Technical perspectives on Connecticut River hydrilla infestation and its potential future management

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Following an early October 2020 site visit facilitated by Dr. Greg Bugbee and based on review of past draft management discussions for this extensive hydrilla infestation and experiences in other NE and national sites, the following thoughts and preliminary recommendations about the Connecticut River (CTR) hydrilla infestation are provided. Some of these comments will likely reinforce key activities already planned or in progress while others may introduce some new concepts or details to consider. It is hoped that these perspectives are useful to the members of the NEANS Panel involved with assessing the CTR infestation and its future containment and management.

1) **High risk of regional spread and urgency of initial prevention efforts**: As Panel members have identified, this infestation does pose a high risk of regional spread to other waterways throughout the NE. This is acutely evident from recent reports of hydrilla detection via ramp inspections on boats attempting to enter Lake Champlain in 2019 (https://www.adirondackalmanack.com/2019/10/new-invasive-intercepted-at-lake-champlain-boat-launch.html) and Lake George in 2020 (https://poststar.com/news/local/lake-george-boat-inspection-prevents-invasive-species-from-entering-lake/article_be39099d-e0c6-5aee-869f-7e16ba3c2cc5.html). Through its effective boat steward program and documentation of origin points of boat travel, NYSDEC is also quantifying the regional risks associated with boats moving from the CTR to NY State. Echoing the recent hydrilla detections via inspection above, 2020 data below from NYSDEC recording inspected boats last waterbody visited confirms that Lake George and Lake Champlain standout unfortunately as having elevated risk of potential AIS spread from the CTR. However, 2020 data also documents 19 other NYS waterbodies where inspected boats had originated from the CTR including three of the Finger Lakes and Oneida Lake, the largest inland NYS lake.

2020 NYS Boat Stewardship Inspection Locations / Events citing Connecticut River as last waterbody visited

Waterbody Name	# 2020 Inspections	Waterbody Name	# 2020 Inspections
Lake George	143	Cayuga Lake	1
Lake Champlain	42	Indian Lake	1
Hudson River	4	Lake Kushaqua	1
Fulton Chain Lakes	3	Lake Placid	1
Great Sacandaga Lake	3	Lake Pleasant	1
Second Pond	3	Mohawk River	1
Canada Lake	2	Oneida Lake	1
Long Lake	2	Otisco Lake	1
Saratoga Lake	2	Round Lake	1
Cayuga Lake	1	Salmon River	1
Indian Lake	1	Seneca Lake	1
Lake Kushaqua	1	Skaneateles Lake	1
Saratoga Lake	2	Other roadside inspections	23

These occurrences of documented regional movement and specific finds of hydrilla the last two summers at two popular, well-visited NE locations reinforce the urgency of containing hydrilla from leaving the CTR. Containment can be fostered through several strategies but a strong inspection program at all CTR public access points beginning with the most utilized should be implemented. Localized hydrilla control at these access points should at a minimum also be implemented (see below). In parallel, related education and outreach to CTR users should be enhanced to reinforce Clean, Drain, and Dry procedures with emphasis on hydrilla and its high, unique threat to other lakes within CT and in the NE at large.

2) **CTR Phenology / Control Studies**: Preliminary studies have documented that CTR hydrilla is genetically different from common dioecious and monoecious biotypes found in other US locations. Visual observations support the population has intermediate and novel characteristics compared to other US hydrilla. Subterranean turion, or tuber production, has not yet been detected but aboveground vegetative turion production appears common (photo below). As with all invasive species, understanding of CTR hydrilla's seasonal growth and senescence patterns as well as reproductive strategies—in this case, perhaps focused on turions—will greatly assist short-term and long-term management planning and implementation. Collaborative studies by NC State University with support from Dr. Bugbee and funded in part by the Aquatic Plant Management Society's Michael D. Netherland Graduate Student Research Grant should provide helpful data about this hydrilla population and insights on most effective management. Since vallisneria (val) is a key native aquatic plant in the CTR, recent NYSDEC-funded studies by Dr. Katia Everhardt looking at herbicide sensitivity (fluridone-focus) of different val populations may provide additional supporting information to project selectivity outcomes for possible CTR herbicide management, particularly at larger scales. Similar scientific efforts focused on key pieces of information relevant to control should be continued and potentially augmented.

CTR hydrilla turion development, October 6, 2020

3) **Outlook for future containment, maintenance and restoration**: The scale of the CTR hydrilla infestation is significant with over 50+ miles of the river infested from southern MA to circa Brockway Island (on a line between Essex and Lyme). The lower river limits of the well-established infestation are likely driven by 5 – 15 ppt salinity in the summer greatly inhibiting hydrilla establishment. Although 2020 CTR survey results remain pending, the CTR and its tributaries have at least hundreds of acres dense infested of hydrilla in total. The mainstem of the river has high baseline flows due to its sizable watershed and is tidally-influenced in a large fraction of the infestation. Evaluation of USGS tidally-corrected discharge for the CTR at Middle Haddam indicates that median-75th percentile CFS ranges from 5,000 to 30,000 between June 1 and Oct 1. Lowest flows are in the late summer and higher flows are the late spring as would be expected. Several relevant USGS data graphs are included for reference at the end of this short document.

   Management objectives and implementation for this infestation can range from small-scale to large-scale intervention even up to river-wide management. At small scales, control efforts can be part of integrated strategies to greatly reduce/eliminate risk of spread from infested public access points. An aggressive control program around public access points on the river including DEEP public ramps and various marinas should be considered with initial demonstration in 2021. For preliminary consideration by NEANS members seeking to secure future resources for treating high water-exchange, public access points/marinas, a rough cost range for 5A of combined use of maximum rate Sonar (fluridone) pellets (split treatments) with additional use of monthly, contact/localized short-exposure systemic treatments from June into October would be $35,000 to 65,000 per 5A demonstration site per season (focus of estimate is herbicide and application before monitoring or any other efforts). Such a program has a high probability of greatly reducing the presence of hydrilla at access points. Several such locations should be targeted for operational demonstration efforts starting in 2021. If use of chelated copper herbicides or other potential spot treatment tools may be precluded under most permitting actions for such management, that should be verified as soon as possible.

   At larger scales, management efforts would seek to reduce hydrilla in key sections or even most/all of the river to improve/restore long-term habitat quality. Historically, the most cost-effective strategy for large-scale hydrilla control is the use of sterile triploid grass carp. There are a number of technical reasons why carp seem inappropriate for large-scale hydrilla control in the CTR including lack of selectivity in carp feeding and uncontrolled carp movements. Nationally, there are more selective uses of low stocking rates of grass carp (1-5 fish per hydrilla-infested acre…or even less) in combination with herbicide management. However, the level of uncertainty associated with use of grass carp in a complex system like the CTR and possible impacts to val and other aquatic vegetation make their use in any manner unlikely.

   Larger-scale, efficient and selective uses of aquatic herbicides can provide predictable outcomes with sufficient selectivity relative to val and other aquatic plants with minimal risks to non-target fauna. In larger, partial sections of the river with better retention (coves etc…days versus hours of contact time to simplify the retention picture), herbicide demonstration treatments would likely cost between $1,500 to $3,000/acre for basics of implementation (herbicide + application) but site-specific parameters should be considered for detailed planning and budgeting. 1 – 3 demonstration efforts in such locations should be considered for 2021. It would be anticipated that several years of targeted research (turion dynamics for example), operational demonstration at small scales in the

river, and general environmental assessment may be necessary to allow fully operational large-scale herbicide management. At the largest scale, managing the majority of CTR hydrilla is not necessarily outside the realm of possibility. June-September low-dose Sonar injection treatment (up to 10 injection locations) and/or combined management with pellets and injection, or possible large-scale use of a shorter-exposure systemic herbicide (ProcellaCOR considered for selective, mid-summer application) have been scoped. A preliminary cost range for river-wide management using one of these strategies would be $12M to $25M for a season. If the CTR hydrilla population in fact forms few or no tubers and its year-to-year 'reproductive success' is reliant on successful turion development and germination each year that could be disrupted with larger-scale control efforts, a single season's effort at this scale would dramatically reduce hydrilla densities in the river, and the extended 5-8 years of consecutive management associated with reducing hydrilla tuber banks should not be needed. This could restore the river to a much-improved condition that would assist smaller scales of maintenance control into the future to be more effective. It is recognized that this scale of control effort is uncommon. States such as Florida and California implement successful, annual multi-million dollar herbicide programs that can inform consideration of this largest scale of management. California Parks Division of Boating and Waterways successfully manages several thousand acres per year of *Egeria densa* using Sonar in the dynamic tidal freshwater Sacramento-San Joaquin River Delta (https://dbw.parks.ca.gov/?page_id=28994). Successful injection treatment programs in several US states (NY, NJ, NC among others)—some overseen by NEANS Panel members—further inform how flowing water can be treated for hydrilla control. Large-scale operational management is referenced to provide context for different strategies for CTR hydrilla control that could seek to not only contain the river's hydrilla—which will be difficult at small scale due to high water exchange and perpetual hydrilla pressure from unmanaged sections of the tidal river—but also seek to greatly improve its overall habitat condition from where it stands today.

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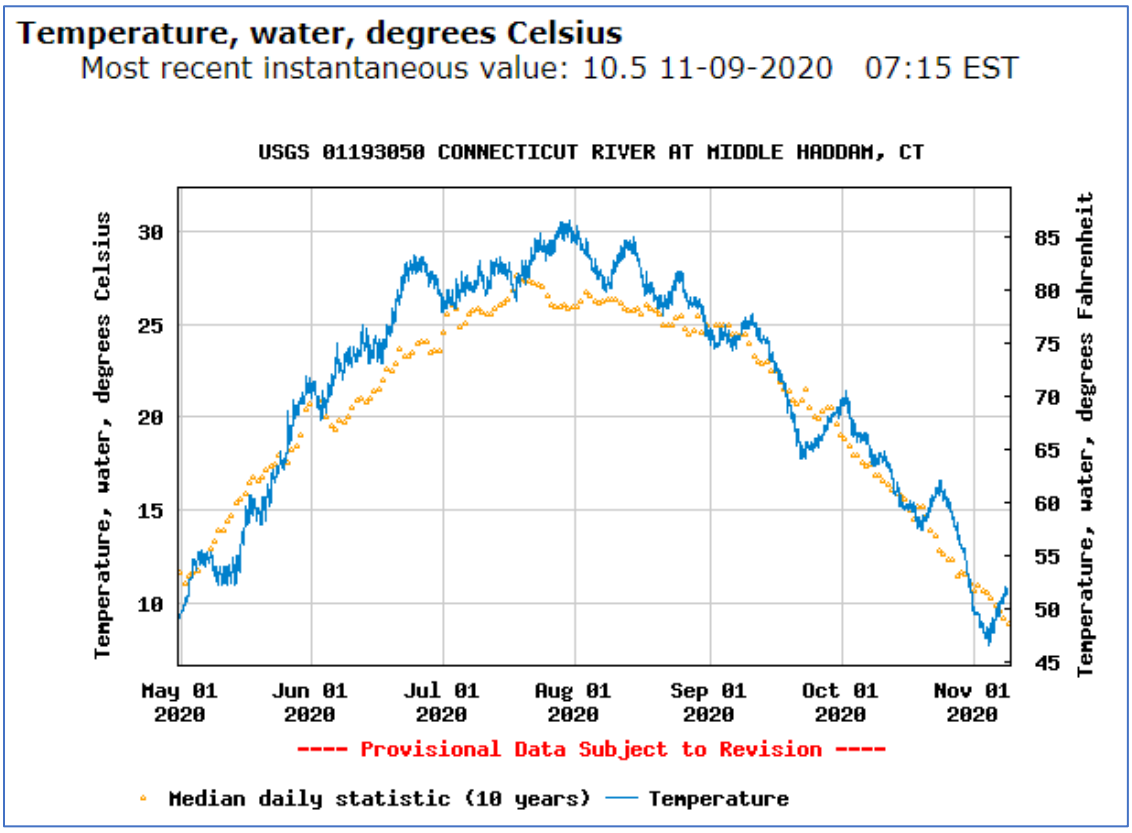
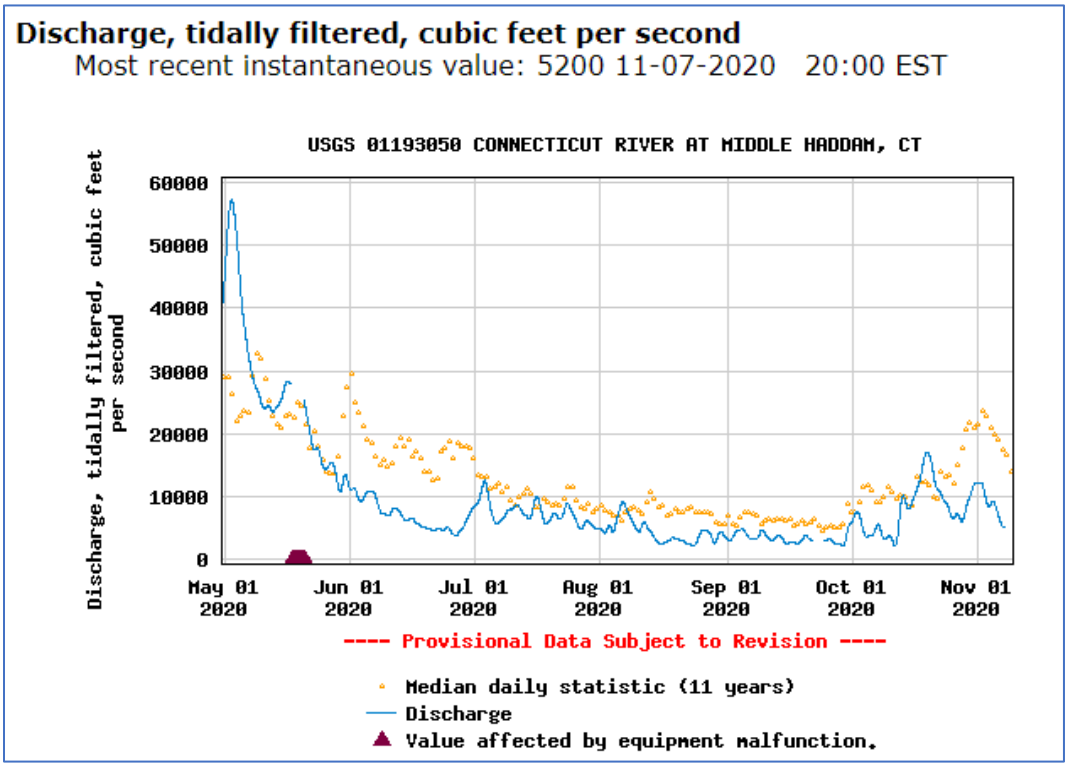
Supplementary USGS data for Connecticut River





Salinity, water, unfiltered, practical salinity units at 25 degrees Celsius, at Essex Island Top

Most recent instantaneous value: 2.5 11-09-2020 09:30 EST