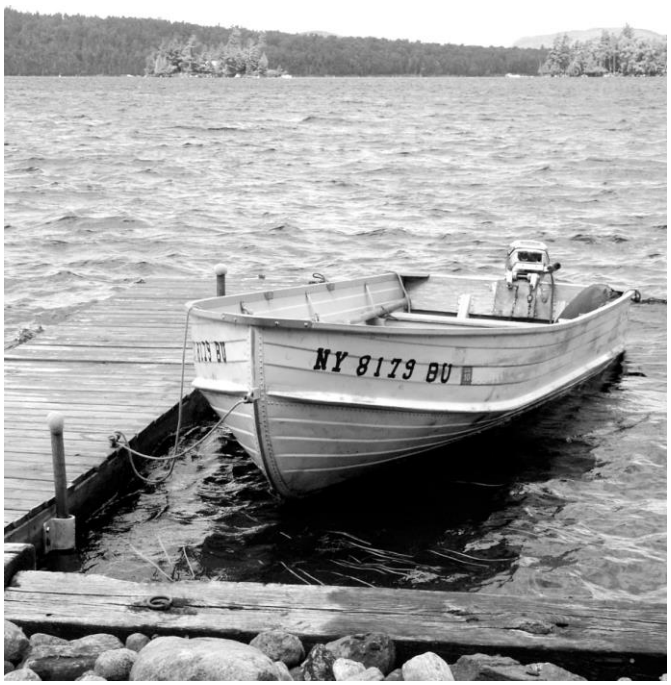
Boat Inspection and Decontamination for Aquatic Invasive Species Prevention

Recommendations for the Adirondack Region



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RQEHDQDWRQDQPPXQWLRQLRQFURQNRRDG
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DRQVEHRHUHQ

As of 2013, nearly 90 waterways in the region had one or more AIS however, more than two out of three waterways surveyed, at least 230, are still free of AIS, which presents an opportunity to limit their spread. While there are many AIS pathways, recreational boating remains one of the most significant in the Adirondack region. As a result, groups are promoting the expansion of the boat launch steward program, which conducts education and inspections at boat launches. Data from 25,000 boating parties surveyed in 2012 show that boaters are traveling from more than 600 destinations, and 35 are not taking any spread prevention measures. This signals the need for additional focus on the importance of cleaning recreational equipment.

Prevention efforts promoting clean boating practices are underway and include education, such as brochures, signage, presentations, news releases etc. inspections, i.e. volunteer and paid boat launch stewards local laws prohibiting the transport of aquatic species and, boat washing, i.e. decontamination. An increasing emphasis on inspection and decontamination among lake communities highlights the need for determining its role in a regional AIS prevention program.

This report evaluates the concepts of inspection and decontamination and uses existing datasets to inform recommendations for the region. The process involved five steps: 1) reviewing peer-reviewed scientific literature on recreational watercraft as an AIS pathway and the effectiveness of inspections and decontamination in removing AIS, 2) compiling Adirondack AIS distribution and boat access data, 3) compiling Adirondack boat launch steward data, 4) analyzing information in aggregate to understand trends, and 5) developing recommendations appropriate to the region. The process began in anuary 2013, and several drafts of the report were shared with a team of reviewers and the Adirondack Aquatic Invasive Species Committee members for input.

Though the peer-reviewed literature on the effectiveness of inspection and decontamination is limited, the papers that are available are credible, informative, and provide important guidance on integrating inspection and decontamination in a regional prevention strategy. The reference material is further enhanced by white papers and state reports from across the country. In addition, the AIS distribution and steward data available for the Adirondack region are among the most complete in New York State and were instrumental for informing the specific recommendations presented here. Because it is difficult to forecast which AIS will arrive, survive, and reproduce in Adirondack waterways, it is necessary to take a multi-species, long-term approach to AIS prevention efforts in the region. Therefore, in order to address all possible threats and offer the highest possible protection to the region, the recommendations presented include methods shown to be *more effective*
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7KIROORZQNHFRHSWVIRPWKHOWHDWHUDWXUHRWKHUWLYHLQRPDWLRQ

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WKHEHVWWRSUHFWQGHGDUHDVLVWRDOORFDWHUHVRXUFHVWRQDGHGDUHDV

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RI$6VSUHDGQLGHQLLQDVRQSUHGXVQWOLQJHZWHVV

6LWHVHFLILF$6GLVWULEXWLRQDWDQERDWHEHKYLRUDQXHSDWWHQFDSOSSLUULWLHPHQ
RISUHYHQWLRQEJDPV

I. Introduction: The Need for Resource Protection

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[1] 7KH1LFRODV,QVWLWXWHGHILQHGWKHERXQGDULHVRIWKH1LFRODV3DUWQHUVKLSIRU5HJLRQDO,QVWLWXWHV0DQDJHPHQW35,60KLFKLQFOXGHVWKH1LFRODV3DUQDGHIWHGRUWKZUGLQDQLQQRUWKHDVWHUQ%DGLDERUGHU7KH1LFRODV35,60ERUGHULVRZEDVHGRQ%

[2] ,QVWLWXWHSHFLHVDWKZDUHWKHPDLQFKLFKQLWHSHFLHVUHPRYHGIURPREORFDWLRQRRWKHU

*Myriophyllum spicatum 0RYHPHQWRIDQLQYDVLYHDQLPDOVPVEERDWHUFDUHIXOWRDOHJDVEDLW EX LVRIWHQLPHVKDYHQRWHQLRQOLWKPDOOERGLHGRIDQLPDOVPVEWYLVLEOHWRWKHQNHGHHJHDPXVHOODVDH RMXHQOHVSLDWHLOHDFFLGHQWDOOFDUHGLEDLWEFNHWVOLYHZOOVDQELOJHDZEQVPVFDQ DOVREHWDQSRUWHGRQKHWURRIERDWVHQDQOHGRQHSHOOHUDQWDLOHURHYHQWWDFKGWRRWKU KWFKNLQRIDQVPV &QHTKQOHYHWLPHUFHDWLRQOERDWLVWDQSRUWHGYHODQDIWHUWHQ \$LQDGHGZHWZKHLVWKRSSRWWBWLWZOOSHDG\$GWRQQDGHGZHWV

3HYHQWLQ\$IHPQWHLQWKHJRQZHWV E\DGGHVVLQSDWBVRIVSHDGHVSHFLDOOWK HFHDWLRQOERDWLQSDWBLVBFHVVDWRPDQJHWKVWKDWHXHLWLVGLIILFXOWWRIHFDVWBF\ ZOOLYHQJBYHWKDELOLWWRVXLYHQLSHGFKLQLDQGFNZHZVWKDGRSWLRQIEHVW PDQJHPHQVSDFWLFHVWRSHFOXGHLQVBGFKWLRQRIDEBDGDQHRIWDPRYHWKORQWHBLVWKPRVW HIIHFWLYHSHYHQVDWLYHDFWLRQ

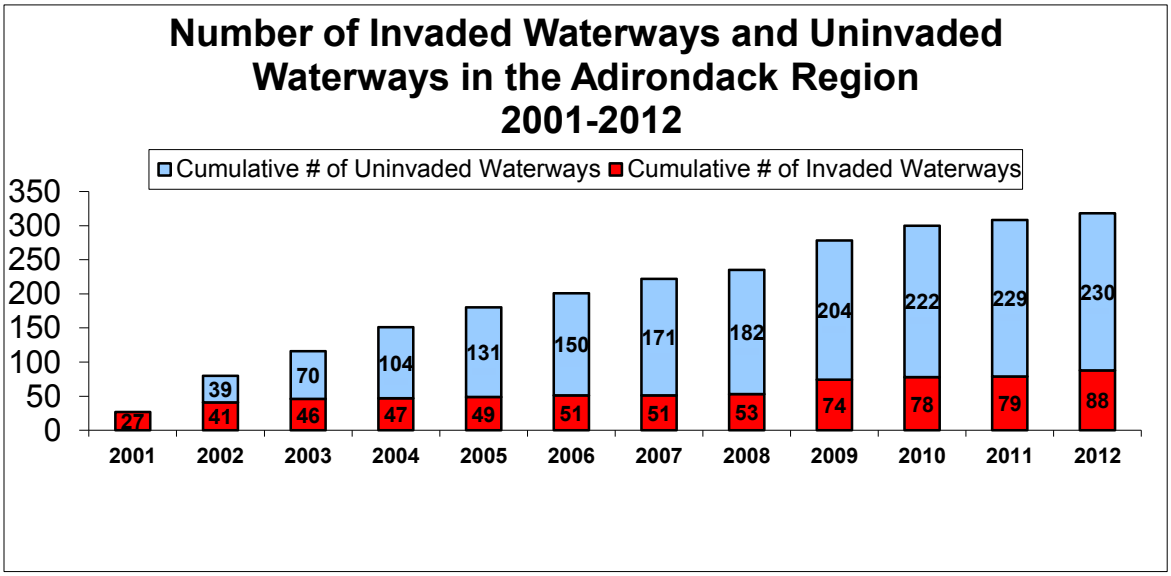
Table 1. Aquatic non-native and invasive species in the Adirondack region, 2012.[d]

Species Name	Number of Waterways
Alosa pseudoharengus	
Corbicula fluminea	
Alosa aestivalis	
Dreissena polymorpha	
Cyprinus carpio	
Potamogeton crispus	
Myriophyllum spicatum	
Hydrocharis morsus-ranae	
Scardinius erythrophthalmus	
Cabomba caroliniana	
Dorosoma cepedianum	
Bythotrephes longimanus	
Tinca tinca	
Myriophyllum heterophyllum	
Trapa natans	
Morone americana	
Nymphoides peltata	

(Figure 1), reinforcing the opportunity to prevent the spread of AIS among inland waterways in the Adirondack region.[e]

Preventing the spread of aquatic invasive small-bodied organisms that are already in the Adirondack region, such as zebra mussel and Asian clam juveniles and spiny waterflea, is of special concern. Asian clam and spiny waterflea have demonstrated their ability to survive and reproduce in Adirondack waterways. Due to their limited calcium and pH tolerance ranges, zebra mussels are not predicted to survive and reproduce in most Adirondack waterways; however, waterways can receive excessive inputs of calcium from human activities creating situations where populations can persist. For example, calcium chloride is often used for roadway deicing in the winter. When calcium chloride is applied for these purposes in close proximity to waterways, or streams that drain into them, the compound can be transported into the waterway during periods of high runoff (e.g. spring snowmelt) or through the soil. This results in localized areas of lake shoreline with high calcium concentration, which can increase the potential for zebra mussels to colonize, as shown in Lake George by the NYSDEC.[25] Furthermore, the possibility exists for zebra mussel populations to evolve genetic adaptations to local ecological conditions.[26] Thus, zebra mussels do pose a risk to waterways within the Adirondack region and actions should be taken to limit their spread.

Figure 1. Cumulative number of invaded waterways and waterways monitored by APIPP volunteers where no invasive species were detected. The increase between 2001 and 2002 is accounted for by the inception of a standardized regional volunteer monitoring program (2001 was pre-volunteer surveys and 2002 was the first year of systematic volunteer surveys). The increase between 2008 and 2009 is accounted for by the inclusion of variable-leaf watermilfoil as an invasive species, rather than as a watched species. The increase between 2011 and 2012 is accounted for by the inclusion of thorough, systematic surveys on numerous waterways performed by the Aquatic Rapid Response Team. APIPP began including invasive animal data in 2009.



[e] AIS and survey data are summarized in the Adirondack Park Invasive Plant Program 2012 Annual Report.

Table 2. Examples of priority AIS in the New York region outside of the Adirondacks.
Hemimysis anomala
Egeria densa
Hydrilla verticillata
Myriophyllum aquaticum
Dreissena rostriformis bugensis
Limnoperna fortunei

Figure 2. Total number of known aquatic non-native and invasive species in the regions hydrologically connected to the Lake Champlain Basin as of 2011.[28]

DATA SOURCE: UVM, Lake Champlain Sea Grant, Great Lakes Environmental Research Laboratory, Lafontaine and Costan 2002, and Strayer 2012.

AIS Distribution at State-operated Boat Access Points

Current AIS Spread Prevention Efforts

UHYHWLJ WKHSUHDGRI,QHTLUHDLWHJUDWHGDSSURDFKLJDYDULHWRIWUDWHJLH
DUHGHUDLWKHGLURGDFNUHJLRQWKDWRUHERWDWHUDDQH
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WUDSRUWORIHYHRHOODJHGWKUHRWLHWKHGLURGDFNDUNSDHG
DTDWLFWUDSRUWPRGHRDWLSHFWLRDGHFRWDPLDWLRDUHLFUHDLJOELJHGDGRU
FRLGHUHGWRFRPSOHPHWWKHHIIRUWKLFKSULPDULODLPWRDGGUHWKHUHFUHDWLRD

Status of Inspections

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DRWKHUERDWWUDLOHUDGRWKHUUHFUHDWLRDOHTLSPHW

RDWODFKWHDUGSURJUDPHPSORWUDLHGWDIIWRUHHWHUWRD
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SUHGSUHYHWLRPHDUHDGLIRUPHUDERW,ISDFWKL
LWHUDFWLRSURYLGHDRSSRUWLWWRJDWKHULIRUPDWLRDERWWKHHU
WKHODWERGRIDWHUWKHYLLWHG
DWKHWDWHRIYHHO
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WKHRSHUDWRURIWKHYHHOWRN
WDNHD,SUHGSUHYHWLR
PHDUHKHDOOPLWK
ROOHJHDWHUKHGWHDUGKLS
URJUDPWKHDNHHRUJHDNH
WHDUGURJUDPDGWKHDNH
KDPSODLRDWDFKWHDUG
URJUDPDUHWKHPRWHDEOLKHG
ERDWODFKWHDUGSURJUDPLWKHGLURGDFNUHJLRQGKDYHEHH
LRSHUDWLRIRUPDHDU

KHUHJLRILUWDGODUJHWERDWODFKWHDUGSURJUDPWKHDO
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KHKDJURLFRYHUDJHIURPRHDWHUDSSHW
5HJLDNHLWRDWHUDWDIIHGERDWODFKWHDUG
DFURWKHGLURGDFNUHJLRLDEOHRYHUDJHYDULHIURP
HHNHGWRDOOHNGIUUP5HPRULDODWRERUDRDW
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YLLWRURUPHRIKLFKHUHUHSHDWYLLWRU


KRWRFUHGLWDXO6PLWKV&ROOHJH

Table 3. Paul Smith's College Watershed Stewardship Program boat launch steward locations, 2012.	
Duty post	Coverage, days per week
ODFLGDNH	
UDEHUUDNH	
)LIWKDNH RSIRUG	
WKDNH DPSJURG	
)RUWKDNH	
ROORQGR5HJLRQ DDQD	
WKRIHU	
DNHOODFLG	
DNHOODFLGOODJH	
LWWOHHDURG 5HJEORHH	
HGHUWDNH DPSJURG	
RIDNH	
5HDKDPDNH	
2RRGRG	
5DLERDNH	
5DTHWWHDNH OODJHRDWDFK	
5DTHWWHDNH UN6DUDD	
6DUDWRJDDNH	
6FRGRG	
HYHWKDNH	
WLOODWHU5HHU	
6SHFDNH	
SSHU5HJLDNH	
:KLWHDNH	

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:DWHUKHGDOLWLR,YDLYHSHFLHDN)RUFH,WKHDNHHRUJHRFLDWLRDPHG

IV. Inspection and Decontamination Efforts in the Adirondack Region

WUDLQHUV3DX6PLWKKOHJH:DWHUKHG6WHZUGKLS3URJUDPIRUWHZUGSDUWLFLSDWLQJHUGSURJUDPPDQDJHUVWKHUHJLRQDOWHDP/$

Table 4. Boat launch steward programs in the Adirondack region. *[illegible]*

Waterway name	Organization	# of launches with a steward	Years of steward coverage to-date	General coverage
[illegible]	[illegible]			[illegible]
[illegible]	[illegible]	[illegible]		[illegible]
[illegible]				[illegible]
[illegible]	[illegible]	[illegible]		[illegible]
[illegible]	[illegible]	[illegible]		[illegible]
[illegible]	[illegible]	[illegible]		[illegible]
[illegible]	[illegible]	[illegible]		[illegible]
[illegible]	[illegible]	[illegible]		[illegible]
[illegible]	[illegible]	[illegible]		[illegible]
[illegible]	[illegible]	[illegible]		[illegible]

IV. Inspection and Decontamination Efforts in the Adirondack Region

Alternatives to Inspections

A common concern among lake communities is that AIS can be spread when stewards are not on duty. One tool that is available during those times is the Internet Landing Installed Device Sensor (I-LIDS). A private company in the mid-west developed I-LIDS, which is a motion-activated camera installed at a boat launch. When a boater enters or exits the launch, the camera is triggered, playing an audio message reminding boaters to inspect and clean their gear and taking images and videos of the boat. This technology was in its third year of use on Raquette Lake in 2013, which is complementary to the steward program. Boat launch stewards review the videos to check for signs of AIS on boats and trailers to record frequency of usage and number of instances where plant material is visible.


Photo by Meghan Johnstone, APIPP

Status of Washing and Decontamination

Boat launch stewards generally focus on inspecting boats, removing or draining any water, and hand-removing any aquatic plants and debris, but often they do not have the time or the equipment to wash or decontaminate boats entering and exiting launches. Boat washing involves rinsing and flushing boat compartments and recreational equipment, which removes AIS, whereas boat decontamination involves high-pressure, hot water spraying, which removes and often kills AIS.

While some boaters may be able to wash their watercraft and gear at their homes, this may not always be the case. Boaters may visit various waterways in a short period of time while recreating or vacationing. In the last decade, shoreowners and municipalities have expressed increasing interest in offering public boat wash and decontamination stations. Currently, there are several active public boat wash and decontamination stations in the Adirondack region.

Upper St. Regis Lake

Upper St. Regis Landing in the Town of Harrietstown has a high-pressure, cold water boat wash with a catchment vault and screen-protected overflow pipe to Upper St. Regis Lake. The Upper St. Regis Foundation sponsors 7-day per week steward coverage at this moderate-to-lightly-used boat launch. When speaking with boaters, the boat launch steward recommends that they use the wash station upon entering and exiting the launch.

Buck Pond

Buck Pond State Campground has a low-pressure, cold water hose at the R.V. dump station adjacent to the boat launch into the Kushaqua Narrows. The boat launch steward recommends that boaters use the hose upon entering and exiting the launch.

Paradox Lake

Paradox Lake State Campground has a frequently used low-pressure, cold water boat wash station.

Lake George

In 2006 and 2007, as part of the pilot Lake Steward Program on Lake George, the Lake George Watershed Coalition purchased two portable boat wash units for use at launch locations. The units consisted of pressure washers powered by portable gas-powered generators. Boat launch stewards washed boats on a large mat

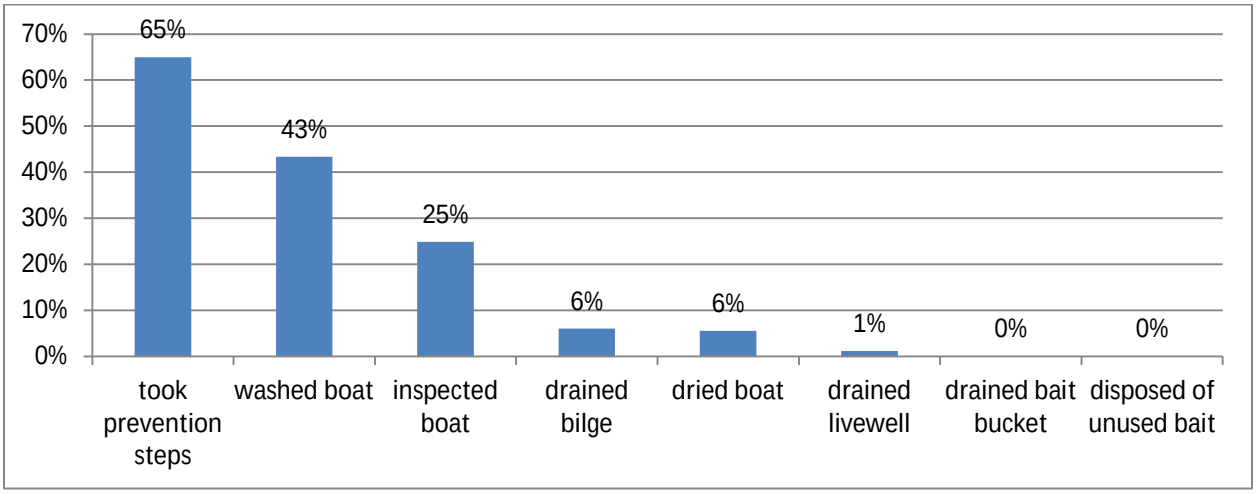
IV. Inspection and Decontamination Efforts in the Adirondack Region

Loon Lake

Other

Boater Trends

Figure 3. Boater-reported AIS spread prevention measures (Paul Smith's College WSP, 2012)Some boaters take more than one spread prevention measure for their boat, which is why the spread prevention measures exceed 100 percent. Not all boats have bilges, carry bait buckets, or have live wells, and boat launch stewards did not record the presence or absence of live wells.



IV. Inspection and Decontamination Efforts in the Adirondack Region

Inspection and Hand-removal

Decontamination

Washing

and does not kill

Drying

Chemicals and Other Liquids

Freezing

Decontamination of Specific Watercraft Components

Motorized and Non-motorized Watercraft

Both motorized and non-motorized vessels are able to transport AIS however, motorized vessels, including personal watercraft, have more compartments and places in and on the motor where plants, animals, and water, which can contain small-bodied organisms not visible to the naked eye, can be transported. AIS may be transported via other locations in motorized vessels, including live wells, bilge water, on anchors and ancho lines, and on trailers. Non-motorized vessels such as kayaks and canoes have compartments, lines, and rudders where AIS can attach or hide. Stand-up paddleboards are growing in popularity, and mud and plant material can cling to those surfaces as well. Most of these non-motorized vessel components are more easily accessed and may be easier to drain or dry out. Few published papers exist that describe the risk of non-motorized vessels transporting AIS however, Paul Smith's College Watershed Stewardship Program (WSP) data show while non-motorized vessels transport AIS, they pose less of a risk for transporting AIS than motorized vessels. According to 2013 WSP data, motorized vessels are 40 times more likely to transport AIS than are kayaks.[41] Despite this, inspecting, cleaning, draining, and drying non-motorized vessels is still important.

Invaded and Uninvaded Waterways and Inspection upon Exit and Entry

Determining where and when to implement prevention efforts when resources are limited can be a challenge and depends on the scale of the prevention program and its goals. Drury and Rothlisberger (2008) investigated the question of whether containing invasive species at invaded sources slows their spread more than preventing entry to uninvaded destinations. Results show that protecting only uninvaded, isolated waterways, rather than containing the invaded ones early on in the invasion process, allows AIS to spread from invaded sources at an unguarded rate to many other unprotected uninvaded locations. Recently invaded waterways can then become sources of AIS and contribute to the landscape-level spread. Therefore, early in an invasion, when the goal is to slow the spread of AIS through a collection of waterways, the best way to protect uninvaded areas is to allocate resources to containing invaded areas.[42] Because the number of invasive-free waterways in the Adirondack region is more than 2.5 times that of invaded waterways, it is beneficial to implement spread prevention measures at invaded areas. Visual inspection and hand-removal and or decontamination of boats and equipment *after they exit*

VI. Landscape-level Spread Prevention Concepts

Landscape-level Analysis

Invasion Spread Hubs

[1] 7KHSLURQDFN:DWHUVKHG6WHZDUG1HWZRUNGHILQHGDWKHODNHRQLFKERDWODXQFKHDUDPSURJUDPLWKHGLUHFWRUGUHSUHVHQWDWLYHDQGWKHFKDLUPDQRIWKHSDUNVDQGUHFUHDWLRQVWRSUHGLFW
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WKRVODNHZKERDWODXQFKHDUDPSVHQVXVHVWRILYHPRQFRQWHVWVUHPRYDOSURJUDPODNHZKLQWKHSURJUDFN
:DWHUVKHG6WHZDUG1HWZRUNWRDFKLHYHWKHVWUDWHJLFRUHVXOWVDQGRXWFRPHVRIWKHSURJUDPDQG
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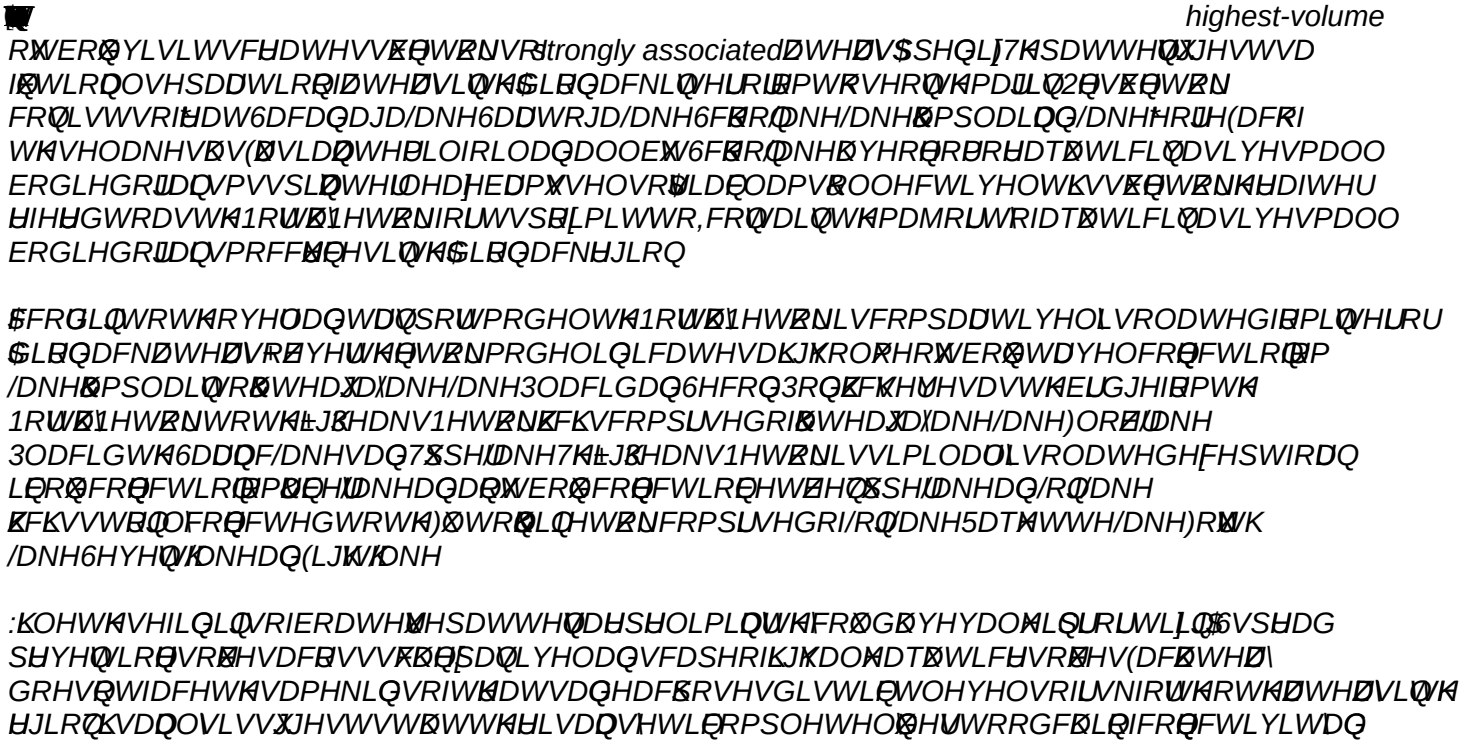
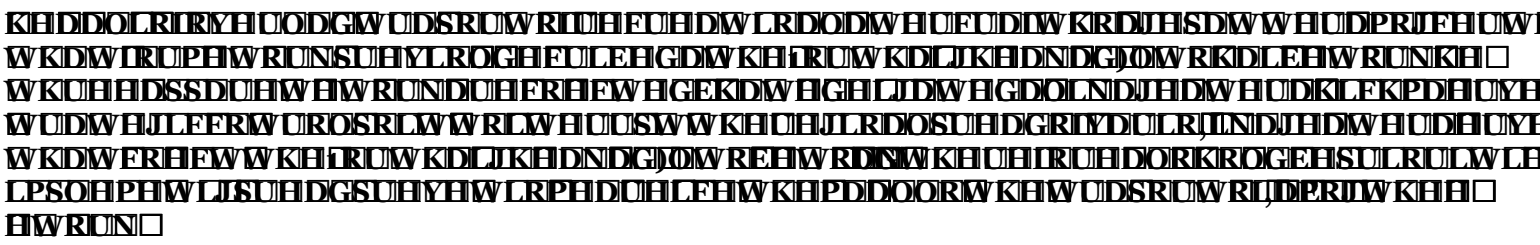
ODNHZKLQWKHEWZRUNWKLWKUHDWDQGWRQULEXWHGWRWKHGHVLJQDWLRQSURJDFNLQJVRUHDGKEV

Preliminary Adirondack Overland Transport Sub-networks: Northway, High Peaks, and Fulton Chain



Linkage Waterways



Applying Scientific Principles to Prevent the Spread of AIS in the Adirondack Region

GHFRQWDPLQWLRQUHFUHDWLRQDOZDWHUFUDIWZLWKJUHVVXUHKRWZDWHUZDVKRQ exiting ZDWHUZDVZWKDTXDWLF LQYDVLYHVPDOOERGLHGRUJDQLVPVZLOOOLPLWWKHLUVSUHDG. entering and exiting

landscape-level spread of AIS *OLPLWHGVSUHDGSUHYHQWLRQPHDVXUHVVKRXOGEHLPSOHPHQWHGDWLQDGHGDQVHOHFWSULRULW\ODQGHG ZDWHUV.*

Table 5. Recommendations for preventing the landscape-level spread of AIS in the Adirondack region based on scientific literature reviewed and regional factors.

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,QYDVLRQ VSUHDG E\ OLQNDJH	;	;	;	;
,QYDGHG E\ VPDOO ERGLHG RUJDQLVPV	5$	5$	;	;
,QYDGHG E\ SODQWV RQO\	5$		;	
3ULRULW\ XQLQYDGHG	;	5$		

Invasion Spread Hub Waterways

Table 6. Preliminary invasion spread hubs in the Adirondack region.

Linkage Waterways

LQGLFDWHV WKDW HDFK RI WKHVH ZDWHUZD\V KDV EHHQ LGHQWLILHG DV D SRWHQWLDO OLQNDJH EHWZHHQ WZR RU PRUH ZDWHUVKHGV LQ WKH $GLURQGDFN UHJLRQ 7KH\ DUH QRW QHFHVVDULO\ WKH RQO\ SRVVLEOH OLQNDJHV EHWZHHQ WKRVH ZDWHUVKHGV EXW UDWKHU WKH\ DUH WKH RQHV WKDW KDYH EHHQ LGHQWLILHG DV PRVW OLNHO\ WR EH VXLWDEOH IRU WUDQVSRUW RI DTXDWLF RUJDQLVPV EHWZHHQ WKH ZDWHUVKHGV 7KH\ DUH DOVR WKH RQHV WKDW KDYH EHHQ LGHQWLILHG DV KDYLQJ WKH OHDVW DPRXQW RI SRWHQWLDO HQYLURQPHQWDO LPSDFW RQ WKH ZDWHUVKHGV WKH\ FRQQHFW 7KH SRWHQWLDO OLQNDJHV OLVWHG LQ 7DEOH DUH DOVR WKH RQHV WKDW DUH PRVW OLNHO\ WR EH IHDVLEOH WR LPSOHPHQW LQ WKH QHDU WHUP

Table 7. Preliminary linkage waterways in the Adirondack region.
ZDWHUZD\V WKDW KDYH EHHQ LGHQWLILHG DV SRWHQWLDO OLQNDJHV EHWZHHQ $GLURQGDFN ZDWHUVKHGV

RQH GDPOHVV
SSHU DQG /RZHU &DQDGD
DQH GDPSRGLDN

Overland Transport Sub-networks

EHWZHHQ ZDWHUVKHGV DQG WKH GLUHFW RYHUODQG WUDQVSRUW RI DTXDWLF RUJDQLVPV EHWZHHQ WKHP 7KHVH DUH WKH RQHV WKDW DUH PRVW OLNHO\ WR EH XVHG E\ DTXDWLF RUJDQLVPV WR PRYH RYHUODQG EHWZHHQ ZDWHUVKHGV DQG WKHUHIRUH DUH WKH RQHV WKDW DUH PRVW OLNHO\ WR UHVXOW LQ WKH WUDQVIHU RI DTXDWLF LQYDVLYH VSHFLHV

Waterways Invaded by Small-bodied Organisms

Table 8. Waterways with aquatic invasive small-bodied organisms in the Adirondack region through 2012.

Waterways Invaded by Plants Only

Priority Uninvaded Waterways

Summary of Recommended Waterways for Boat Decontamination Stations

Table 9. Summary of waterways recommended for boat launch steward inspections *and* boat decontamination stations. ● Waterways with state or state-assisted boat launches ‡ Waterways with state or state-assisted launches only ■ Waterways with public boat launches
Lake George ● ‡ ■
Great Sacandaga Lake ● ■
Lake Champlain ● ■
Saranac Lake ● ■
Upper Saranac Lake ●
Middle Saranac Lake ●
Lower Saranac Lake ●
Schroon Lake ●
Long Lake ‡
Tupper Lake ‡
Piseco Lake ■
Sacandaga Lake ■
Westport Area ■

Proposed Tiered Approach for Using Boat Inspection and Decontamination in an Integrated AIS Prevention Strategy

JHE(HEWLYHDGHJLODWLYHJLGDEHUHRFEHDYDLODELOLWLWHUHTLUHPHWDGSEOLERSL
GHWHUPLHDLPSOHPHWDWLRSODURSUHYHWLWKHSUHGRJLWKHGLURGDENUHJLRKH
DSSUROFKHDUHEDWHJRULHGLWHUPRIOHYHORISURWHFWLRDGULNPDDJHPHWEDHGREV
DGYDULRDEWLRDEOHRWHRWDOOLYDGHGDWHUDKDYHWDLOHUHGERDWDFFHVV
DWHUDODENWUDLOHUHGERDWDFFHHEWDUHKGURORJLFDOOERHEWHGWRLYDGHGDWHU
ERDWDFFHKHHGLUHWHWWLHUDSSOWRDWHUDDPHGLDEOHDGEHWRDWHUDDPHGL
SSHGLEHDG,

Platinum

- δ *at allLQDVLRQSHUDGKVDQOLQDJHWHV,QSHFWLRQQ GHFRQWDPLQWLRHQWU and HLW*
- *at overlaδd transport sub-networks.*
- δ *at allWHVWVWKTWLFQDVLYHVD OOERGLHGRIDQVPV ,QSHFWLRQFFMREQG GHFQDPLQWLRQFFMLHFHVVDUHFRQDPLQWLRQFFMRQLW*
- *allWHVWVWKqTWLFQDVLYHSODQVWKWYHWDLOHUGERDWDFFHVV ,QSHFWLRQFFMREQU andHLW*
- *allpSRUWQQDGHGWHV,QSHFWLRQFFMREQU*

Gold

- δ *at allLQDVLRQSHUDGKVDQOLQDJHWHV,QSHFWLRQFFMRQ HQU and HLWHFRQDPLQWLRQFFMLHFHVVDU*
- δ *at all WHVWVWKTWLFQDVLYHVPDOOERGLHGRIDQVPV HFRQDPLQWLRQFFMREQLW*
- *allWHVWVWKqTWLFQDVLYHSODQVWKWYHWDLOHUGERDWDFFHVV ,QSHFWLRQFFMREQU and HLW*
- *allpSRUWQQDGHGWHV,QSHFWLRQFFMREQU*

Silver

- ρ ρ *near LQDVLRQSHUDGKVDQOLQDJH WHV,QSHFWLRQQGHFRQWDPLQWLRQFFMREQU*
- ρ ρ *near allWHVWVWKTWLFQDVLYH VPDOOERGLHGRIDQVPVHFRQDPLQWLRQFFMREQLW*
- *all WHVWVWKqTWLFQDVLYHSODQVWKWYHWDLOHUGERDWDFFHVV ,QSHFWLRQFFMREQLW*
- *all SRUWQQDGHGWHV,QSHFWLRQFFMREQU*

Bronze

- ρ ρ *near high trafficWHVWVWKTWLF LQDVLYHVPDOOERGLHGRIDQVPVHFRQDPLQWLRQFFMREQLW*
- *high trafficWHqVWVWKTWLFQDVLYHSODQVWKWYHZWKWDLOHUGERDW DFFHVV,QSHFWLRQFFMREQLW*

Table 10. Proposed tiered approach for using inspection and boat decontamination in an integrated AIS prevention program.

Visual inspection: 1VXDOO\SHUIRUPHGE\ HUVRQ HIRUH HDFKHQWU\LQWR DQG HDFKWLPH LWOHDYHV DQ\ZDWHU

Decontamination: LI SUHVXPHGLQIHVWHG DQG HDFKWLPH LWOHDYHV DQ\ERGLHV RIZDWHU DQGGHFRQWDPLQDWHG DFFRUGLQJWR VWDWHRUSURYLQFLDOPXVVHO SURWRFROV

	Non-motorized boats	Motorboats stored on trailers	Motorboats stored in the water	Motorboats stored on docks, lifts, or moorings
Tier 1	Watercraft inspection required at all launches and at all locations where boats are removed from the water and then launched again. Boats must be drained and dried before launching.	Boaters must stop at all inspection stations and have their boats inspected before launching. Boats must be drained and dried before launching.	Watercraft inspection required at all launches and at all locations where boats are removed from the water and then launched again. Boats must be drained and dried before launching.	Watercraft inspection required at all launches and at all locations where boats are removed from the water and then launched again. Boats must be drained and dried before launching.
Tier 2	Watercraft inspection required at all launches and at all locations where boats are removed from the water and then launched again. Boats must be drained and dried before launching. Boats must be decontaminated if they have been in infested waters.	Boaters must stop at all inspection stations and have their boats inspected before launching. Boats must be drained and dried before launching.	Watercraft inspection required at all launches and at all locations where boats are removed from the water and then launched again. Boats must be drained and dried before launching.	Boaters must stop at all inspection stations and have their boats inspected before launching. Boats must be drained and dried before launching.
Tier 3	Watercraft inspection required at all launches and at all locations where boats are removed from the water and then launched again. Boats must be drained and dried before launching. Boats must be decontaminated if they have been in infested waters.	Boaters must stop at all inspection stations and have their boats inspected before launching. Boats must be drained and dried before launching.	Watercraft inspection required at all launches and at all locations where boats are removed from the water and then launched again. Boats must be drained and dried before launching.	Boaters must stop at all inspection stations and have their boats inspected before launching. Boats must be drained and dried before launching.
Tier 4	Watercraft inspection required at all launches and at all locations where boats are removed from the water and then launched again. Boats must be drained and dried before launching. Boats must be decontaminated if they have been in infested waters.	Boaters must stop at all inspection stations and have their boats inspected before launching. Boats must be drained and dried before launching.	Watercraft inspection required at all launches and at all locations where boats are removed from the water and then launched again. Boats must be drained and dried before launching.	Boaters must stop at all inspection stations and have their boats inspected before launching. Boats must be drained and dried before launching.
Tier 5	Watercraft inspection required at all launches and at all locations where boats are removed from the water and then launched again. Boats must be drained and dried before launching. Boats must be decontaminated if they have been in infested waters.	Boaters must stop at all inspection stations and have their boats inspected before launching. Boats must be drained and dried before launching.	Watercraft inspection required at all launches and at all locations where boats are removed from the water and then launched again. Boats must be drained and dried before launching.	Boaters must stop at all inspection stations and have their boats inspected before launching. Boats must be drained and dried before launching.
Tier 6	Watercraft inspection required at all launches and at all locations where boats are removed from the water and then launched again. Boats must be drained and dried before launching. Boats must be decontaminated if they have been in infested waters.	Boaters must stop at all inspection stations and have their boats inspected before launching. Boats must be drained and dried before launching.	Watercraft inspection required at all launches and at all locations where boats are removed from the water and then launched again. Boats must be drained and dried before launching.	Boaters must stop at all inspection stations and have their boats inspected before launching. Boats must be drained and dried before launching.

Applying the Recommendations

Using Existing Partnerships

Efforts Underway by the New York State Department of Environmental Conservation

Efforts Underway by the New York State Office of Parks, Recreation and Historic Preservation

Efforts Underway by the Adirondack Partnership for Regional Invasive Species Management

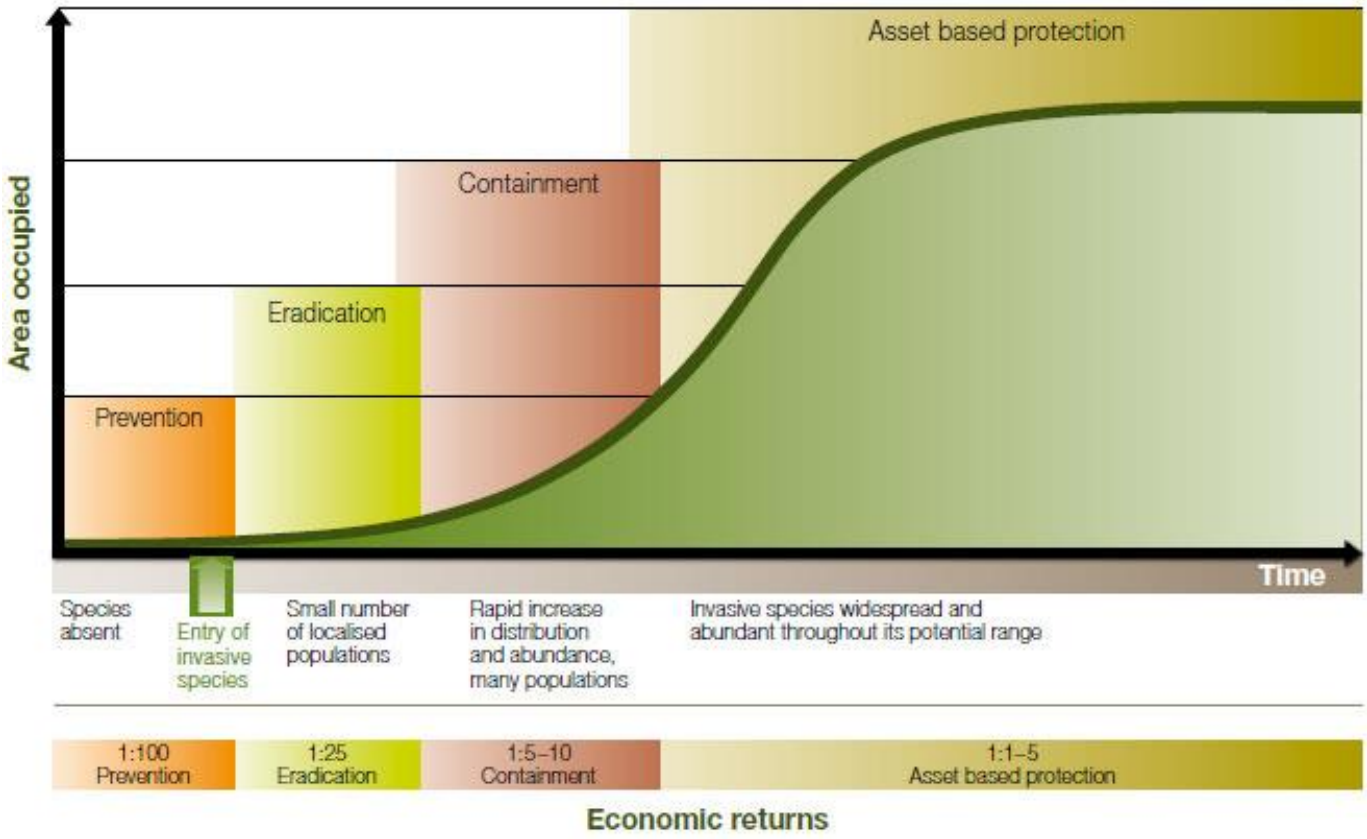
The Adirondack Park Invasive Plant Program serves as the Adirondack Partnership for Regional Invasive Species Management and coordinates more than 30 organizations that work collaboratively on invasive species issues in the region. In summary, the partnership focuses on the following high priority strategies coordinating stakeholders and collaborating on invasive species solutions preventing new infestations by implementing innovative prevention programs and practices enhancing a region-wide early detection network that utilizes professionals and volunteers to detect and report new infestations formalizing Regional Response Teams, comprised of seasonal crews with the training and capacity to implement swift controls on new infestations implementing strategic management on existing infestations to limit their spread launching an invasive species education, marketing, and advertising campaign that raises awareness about how to stop the spread of invasive species and, leveraging resources to the region to implement the full suite of actions required to stop the spread of invasive species.

Specific AIS actions that APIPP partners are working on include providing guidance to local governments on local transport laws expanding the boat launch steward program providing training to staff and volunteers on AIS identification, survey, and prevention techniques coordinating volunteer monitoring for AIS evaluating applications of new AIS surveillance methods maintaining a database on the distribution of invaded and uninvaded waterways managing AIS infestations ensuring that aquatic invasive species prevention signage is posted at water access sites and that invaded waterways have special invasive species signage designing and distributing AIS educational materials offering educational presentations upon request and, coordinating these and other priority actions as needed.

Numerous lake associations and municipalities in the Adirondack region are working on AIS prevention and management programs, many in partnerships with APIPP, the NYS Federation of Lakes Association, and the Adirondack Lakes Alliance, a network of lake groups throughout the Champlain Valley and beyond.

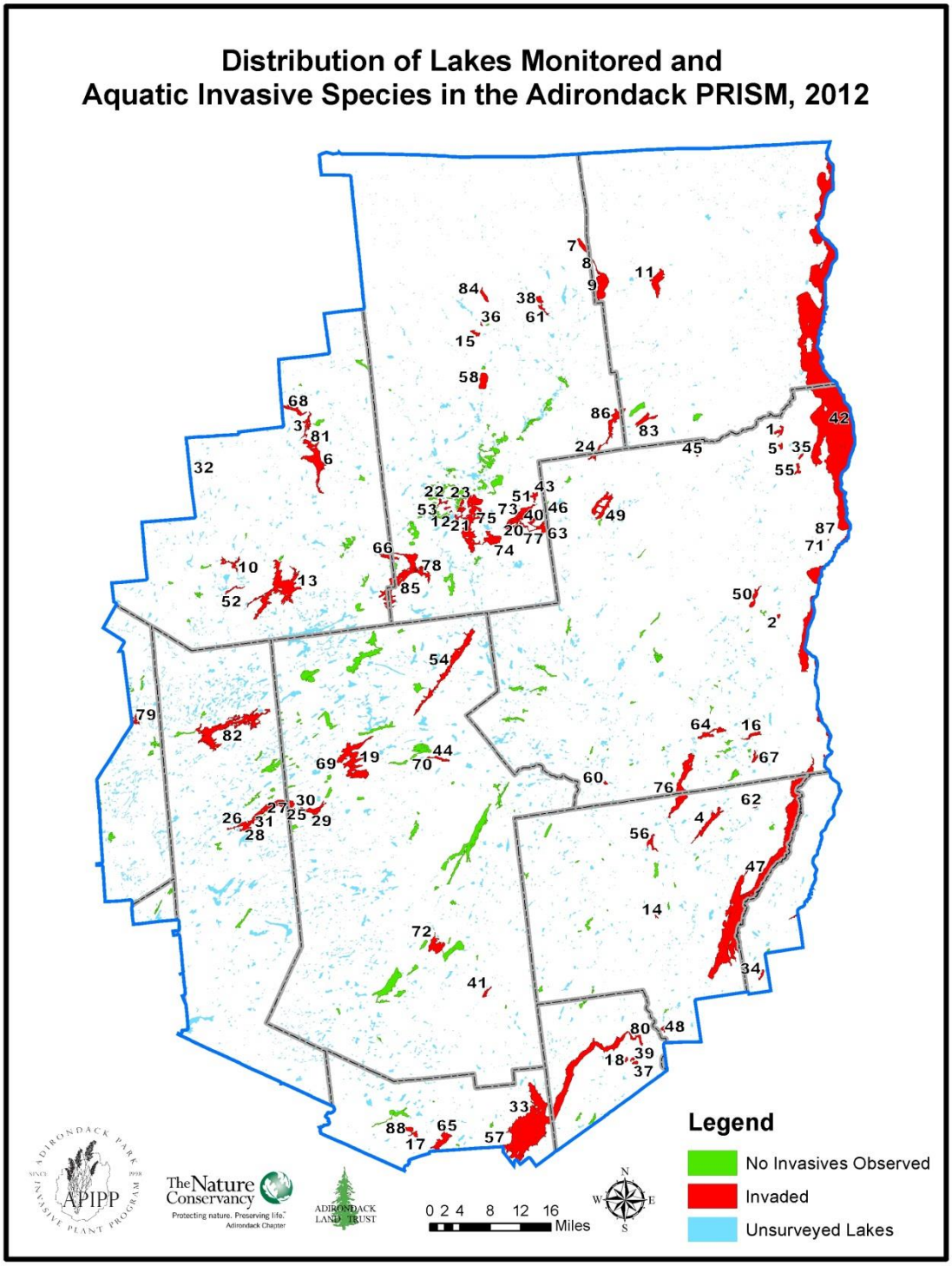
IX. Conclusion

Appendix A. Invasion curve showing actions appropriate to each stage of invasion.[45]



Appendix B. Distribution of lakes within the Adirondack Partnership for Regional Invasive Species Management that contain aquatic invasive species.

3OHDVHUHIHUWRWKHWDEOH WKHQ[WSDJHWRILQODNHVWKDWFRUUHVSRQGWRQPEHUVRQWKHPDS



LIST OF ADIRONDACK WATERS WITH AQUATIC INVASIVE SPECIES

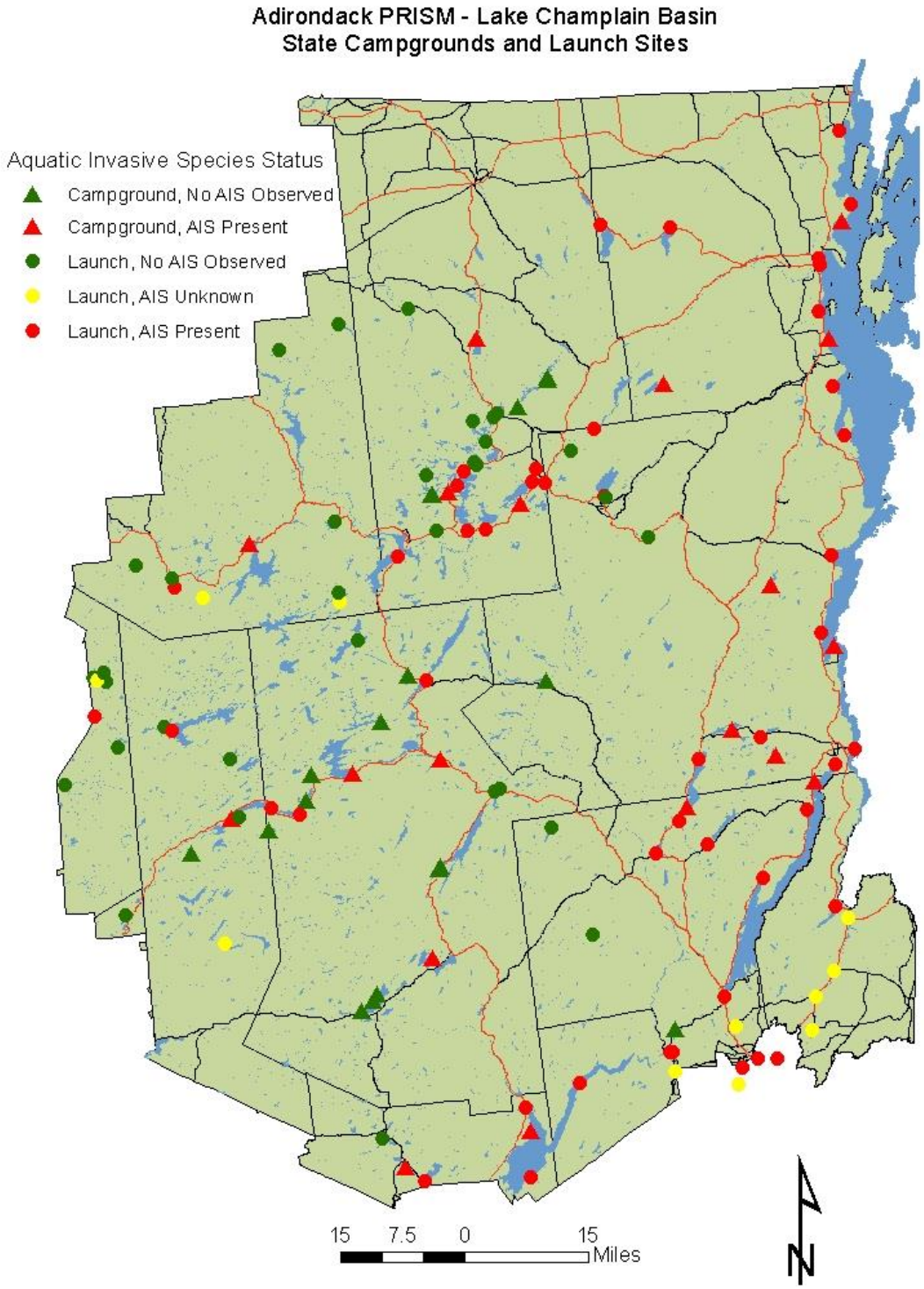
Key	
(0 (XUDVLDQ :DWHUPLOIRLO	)DQ)DQZRUW
9/0 ± 9DULDEOH/HDI 0LOIRLO	6:) 6SLQ\ :DWHU)OHD
&/3 ± &XUO\/HDI 3RQGZHHG	%1 %ULWWOH1DLDG
:& :DWHU&KHVWQXW	$& $VLDQ&ODP
=0 =HEUD0XVVHO	<)+ <HOORZ)ORDWLQJ+HDUW
(Q (XURSHDQ)URJELW	

Name (Alphabetized)	#	EWM	VLM	CLP	WC	ZM	EF	Fan	SWF	BN	AC	YFH
$XJXDNH	1	;										
%DOWRQ	2	;										
%DNHU5LYHU	3		;									
%DOOLNH	4	;		;								
%URZQ	5	;										
&DQDGD5LYHU	6		;									
&KDXWDXTXD/DNHORZ	7	;										
&KDXWDXTXD/DNHORZHU	8	;										
&KDXWDXTXD/DNHXSSHU	9	;										
&ROXPEXVRQ	10		;									
&R/DNH	11	;										
&RSSHUDVRQ	12	;										
&RQD/DNH	13		;									
'DURQ	14	;										
'HORZ	15	;										
'DNH(DVH =RQHD	16	;										
'DVW&DQDGD/DNH	17	;										
(FQ/DNH	18							;				
(HQ/DNH	19		;									
)LUVW&RQQHFWLFXW/DNH	20	;										
)LVK&UHHN	21	;										
)RUW(GZDUG	22	;										
)RUEHVRQ	23	;										
)UDQNOLQ)DOOV	24	;		;								
)XOWRQ&KDLQ)LUVW /DNH	25	;	;									
)XOWRQ&KDLQ)RXUWK/DNH	26		;									
)XOWRQ&KDLQ)LIWK/DNH	27	;	;									
)XOWRQ&KDLQ6HFRQG/DNH	28	;	;									
)XOWRQ&KDLQ7KLUG/DNH	29	;	;									
)XOWRQ&KDLQ6L[WK/DNH	30	;	;									

Name (Alphabetized)	#	EWM	VLM	CLP	WC	ZM	EF	Fan	SWF	BN	AC	YFH
)[WRR'LZKLUG/DNH	31		;									
*UDW5LYHUDW/DPS)OOV	32						;					
*UHDW6DFDGDJD/DNH	33	;							;	;		
+GORFN 3RG	34	;		;	;					;		
+JKODGV5RJH/DNH	35	;										
+RUVHRH3RGUDQOLQ [HG	36	;										
[V/DNH	37							;				
,GLDQDNH)UDQOLQ	38	;										
-HQDNH	39							;				
.LVV/DNH	40	;										
/DNHGJRQ[	41	;										
/DNH&DPSODLQ	42	;	;	;	;	;	;			;		;
/DNH&OE\	43	;										
/DNH[DQV	44		;									
/DNH(DWRQ[	45						;					
/DNH)OR[U	46	;	;	;								
/DNH+RUJH	47	;		;		;			;		;	
/DNH/]KUH	48	;		;								
/DNH3ODFLG	49		;									
/LEHUO3RG	50	;										
/LWWOH&OE3RG	51	;										
/LWWOH5LYHU)OR	52		;									
/LWWOH6TX[UH3RG	53	;										
/RQJDNHPPLORQ	54		;									
/RQ3RG(FKR/DNH (V[V\	55	;										
/RRQDNH:DUUHQ[V\	56	;										
0D\LHOG/DNH	57	;		;								
0HDFKDP/DNH	58	;										
0LOO3RG6DUDWRJD[V\	59							;				
0LQUYD/DNH	60	;										
0R[VDLQLHZDNH	61	;										
1RUWK3RG	62	;										
2WHWDK/DNH	63	;	;									
3DUDGR[DNH	64	;		;								
3HFN/DNH	65								;			

Name (Alphabetized)	#	EWM	VLM	CLP	WC	ZM	EF	Fan	SWF	BN	AC	YFH
3LHUFHILHOG)ORZ	**66**		;									
3XVKP3RG	**67**	;										
5DLQZDOO5HWUYRLU	**68**		;									
5DTXHWWH/DNH	**69**		;									
5RFN3RGBPLOWRQ	**70**		;									
5RJHU3RG	**71**						;					
6DFDGDJD/DNH	**72**								;			
6DUDQF/DNH/RZU	**73**	;		;								
6DUDQF/DNH0LGGOH	**74**	;										
6DUDQF/DNH8SSHU	**75**	;										
6FKURRQDNH	**76**	;		;								
6HFRG3RG6DUDQF&DLQ	**77**	;	;									
6LPS3RG	**78**		;									
6RIW0DSOH5HWUYRLU	**79**		;									
6WHZUW%ULGH5HWUYRLU	**80**								;			
6WDUN)DOO5HWUYRLU	**81**		;									
6WLOOZWHU5HWUYRLU	**82**		;									
7DORU3RG	**83**	;										
7LWXDNH	**84**	;										
7XSHU/DNH	**85**		;									
8QQDOO\/ORZ	**86**	;	;									
:HE5RFH6ZPS	**87**						;					
:HW&URJD/DNH	**88**	;										

Appendix C. New York State campgrounds and boat launch sites in the Adirondack Partnership for Regional Invasive Species Management (PRISM).



Appendix D. 2011 and 2012 top 50 previously visited waterways with combined data from the Lake Champlain Basin Program (LCBP), Lake George Association (LGA), Paul Smith's College (PSC), and East Shore Schroon Lake Association (ESSLA).

Top 50 Previously Visited Waterways- Combined Data from LCBP, LGA, PSC, SLA						
Previously Visited Waterbody, 2011	Sum of # Visits	Percent of total visits		Previously Visited Waterbody, 2012	Sum of # Visits	Percent of total visits
None	8267	31.14%		None	10938	38.48%
Saranac Lake Chain	358	1.35%		Rental	733	2.58%
Rental	352	1.33%		Saranac Lake Chain	527	1.85%
Hudson River	293	1.10%		Lake Champlain	313	1.10%
Lake George	215	0.81%		Hudson River	264	0.93%
Lake Champlain	203	0.76%		Lake George	155	0.55%
Lake Placid	162	0.61%		Saratoga Lake	149	0.52%
Saratoga Lake	162	0.61%		Lake Placid	147	0.52%
Lake Flower	158	0.60%		Raquette Lake	123	0.43%
Upper Saranac Lake	129	0.49%		Mirror Lake	113	0.40%
Mohawk River	125	0.47%		St. Lawrence River	113	0.40%
St. Lawrence River	107	0.40%		Oneida Lake	110	0.39%
Lake Ontario	101	0.38%		Lake Ontario	106	0.37%
Schroon Lake	99	0.37%		Fourth Lake	103	0.36%
Tupper Lake	94	0.35%		Mohawk River	98	0.34%
Great Sacandaga Lake	86	0.32%		Atlantic Ocean	93	0.33%
Raquette Lake	85	0.32%		Tupper Lake	89	0.31%
Brant Lake	84	0.32%		Long Lake	82	0.29%
Fourth Lake	82	0.31%		Schroon Lake	82	0.29%
Oneida Lake	79	0.30%		Great Sacandaga Lake	77	0.27%
Atlantic Ocean	77	0.29%		Brant Lake, NY	74	0.26%
Buck Pond	76	0.29%		Lake Flower	72	0.25%
Candlewood Lake, CT	72	0.27%		Sacandaga Lake	70	0.25%
Mirror Lake	72	0.27%		Seventh Lake	67	0.24%
Long Island Sound	66	0.25%		Lake Hopatcong, NJ	62	0.22%
Connecticut River	64	0.24%		Indian Lake, NY	60	0.21%
Long Lake	64	0.24%		Upper St. Regis Lake	57	0.20%
Lake Hopatcong	59	0.22%		Lower Saranac Lake	52	0.18%
Sacandaga Lake	56	0.21%		Did not ask	51	0.18%
Fish Creek Ponds	50	0.19%		Long Island Sound	51	0.18%
Chateaugay Lake	49	0.18%		Unknown	51	0.18%
Lake Champlain	49	0.18%		Delta Lake	50	0.18%
Little Clear Pond	49	0.18%		Raquette River	48	0.17%
Upper St. Regis Lake	46	0.17%		Black River	43	0.15%
Raquette River	45	0.17%		Candlewood Lake, CT	42	0.15%
Lower Saranac Lake	40	0.15%		Follensby Clear Pond	42	0.15%
Seventh Lake	32	0.12%		Blue Mountain Lake	40	0.14%
Cossayuna Lake	31	0.12%		Lake Bonaparte	39	0.14%
Cranberry Lake	31	0.12%		Canandaigua Lake	38	0.13%
Lake Colby	31	0.12%		Chateaugay Lake	36	0.13%
Lake Bonaparte	30	0.11%		Connecticut River	36	0.13%
Canandaigua Lake	29	0.11%		Lake Colby	36	0.13%
Rainbow Lake	29	0.11%		No Data Collected	35	0.12%
Rollins Pond	29	0.11%		Black Lake	34	0.12%
Osgood Pond	28	0.11%		Fish Creek Ponds	34	0.12%
Rental	28	0.11%		Upper Saranac Lake	33	0.12%
Middle Saranac Lake	27	0.10%		Other (write in notes)	32	0.11%
Saranac River	27	0.10%		Saranac River	31	0.11%
Ballston Lake	26	0.10%		Skaneateles Lake	31	0.11%
Skaneateles Lake	26	0.10%		Kayuta Lake	30	0.11%

Appendix E. Adirondack Watershed Steward Network aquatic invasive species threat analysis.

Lake	A. # AIS present (plants)	B. # AIS present (animals)	C. Average # of boats inspected per day[2]	D. % of Incoming Boats At-Risk of AIS transport (boat operators report a visit to another waterbody within the previous two weeks)	E. % of all boats encountered transporting any organism (launching plus retrieving)[3]	F. % of all boats encountered transporting AIS (launching plus retrieving)	G. Number of *different* previously-visited waterbodies reported by all boat operators over the summer. (higher values = greater degree of potential connectivity)	H. % of confirmed outbound visits to *lakes with no AIS* in ADK steward network[4]	I. % of confirmed outbound visits to lakes with *no invasive animals* present in ADK steward network	J. Top 3 previously visited water bodies	K. Most frequently occuring outbound connections within ADK steward network[5] (lakes that are next in the AIS spread vector chain. 2011-2013 data.)	L. Inbound AIS vulnerability[6] (Columns D + E + G)	M. Risk of lakes functioning as invasion spread hubs[7] (Columns A + B + C+ F + H + I)
Chateaugay Lake	1	0	35	16%	14%	7.1%	54	14%	81%	Champlain, St. Lawrence, Chazy	Lake Champlain, Second Pond, Meacham Lake	low	high
Cranberry Lake	1	0	25	22%	11%	2.2%	77	6%	94%	St. Lawrence, Bonaparte, Black	Tupper Lake	medium	low
Eighth Lake	0	0	6	36%	1%	0.0%	15	10%	100%	Seventh, Fulton Chain, Raquette	Fourth Lake, Seventh Lake, Raquette Lake	low	low
Forked Lake	0	0	18	59%	34%	0.0%	24	3%	100%	Rental, Raquette, West	Long Lake	high	low
Fourth Lake	2	0	31	28%	9%	1.2%	76	7%	100%	Raquette, Oneida, Seventh	Raquette Lake, Seventh Lake	medium	medium
Great Sacandaga Lake	2	1	19	19%	0.3%	0.0%	42	2%	20%	Saratoga, Lake George, Hudson River	Saratoga Lake, Lake George	low	medium
Hoel and Little Clear Pond	0	0	9	53%	4%	0.0%	59	44%	100%	Rental, St. Regis, Saranacs	not enough data	medium	low
Lake Champlain	7	1	24	10%	13%	8.0%	92	4%	55%	Hudson, Candlewood, Lake George	Lake George, Saratoga Lake, Chateaugay Lake, Lake Placid,	medium	high
Lake Flower	3	0	21	37%	18%	4.2%	80	23%	99%	Saranacs, Placid, Rental	Lake Placid, Second Pond, Upper St. Regis	high	high
Lake George	3	3	84	13%	2.7%	2.0%	156	2%	48%	Champlain, Hudson Riv, Saratoga	Saratoga Lake, Schroon Lake, Lake Champlain	high	medium
Lake Placid	1	0	21	25%	2%	0.0%	128	15%	93%	Mirror, Rental, Lake Flower	Lake Flower, Second Pond	high	low
Long Lake	1	0	24	20%	14%	0.2%	102	9%	92%	Rental, Raquette, Tupper	Tupper Lake, Raquette Lake	high	low
Meacham Lake	1	0	9	44%	5%	0.4%	26	17%	92%	Chateaugay, St. Lawrence, Upper St. Regis	not enough data	low	low
Osgood Pond	0	0	7	81%	5%	0.0%	31	70%	100%	St. Regis River, Champlain, Jones Pond	Upper St. Regis Lake	low	low
Rainbow Lake	0	0	10	43%	13%	0.1%	52	31%	93%	Champlain, Saranacs, Kushaqua	Upper St. Regis Lake	medium	low
Raquette Lake	1	0	18	58%	17%	2.7%	92	5%	97%	Fourth, Blue Mountain, Seventh	Long Lake, Fourth Lake, Seventh Lake	high	low
Saratoga Lake	3	1	37	12%	25%	10.2%	81	0%	37%	Hudson R., Lake George, Champlain	Lake George, Lake Champlain, Schroon Lake, Great Sacandaga	medium	high
Schroon Lake	2	0	29	16%	0%	0.0%	45	3%	31%	Lake George, Hudson R., Brant Lake	Lake George, Saratoga Lake	low	low
Second Pond	3	0	43	54%	7%	2.2%	162	20%	94%	Rental, Saranacs, L. Placid	Lake Placid, Upper St. Regis Lake	high	medium
Seventh Lake	2	0	8	49%	4%	1.0%	59	9%	100%	Fourth, Raquette, Eighth	Fourth Lake, Raquette Lake	low	low
Stillwater Reservoir	1	0	18	26%	10%	2.3%	47	7%	100%	Black, Ontario, Fourth	not enough data	low	low
Tupper Lake	1	0	16	19%	12%	0.2%	62	6%	97%	Long L., Saranacs, Rental	Long Lake, Second Pond, Lake Flower, Cranberry Lake	low	low
Upper St. Regis Lake	0	0	10	48%	3%	0.2%	88	22%	96%	Rental, Lower Saranac, L. Placid	Second Pond, Lake Placid, Lake Flower, Chateaugay Lake	low	low
White Lake	0	0	10	17%	6%	0.01%	27	0%	57%	Oneida, Kayuta, First Lake	Fourth Lake	low	low

Notes:

Explanation of the assignation of risk colors: The team assigned the three AIS spread risk colors (green = lowest risk; yellow = medium risk; red = high risk) according to defensible breaks in the data and collective judgment. A summary of the categorization rules follows. Column A: low = 0 AIS plants; medium = 2; high >2. Column B: low = 0 AIS animals; no medium-risk category; high > 0. Column C: low = 0-10 boats per day; medium = 11-30; high >30. Column D: low = 0-19% of boats at risk of AIS transport; medium = 20-49%; high >50%. Column E: low = 0-5% organism transport rate; medium = 6-14%; high >14%. Column F: low = 0-2% AIS transport rate; medium = >2 – 4%; high > 4%. Column G: low = 0-50 previous waterbodies; medium = 51- 100; high >100. Column H: low = 0-9% of outbound visits; medium = 10 – 25%; high >25%. Column I: low = 0 – 40% of outbound visits; medium = 41- 59%; high > 59%.

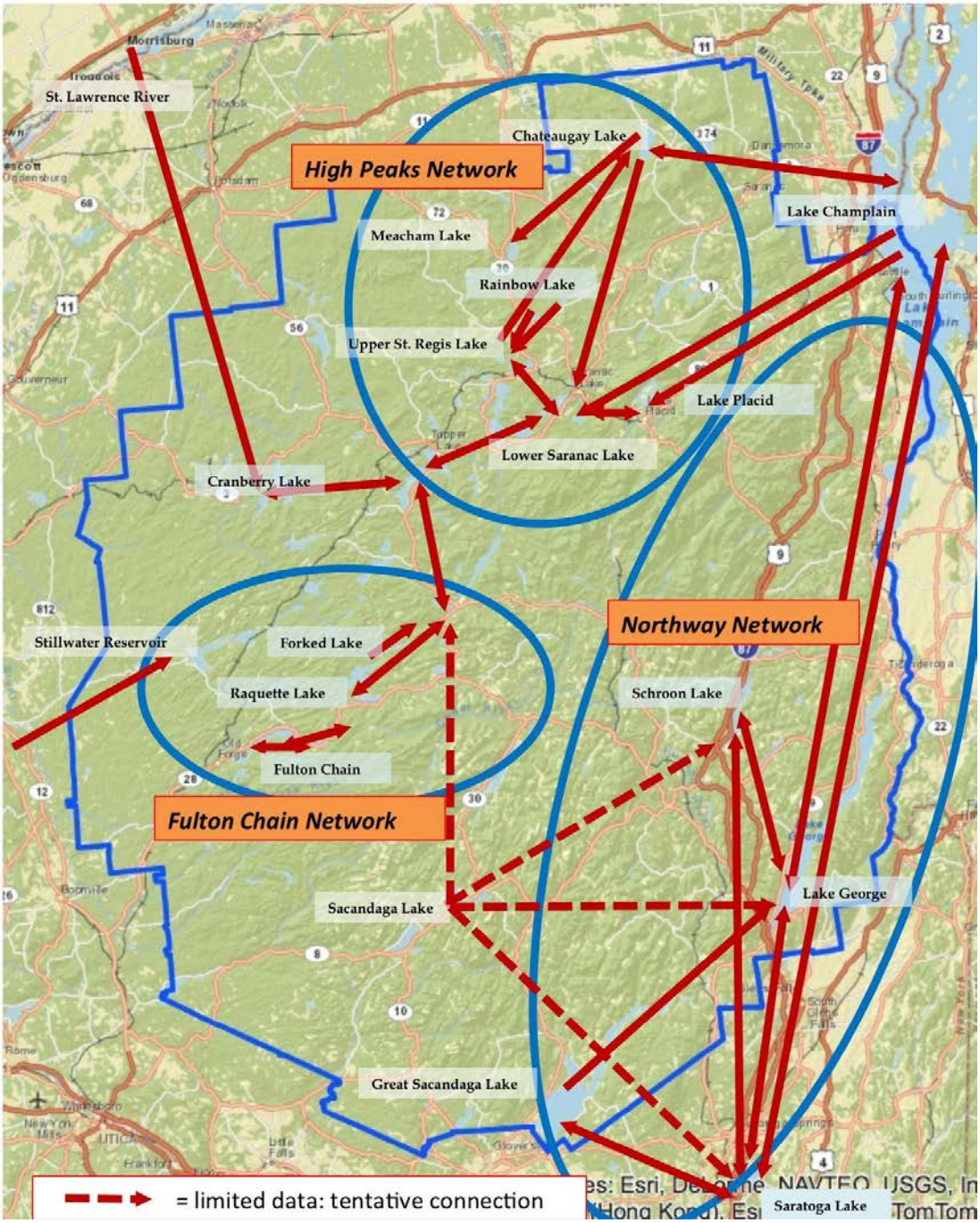
1. The Adirondack Watershed Steward network consists presently of active boat launch steward programs managed by the Lake Champlain Basin Program, the Lake George Association, Paul Smith's College, and the East Shore Schroon Lake Association.

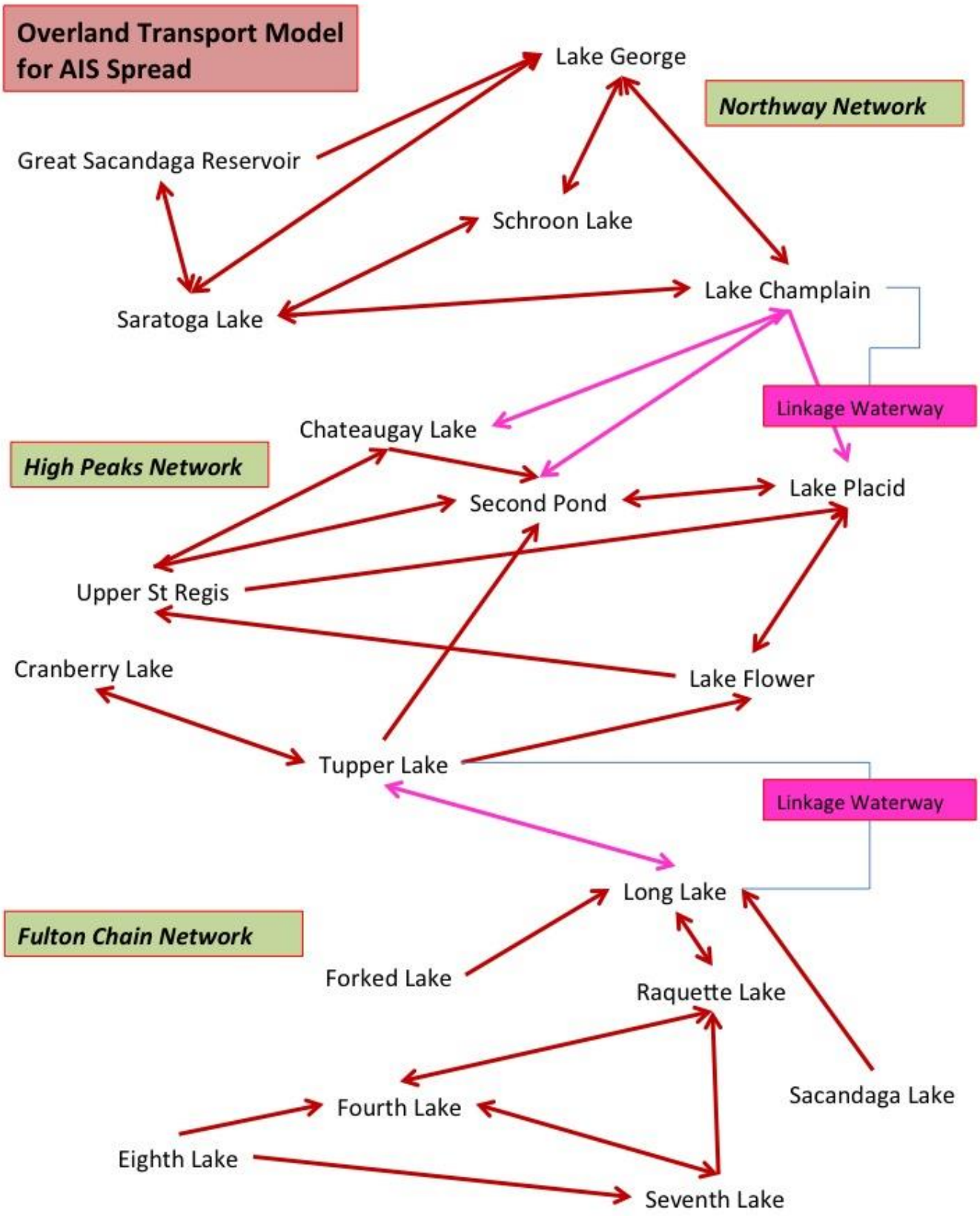
2. Unequal boat launch coverage was accounted for by dividing the total number of boats inspected by total days of service over the field season. Figures for lakes with multiple launches were combined and averaged using available data. These figures are based on 2012 steward coverage from Memorial Day to Labor Day. Not all sites had seven day per week steward coverage. Boat launch steward coverage is limited to working hours (typically eight hours per day), less breaks. Actual traffic is undoubtedly higher at each location for a 24 hour period.
3. The AIS transport rate is influenced by the combination of human factors (boat launch steward effort, ability, work pattern) and environmental factors (variation in annual density of vegetation growth, prevailing wind, water temperature, etc.).
4. "Outbound visits" take place when a boat is retrieved from one lake and launched in another, within a two-week period. "Confirmed" indicates that these visits are *actual* visits based on voluntary visitor statements about the last waterway they had visited prior to boat launch steward contact. E.g., if a visitor to Lake Placid states that they had visited Lake George last, this counts as a confirmed *outbound* visit from Lake George to Lake Placid.
5. This column indicates the lakes most likely to serve as destinations for boats leaving the lake in question. N.B., outbound visits can only be determined for the 24 lakes within the Adirondack Watershed Steward Network. The list includes the top two to five outbound destinations, in descending order. It is possible that other destinations not within the network are more common, but this information is not available. By analyzing these most frequently occurring outbound destination connections, managers can infer typical pathways for the spread of invasive species new to the region, and institute appropriate spread prevention interventions and/or facilities.
6. Inbound vulnerability to AIS infestation is an important defensive consideration. Managers must prioritize certain high value or high risk lakes for protection from outside invasion by considering placing boat launch stewards and/or boat washes at these locations.
7. In order to determine outbound invasion spread hub status, we looked for patterns of low, medium, and high comparative risk in terms of combinations of the following criteria: # AIS present (plants), # AIS present (animals), volume of boater traffic, how "dirty" boats are at particular locations, and the likelihood of boats departing the waterway to visit uninvaded (by plants and/or animals) waterways. Outbound AIS spread hubs are important to consider for effective and well-resourced intervention. Boat launch stewards and the accessibility of effective boat wash facilities provide boaters departing infested waterways with usable and timely ways to disinfect watercraft, thus providing residual protection to the entire Adirondack network.

Appendix F. Preliminary Adirondack Overland Transport Sub-networks maps.

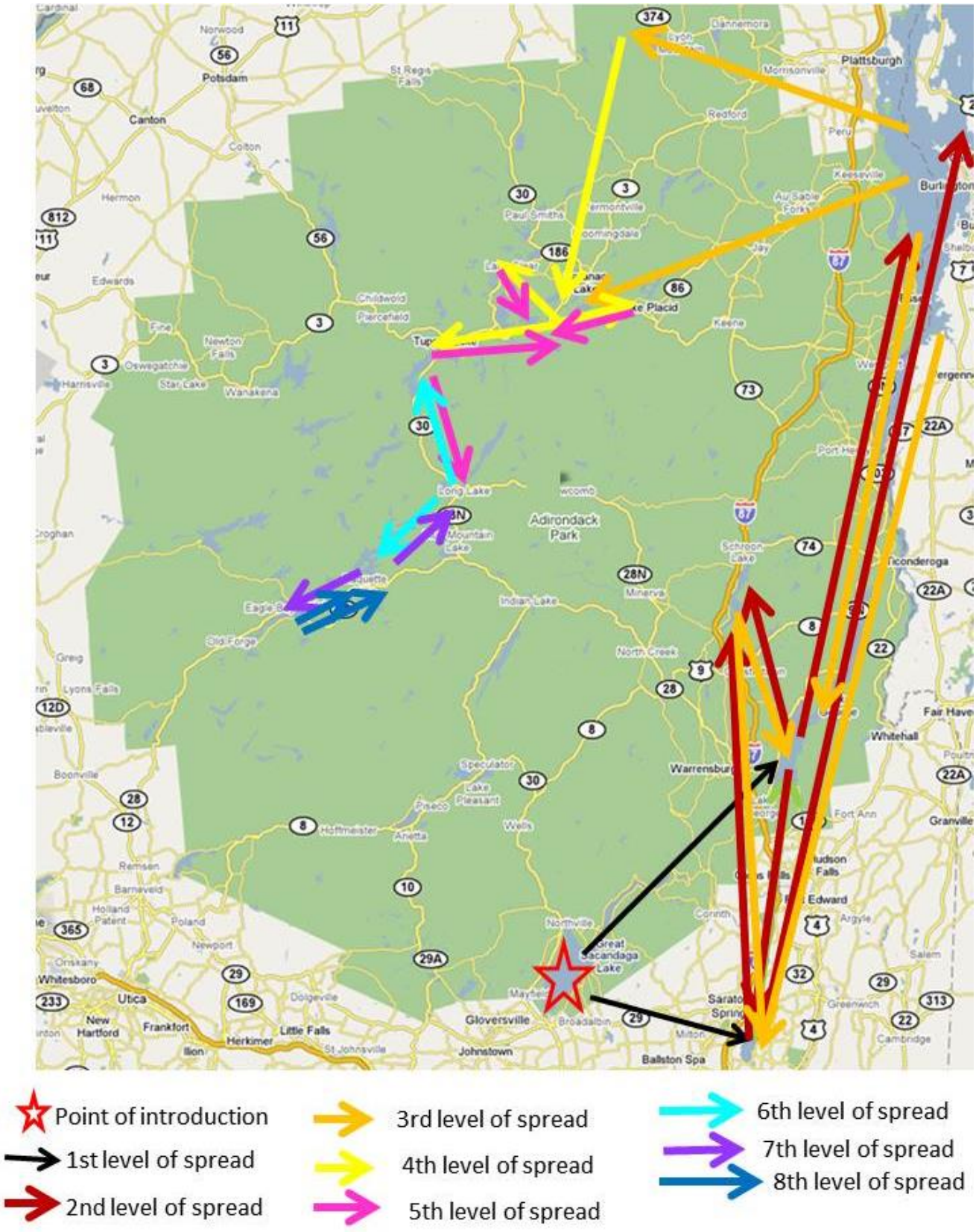
2WKHUHIRUHWRUNPDLQWKHYHUHDUHDWOHDVWWKUHHGLVWLQFWVXEQHWZRUNVLQWKHJ
UHJLRQWKHVHDUHRIWHQFRQQHFWHGWRRWKHUQHWZRUNVLQWKHUHJLRQEXWWKHUHDUH
HQRXJKGLIIHUHQFHVLQWKHLUSDWWHUQVWRMXVWLI\WUHDWLQJWKHPDVVHSDUDWHO\
SLDWHUQVRIWHQRQHDUHDQRWKHUQHWZRUNLQWKHUHJLRQEXWWKHUHDUHHQRXJKGLIIHU
SUHGKEDUSLDWHUQVRIWHQRQHDUHDQRWKHUQHWZRUNLQWKHUHJLRQEXWWKHUHDUHHQR
LYDLRSUHGKEDWWKLWLPHKHSODFHPHWRRWKHUQHWZRUNVLQWKHUHJLRQEXWWKHUHDUH
WKLSHFLILFDWHUDLQLQJWKHSWRGLWKHSUHGHFHVVRUQHWZRUNVRIWHQRQHDUHDQRWKHU

Boat Launch Use Network Data, 2011-2013:
Primary Outbound Destinations from Boat Launches in the Adirondack Region

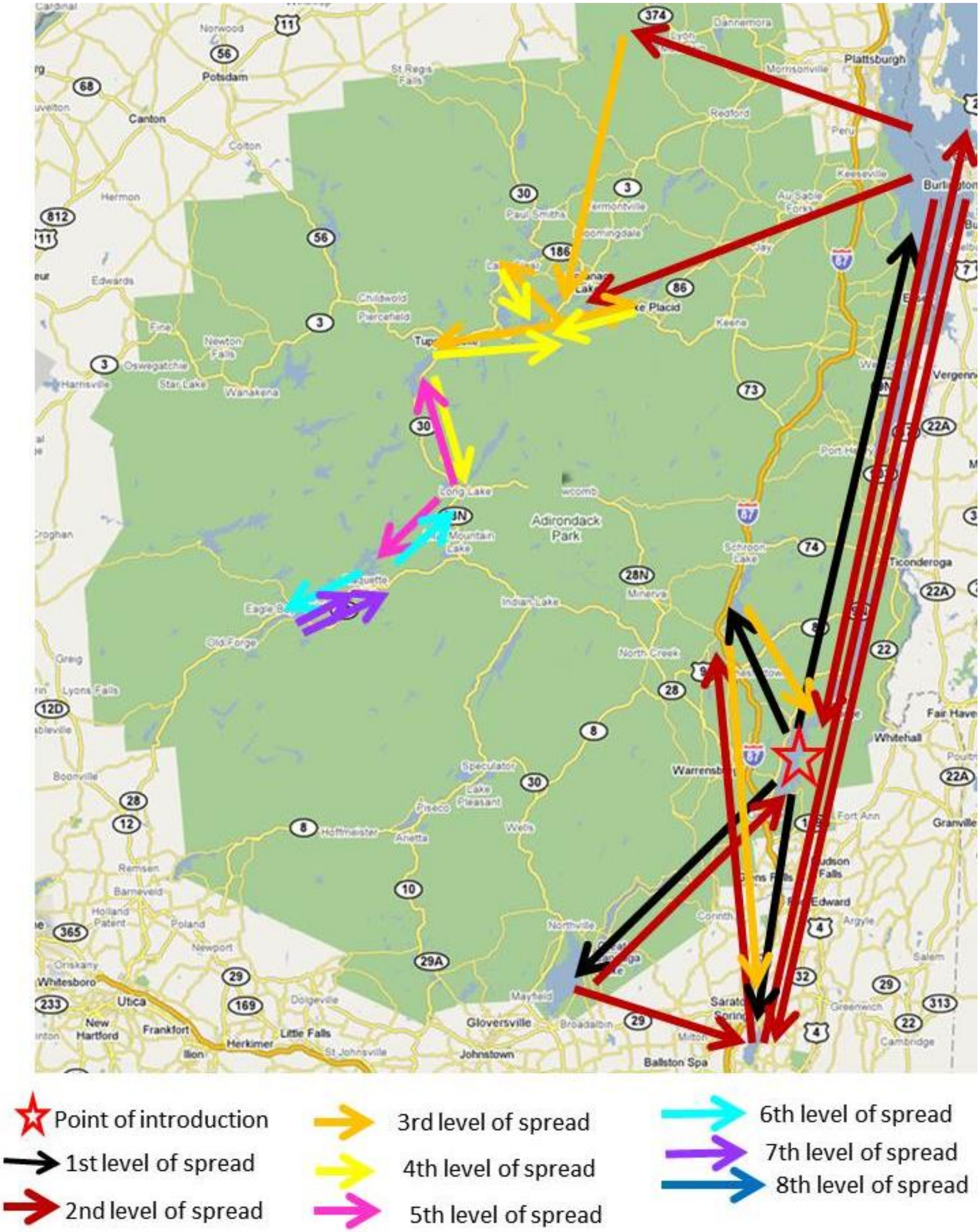



Overland Transport Model for AIS Spread
Lake George
Northway Network
Great Sacandaga Reservoir
Schroon Lake
Lake Champlain
Saratoga Lake
Linkage Waterway
Chateaugay Lake
High Peaks Network
Second Pond
Lake Placid
Upper St Regis
Cranberry Lake
Lake Flower
Tupper Lake
Linkage Waterway
Long Lake
Fulton Chain Network
Forked Lake
Raquette Lake
Sacandaga Lake
Fourth Lake
Eighth Lake
Seventh Lake

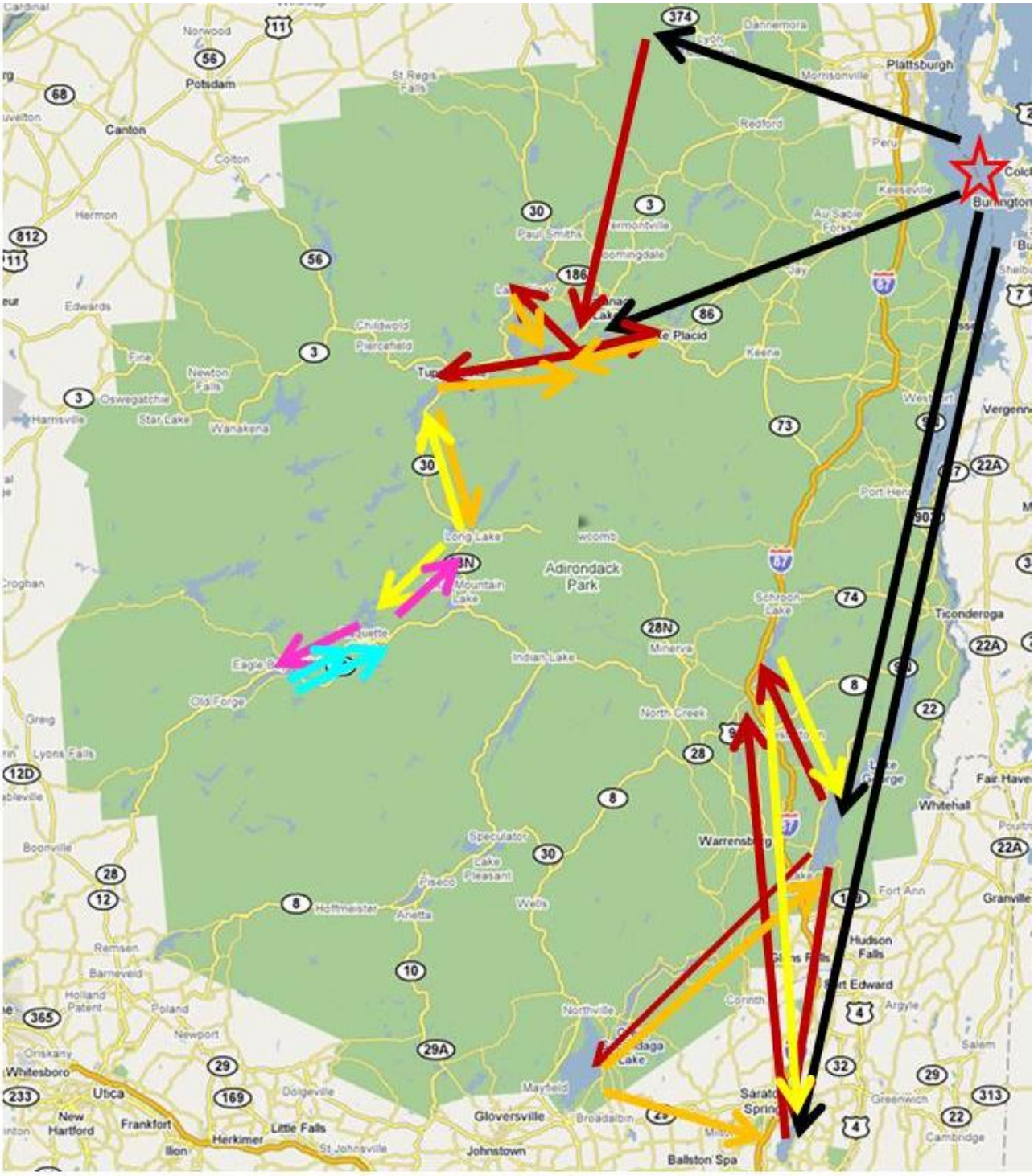
AIS Spread Potential from Great Sacandaga Lake



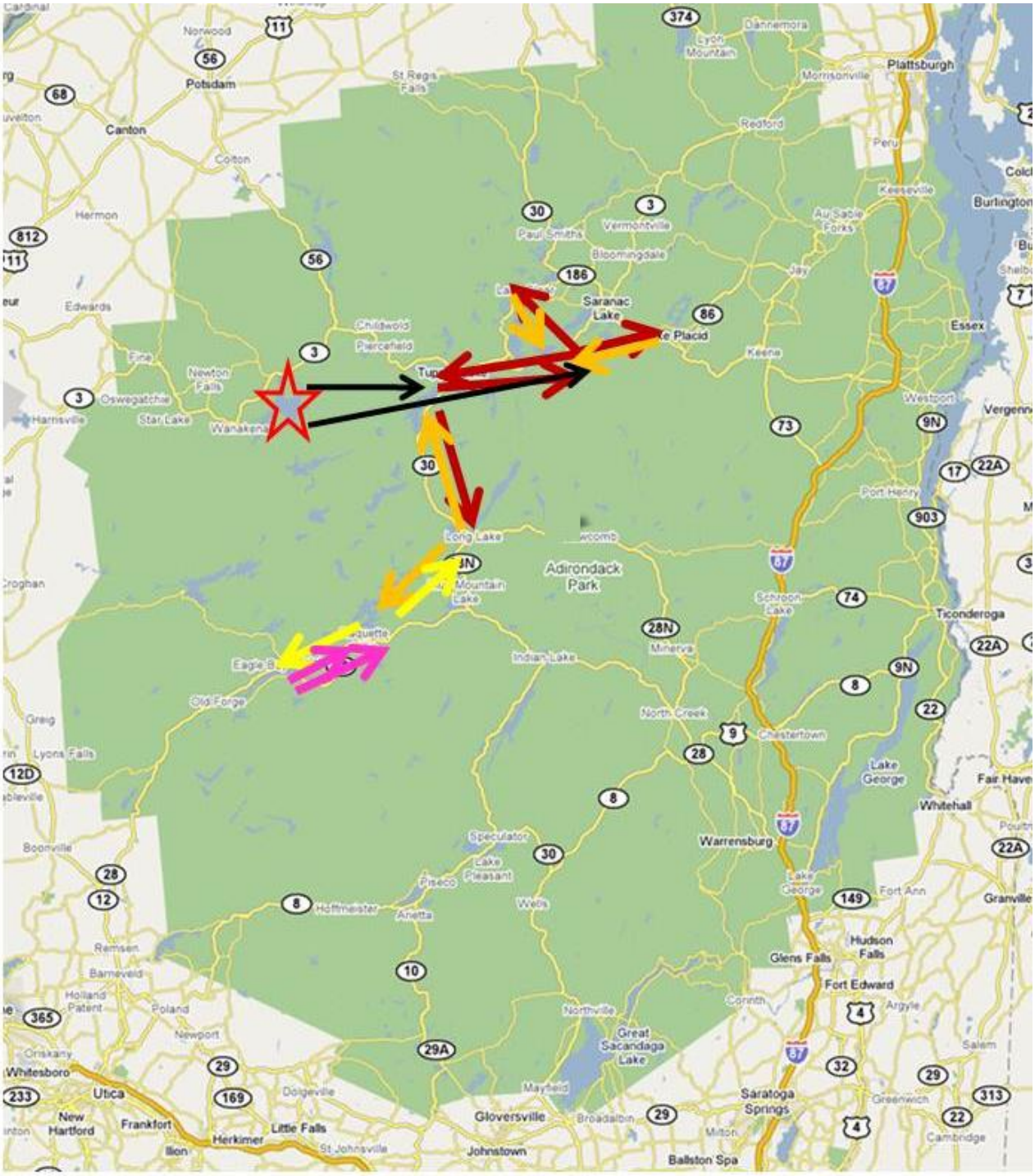
AIS Spread Potential from Lake George



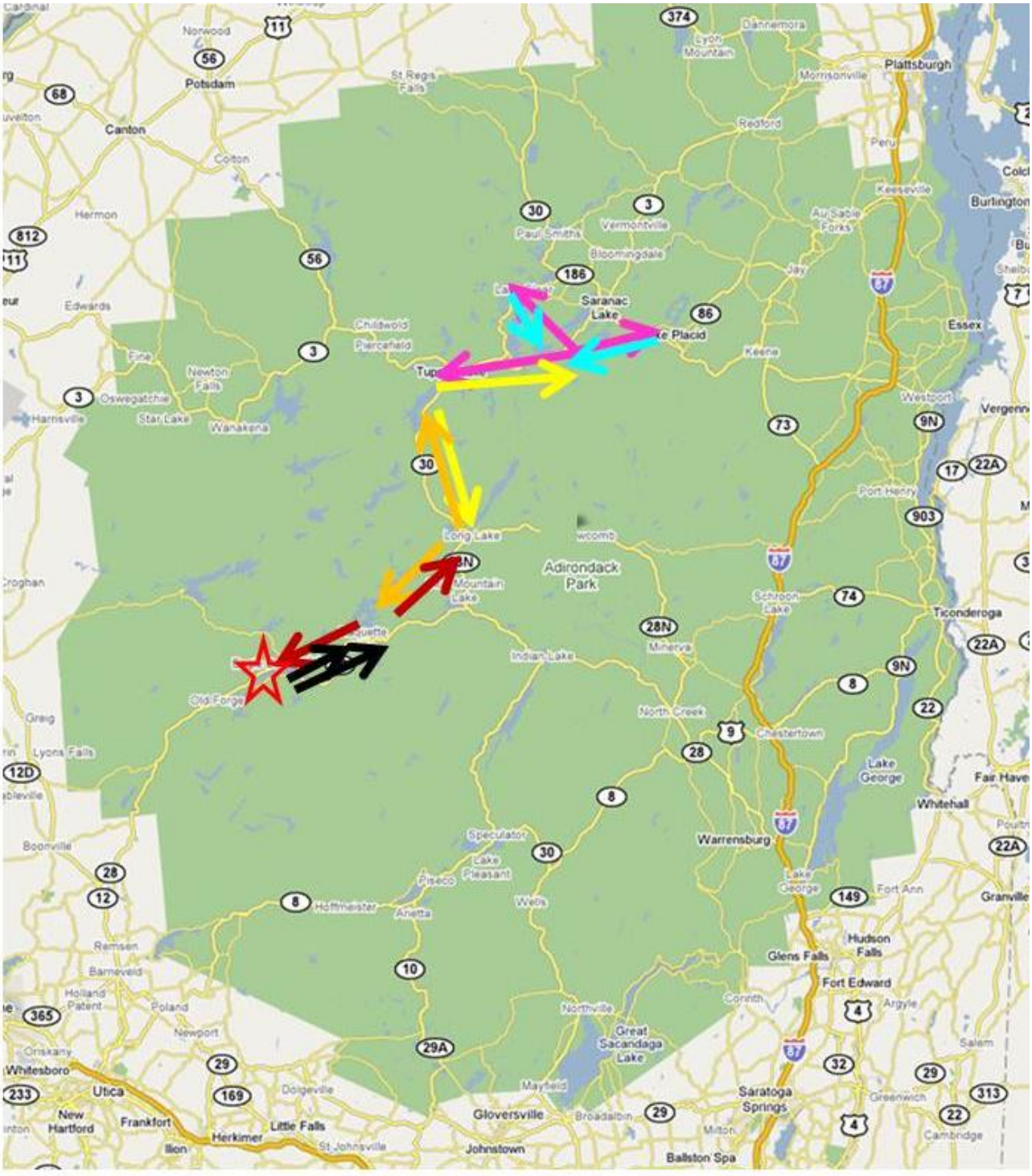
AIS Spread Potential from Lake Champlain



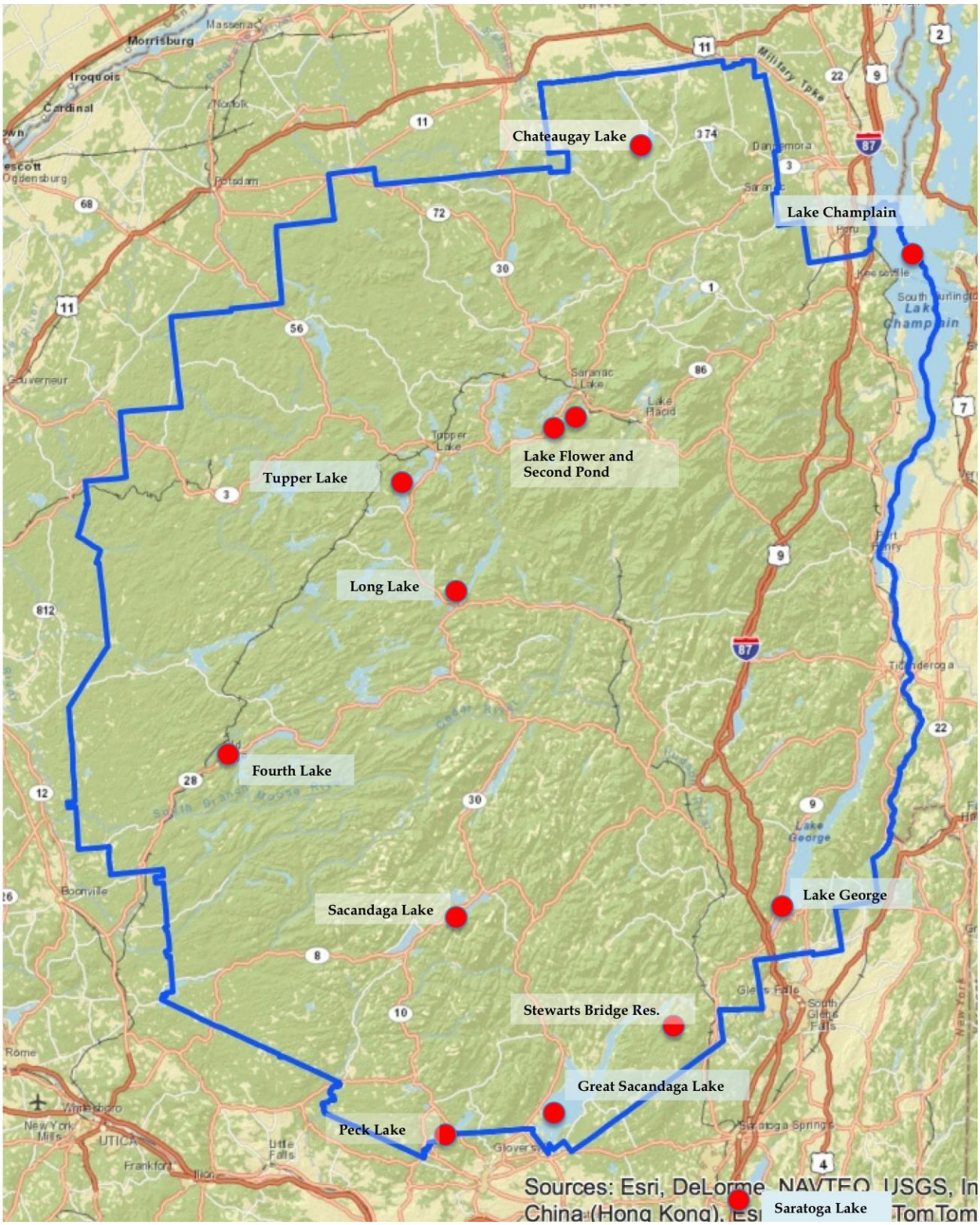
AIS Spread Potential from Cranberry Lake



AIS Spread Potential from Fourth Lake



Appendix G. Adirondack Watershed Steward Network: Invasion Spread Hub Waterways and Linkage Waterways



Appendix H. Waterways with aquatic invasive plants in the Adirondack region through 2012.

HEQWHVWDWHUDVVZKDFWLYHERDWODXQFKVWHDUGSURJUDPVLQ

%DUWOHWW3RQG[	)DXWRQDLG6[WK/DNH HPLOWRQ	0LOO3RQG6DUDWRJD
%ODNH5HVHUYRLU6W/DZHQFH	*UDVV5LYHUDW/DPSRQDOOV 6W/DZHQFH	0RRVDLQH[HZDNH)UDQNOLQ
%UDQW/DNH:DUUHQ	*UHDW6DFDQGDJD/DNH)DXWR6DUDWRJD	1RUWK3RQG:DUUHQ
%XWWHUQXW3RQG[	HGORFN3RQG:DVKLQJWRQ	2VHWDK/DNH)UDQNOLQ
&UUR)DOO5HVHUYRLU6W /DZHQFH	LJKODQGVRUJH/DNH[	3DUDGR/DNH[
&DWHDJXH/DNH/RZHU)UDQNOLQ	RUVKRH3RQG)UDQNOLQ ± XEO	3LHFHILHOG)ORZW/D ZHQFH
&DWHDJXH/DNH1DUURZ)UDQNOLQ	W/DNH6DUDWRJD	3XWQDP3RQG[
&DWHDJXH/DNH8SSHU&LQWRQ	,QLDQDNH)UDQNOLQ	5DLERZ/DOO5HVHUYRLU6W /DZHQFH
&DPURQ3RQG6W/DZHQFH	-HQNDNH6DUDWRJD	5DTXHWWH/DNHPPLOWRQ
&DQDGDNH&LQWRQ	.LQJV/DNH)UDQNOLQ	5RFN3RQGPLOWRQ
&SSHUDS3RQG)UDQNOLQ	/DNHSJRQDNHPLOWRQ	5RJHU3RQG[
&DEHUUY/DNH6W/DZHQFH	/DNH&DPSODLQ	6DUDQDF/DNH/RZHU)UDQNOLQ
DJJHWW3RQG:DUUHQ	/DNH &OE)UDQNOLQ	6DUDQDF/DNH0LGGOH)UDQNOLQ
HHU5LYHU)ORZ)UDQNOLQ	/DNHXDQWPLOWRQ	6DUDQDF/DNH8SSHU)UDQNOLQ
(DJOH/DNH[± 7LFRQGHURJD	/DNH(DWRQ[	6FKURRQ/DNH[DUUHQ
(DW&RURJD/DNH)&WRQ	/DNH)ORZ)UD QOLQ	6HFRQ3RQG6DUDQDF&DLQ)UDQNOLQ
(IU/DNH6DUDWRJD	/DNH+RUJH :DUUHQ&KLQWRQ[	6LPRQ3RQG)UDQNOLQ
(OGRQ/DNHPPLOWRQ	/DNH/KUE:DUUHQ	6RIW0DSOH5HVHUYRLU/HZV
)LUW3RQG6DUDQDF&DLQ)UDQNOLQ	/DNH3OFLG[	6WDUN)DOO5HVHUYRLU6W /DZHQFH
)LV&UHHN3RQG)UDQNOLQ	/LEHUW3RQG[	6WLOOZDWHU5HVHUYRLUHUNLPHU
)ORRGZRG3RQG)UDQNOLQ	/LWWOH&RE3RQG)UDQNOLQ	7DO1RU3RQG&LQWRQ
)ROOHU&UHHN3RQG)UDQNOLQ	/LWWOH5LYHU)O6W/DZHQFH	7LWXV/DNH)UDQNOLQ
)UDQN/DOO)ORZ)UDQNOLQ	/LWWOH6TXUH3RQG)UDQNOLQ	7XSSHU/DNH)UDQNOLQ6W /DZHQFH
)&WRQ&DQHPPLOWRQ	/RQ/DNHPPLOWRQ	8QLRQDOO)ORU&LQWRQ
)&WRQ&DQW/DNH HUNLPHU	/RQ3RQG(FKR/DNH[	:HE5RFN6ZPS[
)&WRQ&DQ&WK/DNH HUNLPHU	/RRQDNH:DUUHQ	:HW&RURJD/DNH)&WRQ
)&WRQ&DQG&HFRQ/DNH HUNLPHU	0DLLHOG/DNH)&WRQ	
)&WRQ&DQHYHQQK/DNH PPLOWRQ	0HDFKDP/DNH)UDQNOLQ	

Appendix I. Waterways surveyed where no aquatic invasive species have been observed in the Adirondack region through 2012.

OGHURG(H	(LJKWKDNHDPLOWR	LWWOHLOODGRGDPLOWR	5RFNRG(H
DEOHDNH RHU(H	(ONDNH(H	LWWOHRURGHDUHDURG)UDNOL	5RFNRG)UDNOL
DEOHDNHSSHU(H	)DDNHDPLOWR	LWWOHRURGHDU)LKRG)UDNOL	5RFNRGHL
WLRGDUH	)HUDNHOLWR	LWWOH5DNLRG(H	5ROOLRG)UDNOL
DOIRUDNH(H	)LKRG)UDNOL	LWWOHSSHUDNHDPLOWR	5RHRGHUNLPHU
DUHRG(H	)ROOHERG)UDNOL	LWWOH:ROIDNH)UDNOL	5RGDNHDPLOWR
DUPRG)UDNOL	)RUNHGDNHDPLOWR	LYLJWRDNH:DUH	5RGRGWDUHFH
DDNH(H	)RUWKDNH:DUH	LDUGRG:DUH	5HWWRG(H
HDURG)UDNOL	)UDFLDNHHL	RUDNH2HLGD	5LDDNHDPLOWR
HDYHUDNHHL	)UHFKRGHL	RURG)UDNOL	DJDPRUHDNHDPLOWR
LJ5RRHDNHHUNLPHU	)ULHGDNH:DUH	RURGHL	DLW5HJLDNHRHU)UDNOL
LJRG(H	DUHWDNH:DUH	RURGWDUHFH	DLW5HJLDNHSSHU)UDNOL
LJ:ROIDNH)UDNOL	LOPDDNHDPLOWR	RRDNH)UDNOL	DGRG(H
ODFNRGHDURHUW5HJLDNH)UDNOL	OHRG)UDNOL	RWRG)UDNOL	KDOORRGHUNLPHU
ODFNRGHDU:KHRG)UDNOL	RRGRJORG(H	5DUYLRG)UDNOL	KLJOHKDWRGDPLOWR
OH5RWDLDNHDPLOWR	RRHRG(H	5DRDNHDPLOWR	LDPHHRGRHU:DUH
ONLRGSHFWDEOHRG)UDNOL	UHHDN HJOWR	5DDHSLHDNHWDUHFH	LDPHHRGSSHU:DUH
RURG)UDNOL	UHHRG)UDNOL	5FDYDDJKRG)UDNOL	LOYHUDNHOLWR
RRWWUHHRGWDUHFH	OORG(H	5LGGOHRG)UDNOL	LOYHUDNHWDUHFH
UDGUHWKDNHDPLOWR	OORGWDUHFH)UDNOL	5LOORG(H	LDNHHUNLPHU
UDWLKDPDNHHL	DUULDNH(H	5LUURUDNH(H	ODJRG)UDNOL
URUDFWRGRHUDPLOWR	HDYHRG)UDNOL	5RKHJDDNHDPLOWR	RWKRGDPLOWR
URUDFWRGSSHUDPLOWR	HGHURDNH(H	5RRGRG(H	RWKRGEOHWDPLOWR
URJDOO5HHUYRLUWDUHFH	RHORG)UDNOL	5RRHRG(H	SHUURG DPLOWR
EEDNHHUNLPHU	ROPHDNHJOWR	5RUHKRHDNHDPLOWR	SLWIUHDNH)UDNOL
ENRG)UDNOL	RUHKRHDNHWDUHFH	5RKLH5HHUYRLUHUNLPHU	SUDJHRGDPLOWR
LWRGDUH	RUHKRHRGWDUH FH	5RDNHHUNLPHU	SDNHDPLOWR
DGDDNHJOWR	RUHKRHRG)UDNOL	5RWUDEDNHWDUHFH	WDUDNHWDUHFH
DEDGHDNHDPLOWR	,GLDDNHDPLOWR	5RWDLDNHJOWR	WHHOH5HHUYRLUDUDWRJD
DEDGHDNHRHU(H	,UHOGODUDWRJD	5RWDLRGHDUDPRG)UDNOL	WRHUDNH(DWDPLOWR
DEDGHDNHSSHU(H	-DEHRGDUH	5RWDLRGHDUHGJHRG)UDNOL	WRUHHNRG)UDNOL
DWDPRWRGWDUHFH	-DFNRPPLW5HHUYRLUJOWR	5GRGHL	WUHHWHUDNHWDUHFH
HGDU5LYHUJORGDPLOWR	-RH,GLDRGWDUHFH	5UHPRNHRG(H	ENHUDNHWDUHFH
HWHURGDPLOWR	-RKRRG(H	1HOOLHRG)UDNOL	DDKHURG(H
KDOOLRG(H	-RHRG)UDNOL	1HERPEDNH(H	KDHUDNHDPLOWR
KDEDNHHL	-RUGDDNHWDUHFH	1HSRUWRG(H	KLUWHHWKDNH:DUH
KDWLHPDNH:DUH	.HHORGDPLOWR	1LFNDNHHUNLPHU	KUPDRG(H
KEDNHDPLOWR	.DNHEDDNHDPLOWR	1RUWKDNHHUNLPHU	RROHRGWDUHFH
KUFKRG)UDNOL	.DNHGLURDFNDPLOWR	2OLYHURG(H	RU LHRGWDUHFH
ODPKHOORG)UDNOL	.DNHOHDU)UDNOL	2JRRGRG)UDNOL	UUSSRGDUH
OHDURGHDU5DLERDNH)UDNOL	.DNHOHDU2WOHW)UDNOL	2WWHUDNH2HLGD	URWDNHHL
OHDURG(H	.DNH(DWRDPLOWR	2YH5RWDLRGDUH	UWOHRG)UDNOL
OHDURGHDU6HDFKDPDNH)UDNOL	.DNH+DTD)UDNOL	2ERDNHDPLOWR	LWFKHOODNHHUNLPHU
OHDURGHL	.DNHLODDPLOWR	DFNJRUHWDNH:DUH	NRHDU)LKRG)UDNOL
OHDURGWDUHFH	.DNH1HERDKLWR	DOPHURG:DUH	NRHDU)LKRG)UDNOL
OHYHODGDNHHL	.DNH2ULDWDUHFH	DHDNHHL	WRDDDNHDPLOWR
RWDEOHRG DPLOWR	.DNHOHDDWDPLOWR	KDUDRKDNH(H	:DNHORGDPLOWR
UDH6RWDLRGDUH	.DNH5RGDHHUNLPHU	LHFRDNHDPLOWR	:HWDNHHUNLPHU
UDHRG(H	HGJHRG)UDNOL	ROOLURG)UDNOL	:HWLH RG)UDNOL
HHURGDPLOWR	HDNHDUH	URFWRURG(H	:KHRG)UDNOL
HHURGWDUHFH	HHDNHDPLOWR	UDPLGDNH(H	:KLWDNHUDNHDPLOWR
(DJOHUDJDNHWDUHFH	LORGDUH	4LYHURGHUNLPHU	:LOFRDNH:DUH
(DJOHDNHDPLOWR	LPHNLODNHHUNLPHU	5DLERDNH)UDNOL	:LOOLDNHDPLOWR
(DJOHRG)UDNOL	LWWOHOHDURG)UDNOL	5DNLRG(H	:RRGUXIIRG(H
(DWLHRG)UDNOL	LWWO)LKRG)UDNOL	5DWRG)UDNOL	:NLRGSHFWDEOHRG)UDNOL
(FKRDNHDPLOWR	LWWOHUHHRG)UDNOL	5LFKDNH(H	DFNRG(H

Appendix J. NYSDEC campgrounds with aquatic invasive species present and boat launches in the Adirondack region.

Campground Name	Waterway Name	Aquatic Invasive Plants	Aquatic Invasive Small-bodied Organisms	Action
[illegible]	[illegible]	;		[illegible]
[illegible]	[illegible]	;	;	[illegible]
[illegible]	[illegible]	;		[illegible]
[illegible]	[illegible]	;		[illegible]
[illegible]	[illegible]	;	;	[illegible]
[illegible]	[illegible]	;		[illegible]
[illegible]	[illegible]	;		[illegible]
[illegible]	[illegible]	;		[illegible]
[illegible]	[illegible]	;		[illegible]
[illegible]	[illegible]	;		[illegible]
[illegible]	[illegible]		;	[illegible]
[illegible]	[illegible]	;	;	[illegible]
[illegible]	[illegible]	;		[illegible]
[illegible]	[illegible]	;		[illegible]
[illegible]	[illegible]	;	;	[illegible]
[illegible]	[illegible]	;		[illegible]
[illegible]	[illegible]	;		[illegible]
[illegible]	[illegible]	;		[illegible]

Appendix K. NYSDEC campgrounds without aquatic invasive species in the Adirondack region.

1RWH2EHFDPSJURXQG0HDGRZURRNGRHVQWKDYHZDWHUFFHVV7KHHFDPSJURXQGV6DFDQDJD6DFDQDJD5LYHU6KDUS%LGJH6FKURRQ/LYHUDQ:LOPLQJWRQ RWFK:HVW%DQKXVDEOH5LYHU%DYHQWEHQVXUYHG

Campground Name	Waterway Name
%URZQUDFW3RQG	/RZHU%URZQUDFW3RQG
%XN3RQG	%XN3RQG/DNH.DTX
(LJKWK/DNH	(LJKWK/DNH
)RUNHG/DNH	)RUNHG/DNH
,QLDQDNH,VODQGV	,QLDQDNH
/DNH(DWRQ	/DNH(DWRQ
/DNHBUULV	/DNHBUULV
/HZ\DNH	/HZ\DNH,QLDQ /DNH
/LPHNLOQDNH	/LPHNLOQDNH
/LWWOH6DQ3RLQW	3LVFR/DNH
/\KUE	)R[WK/DNH
1LFN\DNH	1LFN\DNH
3RLQW&RPIRUW	3LVFR/DNH
3RSODU3RLQW	3LVFR/DNH
5RROLQRQ	5RROLQRQ

$GHQF3DUN,QVLDDPP$GHQF3DUN$TXDWLF,QYDVLYH6SHFLHV
0DQ KDGLQVLMRP$TXDWLFVRXUFHV(KPSDJSG $FFHVV
@

$GHQF:DWHUVKHG,QLWLDWLYHVPXPPDU\RISURJUDPVDQ
5HSRU
KWWSDGLQVLMRP$TXDWLFVRXUFHVGRFXPV:DWHUVKHG
$FFHVVHG@

$TXDWLF,QYDVLYH6SHFLHV7DVN)RUFH1DWLRQDO0DQDJHPHQWRI$TXDWLF,QYDVLYH
6SHFLHV6XUYHLOODQFH3URJUDP
KWWSDQVWDVNIRUFHRUJ6XUYHLOODQFHSG $FFHVVHG-XO
@

$TXDWLF,QYDVLYH6SHFLHV7DVN)RUFH KWWSDQVWDVNIRUFHRUJSK $FFHVVHG
0D@

%HUJQDQ,,QHUH, Myriophyllum VSLFDWXP/LQQH
7HQQHVVHH9DOOH\$XWKRULW\SODQWDQGGLVWULEXWLRQ In: 3URF)LUVW,QW6\PSRQ:DWHUPLOIRLO
Myriophyllum spicatum DQG5HODWHG+DORUDJDFHDH6SHFLHV$TXDWLF3ODQW0DQDJHPHQW6RFLHW\,Q
SS

%RVVHQEURHN-0.DXIPDQ1HNRODJ-&3UHGLFWLRQRIORQJGLVWDQFHGLVSHUVDOXVLQJJUDYLW\
PRGHOVJHEUDPXVVHOLQYDVLRQRILQODQGODNHV Ecological Applications, 11,

%XFKDQDQ3DGLOODD'3UHGLFWLQJWKHOLNHOLKRRGRI(XUDVLDQZDWHUPLOIRLOSUHVHQFHLQODNHVD
PDFURSK\WHPRQLWRULQJWRRO Ecological Applications, 10,

&RPHDX5DLQYLOOH6=DOGLYDU)HUWHOHIIH6RVVDQ:RQ+
6XFHSWLELOLW\RITXDJJDPXVVHOV Dreissena rostriformis bugensis WRKRWZDWHUVSUD\DVDPHDQVRI
ZDWHUFUDIWGHFRQWDPLQDWLRQ Biofouling, 27

'6DQ5RWKOLVEHUJHU-2IIHQHHDQGGHIHQHLQDQVFDSHOHYHOLQYDVLRQRURQWURO Oikos, 117,

(PLOHFRPSOHWLRQDOFRPPXQLFDWLRQ

)ROPOQ(:LOH\(GLWRUV Watershed Stewardship Program Summary of Programs and Research 3DXO6PLWK1\$GLURQGDFN:DWHUVKHG,QVWLWXWHRI3DXO6PLWK&ROOHJH

-RKQVRQ(5LFFLDUGL$-RKQVWRQ2YHUODQGGLVSHUVDORIDTXDWLFLQYDVLYHVSHFLHVDULVN
DVVHVVPHQWRIWUDQVLHQWUHFUHDWLRQDOERDWLQJ Ecological Applications, 11,

.HOOHU53&R$9D(RR(RGJH0HHEHU00DQ5RWKOLVEHUJHU-)RUPEDLW
VRSVWRWKHIRUHVWIORRUHDUWKZRUPHDQGGLVSRVDOEDLWLQJOHUV American Midland Naturalist, 158,

/DNH&KDPSODLQ%DVLQ$TXDWLF,QYDVLYH6SHFLHV5DSLG5HVSRQVH7DVN)RUFH6SLQ\ZDWHUIOHDUDSLG
UHVSRQVHLQWKH*OHQ)DOOVDQG&KDPSODLQFDQDOV KWWSOFESRUJ3)VDVWULEVSLQ\UHSGI
$FFHVVHG0D@

/DNH&KDPSODLQ%DVLQ3URJUDP$,6SUHDG3UHYHQWLRQ KWWSOFESRUJZDWHU
HQYLURQPHQWDTXDWLFLQYDVLYHVSHFLHVDTXDWLFLQYDVLYHVSHFLHV $FFHVVHG$SU@

References

$QDNRSRXORX9OLQVODQGV$0DUWLQ$-RKQ7$:LOOLDPVRQ$)UDQFHV5$
.HZDOR$6RSHOD$/RUHQ]R$0DUFR$6DQWDJR$0DULD$&DVWUR$3DXOR$-RUJH$
$QWRQLR$6RXVD$3HGUR$%HUQDUGR$*DUFLD%HUWKRX$(PLOLR$7[DUWLQR$
&DUORV$&DVWUR$&DUORV$&DVWUR$-RVp$0DUWLQH]$&RUUDO$0DULD$&DUPHQ$
&DVWUR$&DUORV$&DVWUR$-RVp$0DUWLQH]$&RUUDO$0DULD$&DUPHQ$
Biological Invasions, 8,

/HQ]L0DUFR$*LDQQHWWL%UXQR$&DVWUR&DUORV$-RVp$0DUWLQH]&RUUDO0DULD&DUPHQ$
DOOHHHIIHEcology, 85,

0DF,VDDF$-RH\$900XUGRFK$-DG-5DQGDOO$-RKQ0$)UDQFLVFR$DQG$IRUHFDVWLQJ
ELRORJLFDOLQYDVLRQVILQDQFLDOEcology, 14,

0RUHQH-7$VHVVLQJWKHIIHFWVRIDSSOLFDWLRQVLPDWHPSHUDWXUHRQWKHILOWUDWLRQ
VSDVWRPLWLJDWHIRUOLQDreissena polymorpha]HEDPXVHO3DOODV Biofouling, 25

0XUGRFK-5DQ0DF,VDDF+YHORSPHQWRILQDQODNHVDVKLQJLQQDVLRQWRN
Journal of Applied Ecology, 42,

1DWLRQDO2FHDQFQGWPRVSKHULF$GPLQVWUDWLRQ1RUWKHDVW6HFLHQWLILF&HQWHU
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5DPFKDQGDQ'DQRGVR0RGHOVWR3UHGLFW3RWHQWLDO2FFXUHQHQHW\
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6HSW@

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Ambient Levels of Calcium and Chloride in the Streams and Stormsewers That Flow into Lake George (Warren County), New York

Endnotes

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*VVHE6HN-0DIW4DQ1HNOD-&HGLFWLRQIORQGLVWDE6HGLVSHUDOXLQJDYLW\ PRGHOVJHDPXVHOLQDVLRQILQDQODNHV Ecological Applications, 11,

-RKQRQ6LFFDG+LDQ2WRQ72YHUDQGLVSHUDORIDTXDWLFQDVLYHVSHFLHVDLVN DVVHVVPHQWRIWDQLHUFHDWLRQOERDEcological Applications, 11,

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*6XWKDQ-:RRRPILHOG-$PEDG57DQ:HVW7$ELHQ/HVRI2OLFRDQ KORLGHQVH6WHDPVDQ6WRPDVHZ7KW)ORZQVR/DNHHRJH:DHQN1HXNSEDQ 16HSDWPHQVRI(QLEHQHQDO&QHVDWLRQ*HQHWLFDQDO\VHVRIWKH Dreissena polymorpha. Canadian Journal of Fisheries and Aquatic Sciences, 49,*

*1HZN,QDVLYH6SHFLHV&HDLUQXHGL Hydrilla verticillata /I5RVH KWWSZZZLRLQHSDFWLQDVLYHBGHWDLOLG $FFHVVHG$@

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