species were counted and released. Most salmonids, except for landlocked Atlantic salmon sent to the hatchery for spawning, were measured for total length, examined for fin clips and sea lamprey wounds, sexed, marked with a lower caudal fin punch and released. Salmon collected for spawning were processed when they were tagged at the hatchery. A small sample of lake trout was also sent to the hatchery but these fish were processed before they were transported. Sea lamprey were measured for total length and destroyed. Water temperatures were recorded near mid-day.

Results

The average time to empty the net and process the catch was about 2 hours each day. This time does not include the processing time for the landlocked salmon sent to the hatchery for spawning. An additional ½ hour was spent preparing the truck to transport fish to the hatchery. Water temperatures recorded around mid-day ranged from 50.9°F to 51.7°F during the week.

Catch

A total of 342 lake trout were captured over the four nights (181 males and 155 females). Four lake trout were recaptured after being marked and released on previous days. The average lake trout catch rate was 86 lake trout per overnight trapnet set, with a low of 62 and a high of 130 (Table 1). The average total lengths (TL) of male and female lake trout were 632mm & 667mm respectively with males ranging in length from 503mm to 784mm and females ranging in length from 563mm to 806mm (Figure 2).

Figure 1. Location of trapnet set in Hatchery Cove. Note Hatchery Brook to the right of the trapnet.

Fin clips were observed on all lake trout, with the exception of 2 fish. The majority of the lake trout were marked with a Right Pectoral (RP) fin clip (Table 2). Of the 155 female lake trout captured, 10 (6%) were spent, 23 (15%) were running ripe, and 122 (79%) were green.

Forty-seven lake trout (21 males and 26 females) were sent to the hatchery for spawning to monitor the potential impacts of alewives on thiamine levels in lake trout eggs. A sample of unfertilized eggs was to be collected from 20 females to determine thiamine levels. A small portion of eggs from each female was to be fertilized and reared to hatching in isolation to see if fry exhibited symptoms of Early Mortality Syndrome caused by a diet high in alewives.

A total of 59 landlocked Atlantic salmon were captured. The average daily catch rate was 15 salmon, with a low of 3 and a high of 38 (Table 1). Fifty-six salmon were sent to the hatchery for spawning (31 males and 25 females). The average total lengths (TL) of male and female landlocked Atlantic salmon were 523mm & 525mm respectively with males ranging in length from 356mm to 657mm and females ranging in length from 452mm to 650mm (Figure 3). Fin clips were observed on all landlocked Atlantic salmon with the exception of 2 fish. Forty-eight of the 54 marked salmon had been marked with a Right Ventral (RV) clip (Table 2). The remainder had AD/RV fin clips.

Thirty-one adult sea lamprey, ranging in size from 306mm to 479mm TL, were also collected in the trapnets with an average catch of 8 per night (Table 1). All sea lamprey were destroyed.

In addition to lake trout and landlocked Atlantic salmon, a total of seven other fish species were also captured in the trapnet. There were 22 yellow perch, 5 rock bass, 1 brown bullhead, 1 bluegill, 2 rainbow trout (435mm and 505 mm), and 1 brown trout (535mm) collected.

Wounding Rates

A total of 148 lake trout were captured that fell within the 533mm-633mm total length (TL) slot used for sea lamprey wounding rate assessment. The lamprey wounding rate for lake trout with fresh (A1) and healing (A2 & A3) wounds was 55 wounds per 100 fish.

A concern was raised with the high numbers of lamprey wounds reported on lake trout collected on the first 2 days. On Friday, the lamprey wounds on 62 lake trout were assessed independently by 2 people. The person that had been evaluating wounds during the rest of the week reported fourteen A3 wounds while the other evaluator reported nine A3 wounds. The lake trout that were

Table 1. Species catch per trapnet haul and average catch per trapnet haul, Hatchery Cove, Lake Champlain.

Date Checked	Lake Trout	Salmon	Lamprey
10/27/2009	92	14	4
10/28/2009	58 (1 recap)	38	8
10/29/2009	130 (2 recaps)	4	11
10/30/2009	62 (1 recap)	3	8
Totals	**342**	**59**	**31**
Avg./Trapnet Haul	**86**	**15**	**8**

Table 2. Fin clips observed on salmonids collected in the trap net set in Hatchery Cove, 2009.

Species	**N**	**Clip Observed**						
		None	**AD**	**AD/RV**	**RV**	**LV**	**RP**	**LP**
Landlocked Atlantic Salmon	56	2		6	48			
Lake Trout	337	2	54		44	34	152	51
Rainbow Trout	2		2					
Brown Trout	1	1						

rated as having more A3 wounds all fell within the slot size (533mm to 633 mm TL) used as the index of sea lamprey wounding rates. The numbers of A1 and A2 wounds reported by the two evaluators for the index size category was the same. The fish were not kept and pictures were not taken so there is no way to determine which rating was correct.

Based on the difference observed in the categorization of A3 wounds, the lamprey wounding rate of lake trout between 533 and 633 mm TL with fresh (A1) and healing wounds (A2 and A3)

ranged from 48 to 55 wounds per 100 fish. The wounding rate based for slot-sized lake trout with just A1 and A2 wounds was 35 wounds per 100 fish.

A total of 35 landlocked Atlantic salmon were captured that fell with the 432mm-533mm slot used for sea lamprey wounding rate assessment. The lamprey wounding rate for salmon with fresh (A1) and healing (A2 & A3) wounds was 37 wounds per 100 fish.

Summary

Hatchery Cove was an excellent site for fishing a trap net. Large numbers of salmon and lake trout, attracted by the Ed Weed Fish Culture Station outflow, congregate in this location and are susceptible to capture by this method. The depth of the cove (approximately 8' maximum) allowed this trapnet to fish effectively as it covered most of the water column. The site is well-protected from the wind and the boat can be left on site which reduces the time required to check net.

During this evaluation the net was set in one location and not moved. If the net was to be set in the future it could be oriented differently, or set in other locations to increase catches, depending on what fish species is being targeted.

Captured fish were in good condition when released or moved to the hatchery. One dead steelhead was found in the net and 8 lake trout and 2 salmon died due to a lack of oxygen while being held in a hatchery truck tank waiting to be transported to the hatchery.

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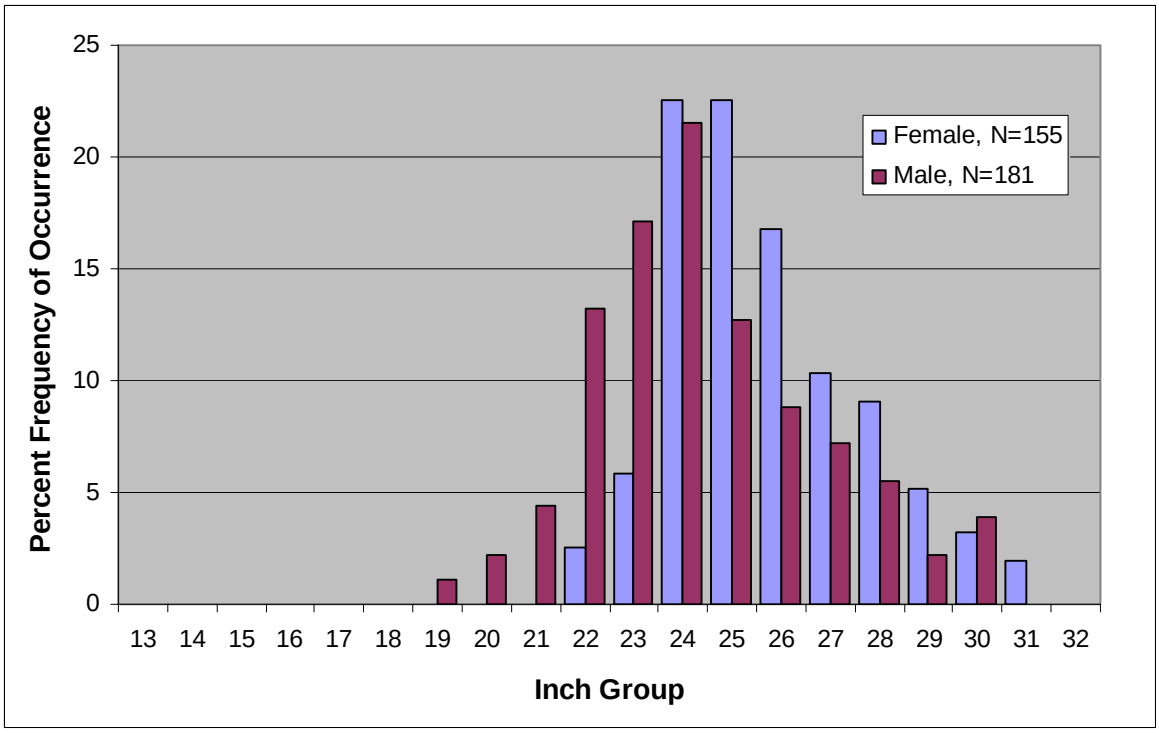

Figure 2. Length distribution of male and female lake trout captured in the Hatchery Cove trapnet.

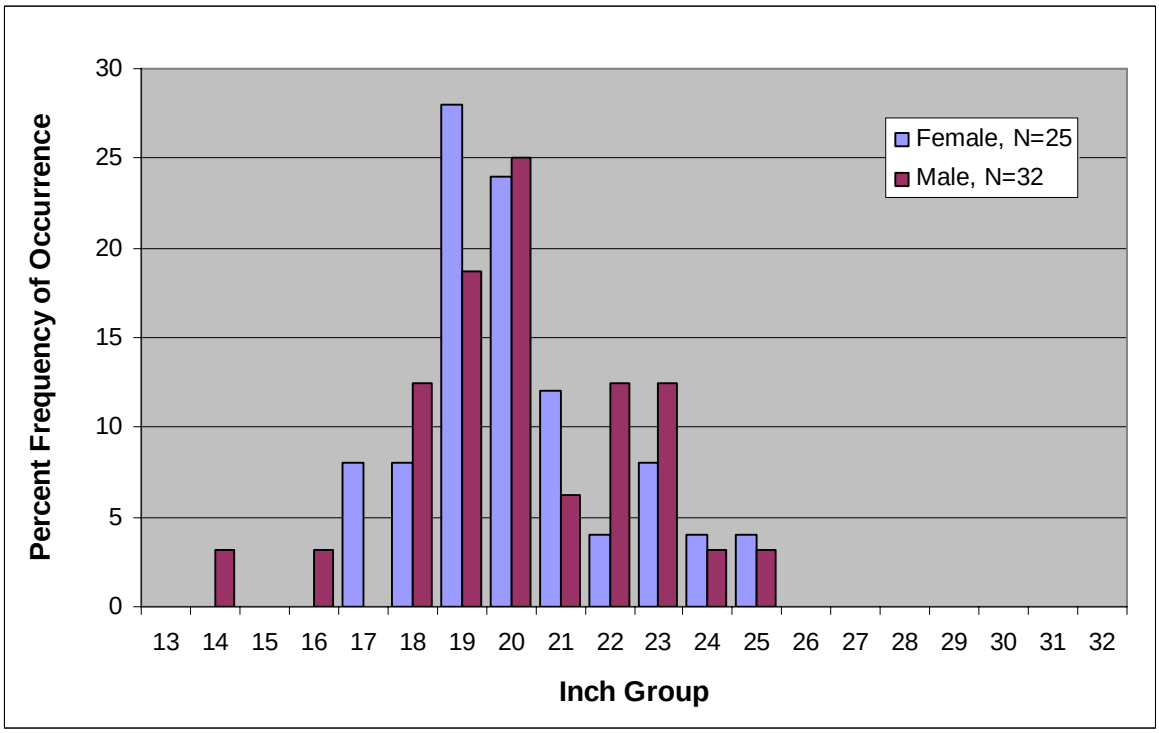

Figure 3. Length distribution of male and female landlocked Atlantic salmon captured in the Hatchery Cove trapnet.

Winooski River Fish Trap and Landlocked Atlantic Salmon Stocking Evaluation

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 *Salmo salar* and steelhead rainbow trout *Oncorhynchus mykiss* 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 "dumped" 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 (Walleye *Sander vitreum* and all salmonids) were saved for processing by state or federal biologists while other catch was released back downstream. Biological data collected from targeted species 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. Lake trout *Salvelinus namaycush* captured were also tagged.

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 provided by the Winooski One station.

Findings

Fall lift season

The fish lift operated continuously from September 15 thru November 13, 2009. The fish hopper was lifted 185 times in 59 days of operation. Thirty-eight adult salmon were recorded (Table 1). Several salmon were captured more than once (see **Fish Lift Efficiency Assessment).**

There were 16 male, 21 female and 1 immature salmon processed at the lift. Thirty-three salmon aged had spent one year in the lake (1-lake-year). Mean lengths of male and female 1-lake-year salmon were 548 and 542 millimeters (mm), respectively (Table 2). Four salmon were two-lake-year fish with a mean length of 612 mm. Twenty-one salmon (6 male, 15 female) were transported to the Ed Weed fish culture station. These fish were utilized for brood stock.

In addition to the salmon, 26 steelhead were lifted in the fall, 2009. These fish averaged 470 mm and were 1-lake-year fish. Two steelhead were lifted twice.

Spring lift season

The fish lift operated from March 15 thru May 14, 2010. The fish hopper was lifted 132 times in 61 days of operation. Thirteen steelhead were trapped (Table 1). Five of the steelhead had been previously lifted in the fall, 2009. Several fish were re-lifted during the season.

In addition to the steelhead, 3 salmon, 1 lake trout and 2 walleye were captured.

Lamprey wounding rates

The goal of the Lake Champlain sea lamprey *Petromyzon marinus* 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 has been established for landlocked salmon in the 432-533 mm length class. In 2009, 12 salmon fell within this length class with a calculated lamprey wounding rate of 83 wounds per 100 fish (Table 3).

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 on DC-pulse output.

Findings

No electrofishing for salmon or steelhead below the Winooski One dam was conducted in the fall of 2009 or the spring of 2010. However, during the fall 2009 lift season several tagged salmon which were released below the lift were recaptured. Fifty-two salmon were released below the dam (including recaptures) which resulted in 7 fish being recaptured – one salmon was recaptured twice. Similarly, in the spring, 7 steelhead were recaptured – again, one steelhead was lifted 3 times.

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 31,169 Sebago strain (Sebago Lake, Maine) landlocked Atlantic salmon smolts were stocked in the Winooski River in 2010 (Table 4). The salmon had mean lengths ranging from 178 - 192 mm and were from the Ed Weed Fish Culture Station in Grand Isle, Vermont. All the salmon stocked received a right ventral fin clip (RV) before stocking and were stocked at the dam (March 12 and 15) and at the fishing access near the mouth (March 11 and 12).

In fall 2009, 30,000 fingerling salmon were stocked in the main stem Winooski from Richmond, Vermont upstream on October 15. These fish came from the Ed Weed Fish Culture Station and averaged 115 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 98,000 salmon fry in May, 2010 (see **Winooski River Tributary Salmonid Assessment**).

A total of 20,680 Chambers Creek, Lake Ontario strain steelhead was stocked in the Winooski River in 2010. 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 11, 12 and 15 (Table 5).

The success of either the salmon fry or smolt stocking is measured by the subsequent adult returns to the Winooski River trap. Returning salmon were identified as being fry 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

Thirty-one of the 38 returning adult salmon had an RV fin clip. Twenty-nine of the clipped salmon were lake-age 1 and may have been stocked in the Winooski River as smolts in 2008. The remaining 2 fish were 2 lake-year salmon. Of the remaining 7 unclipped fish, 6 were 1-lake year salmon, and the last was a 2-lake year salmon. These salmon had no fin erosion (sometimes typical of hatchery fish; seven of the clipped fish exhibited fin erosion) and may have been from fry stocking.

In 2006, 340 parr were tagged; these salmon would have been expected to return as adults in fall, 2009; no tagged adult salmon were observed in 2009. 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 2012.

Winooski River and Tributary Habitat Assessment

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

Procedures

No habitat assessment was conducted in 2009. However, temperature data was collected for the Winooski and Huntington Rivers, and Mill, Preston, Snipe Island and Brushy Brooks using Stowaway Miniature Temperature Loggers (Onset Instruments, Pocasset, MA), Model WTA08, Optic StowAway Temp. Temperature loggers were programmed to record every hour.

Findings

Table 6 depicts water temperature measurements for the Winooski River and its tributaries. Mean water temperatures during the months of May through September ranged from 9.7 to 20.6 degrees °C. The highest maximum measured water temperature was 27.7 °C measured in the Winooski River.

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 and Memphremagog strain salmon and were incubated at the Roxbury 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 35 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, 2009. Salmon and trout were sampled on the Huntington River and Mill, Pinneo, Ridley, Preston, Duck, Snipe Island, and Joiner 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 2010 was about 98,000. All the fry were put into the Huntington River. It was decided that the fry for the lower Winooski will be stocked in the fall as fingerlings with the hope of improved survival. Fourteen kilometers of the Huntington River was stocked with fry from the Roxbury Fish Culture Station in Roxbury, Vermont on May 3 and 5 (figure 1). These fry averaged 27 mm in length and were stocked at a density of 35 fish per salmon unit.

Salmon parr sampling

Salmon stocked prior to 2010 were found in 4 of the 8 tributaries sampled in the early fall of 2009. Since the Huntington River was the only river stocked in 2009, these fish presumably emigrated from the Huntington River. Mean total lengths at the time of sampling for the young-of-year (YOY) and age 1+ salmon ranged from 88 to 98 mm and from 130 to 174 mm, respectively (Table 7). Density of YOY salmon found in the Huntington River at the lower and upper sampling locations were 3.2 and 5.2 fish per salmon unit, respectively (Table 8). Interestingly, the lower Huntington was stocked heavily at 118 fry per unit but resulted in a lower YOY density. Survival estimates for salmon fry stocked in 2008 and 2009 are presented in Table 9.

A total of 569 trout were collected during the 2009 tributary sampling effort. Table 10 and 11 summarizes YOY mean lengths, population estimates and biomass for the Winooski River tributaries sampled in 2009. Rainbow trout made up 70 percent of the trout collected in the 8 tributaries sampled with the majority of those being YOY (92 %) (Figure 2). Figure 3 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 4).

Salmon Smolt Out-Migration

Objective: (1) describe timing and rates of migration, (2) assessing in-river migrational 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 and fished until June 1, 2010. Periodic high flows prevented the trap from fishing for five days. A total of 205 salmon smolts were captured in 2010 (not including recaptures). Sixteen salmon were recaptured after being released upstream. The majority of smolts (92 %) were captured between May 14 and May 27 (figure 5). This is similar to previous year's out-migration when about 80 percent of the smolts were captured during the last two weeks of May.

Trap efficiency for the peak migration period (May 14 – May 27) was 0.113 and calculated from a recapture of 16 marked and released smolts. About 1,783 salmon smolts passed the trapping site based on the estimated trap efficiency and a total of 205 unmarked salmon captured. Table 12 compares the spring 2010 trapping efforts to the previous six years.

Mean length for trapped salmon was 152 mm (SD = 16) and ranged from 113 – 240 mm. This average size and scale analysis in previous years suggests these fish to be 2 year-olds. One and 3 year-old salmon made up only a small portion of the fish examined as illustrated by length frequency analysis (Figure 6).

Also, 7 salmon trapped had a clipped left-ventral fin. These were salmon marked as YOY in 2008 when 377 salmon were clipped.

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

Two anglers reported having caught fish in 2010 that had been tagged at the Winooski One fish lift. One steelhead was caught below the lift in the Salmon Hole on May 12, and was originally tagged on April 12 at the lift. The second fish, a salmon, was caught on May 4 and was tagged in the fall of 2009. This fish was caught at the mouth of the Ausable River in New York.

There were 19 entries in the volunteer angler survey forms between September 5 and October 23, 2009. Two salmon, 4 steelhead and 1 lake trout were caught in 36 hours of fishing effort reported below Winooski One dam.

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Table 1. Summary of landlocked Atlantic salmon and rainbow steelhead trout lifted at the Winooski One fish passage facility, 1993 – spring 2010.

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	na	na

Table 2. Summary of mean total lengths of landlocked Atlantic salmon collected at the Winooski One fish passage facility, fall 2009. All lengths in millimeters ± one standard deviation. Number of fish in parenthesis.

Sex	Lake Age I+	Lake Age 2+	Total
Male	548 ± 46 (12)	599 ± 21 (3)	15
Female	542 ± 23 (20)	650 (1)	21
Total	32	4	36

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 - 2009.

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

Table 4. Summary of recent landlocked Atlantic salmon smolt stocking in the Winooski River, 2003– 2010. Strain: Mag = Lake Memphremagog, Vermont; Seb = Sebago Lake, Maine.

Year stocked	Stocking location	Number stocked	Size (mm)	Strain	Total stocked
2003	Mouth W. One Mouth W. One	17,896 10,511 18,301 6,238	145 155 178 178	Mag Mag Seb Seb	52,946
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

Table 5. Summary of recent steelhead rainbow trout smolt stocking in the Winooski River, 2003 – 2010. Strain: C = Chambers Creek, Lake Ontario.

Year stocked	Stocking location	Number stocked	Size (mm)	Strain
2003	Mouth	15,185	178	C
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

Table 6. Summary of average water temperature measurements on the Winooski River and its tributaries in 2009. Temperature measurements are in Celsius with maximum temperatures in parentheses. Measurements from May 1 – September 30, 2009.

River	May	June	July	August	September
Huntington – 5.3 km	11.4 (19.7)	15.2 (23.8)	16.2 (23.5)	19.5 (27.3)	15.9 (23.6)
Mill Brook	11.6 (18.1)	---	---	---	14.0 (19.0)
Preston Brook	9.7 (13.6)	12.4 (16.7)	14.3 (18.0)	16.2 (19.5)	12.5 (15.2)
Duck Brook	10.8 (15.5)	13.6 (18.3)	15.6 (19.3)	16.6 (20.6)	12.7 (15.9)
Joiner Brook	10.1 (16.8)	13.8 (20.3)	15.7 (21.0)	18.2 (23.5)	14.2 (18.7)
Winooski River - Jonesville	11.8 (16.9)	16.6 (23.7)	17.8 (23.7)	20.6 (27.7)	13.7 (24.9)
Ridley Brook	9.7 (14.3)	12.6 (17.2)	14.5 (18.6)	16.6 (20.3)	12.4 (15.2)

Table 7. Summary of mean total lengths of landlocked Atlantic salmon collected in the Winooski River tributaries in 2009. All lengths in millimeters ± one standard deviation.

Tributary	Date	Landlocked salmon mean length		
		Young-of-year	1+	2+
Mill Brook	8/27	---	174.5 ± 14.8 n = 2	---
Snipe Island Brook	9/14	---	---	---
Huntington River 0.9 km	8/25	97.9 ± 11.3 n = 80	158.5 ± 5.9 n = 4	---
Huntington River 7.7 km	8/25	92.3 ± 11.1 n = 77	151.2 ± 16.3 n = 10	---
Preston Brook	9/10	88.5 ± 5.5 n = 16	130 n = 1	---
Ridley Brook	8/26	---	---	---
Joiner Brook	8/27	---	159 n = 1	---
Pinneo Brook	9/3	---	---	---
Duck Brook	9/12	---	---	---

Table 8. Population estimates (with standard error) and calculated densities by age class for landlocked Atlantic salmon collected in the Huntington River in 2009.

Tributary	Age group	Sample Size	Population Estimate	Density (no./unit)	95% C.I.
Huntington 7.7	0+ 1+	77 10	94 ± 10.4 10 ± 1.4	5.2 0.6	4.3 – 6.4 0.6 – 0.7
Huntington 0.9	0+ 1+	80 4	99 ± 11.9 4	3.2 0.1	2.6 – 3.9 0.1 – 0.1

Table 9. Population densities and survival estimates by age groups for the 2008 and 2009 age class of landlocked Atlantic salmon in the Huntington River.

Tributary	Density (no./salmon unit)			Survival (percent)			Fry/0+ Survival 95% C.I.
	Fry	0+	1+	Fry/0+	0+/1+	Fry/1+	
2008 Year Class							
Huntington 0.9	32	7.0	0.1	21.9	1.4	0.3	16.6 – 27.2
Huntington 7.7 km	32	5.6	0.6	17.5	10.7	1.9	16.2 – 19.4
2009 Year Class							
Huntington 0.9	118	3.2	na	2.7	na	na	2.2 – 3.3
Huntington 7.7 km	32	5.2	na	16.2	na	na	13.4 – 20.0

Table 10. Summary of mean total lengths of young-of-year trout collected in Winooski River tributaries in 2009. All lengths in millimeters ± one standard deviation.

Tributary	Date	Rainbow trout	Brown trout	Brook trout
Mill Brook	8/7	71.8 ± 9.6 n = 67	85.1 ± 7.2 n = 37	81.0 ± 1.4 n = 2
Duck Brook	9/2	57.6 ± 9.0 n = 84	66.2 ± 6.9 n = 20	72.0 ± 6.2 n = 3
Huntington 7.7 km	8/25	---	81.1 ± 5.8 n = 15	95.0 n = 1
Huntington 0.9 km	8/25	76.3 ± 7.1 n = 37	76.9 ± 7.1 n = 7	---
Preston Brook	9/10	75.4 ± 5.7 n = 64	75.8 ± 8.6 n = 5	68.7 ± 8.2 n = 11
Ridley Brook	8/26	64.5 ± 10.4 n = 22	72.0 ± 3.4 n = 4	67.0 n = 1
Pinneo Brook	9/3	72.2 ± 7.8 n = 20	85.0 ± 7.5 n = 4	65.2 ± 5.2 n = 5
Snipe Island	9/14	76.6 ± 9.6 n = 43	79.8 ± 9.4 n = 8	67.0 n = 1
Joiner Brook	8/27	68.8 ± 9.8 n = 29	76.9 ± 9.2 n = 9	74.8 ± 7.3 n = 5

Table 11. Population estimates for salmon and trout collected in Winooski River tributaries in 2009.

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 2009.

Stream	Elev.	Date	Len	Wth	Species	Class	Num	Est.	LOCI	UPCI	Popmi	Popkm	Mn Wt	Lbac	Kghec
Huntington River 0.9	310	25-Aug	741	50.2	RBT	YOY <6	37 1 38	40 1	7.5 0.0	16.8 0.0	332 8 340	206 5 212	4.8 20.0	0.55 0.06 0.61	0.62 0.06 0.68
					BNT	YOY	7	8	12.5	85.6	66	41	4.3	0.10	0.11
					LLS	YOY 1+	80 4 84	99 4	19.2 0.0	23.6 0.0	822 33 855	511 21 531	8.2 29.8	2.33 0.34 2.68	2.61 0.39 3.00
					TOTALS		**129**				**1262**	**784**		**3.38**	**3.79**
Huntington River 7.7	590	25-Aug	483	38.8	BNT	YOY 6-10	15 1 16	15 1	0.0 0.0	15.1 397.3	165 11 176	103 7 109	5.1 42.0	0.37 0.21 0.58	0.42 0.23 0.65
					BKT	YOY	1	1	0.0	0.0	11	7	8.0	0.04	0.04
					LLS	YOY 1+	77 10 87	94 10	18.1 0.0	22.7 27.2	1034 110 1144	642 68 711	8.4 29.2	3.87 1.44 5.31	4.34 1.61 5.96
					TOTALS		**104**				**1331**	**827**		**5.93**	**6.65**

Table 11. (continued)

Stream	Elev.	Date	Len	Wth	Species	Class	Num	Est.	LOCI	UPCI	Popmi	Popkm	Mn Wt	Lbac	Kghec
Joiner Brook	350	27-Aug	389	27.2	RBT	YOY	29	29	0.0	7.6	394	245	3.2	0.89	0.99
						<6	1	1	0.0	0.0	14	8	31.0	0.29	0.33
						6-10	2	2	0.0	0.0	27	17	86.5	1.63	1.83
							32				434	270		2.81	3.15
					BNT	YOY	9	9	0.0	5.7	122	76	3.8	0.32	0.36
						<6	6	6	0.0	21.7	81	51	19.5	1.10	1.24
						6-10	3	3	0.0	0.0	41	25	76.0	2.15	2.41
							18				244	152		3.57	4.00
					BKT	YOY	5	5	0.0	0.0	68	42	3.8	0.18	0.20
						<6	1	1	0.0	0.0	14	8	18.0	0.17	0.19
						6-10	2	2	0.0	37.7	27	17	106.5	2.01	2.25
							8				109	67		2.35	2.64
					LLS	1+	1	1	0.0	0.0	14	8	37.0	0.35	0.39
					TOTALS		**59**				**801**	**498**		**9.08**	**10.18**
Mill Brook	300	27-Aug	340	28.8	RBT	YOY	67	71	5.6	9.6	1103	685	3.6	2.69	3.02
						<6	1	1	0.0	0.0	16	10	15.0	0.16	0.18
						10-12	2	2	0.0	101.7	31	19	167.5	3.54	3.97
							70				1149	714		6.39	7.17
					BNT	YOY	37	38	2.6	8.3	590	367	6.9	2.78	3.12
						<6	1	1	0.0	0.0	16	10	15.0	0.16	0.18
						6-10	1	1	0.0	0.0	16	10	47.0	0.50	0.56
							39				621	386		3.44	3.85
					BKT	YOY	2	2	0.0	101.7	31	19	4.0	0.08	0.09
						6-10	1	1	0.0	143.8	16	10	82.0	0.87	0.97
						10-12	1	1	0.0	143.8	16	10	154.0	1.63	1.83
							4				62	39		2.58	2.89
					LLS	1+	2	2	0.0	0.0	31	19	43.0	0.91	1.02
					TOTALS		**115**				**1864**	**1158**		**13.32**	**14.93**

Table 11. (continued)

Stream	Elev.	Date	Len	Wth	Species	Class	Num	Est.	LOCI	UPCI	Popmi	Popkm	Mn Wt	Lbac	Kghec
Pinneo Brook	370	3-Sep	360	12	RBT	YOY	20	20	0.0	4.8	293	182	3.9	1.87	2.09
					BNT	YOY	4	4	0.0	30.0	59	36	6.0	0.58	0.65
					BKT	YOY	5	5	0.0	0.0	73	46	2.6	0.32	0.35
						<6	2	2	0.0	0.0	29	18	15.0	0.73	0.82
							7				103	64		1.04	1.17
					TOTALS		**31**				**455**	**283**		**3.49**	**3.91**
Preston Brook	365	10-Sep	342	18.9	RBT	YOY	64	64	0.0	1.5	988	614	4.1	4.61	5.17
						<6	7	7	0.0	9.2	108	67	24.3	2.98	3.34
						6-10	4	4	0.0	0.0	62	38	33.8	2.37	2.66
							75				1158	719		9.97	11.17
					BNT	YOY	5	5	0.0	0.0	77	48	4.0	0.35	0.39
					BKT	YOY	11	11	0.0	3.9	170	106	3.0	0.58	0.65
						<6	2	2	0.0	0.0	31	19	20.0	0.70	0.79
							13				201	125		1.28	1.44
					LLS	YOY	16	16	0.0	1.9	247	153	5.9	1.65	1.85
						1+	1	1	0.0	0.0	15	10	19.0	0.33	0.37
							17				262	163		1.98	2.22
					TOTALS		**110**				**1698**	**1055**		**13.58**	**15.23**

Table 11. (continued)

Stream	Elev.	Date	Len	Wth	Species	Class	Num	Est.	LOCI	UPCI	Popmi	Popkm	Mn Wt	Lbac	Kghec
Ridley Brook	360	26-Aug	382	21.3	RBT	YOY	22	22	0.0	2.0	304	189	2.8	0.74	0.83
						<6	1	1	0.0	0.0	14	9	15.0	0.18	0.20
							23				318	198		0.92	1.03
					BNT	YOY	4	4	0.0	0.0	55	34	3.8	0.18	0.20
						<6	1	1	0.0	339.5	14	9	28.0	0.33	0.37
							5				69	43		0.51	0.57
					BKT	YOY	1	1	0.0	0.0	14	9	3.0	0.04	0.04
						<6	2	2	0.0	0.0	28	17	16.0	0.38	0.43
							3				41	26		0.42	0.47
					TOTALS		**31**				**428**	**266**		**1.85**	**2.07**
Snipe Island Brook	300	14-Sep	521	13.6	RBT	YOY	43	44	2.3	8.3	446	277	4.9	3.47	3.89
						<6	4	4	0.0	26.6	41	25	18.8	1.21	1.36
						6-10	1	1	0.0	143.8	10	6	36.0	0.58	0.65
						12+	1	1	0.0	0.0	10	6	281.0	4.54	5.09
							49				507	315		9.81	11.00
					BNT	YOY	8	8	0.0	33.6	81	50	5.5	0.71	0.80
						<6	1	1	0.0	397.3	10	6	17.0	0.27	0.31
						6-10	3	3	0.0	17.4	30	19	44.0	2.13	2.39
						10-12	1	1	0.0	397.3	10	6	235.0	3.80	4.26
							13				132	82		6.92	7.76
					BKT	YOY	1	1	0.0	0.0	10	6	3.0	0.05	0.05
					TOTALS		**63**				**649**	**403**		**16.78**	**18.81**

Table 11. (continued)

Stream	Elev.	Date	Len	Wth	Species	Class	Num	Est.	LOCI	UPCI	Popmi	Popkm	Mn Wt	Lbac	Kghec
Duck Brook	320	2-Sep	406	11.5	RBT	YOY	84	91	7.7	10.4	1465	910	2.0	5.04	5.65
						<6	8	8	0.0	25.9	129	80	15.5	3.46	3.88
						6-10	1	1	0.0	0.0	16	10	43.0	1.20	1.34
							93				1610	1000		9.70	10.87
					BNT	YOY	20	20	0.0	10.3	322	200	3.1	1.70	1.91
						<6	1	1	0.0	0.0	16	10	24.0	0.67	0.75
							21				338	210		2.37	2.66
					BKT	YOY	3	3	0.0	17.4	48	30	4.0	0.33	0.38
						<6	1	1	0.0	0.0	16	10	32.0	0.89	1.00
							4				64	40		1.23	1.38
					TOTALS		**118**				**2012**	**1250**		**13.29**	**14.91**

Table 12. Summary of out-migrating smolt trapping on the Huntington River, 2004 – 2010.

Year	Start Date	End date	Days Fished	Number new , unmarked Trapped	Number Marked and released[1]	Number Recaptured	Estimate	Trap style[2]
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.

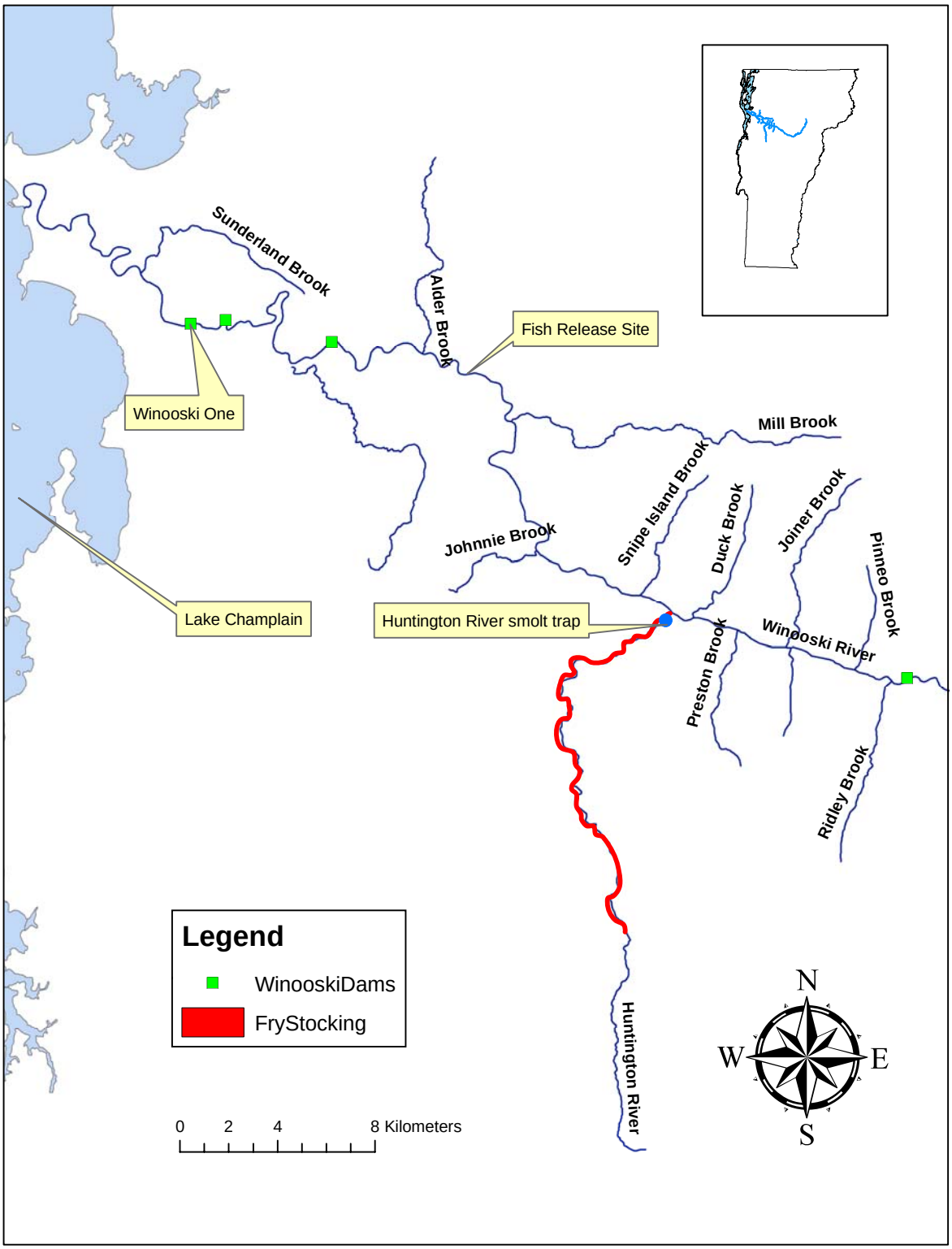
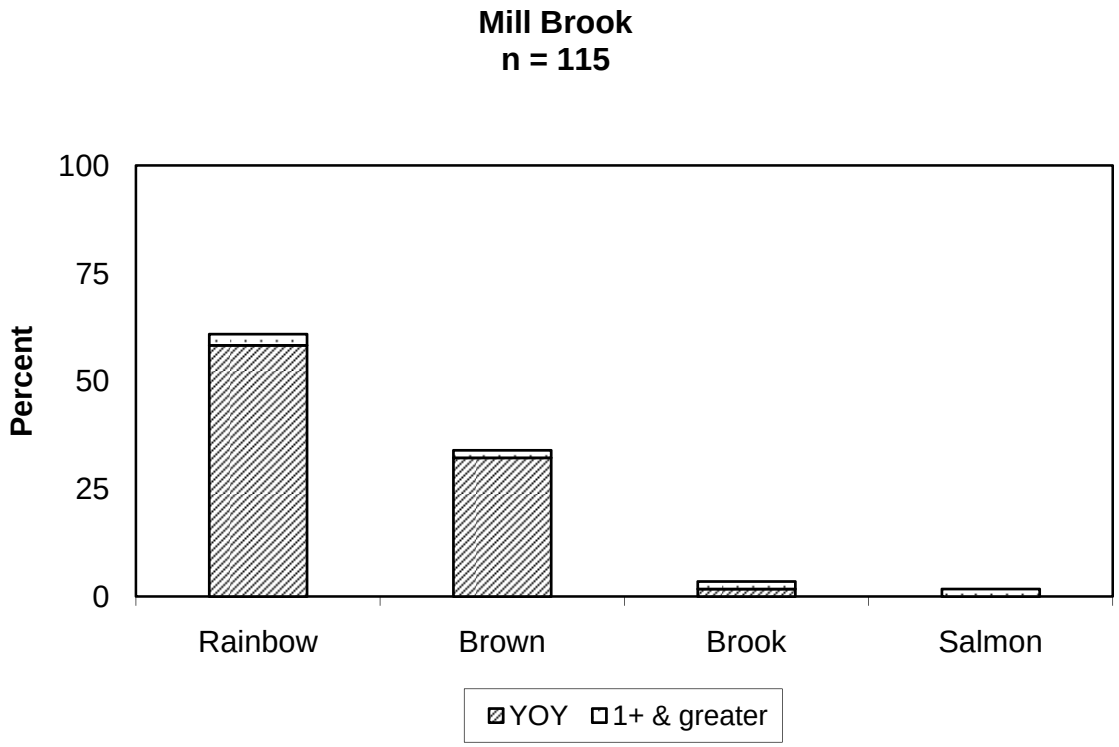


Figure 1. Map of lower Winooski River drainage showing Winooski One Dam, the fish release site, named tributaries, and fry stocking areas.



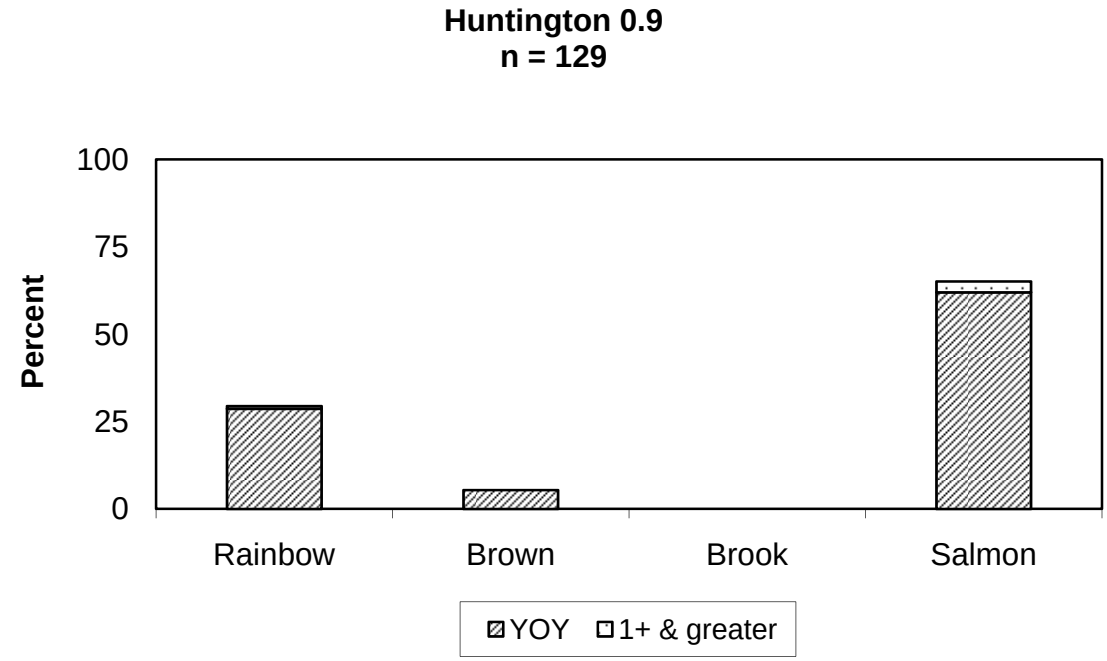
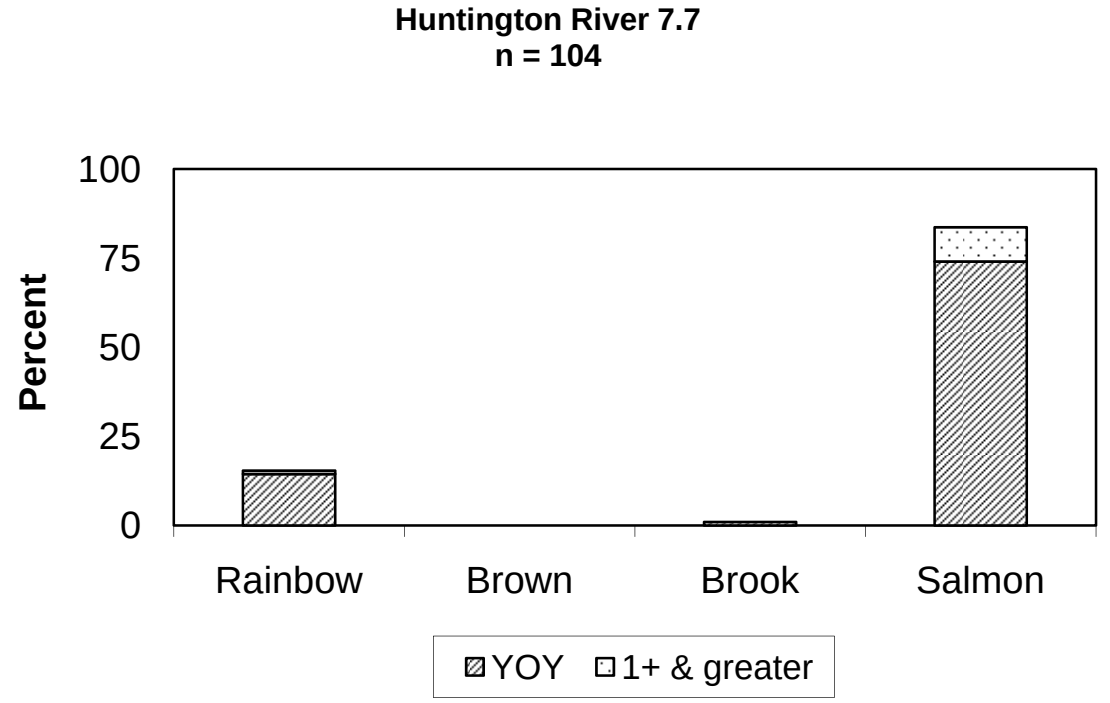


Figure 2. Percent composition of trout and salmon collected by site in 2009.



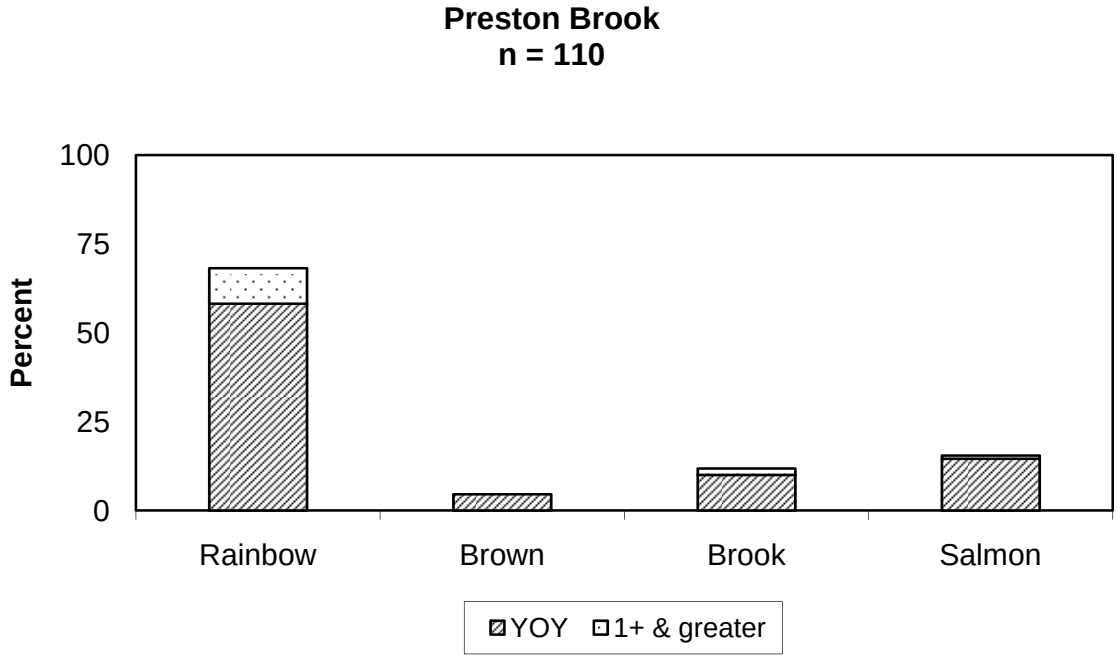
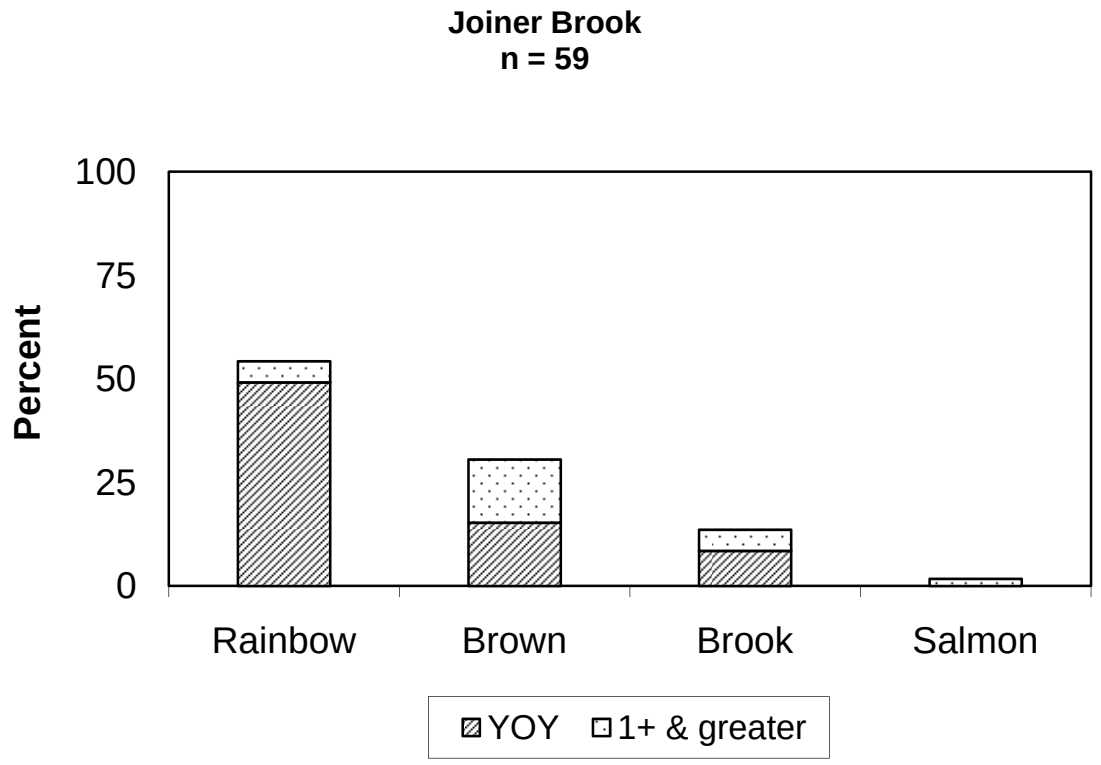


Figure 2. Continued.



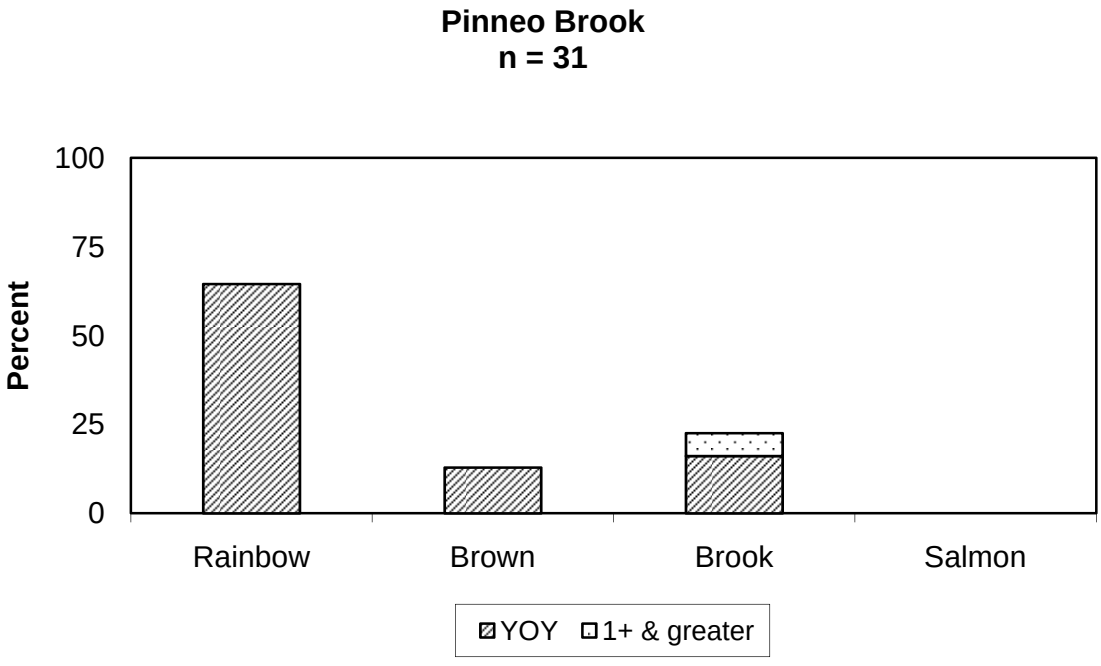


Figure 2. Continued.

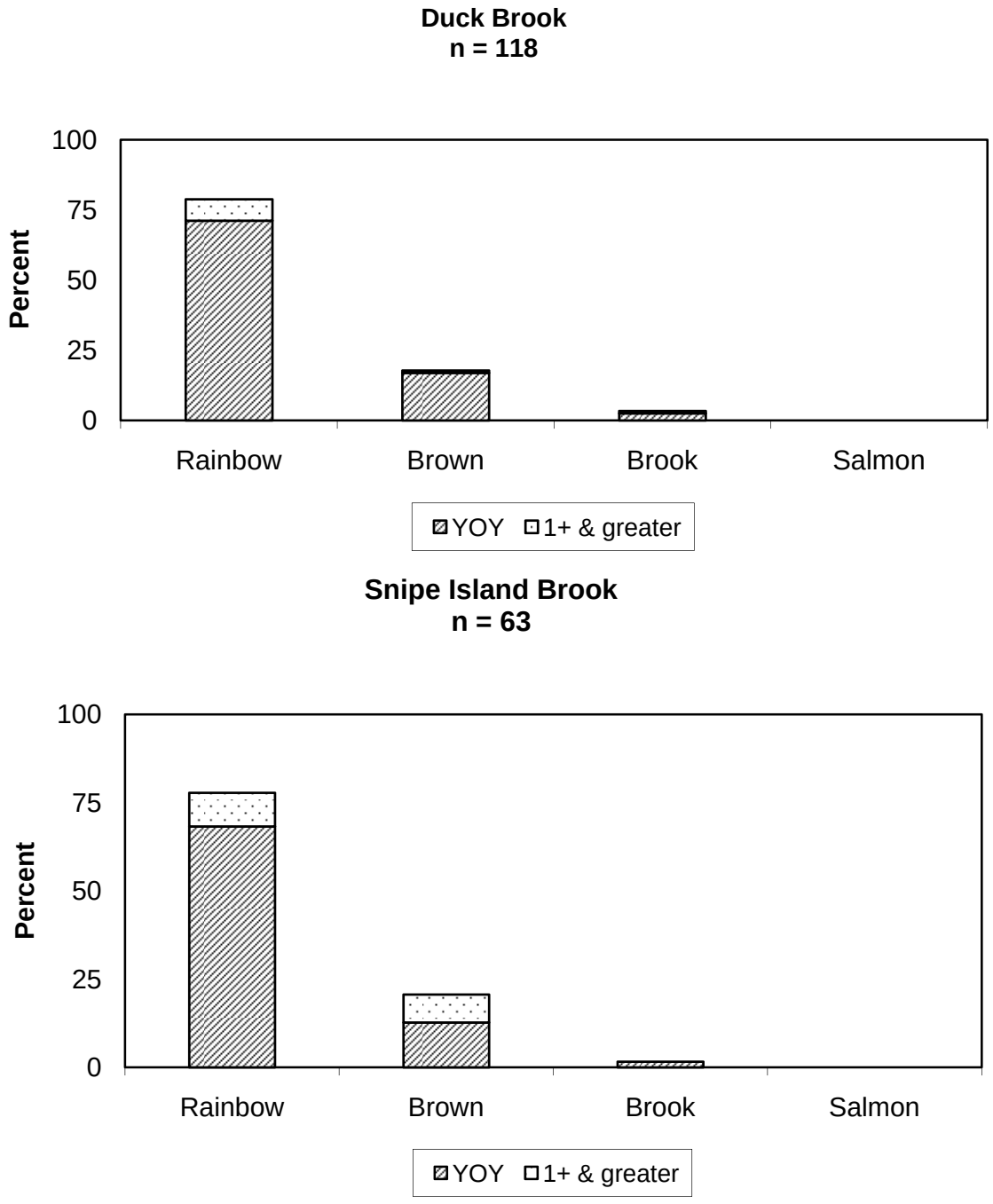


Figure 2. Continued.

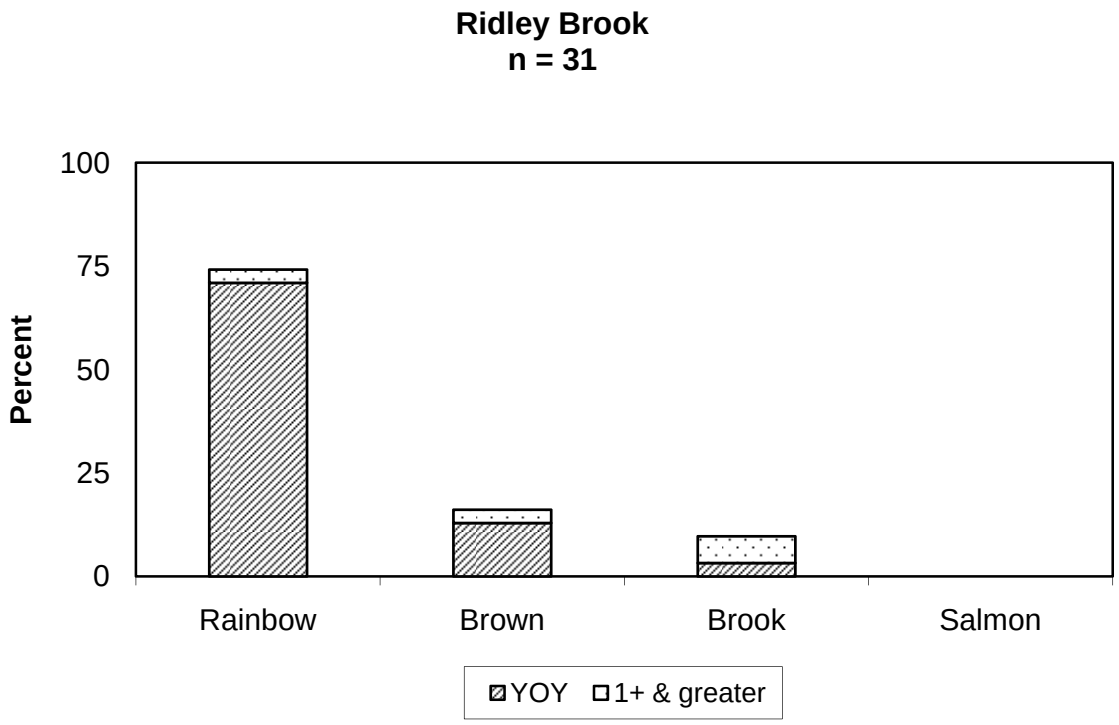


Figure 2. Continued.

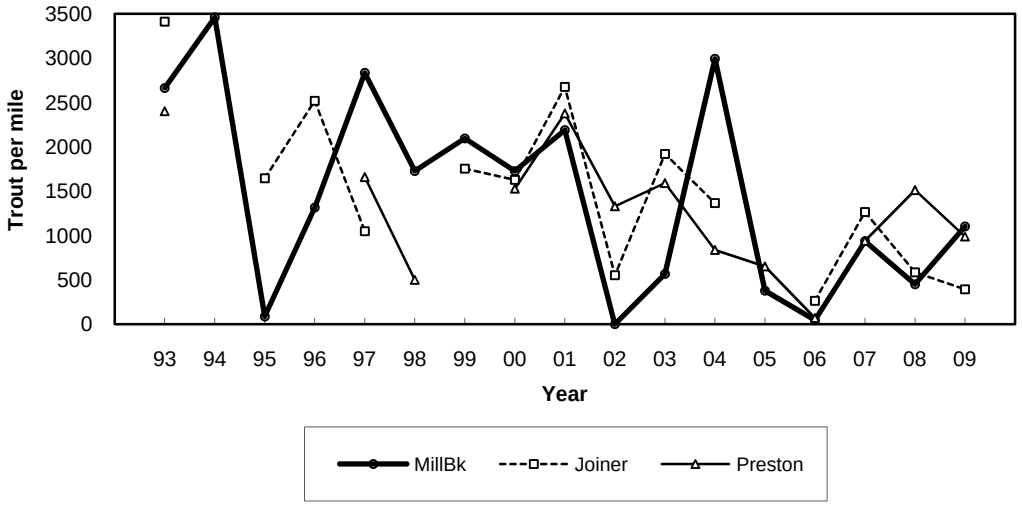


Figure 3. Estimated number per mile of young-of-year rainbow trout for Mill, Joiner, and Preston Book, 1993 – 2009.

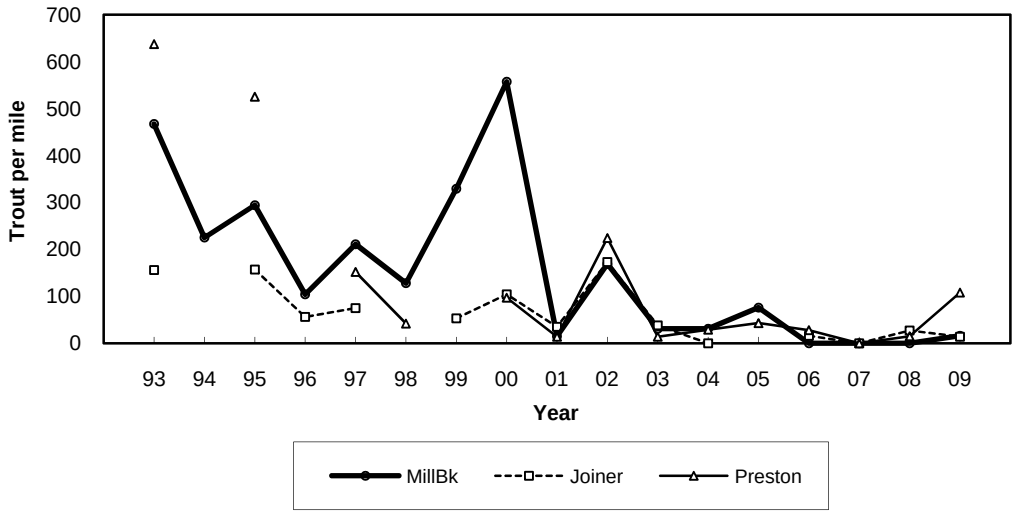


Figure 4. Estimated number per mile of the 100-152 mm length class (age 1+) rainbow trout for Mill, Joiner, and Preston Book, 1993 – 2009.

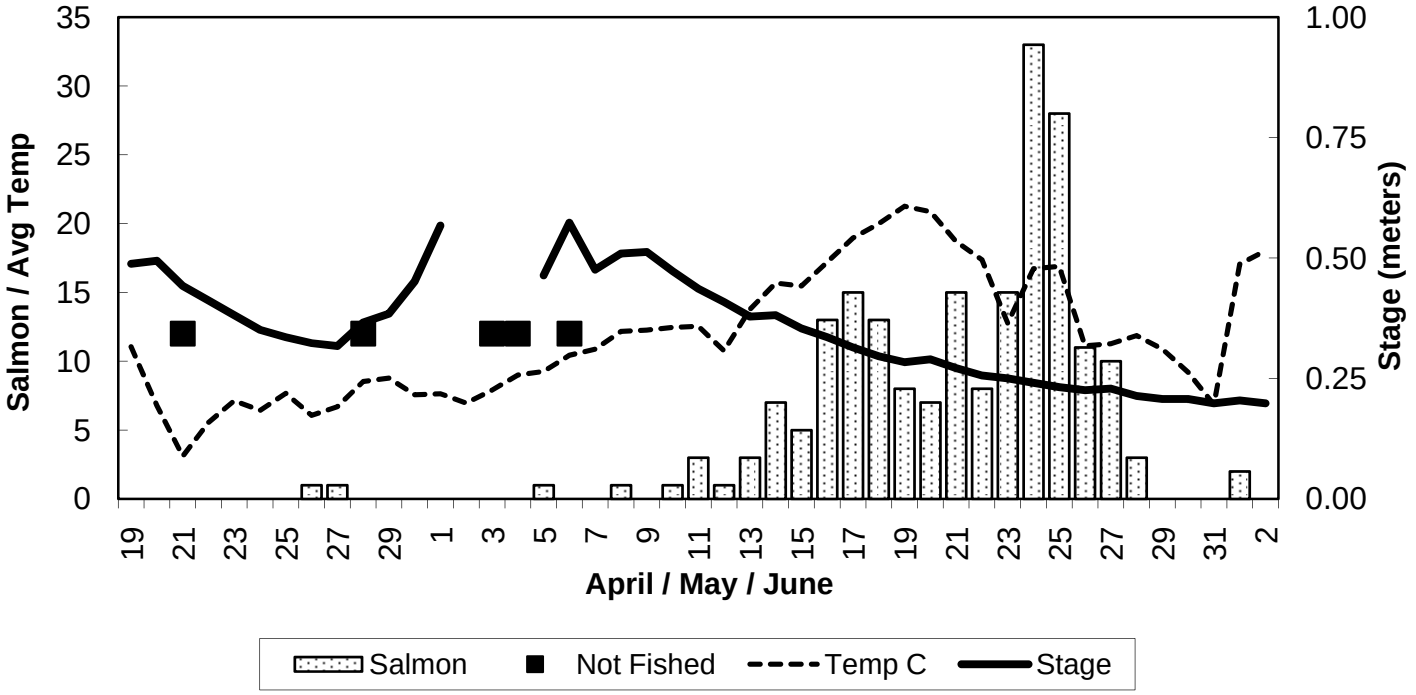


Figure 5. Comparison of stream stage (meters), mean daily stream temperature (Celsius) and number of landlocked Atlantic salmon smolts trapped in the Huntington River, 2010.

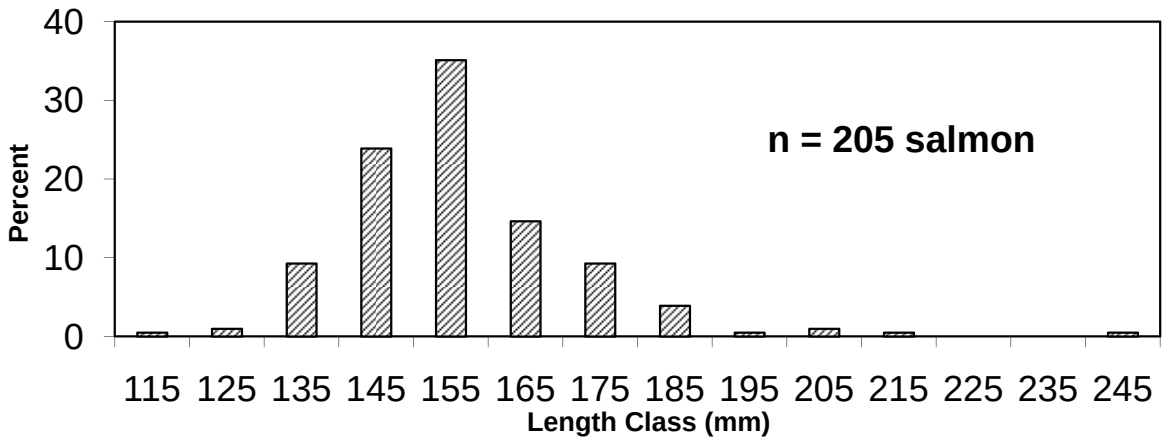


Figure 6. Length frequency graph expressed as a percent of landlocked Atlantic salmon smolts trapped in the Huntington River, 2010.