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Annual Performance Report

2016-17

Connecticut Fisheries Division

Habitat Conservation and Enhancement



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State of Connecticut
Department of Energy and Environmental Protection
Bureau of Natural Resources
Fisheries Division



Grant Title: Habitat Conservation and Enhancement

Job 1: Permitting and Monitoring

Job 2: Habitat Restoration and Enhancement

Job 3: Public Outreach and Technical Assistance

Period Covered: April 1, 2016 to March 31, 2017

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Cover photo: Senior Fisheries Habitat Biologist Brian Murphy shown conducting a mobile search for PIT tagged native brook trout in a tributary of Lyman Brook as part of a monitoring study to assess fish passage and movements at a culvert slipline project.

Summary

During the 30th year of the Habitat Conservation and Enhancement Program, we reviewed 288 projects and activities that had the potential to affect fish habitat and fish populations. This included 125 projects that required permits or approval from CT DEEP regulatory programs and federal licensing or approvals, 11 internal reviews of CT DEEP management plans and projects, and 141 applications to stock Grass Carp for aquatic plant control (76 new applications and 65 applications for re-stocking). For many of these projects we made recommendations to applicants and regulatory staff that resulted in the protection, restoration or enhancement of fish habitat and ensured that fish populations were not harmed. We also worked with partners on the funding, planning and implementation of three stream habitat restoration projects, provided guidance on municipal projects at the request of municipal commissions, and assisted individuals and conservation organizations with a variety of fisheries issues, such as fish stocking, pond management, aquatic plant control strategies, assessments of projects that could affect fish habitat, fisheries resource inventories, habitat restoration and enhancement and shore-based fishing access.

Background

The Habitat Conservation and Enhancement program (HCE program) began in 1987 as the Technical Assistance (TA) Program within the Fisheries Division of the former Department of Environmental Protection.¹ The purpose of the TA program was to assist the regulatory programs of the department, municipalities and the citizens of Connecticut with fish habitat and management issues in inland waters. It quickly expanded to include similar issues in Long Island Sound and tidal rivers and streams. The TA program continued to evolve as new impact assessment and habitat related responsibilities were assumed and staff developed technical assistance relationships with state, municipal and federal agencies.

In 1992, the name of the TA program was changed to the Habitat Conservation and Enhancement (HCE) Program to better reflect what had become the main focus of our efforts. Since that time the Fisheries Division was divided into the Inland Fisheries Division (IFD) and the Marine Fisheries Division (MFD). The HCE program was placed within the IFD, but retained lead responsibility for addressing habitat related issues in estuarine waters, which we do in close coordination with MFD staff. Due to a reorganization in 2017, the Inland Fisheries and Marine Fisheries Division merged

¹ In 2011, the DEP was merged with the Department of Public Utilities Control and sections of the Office of Policy and Management to form the Department of Energy and Environmental Protection, or DEEP.

back into the Fisheries Division (FD). HCE program responsibilities within inland and marine waters remain unchanged, although future efforts may be affected by staff retirements.

The primary goals of the HCE program are to:

- 1) ensure that functioning habitats are not degraded by human manipulations;
- 2) ensure that fish communities and species of sport fish are not adversely affected by various human activities;
- 3) restore and enhance degraded habitats to support fish communities and sport fish, and
- 4) enhance recreational angling opportunities by improving fish habitat and fish populations, as well as providing assistance with increasing angler access to the waters of the state.

Approach

To achieve our program goals we engaged in five major activities, which are described below.

1. Review of project proposals regulated by Federal, state and town governments.

The HCE program has the lead responsibility for reviewing permit applications and requests for approval submitted to DEEP regulatory and environmental review programs for effects on fish and fish habitat. We are typically involved in the pre-application phase to ensure that fisheries related issues are addressed prior to the submittal of formal applications. Most reviews of applications for activities in inland waters are reviewed through the permitting programs of the Land and Water Resource Division (LWRD), formerly the Inland Water Resources Division (IWRD) of the Bureau of Water Protection and Land Reuse (BWPLR) and the Pesticide Program within the Bureau of Materials Management and Compliance Assurance (BMMCA). Due to BWPLR reorganization, activities in estuarine waters and tidally influenced freshwaters are also now reviewed within the LWRD that includes coastal regions of the former Office of Long Island Sound Program (OLISP).

Following are some of the major types of projects that we review, with examples of how we can protect fish populations and restore and enhance fish habitat.

- **Bridges and culverts.** If improperly designed, bridges and culverts can block fish movement in streams. Through a cooperative process developed with the Connecticut Department of Transportation (CTDOT), we work with CTDOT engineers to ensure that new bridges and culverts are designed to allow the unrestricted movement of fish upstream and downstream of the structure and to prevent the degradation of aquatic and riparian

habitat. Projects involving the replacement or repair of existing structures, many of which are not passable and have fragmented stream habitat, are reviewed for the opportunity to restore fish passage. Features that restore or enhance instream habitat are incorporated into projects when possible. Final comments and recommendations are submitted to LWRD for incorporation into the relevant permits for the work. We also review many municipal bridge and culvert projects and provide guidance and technical assistance.



The original box culvert that conveys Bullet Hill Brook under Garage Road in Southbury was perched too high above the streambed to enable fish to pass upstream through the culvert. CTDOT's plan to rehabilitate the culvert provided us with an opportunity to correct the problem and improve habitat. As part of the project, a sequence of rock step pools was constructed so fish could swim up and into the culvert. The deep pools also added an important type of stream habitat that was lacking in this stream.

When bridges are replaced the old piers are usually demolished. In most cases hydraulic breakers are used, but occasionally explosives are necessary. We have two common concerns: (1) underwater noise may interfere with anadromous fish spawning migrations, and (2) pressure waves of sufficient intensity can injure or kill fish. An example is the replacement of the I-95 Pearl Harbor Memorial Bridge over the Quinnipiac River. The old bridge piers (shown in the picture) were demolished in 2014 using both methods of demolition. We worked with CTDOT and the contractors to ensure that



measures were included in the demolition plan that prevented interference with anadromous fish migration and minimized the mortality of fish.

- **Bank and shoreline stabilization and stream channel modifications.** Owners of property along rivers, streams, and coastal shorelines are often faced with bank erosion problems that may threaten infrastructure such as roads and buildings. We are able to work with the property owners and consultants to design bank and shoreline protection measures and instream structures that create, enhance or protect fish habitat while also protecting the banks.

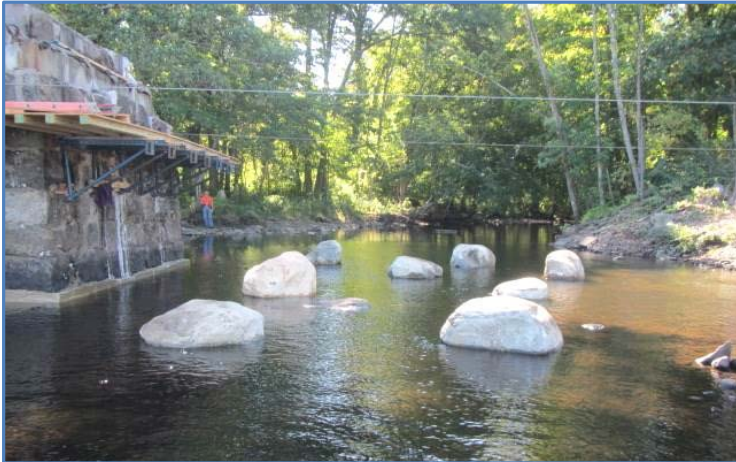


This Eversource Energy transmission tower in Manchester (the tower legs can be seen in the upper left corner of the picture) was originally constructed outside the Hop Brook stream channel. Long-term bank erosion resulted in the stream migrating under the tower to the point where two tower footings were within the stream channel, threatening the stability of the tower. Correcting this problem presented the HCE program with the opportunity to restore 1,550 linear feet of degraded stream channel and riparian corridor. HCE staff assisted with project design and regulatory permit review, and provided

periodic construction oversight throughout the two month construction period. The stream channel was relocated away from the tower, and the streambed lined with natural gravel, cobble and small boulders. Five boulder cross vanes were installed to concentrate high flows into the center of the stream and to create pool habitat for fish. The stream banks were stabilized with a combination of rocks, coir logs, wetland live stakes and container plantings. Over time this re-constructed section of stream will establish a dynamic equilibrium in its new location away from the tower (shown in the picture).

- **Use of herbicides to manage aquatic vegetation and lake drawdowns.** Applications for these activities are reviewed to ensure that the populations of fish and other aquatic biota are not significantly affected.
- **Harbor Management Plans.** Harbor Management Plans are prepared by municipalities in accordance with the Connecticut Harbor Management Act of 1984. These plans are reviewed for consistency with fisheries regulations and policies, with emphasis on the maintenance and enhancement of recreational and commercial fishing opportunities within the designated harbor areas.

- **Habitat restoration and enhancement.** Projects that require permits are reviewed for opportunities to restore and improve fish habitat. We recommend mitigation for unavoidable short-term or long-term impacts a project might cause. We also work with landowners, municipalities and government agencies to develop projects that restore and improve aquatic habitats.



The replacement of the Rte. 275 Bridge over the Willimantic River in Coventry presented an opportunity to enhance fish habitat in a streambed devoid of macrohabitat features. HCE staff reviewed this CTDOT project and worked with DOT staff to incorporate groups of large boulders into the design. The boulders will create a riffle effect along the boulders and eddies behind them, which are attractive as velocity refugia and feeding areas for fish such as trout.

- **Dredging in coastal waters.** Connecticut’s ports, navigation channels and marinas require periodic dredging to maintain authorized depths. These projects, as well as new projects involving dredging, are reviewed for effects on fish and fish habitat. Seasonal work restrictions (also known as “environmental windows”) are often recommended to prevent interference with anadromous fish migration and mortality of fish eggs and larvae. We work with project managers to minimize the degradation of aquatic habitats, such as beds of submerged aquatic vegetation.



- **Diversion of surface and ground water.** Water diversion applications are reviewed for their potential to reduce instream flow, which could adversely affect fish and invertebrate populations.



Without proper water use planning, streams can go dry due to excessive water withdrawals. In 2005, this happened to the Fenton River in Mansfield. The DEEP, with the assistance of HCE staff, took actions that have prevented a reoccurrence of this condition.

- **National Pollution Discharge Elimination System (NPDES) applications.** Pursuant to the federal Clean Water Act (CWA), facilities that discharge to the waters of the state require a NPDES permit. We review NPDES permit applications submitted to the DEEP BMMCA to determine if the proposed activities could affect fish populations or habitat.
- **Review of DEEP land use-plans.** When developing plans for the management of activities on state owned lands, DEEP resource managers contact us for guidance on fisheries related issues. For example, the Forestry Division consults with us on the development of Timber Harvest Plans and Ten Year Forest Management plans. In those cases, we examine the proximity of the proposed timber harvest to wetlands and the nature of wetland crossings, and recommend measures that will avoid degradation of aquatic resources. Opportunities for aquatic habitat enhancement are also included.
- **Triploid Grass Carp stocking.** Grass Carp (*Ctenopharyngodon idella*) is an herbivorous species that was imported into the United States during the early 1960's to control aquatic plants. Since that time, stocking Grass Carp to control nuisance aquatic vegetation in Connecticut's ponds has become a popular alternative to chemical control. Due to the potential for Grass Carp to damage fish habitat by consuming too much aquatic vegetation,

the FD developed an importation and liberation permit program. Only triploid Grass Carp, which are sterile, can be stocked.

Grass Carp are stocked as 10-12 inch fish, and typically live for five to seven years. In the photo at right, HCE Grass Carp specialist Mindy Barnett holds one that was stocked in Ball Pond in New Fairfield and recaptured during the FD Lake and Pond Survey.



The HCE program is responsible for evaluating applications to determine if it is appropriate to stock Grass Carp in an applicant's pond. We conduct a site visit to assess the condition of the pond and how many Grass Carp, if any, would be appropriate for the situation. Also, it is essential that Grass Carp be contained within the pond, so outlets that must be screened are identified. Pond owners often must install suitable screens before a liberation permit can be issued.



Pond owners must ensure that Grass Carp cannot escape to other waterbodies. Screens constructed according to guidelines developed by HCE staff are the typical remedy. The overflow pipe in a small irrigation pond shown at left was easy to block with a screen made of rebar, whereas the pond shown at right, with a large culvert connecting the pond to Indian Lake in Orange, required the fabrication of a more elaborate screen.

- **Other important Federal and State review processes.** The DEEP Office of Planning and Program Development coordinates DEEP comments to a variety of state agencies, commissions and federal regulatory agencies. Examples are hydropower licensing under the jurisdiction of the Federal Energy Regulatory Commission (FERC), federal projects that

require a National Environmental Policy Act (NEPA) scoping, state projects that require a CT Environmental Policy Act (CEPA) scoping, and energy infrastructure proposals requiring approval from the State of Connecticut Siting Council. We are responsible for providing comments on fisheries related issues, which are included in the overall DEEP comments.

We quantified some of the habitat benefits that result from our reviews by calculating three metrics:

Riverine Habitat is the total area (acres) of aquatic habitat protected and/or restored. It is estimated by summing the area of aquatic habitat within each project footprint. Types of projects included are bridges, culverts, stormwater outfalls, dams and habitat restoration/enhancement.

Riverine Habitat Continuity is the number of miles of habitat continuity that is maintained or restored. Continuity means there are no artificial barriers to the movement of fishes and other organisms. For bridge, culvert and dam projects, continuity is measured from the project area to the next barrier upstream, whereas for diversion projects it is measured downstream to the next watercourse of equal or greater size.

Lake and pond habitat (lentic habitat) is measured by summing the acreage of the waterbodies that are maintained or restored. For aquatic herbicide applications and pond restoration (including pond dredging) initiatives, the area of treatment or restoration is summed. For winter drawdown requests, the area of each waterbody is summed.

2. Participate in the development of DEEP and interagency policy, regulations, guidelines and standards

We participate in the development of DEEP policy and regulations when there are implications for fish habitat, as well as policy affecting inter-agency issues. Examples of continuing and new contributions include development of instream flow regulations (Public Act 05-142, An Act Concerning the Minimum Water Flow Regulations), policy for addressing fisheries issues at electric power facilities regulated under the federal Clean Water Act, new guidance for time of year restrictions for in-water construction activities developed in consultation with the DEEP Bureau of Water Protection and Land Reuse, DEEP Bureau of Natural Resources and CTDOT, review of proposed General Permits prepared by DEEP regulatory programs, and policy and procedures for addressing Applications for Aquaculture submitted to the Department of Agriculture, Bureau of Aquaculture and U.S Army Corps of Engineers (USACE).

The Interagency Drought Working Group, which comprises State of Connecticut and federal agencies, is tasked with preparing drought preparedness and response plans. Our continued involvement in drought planning, along with the implementation of instream flow standards for Connecticut's rivers and streams, will ensure that stream flows support aquatic animals and plants, including important sport fish sought by recreational anglers.

We serve on the Science and Technical Subcommittee of the State Water Planning Council. The Science and Technical Subcommittee is responsible for determining data and report requirements for a State Water Plan required by Public Act 14-163. The statute requires a comprehensive plan, and in various places calls for the consideration of the ecological use of water bodies and balancing water uses, economic development and recreation with ecological uses. Therefore we believe our participation on this committee will help ensure Connecticut's fisheries receives appropriate consideration in the plan. The plan, to be completed by July 1, 2017, will be developed by a private consulting firm with oversight by the subcommittee.

We participate on the Instream Flow Council (IFC), an organization comprising representatives from fish and wildlife management agencies in the United States and Canada that is dedicated to improving the effectiveness of agency member instream flow programs. Participation with the Instream Flow Council ensures that we have the necessary tools and knowledge to provide a scientific basis for Connecticut's instream flow and water allocation policy that is protective of fisheries resources and enables us to provide science based reviews of permit applications and water supply plans. Currently, staff serve on the IFC executive committee (two year appointment) as a regional director.

3. Conserve, restore and enhance fish habitats through partnerships and other interactions with private citizens, conservation groups, DEEP programs and the programs of other government agencies.

- ***Habitat restoration and enhancement projects.*** We provide a range of services to a variety of agencies and organizations that facilitate fish habitat restoration and enhancement projects in inland waters. Services include assistance with permit requirements, conceptual planning and project design, identifying and acquiring funding, and organizing volunteers.
- ***Participation on habitat restoration committees.*** We serve on committees and workgroups dedicated to the enhancement and restoration of estuarine and coastal habitats. Examples are the Habitat Restoration Workgroup (HRW) of the EPA Long Island Sound Study (LISS), which comprises biologists, coastal ecologists, geologists, and other technical experts from the states of Connecticut and New York, various federal agencies, New York City, and several conservation organizations, and the LISS Riverine Migratory Corridor Workgroup, which concentrates on the restoration of habitat continuity from Long Island Sound to freshwater reaches of coastal streams.
- ***Participation on Wetlands Restoration committees.*** We participate on the Wetland Restoration Steering Committee and Wetlands Site Plan Review Committee. The activities of the committees are coordinated by LWRD. The main function of these interagency and interdisciplinary committees is to ensure that proposed tidal wetland restoration and enhancement projects and other projects that affect tidal wetlands are properly designed and meet DEEP and USACE policy and permitting standards. We focus on fisheries aspects of the proposed projects, providing technical advice on design and project implementation that will enhance and protect fisheries resources.

4. Provide technical assistance and information about fish habitat to municipal government and Connecticut's citizens

- We respond to inquiries concerning the protection, restoration and enhancement of the state's fish habitat and fisheries resources. HCE biologists are available to meet with individuals and organizations, give lectures and presentations, and participate in resource management coalitions.

- We provide technical guidance and assistance to private landowners in Connecticut who wish to actively manage the aquatic habitats on their property but lack the necessary knowledge. Help may be provided in a variety of ways, ranging from providing information over the phone or email to conducting an on-site inspection and consultation.
- We conduct fisheries resource inventories and provide assessments of projects under consideration by town commissions.
- We assist municipalities, as well as other organizations, with fishing access for the public on properties under their control, including the design of shore-based fishing facilities such as fishing piers.

5. Assess habitat quality

- We conduct long-term monitoring of biological communities and stream health to determine the long-term effects of certain permitted activities and the effectiveness of habitat restoration efforts,
- We investigate many of the fish kills reported to the FD, often in cooperation with the Permitting and Enforcement Division of the BMMCA. Investigations may involve biological (e.g., dead fish counts, observations of vertebral damage, observations of live organisms), chemical (e.g., dissolved oxygen and pH), and physical (e.g., stream length, width and depth) sampling within the impacted area and from unaffected areas nearby.

Key Findings

- Reviewed a total of 136 projects regulated or needing approval by the DEEP and other agencies. Of this total, we reviewed:
 - 11 DEEP projects and activities on state lands (Table 1);
 - 120 projects and activities requiring permits from DEEP regulatory programs (Table 2);
 - four NPDES permits with ongoing issues (i.e., entrainment, impingement, thermal discharge or Best Technology Available screening); and
 - one hydropower project requiring a FERC license

- Of the 136 projects and activities reviewed, the top five categories, in terms of numbers, were:
 - bridge and culvert work, with 62 projects (46% of the total);
 - dredging in tidal and inland waters, with 20 reviews (15%);
 - aquaculture in tidal waters, with 16 reviews (12%);
 - docks and piers in tidal waters, with 14 reviews (10%);and
 - forest management activities/plans, with 9 reviews (7%).
 - timber harvest plans, with 14 reviews (7%); and
 - aquaculture in tidal waters, with ten reviews (5%).
- The following reviews and associated recommendations by staff led to the protection, restoration and enhancement of fish habitat:
 - the review of regulated projects involving bridges, culverts, dams, stormwater outfalls, bank stabilization, habitat enhancement and habitat restoration resulted in maintaining or restoring the continuity of 39.8 river miles and the restoration or protection of 4.2 acres of riverine habitat (Table 3);
 - the review of nine DEEP Forestry Division timber harvest plans supported the maintenance of an additional three riverine corridor miles as well as six linear miles of riparian zone habitat; and
 - the review of six aquatic herbicide applications and eight lake drawdown requests resulted in the protection or restoration of 2,594 acres of lake and pond habitat (Table 3).
- A total of 76 new applications for triploid grass carp introduction was reviewed with pond inspections (see Table 4). Also, 65 renewal applications were reviewed.
- The program continued to assist the Town of New Fairfield with the annual Ball Pond aquatic plant survey, a component of the Ball Pond Grass Carp Study begun in 1996. The invasive Eurasian watermilfoil was not observed (as has been the case since 2004), indicating continued success of using Grass Carp to control the plant in this 82.5 acre public lake.
- Staff assisted Western Connecticut State University and Candlewood Lake Authority with the radio-tagging of 50 triploid grass carp as part of a research study to track movements of the fish after stocking Grass Carp in 2016.

- As the Fisheries Division expanded its participation with the North Atlantic Aquatic Connectivity Collaborative (NAACC) stream crossing inventory program, HCE staff:
 - obtained a grant (for the second year) from the Department of the Interior (Hurricane Sandy Recovery funds) and the NAACC for the purpose of surveying and assessing the aquatic connectivity of road stream crossings;
 - hired two seasonal workers and trained six volunteers from various watershed associations;
 - Surveyed more than 450 crossings, completing the Mount Hope and Fenton River Sub-Regional watersheds, as well as 20% of the Little River Sub-Regional Watershed. The information collected on the crossings will be used to assess priorities for towns or watersheds regarding aquatic organism passage or risk of failure and provide data for prioritizations for future mitigation projects; and
 - Due to continued drought conditions during the survey, many stream were low or had no water. A list of dry streams was compiled to inform Land and Water Resources Division (LWRD) and other agency staff.
- Worked with partners on three stream habitat restoration and enhancement projects (Table 5).
- Progress continued on the Moosup River Dam Removal Project, which has removed two dams since 2012, with the initiation of work to remove Brunswick Mill Dam # 1. Tasks included sediment sampling, topographic survey, wetland survey and preliminary design and engineering. When completed the project will reconnect fish habitats to over 6.9 miles of the mainstem Moosup River.
- The Salmon River Watershed Partnership continued to assist us with year-round monitoring chloride levels in Lyman Brook by installing a conductivity probe in the stream. This follows our measurements three years ago of unusually high conductivity that was related to chloride concentrations of unknown source. One possible source of the chloride is from salt applied to Route 2 during the winter. The effect of salt applications for winter road maintenance on aquatic habitats is an emerging issue nationwide.
- As part of the implementation of Public Act 05-142, An Act Concerning the Minimum Water Flow Regulations, we assisted with the classification of all watercourses within the Housatonic, Hudson, Southwest coastal and Connecticut River watershed basins.
- Assisted town governments with two environmental assessments.
- Provided technical guidance to 43 private landowners with questions about fish stocking, pond management, aquatic plant control and habitat enhancements.

- Responded to six requests for information about, or the investigation of, a range of fisheries related issues, such as algal blooms in coastal ponds, effects of salt used to maintain roads in winter and issues with fishing access.
- Investigated fish kills. Eighteen fish kills were reported, four required further investigation. The majority of fishkills were caused by stress associated with spawning or low dissolved oxygen (Table 6).
- Made six presentations: “Stream Habitat Restoration and Enhancement” at Three Rivers Community College; “Engineering and Design Approaches to Provide Fish Passage at Culvert Slipline Projects, presented at Fish Passage 2017 Conference, UMASS Amherst, MA; Engineering and Design Approaches to Provide Fish Passage at Culvert Slipline Projects at Instream Flow Council Biennial Meeting, State College, PA; Connecticut Experience: Wetland and Stream Buffer Protection presented at USEPA Stream and Wetland Buffer Workshop, Westborough, MA; “Engineering and Design at a Culvert Slipline Projects to Facilitate Brook Trout Passage, presented a 50th Anniversary Southern New England Chapter, American Fisheries Society, Mystic, CT.

Discussion

Many projects were proposed in the aquatic habitats of Connecticut this past year that had significant potential to degrade aquatic habitats or diminish fish populations. We were able to work with regulatory program staff and our partners to avoid these negative outcomes, and many of these projects presented us with opportunities to correct past alterations and further enhance fish habitat.

Our involvement in the development of state and interagency environmental policy greatly expands the ability of the HCE program to promote the conservation, protection and restoration of fish habitat and resources in Connecticut. Participation with organizations such as the Instream Flow Council, a non-profit organization made up of state, provincial and territorial fish and wildlife agencies, ensures that we have the necessary tools and knowledge to inform policy development and enabled us to provide science based reviews of permit applications.

We continued to survey stream crossings with the assistance of grant monies from the North Atlantic Aquatic Connectivity Collaborative (NAACC). The NAACC involves a network of individuals from universities, conservation organizations, and state and federal natural resource and transportation departments focused on improving aquatic connectivity across a thirteen-state region from Maine to West Virginia. Improving aquatic connectivity has long been a priority of the



Fisheries Division and a core function of the HCE program, so participation with the NAACC is a natural fit for our program.

One of the NAACC priorities is to identify and characterize stream crossings in the region that impede connectivity and enter the data into an accessible regional database. To date, Fisheries Division staff have surveyed about 5,400 crossings out of the estimated 30,000 Connecticut crossings.

NAACC seminar attendees in the field working through culvert assessment protocols.

We continued to work with CTDOT to develop ways to restore fish passage through culverts that are rehabilitated by sliplining. In the past, it was common for CTDOT to replace a failing culvert. If fish passage was inhibited because the culvert was perched, the new culvert could be installed with the bottom set below streambed grade and the culvert lined with streambed material, which would provide effective fish passage. Sliplining, however, leaves the original culvert in place with a new pipe installed within it, often not addressing fish passage issues. Restoring fish passage through these culverts has proved to be challenging, but CTDOT has committed to working with us on innovative approaches at these sites to achieve fish passage.



CTDOT planned to slipline a culvert that conveys a tributary of Hubbard Brook under Aircraft Road in Middletown. HCE staff review revealed the culvert was severely perched above the streambed, preventing fish passage. The elevations at the outlet presented a significant challenge for designing and installing a solution to the problem. The final plan was the installation of a prefabricated concrete pool/weir fishway (photo left).

In addition to the fishway, a baffle system was installed inside the culvert to enable fish to swim through it (photo right). The project was completed in 2015. Two priority species – native brook trout and American eel – as well as other resident stream fishes can now access 1.4 miles of high quality habitat upstream of the culvert.



Since the use of weirs and baffles to address fish passage through sliplined culverts is relatively new, there is little known about their effectiveness. Therefore, we entered into a cooperative agreement with CTDOT to evaluate fish passage through a sliplined culvert. CTDOT has provided funding for monitoring equipment and HCE staff will conduct the study.

The study will be conducted in a tributary of Lyman Brook (Marlborough), which is conveyed through culverts under Route 2. The culverts were perched (above picture) preventing native Brook Trout and other species from moving upstream. We reviewed the CTDOT plan and recommended installation of a concrete weir/pool fishway and corner baffle system.

HCE Senior Fisheries Biologist Brian Murphy, who is the project lead on the fishway installation and fish passage efficiency study, is shown(right) installing a PIT tag antenna at the culvert outlet.



We will assess if these measures enable Brook Trout to pass through the modified culvert by using passive integrated transponder (PIT) tags to monitor brook trout movements. The tiny electronic tags will be inserted into Brook Trout captured downstream of the culvert. Each tag has a unique code that can be detected by a tag reader or array of antennas placed upstream and downstream of the culvert. The results of the study will inform future reviews of proposals to slipline perched culverts.



HCE Senior Fisheries Biologist Brian Murphy is shown inserting a PIT tag into the peritoneal cavity of an adult brook trout. A total of 61 fish was tagged in 2016.

We also continued to successfully partner with private individuals, groups and organizations to restore previously degraded habitats and enhance existing habitat. These partnerships provide the

resources and expertise needed to tackle significant habitat impairments that might not otherwise be addressed.

Moosup River Dam Removal Project. This project is a partnership between American Rivers, the USDA Natural Resources Conservation Service and the HCE Program. The project, to be implemented over a 10 year period, includes the removal of five dams. Two dams have been removed so far, Moosup River Dam #1 and Griswold Rubber Dam. Brunswick Mill Dam #1 (photo to right) is proposed to be removed 2017/2018. When completed, the Moosup River Dam Removal Project will reconnect fish habitats along 6.9 miles of the Moosup River.



As in previous years, there was considerable interest in using triploid Grass Carp to control aquatic plants in private ponds and lakes. Notable was prior approval of an application by the Candlewood Lake Authority (CLA) to stock 3,813 Grass Carp at various locations in Candlewood Lake to control invasive Eurasian watermilfoil and other aquatic plants.

An understanding of the post-stocking movements of these fish is essential for future stockings, so a tagged fish study, developed by the CLA, Western Connecticut State University, HCE program, and other interested parties, was initiated in the summer of 2016. A total of 50 triploid grass carp was tagged with radio transmitters and stocked into Candlewood Lake. This study is ongoing and data are not yet available at this time. This study is the first of its kind in Connecticut and will provide valuable information for future permitting decisions.



Mindy Barnett, Fisheries Biologist and Todd Bobowick of Rowledge Pond Aquaculture, clipping a fin of a radio-tagged triploid grass carp to mark the fish for different stocking locations.

We received many requests from governments, conservation organizations and private landowners for technical assistance and guidance on fish habitat issues and projects. We believe that providing this assistance contributes significantly to the conservation and restoration of fish habitats and populations in the estuaries, rivers, streams, lakes and ponds of Connecticut, and so should remain a priority for the HCE program.



As a result of severe damage caused by storms Irene (2011) and Sandy (2012), the Fort Hale Fishing Pier was closed to the public. The former 350 foot long pier will be entirely replaced with a 333 foot long pier with a 140 foot "T" head. The pier is being designed for the purpose of fishing.

Staff continued to provide guidance to the City of New Haven's design consultant working on the replacement of the Fort Hale Fishing Pier in New Haven. Suggestions were made to include railing features that will enable most people to comfortably fish from the pier as well as various amenities such as cutting boards and running water. Once the plans are completed, the City will submit an application to replace the damaged pier to DEEP's LWRD.

Recommendations

No modifications to this job are recommended at this time.

Expenditures

Total Project Cost: \$494,100

Federal Share: \$370,575

State Share: \$123,525

Appendix. *Tables 1-6 list specific information referenced in the report.*

Table 1. List of 11 DEEP projects reviewed by HCE biologists. DEEP project proposals on state properties are reviewed for their potential effects on fish populations and fish habitat through an internal review process developed with other DEEP programs (the number of projects reviewed of the same type on a property is provided in parenthesis if greater than one).

Major Watershed Basin	Property (SF=State Forest; SP=State Park)	Waterbody	DEEP Program*	Project/activity
Southeast Coast	Barn Island Wildlife Management Area	Various	FRD	Prescribed burn
	Nehantic SF	Beaver Brook	FRD	Timber harvest plan
Thames River	Beach Pond Boat Launch	Beach Pond	BD	Boat launch improvements
	James L Goodwin SF	Various	FRD	Prescribed burn
	Mansfield Hollow Reservoir Boat Launch	Mansfield Hollow Reservoir	BD	Boat launch improvements
	Nye Holeman SF	Bonemill Brook	FRD	Timber harvest plan
	Pachaug SF	Various	FRD	Timber harvest plan (3). forest management plan
Connecticut River	Cockaponset SF	Various	FRD	Prescribed burn

*BD= Boating Division; EFSSD = Engineering and Field Support Services Division; FRD = Forestry Division; SP = State Parks and Public Outreach Division; WD = Wildlife Division

Table 2. List of projects and activities reviewed by HCE biologists through DEEP regulatory programs (Total = 120).

Major watershed	Waterbody	Project or activity reviewed
Southeast Coast	Anguilla Brook	bridge replacement
	Black Hall River	bridge replacement
	Jordan Cove	bridge replacement
	Latimer Brook	culvert modifications
	Long Island Sound	aquaculture cages (2), aquaculture longlines, beach nourishment (2), dock, fish barrier
	Niantic Bay	dredging
	Niantic River	aquaculture cages, dock (3), fishing platform
	Oil Mill Brook	culvert replacement
	Pattagansett River	culvert modifications
	Pequonnock River	barrier fence
	Sheffield Brook	culvert replacement, stream restoration
	Stonington Harbor	dock
	Ventian Cove	dredging
	Wilcox Cove	aquaculture upweller
Thames	Whitford Brook	culvert replacement
	Wyassup Lake	winter drawdown
	Ayers Brook	culvert replacement
	Bark Meadow Brook	culvert replacement
	Beaver Brook	culvert slipline (2)
	Bolton Lake, Lower	herbicide treatment, winter drawdown
	Bolton Lake, Middle	winter drawdown
	Bungee Brook	bridge replacement, habitat enhancement
	Byron Brook	culvert slipline
	Byron Brook, Tributary	culvert replacement
	Charters Brook	culvert replacement
	Crystal Lake	dam repair
	French River, Tributary	pedestrian bridge replacement
	Gardner Lake	winter drawdown
	Gravelly Brook	culvert replacement
	Hammer Brook	culvert concrete lining

Major watershed	Waterbody	Project or activity reviewed
Connecticut	Hewitt Brook	culvert replacement
	Hop River	bridge replacement
	Koistenen Brook	bridge replacement
	Lathrop Brook	culvert replacement
	Little Mountain Brook	culvert slipline
	Mary Brown Brook	culvert replacement
	Mashapaug Lake	winter drawdown
	Merrick Brook	bridge replacement
	Mill Brook	bridge replacement
	Natchaug River	bridge replacement (2)
	Oxoboxo Brook	surface water withdrawal
	Pachaug Pond	winter drawdown
	Pachaug River	bridge replacement (2)
	Quaddick Reservoir	herbicide treatment
	Quinebaug River	surface water withdrawal
	Roaring Brook	bridge replacement
	Skungamaug River	bridge replacement
	Sunset Hill, Tributary	culvert slipline
	Thames River	dock, shoreline development
	West Stafford Brook	culvert replacement (2)
	Yantic River	bridge replacement
	Allyn Brook	waterline crossing
	Angus Park Pond	herbicide treatment
	Back River	dock
	Bashan Lake	herbicide treatment
	Beemans Brook	culvert replacement
	Beseck Lake	winter drawdown
	Blackledge River	bridge replacement
	Candlewood Brook	bridge replacement, habitat enhancement
	Christopher Brook	culvert replacement
	Connecticut River	bridge repairs, dock (5), dredging (2)
	Eight Mile River	groundwater withdrawal
	Falls River	bridge replacement, culvert replacement
	Fawn Brook	bridge replacement, powerline tree clearing

Major watershed	Waterbody	Project or activity reviewed
	Flat Brook	culvert replacement
	Folly Brook	powerline tree clearing
	Great Brook	culvert liner & rock outlet weirs
	Hubbard Brook, Tributary	powerline tree clearing
	Hockanum River	culvert replacement, habitat enhancement
	Hop Brook	bridge replacement
	Hubbard Brook, Tributary	culvert slipline & fishway
	Hungerford Brook	bridge replacement
	Jeremy River	culvert replacement
	Lake Hayward	herbicide/algaecide
	Little Brook	bridge replacement
	Lyman Brook	culvert slipline & concrete outlet weir
	Lyman Brook, Tributary	culvert slipline & fishway
	Lyman Meadow Brook	bridge replacement
	Pewterpot Brook	culvert replacement (2)
	Pickerel Lake	winter drawdown
	Pocotopaug Creek	culvert replacement
	Podunk River	pedestrian bridge replacement
	Pole Bridge Brook	culvert slipline
	Rogers Lake	herbicide treatment
	Salmon Brook	bridge replacement, powerline tree clearing, streambank stabilization
	Slocumb Pond	dam repair
	Terry Brook	culvert slipline & concrete outlet fishway

Table 3. Habitat benefit metrics. Some of the benefits resulting from reviews of particular projects listed in Table 2 are quantified using three habitat benefit metrics. For riverine habitat, two metrics are estimated for projects that involve bridges, culverts, stormwater outfalls, dams and habitat restoration or enhancement. One habitat benefit metric is calculated for lake and pond habitat that is maintained or restored through the review of aquatic herbicide applications, winter drawdown requests, pond restoration, and pond dredging initiatives. See text (page 8) for further explanation.

Major watershed basin	Habitat Benefit Metric		
	Riverine Habitat (acres)	Riverine Continuity (linear miles)	Lake/pond Habitat (acres)
Pawcatuck	0.0	0.0	101
Southeast Coast	0.2	1.9	0
Thames	2.4	20.7	2,112
Connecticut	1.2	13.4	269
South Central Coast	0.4	3.8	112
Statewide total	4.2	39.8	2,594

Table 4. Number of ponds by town that were inspected to determine the suitability of stocking triploid Grass Carp for aquatic vegetation control.

Town	Number of Inspections	Town	Number of Inspections
Avon	1	New Canaan	6
Barkhamsted	1	New Fairfield	1
Bethlehem	1	Newtown	1
Branford	1	North Haven	1
Brookfield	1	Plymouth	2
Canterbury	1	Pomfret	1
Chester	1	Redding	2
Colchester	1	Ridgefield	5
Columbia	1	Roxbury	2
Cornwall	2	Salisbury	1
East Haddam	1	Sherman	1
Easton	3	Stafford	1
Ellington	1	Stamford	2
Granby	3	Torrington	1
Greenwich	5	Trumbull	1
Guilford	1	Wallingford	1
Hebron	1	Warren	1
Kent	2	Washington	1
Lebanon	1	Watertown	1
Litchfield	2	Weston	1
Marlborough	1	Westport	3
Middletown	1	Wethersfield	1
Milford	2	Wilton	2
Morris	1	Woodstock	1
		Total	76

Table 5. List of three collaborative habitat restoration and enhancement projects active during the project year.

Watercourse	Project description	Project partners	Local sponsor	Status*
Hillard Pond/Bigelow Brook	Dam removal, fish passage restoration, habitat enhancement	HCE, Town of Manchester	Yes	C
Leadmine Brook	Fish passage restoration, habitat enhancement	HCE, Town of Ashford, Yale University, Trout Unlimited-Thames Valley Chapter	No	C, M
Moosup River	A compensatory mitigation project that will restore fish passage by removing five dams. Design was initiated for removal of Brunswick Mill Dam #1.	HCE, USDA NRCS, American Rivers, Inc.	No	I,C,M

* P = planning, I = initiated, C = completed, M = monitored.

Table 6. List of 18 fish kills investigated by Division staff.

Town	Waterbody	Suspected Cause
Bristol	Page Park Lagoon	Stocking stress
Colchester	Pickerel Lake	Hypoxia
Columbia	Columbia Lake	Spawning related
Cromwell	Gafney Pond	Hypoxia
East Haven	Farm River	Spawning related
Essex	CT River	Spawning related
Farmington	Farmington River	Stocking stress
Greenwich	Binney Pond	Hypoxia
Guilford	Private Pond	Hypoxia
Lisbon	Blissville Pond	Spawning related
Mansfield	Mansfield Hollow Reservoir	Hypoxia
Meriden	Mirror Lake	Hypoxia
Middlefield	Beseck Lake	Spawning related
Salem	Gardner Lake	Spawning related
Southbury	Lake Zoar	Hypoxia
Southington	Crescent Lake	Hypoxia
Suffield	Private Pond	Hypoxia
Vernon	Middle Bolton Lake	Spawning related