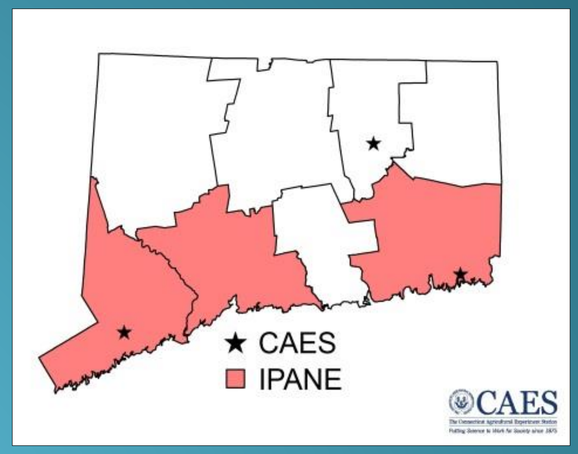
Hydrilla in the Connecticut River

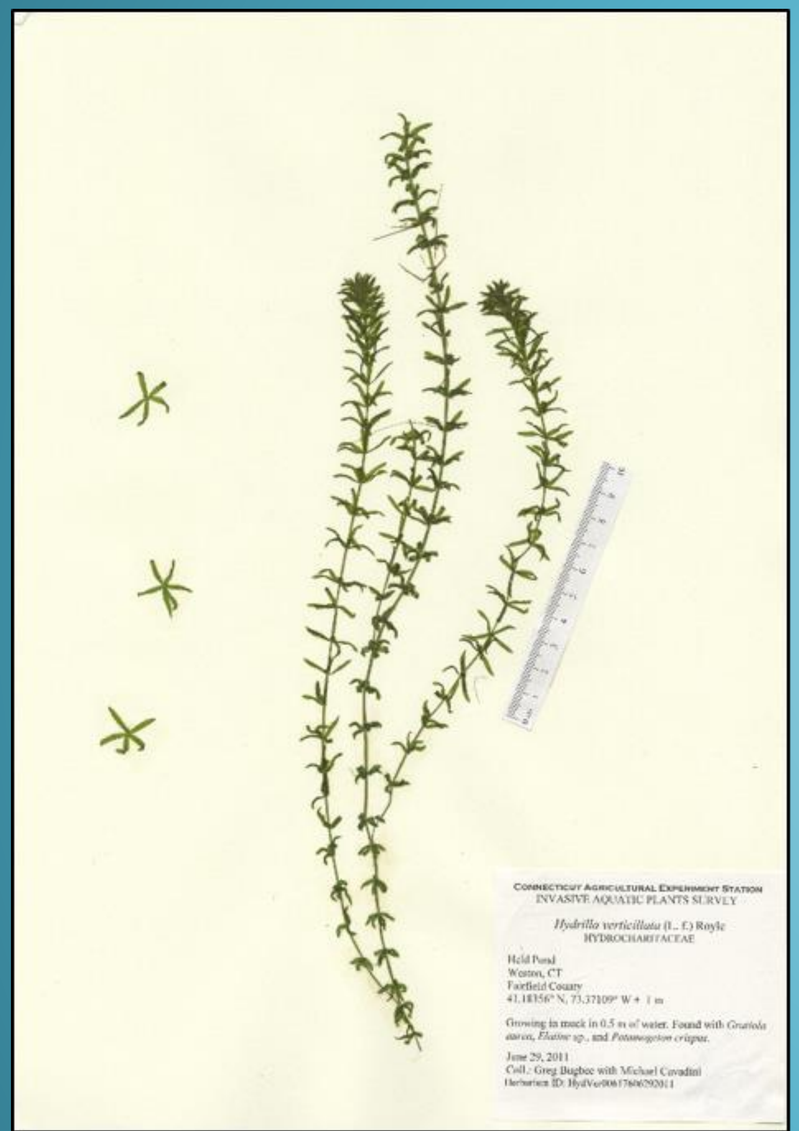
Gregory J. Bugbee and Summer Stebbins
Invasive Aquatic Plant Program
The Connecticut Agricultural Experiment Station

Hydrilla verticillata
(Hydrilla)

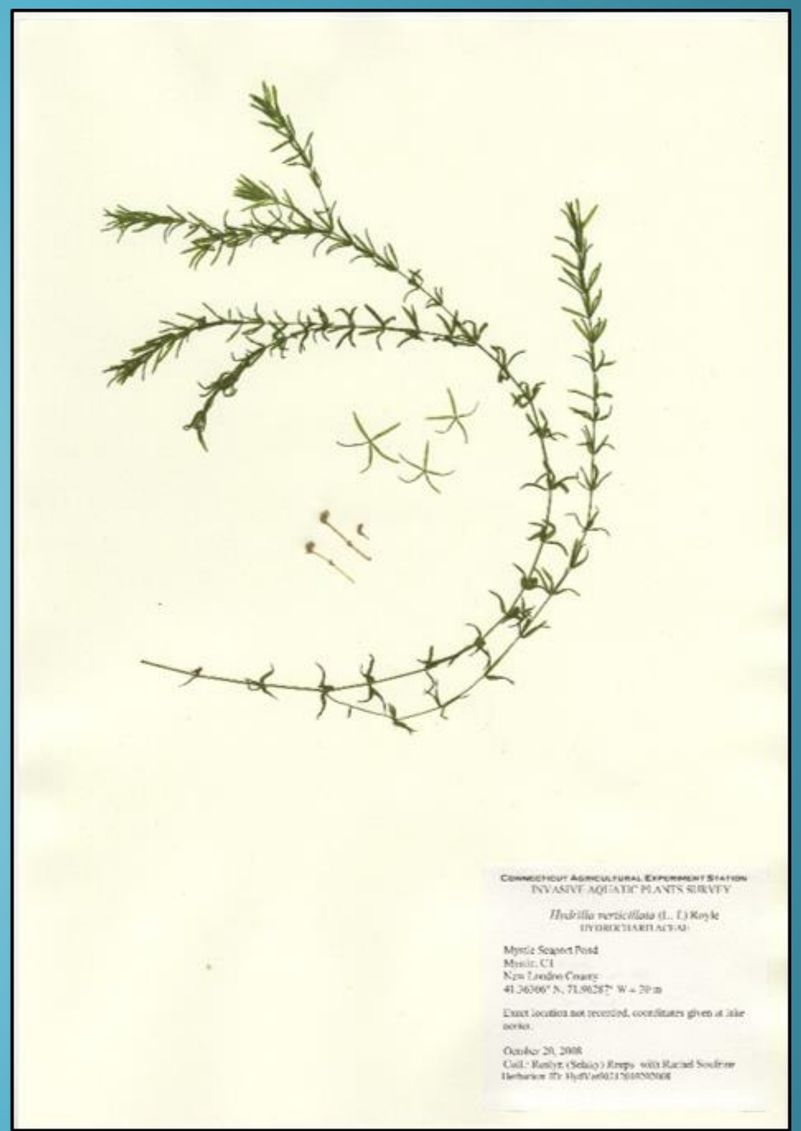
Photo by Judy Preston,
CT Sea Grant

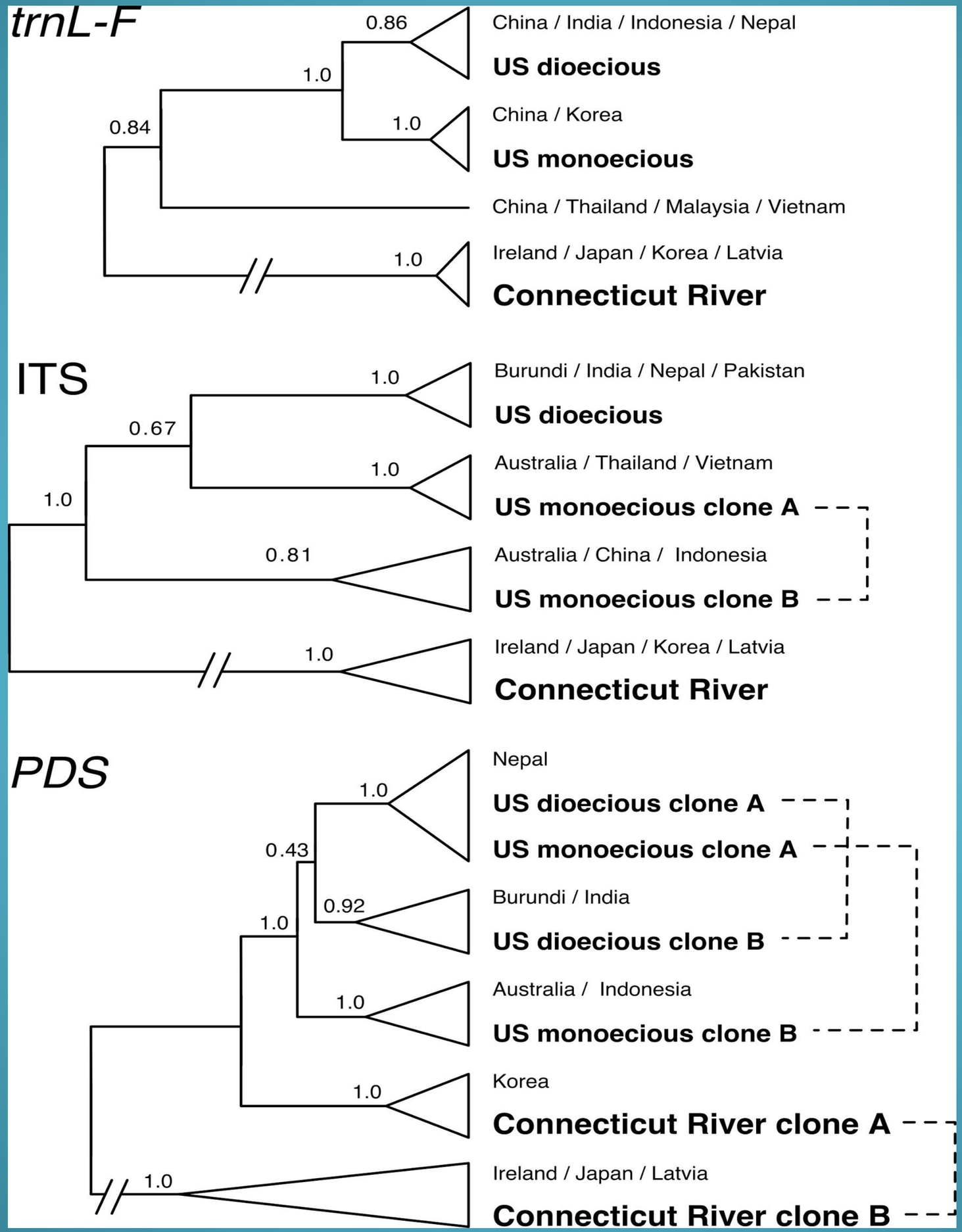
Hydrilla
Hydrilla verticillata




CONNECTICUT AGRICULTURAL EXPERIMENT STATION
INVASIVE AQUATIC PLANTS SURVEY
Hydrilla verticillata (L. f.) Royle
HYDROCHARITACEAE
Held Pond
Weston, CT
Fairfield County
41.18356° N, 73.37109° W ± 1 m
Growing in muck in 0.5 m of water. Found with Gratiola aurea, Elatine sp., and Potamogeton crispus.
June 29, 2011
Coll.: Greg Bugbee with Michael Cavadini
Herbarium ID: HydVer00617860920011


CONNECTICUT AGRICULTURAL EXPERIMENT STATION
INVASIVE AQUATIC PLANTS SURVEY
Hydrilla verticillata L. f. Royle
HYDROCHARITACEAE
Connecticut River
Glastonbury, CT
Hartford County
41.73083° N, 72.63056° W ± 1 m
Collection information unstated.
September 8, 2017
Coll.: Laurie Callahan
Herbarium ID: HydVer09900009082017


CONNECTICUT AGRICULTURAL EXPERIMENT STATION
INVASIVE AQUATIC PLANTS SURVEY
Hydrilla verticillata (L. f.) Royle
HYDROCHARITACEAE
Mystic Seaport Pond
Mystic, CT
New London County
41.36366° N, 71.98287° W ± 20 m
Exact location not recorded, coordinates given at lake access.
October 20, 2008
Coll.: Marilyn (Sehaig) Reeps with Rachel Southrow
Herbarium ID: HydVer00717049050808


trnL-F
0.86
1.0
1.0
0.84
1.0
China / India / Indonesia / Nepal
US dioecious
China / Korea
US monoecious
China / Thailand / Malaysia / Vietnam
Ireland / Japan / Korea / Latvia
Connecticut River
ITS
1.0
0.67
1.0
1.0
0.81
1.0
Burundi / India / Nepal / Pakistan
US dioecious
Australia / Thailand / Vietnam
US monoecious clone A
Australia / China / Indonesia
US monoecious clone B
Ireland / Japan / Korea / Latvia
Connecticut River
PDS
1.0
0.43
0.92
1.0
1.0
1.0
Nepal
US dioecious clone A
US monoecious clone A
Burundi / India
US dioecious clone B
Australia / Indonesia
US monoecious clone B
Korea
Connecticut River clone A
Ireland / Japan / Latvia
Connecticut River clone B

Evidence for a genetically distinct strain of introduced *Hydrilla verticillata* (Hydrocharitaceae) in North America

Nicholas P. Tippery, Gregory J. Bugbee, and Summer E. Stebbins*

*First author: Department of Biological Sciences, University of Wisconsin-Whitewater, Whitewater, WI 53190. Second and third authors: Department of Environmental Sciences, Connecticut Agricultural Experiment Station, New Haven, CT 06511. Corresponding author's E-mail: tipperyn@uww.edu. Received for publication _____ and in revised form _____.

ABSTRACT

The invasive aquatic weed hydrilla (*Hydrilla verticillata*) exists in North America as two genetically and morphologically distinct strains, with the dioecious strain mostly found in the southern United States and the monoecious strain being more northern, including previously known sites in Connecticut. In 2016 an additional hydrilla population was located in a portion of the Connecticut River in Hartford County, Connecticut, with unusual morphological features relative to other Connecticut populations. Hydrilla plants from this population were subjected to genetic testing, and their molecular sequences for one chloroplast (*trnL-F*) and two nuclear gene regions (ITS and *PDS*) were compared against published data. The Connecticut River hydrilla plants are distinct from all known North American plants, representing a novel introduction, likely from northern Eurasia. The genetic novelty of this recent introduction may present additional ecological and management challenges beyond what has been encountered for hydrilla to date.

Key words: hydrilla, invasive species, aquatic plants, Hydrocharitaceae, ITS, PDS, molecular phylogenetics

INTRODUCTION

Hydrilla verticillata (L.f.) Royle ('hydrilla') is a submersed aquatic angiosperm of ecological and economic importance. Globally it is among the most noxious invasive aquatic plants because of its ability to adapt to a variety of environments and outcompete native vegetation (Langeland 1996, Haller 2014). In North America, hydrilla eonsists of two 'strains', or 'biotypes': a monoecious strain and a dioecious strain, the latter comprising only female individuals in the introduced range (Ryan et al. 1995). Phylogenetic evidence from chloroplast (*trnL-F* region) and nuclear gene regions (internal transcribed spacer [ITS] and phytoene desaturase [*PDS*]) has demonstrated that the introduced hydrilla strains in North America were derived from two distinct sources. The monoecious strain most closely matches hydrilla plants that are native to Korea, whereas the dioecious strain resembles plants from India (Madeira et al. 1997, 2007, Benoit et al. 2019) and also matches plants more recently introduced to South America; Lucio LC, unpublished; Zhu et al., 2017).

Molecular data from the ITS and *PDS* regions have enabled a more thorough understanding of phylogenetic structure among hydrilla populations worldwide, including the two invasive North American strains. In addition to revealing extensive genetic variation, correlated to some extent with biogeography, the combined chloroplast and nuclear sequence data revealed a pattern of genetic mixture among geographically disparate populations, in both native and non-native ranges of hydrilla (Benoit et al. 2019). Both the monoecious and dioecious strains are predominantly triploid (Harlan et al. 1984, Langeland 1989), and their molecular sequences

Hydrilla Survey
Connecticut River

Fall 2018 Surveys

Surveyor

- Amy Smagula, NHDES; Meg Modley, LCBP
- GZA and Mass DCR
- Heidi Himes, USFWS; Dave Sagan, Silvio O. Conte*
- Kim Jensen, VTDEC*
- Margot Burns, RiverCOG; Judy Preston CT Sea Grant*
- Greg Bugbee, CAES; Margot Burns, RiverCOG*
- Laurie Callahan, SEVTAIS Project
- Laurie Callahan; Ann Bove

*Hydrilla Found

N

0 5 10 20 Miles

Windsor
Sullivan
Merrimack
ndham
Hillsborough
Cheshire
Middlesex
Franklin
Worcester
Greene
Berkshire
Hampshire
Columbia
Hampden
Tolland
Windham
Litchfield
Hartford
Dutchess
New Haven
New London
Middlesex

Esri, USDA Farm Service Agency

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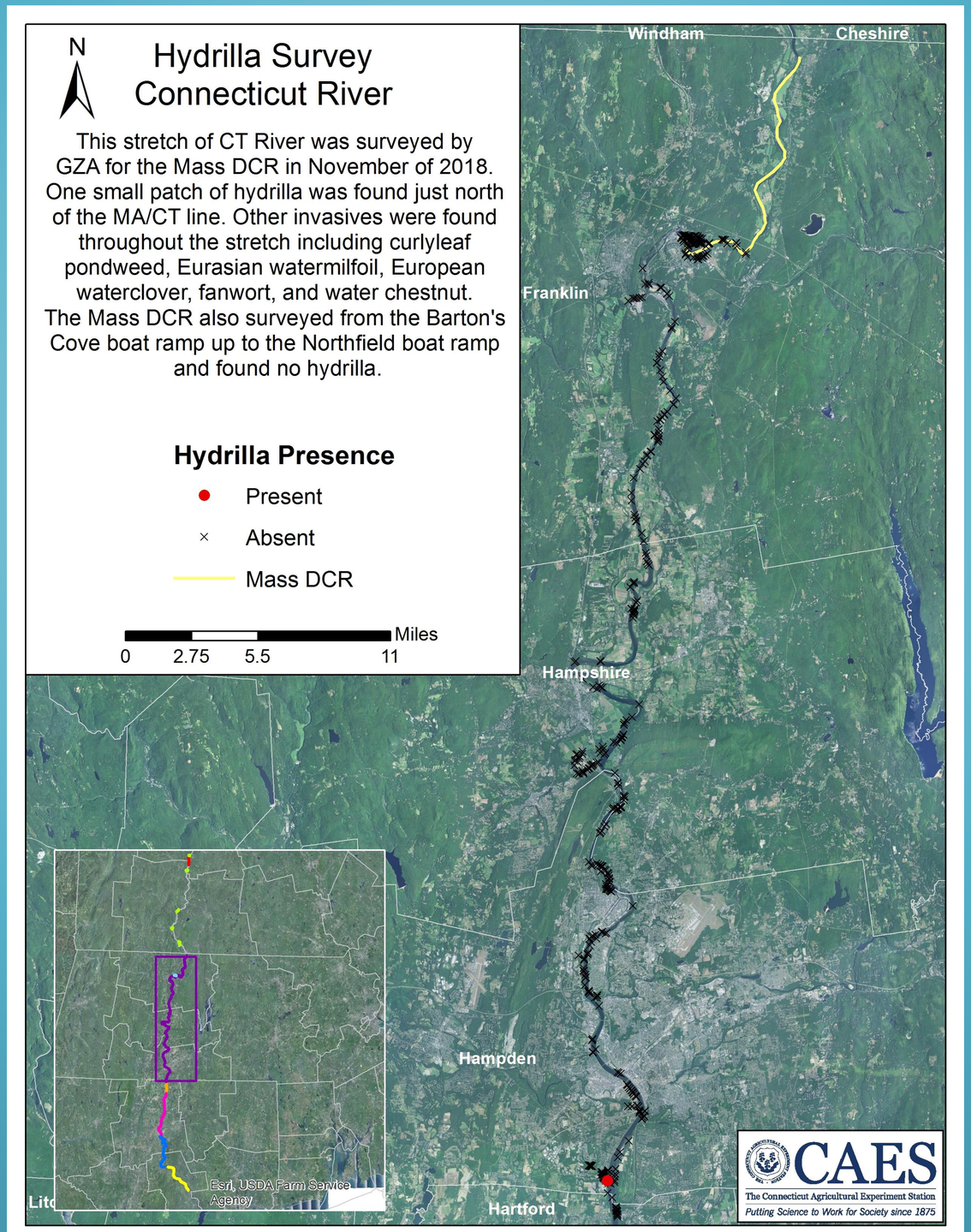
Hydrilla only found along MA/CT border



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Hydrilla Survey Connecticut River

Surveyed on August 30, 2018
By Margot Burns and Judy Preston

Photos taken by Judy Preston

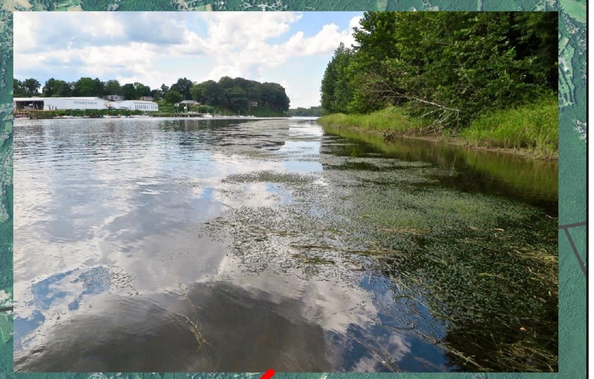
N

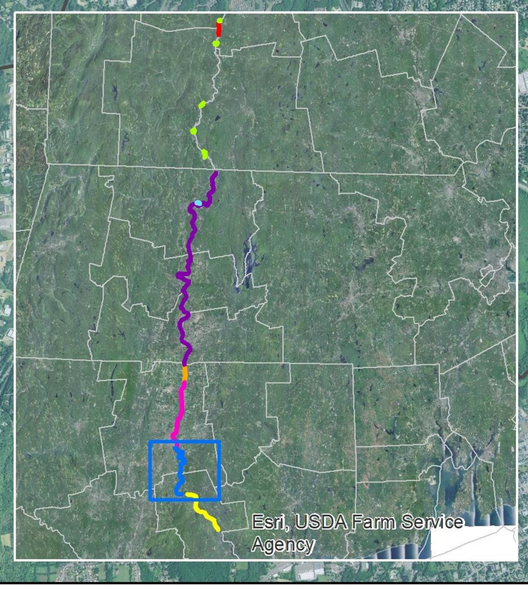
Legend

- Hydrilla Sampling Locations
- Cities

0 0.5 1 2 Miles

East Hartford
Glastonbury
Rocky Hill
Berlin
Cromwell
Ne
n





Esri, USDA Farm Service Agency

3 4 5 6 7 8 9 10 2 11 1 12

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Keeney Cove - East Hartford, CT

Laurie Callahan, 6/26/18

Hydrilla Survey
Connecticut River

Surveyed on October 1-2 and 31, 2018
By Greg Bugbee, Margot Burns,
Summer Stebbins, and Riley Doherty

N

Legend

- Collection Point
- Cities

Hydrilla Abundance

- Zero
- Trace
- Sparse
- Medium
- Dense

Miles
0 0.5 1 2

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Middletown
East Hampton
Haddam
East Haddam
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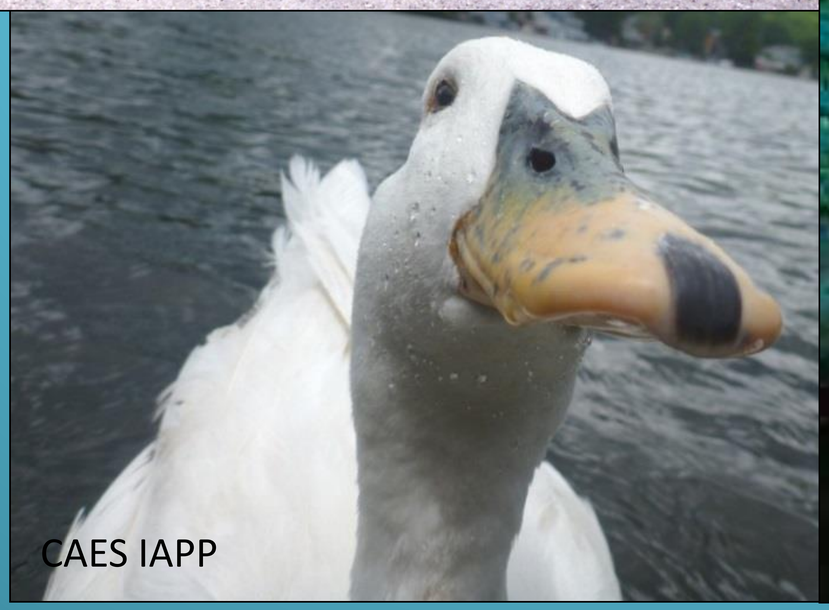
East Hampton, CT

Introduction and Dispersal

CAES IAPP

CAES IAPP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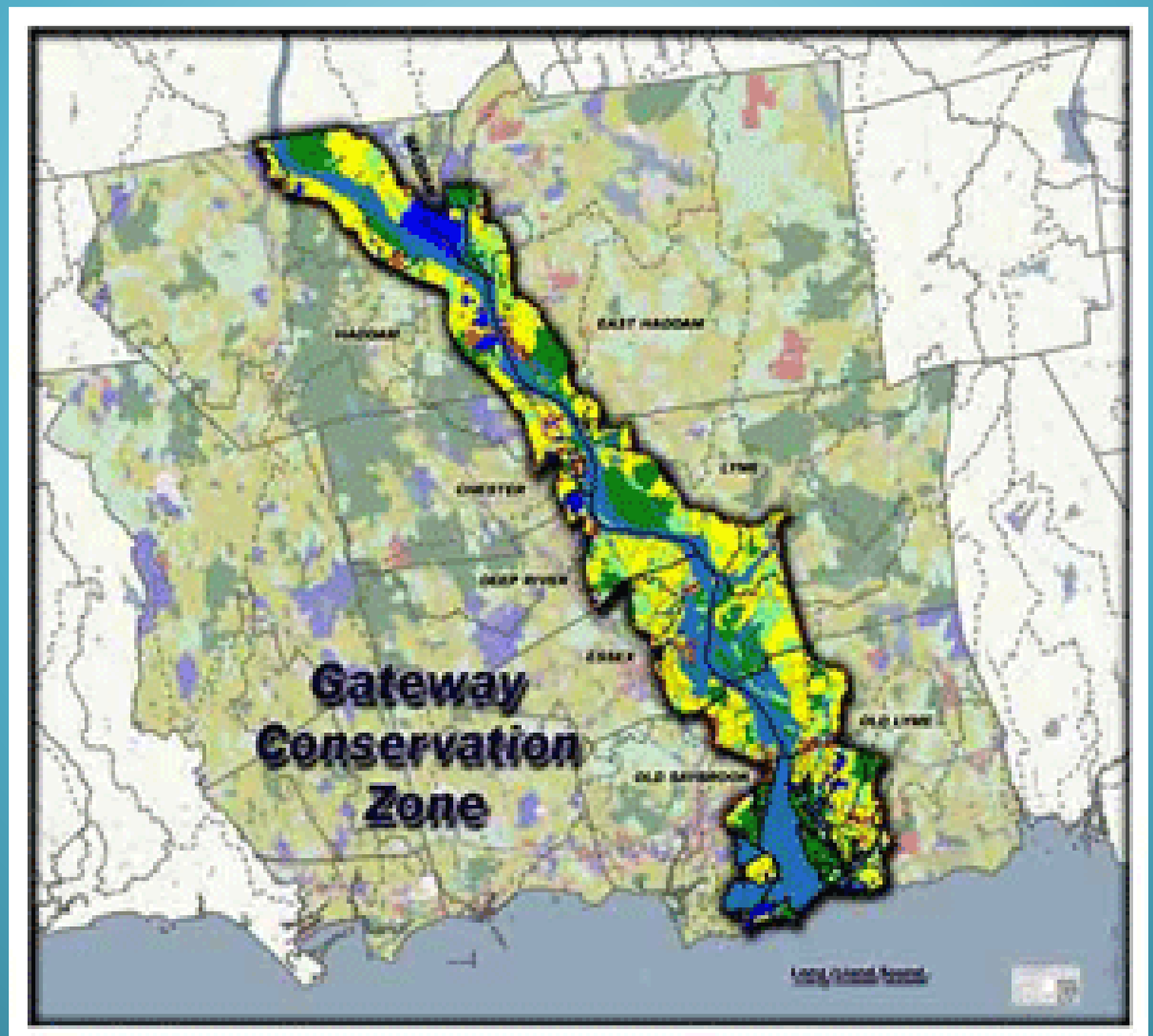
Gateway Zone Survey 2019

Gateway Commission
Eightmile River Watershed
National Wild and Scenic Rivers



2019 Scope of Work

- Survey the invasive aquatic vegetation in the Connecticut River Gateway Zone utilizing protocols established by the Connecticut Agricultural Experiment Station Invasive Aquatic Plant Program (www.portal.ct.gov/CAES/IAPP).
- Identify all invasive plant species and produce a vegetation map showing their locations.
- Determine vegetation species and abundance on georeferenced transects established in priority areas. Mount and digitize all species in CAES IAPP herbarium.
- Prepare a report containing maps, transect data and management options.
- Meet with stakeholders and present report. Provide educational workshops per request.

Questions?

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