

Invasive Aquatic Plant Screening and Mapping Survey Procedures

Though many of the methods and tools used to conduct the various IAP surveys are the same, there are some distinctions among survey types that are worth noting. Invasive aquatic plant surveys generally fall into three categories: 1) IAP Screening Surveys; 2) Baseline Infestation Surveys; and 3) Infestation Monitoring Surveys. Because each survey type is suited to a specific goal or purpose, each is approached a bit differently. The following table provides an overview of the fundamentals of conducting all three IAP surveys.

TYPE	GOAL / PURPOSE	APPROACH
IAP Screening Survey	Early Detection	The target waterbody is checked on a regular basis in order to detect any new introductions as early as possible. The scope and frequency of screening surveys may be adjusted in accordance with the availability of resources.
Baseline Infestation Survey	Evaluation of a newly-identified infestation	The target waterbody is thoroughly surveyed to determine the full extent of a newly-identified infestation and is mapped using characterization codes. The resulting survey map can be used in the development of a successful control strategy.
Infestation Monitoring Survey	To monitor progress of ongoing control activities, and to identify new pioneer plants and areas of concern	The target waterbody is surveyed on a regular basis to monitor the infestation and to update the infestation map. Special attention is given to evaluating the status of current and recent control sites and to identifying new infested areas.

The primary goal of your screening survey project is to 1) visually scan as much of the existing aquatic plant habitat as possible, looking for possible invaders, and 2) to record the location of any suspicious organisms (or invasive species colonies) in a way that will ensure timely and effective follow up action.

An active, well trained, fully equipped survey team benefits your lake community in many ways. The team can rule out the presence of invasive aquatic plants annually, help educate and engage the lake community (friendly face-to-face encounters, dockside, are commonplace during plant surveys), and provide a better understanding of your lake's unique native plant communities.



Volunteers use a trunk scope during a screening survey.
Photo: Maine Volunteer Lake Monitoring Program.

Screening surveys may be conducted at various levels of detail, depending on the time and resources available to devote to the task. A Level 1 survey includes public access points and areas of concentrated boat traffic (e.g., marinas), Level 2 surveys include all Level 1 plus areas where aquatic plant growth occurs, and Level 3 surveys cover the entire shoreline and littoral zone. Surveys may be conducted over a period of time, especially Level 3 surveys on large lakes, which may require several weeks or longer to complete.

Getting Ready

You will need to obtain or create a base map for your waterbody. Simple lake depth maps are available on the VLMP Lakes of Maine website: lakesofmaine.org, and higher quality depth maps may be available commercially. Other sources of maps showing shorelines and wetland areas are available from state natural resource agencies, state geological survey offices, USGS, Google Maps, Google Earth, etc.

Invasive Aquatic Plant Survey Levels

Level 1

Points of public access and other areas of concentrated boat traffic (e.g., marinas and narrow navigation channels) are surveyed. Survey areas extend horizontally along the shoreline at least 100 meters (~300 feet) on either side of the high-risk zone, and outward along the entire length to the depth at which the bottom is no longer visible from the surface.



Level 2

Level 2 surveys include all Level 1 areas, plus all areas of the shoreline that are likely to provide suitable habitat for aquatic plants, such as shallow, sheltered coves. Floating leaved plants are often a good indicator of a rich plant community below the surface. In addition to supporting native plants, these areas may provide suitable habitat for an invader to take hold and (at least initially) hide.



Level 3

A Level 3 survey covers the entire shoreline area and littoral zone. (The littoral zone includes all areas in the waterbody where sunlight reaches the bottom and rooted aquatic plants may grow.) In the case of the confirmed presence of an invasive aquatic plant in a waterbody, it is recommended that a Level 3 survey be conducted in order to determine the full extent of the infestation.



Using highlighters, colored pencils, marking pens, etc., color in the littoral zone (The *littoral zone* includes all areas in the waterbody where sunlight reaches the bottom and rooted aquatic plants may grow.) It is also helpful to mark the location of protected areas that are likely to provide good plant habitat, inlets, outlets, and area with high boat traffic (e.g. public and private boat launches, marinas, etc.). Make copies of the base map for use by volunteers in the field.

Study invasive and native plant identification guides and keys so you will be familiar with all invasive aquatic plants of concern. Most invasive plants have native look-alikes such as variable watermilfoil (*Myriophyllum heterophyllum*) which looks like the native coontail (*Ceratophyllum* sp.), water marigold (*Bidens beckii*), and some bladderworts (*Utricularia* sp.). Milfoils exhibit a wide degree of vegetative variability, often making it difficult to distinguish between native and invasive species without assistance.

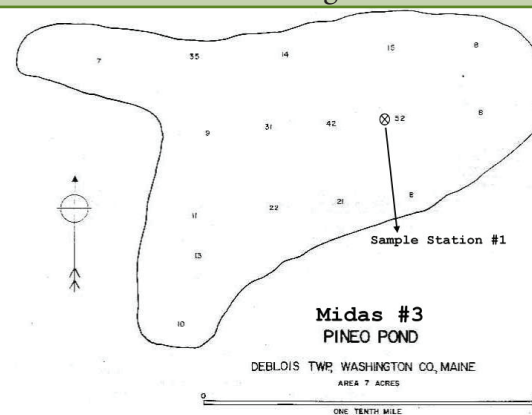
Learning the structural characteristics of the look-alike species before beginning the survey will save you a great deal of time.

Conducting the Survey

During the screening survey you are trying to visually scan as much of the littoral area as possible, looking for suspicious organisms, and recording their location. Primarily you are looking for any possible invaders, but since you are going through the process of conducting a comprehensive survey of the waterbody, you may wish to expand the scope of your screening survey to include identifying native species. Some lake groups inventory just the dominant native plant species, while others create a comprehensive list of all native species growing in the waterbody. Consideration

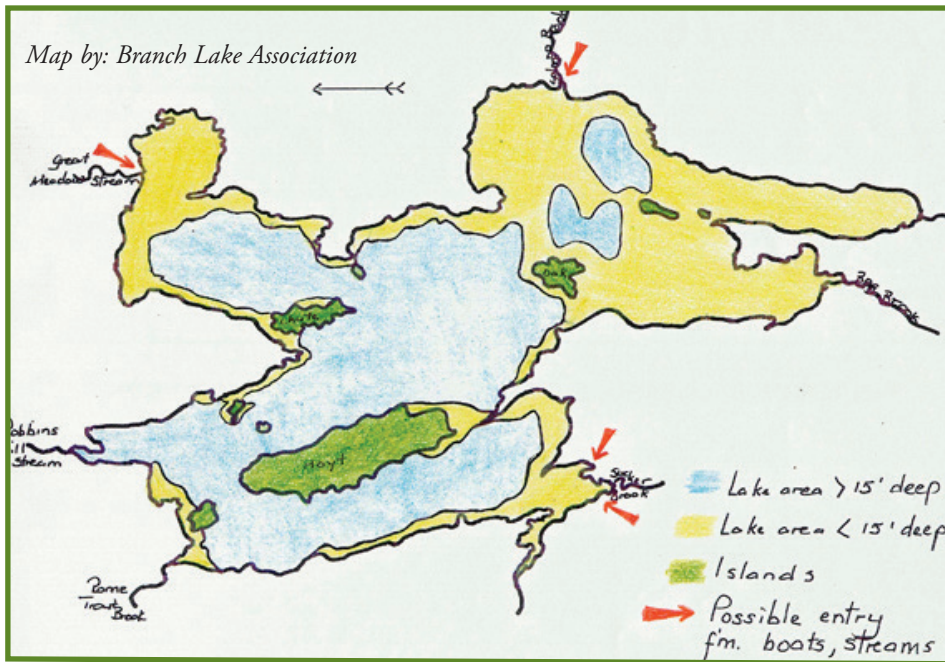
Need a lake map?

Depth maps for many Maine lakes are available on the VLMP Lakes of Maine website: lakesofmaine.org



Is your lake already mapped?

It is possible that the initial screening survey on your lake has already been done. Be sure to check with your state's environmental protection department or other lake organizations to determine if this is the case.



of the time and number of people you have available for this project should help you to determine an appropriate scope for your survey before you set out.

Surveys should be conducted when there is adequate light, and when conditions are relatively calm. Early morning conditions are often ideal because the water is calm and reflection on the water surface is minimal. It will be difficult to conduct an effective survey during windy conditions and weekends may be problematic because of heavy powerboat activity.

As far as season timing, July through September is generally the best time of year to conduct screening surveys. Prior to July, many aquatic plants are not fully developed. Emergent flowering structures are sometimes needed for plant identification and for many species flowers do not typically start to develop until July. Curly-leaf pondweed (*Potamogeton crispus*) is an exception to this rule, usually reaching maturity by late spring to early summer.

The area to be surveyed extends from the shoreline to the point at which it is no longer possible to see the lake bottom with a viewing scope. The depth of the littoral zone may actually go out further, depending on water clarity. Very clear lakes may support rooted plants at depths of 15-20 feet. Hydrilla (*Hydrilla verticillata*), one of the most notorious invasive aquatic plants, can grow in extremely low light to depths of 30 feet or more. Using SCUBA divers, an underwater video camera, or a weed weasel enables surveying to these greater depths.

The course surveyors' travel will vary in accordance with the natural variability of the littoral zone and, to a lesser extent, occasional human-placed obstacles. In areas where the lake bottom drops relatively steeply from the shore, plotting a straight course roughly parallel to the shore generally allows adequate screening of the area from both sides of the boat. Working in groups of two or more, one surveyor scans the area from the boat toward the shore, the other from the boat toward the outward extent of the littoral zone. Scanning will involve looking through the glass-like surface of the water, when weather and light conditions are optimum; or through the view scope, when they are not. In addition for scanning the area for aquatic invaders, the surveyor is generally watching for submersed hazards such as rocks, logs, and mooring lines, while the surveyor in the stern is steering the boat.

The relatively straight line of travel along the shore may wiggle and contort from time to time to conform to and accommodate shoreline features, docks, moored boats, floats, and the like. The assumed width of the littoral zone should be verified from time to time by spiking out (heading out perpendicular to shore) and visually checking the depth.

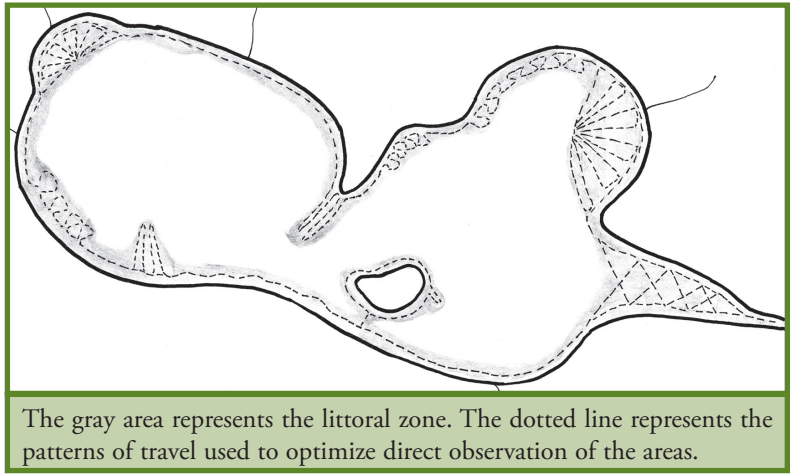
In areas where the littoral zone is wider, in shallow coves, inlets and outlets, and where the plant community is dense and complex, other course patterns including point-to-point transects should be employed. Shallow ponds may support rooted plants from shore to shore. The overall goal in selecting a proper course pattern is to optimize direct observation of the plant communities.

VOLUNTEER SURVEYORS

We recommend that all novice surveyors attend an Invasive Plant Patrol training workshop before survey activity, and that an experienced surveyor provides oversight to ensure that standard procedures and protocols are followed. IPP training and technical support is offered free to volunteers through the Volunteer Lake Monitoring Program (mainevlmp.org).

Highlighter pens or colored pencils are used to track the progress of the survey on the field map.

Surveyors obtain specimens when a closer look is needed to distinguish friend from foe. Collect a representative sample or specimen and float it in clean water in a white tray or container. Use a hand lens to view minute features and consult your identification guides and keys. If you are noting dominant native plants observed in your survey, be sure to record these as you go.



The gray area represents the littoral zone. The dotted line represents the patterns of travel used to optimize direct observation of the areas.

If you have determined that an invader has been found, mark the location using a weighted buoy and mark it on the field map. Be sure to indicate local landmarks (shoreline cottages, unusual rocks or trees, etc.) to help others re-locate the site. If you have a GPS, mark the waypoint or record the longitude/latitude coordinates. But remember, unless you have a high-end GPS unit, the accuracy may be off by 15 feet or more. Use a consistent marking code on the survey form, the plant specimen bag, the map, and the marking buoy.

If larger infested areas are encountered, places where plants and plant clusters are sparsely distributed and too numerous to mark individually, the entire infested area should be shaded in on the map. Mark the perimeter of the infested areas with a series of buoys and/or GPS waypoints.



A volunteer taking a closer look at a plant while conducting a screening survey.

Photo: Maine Volunteer Lake Monitoring Program.

Many aquatic plants (native and invasive) can spread through fragmentation so avoid disturbing plants unless a specimen is required. Specimens should be obtained by a clean cut, if possible. Scoop up any and all fragments with the leaf rake or a net.

When the survey is complete, organize your findings and consider how you are going to use the survey results. Data may be organized simply by copying and collating the documentation forms and field maps. However, to share your findings with the public, you will want to present the information in more user-friendly formats, such as a narrative report, a poster sized map, a PowerPoint presentation, etc.

Evaluating and Mapping an infestation

Knowing the current status of your infestation at any point in time is essential to developing and implementing an effective control strategy. Since even minor infestations may persist for at least several years, and most infestations persist for significantly longer, you should plan accordingly. Conducting an initial Baseline Infestation Survey and developing, activating, and supporting a sustainable Monitoring Infestation Survey program should be a critical part of your IAP action plan.

Two distinct types of surveys are required for effective IAP management: the Baseline Infestation Survey and the Infestation Monitoring Survey. Each has a specific purpose and emphasis, and the strategies for accomplishing each survey type may vary.

- The purpose of the Baseline Infestation Survey is to determine the extent of the infestation and gain a clear understanding of the unique characteristics of each infested area and use that information to develop the optimum control strategy. With a Baseline Infestation Survey the emphasis is on thoroughness. The best way

to achieve this is to conduct a comprehensive Level-3 survey and to clearly record and map all survey findings. A group that does not yet have an existing volunteer-based survey team may opt to hire professionals or trained student interns to conduct this initial baseline survey, or develop and activate a trained volunteer IAP survey and mapping team.



Surveying by snorkeling provides an excellent view of submersed plants.

Photo: Maine Volunteer Lake Monitoring Program.

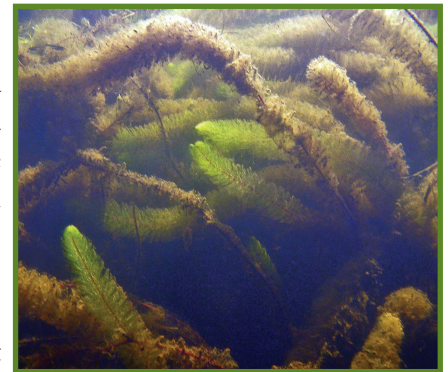
- The purpose of the Infestation Monitoring Survey is to regularly monitor (annually or more frequently) the infested waterbody to assess control activity effectiveness and detect new pioneer colonies as early as possible, in order to inform ongoing adjustments to the management strategy. With an Infestation Monitoring Survey, the emphasis is on vigilance. Possible strategies for this ongoing monitoring effort include: the development of the volunteer team, engaging the control crew in the monitoring and assessment of the control sites, engaging boaters and shoreline property owners in a buoy-marking campaign, or a combination of the above.

Much of the process involved in both types of infestation surveying is similar to conducting a screening survey. The difference being that for the infestation surveys you know there is an invader in your waterbody and that invader is the primary target of your survey activity.

Primarily you are looking for the “confirmed” invader. But since you are going through the process of conducting a comprehensive survey of the waterbody, you may wish to expand the scope of your survey to include being on the lookout for the other invasive plants that are listed IAPs in Maine.

Conducting an infestation survey

When there is a confirmed presence of an invasive aquatic plant in a waterbody, it is recommended that a Baseline Infestation Survey is conducted and the entire littoral zone is surveyed. The earlier the detection of all invasive plant populations in the waterbody, the better the chances for successful control and the greater the potential to prevent spread of the invader to other, non-infested regions of the water body.



A dense stand of variable watermilfoil, (*Myriophyllum heterophyllum*).

Photo: Lew Wetzel.

It is important to note that some invasive aquatic plants may be found at depths beyond those typical for a littoral zone. Hydrilla can grow in water depths of 50 feet. Whatever the target plant, it is always advisable that you research its growth habits and adjust your survey strategy accordingly. Spend time getting familiar with the appearance and growth habit of the target invader. Visit a known infested area to observe the plants as they appear from the boat, and carefully collect a sample for closer inspection.

As with the screening survey, obtain a base map for your waterbody and, using colored pencils or highlighters, shade in the areas to be surveyed. Provide copies of the base map for each of your infestation survey teams with assigned sections. When an IAP population is found indicate where on the map and note local landmarks (shoreline cottages, unusual rocks or trees) to help others re-locate the site. Mark the GPS waypoint or record longitude/latitude coordinates if you are using this technology. To keep the map readable, you can simply number the observation on the map and then record the location, landmarks, and/or waypoints on a separate form.

Characterize all of your IAP observations on the map and/or separate form. The chart on the next page is an example of a simple code system that can be used for characterizing each IAP observation. Record each

Figure A - Buoy illustration.
 Figure: Maine Volunteer Lake Monitoring Program.



Figure B - Marker buoys in amongst floating plants.
 Photo: Jacolyn Bailey.



The perimeter of larger infested areas may be marked with a series of weighted buoys.

characterization code under the observation number on the form. In some cases it may be appropriate to use more than one code, for example SIA/MXN would indicate an infested area where invasive plants are sparsely scattered among a dense colony of native plants.

Once a Baseline Infestation Survey has been completed, it can be used to determine management priorities and methodologies. It is crucial to continue a surveying program over the long-term in order to assess control activities and help guide management priorities going forward. This is when an Infestation Monitoring Survey should be conducted. Mapping and infestation characterization still occurs as in Baseline Infestation Surveys however the survey area consists of the known locations of infestations. Surveyors can assist control crews by marking the location of an invasive plant with weighted buoys. If it is a larger infested area where plants and plant clusters are sparsely distributed and too numerous to mark individually, they can mark along the perimeter of the site with a series of buoys.

In addition to your infestation survey teams, engage lake residents to look for invasive populations. Shorefront property owners, for example, can be issued marker buoys and use them to indicate any new IAP sightings they may happen upon while they are out on the lake.

CODE	OBSERVATION CHARACTERIZATION
IN	Individual IAP
SDP	Small Dense Patch of IAP; primarily single species stands, covering an area less than 100 square feet
MDP	Medium-sized Dense Patch of IAP; primarily single species stands, covering an area 100 to 500 square feet
LDP	Large Dense Patch of IAP; primarily single species stands, covering an area over 500 square feet (Provide an estimate of the area coverage for LDP if possible.)
SIA	Sparsely Infested Area; plants and plant clusters sparsely distributed over a wide area, too numerous to mark individually (Shade SIA on the map &/or mark outer boundaries with series of GPS way points)
MIA	Moderately Infested Area; Plants and plant clusters moderately distributed over a wide area, too numerous to mark individually (Shade MIA on map &/or mark outer boundaries with a series of GPS waypoints)
HIA	Heavily Infested Area; Plants and plant clusters are heavily distributed over a wide area, too numerous to mark individually (Shade HIA on map &/or mark outer boundaries with a series of GPS waypoints)
MXN	IAP mixed in with a significant colony of native plants (Use to modify any of the above codes.)

When the survey is complete, organize your findings and consider how you are going to use the infestation data. Data may be organized simply by copying and collating the documentation forms and field maps or by creating a report or poster that can be used to determine your control strategy and share your findings with the public.

Survey Equipment

With the exception of the boat(s), the equipment needed to conduct a screening survey is fairly simple, inexpensive, and easy fabricate. Surveys are accomplished most easily, and are safer, with two or more persons in the boat: one to paddle/steer; one to watch for obstacles, scan for the target organism(s), make observations, and record findings.

Here is what you will need:

- Small shallow-draft boat, canoe or kayak (**Large boats & motors not recommended as they make the process more difficult and destroy sensitive aquatic vegetation.**)
- Personal flotation device
- Documentation forms, pencil, and clipboard
- Base map of the survey area
- Pocket knife or snips
- Viewing scope - available commercially or easily constructed
- Depth finder or weighted measuring tape
- Zip-seal plastic bags (various sizes) and cooler; for storing specimens
- Species identification guides and keys
- Buoys to mark suspicious plant location
- Permanent marker pens - to mark specimen containers
- Magnifying glass or hand lens - for examining plant specimen structure. 10X to 20X strength are recommended.
- Small white tray or shallow plastic container (e.g., margarine tub) - for floating and observing specimens in the field
- Polarized sun glasses - greatly improve visibility under most conditions

The following items are not essential, but may be very helpful:

- Colored pencils or highlighter pens - for tracking survey progress on the map
- Long-handled net - used for catching stray plant fragments; a leaf rake can perform this task sufficiently
- Long-handled cultivator - for collecting bottom specimens out of reach
- Weed weasel - a tined tool on a rope, used in deeper water to obtain plant samples not visible from the boat.
- Underwater video camera - used in deeper water to see plants that are not visible from the boat
- Small gas-powered or electric motor - facilitates travel to survey locations and through plant-free sections of the littoral zone (**Motors should not be used in areas where there is significant plant growth.**)

View Scopes

View scopes are an essential tool for conducting screening surveys. Ripples and surface reflection may obstruct a surveyor's view of plants below: a scope penetrates through these surface disturbances allowing surveyors to see more effectively. Though scope designs vary, the best scopes are easy and comfortable to use, provide a relatively wide angle of view, and are constructed of opaque materials to shield out as much side and back light as possible. (Being relatively cheap and easy to construct is another plus!). Directions for constructing your own scopes are available online at www.mainevlmp.org.

MAINE SURVEYORS

Be sure to submit copies of all survey and mapping data to MEDEP and VLMP to ensure that this important information will be included in Maine's statewide database.

If You Find a Suspicious Plant

Following the procedures outlined below will help ensure the timely, accurate identification of your specimen. You may email us a digital photo or send us live plant material. First, however, you'll need to collect a specimen. Be very careful not to create fragments while collecting the plant specimen.

Mark the location as described in 'Conducting a Survey', above. When collecting samples from a live lake plant, please be sure not to remove the whole plant. Snip off one or two pieces of stem from the plant (roughly 8 to 12 inches long) including as many different features as you can (flowers, fruits, leaves, etc.). In the event that your plant is invasive this will help the DEP quickly locate the infestation and take proper action.

Keep your plant specimen in water, in a cool place (e.g., refrigerator). This will help keep it fresh until you are ready to photograph or ship.

IMPORTANT: Depending upon the plant, a photograph may not be adequate. We may need to see the physical specimen, so please do not discard it until you hear from us. (Be sure to keep it fresh, as described above.)

Send us Digital Photos

Taking your photos –

- ✂ Gently clean off any attached debris from your specimen.
- ✂ Float the plant in a tray of water long enough to stretch the sample out fully, with enough water for the plant to float freely. The tray bottom should be white (or clear and placed on a white surface).
- ✂ Put something in photos to show scale e.g., a ruler or coin.
- ✂ Take a high-resolution digital picture.
- ✂ The image must be in focus and show the greatest amount of detail possible. Adjust lighting to minimize glare.
- ✂ If possible, take close-ups of specific features, such as individual leaves, a single whorl of leaves, flowers, fruits or other structures.



Submitting your photos – Send the image/s by email to vlmp@mainevlmp.org. Write "Plant ID" in the subject line. Include the following information in the body of the message: your name and contact info; waterbody name and town; date the plant was collected.

Documenting your submission – Log on to the VLMP website and complete an online *Suspicious Plant Form*. This will alert VLMP staff to the fact that you have submitted photos via email, and provide us with the information needed to record your find in the statewide aquatic plant database.

Send us a Live Plant Specimen

Contact the VLMP – The staff is often out in the field during the summer, and it is important that someone be here to receive and process your plant properly.



Package your plant – Put your sample in a resealable plastic bag. Include some water to cushion it during shipping. Be sure to seal the bag tightly. Place the bag in a small box with enough packing material to prevent movement.

Include a Suspicious Plant Form – The form can be downloaded from our website at www.mainevlmp.org. If you need help finding or filling out the form, call us at 207-783-7733.

Ship your plant specimen – Plants should be shipped early in the week. Plants mailed too late may arrive on Saturday, when no one is here to process them.



Send packaged specimens to:

The VLMP, 24 Maple Hill Road, Auburn, ME 04210
You will be contacted within 72 hours of our receiving your specimen.

If you have questions regarding submitting a suspicious plant, contact the VLMP at vlmp@mainevlmp.org or 207-783-7733.