CONNECTICUT RIVER BASIN ANADROMOUS FISH RESTORATION: Coordination and Technical Assistance F-100-R-30

Annual Progress Report
October 1, 2012 - September 30, 2013

U.S. Fish and Wildlife Service
Connecticut River Coordinator's Office
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Executive Summary

Federal Aid Project #F-100-R-30

States: Connecticut, Massachusetts, New Hampshire and Vermont

Project Title: Connecticut River Basin Anadromous Fish Restoration: Coordination and Technical Assistance

Period Covered: October 1, 2012 - September 30, 2013

This report provides an opportunity to organize and document, to varying degrees, all work activities conducted by the Connecticut River Coordinator's Office, which includes work outside of the Connecticut River basin and numerous activities not funded by this grant.

Objectives:

- Coordinate the Connecticut River Anadromous Fish Restoration Program as a unified effort of State and Federal fishery agencies
- Provide technical assistance to the fishery agencies and other program cooperators
- Identify fishery program priorities, design and implement field projects to address issues, plans, and opportunities
- Administer several different federal grant programs to address fish habitat, fish passage, and research projects

Accomplishments:

Program Coordination:

- Coordinated two Connecticut River Atlantic Salmon Commission (CRASC) and one CRASC Technical Committee meetings
- Organized a CRASC Shad Studies and River Herring subcommittee meeting
- Organized the Atlantic Salmon Egg Rearing Program Teacher's Workshop for Western Massachusetts
- Assisted in the completion of the U. S. Atlantic Salmon Assessment Committee Report, provided program update, narrative, updated databases, and presentation at annual meeting (http://www.nefsc.noaa.gov/USASAC/Reports/)
- Organized the CRASC Technical Committee Research Forum
- Coordinated American shad fish health testing and transfers from Holyoke Fish Lift, MA

- Coordinated river herring population assessment and restoration activities in spring 2013
- Coordinated and served as lead writer for, Connecticut River American Shad Habitat Plan, submitted to the Atlantic States Marine Fisheries Commission's Shad and River Herring Technical Committee

Technical Assistance:

- Assisted in salmon spawning activities at Richard Cronin National Salmon Station (RCNSS) in support of Connecticut Department of Energy and Environmental Protection's (CTDEEP) program
- Served as USFWS member to new Northeast Regional Agency River Herring Team, provided a presentation for CT River to group on past Coordinator work and planned work for spring 2013 and attended subsequent meetings dealing with management measures
- Downloaded remote water temperature loggers (river mouth to Wilder VT), performed QA/QC, redeployed, coordinated some sites with CT River Watershed Council and hydropower operators (Oct – Dec 2012)
- Conducted juvenile American shad population assessments and water temperature monitoring in the lower Vernon Dam Pool (Oct). Completed data analyses and developed a report "Juvenile American shad assessment in the lower Vernon Dam Pool Fall 2012" that was released in September 2013, posted on Coordinator's web site.
- Participated in meetings on North Atlantic Landscape Conservation Cooperatives and related meeting on surrogate species selections, The Nature Conservancy CT River Flow meeting and other various meetings
- Organized, cleaned, and began analyses of three years of continuous water temperature data from Wilder Dam (VT) to the Cabot Station, Turners Falls, (MA) – 2009-2012. Began work on report that continued through summer with numerous reviews. Released "Water temperature monitoring and diadromous fishes temperature concerns in the Connecticut River upstream of and downstream of Vernon Dam, Vernon, Vermont" in September 2013, posted on Coordinator's web site (http://www.fws.gov/r5crc).
- Provided program information and requested data to cooperators, researchers, and the public, including one Freedom Of Information Act request from the law firm representing Vermont Yankee (VY), response included over 3,100 hard copy records and over 1,050 electronic files in total, later spring work to index all FOIA materials from FY12 as well, required over 140 staff hours
- Continued to provide ongoing technical assistance to VT Fisheries Biologist over the full course of this report period on the matters of the thermal discharge of VY and diadromous fishes, served a subpoena for VY hearing in State of Vermont, by VY law firm, subpoena rejected by Department of Interior Solicitor in May
- Gave a presentation on migratory fishes status, management, restoration to Connecticut River Joint Commission and Westfield State University (WSU), obtained

and supervised student intern (WSU), and organized and directed other volunteers and staff for various activities over course of the year

- Provided assistance in the continued analyses of the 2011 and 2012 whole river American shad telemetry study in cooperation with U. S. Geological Survey Conte Laboratory (USGS), Dr. Castro-Santos, who assumed analytical responsibilities
- Served on collaborative agency team for Federal Energy Regulatory Commission's (FERC) relicensing process requiring numerous meetings, sites visits, coordinated work efforts over the entire report period (e.g., planning/develop study requests, served as lead writer on many, reviewed to power company proposed study plans, ongoing exchanges of verbal and written comments and ongoing meetings). Total Coordinator time expenditure (tracked) was 8 full weeks of time over the course of the report period, on all aspects of the first year of the FERC process for the five main stem projects.
- Conducted spring fish population assessments targeting river herring in Connecticut and Massachusetts, sampling occurred on 18 dates (day and nights) from early April through June. Over 700 blueback herring, 100 alewife, and 300 American shad were collected and examined with approximately 900 pairs of otoliths removed in the laboratory with paired scale samples taken and prepared for reading
- Captured by boat electrofishing nearly 3,000 blueback herring that were transferred to the Oxbow and Manhan River, Easthampton, MA in May
- Surveyed Oxbow and documented juvenile blueback production attributed to spring transplants
- Specialized digital imaging system (computer, software, lenses, mounts, camera, lighting) was successfully procured and installed in August to use in aging otoliths and scales of species of management concern (e.g., river herring)
- Cleaned and mounted adult sea-run Atlantic salmon scales for age and growth analysis and completed aging and data analyses
- Collected salmon parr for wild fish health testing (summer) and collected precocious parr for spawning of salmon in support of CTDEEP program at RCNSS
- Maintained adult Atlantic salmon return and stocking databases
- Maintained fish passage databases
- Designated as USFWS representative to the Atlantic States Marine Fisheries Commission (ASMFC) Shad and River Technical Committee, participated in identified tasks
- Downloaded basin wide temperature loggers, 20 units, (Old Lyme, CT to Wilder Dam, VT), QA/QC checks, and redeployed (Sept 2013)
- Entered data from all fish population assessment work and transfers into databases or spreadsheets and conducted summary analyses
- Participated on Vermont Yankee Environmental Advisory Committee
- Served on the Middle Atlantic Fishery Management Council's fishery management team examining options on bycatch concern for shad and river herring
- Administered grant agreements with other FWS office staff (Martha Naley, Melissa Grader) to towns, non-government organizations, state, and federal grantees for a

variety of habitat restoration and fish passage projects

- Hallville Dam, fishway, Poquetanuck Brook in the town of Preston, CT was completed and was operational in spring of 2013, using a contributing Coordinator's grant agreement

Acknowledgements

I would like to thank the many people who have contributed to the accomplishments that are contained in this annual report, my Office Assistant, Darleen Cutting continued to make many important contributions over the year that increased office productivity and efficiency. I was provided the service of Darren Desmarais for nearly a full year and who was in process for permanent re-assignment to my office at the time of this report. As a biologist, Darren performed many critical functions this report period, examples include assisting and operating herring surveys, herring restoration, lab work of herring and shad, data management, equipment work and much more often in my absence due to the many meetings and related meeting work noted earlier. Also, importantly, was the relocation of Phil Herzig to this office. Phil worked with Darren and with and without me, to ensure the various fieldwork, equipment, and many other aspects of described activities were successfully completed. Phil and Darren's efforts are greatly appreciated. Phil has additionally adopted a lead role in habitat restoration and fish passage grants that include the Federal "Sandy Storm" Funding initiative, in the basin, that were worked on during this period. Carl Favata completed his undergraduate internship with me through Westfield State University and provided substantial contributions at a high level of proficiency, on spring field and laboratory work associated with river herring and shad activities.

Other USFWS staff assistance came from Martha Naley who continued to administer the Westfield River grant addressing culvert issues through Trout Unlimited and her work on the Fall River Dam removal. Melissa Grader continued with her work on the Manhan River fish ladder grant and project oversight, that will be operational in spring of 2014. John Sweka provided appreciated assistance in data manipulation and statistical analyses for fish population data and water temperature data. John Warner, with assistance from Melissa Grader, has provided important leadership in the tremendous amount of time that has gone into planning, meetings, letters, and responses, with the FERC five main stem relicensing process, over the report period. Brett Towler, provided fish passage engineering expertise on many ongoing matters and was responsible for running fishway inspections at main stem facilities. Bill McDavitt of the National Marine Fisheries Service also provided appreciated input on passage and habitat matters. The S. O. Conte Anadromous Fish Research Center also continued to provide technical expertise on many fish passage issues most notably from Ted Castro-Santos and Alex Haro.

The S.O. Conte National Fish and Wildlife Refuge continued to support the Coordinator's Office with use of a refuge boat/trailer for other on-river work (temp loggers and sampling), truck and boat storage space, and refuge staff assistance in field activities. The Refuge's Student

Conservation Association Interns: Gillian Braver, Heather Furman, Brent Holiday, Wes Isaacson, Marc Bissonette, all provided substantial time and effort to our spring field activities and other duties (scale cleaning, FOIA records indexing). USFWS's Artie McCollum managed SCA intern's time/duties to always meet CRC needs effectively.

The Sport Fish Restoration Grant money provided by the states of Connecticut, Massachusetts, Vermont, and New Hampshire, through F-100-R, are administered by the Wildlife Sport Fish and Restoration Program at USFWS with the appreciated assistance of the following Grant Coordinators; Tony Petrillo (CT), Kris McCarthy (MA), Randy Curtis (NH), Steve Gomez (VT), and Jen Stone (USFWS).

Other thanks for assisting in the accomplishments over this report period go to:

State fishery agencies -

- Connecticut: Steve Gephard, Jacque Benway, Tim Wildman, Dave Ellis, Bruce Williams, and their staff of seasonals,
- Massachusetts: Caleb Slater, Dan Marchant, Ben Gahagan, and Scott Elzey
- New Hampshire: Matt Carpenter, Gabe Gries, and Jason Carrier
- Vermont: Ken Cox, Lael Will and seasonals
- Rhode Island: Phil Edwards and staff

The Anadromous Fish Program and The Connecticut River Atlantic Salmon Commission

The administration of the interjurisdictional cooperative effort to restore Atlantic salmon and other diadromous fish species, including American shad and river herring, to the Connecticut River basin is accomplished through the Connecticut River Atlantic Salmon Commission (the Commission). During the period from 1967-1984 (prior to the Commission), restoration of anadromous fish (e.g. salmonids and clupeids, primarily Atlantic salmon, *Salmo salar*, and American shad, *Alosa sapidissima*) on the Connecticut River was guided by the Policy Committee and the Technical Committee for Fisheries Management of the Connecticut River Basin. The importance of this formally-structured, coordinating and regulatory body to the restoration program was recognized in 1983 when Congressional consent was given to the Connecticut River Basin Atlantic Salmon Compact, Public Law 98-138. The enabling legislation was re-authorized for another 20 years in 2002. This law, originally passed by the legislative bodies in each of the four basin states, created the Commission and conveys Congressional support to an interstate compact for the restoration of Atlantic salmon to the Connecticut River Basin. The Commission is comprised of ten Commissioners (Table 1) including a high-level government employee and a public sector representative appointed by the governor of the appropriate state, and the Northeast Regional Directors of both the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS).

The Commissioners act on policy matters and are advised on scientific and technical matters by a Technical Committee. The Technical Committee is comprised of senior staff biologists from each Commission member agency, the U.S. Forest Service (USFS), and the Massachusetts Division of Marine Fisheries (Table 2). To effectively address numerous technical issues related to diverse restoration and management activities, the Technical Committee expanded and restructured its subcommittees, for a total of nine, with specific areas of responsibility (American Shad, River Herring, Atlantic Salmon, American Eel, Sturgeon, Sea Lamprey, Fish Passage, Habitat, and Fish Culture). Other experts and cooperators from the member agencies including the U.S. Geological Survey, Conte Laboratory (USGS), University of Massachusetts Cooperative Fish and Wildlife Research Unit, Trout Unlimited, The Nature Conservancy, Connecticut River Watershed Council, private industry, and others participate with the subcommittees and Technical Committee as needed. The Connecticut River Coordinator (Coordinator), an employee of the USFWS, acts as the Executive Assistant to the Commission and the Secretary for the Technical Committee. The Coordinator also serves as a member on all the Technical Committee's subcommittees and Chair for the Shad and River Herring subcommittees, and member to the Vermont Yankee Nuclear Power Station's Environmental Advisory Committee, the Atlantic States Marine Fisheries Commission's Shad and River Herring Technical Committee, the Northeast Regional River Herring Agency Team, and the U.S. Atlantic Salmon Assessment Committee.

The Coordinator is responsible for coordination of state and federal activities, providing technical expertise, project development and implementation of fish population assessments,

restoration and management programs at the population and habitat level, program evaluation, and advocacy and outreach of the multi-agency cooperative diadromous fish restoration program in the Connecticut River watershed (Figure 1). The Coordinator also organizes meetings, develops new initiatives, develops plans and provides planning leadership, and maintains contact with interested parties.

The cooperative program to restore Atlantic salmon has faced many significant changes following the severe flood damage to White River National Fish Hatchery in 2011 and the later decision by the USFWS in 2012 to conclude its active use of salmon culture and holding facilities for the Connecticut River Atlantic Salmon Program in 2013. The Commonwealth of Massachusetts subsequently decided to end its salmon culture activities, with a final stocking of fry and sub-yearlings in spring 2013, based on its assessment of program viability in the absence of the USFWS. Similarly, the State of Vermont stocked a final group of fry in spring 2013, from eggs provided by Connecticut, and New Hampshire did not stock salmon in 2013 in its portion of the basin. The State of Connecticut has decided to continue with a "Salmon Legacy Program" at a much reduced scale from the previous cooperative restoration effort. Connecticut has requested USFWS support to hold sea-run salmon, as permitted on an annual basis, at Richard Cronin Station, to maintain a more genetically sound domestic broodstock egg source for their Legacy Program.

These developments will result in a relatively dramatic decline in fry stocked in future years, beginning in 2014, reduced to only select areas in State of Connecticut tributaries. Natural production may occur from released sea-run adults should these fish be allowed to swim the river in 2014, or in subsequent years. Fry stocked in 2013, are expected to grow and smolt principally at age-2 or during the spring of 2015, with the majority of those fish returning as adults in 2017, as two-sea winter adults. At the time of this report, the plans for sea-run returns that may be trapped at facilities remains to be determined by USFWS's ability to support the State of Connecticut's request to hold these fish for spawning. As juvenile salmon will remain in tributaries as late as age-3 smolts, and adults may remain at sea for three winters, Atlantic salmon are expected to be a management topic requiring coordination through CRASC for likely the next five to six years. Assessments of returning adults will continue, providing data for CRASC and the broader U. S. Atlantic Salmon Assessment Committee work, to the extent possible (e.g., determination of age structure) . The CRASC can, has, and continues to serve as an important forum, recognized official organization, and mechanism to address more than Atlantic salmon restoration alone, as will be further described in this report.

Fish species under restoration and enhancement in the Connecticut River basin include American shad, blueback herring, sea lamprey, American eel, and alewife, primarily addressed by efforts to provide upstream passage to historic habitats and post spawn adult and juvenile downstream passage. Shortnose sturgeon, the only federally endangered species population (under recovery), continues to be monitored, studied, and protected through various mechanisms. A significant research text was published on much of the existing research on this population by Dr. Boyd Kynard et al. (2012) in "**Life History and Behavior of Connecticut River Shortnose and Other Sturgeons.**" Atlantic sturgeon is considered extirpated from the river, but the remaining

East Coast populations were designated as federally endangered by NMFS in 2012, the most closely identified extant population to this river being the Hudson River. Field studies on sturgeon by CTDEEP have documented individuals from the Hudson River and other populations utilizing the lower Connecticut River.

The Commission meets at least twice each year and the Technical Committee meets as frequently as needed. This report period, the Commission met on October 2, 2012 and on June 26, 2013. The Technical Committee met on June 18, 2013. Scheduled meetings are open to the public. Interested citizens are given the opportunity to provide input into the decision-making process. Area news publishers are notified of scheduled Commission meetings. Minutes of both Commission and Technical Committee meetings are produced and distributed by the Coordinator's Office once approved. Approved Minutes were posted on the Connecticut River Coordinator's Office website. In addition to serving as an historic record, these minutes describe the progress and status of many coordinated activities. Program reporting occurs in other forms such as the U.S. Atlantic Salmon Assessment Committee which produces a summary document each year for all of New England available online at:
http://www.nefsc.noaa.gov/USASAC/Reports/

Table 1. Connecticut River Atlantic Salmon Commission Membership (as of November 2013).

Connecticut River Atlantic Salmon Commission	
Federal	**U.S. Fish and Wildlife Service** *Wendi Weber* Regional Director, Region 5 *Sherry White, alternate*
	National Marine Fisheries Service *John Bullard* Northeast Administrator *Daniel Morris, alternate*
Connecticut	**Connecticut Dept. of Energy and Environmental Protection** *William Hyatt* Chief, Bureau of Natural Resources *Stephen Gephard, alternate*
	Public Sector Representative *Robert A. Jones*
Massachusetts	**Massachusetts Division of Fisheries and Wildlife** *Wayne F. MacCallum* Director *Mark Tisa, alternate*
	Public Sector Representative *Vacant*
New Hampshire	**New Hampshire Fish and Game Department** *Glenn Normandeau* Executive Director *Scott Decker, alternate*
	Public Sector Representative *Duncan McInnes*
Vermont	**Vermont Department of Fish and Wildlife** *Patrick Berry* Commissioner *Eric Palmer, alternate*
	Public Sector Representative *Peter H. Basta*

Table 2. Connecticut River Atlantic Salmon Commission Technical Committee Membership.

Connecticut River Atlantic Salmon Commission Technical Committee	
Federal	**U.S. Fish and Wildlife Service** *William Ardren*
	National Marine Fisheries Service *William McDavitt*
	U.S. Forest Service *Dan McKinley*
Connecticut	**Connecticut Dept. of Energy and Environmental Protection** *Stephen R. Gephard*
Massachusetts	**Massachusetts Division of Fisheries and Wildlife** *Caleb Slater* Chair
	Massachusetts Division of Marine Fisheries *Ben Gahagan*
New Hampshire	**New Hampshire Fish and Game Department** *Matthew Carpenter*
Vermont	**Vermont Department of Fish and Wildlife** *Lael Will*

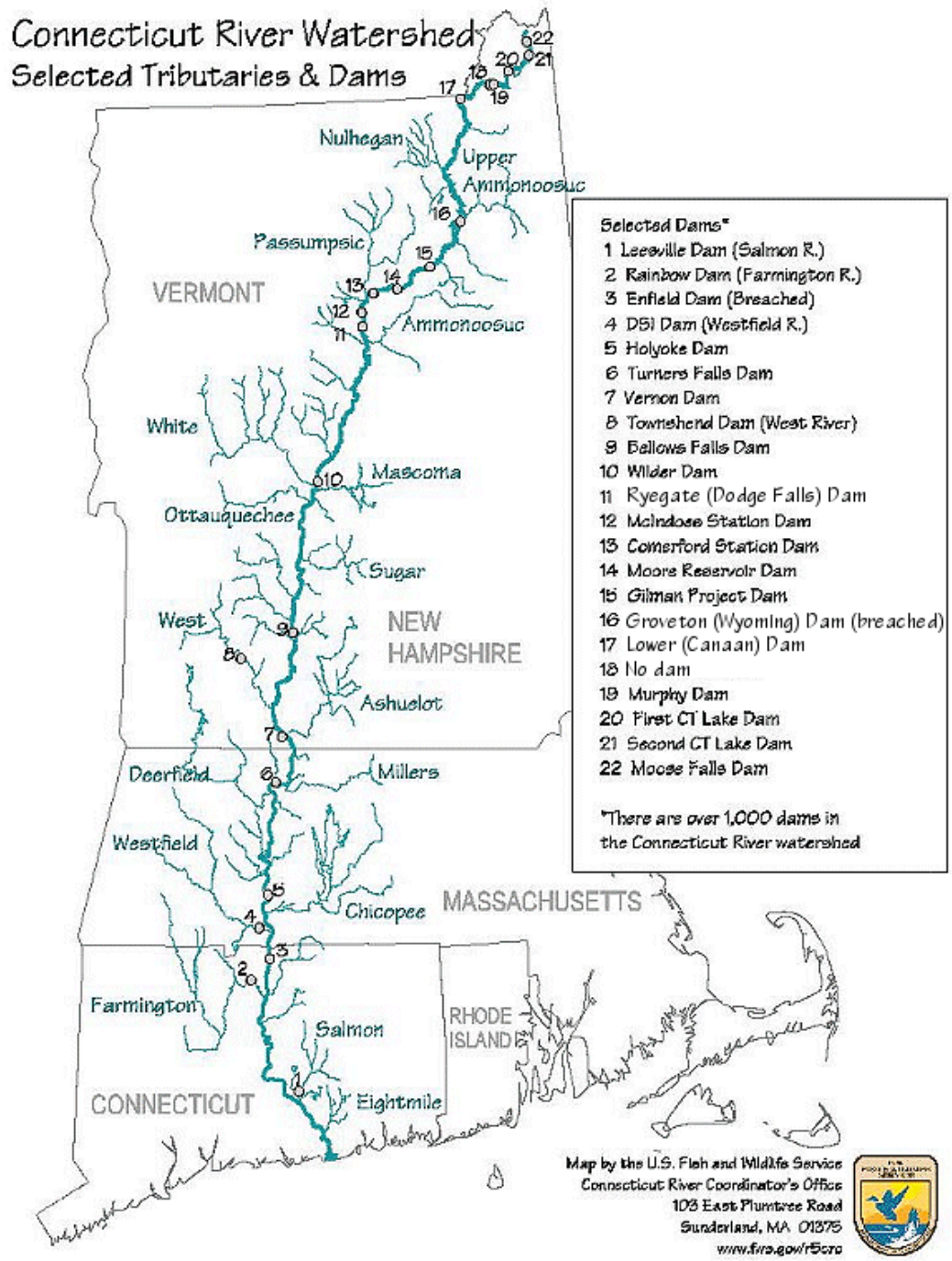

Figure 1. Connecticut River basin with major tributaries and main stem dams shown.

Coordination and Technical Assistance Funding

The Connecticut River Coordinator's Office, under the USFWS' Wildlife and Sport Fish Restoration Program's F-100-R-30, received $20,000 from the four state fishery agencies to coordinate activities and provide technical assistance through the state's annual Sport Fish Restoration Program apportionment. The grant project was assessed an USFWS administrative overhead fee (18%, a substantial increase over past years) leaving $16,393 available. The USFWS utilized the Sport Fish funds, including base funding and fish passage and habitat restoration funding (pass through grant agreements to partners, listed later) that totaled $276,019 to operate the Coordinator's Office and undertake the initiatives and complete tasks described in this report. Operating expenses and salaries for the Coordinator's Office were covered by these funds in fiscal year 2013.

Cost **States:** $16,393 **Federal:** $276,019

Project Accomplishments

The Connecticut River Coordinator's Office enhanced the Commission's ability to manage, evaluate, and implement restoration programs through a variety of activities and accomplishments:

Coordination

- The Coordinator continued to provide administrative support to the Commission and Technical Committee as the Executive Assistant and Secretary, making meeting arrangements, assisting in setting agendas, distributing information, monitoring financial receipts and disbursements, and recording and distributing minutes of Commission and Technical Committee meetings. The Coordinator participated on the CRASC Fish Passage, Salmon Studies, Fish Culture, Shad and River Herring subcommittees during this report period. The Coordinator served as the Chair for Shad and River Herring subcommittees.

- The Commissions' Technical Committee River Research Forum was organized by the Coordinator and included platform presentations on fish passage, climate change, river herring marine management, Atlantic salmon, shortnose sturgeon, and American eel. Over 100 people attended the one day conference held at the USFWS Northeast Regional Office in March.

- The Coordinator's Office continued to administer the four-state (Connecticut, Massachusetts, New Hampshire, Vermont) Wildlife and Sport Fish Restoration Program Coordination and Technical Assistance Project to provide for program coordination and technical assistance. This report cycle was the start of a new five-year agreement period.

- The Coordinator's Office compiled information for use by the U.S. Atlantic Salmon Assessment Committee in its annual report for 2012 year and attended the annual

meeting at CTDEEP's Marine Fisheries Headquarters in Old Lyme, CT in February 2013. A presentation was developed and given on the Connecticut River Salmon Program with a report produced for the Committee. Data calls and planning meetings were held pre and post this meeting during the report period (http://www.nefsc.noaa.gov/USASAC/Reports/).

- The Coordinator participated as a member on the Vermont Yankee Nuclear Power Station's Environmental Advisory Committee, this included reviewing proposals by VY to address requested shad studies that were not ultimately initiated and assistance to the State of Vermont Fisheries Biologist with a State legal hearing process that included arguments on potential operation impacts to anadromous fishes and restoration management measures, that occurred over the course of the report period.

- The Coordinator worked with Connecticut Department of Energy and Environmental Protection (CTDEEP), New Hampshire Fish and Game (NHFG), Rhode Island Division of Fish and Wildlife (RIDFW), U.S. Geological Survey, Conte Lab (USGS), and Holyoke Gas and Electric fishway staff to develop a shad trap and transfer schedule for the Holyoke Fish Lift.

Fisheries Management, Restoration, Assessment, and Technical Assistance, additional select detail:

- The Coordinator developed and implemented a population assessment program for river herring that was initiated in early April, utilizing boat electrofishing as the primary sampling gear. Study objectives were to: 1) obtain a minimum whole fish sample of 45 blueback and alewife for age structures, per target sample location; 2) obtain baseline demographic data on all sampled herring (species, length, weight, sex); 3) derive relative abundance measures with measures of variance, using a standardized approach; 4) conduct surveys across a broad geographic range for spawning aggregation (most downstream area, Middletown, CT upriver to the Holyoke Dam) and over the duration of the runs (April-June), in an attempt to adequately represent spatial and temporal variations for both species; and 5) determine fish ages from otoliths and spawning history from scale examinations. This work was conducted to address identified priority data needs, specific to the Connecticut River and coast-wide, as described in the Atlantic States Marine Fisheries Commission's River Herring Benchmark Stock Assessment Report released in May 2012 (http://www.asmfc.org/uploads/file/riverHerringBenchmarkStockAssessmentVolumeIR_May2012.pdf). Data obtained from this study will increase in its management value over time (as an ongoing monitoring effort) with measures compared over time for status and trends and other fishery analytical methods (e.g., age structure based mortality estimators).

  Sample effort was standardized to two dip netters on the bow of the boat, using two 16 dropper array anodes off booms, with applied power time ("on-meter") of 500 seconds, ~500 volts and 5-6 amps direct current applied at intervals of 3-5 seconds, designated as a run. River herring, alewife and blueback herring, were the primary target species, with American shad also targeted primarily in June for a supplemental study. Shad were secondarily targeted in order to obtain paired otolith and scale samples to compare structures for reading accuracy in age determinations. Sampling dates and locations

typically included 4-5 runs. Surveys were conducted on a total of 18 dates, comprised both of daytime and night-time surveys. Six targeted sampling areas consisted of the lower Mattabesset River (Middletown CT), Wethersfield Cove (Wethersfield CT), lower Farmington River (Windsor, CT), lower Westfield River (Agawam MA), lower Chicopee River (Chicopee MA), and main stem river downstream of Holyoke Dam (Holyoke MA). The first 45 herring (by species) were targeted for later lab processing (otolith extraction and scales), sex and species confirmation. Herring sampled after the lab's target number was achieved, were identified, sexed, measured, weighed, and released, all data were compiled for analyses.

Otolith and scales were cleaned and stored, with all field data entered into a developed database, designed to identify individual fish and corresponding age structures to determine age and spawning history. Some summary analyses for the data obtained in the spring of 2013 is shown in Table 3 and described in following narrative.

Table 3. Summary data statistics (e.g., total sample size, fish total length statistics, sex, and age structures sampled) for blueback, alewife, and American shad sampled from April 8 – June 21, 2013.

	Blueback	Alewife	American shad
N	714	107	316
Mean (TL, mm)	256.2	277.4	497.0
SD	12.7	20.5	45.4
Min	144	236	368
Max	300	320	585
Female	131	64	182
Male	412	39	134
Unknown	171	4	0
Otolith pairs sampled	501	103	315
Scale sampled	501	103	315

USFWS digital imaging system, software display, and blueback herring otolith from the Farmington River in May, annulus are marked with circles, age-3 fish.

A total of 81 timed sampling runs were completed over the 18 sample dates. Alewives were sampled in surveys conducted on all eight first consecutive survey dates, from 8 April through 3 May and none observed on all subsequent sample dates. Blueback herring were sampled on all but two dates, the first and the last. Mean catch per effort (CPE) measures, for each date, were highly variable for blueback, ranging from a low of 0.0 to 18.1 fish/minute, with correspondingly high values of variance for each mean, with the mean of means 1.87 fish/min for the 18 dates. Mean CPE measures for each date for alewife, ranged from 0.0 to 0.72 fish/min, with less variability (standard deviation) for each date's mean value, compared to bluebacks. The mean of means for alewife was 0.15 fish/min, but as noted, included only 8 dates with alewife captured and 10 dates with zero captured. Based on 2013 results, sampling in 2014 is planned to begin in late March to improve samples of early run fish.

In comparison, blueback herring CPE, using the same techniques, but some different locations and timing, was 2.0 fish/min for blueback herring in 2010 (mean of means) on 10 sample dates in 13 areas. The 2010 USFWS surveys were comprised of 41 runs (500 seconds period) and captured 339 bluebacks. These measures are not expected to be directly comparable but may be improved in future years monitoring efforts with refinements from analyses of data. Coefficient of variance for this CPE metric routinely approaches or exceeds 100 (in 2010 and 2013), demonstrating the extremely high variability that is inherent in this aspect of the study with these species.

The 2010 herring assessment work determined blueback herring mean length to be 249.2 mm (SD 13.7), which was significantly different ($P \leq 0.001$, t-test) than the 2013 mean length of bluebacks (256.2 mm) reported in Table 3. Alewife in 2010 assessments had the largest sample size taken from a pound net, (79 fish), with a mean length of 254.5 mm (SD 13.4) that was significantly different ($P \leq 0.001$, t-test) from the 2013 mean length of

alewife (277.4 mm) reported in Table 3. The work of reading both the otoliths and scales for the species sampled in 2013 will be initiated after this report period, primarily during the winter of 2014 and will be reported to respective State agencies, CRASC, and the Atlantic States Marine Fisheries Commission.

- Active river herring restoration measures were initiated as blueback herring catch rates in population assessment work was increased. In the month of May the Coordinator's Office transitioned to capture efforts for pre-spawn herring from Wethersfield Cove, concurrent with population assessments. Unlike the effort in 2010, herring were never observed in any abundance along the shoreline of the cove in areas suitable for the intended use of a large seine net, although several dozen were netted on one occasion. Boat electrofishing, with reduced power settings, making capture more challenging, produced approximately 3,000 herring for transfer to accessible but unutilized habitats upstream of Holyoke Dam (Table 4). Fish were transported in two USFWS tank trucks with salt treatments (10ppt), diffused oxygen, and recirculating water pumps. Transport mortality was extremely low (0 to < 5% per trip) with fish observed at release in better condition than when first placed in truck tanks, attributed to salt and relatively high dissolved oxygen levels (>8ppm).

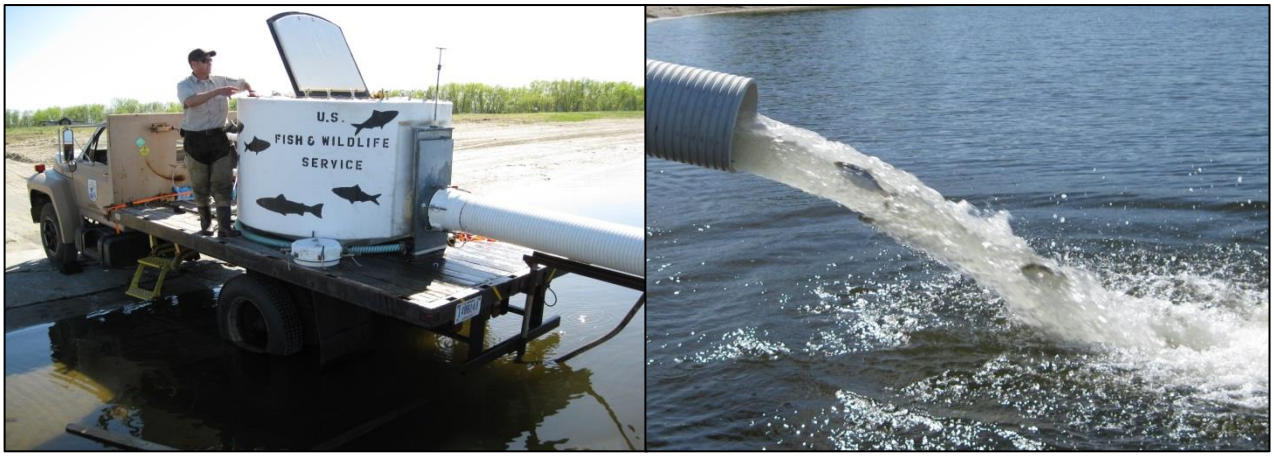

Table 4. River herring (nearly all blueback) captured primarily by boat electrofisher from Wethersfield Cove, CT and released adjacent to main stem river in Oxbow, Easthampton, MA and the Manhan River above the first dam, whose fish ladder will be operational in 2014.

Date	Number Captured	Release Location
5/2	375	Oxbow, Easthampton, MA
5/6	500	Oxbow, Easthampton, MA
5/7	245	Oxbow, Easthampton, MA
5/16	508	Oxbow, Easthampton, MA
5/17	451	Oxbow, Easthampton, MA
5/20	285	Oxbow, Easthampton, MA
5/22	567	Manhan River, Easthampton, MA
Total	**2,931**	

The Oxbow was sampled by boat electrofishing in August and over 100 hundred juvenile American shad and blueback herring were collected. The proportion of juveniles that

were identified as bluebacks was 43%, with size ranges within expected total lengths of 70-90 mm.

- The Coordinator's Office coordinated shad transfers and tracking in cooperation with the NHFG, CTDEEP, RIDFW and the USGS-Conte. A summary of American shad transfers from Holyoke Fish Lift and stocking locations are provided in Table 5.

  Table 5. Summary of American shad transfers from Holyoke Fish Lift spring of 2013 with stocking locations.

Agency	Stocking location	Number Released
RIDFW	Ashuelot River, NH	680
CTDEEP	Upstream of Vernon Dam, NH	133
CTDEEP	Farmington River, CT	154
CTDEEP	Naugatuck River, CT	75
USGS – Conte Lab	Turners Falls Canal, MA	420
RIDFW	Pawcatuck River, RI	400
CTDEEP	Naugatuck River, CT	150
USFWS	North Attleboro NFH, MA^	261
	Total	**2,123**

^ tank spawned with cultured larvae stocked into RI rivers

- The Coordinator's Office sampled 60 shad from the Holyoke Dam for a wild fish health assessment, in cooperation with the USFWS Northeast Fishery Center (NEFC), Lamar Fish Health Center. All shad tested negative for pathogens of concern.

- Coordinator' Office assisted RCNSS with fall 2012 and fall 2013 spawning activities during the report period. In addition the Coordinator and staff spend time from spring through fall applying therapeutic chemical treatments when the single staff at the facility was not available. Coordinator identified and reviewed RCNSS facility with potential partners, and arranged meetings both internally and externally, to explore future facility use options, which is ongoing.

- The Coordinator used S.O. Conte Refuge Student Conservation Association (SCA) interns, primarily spring months, working for the Conte Refuge, and also obtained students and volunteers over the report period to assist on tasks. One formal student internship program was completed with Westfield State University, who provided assistance during the spring months. A total of approximately 300 volunteer hours, along with USFWS personnel from other offices/programs (~200 hours) were essential to achieving project/program objectives.

- The Coordinator spent approximately 8 full weeks of time on the many varied aspects of the FERC relicensing process for the Turners Falls Dam and Northfield Mountain Pumped Storage Project operated by FirstLight Power and TransCanada's Vernon Dam, Bellows Falls Dam, and Wilder Dam. The 5 year process (all licenses expire in 2018) was initiated in fall of 2012 with the two companies Preliminary Application Document submission. The CRC web site (http://www.fws.gov/r5crc) provides links to both FirstLight and TransCanada's web sites where each company has posted many documents on this process. The CRC's web site also has the USFWS' initial Study

Request letter signed under the New England Field Office Supervisor, developed by John Warner and Melissa Grader. The Coordinator served as the study lead for the Requests for First Light on adult shad passage (upstream and downstream), juvenile shad passage, fish assemblage, shad spawning evaluation, littoral zone fish spawning, canal draw down, and entrainment/impingement at NMPS. For TransCanada, Coordinator served as the lead for American shad passage studies, both juveniles and adults. Many of these studies are to be conducted in close coordination by the power companies given identical telemetry and passage study objectives, benefitting study designs and data.

As with the many other study requests, many individuals contributed with the development and review of them. The Coordinator provided similar support to many other leads on their studies as well. In summary, the requested studies submitted by USFWS seek to provide information that is needed to understand the types and extent of any potential project operation, or other project related effects to fish, wildlife, and plant populations, fish passage (up and downstream), and habitats that these species and population depend upon, with special attention to threatened and endangered species (e.g., shortnose sturgeon). This effort has benefitted greatly from extensive coordination among USFWS, NOAA/National Marine Fisheries Service, USGS Conte Lab, State Fish and Wildlife Agencies, State Water Quality Agencies, and non-governmental groups including Connecticut River Watershed Council, The Nature Conservancy, and Trout Unlimited. The FERC effort has been well organized with pending modifications (delay) to many studies start times being likely due to the pending closure of Vermont Yankee in December 2014 by its owners. In 2014, the VY thermal discharge periods and limits are expected to continue, a very different baseline that what is expected after 2014 closure, thus the rationale for the delays.

- The Coordinator's Office completed one cooperative agreement to assist with the removal of a partially breached dam on the Fall River, Gill/Greenfield, MA (Martha Naley). Many previous grant agreements remain open and are administered by the Coordinator's Office that include: Ed Bills Pond Dam Removal, American Rivers, Lyme CT; Hallville Pond Dam Fish Ladder, Eastern CT Conservation District, Preston, CT; Manahan River Fish Ladder, Town of Easthampton, MA; Alewife Brook/Scoy Pond Habitat Enhancement, Town of East Hampton, NY; and Thousand Acre Pond Dam removal project, Town of Athol, MA, and (Stroud Dam) and culverts (Skunk Brook and Kinne Brook) on a tributary to the Westfield River in Chester, MA working with Trout Unlimited. The Hallville Dam fishway was completed in this report period and passed river herring in the spring of 2013.


Hallville Fishway

- The Coordinator's Office cleaned and slide mounted adult sea-run Atlantic salmon scale samples. The Coordinator worked with Steve Gephard (CTDEEP) in the aging of salmon scales and developing the 2013 adult run summary data (details in later section).

- The Coordinator maintained long-term temperature loggers (n=20) from Old Lyme, CT

upriver to Wilder Dam, (VT/NH) in October-December 2012 and in September 2013, first deployed in the fall of 2009. Loggers record year-round at 20 minute intervals. Loggers were also placed in lower portions of selected tributaries, Salmon River, and Farmington River. Data have been downloaded and units were re-deployed twice in the report period.

- The Coordinator's Office conducted juvenile American shad population assessments and water temperature monitoring in the lower Vernon Dam Pool in the fall of 2012. In 2013, data analyses were completed and a report "**Juvenile American shad assessment in the lower Vernon Dam Pool Fall 2012**" was developed. Due to the ongoing litigation in the State of Vermont with Vermont Yankee, this report and the water temperature report were both given substantial review internally and externally, that resulted in its release in September 2013, posted on CRC web site (http://www.fws.gov/r5crc). The study which was limited in effort, identified sustained concentrations of juvenile shad between the VY thermal discharge point and the immediate downstream forebay area for Vernon Dam, where surface downstream bypass structures are operated for these juveniles. A number of substantiated concerns are provided regarding this situation.

- The Coordinator produced a report "**Water temperature monitoring and diadromous fishes temperature concerns in the Connecticut River upstream of and downstream of Vernon Dam, Vernon, Vermont**" in September 2013, that is posted on CRC web site. The Executive Summary states explicitly, the rationale and need for appropriate studies that have yet to be conducted, to properly determine whether Vermont Yankee thermal discharge is negatively impacting fish populations and restoration measures such as passage, as supported by VY data, CRC data, and numerous reports and papers, many of which are specific to the Connecticut River.

Outreach

- The Coordinator developed a one day teacher orientation for the Atlantic Salmon Egg Rearing Program (ASERP) in cooperation with Trout Unlimited and the Massachusetts Division of Fish and Wildlife (MADFW) – January 2013. The ASERP was conducted in over 40 elementary schools in western Massachusetts in 2013. The Coordinator presented the data and rationale behind USFWS decision to no longer actively support restoration of this species with its hatchery facilities.

- The Coordinator's Office updated the station website on the Internet (http://www.fws.gov/r5crc) with current information and activities.

- The Coordinator's Office continued to maintain databases on migratory fish restoration activities. Daily fish counts at eight different dams were entered into a database by Office staff. These fish counts were updated daily (M-F during the spring run) on a telephone hotline (413/548-9628) and on the Internet.

- A presentation on Coordinator activities and migratory fishes was given to the Connecticut River Joint Commission's at their November 2012 meeting in West Lebanon, NH.

- The Coordinator appeared on a morning live radio show, WHMP (Northampton MA), in January as a panel member to discuss fish restoration and the FERC relicensing process for the five main stem hydropower projects.

- The Coordinator gave a presentation on migratory fish restoration, status and trends, to Westfield State University, Ecology Class in March.

Program Results

The Connecticut River Coordinator's Office collected and reported information relating to the activities and accomplishments occurring in the Connecticut River basin diadromous fisheries restoration program. [Some of the data presented here is preliminary. For final, accurate, peer reviewed program data/information, refer to the annual U.S. Atlantic Salmon Assessment Committee Report.]

Adult Atlantic Salmon Returns

A total of 92 sea-run Atlantic salmon adults were documented as returned to the Connecticut River watershed during 2013. This is an increase from the 54 known returning adults in 2012 (Figure 2). Starting in the lower basin, one adult was observed at the Moulson Pond Fishway on video, on the Eightmile River, and passed upstream. Five adults were documented and captured from the Salmon River and six were trapped on the Farmington River at Rainbow Fishway. On the Westfield River 11 adults were documented, two of which escaped being trapped and passed upstream. Holyoke Fish Lift trapped a total of 69 adult salmon. No adult salmon were released from Holyoke Fish Lift. All adult salmon that were trapped or captured (total of 89) were transported to Richard Cronin National Salmon Station. The USFWS had agreed to permit up to 100 adult salmon to be held at RCNSS in 2013 for spawning, with eggs to be removed off station as soon as fish health testing was final (~2 months post spawning) per a written request from CTDEEP. Eleven fish died prior to spawning in the fall. Precocious salmon parr were collected by USFWS and utilized due to skewed female sex ratio. Spawning occurred after this report period and was done for the purpose of supporting the CTDEEP Legacy Program.

Age and origin information was derived from scales and physical examination such as an adipose fin clip (all stocked smolts clipped) of each salmon when available (e.g., some scales not possible to accurately age, thus numbers may not directly relate for cross references). Of the 92 salmon documented as returned in 2013, only 89 were trapped. Based on available data including observations of untrapped adults 88 fish were determined/observed to be of wild (fry stocked) origin, and four were of hatchery origin (smolt stocked). Sea-age (sea winter = SW) of wild salmon was comprised of 89 (2SW) salmon and three grilse (or 1SW) observed. Freshwater age (at smolt emigration on readable scales) of wild salmon was comprised of 9 age-1, 73 age-2, and two age-3 fish.

Atlantic Salmon Egg Collection (Fall 2012)

The Commonwealth of Massachusetts, State or Connecticut and USFWS used fish culture facilities to spawn sea-run, kelt and domestic broodstock, producing a total of 4.785 million eggs by December 2012.

Sea-Run Brood Stock: A total of 202,000 sea-run salmon eggs taken at the RCNSS in

fall of 2012. All fish and eggs tested negative for pathogens of concern.

Captive/Domestic Brood stock: A total of 4.561 million eggs were taken from domestic females held at the Roger Reed State Fish Hatchery (1.460M), and Kensington State Fish Hatchery (3.101M). CTDEEP's Kensington State Fish Hatchery shipped approximately 548,000 to the State of Vermont's Roxbury State Fish Hatchery.

Kelts: A total of 21,500 eggs were taken from kelts at RCNSS.

Juvenile Atlantic Salmon Releases

A total of 1,957,120 million Atlantic salmon were stocked into the Connecticut River watershed in 2013. A substantial reduction from previous years as documented in the U.S. Atlantic Salmon Assessment Committee Report. The 2013 release total includes: 1.449 million unfed fry; 408,032 fed fry; 99,523 age-2 smolts, and 580 age-1 smolt, stocked into tributaries and the main stem (Table 6).

Table 6. Summary table of Atlantic salmon stocked by state, lifestage, and location in 2013.

State	Sub-basin	Ufry	Ffry	2Smolt	1Smolt	Sums
CT	Salmon	107,180	103,300			210,480
CT	Farmington	252,898	304,732	66,232		623,862
MA	main stem			27,580	580	28,160
MA	Westfield	465,232		5,711		470,943
MA	Manhan	30,739				30,739
MA	Mill (Noho)	35,179				35,179
MA	Mill	7,750				7,750
MA	Sawmill	41,776				41,776
MA	Fall	9,930				9,930
MA	Deerfield	199,244				199,244
VT	Deerfield	118,368				118,368
VT	West	91,576				91,576
VT	White	22,993				22,993
VT	Pauls	12,620				12,620
VT	Passumpsic	41,200				41,200
VT	Nulhegan	12,300				12,300
		1,448,985	408,032	99,523	580	1,957,120

Fish Passage

The USFWS' Hydropower Coordinator, John Warner, is the lead for most of the activities summarized below and works closely with State Agency representatives. The following is taken from Mr. Warner's report to CRASC Technical Committee, November 14, 2013.

Holyoke – Connecticut River

- HG&E developed the 3rd new rack and bypass proposal and conducted CFD modeling on that proposal. FWS commented on plans and proposed an alternative lower level bypass design and post-construction modifications if performance was not adequate.
- Comments on post-construction monitoring are currently being prepared by NMFS and others.

- Agencies, TU, CRWC and HG&E agreed to a blend of the two bypass proposals and some other additional changes to the design and are awaiting new CFD modeling runs of the revised design.
- Meeting to review CFD modeling anticipated in December.
- Construction targeted to begin in 2014 with trash rack screening, and completion in 2015.

Connecticut River Relicensings

- We are now into year 2 of a 5-year relicensing process for the 5 projects.
- TransCanada and FirstLight have filed Proposed Study Plans (PSP) based on input from interested parties and FERC. Interested parties participated in a series of meetings to review PSP's with the applicants.
- Vermont Yankee shutdown has led to delays in finalizing the study plans as VY operation status will change river temperatures and may affect timing of some studies.
- FERC meetings on VY and study scheduling on November 25 and 26.
- Agencies and other parties participated in an Instream Flow Study site visit to scope out the study river reaches and habitat types for evaluation. This study was originally scheduled for 2013, but has been delayed until 2014.
- Early 2014 likely to be busy with consultation on final field study plan details.

Manhan River Dam – Manhan River

- Construction of the fishway is almost complete and will be operable in spring 2014.

Migratory Fish Returns

American Shad - A total of 397,958 adult American shad were counted in 2013 at all passage facilities in the basin. A total of 392,967 shad were passed upstream of the fish lift in Holyoke, Massachusetts in 2013 (Figure 2). A total of 4,900 shad were passed upstream of the West Springfield Project in 2013, approximately half of the record number passed in 2012, but still very high in its time series. A total of 91 shad were passed upstream of the Rainbow Dam Fishway on the Farmington River in Connecticut. Of the shad passed above the Holyoke Dam, 35,494 shad were counted and passed at the Gatehouse fishway at Turners Falls Dam in 2013 (Table 7). Overall, the 2013 passage number as a percentage of shad passed at Holyoke is approximately 9%, a relatively high value in the time series, but well below identified targets. The CRASC, Shad Management Plan has an objective of 40-60% shad passage at each successive barrier on the main stem. Continued operational and structural changes at the (Turners Falls) Gatehouse fishway entrances, have been experimentally shown (USGS Conte Lab studies) to explain the increases in passage observed since 2008 of shad out of the canal. Shad passage at Vernon Dam was relatively high for a second consecutive year, following repairs to the Vernon Dam fishway prior to 2012 season, with 18,220 shad passed in 2013. This translates to 51% passage (at Vernon) of the shad passed upstream of Turners Falls Dam, which does meet the noted management plan objective (Table 7).

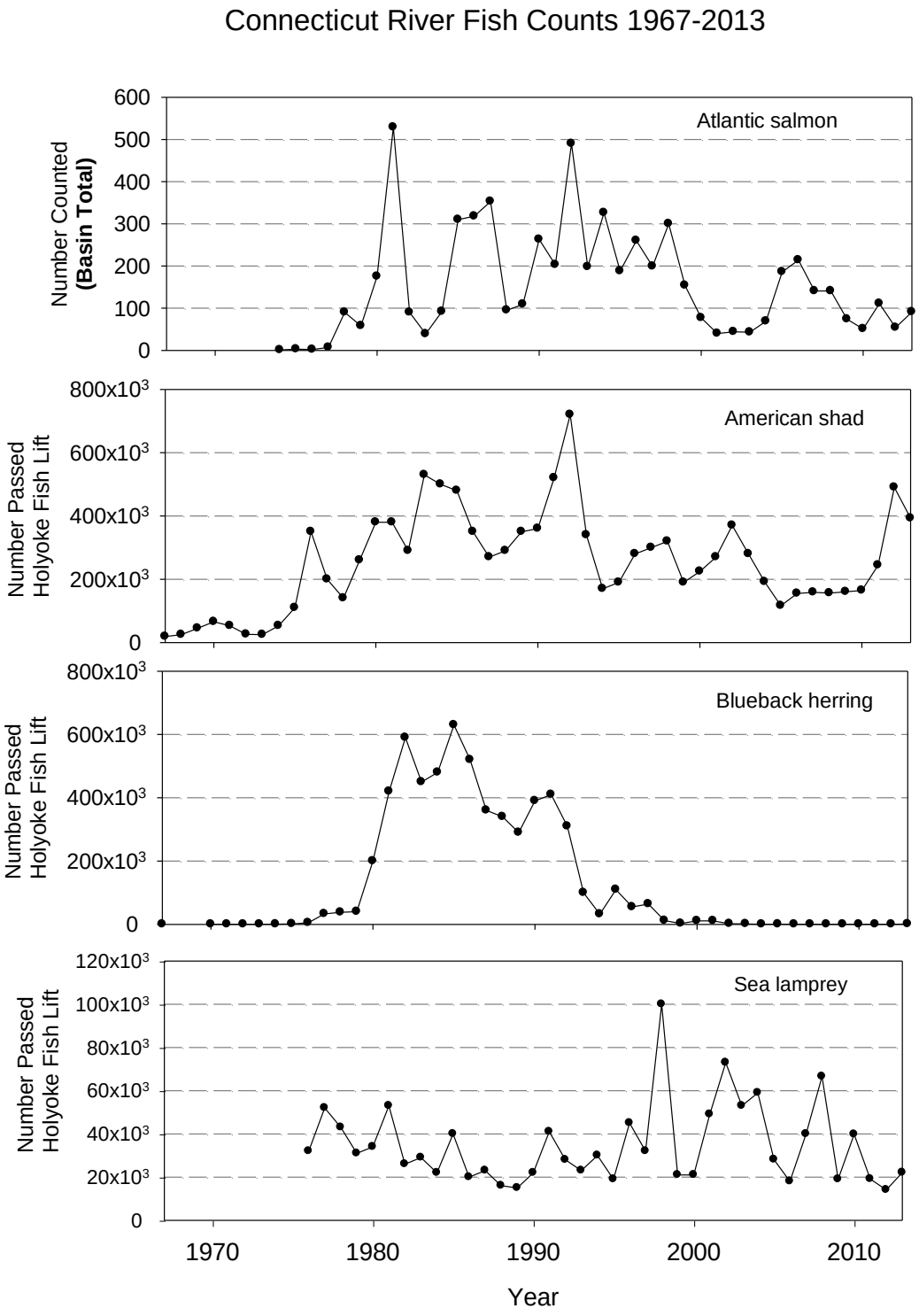

Figure 2. Summary of Atlantic salmon returns to Connecticut River basin (all facilities), and Holyoke Fish Lift passage counts for American shad, blueback herring and sea lamprey (1967-2013). Fish counts are affected by structural and operational changes (dams and fishways), and environmental conditions (temperature and flow/spill).

Table 7. American shad fishway passage counts 1980 – 2013, for Holyoke Dam, Turners Falls Dam, and Vernon Dam.

Year	Holyoke Dam Fish Lift	Turners Falls Dam Gatehouse	% Gate vs. HFL #	Vernon Dam Fish Ladder	% Vern vs. Gate #
1980	380,000	298	0.1		
1981	380,000	200	0.1	97	48.5
1982	290,000	11	0.0	9	81.8
1983	530,000	12705	2.4	2597	20.4
1984	500,000	4333	0.9	335	7.7
1985	480,000	3855	0.8	833	21.6
1986	350,000	17858	5.1	982	5.5
1987	270,000	18959	7.0	3459	18.2
1988	290,000	15787	5.4	1370	8.7
1989	350,000	9511	2.7	2953	31.0
1990	360,000	27908	7.8	10894	39.0
1991	520,000	54656	10.5	37197	68.1
1992	720,000	60089	8.3	31155	51.8
1993	340,000	10221	3.0	3652	35.7
1994	170,000	3729	2.2	2681	71.9
1995	190,000	18369	9.7	15771	85.9
1996	280,000	16192	5.8	18844	116.4
1997	300,000	9216	3.1	7384	80.1
1998	320,000	10527	3.3	7289	69.2
1999	190,000	6751	3.6	5097	75.5
2000	225,000	2590	1.2	1548	59.8
2001	270,000	1540	0.6	1744	113.2
2002	370,000	2870	0.8	356	12.4
2003	280,000			268	
2004	192,000	2192	1.1	653	29.8
2005	116,511	1581	1.4	167	10.6
2006	155,000	1810	1.2	133	7.3
2007	158,807	2248	1.4	65	2.9
2008	156,492	4000	2.6	271	6.8
2009	160,649	3813	2.4	16	0.4
2010	164,439	16422	10.0	290	1.8
2011	244,177	16798	6.9	46	0.3
2012	490,431	26727	5.4	10386	38.9
2013	392,967	35494	9.0	18220	51.3
		Mean	**3.8**		**39.8**
		Standard deviation	3.2		33.9
		Low	0.0		0.4
		High	10.5		116.4

Spring 2013 river flows and water temperatures influenced shad passage rates at Holyoke Dam with two clear pulses of high flow events during the primary passage window (Figure 3). River discharge was well below average from late April through the end of May, when a large flow event occurred, subsided and was followed by another large flow event in the middle of June.

Shad passage was greatly reduced after the June high flow event receded as water temperatures had reached 20C and were largely sustained above that threshold from that point forward.

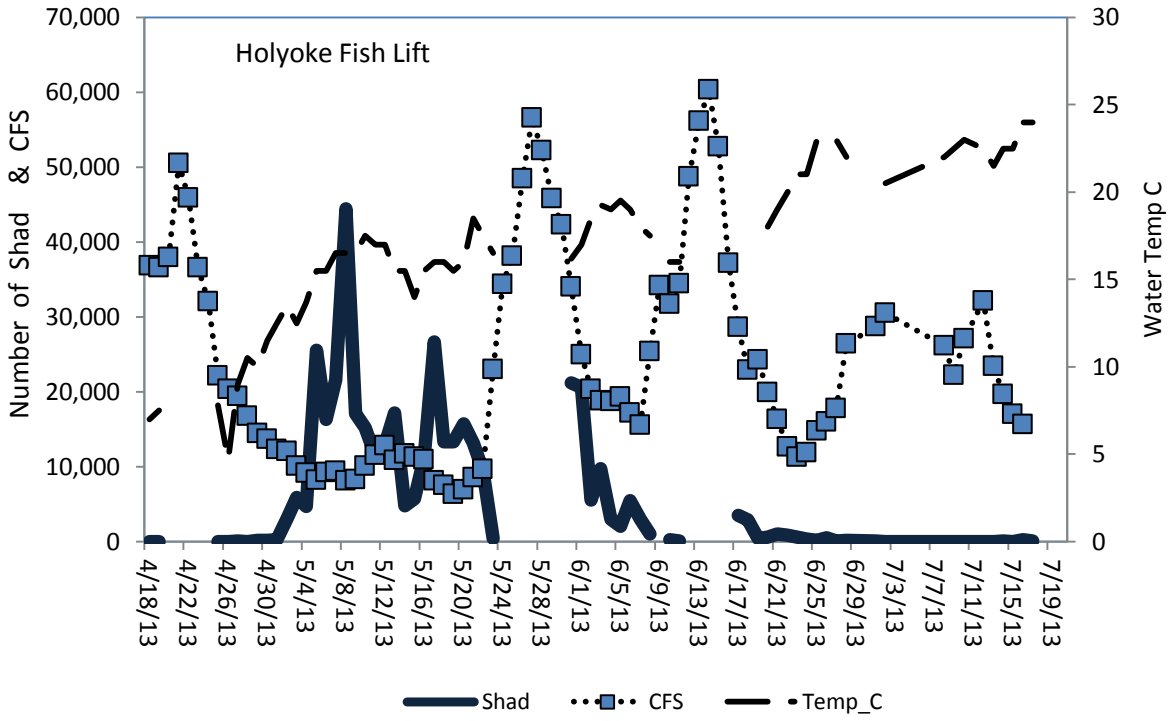

Figure 3. Holyoke Fish Lift American shad passage counts for the spring of 2013, with daily mean cubic feet per second (CFS) discharge value from USGS Holyoke Gage and the reported "daily" water temperature by HFL staff also shown.

Blueback Herring - A total of 976 blueback herring were counted at the Holyoke Dam Fish Lift in 2013. River herring counts are not believed to reliably serve as a population metric for the lower river, and larger lower tributaries (downstream of fishways), where substantial spawning habitat occurs. This situation is a critical assessment need which was addressed by the Coordinator's Office in 2013, as described earlier. The National Marine Fisheries Service issued its determination that river herring did not warrant Endangered Species Protection in the fall of 2013, following a full listing process review.

Sea Lamprey - A total of 24,926 sea lamprey were observed returning to the Connecticut River basin in 2013 based on fishway observations. A total of 2,108 sea lamprey were passed upstream of Rainbow Dam, 726 were passed upstream of the West Springfield Project, and 22,092 lampreys were passed upstream of the Holyoke Dam (Figure 2). A total 6,016 sea lamprey passed upstream of Turners Falls Dam (Gatehouse fishway count), 1,008 passed upstream of Vernon Dam, and 213 passed upstream of Bellows Falls Dam. Figure 4 illustrates daily passage variability among years for sea lamprey at the Gatehouse Fishway at Turners Falls Dam.

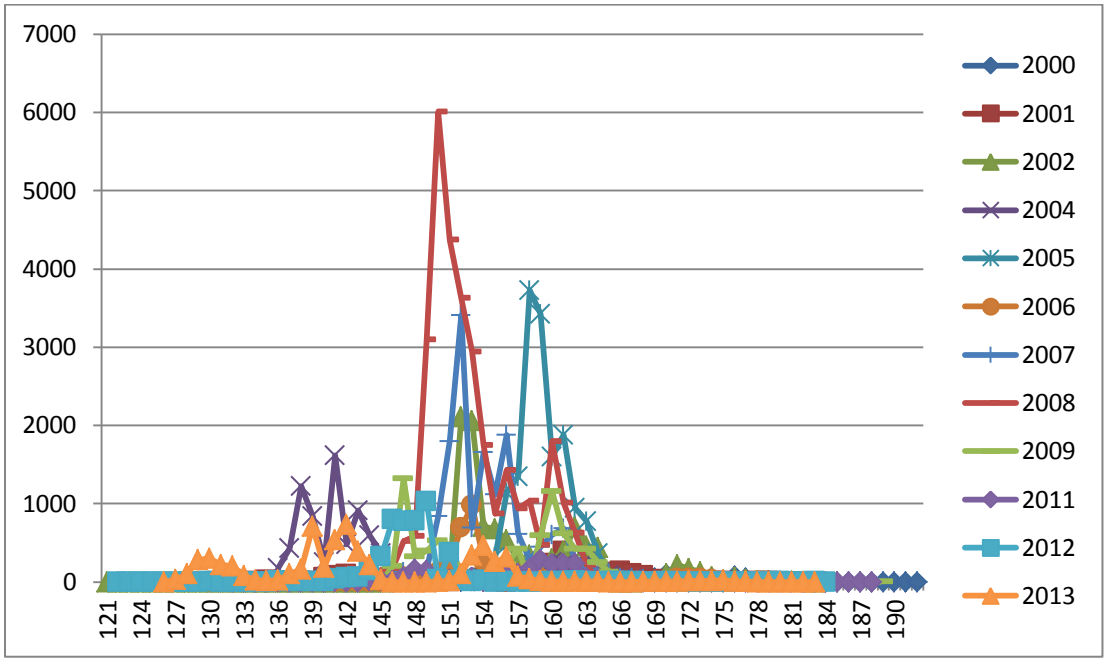

Figure 4. Daily sea lamprey passage counts from Turners Falls Gatehouse Fishway (passed upriver of dam), from 2000 to 2013, in Julian days (130 = May 10th and 160 = June 9th).

Striped Bass - A total of 250 striped bass were counted at the Holyoke Dam Fish Lift in 2013 consistent with recent years' observations.

Gizzard Shad - A total of 827 gizzard shad were counted at the Holyoke Dam Fish Lift in 2013.

American eel – The American eel passage count from eel specific passes operated at Holyoke Dam, were 13,584 in 2013 compared to 39,423 in 2012, 8,755 (2011), 4,138 (2010) and 5,639 (2009). The Rainbow Dam eel pass (Farmington River) passed 910 eels in 2013 compared to 197 eels (2012), 5,512 (2011) and 889 (2010). The USFWS was petitioned to consider listing American eel under the Endangered Species Act in 2011. The review process continues at the time of this report.

Additional data to describe two important environmental parameters (water temperature and river discharge) during the spring fish passage season are illustrated first by the water temperature profile of the Rocky Hill (CT) Ferry, USFWS temp logger (Figure 5) and second by the U.S. Geological Surveys Gage at Thompsonville, CT (Figure 6). Water temperatures increased at a fairly consistent rate up to the large late May flow event (>60K CFS), when the expected concurrent drop in water temperature occurred. The correlated water temperature drop may have been significant in a biological context to any recently spawned eggs and larvae of shad and blueback herring.

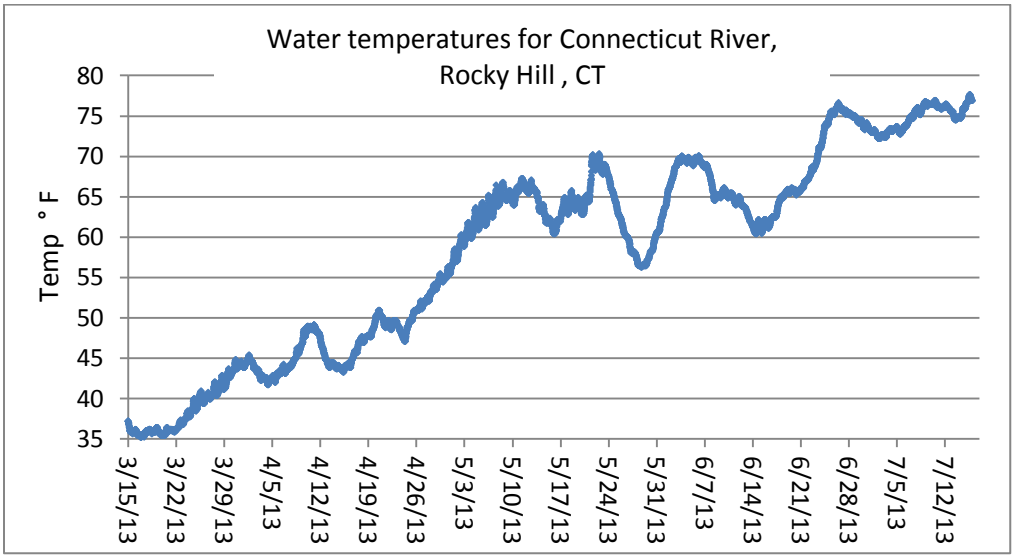

Figure 5. Water temperature (°F) profile, at 20 minute interval, from USFWS temperature logger deployed at Rocky Hill Ferry Crossing, CT, main stem river (3/15/1 through 7/15/13).

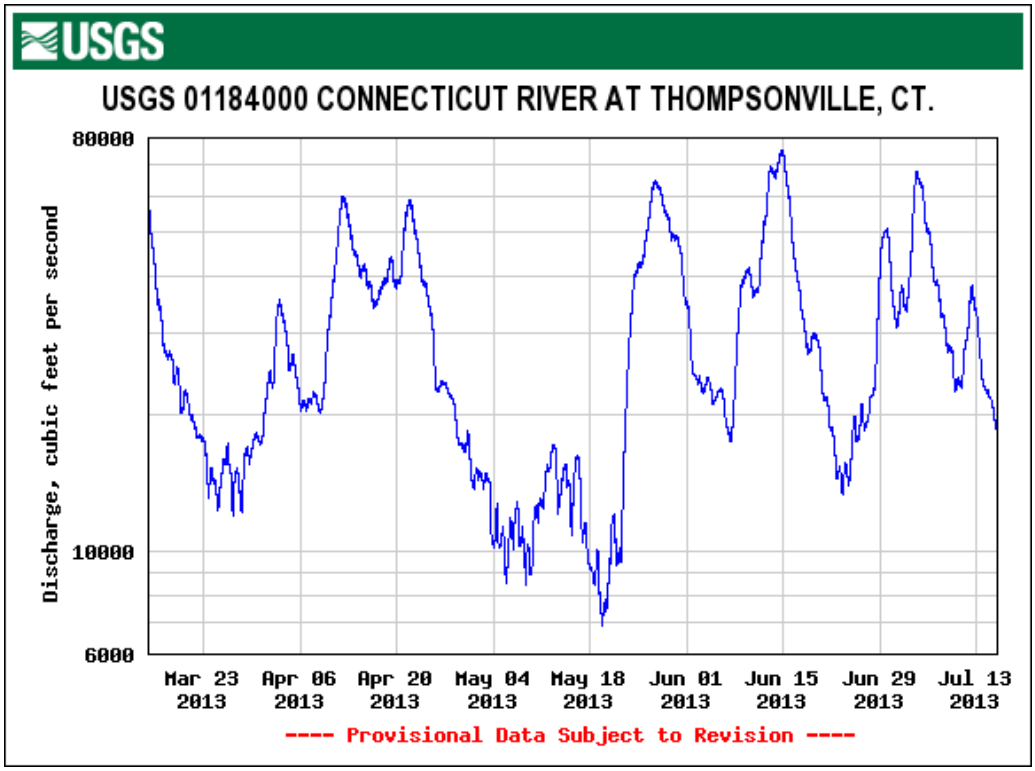

Figure 6. River discharge history for 2013 spring fish passage season (3/15/13 – 7/15/13), Thompsonville, CT, USGS Gage Station. Three substantial flow events occurred in late May, June and early July, which are suspected to have negatively influenced juvenile American shad production in 2013.

Appendix A. Description of the Connecticut River Basin

The Connecticut River is the longest river in New England. It begins in the Fourth Connecticut Lake (2,625 feet above sea level), and collects water from several major tributaries as it flows South between the states of New Hampshire and Vermont, and through Massachusetts and Connecticut. After collecting water from the 11,250 square mile drainage basin, the river flows into Long Island Sound at Old Saybrook, Connecticut, over 400 miles from its origin (Figure 1).

The river basin environment varies from highly developed and urbanized stretches in the lower river valley to more rural and forested reaches in the tributary and headwater areas. Atlantic salmon habitat exists throughout the basin. There were 38 major tributaries of significance to the Connecticut River Atlantic Salmon Restoration Program.

The natural streambed gradient profiles are interrupted by artificially ponded stretches created by the numerous dams located on the river and its tributaries. Over 2,500 dams in the basin impact and fragment habitat and natural steam processes, according to the most recent assessment of barriers in the basin (The Nature Conservancy). Hydropower dams and a main stem pump storage hydropower facility can regulate/alter flows, particularly in the main stem and lower reaches of larger tributaries. Aquatic organism entrainment and or impingement through turbines and for power station cooling systems are also a serious concern. In addition, discharge of heated effluent from power stations, are also cause for concern for organisms. Summer water temperatures average between 70^{o} and 80^{o}F with temperature peaks sometimes reaching 90^{o}F in July and August.

The Connecticut River and its tributaries support a diverse group of fishes and invertebrates. Both intentional and accidental introductions have altered native fish communities within the basin. Currently, at least 11 diadromous fishes utilize (e.g., spawning or feeding forays) or visit the Connecticut River, including American shad, Atlantic salmon, blueback herring, alewife, shortnose sturgeon, Atlantic sturgeon, sea lamprey, American eel, hickory shad, gizzard shad, and striped bass. Surveys in the early 2000s were never able to confirm the presence of rainbow smelt which are believed to be extirpated, along with the Atlantic sturgeon. Occurrences of Atlantic sturgeon have been determined by CTDEEP as visitors from other coastal river populations such as the Hudson and Delaware rivers. In 2012, the Atlantic sturgeon was listed as a federally Endangered Species by NOAA Fisheries, with the Hudson River population identified as the closest Distinct Population Segment to the Connecticut River.

Appendix B. History of the Anadromous Fish Program

Native diadromous fishes were once abundant in the Connecticut River basin excluded from habitat only by natural barriers and or inherent range limitations. Atlantic salmon ascended the main stem Connecticut River to Beechers Falls, VT, nearly 400 miles upriver from its outlet at Long Island Sound. American eel have been documented even farther upstream in the basin. No fishery management or scientific information exists that provides a technical description of the pre-colonial salmon population because extirpation predated the development of fishery science. However, historical accounts of the region are filled with references to large salmon runs and significant use of this species and other diadromous fish runs by the native aborigines and early European settlers. As colonization by Europeans and the development of water power sites expanded throughout the basin, the salmon population declined. The major cause of the decline

was the construction of dams that blocked salmon as well as American shad, and blueback herring migrations to upstream spawning habitat (Figure 1). The first dam across the main stem Connecticut River was constructed in 1798 near the present site of Turners Falls, MA. It blocked the access of salmon to the remaining spawning habitat in the northern portion of the river and the species disappeared from the basin in the early 1800s, after years of unregulated harvest in the lower river and the loss of spawning runs in lower basin tributaries.

An interagency state/federal program to restore salmon to the Connecticut River based on the stocking of fry hatched from eggs taken from Penobscot River salmon was initiated in the 1860s. Although the effort resulted in the return of hundreds of adult salmon for several years in the 1870s and 1880s, the program eventually failed due to both uncontrolled harvest of fish in Connecticut waters and the failure to construct effective fish passage at dams in Massachusetts. Concurrent with the salmon restoration effort were American shad culture and stocking efforts to enhance runs, operated by the fish culture pioneer Seth Green.

Although interest continued in restoring salmon in the basin, no action was taken for decades due to the lack of funds and effective fish passage technology. The condition of the river environment continued to deteriorate in response to widespread pollution and dam construction. By the 1960s, some tributary dams were breached and pollution abatement programs were initiated. Long term cooperative restoration programs became feasible with the passage of the federal Anadromous Fish Conservation Act of 1965 (P.L. 89-304) which made funds available for interstate fish restoration programs. The combined effects of all these events set the stage for Atlantic salmon and other anadromous species restoration. In 1967 the four basin states, USFWS, and NMFS signed a statement of intent to restore anadromous fishes including American shad, Atlantic salmon, and river herring to the Connecticut River. Early salmon stockings were initially comprised of two-year old smolts of Canadian origin reared in federal trout hatcheries that had recently been converted to salmon production. The first adult salmon return from these smolt releases was documented in 1974.

Penobscot River salmon eggs became available later to the program and were used to stock the river starting in 1976. As a result of this release, 90 adult salmon returned to the river in 1978. Early in the program, the management emphasis was placed on stocking smolts. The USFS joined the effort in 1979 because of the impact of the agency's land-based holdings on salmon habitat in the northern watershed. Shortly thereafter, the USFWS built a large, modern salmon hatchery in Bethel, VT, and Connecticut Department of Environmental Protection (CTDEEP) and MAFW converted trout hatcheries for salmon production. In 1983 smolt production shifted from a two-year to a one-year rearing regime in an effort to increase the quantity and quality of smolts. Early experimental stockings of salmon fry into nursery habitat showed the potential for natural, instream rearing of natural, high-quality smolts (referred to as "stream-reared" smolts) which are comparable to wild smolts. Evidence from State of Connecticut studies on the Farmington River indicated that stream-reared smolts produced from fry stocking yielded substantially greater adult return rates than hatchery-reared smolts (10 times greater). Production of stream-reared smolts was combined with smolts produced in hatcheries to increase smolt emigration from the river. A major effort was begun in 1987 to stock as many fry as were available into appropriate habitat in the basin. Adults produced from fry stocking will attempt to return to spawn to the tributary in which they were stocked. Use of fry also maximizes the opportunity for natural selection to occur in the juvenile freshwater phase, to allow development of heritable traits and characteristics.

Since 1994, the Program utilized only "Connecticut River" fish, with no introductions of genetic material (e.g., eggs or milt) from outside the basin. Genetic monitoring had demonstrated the development of some unique genetic characteristics (alleles) that distinguish the Connecticut River population from other populations at that scale. The use of conservation genetics enabled the Program to maintain a genetically healthy population to maximize genetic diversity and reduce risks of inbreeding and outbreeding depression.

Adult salmon returns per 10,000 stocked fry has declined dramatically from what had been documented from 1979 through 1994, when this rate averaged 0.71 (high of 1.6). For the period 1995 through 2008, the mean adult/10,000 fry stocked is 0.11 (refer to U.S. Atlantic Salmon Assessment Committee Report 25 – 2012 Activities (http://www.nefsc.noaa.gov/USASAC/Reports/). latter period is when the program shifted to fry stocking as the primary restoration strategy, directly coinciding with this unexpected dramatic decline in fry return rates (due to marine survival rates decreases). This translates to a sustained reduction on the order of 1/6 of what had been observed for this rate (< 1994) even with the following issues yet to be resolved; no or minimal downstream fish passage measure in place for fry origin smolts, high sea fisheries operating, and the use of mixed genetic origin broodstock. Frustratingly, many of these issues had been addressed, to varying degrees, by the mid and late1990s, which were expected to improve return numbers. Important questions that remain at this time include what are the mechanisms driving this sustained depression in marine survival rates? Will marine conditions improve to those resulting in the adult return rates of the 1970s and 1980s? The questions remain at this time and monitoring and research programs have not identified a primary causal factor. Some data and studies have shown shifts in salmon marine prey species abundance and distributions, shifts in predator assemblages, and shifts in marine habitat area use. As more studies are published on the challenges presented by climate change as one driver, directly and indirectly, it is clear those populations on the extreme extents of ranges (such as Connecticut River Atlantic salmon) are at potentially greater risk of adverse impact.

Going back in time, action to provide upstream fish passage on the river had begun prior to the modern salmon restoration project when, in 1955, a fishlift was constructed at Holyoke Dam to pass American shad and river herring. This facility was expanded in 1975 and 1976 when a trap was built for salmon and other substantial modifications occurred, although not studied, upstream passage efficiency appeared to improve greatly (Figure 2). Other fishways built between 1974 and 1987 at major dams on the main stem river and certain tributaries allowed returning salmon, shad, herring, and sea lamprey access into portions of the basin targeted for restoration. Although most salmon were retained at the lowermost (first) dams, fishways were still constructed at the upstream dams in order to pass American shad and other species. Major issues with several different fishways have been apparent relative to ineffectiveness at passing shad and herring. These issues have been dealt with on a case by case basis, often with limited success. However, with the Federal Energy Regulatory Commission's five main stem project relicensing underway, opportunities for improvements are anticipated along with plans to address other problem sites in the near future (e.g., Rainbow Fishway on the Farmington River).

Upstream passage at Turners Falls Dam fishways have been studied and modified for decades and is one of the projects in the FERC relicensing process at this time. Passage issues relative to American shad are best explained by the fact that no ladders of the size required on the main stem had been designed for that species at that time. USFWS relied on best information (no specific studies available) at the time that suggested West Coast fish ladders on the Columbia were effective at passing American shad. This led to the adoption of these designs, downsized

considerably from the Columbia River basin, for use on the main stem dams. The USFWS worked with the power companies in the design and construction, using the best information available to develop operating parameters for flow, velocities, and turbulence measures. Unfortunately, in the case of Turners Falls, modifications at Cabot Station ladder were determined necessary after only two years, and those changes resulted in improved passage, although still well below target rates.

Fish passage at dams upstream of Vernon Dam (Bellows Falls and Wilder dams) have been built specifically for salmon. Four fishways (Holyoke, West Springfield, Rainbow, and Leesville) are the primary trapping locations for sea-run adult brood stock. As the number of salmon fry stocked in the basin increased during the late 1980s, concern grew for the deleterious effect of hydroelectric turbines on outmigrating smolts as well as juvenile and spent adult American shad. Stream-reared smolts were early on forced to either pass through turbines or spill at gates, at numerous hydroelectric generating stations as they emigrated downstream to the ocean. Efforts to provide downstream fish passage on both main stem and tributary projects were initiated in the 1980s. In 1990, memoranda of agreement (MOA) were signed with two major utility companies that operated hydroelectric facilities at six main stem projects that established time frames for downstream passage construction. Efforts to provide adequate fish (all diadromous species) passage conditions at these projects and throughout the basin are ongoing.

Due to relatively low adult salmon return numbers (Figure 2) since the mid 1990s, the approach to ensure the best scenario for genetic adaptations to develop and be passed on (through natural selection) necessitated the use of adult returns as a single spawning group. To maximize the opportunity for natural selection to act on both freshwater and marine life stages, fry stocking became the primary restoration strategy. The strategy requires a number of eggs not attainable from limited sea-run returns alone, so the progeny of sea-run mating were raised to maturity in a hatchery, referred to as F1 domestic broodstock, which had provided the Program with the majority of eggs to approach target fry numbers on an annual basis (i.e. all F2 stocked fry have grandparents that were sea-run origin). Studies on released adults were conducted in the Westfield River in the 1990s, with some success and issues. In the end, adult return numbers could not support such an effort without "hatchery brood releases" being utilized too. Hatchery fish performance in this capacity was determined unacceptable as a large scale strategy and sea-run adults cannot be made to stay in areas they had not been fry planted in, all creating a challenging situation further complicated by the fragmented habitat/ access issues with many barriers. Had early Program adult return rates based on number of fry stocked been sustained into the 1990s and later, different restoration strategies would have been possible to consider, including tributary specific approaches to restoration.

The severe damage to the White River National Fish Hatchery (WRNFH) in fall of 2011, from a flood event, severely impacted the Program as it maintained a high proportion of the domestic broodstock and subsequently annual egg and fry production for all the states. WRNFH had been producing approximately 65% of the fry for the Program in the preceding 10 years. Vermont and New Hampshire relied on almost exclusively on this production to stock their state waters and the hatchery also supported the States of Massachusetts and Connecticut stocking and hatchery programs. The loss of this facility, in conjunction with ongoing reviews of the best science and information related to restoration efforts, and emerging USFWS Northeast Region fisheries issues (priorities and fiscal), led the USFWS to announce its decision to conclude fish culture activities for the Connecticut River Atlantic Salmon Program. This announcement was made publically at the July 2012 Connecticut River Atlantic Salmon Commission meeting by the

USFWS Northeast Regional Director. Subsequently, in the fall of 2012, the Commonwealth of Massachusetts decided it would no longer culture salmon at its Roger Reed State Hatchery. The last spawning of domestic salmon broodstock occurred at that facility in 2012, with all fry and remaining Connecticut River salmon of various ages stocked out in 2013. As of the time of this report, the State of Vermont and New Hampshire had no plans for future stocking (2014) of any Atlantic salmon.

The State of Connecticut made plans in the fall of 2012 to operate a "Salmon Legacy Program," which will not be a restoration program, by their own definition. The purpose of their program will be to maintain Atlantic salmon in select watersheds (greatly reduced fry stocking program), maintain existing genetics of the Connecticut River salmon, provide fish for their broodstock fishery, and support other benefits such as the school egg/fry rearing program. As of the time of this report, it was not determined whether the USFWS would allow CTDEEP the opportunity to transport captured sea-run salmon to the RCNSS as done in 2013. This has important management implications as adult returns would then likely, be released at all trapping facilities to continue their movements upstream. This scenario will require more coordination and planning details that remain to be considered.

Importantly, as this report presented, there is as great if not greater need for the state and federal agencies to continue to work in cooperation together and with our many partners to address pressing fishery management, protection, enhancement, and restoration matters (population and habitat) for many important ecological, recreational, and commercial benefits. The diversity of topics for necessary work include continuing efforts on many fronts to increase abundance, sustainability, and distribution for all of our native diadromous species, helping to improve and secure their status for the future. The CRASC has served a critical fishery leadership role from policy setting to project implementation over its history, and with the reduced emphasis on Atlantic salmon, presents opportunities to direct more attention to other important areas of resource management responsibility basin-wide.

Appendix C. Administrative Report

Total Federal Aid Expenditures – FY2013

Utilities (Electric & Telephone)	$ 1,642.98
Equipment	$14,732.00
Supplies, Operations & Maintenance	$ 18.46
Sub-Total:	$16,393.44
USFWS Overhead:	$ 3,606.56
Grand Total:	$20,000.00

NHFG (48370550580)

Equipment	$ 4,098.36
USFWS Overhead:	$ 901.64
Total:	$ 5,000.00

MADFW (48370550591)

Utilities (Electric, Telephone & Propane)	$ 1,642.98
Equipment	$ 2,436.92
Supplies, Operations & Maintenance	18.46
USFWS Overhead:	$ 901 64
Total:	$ 5,000.00

VTFW (48370550570)

Equipment	$ 4,098.36
USFWS Overhead:	$ 901.64
Total:	$ 5,000.00

CTDEEP (48370550600)

Equipment	$ 4,098.36
USFWS Overhead:	$ 901.64
Total:	$ 5,000.00