2011 Catskill Region Aquatic Nuisance Species Survey for the Catskill Center for Conservation and Development

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Work Plan:

This plan outlines a contract for services between The Catskill Center for Conservation and Development and the SUNY Oneonta Biological Field Station, Willard N. Harman, Director. The scope of work was stipulated as 1 through 5 below:

1. Compile relevant survey and inventory information from all known sources.

2. Determine access locations for 2 "easily accessed" lakes or reservoirs in each of 5 watersheds to be approved by CRISP.

3. Develop a qualitative sampling technique with approval from members of CRISP and sample aquatic communities in each lake:
   a. benthic macrophytes
   b. benthic macroinvertebrates
   c. zooplankton
   d. fish

4. Concentrating on *Didymosphenia*, macrophytes, macroinvertebrates, sample at 3 locations in each of five (5) major regional streams at what appears to be optimal habitat considering stream character.

5. Develop a final summary report, which should include collected research that was compiled and the results of qualitative sampling for distribution among CRISP partners.

On site observation and sampling procedures:

Upon arrival at a proposed collecting site the following procedures were followed:

1. Observations were made of access, surrounding land use and semi-aquatic invasive exotics. Species in question were collected for future determination.
2. CRISP Aquatic Survey sheets were begun to be filled out with the date, location by descriptive name and coordinates. Semi-aquatic nuisance species and abundances were indicated on check off list (See Working List below).
3. Character of biotope was observed (water quality, trophic status, appearance).
4. Depending on the site, macrobenthic invertebrates and any plants or algae species were collected by hand picking from the substrate. Triangle nets or hand sieves were used to

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collect organisms from vegetation or inorganic substrates. Seines were used in lotic (running) waters via traditional "kick" methods for macroinvertebrate collections. Any ANS were noted and indicated on check off list.

5. A 63µm mesh plankton net was tossed out into the water or lowered from a boat or structure over the water, and retrieved, to observe zooplankton. Any ANS were noted and indicated on check off list.
6. Any ANS fish observed were noted and indicated on check off list.
7. Questionable ANS species were placed in containers and returned to the laboratory for further study and species determination.
8. Any sampling equipment, wading gear, boats and trailers were treated as indicated below before leaving the collection site.

Sampling protocols to prevent inadvertent distribution of ANS followed the current New York State Department of Environmental Conservation, Bureau of Fisheries sampling, survey, boat and equipment protocols. In particular, to prevent inadvertent distribution of any exotics encountered, all equipment before use was clean and dry, or disinfected. After utilization all equipment was disinfected at each collecting site immediately after use.

For all survey work in streams and rivers where the status of aquatic nuisance species (ANS) was unknown, sampling (at any one work day) started at the uppermost reach and then worked downstream. Disinfectant was kept in the transporting vehicle for ready use at each site. Prior to leaving each site any visible plants, animals and substrate were removed from any boat, trailer, sampling equipment, boots or containers, live wells, etc., to prevent transfer of biota or water from one water body to another. In all cases a 10% bleach solution was used as a disinfectant. Boats and trailers were cleaned using a high temperature pressure washer at the BFS after each use (limiting boat based sampling to one collection site daily).

Working List of CRISP Aggressive High Threat Aquatic Nuisance Species:

The list provided in Table 1 has been compiled from ANS species lists from nearby regions (the Great Lakes and New England), from local and nearby records and updated based on the results of this survey. Organisms listed in Categories E and C have limited distributions within the Catskill region. Consideration for "Elimination" or "Containment" as listed is based only on my opinion. Actual strategies planned and/or undertaken to address each situation would depend on concern relative to the aggressive characteristics of the organisms so categorized, resources available, likelihood of success and organization priorities (See Narrative).

Table 1. List of aquatic nuisance species (ANS) considered in the Catskill regional survey.
A = Approaching the Catskill region; documented at locations nearby, E = To be cited for eradication; limited distribution in the Catskills, C = Containment (elimination not feasible); limited distribution but well established in the region, W = Widespread within the Catskills.

Pathogens		
Genus *Novirhabdovirus**	Viral Hemorrhagic Septicemia	A
Myxobolus cerebralis	Salmonid whirling disease	A
Aeromonas salmonicola	Furunculosis	A
***** Viral taxonomy does not follow binomial nomenclature. The species is VHS.		
Algae		
Didymosphenia germinate	Didymo	E
Nitellopsis obtusa	Starry stonewort	C
Vascular plants		
Cabomba caroliniana	Fanwort	A
Egeria densa	Brazilian elodea	A
Hygrophila polysperma	East India hygrophila	A
Hydrilla verticillata	Hydrilla	A
Salvinia molesta	Giant salvinia	A
Myriophyllum spicatum	Eurasian watermilfoil	C
Myriophyllum aquaticum	Parrot's feather	A
Myriophyllum heterophyllum	Variable-leaved watermilfoil	A
Butomus umbellatus	Flowering rush	A
Iris pseudacorus	Yellow flag Iris	C
Fallopia japonica	Japanese knotweed	W
*Lythrum salicari*a	Purple loosestrife	W
Phragmites australis	Common reed	W
Trapa natans	Water chestnut	E
Hydrocharis morsus-ranae	European frog bit	A
Najas minor	Slender-leaved naiad	A
Najas guadalupensis	Southern naiad	C
Nymphoides peltata	Yellow floating heart	A
Potamogeton crispus	Curly leaf pondweed	C
Rorippa amphibia	Great water cress	A
Zooplankton		
Bythotrephes cederstroemi	Spiny water flea	A
Cercopagis pengoi	Fish hook water flea	A
Invertebrate benthos		
Corbicula fluminea	Asiatic clam	A
Dreissena polymorpha	Zebra mussel	A
Dreissena bugensis	Quagga mussel	A
Bithynia tentaculata	Faucet snail	A

Table 1 (cont.). List of aquatic nuisance species (ANS) considered in the Catskill regional survey.

Cipangopaludina chinensis	Chinese mystery snail	A
Potamopyrgus antipodarium	New Zealand mud snail	A
Orconectes rusticus	Rusty crayfish	W
Eriocheir sinensis	Chinese mitten crab	A
Fish		
Gymnocephalus cernuus	Eurasian ruffe	A
Neogobius melanostomus	Round goby	A
Proterothinus marmoratus	Tubenose goby	A
Tinca tinca	Tench	A
Alosa aestivalis	Blueback herring	C
Alosa pseudoharengus	Alewife	C
Cyprinus carpio	Common carp	W
Ctenopharyngodon idella	Grass carp	E
Dorosoma cepedianum	Gizzard shad	A
Morone americana	White perch	C
Scardinius erythrophthalmus	European rudd	C
Channa argus	Snake head	A
Misgurnus anguillicaudatus	Loach, Oriental weatherfish	C
Birds		
Cygnus olor	Mute swan	C

Narrative: CRISP Aquatic Survey: 2011

Results pre-survey data search:

In preparation for conducting the survey, I contacted all relevant NYS DEC regional offices and received important anecdotal information on fisheries. I checked out the 1984 Adirondack Lakes Survey (expanded in 1987 to include Lower Hudson Region) from the DEC library and made hard copies of survey results on over 40 Catskill Lakes over 40 ha in size. Contact was made with the NYC DEP and data were received from their macrobenthic monitoring efforts. I talked to faculty from the SUNY Cobleskill Fisheries and Aquaculture Department. NYS DEC records included some reasonable fisheries inventories, nothing relevant on invertebrates or plants. The NYC DEP provided excellent data concerning macrobenthic invertebrates and anecdotal information on fish. Other than the anecdotal information from DEC fisheries and SUNY Cobleskill Fisheries and Aquaculture personnel there were no satisfactory data from any source relevant to ANS. I found nothing on pathogens attributed specifically to the Catskill region.

Field work:

Wet weather in the spring gave me a late start. Storms of tropical origin terminated sampling in late summer. Despite the weather related problems, collections were made at 30 sites in 8 watersheds (described in Table 2, coordinates given in Table 3). Eighteen lakes (18) and twelve (12) stream reaches were sampled. Originally, the strategy was to sample larger lentic water bodies assuming the potential of a higher diversity of organisms present. In the Catskills the largest water bodies are reservoirs, most with restricted access, arguably precluding the most common vector of ANS dispersal; recreational activities. Therefore, in addition to those water bodies, smaller standing waters in the same catchments were also sampled.

Summary of results:

I encountered fewer exotics than I expected to find in the Catskills and lower numbers of those that were encountered. Both algae listed, didymo and starry stonewort, were present. Twenty (20) vascular plants of concern were on the list. I found eight (8). Of the ten (10) invertebrates listed only two were found; zebra mussels and rusty crayfish. Five (5) out of the 13 fish listed were found. Most of the ANS were present in the Susquehanna River watershed. The Central Catskills are comparatively free of exotics. Some were undoubtedly missed, but both the lake and river sites were selected for their ease of access and therefore exposure to vectors of ANS introductions.

Dominant vascular plant ANS are the emergents purple loosestrife (*Lythrum salicaria*), common reed (*Fragmites australis*) and the (practically) terrestrial Japanese knotweed (*Fallopia japonica*). Although widespread, they are encountered in greater frequency in the northwestern counties (Otsego, Delaware, northern Schoharie). In all cases loosestrife was subjected to herbivory by *Galerucella* spp., a chrysomelid beetle, and appears to be reasonably controlled. Submergent aquatic plants of concern were rarely encountered. White Lake (site 9) and Lake Louise Marie (site 12), both in Sullivan County, support populations of milfoil (*Myriophyllum* spp.), but apparently not Eurasian milfoil. I would like to check again in the future to assure positive identification. The only invertebrate macrobenthos observed were rusty crayfish (*Orconectes rusticus*) found in a few locations where streams were carrying high loads of silt, and zebra mussels (*Dreissena polymorpha*) restricted to the Susquehanna River drainage basin. All fish data were obtained verbally from sources in NYS DEC and SUNY Cobleskill or have been found in locations regularly sampled by Biological Field Station (BFS) personnel.

Recommendations for mitigative activities:

The purpose of developing a survey of aquatic nuisance species (ANS) in the Catskill region is to:

1. Provide an understanding of the current nature and condition of regional aquatic resources relevant to the distribution and abundance of ANS.
2. To begin the development of a baseline from which to assess the importance of newly documented organisms relative to the ANS threat within the region.

3. To enable the CRISP partners to address the implementation of early detection rapid response protocols when appropriate.

Therefore, the following few comments on situations as observed during the summer of 2011.

1. The aquatic algae; didymo , starry stonewort and the plants; yellow flag iris, curly – leaved pondweed and Eurasian milfoil as well as the fish; white perch, and alewife all have restricted distributions within the region. Given the current techniques for management, in areas where they have been successfully established there would be very little chance of success in eliminating them without severe environmental damage and/or tremendous expense. Therefore I suggest containment to the habitats in which they are now encountered by the use of prophylactic measures.
2. The aquatic plant; southern naiad and the loach (a fish) have restricted distributions but may not be particularly aggressive. I believe southern naiad has been beneficial in Otsego Lake stabilizing unconsolidated sediments.
3. European carp has been widespread locally for at least 100 years, and although detrimental to native species and negatively affecting sensitive habitats, its elimination would be impractical and not unlike attempting to remove other "naturalized" species such as several commonly stocked fish such as largemouth black bass, several small sunfishes and yellow perch that are now found throughout the region (that is not to preclude their removal from isolated smaller water bodies where intensive fisheries management takes place).
4. Although I did not encounter grass carp, they are in Summit Lake, Schoharie County. The DEC Region 4 office has issued 233 additional stocking permits (in 2011 for small ponds) for the control aquatic plants. If they are encountered in any waters outside of permitted ponds they should be eliminated. Data for alewife and white perch are also from DEC and SUNY Cobleskill. Fisheries data continue to trickle in. I will update as appropriate.
5. Water chestnut, and in my opinion, mute swans should be eliminated whenever they are encountered.

Table 2. Sampling sites evaluated during the 2011 Catskill regional ANS survey.

Location	**Site #**
1. Susquehanna River:	
A. Otsego Lake, Otsego Co.	(1)
B. Canadarago Lake, Otsego Co.	(21)
C. Moe Pond, BFS Upper Research Site, Otsego Co.	(29)
D. Susquehanna ox bow wetland, Oneonta, Otsego Co.	(30)
2. Delaware River:	
2a. West Branch.	
A. Cannonsville Reservoir. Stilesville, Delaware Co. (Rt. 10)	(5)
B. Oquaga Lake. McClure, Broome Co.	(4)
C. Oquaga Creek, Delaware Co.	(2)
D. West Branch Delaware River at Deposit, Delaware Co.	(3)
E. West Branch Delaware River at Rts. 10/26, Delaware Co.	(6)

Table 2 (cont.). Sampling sites evaluated during the 2011 Catskill regional ANS survey.

F. Little Delaware River at Bovina, Delaware Co. (21A)

2b. East Branch.
- A. Pepacton Reservoir. Downsville (Rt. 30), Delaware Co. (7)
- B. Beaver Kill at Rt. 54, Sullivan Co. (22)
- C. Little Pond, Little Pond State Campground, Delaware Co. (23)
- D. Waneta Lake, Sullivan Co. (24)
- E. Beaver Kill at Rockland, Sullivan Co. (8)

3. Schoharie Creek.
- A. Schoharie Reservoir. near Prattsville, Green Co. (18)
- B. Blenheim Gilboa Reservoir. North Blenheim (Rt. 30), Schoharie Co. (19)
- C. Summit Lake (Rt. 10), Schoharie Co. (20)
- D. Schoharie Creek at Jewett Ctr., Green Co. (17)

4. Hudson drainage.
- A. Esopus Creek at Allaben, Ulster Co. (28)
- B. Ashokan Reservoir. Ashokan (Rt. 28), Ulster Co. (16)

5. Wall Kill
- A. Rondout Reservoir. Lowes Corners (Rt. 153), Sullivan Co. (14)
- B. Rondout Creek, Sundown Wild Forest, Ulster Co. (15)
- C. Cape Pond, Ulster Co. (27)

6. Mongaup/Neversink Rivers
- A. Neversink Reservoir. Neversink (Rt. 55), Sullivan Co. (13)
- B. Lake Louise Marie. Bridgeville (Rt. 17), Sullivan Co. (12)
- C. White Lake, Sullivan Co. (9)
- D. Black Lake. (Rt. 55), Sullivan Co. (26)
- E. Swan Lake, Sullivan Co. (10)
- G. Lake Superior, Sullivan Co. (11)

7. North Brook.
- A. Hunter Lake. Fosterdale (Rt. 52), Sullivan Co. (25)

Table 3. Coordinates for sampling sites described above (Table 2).

1.	N42^{o}43.119’	W074^{o} 55.575
2.	N42^{o}05.860’	W074^{o}23.600’
3.	N42^{o}03.641’	W075^{o}25.123’
4.	N42^{o}01.051’	W075^{o}27.603’
5.	N42^{o}04.162’	W075^{o}19.968’

Table 3 (cont.). Coordinates for sampling sites described above (Table 2).

6.	N42°10.434’	W075°01.966’
7.	N42°04.328’	W074°54.529’
8.	N41°57.852’	W074°54.476’
9.	N41°40.458’	W074°50.311’
10.	N41°45.315’	W074°46.940’
11.	N41°39.663’	W074°52.258’
12.	N41°36.602’	W074°34.386’
13.	N41°94.780’	W074°40.063’
14.	N41°51.439’	W074°30.437’
15.	N41°54.608’	W074°27.203’
16.	N41°59.916’	W074°06.725’
17.	N42°14.555’	W074°19.791’
18.	N42°19.248’	W074°26.217’
19.	N42°26.417’	W074°27.237’
20.	N42°35.130’	W074°35.022’
21.	N42°49.005’	W074°59.550’
21A.	N42°14.930’	W074°49.871’
22.	N42°03.015’	W074°41.353’
23.	N42°02.352’	W074°44.938’
24.	N42°57.709’	W074°49.933’
25.	N41°43.231’	W074°54.291’
26.	N41°37.949’	W074°52.319’
27.	N41°44.914’	W074°26.234’
28.	N42°06.390’	W074°21.122’
29.	N42°43.100’	W074°55.601’
30.	N42°26.486’	W074°06.907’

Table 4. ANS taxa indicating locations collected by site number.

Pathogens		**Site number**
Genus *Novirhabdovirus**	Viral Hemorrhagic Septicemia	
Myxobolus cerebralis	Salmonid whirling disease	
Aeromonas salmonicola	Furunculosis	

***** Viral taxonomy does not follow binomial nomenclature. The species is VHS.

Algae		
Didymosphenia germinate	Didymo	28
Nitellopsis obtusa	Starry stonewort	1,21
Vascular plants		
Cabomba caroliniana	Fanwort	
Egeria densa	Brazilian elodea	
Hygrophila polysperma	East India hygrophila	

Table 4 (cont.). ANS taxa indicating locations collected by site number.

Hydrilla verticillata	Hydrilla	
Salvinia molesta	Giant salvinia	
Myriophyllum spicatum	Eurasian watermilfoil	1,9,21
Myriophyllum aquaticum	Parrot's feather	
Myriophyllum heterophyllum	Variable-leaved watermilfoil	
Butomus umbellatus	Flowering rush	
Iris pseudacorus	Yellow flag iris	1,21
Fallopia japonica	Japanese knotweed	1,3,6,8,9,17,18,20,21A,28,30
*Lythrum salicari*a	Purple loosestrife	1,5,6,9,12,16,19,21,28,30
Phragmites australis	Common reed	14,21,29
Trapa natans	Water chestnut	10,27,30
Hydrocharis morsus-ranae	European frog bit	
Najas minor	Slender-leaved naiad	
Najas guadalupensis	Southern naiad	1
Nymphoides peltata	Yellow floating heart	
Potamogeton crispus	Curly leaf pondweed	1,3,10,21,30
Rorippa amphibia	Great water cress	
Zooplankton		
Bythotrephes cederstroemi	Spiny water flea	
Cercopagis pengoi	fish hook water flea	
Invertebrate benthos		
Corbicula fluminea	Asiatic clam	
Dreissena polymorpha	Zebra mussel	1,21
Dreissena bugensis	Quagga mussel	
Bithynia tentaculata	Faucet snail	
Cipangopaludina chinensis	Chinese mystery snail	
Potamopyrgus antipodarium	New Zealand mud snail	
Orconectes rusticus	Rusty crayfish	1,6,21
Eriocheir sinensis	Chinese mitten crab	
Fish		
Gymnocephalus cernuus	Eurasian ruffe	
Neogobius melanostomus	Round goby	
Proterothinus marmoratus	Tubenose goby	
Tinca tinca	Tench	
Alosa aestivalis	Blueback herring	
Alosa pseudoharengus	Alewife	1,5,7,18,21,19*
Cyprinus carpio	Common carp	1,21
Ctenopharyngodon idella	Grass carp	20*
Dorosoma cepedianum	Gizzard shad	
Morone americana	White perch	1,5,7,12,18*
Scardinius erythrophthalmus	European rudd	1

Table 4 (cont.). ANS taxa indicating locations collected by site number.

Channa argus	Snake head
Misgurnus anguillicaudatus	Loach, Oriental weatherfish*

Birds

Cygnus olor	Mute swan

*****Alewife, grass carp and white perch records are from DEC region 4 and SUNY Cobleskill. Aside from Summit Lake, permits have been issued for stocking of grass carp in 233 sites, all 5 acres or less in surface area in DEC Region 4. Loach are in the Manor Kill, Schoharie County. Fish data continue to come in from various reliable sources. I will continue to update the survey with an indication that records are anecdotal if appropriate.