6-30-2010

Limnological Assistance for Lake Mead National Recreation Area: Quarterly Report, Period Ending June 30, 2010

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Executive Summary

Project 1
- Technical assistance with the implementation of the Interagency Monitoring Action Plan (I-MAP) for Quagga Mussels is ongoing. During this quarter, analysis was completed for 14 adult/juvenile samples from the fall 2009 – spring 2010 sampling.
- Sampling for the first of two small-scale research projects funded by this task agreement (Abundance and settlement at different depths of Lake Mead) was initiated on June 16, 2010.

Project 2
- Topics and proposed analyses have been drafted for annual report development as prescribed by the Plan.
- A plan for developing and organizing NPS limnology-related web pages has been documented and content has been completed for four category pages and two associated pages.

Project 1 Technical Assistance Related to Quagga Mussels

C.1(a) Provide technical assistance in the implementation of the Interagency Management Action Plan (I-MAP)

I-MAP implementation is ongoing; this work is carried out by David Wong, Ph.D. and UNLV graduate students, Scott Rainville and Sean Comeau, in collaboration with NPS staff members Bryan Moore, Ross Hayley, Emily Austin, and Jessie Rinella. Regarding adults and veligers, the spring quarterly sampling was completed at the I-MAP specified sites (soft substrate: CR346.4, LVB 7.3, LVB 3.5, and CR351.7 and hard substrate: Sentinel Island, Black Island, and Boulder Island). Sample analyses, which represent the major portion of staff time on this project (compared to sample collection), include the following measures: density; mean density by depth; length; length frequency; shell length to weight ratio; shell length to tissue weight ratio; and nutritional status. 14 samples analyzed in the lab as of 6/30/10 (see Table 1). All analyses for the previous quarter’s (Q1) hard substrate samples have been completed. On 6/15/10, S. Rainville provided an approximately 6-hour quagga mussel analysis demonstration to Bryan Moore (NPS) and Brianne Billups (NPS Intern) at UNLV.
Veliger monitoring funded through this task agreement is described below [Task C.1(b)], all other I-MAP veliger monitoring is conducted by other NPS partners.

The complete results and relevant data from other agencies, as available, will be summarized within the FY2010 Annual NPS Quagga Mussel Monitoring Activities and Findings Report due in December 2010. All I-MAP samples collected as part of this task agreement are archived frozen at UNLV in S. Gerstenberger’s laboratory.

C.1(b) Research Project: Veliger abundance and settlement at different depths of Lake Mead

This research project is being conducted by S. Comeau as master’s thesis work under the direction of Shawn Gerstenberger, Ph.D. and D. Wong. During this quarter, S. Comeau assisted D. Wong with task C.1(a), above, and underwent training in veliger analysis. Weekly veliger sampling at different depths in Sentinel Island began on 6/16/2010 and is on-going.

Updates on the progress of this project will be provided at Interagency Quagga Mussel Meetings as available.

C.1(c) Research Project: Non-growth of adult quagga mussels within Las Vegas Wash/Las Vegas Bay

This research project is being conducted by S. Rainville as master’s thesis work under the direction of S. Gerstenberger and D. Wong. During this quarter, S. Rainville continued to assist D. Wong with task C.1(a), above, and underwent training in adult analysis. It was mistakenly reported in the previous quarterly report (Q1) that the sampling transects for this research project were scheduled to begin in mid to late June 2010. This sampling was always intended to begin in September 2010; and is on schedule for initiation according to that timeframe.

Table 1. List of I-MAP hard substrate samples collected to date (Q1 and Q2) for which analysis is complete.

<table>
<thead>
<tr>
<th>Samples</th>
<th>Locations and Collection Dates</th>
<th>Depth (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Boulder Island</td>
<td>12/30/09</td>
</tr>
<tr>
<td>2</td>
<td>Boulder Island</td>
<td>12/30/09</td>
</tr>
<tr>
<td>3</td>
<td>Black Island</td>
<td>02/22/10</td>
</tr>
<tr>
<td>4</td>
<td>Black Island</td>
<td>02/22/10</td>
</tr>
<tr>
<td>5</td>
<td>Black Island</td>
<td>02/22/10</td>
</tr>
<tr>
<td>6</td>
<td>Black Island</td>
<td>02/22/10</td>
</tr>
<tr>
<td>7</td>
<td>Black Island</td>
<td>02/22/10</td>
</tr>
<tr>
<td>8</td>
<td>Sentinel Island</td>
<td>02/23/10</td>
</tr>
<tr>
<td>9</td>
<td>Sentinel Island</td>
<td>02/23/10</td>
</tr>
<tr>
<td>10</td>
<td>Sentinel Island</td>
<td>02/23/10</td>
</tr>
<tr>
<td>11</td>
<td>Sentinel Island</td>
<td>02/23/10</td>
</tr>
<tr>
<td>12</td>
<td>Sentinel Island</td>
<td>02/23/10</td>
</tr>
<tr>
<td>13</td>
<td>Sentinel Island</td>
<td>02/23/10</td>
</tr>
<tr>
<td>14</td>
<td>Boulder Island</td>
<td>05/25/10</td>
</tr>
</tbody>
</table>
Updates on the progress of this project will be provided at Interagency Quagga Mussel Meetings as available.

**C.1(d) Facilitation of Interagency Quagga Mussel Meetings**

No Interagency Quagga Mussel Meetings were scheduled to occur during this project quarter. The next meeting is scheduled for 7/15/10. Related activities included updating the list-serve developed for this group with new members and sending out informational e-mails at the request of members.

**Project 2  Technical Assistance Related to Ecological Monitoring of Lakes Mead and Mohave**

**C.2(a) Additions to the Ecological Monitoring Plan for Lakes Mead and Mohave**

The purpose of this task is to acquire existing, current protocols relevant to the *Long-term Limnological and Aquatic Resource Monitoring and Research Plan for Lakes Mead and Mohave*. This task is ongoing.

**C.2(b) Implementation of the Ecological Monitoring Plan for Lakes Mead and Mohave**

Following the 5/6/2010 Interagency Monitoring and Research Coordination Meeting [“Water 2025” Meeting; see C.2(d) below], Drs. Shawn Gerstenberger, Craig Palmer, D. Wong, and J. Miller drafted an strategy (see Attachment 1) for the first annual report development, which included describing the details of analyses that could be conducted to meet the goals of the *Long-term Limnological and Aquatic Resource Monitoring and Research Plan for Lakes Mead and Mohave*. Serious consideration was given to providing the best and most efficient snapshot of the current state of information for various limnological and ecological resources within Lakes Mead and Mohave. Regarding the Water Quality and Limnology category, six water quality-monitoring stations were chosen from which SNWA/USGS data could be analyzed to provide an overview of the limnological status of each of the basins and other key areas of Lake Mead. This draft strategy will be presented to K. Turner and members of the Coordination Meeting group for comment and approval at the upcoming 7/14/10 meeting.

**C.2(c) Coordination of Web Organization and Content for Lake Mead NRA Limnology**

J. Miller met with Kent Turner (ATR, NPS) and NPS staff member Leslie Paige on 4/30/2010 and presented the site map described last quarter (Q1) representing web pages relevant to each of the categories within the *Long-term Limnological and Aquatic Resource Monitoring and Research Plan*. K. Turner approved the concept. Regarding logistics, it was decided that J. Miller would deliver the content text in Word documents, and K. Turner discussed that possible funds (outside of this task agreement) could be made available to cover the costs of L. Paige’s office in uploading the content to the Lake Mead NRA website (accessible only through NPS computers) and conducting other aspects of customizing existing NPS web templates that may be needed, including photography. A web-page update was presented at the 5/6/10 Interagency “2025” Meeting; no concerns were raised by those in attendance at the meeting.
Content was drafted (see Attachment 2) and presented to K. Turner for the following topics, which stem from the Plan: Lake Science Overview; Category 1: Water Quality and Limnology; Category 2: Fish and Aquatic Biota; Category 3: Stressors; and Category 4: Sediment. Appropriate links; photos available through NPS or other participating agency; and any other graphics, reports, or other relevant documents that would enhance the web pages have been identified and inserted. In addition content for a new “Research Permits” page was created to further emphasize that the new limnology web pages identify Lake Mead NRA research needs, and also to document, organize, and present information on the permitting process via the web. Content for this page was based permitting pages posted by other NPS park units and conversations with the Lake Mead NRA permitting office. This page has also been reviewed by K. Turner, revised, and is currently under review by Michael Boyles (NPS Lake Mead NRA Research Permits Office).

An additional component of this task is to update the Lake Mead Science Symposium website (www.lakemeadsymposium.org) with presentation files. As of 6/30/10, permissions had been received to post 34 of 44 PowerPoint presentations and 10 of 12 posters. Under the direction of J. Miller, Megan Iudice (UNLV-PLI) has updated the site with Adobe Captivate screen casts of all presentations for which permissions have been granted. Posters are presented as PDFs. If any new permissions become available, files will be prepared and posted in the same way.

C.2(d) Facilitation of Interagency Monitoring and Research Coordination Meetings

The Interagency Monitoring and Research Coordination meeting (formerly referred to as “Interagency Water 2025 Meetings”) took place on 5/6/2010. The major topics of discussion were task C.2(b) of this task agreement as well as development of a circular synthesizing the state of science knowledge of various limnological and ecological resources within Lakes Mead and Mohave, which will be carried out by the U.S. Geological Survey with input from various NPS Lake Mead NRA partners. Regarding the annual reports stemming from this project, an overview of the task was presented to members present; members suggested example reports from other locations (e.g., Great Lakes and Lake Tahoe); and they decided that for these reports, that if data were not available in 2009, data from the last year it was collected should be analyzed. Regarding the USGS Circular Report, from this group, S. Gerstenberger was invited to contribute to the Water Quality section, and D. Wong was invited to contribute to the Stressor/Threats section. The meeting was documented by J. Miller, and the summary was e-mailed to all meeting members. Meeting summaries resulting from this project will also be included in the final project compendium and are made available sooner upon request.

C.2(d) Technical Assistance to Lake Mead NRA with other Monitoring Programs

No action required this quarter.

Submitted by:

Margaret N. Rees, Project Administrator  07/30/2010 Date
ATTACHMENTS
Category 1 – Water Quality and Limnology

**Report Focus:** Graphs of selected water quality constituents (pp. 28-29) as available for the following six sites (see map), which provide representation of each basin and other key areas.

1. Las Vegas Bay – LVB4.95
2. Boulder Basin – CR346.4
3. Overton Arm – VR13.4
5. **Temple Bar – CR380.0**  *7/14/10 Update: Deleted this site.*
6. **Additional Boulder Basin – CR342.5**  *7/14/10 Update: Added a second Boulder Basin site near intakes, which would provide more valuable information than the originally proposed Temple Bar site.*
7. **Gregg Basin – CR394.0**  *7/14/10 Update: Selected CR390.0 to replace CR394.0*

Analyses will be conducted for all plan-prescribed parameters for which data are stored by SNWA; data analyses should be limited to the epilimnion and plotted as averaged monthly values over time. UNLV will investigate potential to work with SNWA’s Warren Turkett/Peggy Roefer to create an appropriate query of the SNWA database, possibly one that could be auto-generated on an annual basis. Description of results will be noted.

* Although this Quarterly Report documents progress to 6/30/2010, site changes based on discussion at the 7/14/10 at the Interagency Monitoring and Research Coordination Meeting have been also documented here to prevent any future confusion.

Category 2 – Fish and Aquatic Biota

**Report Focus:** Data analysis will include a tabularization of available data as prescribed on p. 34. UNLV proposes to obtain shad data from Eric Loomis’ thesis; sportfish population data from NDOW (Annual Reports/Mike Burrell); razorback sucker data from USBR-LCR (Mohave - James Stolberg) and BioWest (Mead - Paul Holdren). Description of results will be noted. Benthic data will also be included in this category.

Category 3 – Stressors

**Contaminants Report Focus:** Linkage to SNWA Annual Report / CWC Report (Shane Synder). Will include figures and descriptions of mercury results from Sara Mueting’s thesis.

**Quagga Mussel Report Focus:** Relevant figures generated through the I-MAP Program describing hard and soft transects, and abundance vs. size analyses. New Zealand mud snail data will be included. Description of results will be noted.

**Climate Change Report Focus:** Graph generation based on monthly averages of USBR reservoir level data and monthly averages of USGS atmospheric temperature data for daytime highs and overnight lows.
Note that analysis will only be able to establish a picture for 2009 for future comparison; analyses will not reveal any climate change information in and of themselves.

**Aquatic Invasive Plants Report Focus:** Listing of NPS watch species.

**Category 4 – Sediment**

**Sediment Contamination Report Focus:** To be determined; linkage with forthcoming USGS publications.

**Sediment Characterization Report Focus:** To be determined; consider sediment composition information (USGS); sedimentation rates (SNWA); USGS work (David Twichell); UNLV work (Mark Rudin).

**Category 5 – Birds**

**Report Focus:** Presentation of relevant figures generated by UNLV (Joe Barnes/Jeff Jaeger) through MSHCP work. Considering Christmas Day Wash Survey by Audubon Society; Las Vegas Wash Committee work (Keiba Crear, SNWA); and NDOW data from Overton Management Area (Cris Tomlinson). Description of results will be noted.

**Category 6 – Riparian Resources**

**Report Focus:** Presentation of data analyses resulting from Clark County MSHCP work, data analysis from any applicable data from the Weed Sentry Program (Vanessa Truitt, NPS). Description of results will be noted.
With the ability to store approximately 26 million acre-ft of water, Lake Mead is the largest reservoir by volume in the United States. Lake Mead supplies three western states (California, Arizona, and Nevada) and Mexico. Its uses, several of which are critical to life in the West, are diverse: drinking water for approximately 25 million people; agricultural irrigation; habitat for numerous fish and other wildlife species; world-class recreational opportunities; and hydropower generation. Lake Mead’s downstream neighbor, Lake Mohave, re-regulates releases from the Hoover Dam to provide for required downstream deliveries; is the site of a national fish hatchery; serves as important habitat for fish and wildlife, including federally listed endangered species; and provides diverse recreational opportunities. As such, the health of Lakes Mead and Mohave are of interest to and the responsibility of multiple federal, state, and local agencies.

In 2009, an interagency group completed the first edition of a “Long-Term Limnological and Aquatic Resource Monitoring and Research Plan for Lakes Mead and Mohave.” This plan helps to coordinate interagency monitoring and research activities, and calls for joint data and information analysis. Through this effort, current management practices can be evaluated and emerging issues identified before they become widespread or difficult to solve.

The plan features six ecosystem categories, and for each category, strategic objectives, system components and drivers, priority questions, and suggested monitoring foci are described.

1. Water Quality  
2. Fish and Aquatic Life  
3. Stressors  
4. Sediment  
5. Birds  
6. Riparian (Shoreline) Resources

Did you know?  
The health of Lakes Mead and Mohave are of interest to and the responsibility of multiple federal, state, and local agencies.
Long-term Limnological and Aquatic Resource Monitoring and Research Plan for Lakes Mead and Mohave

Category 1: Water Quality and Limnology

Lakes Mead and Mohave are vital resources to the southwestern United States, providing drinking water for more than 25 million people, high quality water-based recreation for more than eight million people annually, including an average of 250,240 angler use days annually\(^1\) for recreational sport fishing. The lakes provide additional critical habitat for the federally listed endangered razorback sucker, as well as key habitats along the pacific flyway for shorebirds and other waterfowl (Web designer: link yellow highlighted text to the Category 5 Birds web page, once created). Lake Mead, with a surface area of 157,900 acres (at full pool) and a 29-million-acre-ft storage capacity, is the largest reservoir in North America. Lake Mohave with 26,500 acres of surface area provides a vital role in Colorado River management in meeting downstream delivery schedules.

The treated sewage effluent of Las Vegas enters Lake Mead via the Las Vegas Wash, for which southern Nevada receives Colorado River return-flow credits vital to extending the community’s water resources. The roles of these water bodies in meeting community and regional needs for drinking water, recreation, and wildlife habitat underscore the vital importance of maintaining water quality and understanding their limnology.

Major parameters of water quality include water clarity, inorganic nutrients, Total Organic Carbon (TOC), bromide, chlorophyll-\(a\), specific conductance, temperature, pH, and dissolved oxygen. Each of these and 29 other parameters are monitored at 43 sites across Lake Mead: 26 stations in Lake Mead’s Boulder Basin (Please link to Boulder Basin section below) are monitored on a weekly basis and an additional 27 sites (dependent on lake level) throughout Lake Mead are monitored on a monthly to quarterly basis. This monitoring is carried out by the Southern Nevada Water Authority, U.S. Bureau of Reclamation, and the water reclamation districts. Water quality is also continuously monitored by automated U.S. Geological Survey stations and at different intervals by researchers working on specific projects at other locations on the lakes. There are five monitoring sites in Lake Mohave, which are monitored for constituents of water quality by the U.S. Bureau of Reclamation as part of their quagga mussel veliger-monitoring program.

Click to view maps of monitoring stations on Lakes Mead (left) and Mohave (right). Please link thumbnails above to the PDFs of the maps, which are in the Documents folder for this category.
Lake Mead's Boulder Basin

Boulder Basin, the basin that receives urban inflows from the Las Vegas Wash and the basin from which drinking water is drawn, is the most extensively studied portion of the lake. It is a focal point of interest for water quality along the lower Colorado River, due to the fact that Boulder Basin is the point of drinking water diversion for SNWA, and that it receives the inputs of the Las Vegas Wash. Downstream Colorado River users have a great interest in the overall water quality released through the Hoover Dam. For those reasons, there is an extensive monitoring program within the Boulder Basin conducted by SNWA and the three water reclamation districts (i.e., Clark County, City of Las Vegas, and City of Henderson).

![Photo by Larry Paulson.](image)

Water sampling from a boat in Las Vegas Wash.

Strategic fundamental objectives for this category

- A healthy sportfishery
- Healthy populations of native fish
- Healthy populations of aquatic dependent wildlife
- Healthy shoreline dependent native vegetation
- Existing high quality setting for water-based recreation
- Regional and community needs for municipal and industrial uses, including domestic water supply and Colorado River System return flow credits

Management questions best answered by monitoring:

- What are the status and trends of physical and chemical water quality parameters (e.g., conductivity, dissolved oxygen, nutrients, temperature, transparency, pH, and water levels)?

Monitoring Activity

- Clark County: [NPDES Regulatory Monitoring](#)
- Southern Nevada Water Authority: [Lake Mead Monitoring](#)
- U.S. Bureau of Reclamation Denver Service Center: [Lake Mead Monitoring and Research](#)
• What are the status and trends of biological water quality parameters (e.g., plankton and chlorophyll-a)?

Recent Reports and Publications


Wong, D. 2009. Zooplankton and quagga mussel veligers: Trends in Lake Mead from 2002 to 2008. Issue paper prepared for Lake Mead National Recreation Area. Click to view report (PDF). (Web designer: This document is provided within the Documents folder for this category. Please upload the file and link to highlighted text.)

• What are the status and trends of contaminants in the water column [e.g., disinfection byproduct precursors, volatile organic compounds (VOCs), radionuclides, priority pollutants (EPA and State), and pathogens]? (Web designer: Clicking a symbol would reveal info in box below)

Monitoring Activity

Management questions best answered by research:

- What are the relationships between any changes in wastewater management, tributary inflows, and climate and impacts to water quality parameters, drinking water, fish, aquatic dependent wildlife, and recreation?  
  (Web designer: Clicking a symbol would reveal info in box below)
  [STUDY NEEDED]

- How does water column stratification affect the position or distribution of tributary inflows?  
  (Web designer: Clicking a symbol would reveal info in box below)
  [STUDY NEEDED]

- What are the mass transport and internal cycling budgets for contaminants and nutrients?  
  (Web designer: Clicking a symbol would reveal info in box below)
  [STUDY NEEDED]

- What is the impact of changes in operations at Glen Canyon Dam and Hoover Dam on water quality?  
  (Web designer: Clicking a symbol would reveal info in box below)
  [STUDY NEEDED]

References
1. (Nevada Department of Wildlife 2004 – 2008 data)

Did you know?
The health of Lakes Mead and Mohave are of interest to and the responsibility of multiple federal, state, and local agencies.
Several fish species inhabit Lakes Mead and Mohave, including game, non-game, and federally listed species that depend on clean water and high quality habitat to maintain healthy populations. Lake Mead provides a nationally recognized sport fishery with an average of 205,164 angler use days annually, making it the most popular destination for fishing in Nevada. Lake Mohave is also a popular sport-fishing destination that supports, on average, 45,106 angler use days annually. Predominant introduced sport fish within these lakes include largemouth bass (*Micropterus salmoides*), striped bass (*Morone saxatilis*), blue gill (*Lepomis macrochirus*), and channel catfish (*Ictalurus punctatus*), among others. The fishery is dependent primarily upon threadfin shad (forage fish) production as a food source. Rainbow trout (*Onchorhynchus mykiss*) are a regularly stocked species.

Lakes Mead and Mohave also provide habitat for populations of razorback sucker (*Xyrauchen texanus*), a federally endangered fish endemic to the Colorado River system. Lake Mohave houses the Willow Beach National Fish Hatchery, which produces thousands of sport fish and raises imperiled fishes such as razorback sucker and bonytail chub for reintroduction efforts. Fish require high water quality and available food resources to maintain healthy populations. Monitoring and research are necessary to track populations and determine health status. Management of both lakes to meet recreational, wastewater, drinking water, hydropower, and flood management needs must be balanced to ensure the integrity of fish populations and their habitats are sustained.

Management questions best answered by monitoring:

- What are the status and trends of sport fish? (Web designer: Clicking a symbol would reveal info in box below)

Long-term Limnological and Aquatic Resource Monitoring and Research Plan for Lakes Mead and Mohave

Click here to download the PDF. This PDF is almost ready as of: 6/29/2010.

Nevada Department of Wildlife

Click here to access news, information, and reports on fishing in Nevada more...

Arizona Game and Fish Department

Click here to access news, information, and reports on fishing in Arizona more...
Recent Reports and Publications

- Arizona Game and Fish Department Fishing Reports
- Nevada Department of Wildlife Fishing Reports

What are the distributions, reproduction rates, and recruitment levels of native, non-native, and invasive fish? How does sediment distribution affect spawning potential and reproductive success of sensitive species? (See also Category 4).

Monitoring Activity – Native Fish

- Bio-West Lake Mead Razorback Sucker Studies jointly funded and by the U.S. Bureau of Reclamation and the Southern Nevada Water Authority, and conducted cooperatively with the Nevada Department of Wildlife, National Park Service, Arizona Game and Fish Department, and the U.S. Fish and Wildlife Service.
- U.S. Bureau of Reclamation Lower Colorado Region – Lower Colorado River Multi-Species Conservation Program
- Razorback Round-up – a Multi-agency effort. Click on the links to view the available web pages dedicated to this effort by various participants: National Park Service, Nevada Department of Wildlife, U.S. Fish and Wildlife Service.

Recent Reports and Publications – Native Fish


Monitoring Activity – Sport Fish

- Nevada Department of Wildlife Lake Mead Larval Threadfin Shad Production Sampling – SNWA Database Project #532

What is the biological, chemical, and physical condition of razorback sucker spawning and rearing habitat? Does water quality support recovery of razorback suckers?

Monitoring Activity

- Bio-West Lake Mead Razorback Sucker Studies jointly funded by the U.S. Bureau of Reclamation and the Southern Nevada Water Authority, and conducted cooperatively with the Nevada Department of Wildlife,
National Park Service, Arizona Game and Fish Department, and the U.S. Fish and Wildlife Service.

- U.S. Bureau of Reclamation: **Endangered Razorback Sucker Program**

**Recent Reports and Publications**

- Kegerries, R.B., B. Albrecht, and P.B. Holden. 2009. Lake Mead razorback sucker recruitment: An informative anomaly regarding continued, natural, wild razorback sucker recruitment despite non-native fish presence. Lake Mead Science Symposium Program. [Click to view abstract and presentation.](http://example.com)

**What is the status and trend of the forage base/plankton?**

[Clicking a symbol would reveal info in box below]

**Monitoring Activity**

**Recent Reports and Publications**

- Tietjen, T. 2009. Long-term patterns in the diversity and composition of phytoplankton in Las Vegas Bay, Lake Mead. Lake Mead Science Symposium Program. [Click to view abstract and presentation.](http://example.com)
- Wong, D. 2009. Zooplankton and quagga mussel veligers: Trends in Lake Mead from 2002 to 2008. Issue paper prepared for Lake Mead National Recreation Area. [Click to view report.](http://example.com) (Web designer: This document is provided within the Documents folder for this category. Please upload the file and link to highlighted text.)

**What contaminants are present in native and non-native fish tissues and to what extent is fish health impaired? Which contaminants, if any, pose a risk to the public (i.e., human health)?**

[See also Category 3](http://example.com) (Web designer: please link highlighted text to the Category 3 web page, once created). [Clicking a symbol would reveal info in box below]

**Monitoring Activity**

- U.S. Fish and Wildlife Service and Southern Nevada Water Authority - [Bioassessment in the Las Vegas Wash and Tributaries](http://example.com) – Fish Study SNWA Database Project #573
- U.S. Geological Survey Nevada Water Science Center – [Endocrine Disruption in Lake Mead](http://example.com)
- U.S. Geological Survey Columbia Environmental Research Center - [Risk](http://example.com)
Assessment of Potential Endocrine Disruptors in Lake Mead

Recent Reports and Publications


- Kramer, Joanna A. “Mercury Concentrations in Muscle Tissue from Sportfish in Lake Mead, Nevada.” MPH thesis, University of Nevada, Las Vegas, 2009. Click to view thesis. (Web designer: This document is provided within the Documents folder for this category. Please upload the file and link to highlighted text.)


• What are the impacts of invasive species on nutrients? (See also Category 3).  
(Web designer: please link highlighted text to the Category 3 web page, once created).  ► (Web designer: Clicking a symbol would reveal info in box below)

STUDY NEEDED

Management questions best answered by research:

What factors (biotic and abiotic) influence invasive fish (e.g., tilapia) distribution and abundance?  ► (Web designer: Clicking a symbol would reveal info in box below)

STUDY NEEDED

What food-web dynamics are in place in Lakes Mead and Mohave? How are these dynamics being altered by drought, invasive species, climate change, and other emerging threats? Are upper trophic levels being adequately maintained to support robust wildlife populations?  ► (Web designer: Clicking a symbol would reveal info in box below)

Research Activity

✓ University of Nevada, Reno – Assessment of Lake Mead’s bottom dwelling community prior to the expansion of adult quagga mussels
✓ U.S. Geological Survey Nevada Water Science Center – Endocrine Disruption in Lake Mead

Recent Reports and Publications


✓ Loomis, E.M. 2009. Trophic Interactions Associated with Introduction of the Invasive Quagga Mussel in Lake Mead, Nevada. MPH thesis, University of Nevada, Las Vegas. Click to view thesis. (Web designer: This document is provided within the Documents folder for this category. Please upload the file and link to highlighted text.)

✓ Sjöberg, J. 2010. The Lake Mead sport fishery and effects of changing lake levels. Presentation at the CRC Symposium on Implications of Lower Lake Levels. Click to view presentation.

What are the native and sportfish population dynamics?  ► (Web designer: Clicking a symbol would reveal info in box below)
STUDY NEEDED

• What is the ecosystem status; are the historic range and frequency of aquatic habitat conditions being maintained?

Research Activity
✓ U.S. Bureau of Reclamation Lower Colorado Region – Lower Colorado River Multi-Species Conservation Program

To what extent are endocrine disruptors or hormonally active agents interfering with fish health and reproduction. What is the prevalence of intersex in fish? (See also Category 3). (Web designer: please link highlighted text to the Category 3 web page, once created). ▶ (Web designer: Clicking a symbol would reveal info in box below)

Research Activity
✓ U.S. Geological Survey Nevada Water Science Center – Endocrine Disruption in Lake Mead

How can razorback sucker recovery in Lakes Mead and Mohave be enhanced? Are threats of (1) habitat modification/loss; (2) non-native predation; and (3) contaminants being adequately addressed? ▶ (Web designer: Clicking a symbol would reveal info in box below)

Research Activity
✓ U.S. Geological Survey Fort Collins Science Center – Rescuing the Razorback Sucker

References
1. (Nevada Department of Wildlife 2004 – 2008 data)

Did you know?

Once abundant throughout the Colorado River basin, Lake Mohave now contains the largest remaining population of endangered razorback suckers. more... (Web designer: Please link “more...” to the fish/razorback sucker page.)
Significant alterations to the environment and community structure by abiotic and biotic stressors (i.e., contaminants, invasive species, and/or climate changes) could affect food webs and dynamics within Lakes Mead and Mohave and thereby cause profound ecosystem changes. Contaminants, invasive species, and climate change are discussed in further detail below.

**CONTAMINANTS**

Water quality in Lake Mead, particularly Las Vegas Bay, is affected by point and non-point sources emanating from Las Vegas Wash, an urban perennial stream that receives more than 175 million gallons per day of treated effluent from three wastewater treatment plants in Henderson, Las Vegas, and Clark County, Nevada. In addition, historic military and commercial industrial complexes located near the Wash have contributed known contaminants such as perchlorate, dichlorodiphenyltrichloroethane (DDT), and polychlorinated biphenyls (PCBs). Runoff and ground-water seepage from urban irrigation in Las Vegas also contribute organic contaminants (e.g., bacteria, oil, grease, pesticides, herbicides, nutrients from fertilizers) and metals to the Wash. Perchlorate has been detected in Lake Mead and downstream of the outlet from Hoover Dam in Lake Mohave in the area of Willow Beach. In addition, drought conditions in the region have lowered lake levels more than 100 ft, which may concentrate contaminants in some locations. Specific monitoring and research questions appear in other categories as appropriate, and are repeated within this section.

**INVASIVE SPECIES**

The spread of invasive species is recognized as one of the major factors contributing to ecosystem change and instability throughout the world. An invasive species is “a non-native species whose introduction does, or is likely to cause, economic or environmental harm or harm to human, animal, or plant health” (Executive Order 13112, 1999).

**Quagga Mussels**

Adult quagga mussels (*Dreissena bugensis*) were detected in Lake Mead in January 2007; they subsequently spread throughout both Lakes Mead and Mohave. This invasive species has the potential to cause millions of dollars of damage by clogging engines and encrusting boats and facilities, disrupting the food chain, disrupting sport fishing, and littering beaches of Lakes Mead and Mohave. Following invasion, NPS developed a Lake Mead NRA Quagga Mussel Response Plan and an *Interagency Management Action Plan (I-MAP) for Quagga Mussels* with its partners. (Web designer, a PDF of I-MAP is provided in the Documents folder for this category. Please upload it and link it to highlighted text. JMM is waiting for the final version of the Lake Mead NRA Quagga Mussel Response Plan). This document focuses monitoring of...
adults, juveniles, and veligers. Adults are monitored at 56 selected sampling stations locations that correspond to sub-surface rocky, sandy, and muddy areas. Veligers are monitored at 42 sampling sites. Monitoring intervals are described within the I-MAP.

Photo by NPS SUBMERGED RESOURCES CENTER
Quagga mussel monitoring in Lake Mead.

Potential Noxious Aquatic Plant Invaders
The introduction of invasive plant species to United States water bodies has been escalating with widespread destructive consequences. Invasive plants are associated with significant habitat destruction, loss of animal communities, reduced fishing and water recreation opportunities, and large mitigation expenditures. Some potential aquatic plant invaders to Lakes Mead and Mohave include the following species listed below.

- Giant Reed (*Arundo donax*)
- Hydrilla (*Hydrilla verticillata*)
- Eurasian Water Milfoil and Parrotfeather (*Myriophyllum sp.*)
- Alligator Weed (*Alternanthera philoxeroides*)
- Curly Leaf Pondweed (*Potamogeton crispus*)
- Giant Salvinia (*Salvinia molesta*)

CLIMATE CHANGE
Colorado River water originates as spring thaws of snowpack in the Rocky Mountains; changes to snow processes in the Rockies will affect all reservoirs along the Colorado, including Lakes Mead and Mohave. Warmer temperatures may create significant water supply shortages in the Colorado River. “A warming climate is, in general, expected to increase water temperatures and modify regional patterns of precipitation, and these changes can have direct effects on water quality (Lettenmaier 2008).” Impacts to Lakes Mead and Mohave ecosystems would likely result from changes in water quantity within the Colorado River system, which would, in turn, correspond to higher probabilities of lowering lake levels, increases in surface water temperatures resulting in changes in plankton/biota and lake mixing, potential increases in urban runoff from increased probability of flash floods, and changes to shoreline vegetation and animal resources.

Management questions best answered by monitoring:

What are the status and trends of contaminants in the water column [e.g., disinfection byproduct precursors, VOCs, radionuclides, priority pollutants (EPA and State), and pathogens] (see also Category 1. Water Quality and Limnology)?

Monitoring Activity

Recent Reports and Publications

• What contaminants are present in native and non-native fish tissues and to what extent is fish health impaired? Which contaminants, if any, pose a risk to the public (i.e., human health) (see Category 2. Fish and Aquatic Biota)?

Monitoring Activity
- U.S. Fish and Wildlife Service and Southern Nevada Water Authority - [Bioassessment in the Las Vegas Wash and Tributaries](http://www.fws.gov) – Fish Study SNWA Database Project #573

Recent Reports and Publications
presentation.

✓ Kramer, Joanna A. “Mercury Concentrations in Muscle Tissue from Sportfish in Lake Mead, Nevada.” MPH thesis, University of Nevada, Las Vegas, 2009. Click to view thesis. (Web designer: This document is provided within the Documents folder for this category. Please upload the file and link to highlighted text.)


✓ Rosen M.R. and P.C. Van Metre. 2009. Assessment of multiple sources of anthropogenic and natural chemical inputs to a morphologically complex basin, Lake Mead, USA. Palaeogeography, Palaeoclimatology, Palaeoecology. Click to view abstract; article may be downloaded with journal subscription.


• How effective are the new Las Vegas Wash wetlands in keeping contaminants out of Las Vegas Bay (see also Category 4. Sediment)? (Web designer: Clicking a symbol would reveal info in box below)

Recent Reports and Publications
✓ Acharya, K and A. Adhikari. 2010. A comparison of water quality improvements from three different wetland types in the Las Vegas Valley watershed. SNWA Report. Click here to view the report.
• **What is the status and trend of re-suspension and transport of contaminants and nutrients from sediments** (see also Category 4. Sediment)?  
  (Web designer: Clicking a symbol would reveal info in box below)  
  **STUDY NEEDED**

  **What are the status and trends of contaminants in sediments** (see also Category 4. Sediment)?  
  (Web designer: Clicking a symbol would reveal info in box below)

  Monitoring Activity
  ✓ U.S. Geological Survey Nevada Water Science Center: [Endocrine Disruption in Lake Mead](#).

  Recent Reports and Publications
  ✓ Rosen M.R. and P. Van Metre. 2009. Assessment of multiple sources of anthropogenic and natural chemical inputs to a morphologically complex basin, Lake Mead, USA. Palaeogeography, Palaeoclimatology, Palaeoecology. [Click here to view abstract; full text is available with journal subscription](#).

• **What is the effect of dredging or other maintenance activities on contaminant release from sediment?** (See also Category 4).  
  (Web designer: Clicking a symbol would reveal info in box below)  
  **STUDY NEEDED**

• **What contaminants are present in aquatic dependant bird tissues, such as eggs** (see also Category 5. Birds)?  
  (Web designer: Clicking a symbol would reveal info in box below)

  Recent Reports and Publications
  ✓ SNWA Report: [Las Vegas Wash Monitoring and Characterization Study: Ecotoxicologic Screening Assessment of Selected Contaminants of Potential Concern in Sediment, Whole Fish, Bird Eggs, and Water, 2000-2003](#)

• **What amount and type of contaminants are in aquatic dependant bird food sources** (see also Category 5. Birds)?  
  (Web designer: Clicking a symbol would reveal info in box below)  
  **STUDY NEEDED**

• **What are the trends in aquatic invasive species (e.g., quagga mussel, Asiatic clam, New Zealand mud snail) abundance and distribution?**  
  (Web designer: Clicking a symbol would reveal info in box below)
What are the trends in invasive species of aquatic plant (e.g., giant reed, hydrilla, Eurasian water milfoil, and giant salvinia) abundance and distribution? (Web designer: Clicking a symbol would reveal info in box below)

STUDY NEEDED

What are the impacts of invasive species on nutrients (see also Category 2. Fish and Aquatic Biota)? (Web designer: Clicking a symbol would reveal info in box below)

STUDY NEEDED

What is the difference between historic lake levels and predicted lake levels due to climate change? (Web designer: Clicking a symbol would reveal info in box below)

Monitoring Activity
✓ U.S. Bureau of Reclamation daily measurement of lake levels

What is the relationship of flows to lake levels? How does climate change relate to water availability? (Web designer: Clicking a symbol would reveal info in box below)

Are lake surface water temperatures changing as a result of climate change? (Web designer: Clicking a symbol would reveal info in box below)

What impacts are brought about by changes to waste water delivery systems to Boulder Basin? (Web designer: Clicking a symbol would reveal info in box below)

STUDY NEEDED

Management questions best answered by research:

What are the mass transport and internal cycling budgets for contaminants? (See also Category 1. Water Quality and Limnology). (Web designer: Clicking a symbol would reveal info in box below)

To what extent are endocrine disruptors or hormonally active agents (contaminants) interfering with fish health and reproduction? (See also Category 2. Fish and Aquatic Biota). (Web designer: Clicking a symbol would reveal info in box below)
Monitoring Activity

- U.S. Fish and Wildlife Service and Southern Nevada Water Authority - Bioassessment in the Las Vegas Wash and Tributaries – Fish Study SNWA Database Project #573
- U.S. Geological Survey Nevada Water Science Center – Endocrine Disruption in Lake Mead

Recent Reports and Publications

- Kramer, Joanna A. “Mercury Concentrations in Muscle Tissue from Sportfish in Lake Mead, Nevada.” MPH thesis, University of Nevada, Las Vegas, 2009. [Click to view thesis. (Web designer: This document is provided within the Documents folder for this category. Please upload the file and link to highlighted text.)]
- Leiker, T.J., S.R. Abney, S.L. Goodbred, and M.R. Rosen. 2009. Identification of methyl triclosan and halogenated analogues in both male common carp (Cyprinus carpio) from Las Vegas Bay and Semipermeable Membrane Devices from Las Vegas Wash, Nevada. Science of the Total Environment, 407, 2102-2114. [Click to view abstract; article may be downloaded with journal subscription.]
- Rosen M.R. and P.C. Van Metre. 2009. Assessment of multiple sources of anthropogenic and natural chemical inputs to a morphologically complex basin, Lake Mead, USA. Palaeogeography, Palaeoclimatology, Palaeoecology. [Click to view abstract; article may be downloaded with journal subscription.]


- How do sediments serve as nutrient and contaminant traps or sinks and how do they affect productivity (see also Category 4. Sediment)? (Web designer: Clicking a symbol would reveal info in box below) STUDY NEEDED

- How do sediments and contaminants interact with the food web (see also Category 4. Sediment)? (Web designer: Clicking a symbol would reveal info in box below) STUDY NEEDED

- What is the relationship between sediment accumulation and contaminant accumulation? What is the fate and transport of contaminants? Is there a subsurface barrier (see also Category 4. Sediment)? (Web designer: Clicking a symbol would reveal info in box below) STUDY NEEDED

- What are the best management practices and treatment methods to deal with invasive species to sustain the biodiversity and function of the Lake Mead/Lake Mohave ecosystems? (Web designer: Clicking a symbol would reveal info in box below) STUDY NEEDED

- What is the life history of a selected invasive species under the environmental conditions of Lakes Mead and Mohave? (Web designer: Clicking a symbol would reveal info in box below) I-MAP

- What are impacts/potential impacts of aquatic invasive species on water quality related to drinking water and recreation? (Web designer: Clicking a symbol would reveal info in box below)
STUDY NEEDED

- What are the impacts/potential impacts of invasive species on the Lake Mead and Mohave ecosystems, especially to fish and other aquatic living resources? (Web designer: Clicking a symbol would reveal info in box below)

- What are impacts/potential impacts of climate change on water quality related to drinking water and recreation? (Web designer: Clicking a symbol would reveal info in box below)

Recent Symposium
- Implications of Lower Lake Levels – A Colorado River Commission of Nevada Symposium (April 20-21, 2010). Click to view presentations.

STUDY NEEDED

- How are the inputs of metals changed over time and place by climate change (see also Category 4. Sediment)? (Web designer: Clicking a symbol would reveal info in box below)

STUDY NEEDED

- What food-web dynamics are in place in Lakes Mead and Mohave? How are these dynamics being altered by drought, contaminants, invasive species, climate change, and other emerging threats? Are upper trophic levels being adequately maintained to support robust wildlife populations? (See also Category 2. Fish and Aquatic Biota and Category 5. Birds). (Web designer: Clicking a symbol would reveal info in box below)

Research Activity
- University of Nevada, Reno – Assessment of Lake Mead’s bottom dwelling community prior to the expansion of adult quagga mussels
- U.S. Geological Survey Nevada Water Science Center – Endocrine Disruption in Lake Mead

Recent Reports and Publications
over time with emphasis of the ecology of adult quagga mussel. Click to view abstract and presentation.

Loomis, Eric Michael, “Trophic Interactions Associated with Introduction of the Invasive Quagga Mussel in Lake Mead, Nevada.” MPH thesis, University of Nevada, Las Vegas, 2009. Click to view thesis. (Web designer: This document is provided within the Documents folder for this category. Please upload the file and link to highlighted text.)

- Can stressors impact water quality, water security, and water delivery systems in such a way that response actions are required that affect ecosystem components? (Web designer: Clicking a symbol would reveal info in box below)

STUDY NEEDED

Did you know?

UNDER CONSTRUCTION
After the completion of Hoover Dam in 1935, sediment began accumulating in the new reservoir (Lake Mead) as the flow of the Colorado River was captured. Three studies have examined the amount of sediment accumulation and the rate of sedimentation in Lake Mead: a 1948-1949 USGS and Reclamation study (Smith et al. 1960), a 1963-1964 Reclamation study after the closure of Glen Canyon Dam (Lara and Sanders 1970), and a 2001 USGS and Reclamation study. Results of the 2001 study show that post-impoundment sediment is generally distributed along the floors of the deepest parts of the lake, mainly following the paths of the former Colorado River and the tributary valleys that fed into it, rather than being deposited as a drape across the entire lake floor (Twichell et al. 2005). These sediments are thickest in the deltas that formed at the mouths of the Colorado River and its tributaries, including the Virgin and Muddy Rivers. Maximum sediment thickness exceeds 80 m where the Colorado River enters Lake Mead, thinning to 15-35 m in thickness along the remainder of the drowned Colorado River channel to Hoover Dam. Tributary valleys have a thinner sediment cover indicating the Colorado River has been the primary sediment source. Sediment cores indicated stratification of fine silt interrupted by graded beds containing as much as 30 percent sand deposited from turbidity currents, which flowed the full length of the lake. With the completion of Glen Canyon Dam in 1964, sediment volume entering Lake Mead from the Colorado River decreased to approximately one tenth of the pre-dam volume (Lara and Sanders 1970). With the lake levels dropping since 2000, delta deposits at the mouth of the Colorado River and tributaries, including Las Vegas Wash, have been eroded by the river flow and redistributed to the deeper parts of the lake.
Sediment cores taken in 1998 have been examined for anthropogenic and natural organic and inorganic contaminants (Covay and Beck 2001; Rosen and Van Metre 2009). In addition, sediment from Las Vegas Wash (the main tributary from Las Vegas) has also been examined for contaminants (Covay and Leiker 1998). These studies found numerous organic compounds associated with urban runoff, industrial contaminants from erosion of the Basic Management Incorporated (BMI) site on Las Vegas Wash, and compounds associated with tertiary treated wastewater effluent, although few compounds were greater than Canadian sediment quality guidelines (Rosen and Van Metre 2009).

In contrast to Lake Mead, remarkably little sediment has accumulated in Lake Mohave since its impoundment in 1953 (Foster 2004). Lake Powell (within Glen Canyon National Recreation Area) and other upstream reservoirs trap virtually all of the sediment transported by the Colorado River. The small amount of fine-grained sediment, which has accumulated, tends to occur in the deepest parts of the lake within sheltered areas along the edges of the drowned Colorado River channel. Other post-impoundment deposits include debris flows found at the mouths of washes probably associated with flash floods and landslides along the base of steep cliffs in the northern section of the lake, which appear to be the result of cliff collapse (Foster 2004). Knowledge of any contaminants present Lake Mohave sediments is currently lacking.

**Strategic Fundamental Objectives**

- A healthy sports fishery
- Healthy populations of native fish
- Healthy populations of aquatic dependent wildlife
- Healthy shoreline dependent native vegetation
- Existing high quality setting for water-based recreation
- Regional and community needs for municipal and industrial uses, including domestic water supply and Colorado River System return flow credits

**Management questions best answered by monitoring:**

- **What is the status and trend of re-suspension and transport of contaminants and nutrients from sediments?** (Web designer: Clicking a symbol would reveal info in box below)

  [STUDY NEEDED]

- **What is the status and trend of sediment delivery at tributaries?** (Web designer: Clicking a symbol would reveal info in box below)

  [STUDY NEEDED]
• What is the status and trend of contaminants in sediments? (See also Category 3). (Web designer: Clicking a symbol would reveal info in box below)

Monitoring Activity

Recent Reports and Publications

• How does sediment distribution affect spawning potential and reproductive success of sensitive species? (See also Category 2). (Web designer: Clicking a symbol would reveal info in box below)

STUDY NEEDED

• How effective are the new Las Vegas Wash wetlands in keeping contaminants out of Las Vegas Bay (see also Category 3. Stressors)? Relevant monitoring activities, data, or reports: (Web designer: Clicking a symbol would reveal info in box below)

Recent Reports and Publications
✓ Acharya, K and A. Adhikari. 2010. A comparison of water quality improvements from three different wetland types in the Las Vegas Valley watershed. SNWA Report. Click here to view the report.

• What is the effect of dredging or other maintenance activities on contaminant release from sediment? (See also Category 3). (Web designer: Clicking a symbol would reveal info in box below)

STUDY NEEDED

Management questions best answered by research:

• How do sediments serve as nutrient and contaminant traps or sinks and how do they affect productivity? (Web designer: Clicking a symbol would reveal info in box below)
• What happens (e.g., microbial degradation, transport, compaction etc.) to contaminants in sediment?  
  (Web designer: Clicking a symbol would reveal info in box below)

• Are quagga mussels and other invasive species affecting sediment dynamics or vice versa? (See also Category 3).  
  (Web designer: Clicking a symbol would reveal info in box below)

• How do sediments and contaminants interact with the lower part of the food web? (See also Category 2).  
  (Web designer: Clicking a symbol would reveal info in box below)

• What is the role of sediment transport in relation to native fish spawning and fish habitat (see also Category 2. Fish and Aquatic Biota)?  
  (Web designer: Clicking a symbol would reveal info in box below)

• Where do sediments accumulate in greatest abundance? Are there places where contaminants accumulate? What is the fate and transport of contaminants? Is there a subsurface barrier?  
  (Web designer: Clicking a symbol would reveal info in box below)

• What is the relationship between suspended sediment and the aquatic food web and success of razorback sucker (see also Category 2. Fish and Aquatic Biota)? How does turbidity vary seasonally?  
  (Web designer: Clicking a symbol would reveal info in box below)

• What pathogen/sediment associations are present and what causes pathogen remobilization into the water column?  
  (Web designer: Clicking a symbol would reveal info in box below)
STUDY NEEDED

- How are the inputs of metals changed over time and place by anthropogenic (e.g., dams, manganese mining), atmospheric (climate change), or other natural actions? (Web designer: Clicking a symbol would reveal info in box below)

STUDY NEEDED

- How do wastewater delivery systems impact sediments? (Web designer: Clicking a symbol would reveal info in box below)

References


Did you know?
UNDER CONSTRUCTION
Research Permits
Thank you for your interest in Lake Mead NRA as a potential research site. The National Park Service (NPS) is responsible for managing the use of all units of the National Park System for the purposes of compliance with the NPS Organic Act. The Act charges all units of the NPS to preserve natural and cultural resources unimpaired for the enjoyment of current and future generations. Preserving Park resources requires an understanding of an area’s natural resource components, cultural and historic components, and visitor interests. It also requires understanding interrelationships among resources, visitors, and physical processes within the Park. Obtaining this background knowledge requires scientific study. In fact, the NPS views research and resulting information as fundamental to protecting the resources in its care.

Park managers increasingly recognize that timely and reliable scientific information is essential for sound decisions and for public information and education. We welcome permit proposals for scientific studies designed to use NPS values to increase understanding of the natural world, the nation’s history and cultures, and, as well, specific Park features as the basis for improved management.

Scientific Research and Collecting Permit (SRCP)
A Scientific Research and Collecting Permit (SRCP) is required for most scientific activities pertaining to natural resources or social science studies in National Park System areas that involve fieldwork, specimen collection, and/or have the potential to disturb resources or visitors. Scientists must submit an application, study proposal, and peer reviews for permit consideration.

How to Apply
The timeframe for obtaining a Research Permit varies from Park to Park, with a maximum of 90 days required. Lake Mead NRA has worked to streamline this process. While, in most cases, we can turn around a permit within 21 days or less, there can be no guarantees on the time it may take for any particular permit. Review periods are influenced by the complexity of the proposed project, resource impacts of the proposed project, potential public controversy related to the proposed project, and availability of review personnel. Please plan ahead because the number of steps that must be completed in the process make it a challenge to reduce the timeframe further. Expedited reviews in order to meet proposals submitted too near to their proposed start date are not typically available. The NPS manages an Internet-based information system called the Research Permit and Reporting System (RPRS) [Insert link when available; currently down for updating]. If you are interested in obtaining a permit to conduct a natural resource or social science study in any unit of the National Park System, please visit the RPRS site to:

- Review NPS scientific permit requirements and application procedures.
- Review permit conditions before beginning the permit application process.
- Review accomplishments of previous research conducted in a park before planning a new study.
- Review the types of research specific parks are especially interested in attracting.
- Complete and submit an application for a scientific research and collecting permit.
- Provide reports on your completed study.

For additional information about your specific permit (including field ethics and safety, ranger contacts, camping accommodations, and maps), please contact Lake Mead NRA’s Research Permit Office at (702)293-8978.

Lake Mead NRA-specific Research Interests
Lake Mead resource managers have worked with scientists and resource managers from other local, state, and federal agencies with interest in the Lake Mead NRA region on a number of science strategies. We have identified priority research and monitoring questions whose answers will directly inform management approaches and actions. Vital signs have been selected to represent the overall condition or health of Park resources. Lake Mead NRA encourages researchers to consider these questions and vital signs and whether they could be incorporated.
into existing academic research or serve as a springboard into new studies (such as a new graduate thesis/dissertation project).

**Limnology and Aquatic Resources**

Regarding the limnological and aquatic resources of Lakes Mead and Mohave, priority monitoring and research questions have been documented within each of six ecosystem categories. Visit the main page of Lake Mead NRA’s Limnology and Aquatic Resource initiative and the web pages dedicated to each of the six categories, where you can view the questions and current effort. ([Link when available](#))

Or view the [Long-term Limnological and Aquatic Resource Monitoring and Research Plan for Lakes Mead and Mohave](#) Click here to download the PDF.

**NPS Inventory and Monitoring (I&M) Program – Mojave Desert I&M Network**

Lake Mead NRA is a part of the [NPS Inventory and Monitoring (I&M) Program’s Mojave Desert I&M Network (MOJN)](#), which also includes Death Valley National Park, Great Basin National Park, Joshua Tree National Park, Manzanar National Historic Site, Mojave National Preserve, and the Parashant National Monument. MOJN has drafted a [MOJN Vital Signs Monitoring Plan](#), which has identified key vital signs of park-resource health for each of its member Parks. Vital signs ranking in the top 20th percentile of importance for Lake Mead NRA are listed in Table 7 on page 30 of [Appendix H](#) of the Plan.

**Interagency Science and Research**

Lake Mead NRA is a member of the [Southern Nevada Agency Partnership (SNAP)](#), whose Science and Research Team has identified a series of priority science and research questions for Southern Nevada’s public lands. The full listing of SNAP science and research questions can be found within the [SNAP Science and Research Strategy](#) and annual SNAP priorities are indicated in its annual needs assessment ([Please link when available](#)).

**Cultural Resource Project Information**

When permits are required for scientific activities pertaining solely to cultural resources, including archeology, ethnography, history, cultural museum objects, cultural landscapes, and historic and prehistoric structures, other permit procedures apply. For additional information visit the [NPS Archaeology Program](#) website or contact Lake Mead NRA’s headquarters at (702)293-8959.

**Did you know?**

Xxx number of permitted scientific research studies have been conducted at Lake Mead NRA since 19xx. [UNDER CONSTRUCTION](#)