STANDARD OPERATING PROCEDURE FOR SAMPLE COLLECTION AND IDENTIFICATION OF HARMFUL ALGAL BLOOMS

WATER QUALITY

State of Utah
Department of Environmental Quality
Division of Water Quality

Revision 5.3
Effective February 2023

Foreword

Utah Division of Water Quality (DWQ) Standard Operating Procedures (SOPs) are adapted from published methods, or developed by in-house technical experts. This document is intended primarily for internal DWQ use. This SOP should not replace any official published methods.

Any reference within this document to specific equipment, manufacturers, or supplies is only for descriptive purposes and does not constitute an endorsement of a particular product or service by DWQ. Additionally, any distribution of this SOP does not constitute an endorsement of a particular procedure or method.

Although DWQ will follow this SOP in most instances, there may be instances in which DWQ will use an alternative methodology, procedure, or process.

The methodology detailed below is the protocol followed by DWQ's monitoring staff and verified by DWQ's Quality Assurance officer.

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Revision Page

Date	Revision #	Summary of Changes	Sections	Other Comments
2019	4	Combined multiple version of the HAB SOP	All	Combined and updated phytoplankton collection SOP with HAB sampling SOP, and added language about toxin analysis.
3/10/20	5	Updated language, grammar, and structure	All	Clarified and revised sentence structure and grammar throughout the entire document.
6/15/20	5.1	Added QA/QC section	11	Increased and clarified the QA/QC protocols for HABs.
4/26/22	5.2	Updated contact information	1.0	
4/26/22	5.2	Updated sample storage and preservative usage	8.0, 9.0	
4/26/22	5.2	Clarified instances for sample collection and replicate collection	9.0, 11.0	
4/26/22	5.2	Updated bloom report form	14.0	
1/13/23	5.3	Updated language and removed paper signature sheet from Appendix	7.0, 14.0	Streamline the qualification process from paper to electronic documentation
1/13/23	5.3	Clarified and updated options for reporting a bloom.	1.0, 9.0	Added the option to record presence of cyanobacteria vs bloom present. Added protocol about taking photos
1/13/23	5.3	Updated appendices	14.0	Updated Report Form and New Quick Guide
1/13/23	5.3	General updates to language and structure	All	

Table of Contents

1.0 Scope and Applicability

This document presents the Utah Division of Water Quality's (DWQ) Standard Operating Procedure (SOP) for collecting water samples during harmful algal blooms (HABs). HABs can occur when certain cyanobacteria, a type of phytoplankton, become abundant enough to change the visual and physical nature of the waterbody. A HAB is defined as an aggregation or accumulation of either toxic or potentially-toxic cyanobacteria that poses a reasonable exposure risk to the public. Although technically inaccurate, the terms "algae" and "algal" are commonly used to refer to both algae and cyanobacteria. Most water protection agencies have adopted the term "harmful algal bloom" to describe these events, and for consistency, DWQ will use the same terminology.

This SOP is followed by all DWQ monitors and is recommended as the procedure for DWQ cooperators or local health department (LHD) staff performing HAB sampling in lakes, reservoirs, rivers, or streams. Any deviations from this procedure should be documented on the DWQ field forms (**Appendix 1**) prior to sample submission to the lab.

HAB samples collected utilizing this protocol may be used to determine the following:

1. Phytoplankton taxa identification and abundance.
2. Concentrations of cyanotoxins: anatoxin-a, cylindrospermopsins, microcystins, saxitoxins and nodularins (results derived from ELISA-CAAS, ELISA test strips, and LC-MS/MS test procedures).
3. Cyanotoxin gene detection/relative concentration (qPCR).

The goal of HAB sampling is to provide results that may be used:

1. To provide LHDs with information to evaluate potential recreational health risks.
2. To provide public water systems with information to evaluate potential risks to drinking water supplies.
3. To record bloom conditions (for DWQ) for use in evaluating water quality across the state.

If sampling as a cooperator:

Prior to any sample collection, contact the DWQ HAB Coordinator Hannah Bonner (hbonner@utah.gov, 385.258.6057) or Ben Holcomb (bholcomb@utah.gov, 801.536.4373). DWQ will coordinate efforts to identify sample types, quantity, and locations appropriate to HABs on a case by case basis. Additionally, the DWQ coordinator will determine if adequate funding is available to cover HAB sampling costs until completion of the bloom.

Cooperators should not assume that DWQ will pay for phytoplankton or cyanotoxin samples without prior notice and coordination.

Prior to any sample collection, DWQ will coordinate with the sample testing lab to ensure:

1. The lab is prepared for an additional workload
2. The appropriate samples are collected
3. The correct level of analysis is conducted
4. The expected reporting time is specified

DWQ's methodology for HAB sampling is based on a targeted, high concentration sample. These methods are not to be used to quantify or generalize abundance of cyanobacteria cells (cells/mL) or concentrations of cyanotoxins (µg/L) in the waterbody as a whole. Instead, these methods are designed to reasonably quantify the highest potential for exposure at high recreation sites.

2.0 Summary of Method

The primary purpose of this method is to characterize the nature of the bloom in the context of plausible exposure pathways, especially blooms with potential to harm people and animals. Therefore, sampling activities should target areas where there is a reasonable maximum risk of human-cyanotoxin interaction and exposure.

> ***The "Reasonable Maximum" area on a waterbody is the area with the highest visible bloom accumulation at the location with the highest recreational potential.***

The justification for this technique is to report on the highest potential for human exposure. This technique, along with the consideration that blooms are highly influenced by wind and current, allows DWQ to make recommendations based on the reasonable maximum locations that are protective of human health and the environment. Prior to sampling, explicit site locations can be found in a project-specific SAP, where a site list identifies public access locations such as beaches, piers, shoreline access, etc. Therefore, the site conditions on the day of the sampling will be the determining factor for the reasonable maximum location.

Samples should be collected in areas of the lake where there is evidence of a potential bloom at the time of sample collection. A bloom is typically a large increase in cyanobacteria material. Due to the uncertainty and rapidly changing conditions, generally a sample will be collected even if it does not meet the formal definition of a bloom. In this instance, the visible presence of cyanobacteria may be marked "present" vs. "bloom".

There are two sampling types DWQ uses to collect samples based on the type of bloom. If the bloom is accumulating on the surface of the waterbody, a surface scum sample is collected to target the top 1-2 inches of the water column. If the bloom is concentrated in the water column, DWQ uses a composite sampling technique. Generally, when a surface sample is collected, a composite sample is also collected to better capture the extent of the bloom. However, cooperators should verify with DWQ to ensure that there is funding for both sample types.

In conjunction with water sampling, a completed field form (**Appendix 1**) is requested to accompany all samples. This field form includes visual estimates of bloom area, descriptions, site details, GPS coordinates and weather conditions. This form may also be completed using DWQ's Survey123 form. Conditions are also documented by taking photos. Routine collection performed by DWQ should also be accompanied by multi-parameter sonde (in-situ) measurements. Consult DWQ's multi-parameter sonde SOP for further information.

This SOP details the procedure for collecting HAB samples in general. For specific information regarding response style sampling, please contact the HAB Coordinator.

3.0 Definitions

DWQ	Division of Water Quality
Field Blank	Performed after equipment decontamination from a previous site using deionized water. Blanks are collected and preserved, stored, handled, and analyzed identically to other samples.
Field Replicate	Two composite samples taken from adjacent undisturbed locations. Replicates are collected and preserved, stored, handled, and analyzed identically to other samples.
HAB	Harmful algal bloom
L	Liter
LHD	Local Health Department
m	meter(s)
mL	milliliter(s)
Reasonable Max	The area with the highest visible bloom accumulation combined with the area with the highest recreational potential (inherent in DWQ's site list).
Site ID	DWQ's unique code for identifying locations
SOP	Standard Operating Procedures
UDEQ	Utah Department of Environmental Quality

4.0 Health and Safety Warnings

Algal blooms may contain toxin-producing cyanobacteria. Samplers should wear elbow/shoulder length gloves, eye protection (such as goggles), and waders/boots during sampling.

Do not ingest water or allow the water to come into contact with exposed skin. Avoid inhaling spray caused by boats, wind or other water surface disturbances. If these conditions are present, wearing a face shield may reduce the risk of inhaling large droplets.

Hands should be washed thoroughly with soap and water after sampling and before eating or drinking. Waders/boots should be rinsed of algal material using tap water (not lake water) before storage. Use of alcohol is not advised as it may release toxins.

It is important that monitors also watch for and report any symptoms of exposure to cyanotoxins, which can occur immediately to several days following exposure. Potential symptoms include:

- Liver toxicity – may take hours or days for symptoms to appear in animals and humans; they include abdominal pain, diarrhea, and vomiting.
- Kidney toxicity – acute, severe gastroenteritis (including diarrhea and vomiting).
- Neurotoxicity – symptoms often appear within 15 to 20 minutes of exposure; animals may experience increased salivation, weakness, staggering, convulsions, difficulty breathing, and in severe cases, death. Humans may experience numb lips, tingling fingers and toes, or dizziness.
- Respiratory problems – runny eyes and nose, sore throat, and asthma-like symptoms.
- Skin irritation – visible rash, hives, or blisters, especially under clothing, swimsuits, or wetsuit.

If any of these symptoms occur, monitors should leave the impacted area and seek medical treatment immediately. Also, these circumstances should be documented and filed on Form 122 by your employer within 7 days.

Field personnel should take appropriate precautions when operating watercraft and working on, in, or around water. All boats should be equipped with safety equipment such as personal flotation devices (PFDs), oars, air horn, etc. Utah's Boating Laws and Rules shall be followed by all field personnel.

Field personnel should be aware that hazardous conditions potentially exist at every waterbody. If unfavorable conditions are present at the time of sampling, the sample visit is recommended to be rescheduled. If hazardous weather conditions arise during sampling, such as lightning or high winds, personnel should cease sampling and move to a safe location.

5.0 CAUTIONS

When operating a boat, hidden hazards exist underwater. Boat operators should take caution when sampling to avoid equipment damage.

Adverse sampling conditions could increase the likelihood of equipment damage. Boat operators should take extra caution when sampling under adverse conditions. If conditions are unsafe, reschedule sampling.

6.0 INTERFERENCES

Care should be taken not to include the lake bottom materials that may be disturbed and suspended if wading.

Minimize duckweed, sediment, etc. in the sample. High turbidity or dense aquatic vegetation may also interfere with sample analysis.

Samples should not be exposed to elevated temperatures during storage (i.e., do not store in a hot vehicle outside of a cooler).

Be sure sample equipment is thoroughly rinsed between sites of residue HAB material.

7.0 Personnel Qualifications/Responsibilities

DWQ personnel performing harmful algal bloom sampling must be familiar with sampling techniques, safety procedures, proper handling, and record keeping. Samplers are required to attend a refresher training held each spring/summer to review procedures and techniques in this SOP. New staff will be trained in the field and lab by DWQ personnel, which fulfills the training requirements as per DWQ's QAPP.

Cooperators are held to the same level of quality as DWQ personnel. Cooperator samplers must be familiar with sampling techniques, safety procedures, proper handling, record keeping and are required to attend annual refresher training on procedures and techniques in this SOP. New staff will be trained in the field and lab by DWQ personnel. It is permissible for coordinators who have attended DWQ's training within the last year to train their own staff directly without DWQ's participation (e.g. seasonal workers) as per DWQ's QAPP.

DWQ will maintain a record of all DWQ training dates and personnel in attendance.

Due to the immediacy of data needs for recreational health, cooperative samplers may not have attended an in person training, but will have read this SOP, reviewed the procedures with the Program Coordinator and watched a sampling video.

8.0 Equipment and Supplies

- ❑ Copy of this SOP
- ❑ Protective equipment:
  - ❑ extended gloves, safety goggles, face shield, chest/hip waders, and PFD
- ❑ One of sample bottle, as requested:
  - ❑ amber 250 mL glass toxin bottle (microcystin, cylindrospermopsin toxins),
  - ❑ amber 250 mL glass toxin bottle with sodium bisulfate preservative (anatoxin-a, saxitoxin)
  - ❑ phytoplankton bottle - clear or amber 250 mL plastic bottle
- ❑ ½ gallon plastic bottle, for collecting composite sample
- ❑ Clean 2 gallon or greater HDPE bucket for compositing samples
- ❑ Tablet with camera
- ❑ GPS if not included with tablet
- ❑ Pencils and sharpies
- ❑ DWQ field form (**Appendix 1**) or Survey123 form on phone/tablet
- ❑ Cooler with ice
- ❑ Chain of Custody forms
- ❑ Gluteraldehyde, 25% preservative

9.0 Procedure

Sampling for HABs has two sections: visual assessment and sample collection. The visual assessment is done at every location on the waterbody and influences if and where samples are collected. Sample collection occurs only at the location determined to be the "reasonable

maximum" location of the HAB on the waterbody. If no bloom is observed, then no sample bottles will be collected.

The only exception to this is if this location is on advisory due to high toxin levels and/or high cell count levels within the last two weeks. If this is the case, it is considered "response sampling" and sample bottles should be collected to verify that the bloom has dispersed. If no bloom is present, this sample should be taken from the same location as the previous sample.

If there are any questions on when or where to sample, contact the HAB Coordinator.

Note: A sampler may also take a phytoplankton sample only at locations where there is evidence of phycocyanin present, even if no bloom is observed and no response sampling is occurring. See project specific SAP for more details.

9.1 Visual Assessment

Due to the varied nature of HABs, a visual assessment of the bloom should be conducted prior to sample collection. The visual assessment informs whether a set of bottles should be collected. A visual assessment is completed by following DWQ's field form (**Appendix 1**). This form may also be filled out electronically using Survey123.

1. Fill out DWQ field form to include:
    a. Sampler name
    b. Location:
        i. Include: Waterbody, access point and GPS location
    c. Date and Time
    d. Cyanobacteria presence: (Present / Bloom / No cyanobacteria present)

Note: Select "Bloom" when visible surface scum is present or water clarity is affected by cyanobacteria.

        i. Location of cyanobacteria: (surface / water column / both)
        ii. Colors: (green, blue, brown, white, etc.)
        iii. Appearance of bloom: Spilled paint, grass clippings, pea soup, globules, etc. (See photos in **Appendix 2**).
        iv. Extent of bloom: (in ft^2)
    e. Samples collected: (y / n),
        i. if yes, select type/s (surface / composite / both)
    f. Weather conditions: (wind direction, wind speed, cloud cover, etc.)
    g. Comments: (i.e: high recreation, fish kill, increase in accumulation from last visit, etc.)
2. Take photos of bloom. Since HABs are very visual, photos can be very beneficial to help depict the conditions.
    a. Landscape – photos including a horizon and as much of the bloom as possible. This should be taken holding the camera horizontally.
    b. Closeup – take photo within a few inches of the bloom – be sure that it is in focus
    c. Shoreline or anything else of note – often the bloom is pushed up against the shoreline, different colors of decomposing material, etc.

3. Take field measurements using a multiparameter sonde and phycocyanin readings, if possible. This is protocol for DWQ staff.
4. Send photos and form to the DWQ HAB Coordinator as soon as possible. When using Survey123, be sure data is "submitted" when in cell service or on WiFi.
5.

9.2 Sample Collection

9.2.1 Determination for Sample Collection

Below are cases in which sample collection will occur:

1. Only one monitoring location on the waterbody:
    a. If a bloom was observed in the visual assessment, then samples will be collected.
2. Multiple monitoring locations on a waterbody
    a. If multiple locations have visual bloom material, sample at the location with highest visual accumulation.
    b. Utah Lake is a special case due to its large size. Collect samples from each region that has a visible bloom.
3. If the sample is requested due to advisory status
    a. Samples will be taken regardless of a visible bloom. When no bloom is visible, collect the sample from the area previously collected.
    b. If an advisory is posted at only one area of the waterbody, multiple samples may be collected from both the advisory location and an additional location containing a bloom that is not under advisory. (Seek guidance from the HAB Coordinator in these instances)..

9.2.2 Sample Collection Overview

There are two types of HAB samples: a surface scum sample and a composite sample.

Surface Scum Sample: Select this method only if the bloom forms a concentrated algal mat, scum or large clumps on the surface (top 1-2in) of the water.

- Targeted - sample
- collected directly from the water surface (top 1-2in)

Composite Sample: Generally, collect this type anytime a sample is collected. If a surface scum is collected, collect a composite sample also.

- Elbow-depth integrated - sample
- 3x bottle immersion from elbow depth to the surface, combined in a bucket

A sample includes a set of a phytoplankton taxa bottle and cyanotoxin bottle/s. Additional bottles may be included as requested by the HAB Coordinator. When both types of samples are performed, two sample sets should be collected.

9.2.3 Surface Scum Sample Procedure

If the bloom contains a concentrated algal mat or scum on the surface of the water, perform a surface grab sample from the center of the bloom with both toxin and phytoplankton bottles (See **Figure 1**).

1. Label bottles with sample code, date, time, site ID and description, initials.
    a. Sample code: Waterbody-Instance-mmddyyyy-sample type (S or C). **See Appendix 4.**

Note: label the accompanying composite sample bottle the same, except for the sample type distinction.

2. Put on protective gear (gloves, waders, etc.)
3. Target the highest visual accumulation area
4. Tilt the bottle parallel to the water surface to capture the top 1-2 inches of the surface water scum. If there is any preservative in the bottle, be careful not to invert the bottle.

Note: For thick mats, you may need to help push the material into the bottle. The precise locations of these samples may be determined by the bloom extent and water uses for that particular waterbody.

5. Immediately store samples in the cooler on wet ice or ice packs.

Note: This method, although generally used for shore sampling, can be used to collect samples from a dock or a boat.

9.2.4 Composite Sample Procedures

If a surface scum sample was taken or the bloom is concentrated only in the water column, a composite sample is collected. This sample is a composite of 3x integrated samples collected 10 ft apart, and combined in a bucket. This sample type may be collected near-shore and in open water, collecting both toxin and phytoplankton bottles (See **Figure 1**).

1. Label bottles with sample code, site ID and description, date, time, initials
    a. Sample code: Waterbody-Instance-mmddyyyy-sample type. See **Appendix 4**

Note: label the accompanying surface scum sample the same, if collected, except for the sample type distinction.

2. Put on protective gear (gloves, waders, etc.)
3. Triple rinse any reusable sampling equipment (bucket and ½ gallon transfer bottle) away from the sampling area.
    a. Triple rinse by filling up the sampling container half full of site water, agitating, and emptying the container 3 times. The phytoplankton and glass bottles SHOULD NOT be rinsed.
4. Carefully wade into the waterbody until knee deep (to ensure sufficient depth of collection) and avoid collecting sediment stirred from the bottom of the waterbody.

5. Remove the lid of the ½ gallon plastic transfer bottle and carefully dip the inverted bottle beneath the surface of the water to elbow depth, revert the bottle and slowly bring to the surface, evenly sampling as much of the water column as possible.
6. Pour contents into a triple rinsed bucket.
7. Walk 10 feet in one direction (paralleling the shoreline) from the first sample collection point to grab the second subsample (see **Figure 2**).
8. Pour contents into the bucket
9. Walk another 10 feet to grab the third subsample, pouring it into a bucket after each sample.

Note: Take extra care when paralleling the shoreline to minimize disturbance of the bottom sediments (i.e. do not sample the kicked up sediment plume).

10. Return to shore and mix the samples by agitating the bucket
11. Pour water contents from the bucket into the toxin and phytoplankton bottles (See **Figure 1**) or using clean bottles, dip them into the bucket to fill the bottles..
12. Immediately store the samples in a cooler on wet ice or ice packs.

Note: This method can be altered to collect sample bottles from a dock or a boat. After rinsing equipment, lay on the dock or boat, facing the water, to collect the sample from elbow depth to the surface. Move roughly 10 ft in any direction (on the boat or dock) to collect the second and third subsamples in the same way as the initial sample.

9.3 Sample Processing

1. For samples to be delivered to a lab, fill out the appropriate chain-of-custody form, see project-specific Sampling and Analysis Plan.
2. Samples must be kept in a cooler on wet ice, or refrigerated in dark conditions until delivery to the lab for analysis.
3. Submit cyanotoxin samples within 48 hours.
    a. If the samples are to be stored for more than 48 hours, place the glass jars in the freezer until delivery. Be sure the jar is only about half full to ensure the jar does not break.
4. Submit phytoplankton bottles to PhycoTech, Inc. within 24 hours.
    a. If samples are to be stored for more than 24 hours, preserve samples with glutaraldehyde, 25%. Using a dropper, add 1 mL glutaraldehyde / 100mL sample and store in a dark, cool (< 25°C) location. *(i.e. 2.5mL for a 250mL sample)*
    b. Mark preservative on the label.

10.0 Data and Records Management

All data recorded in the field should be reviewed for completeness before leaving the sample site. Before delivering samples to a laboratory, ensure that all lab sheets and chain-of-custody forms have been filled out correctly and completely, and sample information is consistent with bottle labels. For cyanotoxin samples, pay particular attention that the correct toxin is indicated on the Chain of Custody.

Phytoplankton samples will be identified to the lowest possible taxonomic level (generally species) and enumerated, as negotiated with one or more contracted laboratories. Until further notice, phytoplankton will be analyzed by PhycoTech, Inc.

Cyanotoxin samples will be analyzed by one or more contracted laboratories using ELISA-CAAS and LC-MS/MS procedures to determine the presence and concentration of specific toxins.

Data is returned to DWQ and populated in a spreadsheet along with the cyanotoxin data. This spreadsheet is shared with cooperators and LHD's to aid in advisory decisions.

All field data will be reviewed by the DWQ monitoring field lead for accuracy of site ID's and completeness. All laboratory data will be received by the HAB Coordinator and evaluated for accuracy using the available lab-QC results and field-sample data-flags.

11.0 Quality Assurance And Quality Control

QA/QC procedures for HAB monitoring are slightly modified from DWQ standard sample collection procedures due to the episodic nature and high spatial variability of suspected blooms. As described earlier and when required, HAB-samples will be collected from targeted areas representative of the reasonable maximum risk of human-cyanotoxin interaction and exposure, notably the interior of a surface-scum or upper water column bloom.

Since action levels for many cyanotoxins are in the low-ppb range, and since algal blooms can strongly affect the concentrations of other constituents in the waterbody (e.g. dissolved and particulate organic matter), key sample-QC concerns involve (i) detection of background contamination, and (ii) ensuring the accuracy of low (5 to 20 ug/L) cyanotoxin concentrations from diverse sample matrices. For most laboratories, DWQ requests that laboratories report analytical details equivalent to a Level II data package for all cyanotoxin results. Of primary interest to the DWQ-HAB program are results from laboratory method blanks (also referred to as 'laboratory reagent blanks') and sample matrix spikes (aka 'lab-fortified sample matrix') for each analytical batch, including any result-specific data-flags that indicate that the analysis may be outside control limits.

Because of the high sample-analysis cost and high spatiotemporal variability of suspected blooms, field replicates should be collected for approximately 5% of composite samples (*note: not the surface-scum sample*), and field blanks may be collected monthly or as detailed in a project-specific sampling and analysis plan (SAP). When possible, i.e. when project-resources and analytical-sampling equipment are available, additional split-samples may receive lower-level field-spikes to quantify the analytical accuracy of reported cyanotoxin concentrations and to demonstrate low-levels of matrix interference.

Field replicates should be collected from bloom sites that have a visual bloom of about 50ft² or greater to avoid sample disturbance from the initial collection. Collect a sample following the same protocol as the initial sample and make note of any differences between sample appearances.

12.0 References

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Proceedings of the interagency, International Symposium on Cyanobacterial Harmful Algal Blooms (ISOC-HAB): State of the Science and Research Needs. Available at: www.cdph.ca.gov/HealthInfo/environhealth/water/Documents/BGA/ISOCHABdocument.pdf

Related DWQ SOPs

Standard Operating Procedure for Calibration, Maintenance, and Use of Multiparameter Water Quality Sondes

13.0 Figures

Figure 1: HAB Sample Bottles

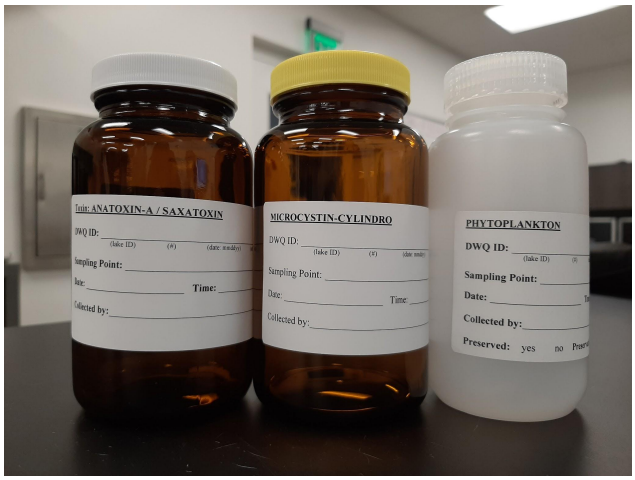


Figure 2: Subsample locations for depth-integrated composite sample

14.0 APPENDICES

Appendix 1: Bloom Report Form

Utah DWQ Cyanobacteria Bloom Report Form

Recreation Season 2023

Fill in all information, as applicable

UTAH DEPARTMENT of ENVIRONMENTAL QUALITY
WATER QUALITY

Sampler Name:_____

Contact Information (email/phone):_____

Organization:_____

Waterbody:_____

Site description/ID:_____

GPS Coordinates (latitude/longitude):_____

Sample Date:_____ Sample Time:_____

Cyanobacteria Observed?

Note: Select "Bloom" when surface scum is present or have visible reduction in water clarity due to cyano.

- ☐Present
- ☐Bloom
- ☐No cyanobacteria observed

Estimated Bloom Extent (ft^2):

- ☐1-10
- ☐10-50
- ☐50-200
- ☐>200

Location in Water Column:

- ☐Surface Only *(top 1-2in)*
- ☐Water Column Only
- ☐Both Surface and Water Column

Sample Type Collected (*select all that apply*):

- ☐Surface
- ☐Composite

Bloom Colors Observed (*select all that apply*):

- ☐Green ☐Rust
- ☐Blue ☐Brown
- ☐Red ☐White
- ☐Milky ☐Yellow
- ☐Purple ☐Other:_____

Material Present (*select all that apply*):

- ☐Spilled Paint
- ☐Grass Clippings
- ☐Green mats
- ☐Globules
- ☐Pea soup
- ☐ Cylindrical nodules
- ☐Decaying Bloom Material
- ☐Other: _____

Additional Comments (*wind speed/direction, recreational activity, nutrient inputs, fish kill, etc.*):

Please Take Pictures: Landscape (to show extent) & Close up (to show bloom material)

Please contact Ellen Bailey ASAP to coordinate sample submission. Submissions may be limited due to priority or lab capacity. **Samples need to be kept cold and in the dark.**

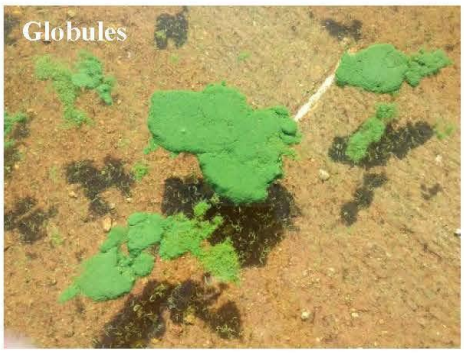
Send Pictures and form to Ellen Bailey via email: ellenbailey@utah.gov or text 407-310-8883.

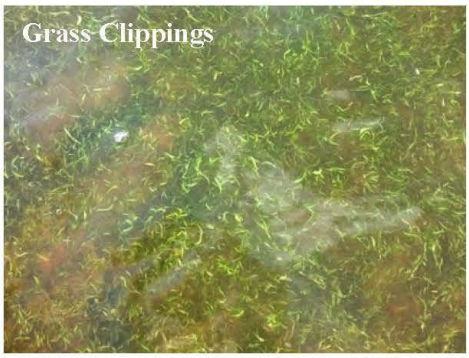
Appendix 2: Cyanobacteria Identification Guide

Identifying Harmful Algal Blooms (HABs)

See below for examples of different types of HAB blooms

- In general, the water will have a bright green hue and lack water clarity
- Typically blooms accumulate along shorelines, but can persist in the open water
- At times, blooms may not be visible at the surface. Cyanobacteria may move or disperse depending on temperature, wind and weather.





Commonly Misidentified as Harmful Algal Blooms (HABs) – NOT HABs

Using a stick test can help distinguish between filamentous algae and cyanobacteria (HAB).

1. Run a stick through the bloom
2. If the stick looks like it has been in a can of paint, it is likely a HAB.
3. If the bloom hangs off in filaments, or thin hairs, it is likely filamentous green algae and not a HAB.

Duckweed can make the surface of the water look bright green. On closer inspection you can see individual leaves of the duckweed. This is not cyanobacteria.

Appendix 3: Quick guide sampling flow

UTAH DWQ'S QUICK GUIDE TO HAB SAMPLING

Is there a HAB present?

- Look for indicators of a harmful algal bloom (HAB), particularly in areas of high recreation use.
- Use cyanobacteria reference guide (watch out for commonly misidentified algae and plants).
- **If HAB is found, contact DWQ to coordinate potential sample collection.**

HAB Present:

Determine Sample Collection Area and Sample Type:

- Fill out the HAB Survey 123 App or Datasheet. **Take pictures!**
- Find the area of highest bloom accumulation at the site to take a sample.
- Only take a sample where bloom material is the most dense.
- Determine which sample type(s) to take. Sample types are **Surface** and **Composite.**

No HAB Present:

- Fill out the HAB Survey123 App or datasheet.
- Pictures are not necessary, but can be helpful if there are other algae present.
- Only take a sample if it was specifically requested, such as when the site is on advisory.

Sample Types:

Surface Scum (targeted sample):

- Collect this type only when surface scum or heavy bloom material is in top 1-2 inches.
- When taking this type, also collect a composite sample.

Composite Sample (depth-integrated sample):

- Collect this type when bloom is dispersed throughout the water column.
- Also collect this type after a surface sample is collected or on advisory when no bloom is present.
- If you are unsure a surface bloom is present (i.e. it is mixed throughout the water column and surface) then take a composite sample only.

Label Bottles for Collection:

- Sample set for each type of collection includes both a plastic and glass bottle.
- Use a sharpie to fill in the label – be sure to note which samples are Surface (S) and Composite (C).
  - Sample code: Check with DWQ for this ID, also provided if using Survey123.
  - Sampling Point: Site description and MLID, if known.
  - Date / Time / Initials

Collect Surface Scum Sample:

- Fill sample bottles directly from the lake/reservoir, scooping bloom material into the bottle.

Store all samples on ice.

Samples need to be submitted within 24 hours of collection.
Text/email datasheets and photos as soon as possible

Collect Composite Sample:

- Collect samples from dock, boat or knee-depth.

1. Triple rinse bucket and half-gallon bottle with site water
2. Invert ½ gallon bottle below the surface to elbow depth. Tip bottle up and slowly bring back to the surface until the bottle is full.
3. Pour ½ gallon into composite bucket.
4. Repeat steps 2 and 3, collecting 10 ft apart, for a total of 3x pours into the bucket.
5. Fill sample bottles with water from bucket.

Coordinate data and sample submission with Monitoring Coordinator Ellen Bailey:
ellenbailey@utah.gov, 407-310-8883

Appendix 4: Sample Labeling

Unique Code

During sample collection, a unique code will be assigned to each sample as part of the data record.
If unsure of the code, leave blank and check with HAB Coordinator or monitoring lead.
This code is given in Survey123, if using this App.

Sample ID: Waterbody - instance - date - sample type

- **Waterbody** is usually the first 3 letters of the waterbody name
- **instance** default is "1". Increases incrementally if samples are collected at multiple locations around the waterbody
- **date** - mmddyyyy
- **sample type**
    - **S** for Surface sample or
    - **C** for Composite sample

Example: For a surface and composite sample collected on Utah Lake on 10/11/22

- UTA-1-10112022-S
  AND
- UTA-1-10112022-C