Streams/Rivers Aquatic Invasive Species Early Detection Monitoring

State of Wisconsin Department of Natural Resources
STANDARD OPERATING PROCEDURES

Bureau of Water Quality
June 2017

Table of Contents

MONITORING OBJECTIVES

The monitoring objectives are to detect new populations of prohibited species and to understand the distribution of invasive species along streams. The Wisconsin Department of Natural Resources (DNR) currently relies on a network of DNR stream biologists and volunteers (i.e. Water Action Volunteers, River Alliance of Wisconsin, Trout Unlimited, etc.) to collect data on the presence and absence of invasive species. The biologist's efforts help evaluate the relationship between stream water quality and invasive species, and the variable volunteer efforts provide additional reconnaissance, but early detections from these efforts have been incidental. A more strategic effort specifically targeting likely location for invasive species establishment is needed to efficiently identify pioneer populations of invasive species.

The most important factor influencing the introduction and establishment of invasive species are pathways for invasive species to favorable habitats for establishment (Vander Zanden and Olden 2008). The primary vectors for invasive species are anthropogenic, such as public access and recreational opportunity (Leung 2002; Vander Zanden and Olden 2008; Rothlisberger et al. 2011; Latzka personal communication). Disturbed or degraded ecosystems are generally unfavorable for native species and provide niches for invasive species establishment and expansion once a species is introduced (Didham et al. 2005, MacDougall and Turkington 2005, Havel et al. 2005; Johnson et al. 2008).

Our earlier studies suggest that urban land use increase risk of invasive species establishment along streams. Other research suggests that invasive species dispersal is about 15 miles, though more research is needed. Therefore, identifying pioneer populations of invasive species in these locations (i.e. urban land use and within 15 mile buffers of know populations) is important to detect new populations and enable response efforts

DESIGN

Sample Period: May through September

Frequency: Rotating cycle or as needed

Locations: Access points, transects

Parameters: list of invasive species

Methods:

1. Determine number of sampling transects based on mean stream width,
2. 2 minutes examining the right bank for riparian invasive plants.
3. 2 minutes examining the left bank for riparian invasive plants.
4. 2 minutes examining the stream bed for invasive aquatic plants/algae and invertebrates.
5. 5 minutes or less collecting or macroinvertebrate samples from a cross-sectional transect of the stream bed.
6. Survey streambed and banks between transects.
7. Repeat 2-5 along each transect.

SITE SELECTION

Central Office will generate a list of stations within 15 mile proximity to prohibited species for regional staff to choose from.

TARGET SPECIES

Table 1 Species targeted for aquatic invasive species surveys. Species with an asterisk (*) are established and species with a dagger (†) are not established in the state.

Common Name	Latin Name	Species Code
Aquatic Plants		
European Frog-bit†	*Hydrocharis morus-ranae*	EFB
Yellow Floating Heart†	*Nymphoides peltata*	YFH
Water Chestnut†	*Trapa natans*	WC
Brazilian Waterweed†	*Egeria densa*	BWW
Hydrilla†	*Hydrilla verticillata*	HYD
Curly-Leaf Pondweed*	*Potamogeton crispus*	CLP
Fanwort†	*Camboba caroliniana*	FW
Parrot Feather†	*Myriophyllum aquaticum*	PF
Eurasian Water Milfoil*	*Myriophyllum spicatum*	EWM
Water Hyacinth†	*Eichhornia crassipes* and *E. azurea*	WH
Water Lettuce†	*Pistia stratiotes*	WL
Didymo†	*Didymosphenia geminata*	DIDY
Wetland Plants		
Flowering Rush*	*Butomus umbellatus*	FR
Phragmites*	*Phragmites australis*	PHRG
Japanese Knotweed*	*Polygonum cuspidatum*	JK
Giant Knotweed†	*Polygonum sachalinense*	GK
Purple Loosestrife*	*Lythrum salicaria*	PL
Japanese Hop*	*Humulus japonicus*	JH
Yellow Iris*	*Iris pseudoacorus*	YI
Invertebrates		
Zebra Mussels*	*Dreissena polymorpha*	ZM
Quagga Mussels*	*Dreissena bugensis*	QM
Asian Clam†	*Corbicula fluminea*	AC
Faucet Snails†	*Bithynia tentaculata*	FS
Spiny Waterfleas	*Bythotrephes longimanus*	SWF
Chinese Mystery Snails*	*Cipangopalundina chinesis*	CMS
Banded mystery Snails*	*Viviparus georgianus*	BMS
New Zealand Mudsnail†	*Potamopyrgus antipodarum*	NZMS
Red Swamp Crayfish†	*Procambarus clarkii*	RSC
Rusty Crayfish*	*Orconectes rusticus*	RC

For guidance on target species identification and habitat preference, please review the attached and the following guides:

AIS Identification Guide (2017) – multi-page
AIS Identification Guide (2014) – one-page
Crayfish of Wisconsin Guide (2017) – multi-page

Other resources:

- DNR website
- Aquatic Invasive Species Monitoring section of the Citizen Lake Monitoring Network Manual
- Field guide to Wisconsin Streams
- University of Wisconsin – La Crosse freshwater snail key
- Key to Wisconsin Freshwater Snails

EQUIPMENT

Equipment is needed for defining mean stream width (MSW), sample collection, macroinvertebrate screening, identification, documentation, preservation, and vouchering.

A 50 m tape measure will be used to determine the mean stream width.

Net mesh size strongly influences the types and proportions of macroinvertebrate taxa collected. A 600-micron mesh kick net should be used for collecting baseline macroinvertebrate samples for the Department. Kick net frames are available in various sizes and shapes. Rectangular or D-shaped net frames are good choices. Smaller triangular-shaped net frames should not be used as their relatively small size miss many of the invertebrates dislodged from the substrate when kick sampling. Dredge in waterbodies too deep to use a D-net. If using a dredge either use an open kayak or a canoe.

Ziploc bags or sample jars are needed for specimen preservation. Labels are used to properly identify the collection site. In addition to a specimen, photos can be used for photo documentation. Where illegal access would prohibit specimen collection, a photograph might suffice. Ethanol and a plant press are used for vouchering specimens.

A datasheet will be completed for each site. Since SWIMS station ID will be recorded on the datasheet, further location information is not mandatory. However, a geographic positioning system (GPS) unit can be used to record the exact location within the stream where a SWIMS station does not already exist.

Multiple pairs of waders if sampling more than one site to speed up disinfection and in case of tears. Hips boots, safety vest with lots of pockets (surveyor vest work well). Walking sticks. Kayaks canoes (kayaks are better)

White trays, forceps, 580 and 300 micron sieves, funnels, hand lens, dissecting scope, scrap paper, pencils, and spray bottles are needed for screening benthic samples.

A Field Guide to Wisconsin Streams (Miller et al. 2014) and the laminated handout, Invasive Plants to be on the Lookout for in Wisconsin Streams, are useful identification guides.

FIELD METHODS

Setup

DNR employees will monitor assigned sites for target invasive species using methods described below. At each station, monitoring will target either upstream or downstream of the access point. Mean stream width (MSW) is an important characteristic of each stream assessment station (reach), and is used to define the length of the station for most wadable streams. The MSW is based on the mean of **10** preliminary measurements of stream width from throughout the station (within approximate station boundaries), including all types of macro-habitats. If the stream width does not vary significantly throughout the approximate station length, the 10 width measurements can be taken closer to the start of the station to save time, instead of walking the entire approximate station length. **Station length should be 35 times the MSW for streams between 2.9 m and 23 m MSW.** For streams with a MSW less than 2.9 m, a 100 m long station should be sampled, and streams greater than 23 m MSW an 800 m long station is assessed (Table 2). Number of sites sampled in each station will vary with 35 times the MSW as identified in Table 2. The number of sites on each station will be equally divided in either direction from the access point.

Table 3 Reference table identifying the station length and number of sites for each range of mean stream width

Mean stream width (MSW) (m)	35 x MSW (m)	Number of sites
< 2.9	<100	4
2.9 < 5.7	100 - 200	5
5.7 < 11.5	200 - 400	6
11.5 < 17.1	400 - 600	7
17.1 < 23	600 - 800	8

If the water level appears to be substantially (**> 0.15 m**) above normal, sampling should not occur (see below for determination of water levels). Sampling will occur if stream is close or below normal, and access is legal. Any road crossing is a legal access point. However, if the stream crosses private land you may only be in the stream up to the normal high water make, meaning no walking on the banks without permission. Once the MSW for a station has been determined, this value is used for **all** future AIS sampling, including future years when changes in riparian land use or instream habitat improvements may have caused a change in the actual stream width.

A watercraft will be used on non-wadable stations.

Note: Channel characteristics rather than the amount of precipitation in the recent past should be used to determine water level. Streams with a high proportion of ground water input may retain normal flows well into drought periods. Conversely, such streams may show little response to heavy rains, particularly if the local water table has been greatly lowered by prolonged drought. On the other hand, streams that are runoff dominated may fluctuate greatly in water level in response to short-term wet and dry periods.

On each station, sites will be equally distributed upstream and downstream for data collection, including the access point, and distinct habitat features (e.g. pool, riffle, run). If a stream does not have a well-developed pool-riffle structure, target evenly spaced areas along the station. Attention should be made in areas of disturbance such as bridges, old bridge abutments, and dams.

Monitoring within a station is quantified using a modified transect method targeting both banks and the stream bed as described below. Stations are sampled in an upstream direction and sites within stations are visually and physically examined for invasive species. Each site on a station is sampled using a modified transect. Within each station, a minimum of eight modified transects (four upstream and four downstream of access), depending on MSW, are sampled to provide an overall assessment of habitat and invasive species presence.

Data Collection

Collect data using appropriate forms on waterproof paper.

- Aquatic Invasive Species Early Detection Monitoring Stream Data Form

Voucher Collection Protocol

- Collect **photographs** of all new occurrences for verification purposes following the DNR photo guidance.
- Collect specimens of **prohibited** or unusual invasive species for vouchering. Collect about 5 intact specimens that contain all the identifying characteristics. While in the boat, store specimens in separate sample bottles or in Ziploc bags with water or a wet paper towel. Upon completion of the survey, specimens should be properly preserved. Plants should be vouchered once per week and animals should be preserved daily. See the attached *AIS Voucher Guidance*.
- Record data on the Early Detection Form.

Protocol

The following method will be used at each of the target sites (access, riffle, run, and pool, or evenly spaced if habitat variation does not exist), examine both banks and the stream bed per the specified guidelines below:

1. 2 minutes examining the right bank for riparian invasive plants.

2. 2 minutes examining the left bank for riparian invasive plants.
3. 2 minutes examining the stream bed for invasive aquatic plants/algae and invertebrates.
4. 5 minutes or less collecting macroinvertebrate samples from a cross-sectional transect of the stream bed. Sample with a dip net by holding the net frame firmly against the stream bottom and disturbing the substrate upstream (approximately a full arm's length) from the net with your feet. Dig deeply into the substrate with the heel or toe to dislodge macroinvertebrates from the streambed. Avoid kicking course debris into the net (let the macroinvertebrates wash downstream into the net). Make sure that the plume of silt that results from disturbing the substrate is flowing into the net, as this plume also contains the dislodged invertebrates. In streams that lack riffles, vegetation (twigs, leaves, grass) caught in instream snags or logjams, or riparian vegetation overhanging into the stream can be sampled. Sample by jabbing the net into the vegetation to dislodge the clinging invertebrates. The net should be inspected often to make sure the invertebrates that are being dislodged are washing into the net. If two people are collecting the sample, one person can hold the net while the other manually removes vegetation from the snag or logjam and rinses it into the net, or shakes the snags to loosen the vegetation caught so it drifts into the net. Course debris should be removed from the net, while making sure to rinse the macroinvertebrates that are clinging to the vegetation back into the net.
5. Within transects, collect all rooted vegetation and vegetation caught in logjams, snags, and vegetation overhanging from the stream banks by hand. Coarse debris should be examined and removed from the net. Place macrophytes in a sample jar.
6. Examine and rinse off small rocks, coarse debris, artificial substrates and hard substrates too large to collect, depositing or allowing all removed materials to float into the net.
7. Examine each macroinvertebrate sample using various sized sieves and a white screening tray for about 10 minutes.
8. Record species observed incidentally within each sample site, and not within targeted habitat features.
9. If target species are observed during the survey:
    - Collect up to 5 specimens of each species per station, if possible. Beware of private property and trespassing laws when identifying or collecting riparian species for vouchering.
    - Collect photographs that illustrate species and general area/habitat, if possible.
    - Beware of private property and trespassing laws when identifying, collecting, or photographing riparian species for vouchering.
10. Complete field data sheet (3600-532Ai) including:
    - Site name - access site (A), target sites (T) and incidental occurrences sites (I).
    - Land use – natural, agriculture, or urban in immediate area.
    - Geographic coordinates, if possible.
    - Species name, area, and density
        - Estimate area - 0.001 acre: 1 plant 0.01 acre: living room; 0.2 acre: baseball diamond without field; or 1 acre: football field
        - Estimate density - 1: A few individuals (1-25); 2: Many small, scattered populations (25 – 500); 3: Dense population (> 500)

- Samples collected.
- Photos should be collected at each site.
- No AIS were observed.
- If it is not possible to obtain this information, supply as much information as possible in the comments.

11. All equipment should be disinfected following the Boat and Gear Decontamination Protocol Manual Code 9183.1.
12. Depending on AIS observed, the total estimated time on each site is no more than 4 hours.

Data Entry

- Enter Early Detection form data into SWIMS once each week in the "Baseline Statewide Monitoring - Aquatic Invasive Species Early Detection Streams 2017" project.

Verification Protocol

- This document outlines the protocol for verifying invasive species. It includes links to the various forms, how to take photographs, collect vouchers, and create and edit resources of interest.

Communication

- If AIS not previously observed in a waterbody are found, follow the Department's communication protocol: http://dnr.wi.gov/lakes/invasives/AISDiscoveryCommunicationProtocol.pdf.

Voucher Preparation

- This document outlines how to voucher plants and animals, including preservation method, referred labels, and contacts.

References

Didham, R.K., J.M. Tylianakis, M.A. Hutchinson, R.M. Ewers, and N.J. Gemmell. 2005. Are invasive species the drivers of ecological change? Trends in Ecology and Evolution 20:470-474.

Hauxwell, J., S. Knight, K. Wagner, A. Mikulyuk, M. Nault, M. Porzky and S. Chase. 2010. Recommended baseline monitoring of aquatic plants in Wisconsin: sampling design, field and laboratory procedures, data entry and analysis, and applications. Wisconsin

Department of Natural Resources Bureau of Science Services, PUB-SS-1068 2010. Madison, Wisconsin, USA. http://www.uwsp.edu/cnr-ap/UWEXLakes/Documents/ecology/Aquatic%20Plants/PI-Protocol-2010.pdf

Havel, J.E., C.E. Lee, M.J. Vander Zanden. 2005. Do reservoirs facilitate invasions into landscapes? BioScience 55:518-252. (Click for PDF)

Johnson, P.T., J.D. Olden, M.J. Vander Zanden. 2008. Dam invaders: impoundments facilitate biological invasions in freshwaters. Frontiers in Ecology and the Environment 6:357-63. (Click for PDF)

MacDougall, A.S. and R. Turkington. 2005. Are invasive species the drivers or passengers of change in degraded ecosystems? Ecological Society of America 86:42-55.

Miller, M., K. Songer, and R. Dolen. 2014. Field guide to Wisconsin streams: plants, fishes, invertebrates, amphibians, and reptiles. The University of Wisconsin Press. Madison, Wisconsin, USA.

Papes, M. M. Sallstrom, T.R. Asplund, and M.J. Vander Zanden. 2011. Invasive species research to meet the needs of resource management and planning. Conservation Biology 25:867-872.

Rothlisberger, J.D., W.L. Chadderton, J. McNulty, and D.M. Lodge. 2010. Aquatic invasive species transport via trailered boats: what is being moved, who is moving it, and what can be done. Fisheries 35: 121-132.

Stevens Jr., D.L. and Olsen, A.R. 2004. Spatially balanced sampling of natural resources. *Journal of the American Statistical Association.* 99(465): 262-278.

Vander Zanden, M. J., and J. D. Olden. 2008. A management framework for preventing the secondary spread of aquatic invasive species. Canadian Journal of Fisheries & Aquatic Sciences 65:1512–1522.

Appendix A Aquatic Invasive Species Monitoring Data Form (Form 3600-532A)

Aquatic Invasive Species Monitoring Data Form Form 3600-532B (R 7/15)

Instructions: Bold fields must be completed.

Location Name	**WBIC**	**SWIMS Station ID**	**County**	**Date**	**Start Time**	**End Time**	**Total Time (hrs x ppl)**	**Collector(s)**	Contact info	**35 X MSW***

*1: <100, 2:100-200, 3:200-400, 4:400-600, 5:600-800

Step 1: Circle species that you looked for - review the laminated picture field guide and *A Field Guide to Wisconsin Streams**.

AQUATIC PLANTS/ALGAE			**RIPARIAN PLANTS**		**INVERTEBRATES**	
European frogbit	Hydrilla	Water hyacinth	Flowering rush	Yellow flag iris	Zebra/quagga mussels	Faucet snails
Yellow floating heart	Curly leaf pondweed	Water lettuce	Phragmites	Japanese knotweed	Asian clam	Chinese mystery snails
Brazilian waterweed	Fanwort	Eurasian water milfoil	Purple loosestrife	Japanese hop	New Zealand mudsnails	Banded mystery snails
	Parrot feather	Didymo		Java Waterdrop		Rusty/red swamp crayfish

STEP 2: Record the sample site, habitat, and land use. If possible, record latitude and longitude (in decimal degrees). If AIS are observe, record species name, area, and density. If possible, collect up to 5 specimens of each AIS and take photos. Include internal and external labels with **species code, waterbody name, SWIMS station ID or WBIC or lat/long, collector's name, and date**. If needed, preserve specimens with adequate ethanol and identify ethanol type on label.

Site*	Latitude	Longitude	**Habitat Type†**	**Land Use‡**	**Sub¥**	**#1 name, L/D¶, area§, density‖**	**#2 name, L/D¶, area§, density‖**	**#3 name, L/D¶, area§, density‖**	**Sample(s) collected (list/NA)?**	**Photo(s) collected (list/NA)?**	**No AIS observed**	Comments

*Miller, M., Songer, K., and Dolen, R. 2014. Field Guide to Wisconsin Streams. University of Wisconsin Press. Madison, Wisconsin. (http://uwpress.wisc.edu/books/4887.htm)

* AU: access upstream, AD: access downstream, TU1: target upstream 1, TD1: target downstream 1, IU1: incidental upstream 1, etc.
† Riffle, Run, Pool
‡ Natural, Agriculture, Urban
¥ Silt, Sand, Gravel, Clay
§ Area estimates: only one plant (.0001 ac), my living room (12'x16' or .004 ac); a baseball diamond (90' X 90' or 0.2 ac); or a football field (300'x 160' or 1.1acre). If linear use appropriate conversion of miles to acres (# of miles X 3.62 (if only on one side of the stream/road divide by 2)
‖Density ratings: 1 - a few individuals (1-25), 2 - many small, scattered populations (25 – 500), 3 - dense population (> 500)
¶L: live, D: dead

Step 3: Notify the appropr

iate DNR AIS Contact and deliver specimen, if collected (see Report Invasive Species below).
Step 4: Enter data into SWIMS. Work with appropriate DNR AIS specialist on data entry, if needed. If a photo is taken, attach it to the SWIMS record.
Step 5: Data was entered into SWIMS on _____ by _____
Step 6: Data entered in SWIMS was proofed on _____ by _____

Report Invasive Species
Contact your local DNR Aquatic Invasive Species Contact and deliver this report form, specimens, and digital photo (id available). Please do this as soon as possible – no later than 4 days after you discover the plant. For more information visit: http://dnr.wi.gov/topic/Invasives/report.html.

- Milwaukee Area – Heidi Bunk, 262-574-2130, heidi.bunk@wi.gov
- Green Bay Area – Brenda Nordin, 920-662-5141, brenda.nordin@wi.gov
- Green Bay Area – Mary Gansberg, 920-662-5489, mary.gansberg@wisconsin.gov
- Oshkosh Area – Ted Johnson, 920-424-104, tedm.johnson@wisconsin.gov
- Madison Area – Susan Graham, 608-275-3329, susan.graham@wi.gov
- Rhinelander Area – Kevin Gauthier, 715-356-5211 ext. 214, kevingauthiersr@wi.gov
- Park Falls Area – Jim Kreitlow, 715-365-8947, james.kreitlow@wi.gov
- Spooner Area – Craig Roesler, 715-635-4076, craig.roesler@wi.gov
- Eau Claire Area – Jodi Lepsch, 715-838-8385, Jodi.lepsch@wi.gov

Notes:

*Miller, M., Songer, K., and Dolen, R. 2014. Field Guide to Wisconsin Streams. University of Wisconsin Press. Madison, Wisconsin. (http://uwpress.wisc.edu/books/4887.htm)

*Miller, M., Songer, K., and Dolen, R. 2014. Field Guide to Wisconsin Streams. University of Wisconsin Press. Madison, Wisconsin. (http://uwpress.wisc.edu/books/4887.htm)