
**Water Quality Monitoring Report, Issue 1, July 2004** **From the Lab of Dave Walker, Ph.D. University of Arizona**
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## Initial Saguaro Lake Sampling

Susan Fitch and Jenny Hickman (ADEQ Clean Lakes Program) sampled from Sagauro on 6/30/04. Only a few dead fish were noticed. They collected long plankton tows that were sent away for analysis of a suite of algal toxins including anatoxin-a, microcystin, saxitoxin, and cylindrospermopsin. We are still awaiting results of these analyses.

Profile data shows a relatively deep thermocline around 7-8 meters. The epilimnetic:hypolimnetic temperature differential was not as great as previous years and as compared to other reservoirs in the region. Lake Pleasant, for example, was 28 degrees C at the surface and only 11 at the bottom of the hypolimnion.

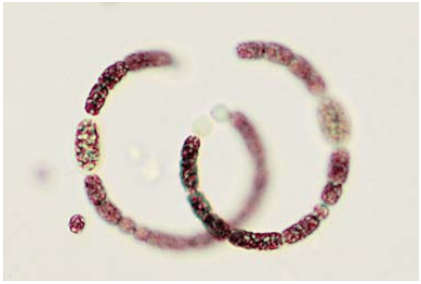
Algae counts and identification shows a reservoir-wide dominance of cyanobacteria. Chlorophyll-a levels are considerably higher than they were last year at a similar time (early June in 2003 v. late June this year). Chlorophyll-a

levels last year were 1.604 and 2.572 mg/m$^3$ at sites SRSAG-A (front of dam) and SRSAG-B (inside no-wake buoys) respectively. So, there has been an increase in algal biomass as compared to last year and the type that has lead to that increase is cyanobacteria. Not the best scenario when trying to manage for potential algal toxicity and eutrophication in general.

Average cell size of suspect organisms capable of toxin production continues to increase especially in species of *Anabaenopsis circularis* and *Cylindrospermopsis raciborskii*. There is a direct correlation, in the case of *C. raciborskii*, between cell size and amount of toxin produced. We have found both the curled and straight morphologies of *C. raciborskii* with the straight being much large than the curled type.

The effect of the monsoon on toxins released to the water is unknown. Typically, algal biomass is suppressed if sunlight is reduced through several cloudy days in a row. This may result in a pulse of toxin as some cells begin to die off. We'll continue to monitor and keep everyone updated.

*Cylindrospermopsis raciborskii*



*Anabaenopsis circularis*

# Saguaro Physical Water Quality Parameters

| Site ID | Date | Time | Temp | SpCond | TDS | DO % | DO Conc | Depth | pH | ORP |
|---|---|---|---|---|---|---|---|---|---|---|
| | M/D/Y | hh:mm:ss | C | mS/cm | g/L | % | mg/L | m | | mV |
| **SRSAG-A** | 6/29/2004 | 13:02:19 | 27.36 | 2.155 | 1.401 | 115 | 9.05 | 0.126 | 8.33 | 181 |
| **SRSAG-A** | 6/29/2004 | 13:03:14 | 27.34 | 2.155 | 1.401 | 113.4 | 8.93 | 0.658 | 8.35 | 208 |
| **SRSAG-A** | 6/29/2004 | 13:05:10 | 26.53 | 2.149 | 1.397 | 116.9 | 9.34 | 2.047 | 8.39 | 246 |
| **SRSAG-A** | 6/29/2004 | 13:06:09 | 25.39 | 2.113 | 1.374 | 119.4 | 9.74 | 2.98 | 8.35 | 262 |
| **SRSAG-A** | 6/29/2004 | 13:07:08 | 24.37 | 2.105 | 1.368 | 109.5 | 9.09 | 4.077 | 8.29 | 276 |
| **SRSAG-A** | 6/29/2004 | 13:08:05 | 23.73 | 2.105 | 1.368 | 87.6 | 7.37 | 5.046 | 8.16 | 289 |
| **SRSAG-A** | 6/29/2004 | 13:11:25 | 23.18 | 2.097 | 1.363 | 57.9 | 4.92 | 6.647 | 7.99 | 310 |
| **SRSAG-A** | 6/29/2004 | 13:13:21 | 22.78 | 2.096 | 1.363 | 35 | 2.99 | 8.487 | 7.82 | 319 |
| **SRSAG-A** | 6/29/2004 | 13:14:33 | 22.49 | 2.095 | 1.362 | 9.5 | 0.82 | 9.578 | 7.69 | 326 |
| **SRSAG-A** | 6/29/2004 | 13:16:00 | 21.86 | 2.091 | 1.359 | 5.4 | 0.47 | 14.516 | 7.61 | 331 |
| **SRSAG-A** | 6/29/2004 | 13:17:56 | 21.15 | 2.09 | 1.358 | 7.5 | 0.67 | 25.93 | 7.55 | 337 |
| **SRSAG-A** | 6/29/2004 | 13:19:27 | 20.73 | 2.086 | 1.356 | 11.4 | 1.02 | 29.548 | 7.52 | 140 |
| | | | | | | | | | | |
| **SRSAG-B** | 6/29/2004 | 11:34:47 | 27.42 | 2.148 | 1.396 | 111 | 8.73 | 0.106 | 8.28 | 198 |
| **SRSAG-B** | 6/29/2004 | 11:37:35 | 26.87 | 2.142 | 1.392 | 111.8 | 8.88 | 1.074 | 8.32 | 263 |
| **SRSAG-B** | 6/29/2004 | 11:38:38 | 26.41 | 2.138 | 1.39 | 108.7 | 8.7 | 1.965 | 8.32 | 278 |
| **SRSAG-B** | 6/29/2004 | 11:39:45 | 25.63 | 2.131 | 1.385 | 95 | 7.72 | 2.935 | 8.23 | 293 |
| **SRSAG-B** | 6/29/2004 | 11:41:19 | 24.36 | 2.11 | 1.372 | 71.8 | 5.97 | 4.072 | 8.05 | 310 |
| **SRSAG-B** | 6/29/2004 | 11:43:13 | 22.89 | 2.094 | 1.361 | 56 | 4.79 | 6.047 | 7.94 | 324 |
| **SRSAG-B** | 6/29/2004 | 11:44:06 | 22.42 | 2.089 | 1.358 | 53.1 | 4.58 | 8.046 | 7.89 | 329 |
| **SRSAG-B** | 6/29/2004 | 11:45:14 | 22.15 | 2.085 | 1.355 | 50.2 | 4.35 | 10.106 | 7.83 | 334 |
| | | | | | | | | | | |
| **SRSAG-C** | 6/29/2004 | 10:30:30 | 25.48 | 2.12 | 1.378 | 90.6 | 7.38 | 0.101 | 8.13 | 153 |
| **SRSAG-C** | 6/29/2004 | 10:32:14 | 24.83 | 2.116 | 1.375 | 88 | 7.25 | 1.004 | 8.14 | 173 |
| **SRSAG-C** | 6/29/2004 | 10:33:21 | 24.75 | 2.114 | 1.374 | 87 | 7.18 | 1.438 | 8.13 | 183 |
| **SRSAG-C** | 6/29/2004 | 10:34:22 | 24.68 | 2.115 | 1.374 | 84.1 | 6.95 | 2.131 | 8.12 | 192 |
| **SRSAG-C** | 6/29/2004 | 10:35:15 | 24.65 | 2.115 | 1.375 | 82.6 | 6.83 | 2.827 | 8.12 | 198 |
| **SRSAG-C** | 6/29/2004 | 10:36:08 | 24.63 | 2.114 | 1.374 | 80.9 | 6.69 | 3.535 | 8.11 | 204 |
| **SRSAG-C** | 6/29/2004 | 10:37:40 | 24.56 | 2.115 | 1.375 | 77.2 | 6.4 | 5.666 | 8.08 | 212 |

# Saguaro Algae Counts

**SRSAG-A** (Lacustrine area).
Chlorophyll *a*: 7.056 mg/m$^3$
Pheophytin *a*: 1.358 mg/m$^3$

| Division | Genus | Species | Units/mL |
|---|---|---|---|
| Cyanophyta | Oscillatoria | agardhii * | **3211** |
| Cyanophyta | Cylindrospermopsis | raciborskii * | **2187** |
| Chlorophyta | Chlorella | sp. | **884** |
| Cyanophyta | Anabaenopsis | circularis * | **730** |
| Cyanophyta | Anabaena | laxa * | **533** |
| Cyanophyta | Aphanizomenon | flos-aquae * | **387** |
| Chlorophyta | Chlamydomonas | sp. | **291** |
| Cyanophyta | Anabaena | torulosa * | **94** |

*Total units/mL: 8317*
* = potential toxin producer

**SRSAG-B**
(Transitional zone just inside no-wake buoys)
Chlorophyll *a*: 11.440 mg/m$^3$
Pheophytin *a*: 2.889 mg/m$^3$

| Division | Genus | Species | Units/mL |
|---|---|---|---|
| Cyanophyta | Oscillatoria | agardhii * | **4709** |
| Cyanophyta | Cylindrospermopsis | raciborskii * | **3047** |
| Cyanophyta | Anabaenopsis | circularis * | **1881** |
| Cyanophyta | Anabaena | laxa * | **1287** |
| Chlorophyta | Chlorella | sp. | **488** |
| Chlorophyta | Thoracomonas | sp. | **417** |
| Chlorophyta | Carteria | sp. | **379** |
| Chlorophyta | Scenedesmus | sp. | **360** |
| Pyrrophyta | Glenodinium | sp. | **302** |
| Cyanophyta | Microcystis | sp. * | **106** |

* = potential toxin producer
*Total units/mL: 12,976*

***Saguaro Algae Counts Continued***

**SRSAG-C** (Riverine zone)
Chlorophyll *a*: 14.460 mg/m$^3$
Pheophytin *a*: 4.051 mg/m$^3$

| Division | Genus | Species | Units/mL |
|---|---|---|---|
| Cyanophyta | Cylindrospermopsis | raciborskii * | **7325** |
| Cyanophyta | Anabaenopsis | circularis * | **4472** |
| Cyanophyta | Aphanizomenon | flos-aquae * | **962** |
| Cyanophyta | Oscillatoria | agardhii * | **707** |
| Cyanophyta | Anabaena | laxa * | **685** |
| Cyanophyta | Merismopedia | elegans | **527** |
| Chrysophyta | Fragilaria | sp. | **516** |
| Chlorophyta | Carteria | sp. | **503** |
| Pyrrophyta | Glenodinium | sp. | **480** |
| Cyanophyta | Oscillatoria | limnetica * | **242** |
| Chlorophyta | Scenedesmus | sp. | **83** |
| Chrysophyta | Gomphonema | sp. | **37** |
| Chrysophyta | Nitzchia | sp. | **29** |
| Cyanophyta | Spirulina | sp. | **17** |

* = potential toxin producer
*Total units/mL: 16,585*

## Scope of Project : Watershed-wide Water Quality and the Potential Effects of the Willow Fire on the Verde River Watershed.

It was recently stated that we "are only working on the reservoirs" for this project. Let me assure you, nothing is farther from the truth. The title is "*Comprehensive Watershed Management*" for a reason and to only focus on one section of any particular watershed we are examining, not only doesn't make sense, but is a waste of time, effort, and dollars. We have established sampling sites well above and below the reservoirs. We have examined and are continuing to examine the effects of drought and wildfire since the inception of this project and will continue to do so. We have established on-going collaboration with state, federal, and tribal agencies because watersheds know no jurisdictional boundaries. We had a representative (Cheryl Pailzote) from the White Mountain Apache Tribe at the last meeting who gave an incredible presentation about the devastating effects of the Rodeo-Chedeski Fire on tribal lands, gave some predictions about on-going restoration efforts, an overview of water quality, and saddening information about the archeological impact. We are also working with ADEQ, AzG&F, CAP, USGS, Tonto N.F., and several other collaborating agencies to protect the aquatic resource in these watersheds. Additionally, we have sampled from Colorado River reservoirs (Mohave, Havasu, Mead) and from sites well above the reservoirs on the Salt and Verde Rivers. We routinely monitor several biological, chemical, and physical attributes at each site within each watershed. A list of analytes and methodology was included with the latest UA/NSF Water Quality Center report. If anyone would like this list, or the latest report, please feel free to contact me at dwalker@ag.arizona.edu and I'll mail it to you. The presentations from the March meeting are available at http://ag.arizona.edu/limnology/watersheds/presentation/WtrshdAgenda.pdf

*Eugene Solberg photo*
*Willow Fire Smoke Plume*

Recently, the Willow Fire poses a similar risk to water quality in the Verde River system that the Rodeo-Chedeski fire did to the Salt River system last year. The Willow Fire, which started on June 24th, has grown to 85,000 acres consumed as of today (07/06/04) and is 17% contained. The areas affected are generally drainages to the north and west of North and Mazatzal peaks including sections of the East Verde River, Wet Bottom, Sycamore, and Deadman Creeks. All of these drainages flow into the either the Verde River or, in the case of Deadman Creek, directly into Horseshoe Reservoir (we cross Deadman Creek on the way to our long-term site on the Verde River at Sheep Bridge). Influxes of nutrients, metals, and carbon may, like the Salt River reservoirs, increase the trophic status of Bartlett and Horseshoe reservoirs. It is this eutrophication which may have long-term impacts regarding water quality in this watershed for years to come. This is what we stated about the Rodeo-Chedeski Fire's impact on the Salt River reservoirs immediately following that event and, thus far, these statements have proven to be true. Like the Rodeo-Chedeski Fire's affects on the Salt River reservoirs, increases in trophic status, once initiated, are difficult if not impossible to reverse.

*Jack Kurtz/The Arizona Republic*
*Tanker Fighting the Willow Fire*

We will be monitoring from the Verde River prior to the reservoirs and from some of the affected drainages throughout the monsoon season and will keep everyone informed about the situation.

**Approximate Area of the**
**Willow Fire as of 07/06/04**