National Park Service
U.S. Department of the Interior

Lake Mead National Recreation Area

Lake Mead NRA Recreation Suitability: Guidelines for Water-Based Recreation

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Lake Mead and Mohave Significance

Essential In Sustaining the Urbanized SW US

Stores over 28,800,000 acre feet – Almost Twice CR Annual Avg
Over 6,000,000 Visitors Annually – Lake Mead Alone – 8th
Over 1,400,000 Visitors Annually – Lake Mohave – Top 15%
Recreational Industry – Annually $479 million Lake Mead, $200 million Lake Mohave – Batker, et. al. 2014
Drinking water for more than 25 million people
Designated Critical Habitat for Razorback Sucker
Significant Wildlife Habitats: >33 Peregrine falcon territories, >120 wintering Bald Eagles, >1,000 desert bighorn sheep
Power Generation for more than 1.4 million households
Irrigate More than 2.5 million acres; >90% lettuce; >66% winter vegetables

Lake Mead Ecosystem Monitoring Workgroup Purpose Statement

mutual interest in understanding and protecting the ecosystems of Lake Mead and Lake Mohave and their interrelated components. Of particular interest is protecting and enhancing the water quality of Lake Mead for public and municipal water supply, aquatic life, wildlife, recreation, and other beneficial uses

Nation's First National Recreation Area - 1964

NPS Organic Act

"to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such a manner and by such means as will leave them unimpaired for the enjoyment of future generations"

Lake Mead NRA Legislation

"preserve, develop, and enhance the recreation potential, and in a manner that will preserve the scenic, historic, scientific and other important features of the area . . . general recreation use, such as bathing, boating, camping and picnicking"

Lake Mead NRA Mission Statement

"We provide diverse inland water recreation opportunities in a *spectacular desert setting* for present and future generations"

By Metrics of Applicable NDEP Standards, Visitation, Visitor Satisfaction Surveys, And Anecdotally . . Thanks to Efforts of Many Local, State and Federal Agencies – That Healthy and Pleasing Recreational Environment Has Consistently Been Provided

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Summary of Water Quality Analysis Relative to Water Based Recreation

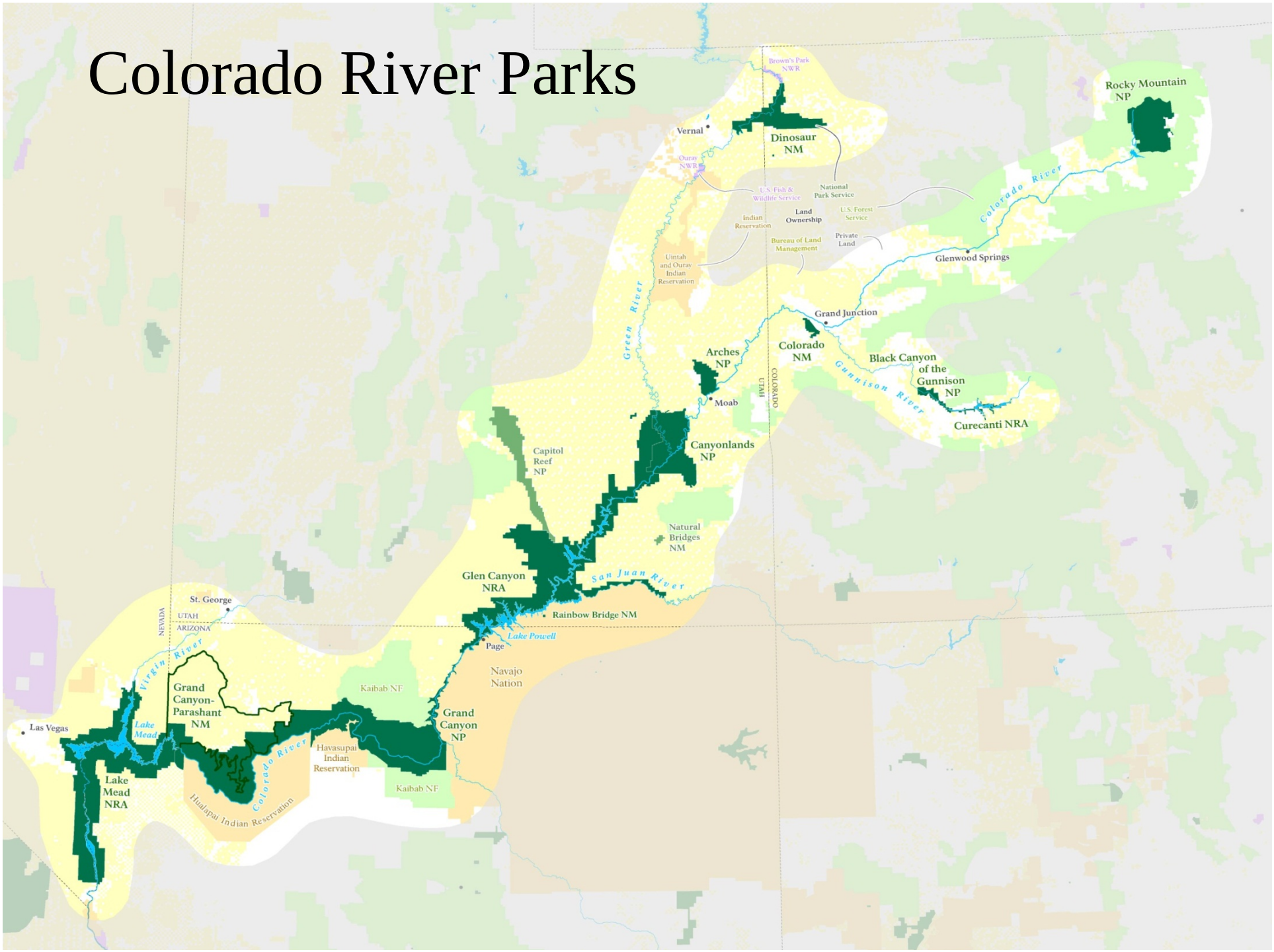
USGS 2012 Circular 1381 Found:

- Lakes Mead and Mohave scored well within the good category relative to parameters for recreational waters set forth within the EPA National Lakes Assessment.
- Only 0.6 percent of 649 bacterial samples from 2003 through 2010 exceeded acceptable standards for E. coli indicator bacteria.
- Chlorophyll *a* levels from 2002 through 2010 were well within Nevada state standards published to be protective of the existing high water quality of Lake Mead.

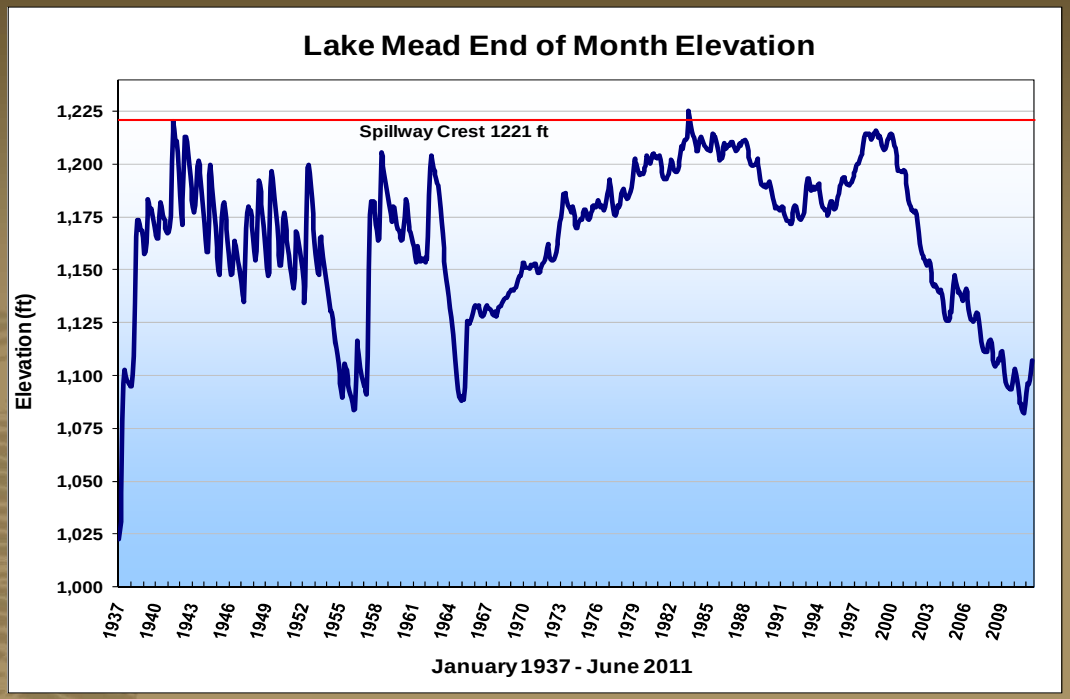
By all standard measures utilized to characterize water quality for a recreation experience and setting, both Lakes Mead and Mohave provide outstanding water quality

Diverse opportunities in an Outstanding Recreational Water Environment: Safe, Healthy, Aesthetically Pleasing

Colorado River Parks



Changing Conditions



Lowering Lake Levels

Climate Change

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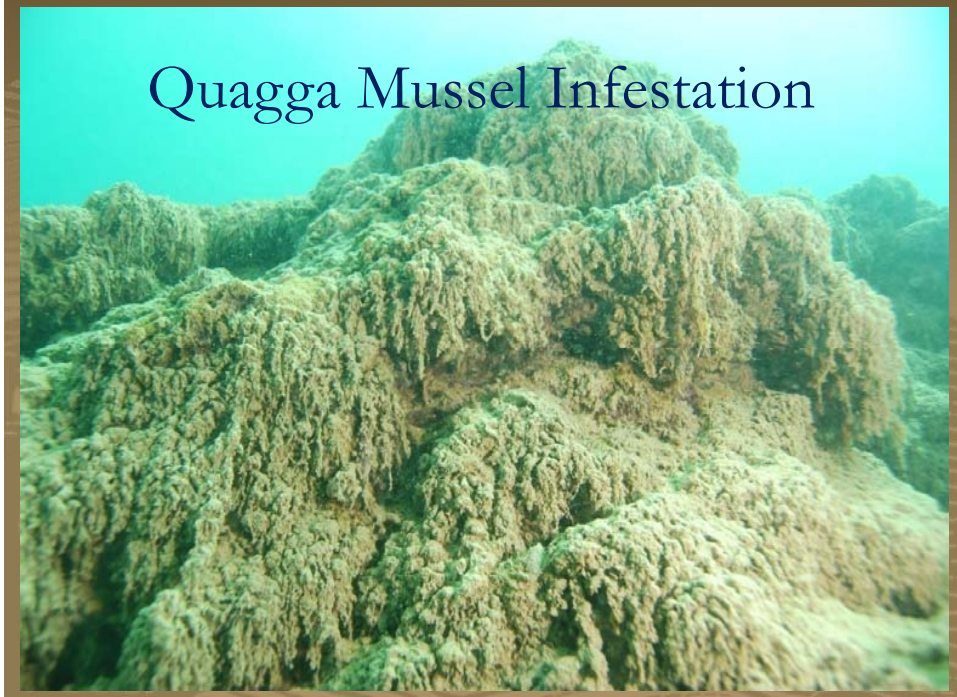

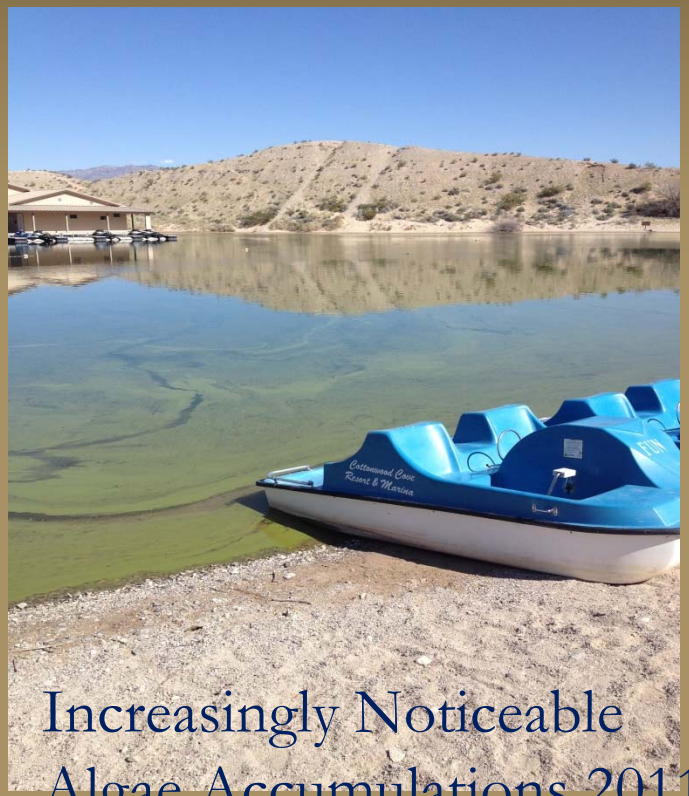

Increasingly Noticeable
Algae Accumulations 2011-2014

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- Emerging Threats to Recreational Environment -

Potential Quagga Mussel Impacts
Potential Low Water Impacts
Low Water/Quagga/Climate Change
Synergistic Effects
Changing Visitor Use Patterns
*Anecdotal Indicators – "More reports of unusual conditions"
First - Lake Mohave 2011-2014
Lake Mead 2014-2015 fall/winter

Be Prepared With Rapid
And Appropriate Management for
Response to Changing Conditions
Related to Providing a Safe,
Healthy, and Pleasing
Recreational Environment

EPA National Lake Assessment (2012)

Suitability for Recreation – Chpt 4

Indicators: Algal Toxins, Fish Contaminants (Hg)
Pathogens

World Health Organization: Guidelines for Safe Recreational Water Environments (2003)

"Safe, Healthy, and Aesthetically Pleasing"

Above: Plus Aesthetics: Debris, Scums, Alga

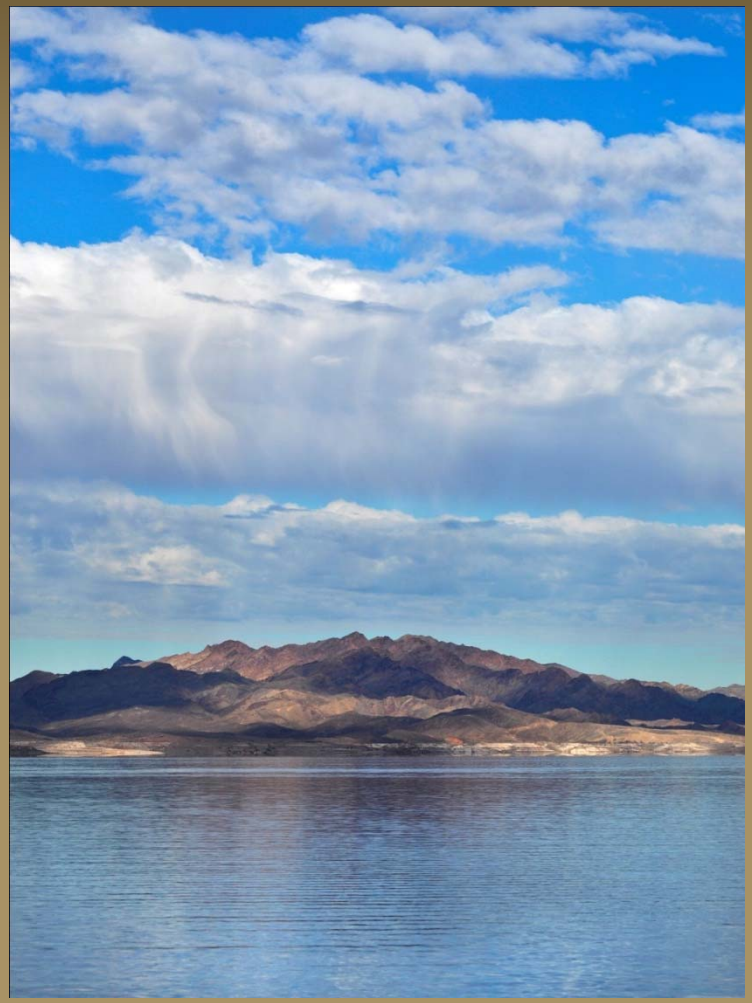
Suggested Components of Recreational Suitability – Lake Mead NRA

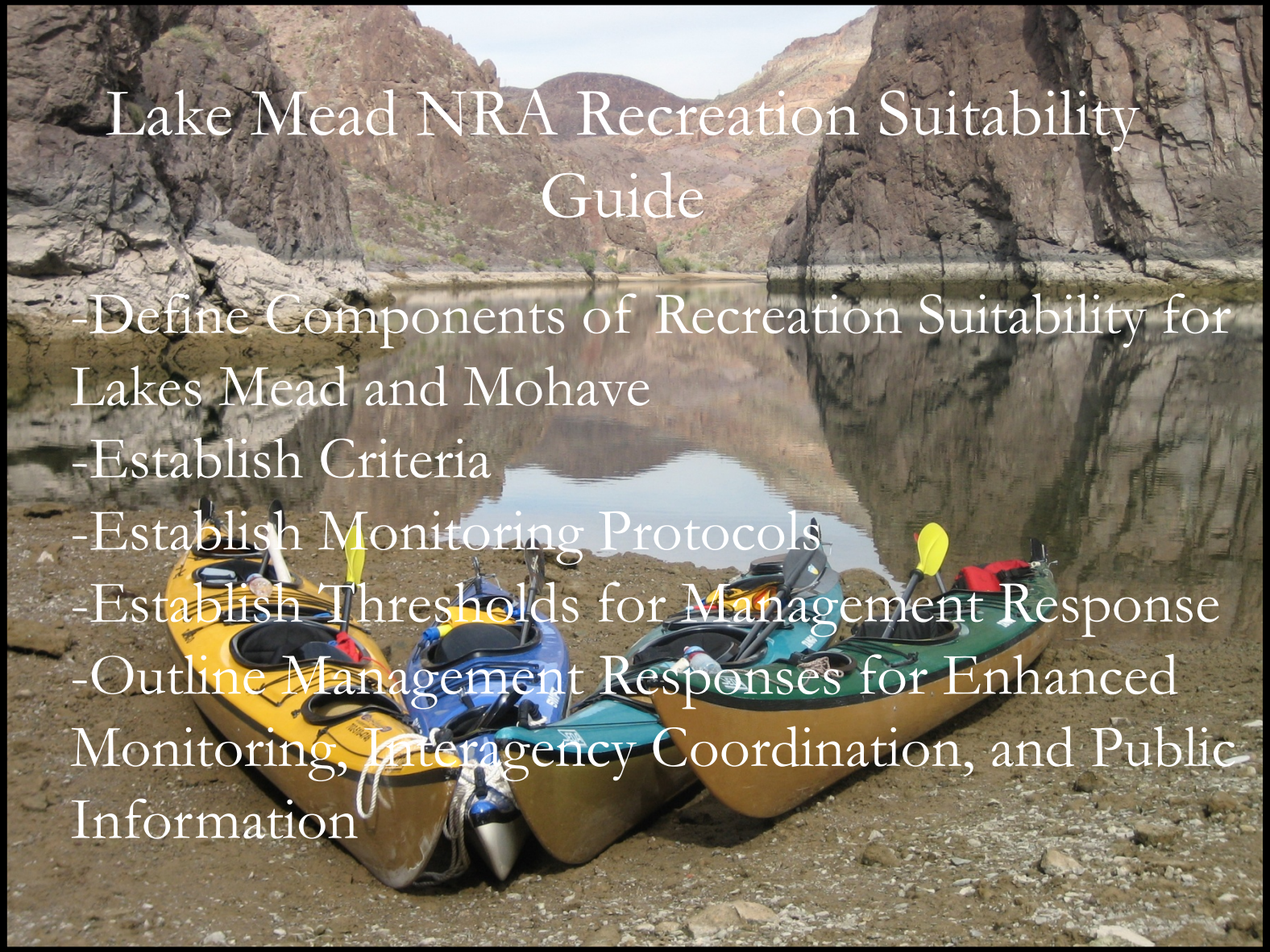
1. Pathogens – Body Contact Recreation

2. Algal Toxins - HAB

3. Contaminants in Fish Tissue

4. Setting/Scenery/Aesthetics





Lake Mead NRA Recreation Suitability Guide

-Define Components of Recreation Suitability for Lakes Mead and Mohave

-Establish Criteria

-Establish Monitoring Protocols

-Establish Thresholds for Management Response

-Outline Management Responses for Enhanced Monitoring, Interagency Coordination, and Public Information

Pathogens

Establish Monitoring Protocol for High Use Areas/Basins That Provide Assessment of Status Relative to Recreational Suitability Criteria Indicators E. Coli and Fecal Coliform

Develop Recreational Suitability Criteria Based Upon NDEP Standards, EPA Guidelines, NPS Management Policies, NPS DO 83, NPS DO 83A1 and D1, and WHO Guidelines

Adopt Elements of NDEP, EPA, WHO and NPS Public Notice Guidelines

Prepare Public Response Plan For Times When Recreational Suitability Criteria Not Met

Public Response Plan and Information Coordinated Among Agencies
Partner to LMEMWG

Table Criteria, Response Levels, Actions for Pathogen Monitoring

Lake Mead NRA Recreation Suitabilty Guide

Management Status – Alert Level	E. coli levels	Fecal coliform levels	Monitoring Needs	Recommended Management Actions
Routine Conditions All levels below thresholds	< 126 MF/100 ml All samples	< 200 MF/100 ml All samples	Standard Monitoring Protocol utilized between May through September for high use areas see Appendix 1	No actions beyond routine monitoring
Alert Level Single Sample Exceeding Stds	> 235 MF/100 ml Single Sample	> 400 MF /100 ml Single Sample	Re-Sample area as soon as feasible, in no case in more than one week	Alert LAKE Mgmt Team; Prioritize Re-Sample
Tier I – Caution Response Second Sample Exceeding Stds	235 MF/100 ml In Second or Follow Up Sample	400 MF/100 ml	Initiate Extended Monitoring Protocol ; Coordinate with SNWA, NDEP and NPS WRD. Extended Monitoring Protocol calls for five samples in broad geographic context over 30 days	Press release on initial findings and follow up monitoring; Alert NDEP and ADEQ; Visitor Notification
Tier II – Warning Response	30 day log mean > 126 MF/100 ml	30 day log mean > 200 MF/100 ml	Coordinate with NDEP, SNWA, NPS WRD, NPS Public Health on Results; Adjust Protocol to Investigate Causes	Public Info Campaign; Public Advisory to Avoid Area; Possible Closures
Tier III – Hazard Response	Extended period > 126 MF/100 ml	Extended period > 200 MF/100 ml	Continue Monitoring Until Results Return Below Advisory Action Levels	Temporary Closures; Advisory Info Campaign

Pathogen Mgmt Flow Chart

Any E. coli sample or Fecal coliform samples exceed the mean sample standard of 126 or 200 MF/100ml? If yes, re-sample. Do two consecutive samples exceed mean standard?

NO

Continue Routine Monitoring

No Management Response

YES

Tier I:
Two Consecutive Samples of Either E.coli or fecal coliform exceed mean value standard of 126 MF of E. coli or 200 MF of fecal coliform/100 ml
Initiate CAUTION Response
Begin 30 day enhanced monitoring protocol to determine log mean to evaluate standard
Coordinate Findings with NDEP, SNWA, BOR
FAQs Park Staff and Web
Talking Points/Hand-Outs At Nearby Contact Station
Enhanced Visitor Education on Sanitation

30 day enhanced monitoring shows log mean meets NDEP standard (126 MF of E.coli, 200 MF of fecal coliform)

One 30 day enhanced monitoring period shows log mean meets NDEP standard of 126 E. Coli and 200 fecal coliform – Return to Routine Monitoring

Should no more than two samples E. Coli or fecal coliforms exceed respective standards for single values – 235 MF of E. coli or 400 MF for fecal coliform; and two follow up samples are below the single value standard-Return to Tier I

Do Any Two Consecutive Samples at One Location Exceed the Single Value E. coli or fecal coliform of 235 MF/400 MF respectively? YES NO

Tier II:
Initate WARNING Response
PIO Press Release and Social Media
Fee and Contact Station Messaging
Concession Notices
Active Ramp and Rove Team at shoreline site
Shoreline Sanitation Surveys and Mitigation
Coordinate Findings with NDEP, SNWA, BOR
Advisory Signs at Site
Enhanced Monitoring – Continue 30 day period

Return to Tier II When E. coli and fecal coliform levels show three consecutive samples are below the single exceedance value

First 30 day monitoring period shows E. coli and/or fecal coliforms exceed standard for 30 day log mean – Initiate second 30 day sample period and go to Tier III

Tier III
Initiate HAZARD Response
Consider Temporary Closures
Enhanced Presence On Site
Enhanced Warning Messaging
Investigate Causes and Coordinate NDEP
Enhanced Shoreline Sanitation

Hazard Algae Bloom
Algal Toxins

Establish Criteria and Metrics Based Upon WHO and EPA Guidelines

Establish Monitoring Protocol for High Use Areas/Basins That Provide Assessment of Status Relative to Criteria Including Chlor a, Cyanobacteria Cells/L, and Microcystin; Incorporate Existing SNWA, NPDES, and BOR Monitoring

Enhance Existing Monitoring When Triggers Met

Develop Recreational Suitability Criteria Based Upon NDEP Standards, EPA Guidelines, NPS Management Policies, NPS D0 83, NPS DO83A1 and D1, and WHO Guidelines

Adopt Elements of NDEP, EPA, WHO and NPS Public Notice Guidelines

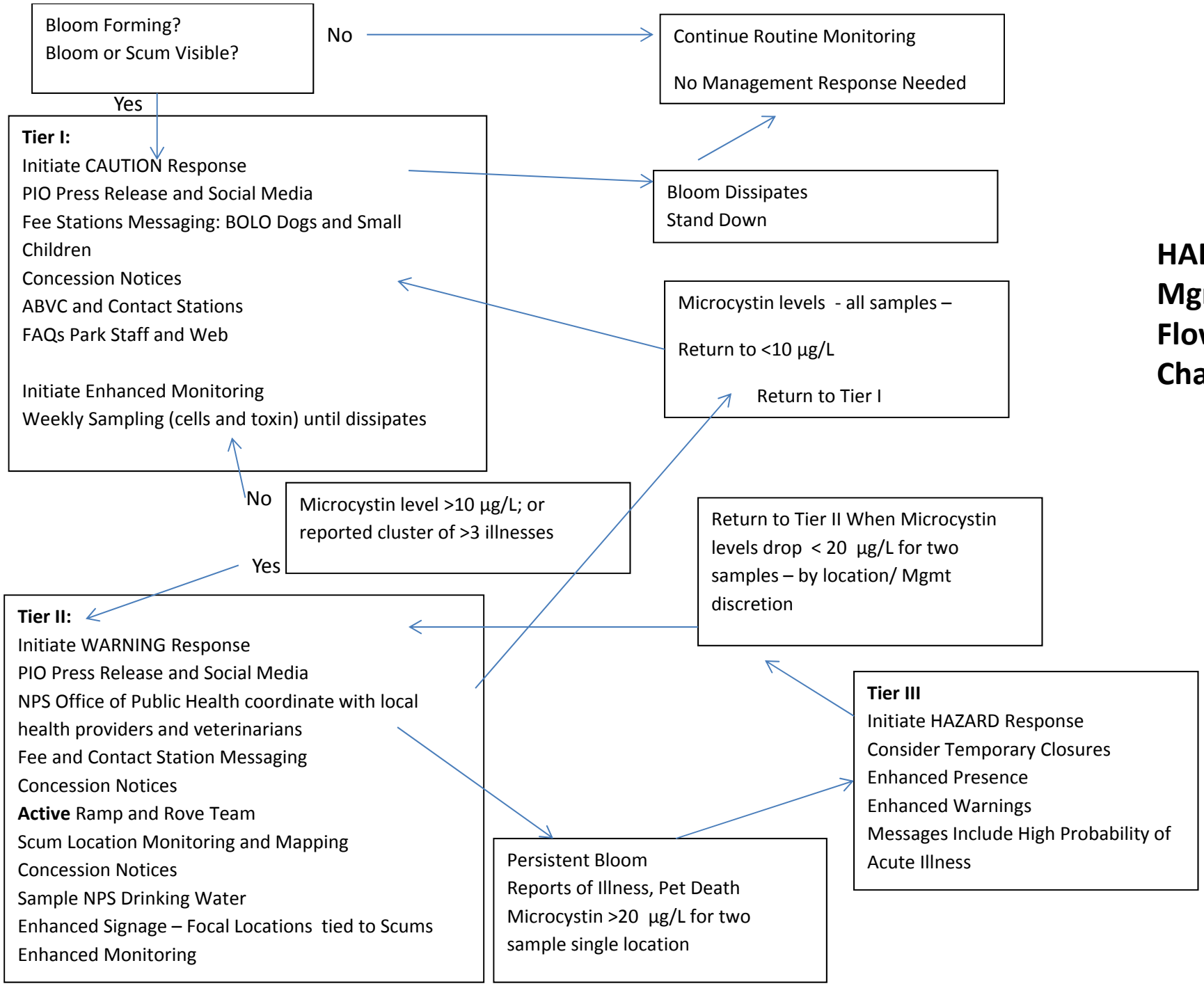
Prepare Public Response Plan For Times When Recreational Suitability Criteria Not Met

Public Response Plan and Information Coordinated Among Agencies Partner to LMEMWG

Table: Criteria, Response Levels, Actions for HAB Monitoring
Lake Mead NRA Recreation Suitabilty Guide

Blue-Green Algae Cells/ml Action Level	Microcystin-LR levels	Chlor-a levels	Monitoring Needs	Recommended Management Actions
<500 Background Levels Routine Operations		<5µg/L	Standard Limnological Monitoring Schedule	None
500 – 5,000 Alert Level Algae concentrations noted, limited scums	Zero to <5 µg/L <5 samples	5 to 10µg/L	Sample algae areas weekly, start algal toxin monitoring, track extent of noticeable algae concentrations	None Inform Mgmt Team Enhance Sampling
5,000 – 20,000 Caution Level - Tier I Obvious concentrations; Low Probability of Acute Health Effects	>5 Samples Toxin Detect <10µg/L	<10 µg/L	Sample Weekly for cells and algal toxins in all areas of bloom , track extent of algae, notify NDEP and ADEQ; Sample NPS intakes Coordinate closely with SNWA	General Public Information; Press Release, Visitor Information Focus: Dogs, small children Illness reporting network set
20,000 – 100,000 Warning Level – Tier II Moderate Probability of Acute Health Effects	10-20µg/L	10-50 µg/L	Continue to monitor weekly at minimum including algal toxins. Coordinate with partners to investigate causes. Provide updates to NDEP, ADEQ and partners	Media Campaign with Partners; Active Messaging to Visitors of Areas to Avoid Public Health Provider Coord
>100,000 Hazard Level - Tier III High Probability of Acute Health Effects	20-2,000 µg/L	>5,000 µg/L	Continue enhanced monitoring with partners, track/map extent of bloom; media advisory with maps of areas to avoid	Consider Closures of Bloom Area on Temporary Basis; Media Campaign; Posts/Signs and Park Presence

HAB Mgmt Flow Chart



Lake Mead NRA Website Algae Basic Message

Blue-green Algae.

Algae are still present on both Lake Mead and Lake Mohave. The algae may appear as green or yellow streaks or scum on the surface of the water or as green globs or streaks floating below the surface. Some blue-green algae may produce toxins harmful to people and pets. At least one-third of lakes in United States that are larger than 10 acres have these toxin producing algae, and this trend is increasing worldwide. To report algal blooms or illness, call 702-293-8998. To report a medical emergency, call 702-293-8932.

- Do not swim, dive or contact water in areas with algae.
- Do not drink untreated lake water.
- Keep pets and children out of areas with algae.
- Clean fish well, and discard guts.
- Rinse off with clean water after swimming.

Interagency Fact Sheets Or Web Background e.g. Ohio EPA Accessed 2/9/2015

"Remember, you can still Boat, fish and recreate in Ohio's lakes, streams and Rivers. Just be aware That HABs exist."

http://epa.ohio.gov/habalgae.aspx

Ohio Algae Information for ...

Ohio.gov State Agencies | Online Servi

OhioEPA
Ohio Environmental Protection Agency

Search...

Home | About | Divisions and Offices | Do Business | Citizens and Educators | News | How Do I? | Contact

Ohio Algae Information for Recreational Waters

Algal blooms have become more noticeable in Ohio's lakes, streams and rivers during the last few years.

WATCH VIDEO to learn more about harm algal blooms and state p beach advisories.

Although most blooms are green algae and not harmful, there are some that are actually a type of **cyanobacteria** that have the ability to produce toxins – called harmful algal blooms (HABs).

Remember, you can still boat, fish and recreate in Ohio's lakes, streams and rivers. Just be aware that HABs exist. We hope the information here will give you a better idea of what HABs can look like and provide you with the information you need to safely enjoy Ohio's waterways.

WHEN IN DOUBT, STAY OUT!

Basics | Advisories | Pets and Livestock | Publications and Helpful Links

What is a harmful algal bloom?

A harmful algal bloom (HAB) is a large growth of bacteria that can produce toxins. These toxins may affect the liver, nervous system and/or skin.

What causes HABs to form?

Some factors that can contribute to HABs include sunlight; low-water or low-flow conditions; calm water; warmer temperatures; and excess nutrients (phosphorus or nitrogen). The primary sources of nutrient pollution are runoff of fertilizers, animal manure, sewage treatment plant discharges, storm water runoff, car and power plant emissions and failing septic tanks. The State of Ohio is currently working on a statewide nutrient reduction strategy that will document ongoing nutrient reduction activities and identify areas where more work is needed.

How dangerous are HABs?

If you touch HABs, swallow water with HAB toxins or breathe in water droplets, you could get a rash, have an allergic reaction, get a stomach ache, or feel dizzy or light-headed. HABs also are toxic to pets.

Always look for HABs before going in the water. Check for HAB advisories. Ask the park manager if there has been a recent HAB because colorless toxins can still be in water.

How will I know if there is a HAB?

HABs have different colors and looks. Some colors are green, blue-green, brown, black, white, purple

QUICK LINKS

HAB ADVISORY MAP

This map identifies state park beaches and pub drinking water systems with active harmful alga bloom advisories.

State of Ohio Response Strategy (2014)
State of Ohio Harmful Algal Bloom Respons Strategy for Recreational Waters

Ohio EPA
Division of Drinking and Ground Waters
Assist public water system operators with preventing, identifying and responding to HA

Ohio Department of Health
Identify types of health problems people anc pets may experience from exposure to HAB

Ohio Department of Natural Resources
Keeping state park lake beach goers inform

Monitoring Network
Grand Lake St. Marys and Buckeye Lake

ALGAL TOXIN RESULTS

From Lake Erie, Ohio state park beaches and p water supplies:
Excel file or PDF file

REPORT A BLOOM

If you see surface scum or something that look blue-green algae at a state park lake beach, re it to Ohio EPA by completing the Bloom Report Form (click here for a fillable form) and emailing HABmailbox@epa.ohio.gov.

CONTACT

For more information about harmful algal bloom contact:

Veterinarian Reference

Cyanobacteria blooms. *When in doubt, it's best to stay out!*

What are cyanobacteria?

- Cyanobacteria, sometimes called blue-green algae, are microscopic organisms that live in all types of water.

What is a cyanobacteria bloom?

- Blue-green algae grow quickly, or bloom, when the water is warm, slow-moving, and full of nutrients.

What are some characteristics of cyanobacteria blooms?

- Cyanobacteria usually bloom during the summer and fall. However, they can bloom any time during the year.
- When a bloom occurs, scum might form on the water's surface.
- Blooms can be many different colors, from green or blue to red or brown.
- As the bloom dies off, you might smell an odor that is similar to rotting plants.

What is a toxic bloom?

- Sometimes, cyanobacteria produce toxins, such as microcystins.
- The toxins can be present in the cyanobacteria cells or in the water.

Other important things to know:

- Swallowing water that has cyanobacteria or cyanobacterial toxins in it can cause serious illness.
- Dogs might have more severe symptoms than people, including collapse and sudden death after swallowing the contaminated water while swimming or after licking cyanobacteria from their fur.
- There are no known antidotes to these toxins. Medical care is supportive.

You cannot tell if a bloom is toxic by looking at it.

To report a cyanobacteria bloom or related health event:

- Call your local or state health department

For more information:

- http://www.cdc.gov/nceh/hsb/hab/default.htm

National Center for Environmental Health
Division of Environmental Health Hazards and Health Effects

CS223677-B

Fish Contaminants – Human Health (Mercury)

Include Nevada Division of Health and NDOW Fish Advisory Standards in Lake Mead NRA Recreational Suitability Guidelines, per NPS policies and 515 DM (DOI)

Coordinate with NDOW for Public Information Program Relative to Advisories

Incorporate Fish Advisory Information Into NPS web site and public education programs

Coordinate Public Information on Advisories Among Agencies Partner to LMMWG

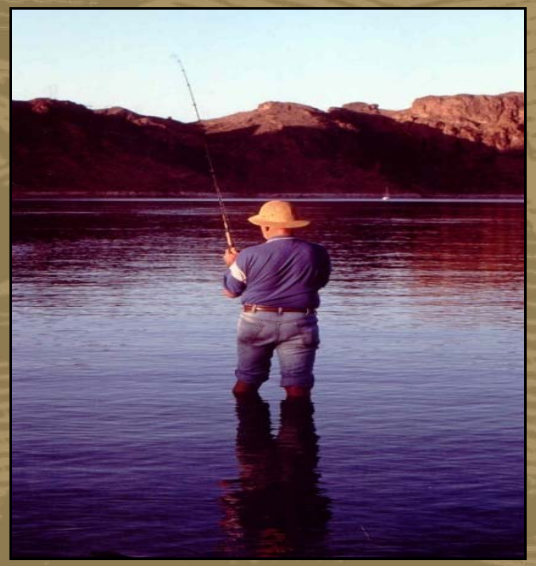


Photo USBR

Table: NDOW and Nevada Division of Health
Fish Advisory Standards of Lakes Mead and Mohave
Lake Mead NRA Recreation Suitabilty Guide

Location; Lake and any specific area	County (NV)	Fish Species	Advisory Meals Per Month*
Lake Mead (Boulder Basin)	Clark	Carp	8
Lake Mead (Boulder Basin)	Clark	Channel Catfish	12
Lake Mead (Boulder Basin)	Clark	Largemouth Bass	16
Lake Mead (Boulder Basin)	Clark	Striped Bass	4
Lake Mead (Boulder Basin)	Clark	Tilapia	unrestricted (>16)
Lake Mead (Colorado River Inflow Arm)	Clark	Channel Catfish	8
Lake Mead (Colorado River Inflow Arm)	Clark	Largemouth Bass	16
Lake Mead (Colorado River Inflow Arm)	Clark	Striped Bass	4
Lake Mead (Colorado River Inflow Arm)	Clark	Tilapia	unrestricted (>16)
Lake Mead (Overton Arm)	Clark	Channel Catfish	4
Lake Mead (Overton Arm)	Clark	Largemouth Bass	4
Lake Mead (Overton Arm)	Clark	Smallmouth Bass	4
Lake Mead (Overton Arm)	Clark	Striped Bass	4
Lake Mohave	Clark	Carp	12
Lake Mohave	Clark	Channel Catfish	8
Lake Mohave	Clark	Largemouth Bass	4
Lake Mohave	Clark	Striped Bass	4

*An adult meal is considered to be an eight ounce portion. See NDOW website, http://www.ndow.org/Fish/Fish_Safety/Mercury/, for portion recommendations for children and for pregnant or nursing women.

Aesthetics/Scenery and Setting

Establish Aesthetic and Setting Parameters from NPS Management Documents, and WHO Guidelines, and NDEP Standards

Develop metrics and criteria for parameters; consider NDEP chlor a standard as surrogate for suitable algal conditions

Develop monitoring protocol and Thresholds for Criteria

Prepare Public Response Plan For Times When Recreational Suitability Criteria Not Met or Conditions Warrant – Obvious to Public
Public Messages and Information Coordinated Among Partner Agencies

Monitor with Partner Agencies to Evaluate Causes; Seek Mitigation

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Table: Setting/Aesthetics Indicator Criteria
Lake Mead NRA Recreation Suitabilty Guide

Management Status – Alert Level	Chlor a Levels	Secchi Disk Annual Avg	Visible Scums	Debris	Monitoring Needs	Recommended Management Actions
Routine Conditions All levels below thresholds	<5 µg/l Open Waters (Not Tribs or LV Bay)	>25 smoothed Annual average All locations Open Waters	<10 m Square Or 100 Linear Ft.	<10 m Square Or 100 Linear Ft.	Chlor a and Secchi part of routine monitoring; Scum and debris Citizen Science needs	No actions beyond routine monitoring
Alert Level A reported scum or debris event; elevated chlor a	>5 µg/l Open Waters Growing Season Avg >10 µg/l Numerous	Single Month Avg <15 ft. Open Waters	>10 m Square Or 100 Linear Ft	>10 m Square Or 100 Linear Ft	Have staff evaluate scum or debris event	Alert LAKE Mgmt Team; Consider Press Release; Consult Partner Agencies
Public Notice Response Scum or Debris Noticeable to Public; Poss. Algae bloom	>20 µg/l Open Waters	Single Month Avg <10 ft. Open Waters	Clearly Visible >20 m square or 200 Linear Ft	Clearly Visible >20 m square or 200 Linear Ft	Evaluate and map scum or debris field. Grab Samples.	Press release on initial findings ;Alert NDEP and ADEQ; Visitor Notification; Consult Partners
Management Action Response	Persistent and Extensive >50 µg/l Open Waters	Two or More Months <10 ft. Open Waters	Persis-tent and Ex-tensive	Persis-tent and Ex-tensive	Coordinate with NDEP, SNWA, NPS WRD, NPS Public Health on Results; Adjust Protocol to Investigate Causes	Public Info Campaign; Public Advisory to Avoid Area; Possible Closures; Interagency Mitigation

Principles for Lake Mead Recreation Suitability Guidelines

Incorporate Existing SNWA, NPDES, BOR and NPS Monitoring to extent possible – Generally Sufficient

Coordinate Pathogen Protocol and Response Plan with NDEP

Utilize Existing Information and Concepts from 2004 Lake Mead Algal Contingency Plan developed by NDEP and SNWA

Seek Interagency Coordination for Planned Actions

Seek Interagency Coordinated Public Messaging Programs