LAKE WISE

… a voice for quiet waters

NEWSLETTER FROM OREGON LAKES ASSOCIATION

MAY 2020

Connie Bozarth, Newsletter Manager

IN THIS ISSUE

To Stream or Not to Stream In the Times of Covid-19

Annual Conference of the Oregon Lakes Association (OLA)

October 7-8

Alumni Center, Oregon State University, Corvallis

Because of uncertainties caused by the coronavirus pandemic, this meeting may need to be held online. The 2020 HABS Stakeholder meeting was successfully conducted online, and will serve as a 'trial run' if the conference needs to be held online. The program will be based on submitted abstracts and presentations highlighting lake research being conducted in Corvallis, mostly at OSU.

To better facilitate attendance supported by employers and state agencies, the 2020 meeting is planned mid-week, Wednesday/ Thursday, 7-8 October.

Abstract submission and Early-bird registration deadlines: TBD

Look for forthcoming details on the conference event website

2020 Oregon Lakes Association (OLA) Graduate Student Scholarship Announcement

Contributed by Wayne Carmichael, OLA Board Secretary

- ✓ **The Oregon Lakes Association as part of its scholarship and outreach commitment is pleased to announce the availability of a $1000 academic scholarship.**
- ✓ Application deadline is **May 31, 2020.**
- ✓ Award will be announced by **June 15, 202**
- ✓ The successful applicant will also be awarded a one-year membership in OLA, an invitation to attend our annual meeting with up to $200 in travel expenses and a waiver of the conference fee, in order for OLA to present your award. In addition, OLA encourages the scholarship recipient to present results of their lakes project at an OLA future annual meeting.
- ✓ See our website with instructions and details at: **http://www.oregonlakes.org/Scholarship**

Crysta Gantz and Lara Jensen, OLA's 2019 academic scholarship winners.

MAKE A 2020 DONATION TO SCHOLARSHIP FUND

Thus far OLA has provided over $10,000 in scholarships and travel expenses to the recipients. Please consider donating to the Scholarship and Outreach Fund today, so we can sustain this well into the future. Please consider making a donation today!

Harmful Algae Blooms (HABs) Corner

Contributed by Theo Dreher, President, OLA, Professor Emeritus of Microbiology, Oregon State University

Report of the 2020 Oregon CyanoHABs Stakeholder Meeting

As in recent years, I organized this gathering of CyanoHABs stakeholders as a collaborative effort of OLA, Oregon State University, Oregon Health Authority and Dept of Environmental Quality. 58 people participated in the remote meeting, offered through the Zoom online platform that OSU is using now to teach all of its courses during the COVID-19 shelter-in-place orders.

OHA has continued to make improvements to their monitoring and management of CyanoHAB risks. With the ready availability of toxin testing, OHA has now entirely dropped the use of cell counts of toxigenic species as predictors of possible recreational exposure to toxins. This has resulted in a lower number of advisories, since some of Oregon's CyanoHABs (particularly *Aphanizomenon flos-aquae)* and some *Dolichospermum spp* blooms) can now be shown to be non-toxic. In the past such dense blooms would have been presumed to be toxic. The cyanoHABs advisories issued during 2019 can be seen at the OHA Cyanobacteria Blooms website

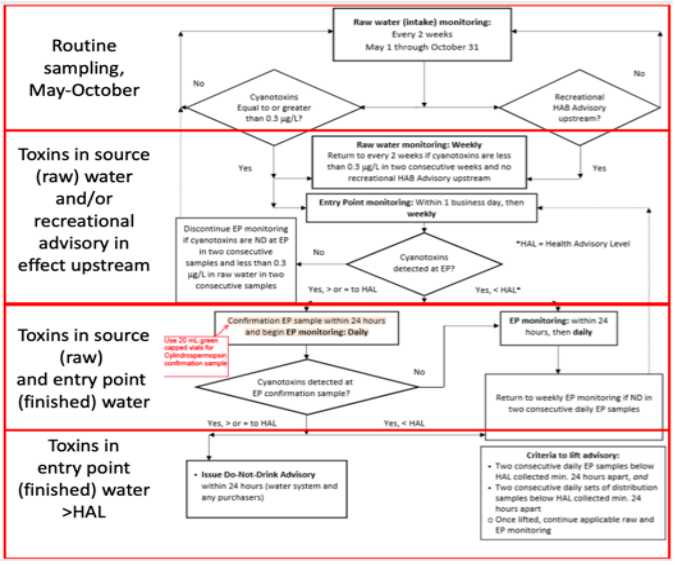
Theo Dreher convening the Stakeholder Meeting from the comfort of home.

Aphanizomenon flos-aquae (AFA), which for the last few years was considered non-toxigenic, is now once again considered toxigenic by OHA, requiring toxin analysis of large AFA blooms. Because the turn-around time for toxin analyses conducted out-of-state can take a few days, in cases of lakes with repeated HABs OHA will experiment with issuing proactive advisories for recreational exposures; these are either dropped or confirmed when results come in. OHA will also issue advisories for localized parts of water bodies with CyanoHABs if these are discrete from unaffected areas of the same lake.

On the drinking water side, OHA has obtained a CDC grant to support education and outreach to small water utilities and those with private intakes from lakes. For larger drinking water utilities using water that is at risk of CyanoHABs, OHA has implemented permanent rules that govern the sampling and toxin analysis frequency of source and finished waters. DEQ has developed the capacity to run these analyses through recent funding from the Oregon legislature. In the absence of a federal standard, Oregon is one of only three US states with such regulations. Details on OHA's recreational and drinking water regulations can be found on the Advisory and Sampling page of the OHA Cyanobacterial Blooms website.

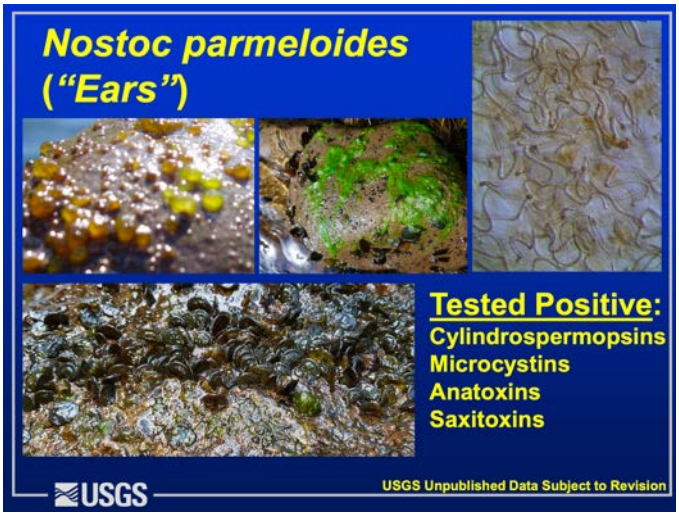
In providing the toxin analyses mentioned above, DEQ has built up considerable expertise in CyanoHABs. In addition to the toxin analyses, which are primarily ELISA-based, they are exploring the use of quantitative PCR to measure the genes of toxigenic CyanoHABs as an alternative for initial monitoring or for early warning. Ohio has led the way in the use of such DNA-based monitoring. DEQ is also investigating the use of satellite imagery delivered via NOAA and EPA for early monitoring of developing blooms. This is most useful for lakes across the state managed by US Forest Service or Army Corps of Engineers. Another option for remote monitoring is the use of sondes placed in lakes to relay real-time conditions.

Over recent years, the US EPA has become an invaluable partner and a resource when dealing with CyanoHABs. Important resources include training in responding to toxin emergencies, particularly the type of emergency that City of Salem faced during summer 2018. EPA is conducting some regional studies on toxin-hotspots, Detroit Lake in Oregon, and Anderson and Spanaway Lakes in WA. USGS is also engaged in research on Santiam, MacKenzie and Willamette watersheds, integrating on-site evaluations with semi-permanent in-situ sondes and the use of passive toxin sampling ("SPATT") to understand toxin threats. As has been extensively documented in California, benthic cyanobacterial mats attached to rocks, dam walls, etc., are a widespread source of toxins. Fragments of mats that break loose can be buoyant due to trapped oxygen bubbles and can then be ingested by dogs or enter water treatment systems.



Decision tree used by OHA & DEQ in monitoring surface water drinking sources for cyanotoxins. From Alison Minerovic (DEQ) presentation.

CyanoHABs research projects in Oregon. Short reports by researchers showed that a number of studies are ongoing in Oregon, despite the paucity of grant opportunities. Desiree Tullos (OSU) is leading a study to collect parameters of the Ross Island Lagoon CyanoHAB in support of her modeling studies aimed at finding an intervention that can prevent these blooms affecting the Willamette River in downtown Portland. Dan Sobota (DEQ & PSU) is combining sonde and satellite remote sensing to study the toxic bloom in Odell Lake, using nearby Crescent Lake as a bloom-free control. James Watson & Mat Titus (OSU) are using computer modeling and machine learning to use similar inputs for making forecasts (currently 2 weeks) of CyanoHAB activity in Detroit Lake. Kim Halsey (OSU) is measuring volatile organic compounds associated with CyanoHABs and exploring whether these chemical signatures can be used to monitor the type and physiological status of a CyanoHAB. Kurt Carpenter (USGS) is combining on-site, in-situ sonde and other inputs to study CyanoHABs in the greater Willamette Basin, and is also assessing the toxicity associated with benthic (attached) cyanobacteria in lakes and streams. Theo Dreher's OSU lab has compiled the genome sequences of multiple recent Oregon CyanoHABs (e.g., Detroit Reservoir, Odell Lake) and the most abundant bacteria that cohabit with each bloom. In another study, the Dreher lab has shown that CyanoHABs that enter the Klamath River from Upper Klamath Reservoir also become distributed through the Klamath Irrigation District. If toxic blooms are present, this could result in toxin becoming aerosolized from overhead sprinklers. The Deschutes River Alliance is assessing nutrient inputs in the Crooked River valley affecting CyanoHABs in Prineville Reservoir and Lake Billy Chinook.



Benthic cyanobacteria, which can be found on rocks in streams and on dam walls and other structures in lakes and reservoirs, often present multiple toxicities. From Kurt Carpenter (USGS) presentation.

Legislative action for stronger state support for CyanoHAB resiliency. OLA has been closely involved in recent discussions aimed at legislative action to support an improved CyanoHABs program in Oregon. During the 2019 legislative session, Rep. Ken Helm sponsored HB 3326, which outlined an improved CyanoHABs program. After some amendments, the bill

became an emergency funding vehicle to better support DEQ's efforts to provide toxin analysis for drinking water sampling mandated by OHA. This was caused by a political decision to focus on getting carbon cap-and-trade legislation passed. In the end, the shameful departure of Republicans from the Capitol meant that most bills were not voted on, including HB 3326. After the legislative session, Rep. Helm's committee asked a group of stakeholders to continue discussions to assist in setting priorities for future legislation. The chairs of the three subgroups recapped the reports presented to the legislature last fall. One outcome was to collate the CyanoHAB-related activities in Oregon, including the involvements of state agencies and the various programs at the national level. The OR Legislative Policy & Research Office will conduct this survey.

Rep. Helm, who now chairs the newly formed House Committee on Water, described the current status of legislative activity. After some modification, the funding request from the 2019 HB 3326 was passed out of the Water Committee with bipartisan support, but the coronavirus crisis has stopped Ways and Means allocations, and funding availability for the future is uncertain. The Governor's 100-year Water Vision program is currently stalled because of these uncertainties. Rep. Helm is hopeful that a federal infrastructure bill could bring funds for water security issues related to CyanoHABs. In concluding the meeting, the preferred course was to continue stakeholder discussions in the framework of the legislatively convened group, in support of the Committee on Water. The focus will be on point by point analysis of the pros and cons of the original forms of 2019 HB 3326. It is hoped that this would result in a bill that would attract wide support when general legislative action is again able to move forward.

Oregon Lakes in the News

Contributed by Paul Robertson, Past OLA President

Fishing in Oregon Lakes During Coronavirus

According to ODFW, Governor Kate Brown's order regarding the COVID-19 pandemic does not prohibit fishing and hunting in Oregon. However, as of March 23 Oregon State Parks have been closed, USFS trailheads are closed, and many coastal communities closed lodging amenities and parks (all of Lincoln County and much of the north coast). Therefore, access to your favorite fishing spot may be restricted. The response remains fluid, so check with ODFW for more up to date information. https://myodfw.com/COVID-19

Oregon Lakes Association recommends that if you can stay at home, stay at home

Viruses in Lakes and Rivers

Contributed by Theo Dreher, President, OLA, whose research focus for many years at OSU was molecular virology, and who taught Virology in the Dept of Microbiology

In the midst of a global lockdown intended to suppress the spread of the novel coronavirus that causes COVID-19 respiratory illness, viruses are very much on people's minds. So it's a good time to think about what sort of viruses might be found in lakes, rivers and drinking water and be transmitted to people to cause disease. The answer is that quite a lot can be, but the novel coronavirus is not on the list.

There are various routes by which viruses can be transmitted, very common ones being through respiratory dissemination (e.g., novel coronavirus, influenza, common colds), via the fecal-oral route (e.g., poliovirus, hepatitis A virus, norovirus), or via arthropod vectors such as mosquitoes or ticks (Zika virus, dengue virus, yellow fever virus). Viruses that spread by the fecal-oral route are the ones that can remain stable and infectious in water for a considerable time. That is because these viruses are comprised of very stable protein shells that enclose and protect the genome, while other viruses (like the novel coronavirus) are surrounded by a lipid membrane that is more easily disrupted by drying or exposure to chemicals in the environment (Fig. 1). Membrane-bound viruses also tend to be less stable in the intestines, since they are more easily disrupted by the combination of acidity in the stomach, alkalinity in the duodenum, and presence of bile salts and digestive enzymes.

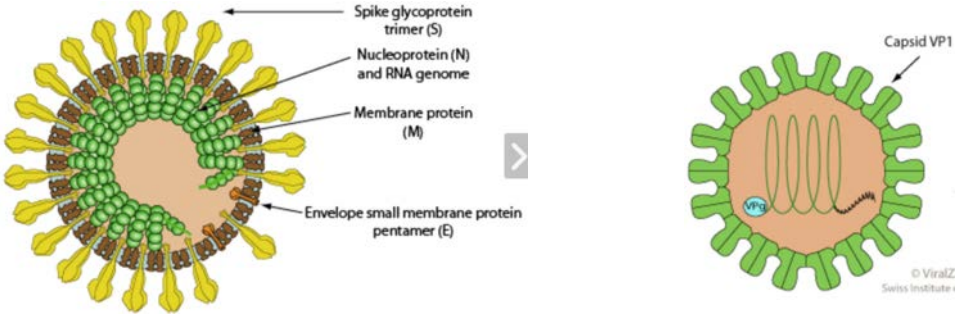


Figure 1. Diagrams of the structures of SARS-CoV-2, the cause of COVID-19 disease (left), and norovirus, the cause of severe gastroenteritis (right). Both are spherical viruses with protein spikes, but in the case of coronavirus, the spikes are embedded in a membrane (also called envelope, shown in brown). Source: viralzone.expasy.org

So the human viruses found in environmental waters are typically highly stable viruses without an envelope, corresponding to those with fecal-oral transmission. They are found in sewage and are removed by modern waste water treatment and good hygiene. This means that they may be a problem in underdeveloped countries with poor water infrastructure, or in developed countries when septic systems fail or when flooding results in raw sewage spillover into rivers. WHO lists the water-borne viral pathogens of highest health significance as hepatitis A and E viruses, norovirus, rotavirus (cause of severe diarrhea in young children) and enteroviruses (including poliovirus and coxsackievirus). Adenoviruses and astroviruses, both causing gastroenteritis and respiratory disease, are water-borne viruses of lower concern. Chlorine treatment is effective in inactivating all of these viruses.

Of course, human viruses are not the only viable viruses present in environmental waters. Most plant viruses are made of very stable protein shells that confer a long half-life in the environment. Tobacco mosaic virus and many others have been detected in waters, as have bacteriophages, the viruses that infect bacteria.

But back to COVID-19, which is so thoroughly dominating our life now. Could the coronavirus be disseminated in environmental waters? While that does not seem to be a worry, the principals I've outlined above aren't always the whole story. Influenza A virus, the main one causing our annual flu disease, is an enveloped virus that, like coronavirus, does not survive long in the environment. As a respiratory virus, it also is

not expected to be produced in the gut and shed into water in any substantial amounts. Well, flu viruses are fundamentally viruses of waterfowl, such as ducks, and in those birds the virus is in fact shed in the feces, in addition to the saliva and mucous as is typical of a respiratory virus. And while the virus may not be stable in water for long periods, the notably poor hygiene practiced by waterfowl results in transmission being mostly fecal-oral among birds. Some cases of viable influenza virus in the feces of human patients have been reported, and fecal shedding is known to occur with SARS and MERS, the close relatives of the coronavirus causing COVID-19. Indeed, there is some evidence that SARS-CoV-2 can be present in the feces. So flu and COVID-19 may be transmitted at some low level by the fecal-oral route, but this would be limited to within close quarters. Hand-washing and awareness of aerosols from the toilet bowl (flush after closing the lid!) would be effective remedies.

Oregon Boating News

Contributed by Steve Wille, OLA Board Member

Effective January 2020

As a boat owning member of OLA, I try to keep track of any boat regulation changes that might impact my boating experience. Many of our members may not own boats, but use some type of floating contraption in the performance of their limnological duties. To all those boaters out there, there are a couple of new Oregon boating regulations you should be aware of.

But first, a word from our sponsor - The Oregon State Marine Board is unique from other state agencies because it is an agency devoted entirely to recreational boating with dedicated funding supported by user fees. Registration dollars help pay for marine law enforcement services, grants for launch ramps and other boating facility improvements, boating safety education and education outreach materials.

So, if you are a boater in Oregon, there are some new laws effective January 1, 2020 you should be aware of. The information provided is summarized from the Oregon State Marine Board, a good place to visit if you have additional questions or need further clarification.

The Waterway Access Permit (WAP) (SB 47) replaces the Aquatic Invasive Species (AIS) permit for non-motorized boats.

Oregon residents and out-of-state operators of non-motorized boats—canoes, kayaks, stand-up paddleboards, rafts, drift boats and other manually powered boats, which are 10 feet in length or longer, and sailboats under 12 feet long—must purchase a one week ($5), one year ($17) or a two year ($30) permit when operating on Oregon waters.

- One permit is required per boat,
- it is transferable from boat to boat, and
- it is not required for youth aged 13 and younger.

The permit funds two programs: AIS Prevention Program and non-motorized access. These programs will improve facilities by adding single parking spaces, non-motorized boat launches, restrooms, low-freeboard docks, and will continue to inspect boats for aquatic invasive species at the roadside inspection stations.

Beginning August 1, 2020, boaters who operate a non-motorized boat 10 feet or more in length without WAP can be fined $115 and out-of-state motorboats who do not possess a $20 out-of-state AIS permit can be fined $50 (a Class D violation). Oregon motorized boats must have a valid registration displayed on the motorboat (boat registration includes the WAP).

The "Pull the Plug" Law (HB 2076) was added as an amendment to the AIS Prevention Program and requires boaters to remove the boat plug when leaving a waterbody *and during transport* to allow any water-holding compartments to drain. This reduces the risk of aquatic invasive species being spread from one waterbody to another. The fine for failure to pull the plug is $30 for non-motorized and $50 for motorized, and is a Class D violation.

Also included in the amendment was a provision whereby if a person bypasses a mandatory boat inspection station, they can be ordered back by law enforcement if the station is within 5 miles. If the station is closed, you are not required to stop. If a person fails to go back to the station for an inspection/decontamination, they can be charged with a Class C misdemeanor that could result in a $115 fine.

Steve Wille (arrowed) having a boating experience at the 2018 OLA meeting in Portland, OR

Environmental Conditions at Lake Abert-Oregon's Only Hypersaline Salt Lake

Contributed by Ron Larson, OLA Board Member

Figure 1. Lake Abert is bordered on its east side by Abert Rim, a 2,000-foot-high fault scarp.

Lake Abert, located in south-central Oregon and Lake County, is the state's only hypersaline lake and the state's 6th largest lake. As a salt lake, it has a biota adapted to saline conditions, and has a relatively simple food web consisting of numerous bacteria, one species of green algae, brine shrimp and alkali flies, and many species of migratory water birds. In fact, in summer, the lake can attract hundreds of thousands of water birds, such as, avocets, stilts, ibis, ducks, sandpipers, and phalaropes (Figure 2). The birds literally "flock" to the lake to feed on the very abundant brine shrimp and alkali flies. Because this lake is so unique, being just one of three large hypersaline lakes in the western US, the Oregon Lakes Association has been monitoring conditions there.

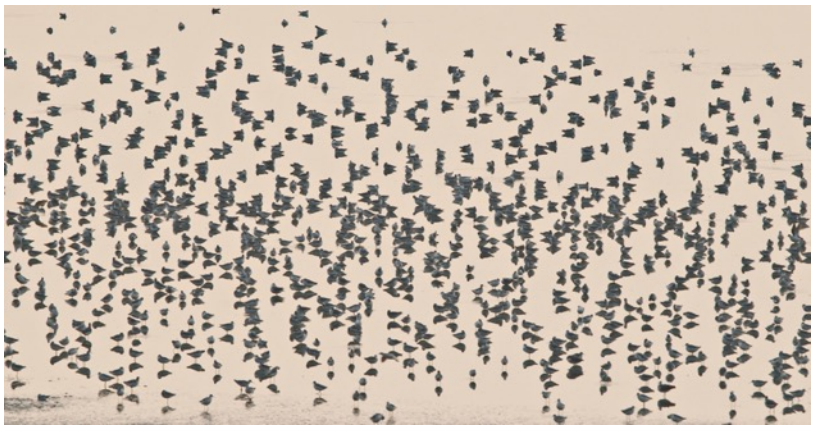


Figure 2. Part of a large flock of Wilson's Phalarope present in shallow water at Lake Abert, August 2012. After spending a month gorging on brine shrimp and alkali flies, the phalaropes fly approximately 5,000 miles to South America, where they spend the Austral summer in salt lakes.

Lake Abert water levels vary considerably from year to year. This is because the lake has a large shallow basin, and is located in Oregon's high desert, where annual precipitation averages less than 1-foot and is highly variable. Additionally, the lake is mainly fed by one source, the Chewaucan River, which also provides water to numerous ranches upstream. Consequently, in some years, little water reaches the lake. Over the past century, the lake only reached its highest water levels of 4260 feet elevation in 1958 and in the early 1980s (Figure 3).

As can be seen in Figure 3, the lake was quite low from the 1920s to 1950, then was high but variable through to about year 2000, and then sharply declined and has remained relatively low since then. The recent

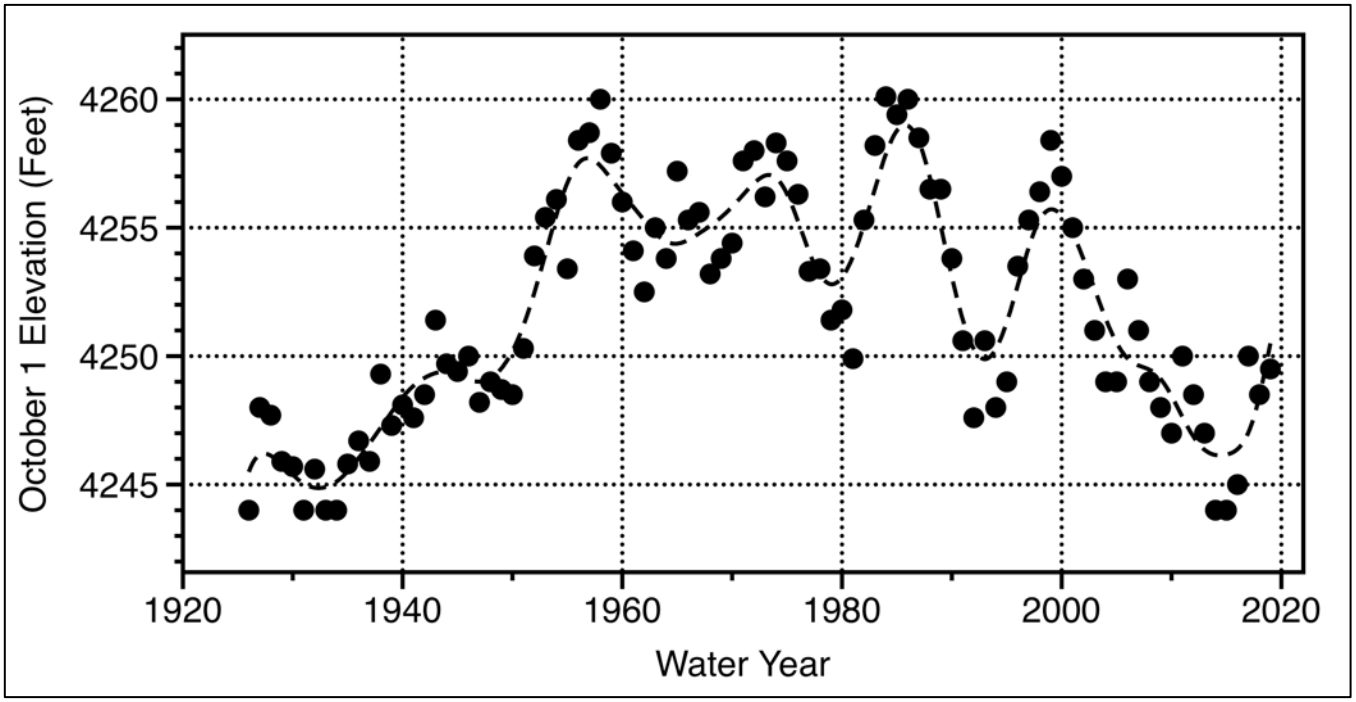


Figure 3. A scatter-plot showing annual variations of October 1 Lake Abert elevations, 1926-2019. The dashed line is a smoothed curve displaying trends.

low lake levels caused high salinities that reached a peak in 2014, when the lake was so salty (~25% salinity), that alkali salt covered the shore and lake bed. What remained of the lake in July 2014 was bright red from a bloom of hypersaline-adapted microorganisms called “halophilic extremophiles,” which are bacteria-like archaea that only live in extremely saline environments (Figure 4).

As a result of the extremely harsh conditions in the lake in 2014, brine shrimp and alkali flies were rare and few water birds came to the lake that summer; in fact, some birds didn’t return to their previous abundances until in 2017. Now, there is concern that the lake will once again experience high salinities that would impact its ecosystem. Last fall, salinities were 10%, which is within the zone tolerated by brine shrimp and alkali flies that form the food base for the birds. Dry conditions have prevailed in southcentral Oregon through the 2019-2020 winter, snowpack is below average, and accumulative flows in the Chewaucan River are the lowest in 5 years. There is concern that by the end of this summer, salinities could reach 15%, which can adversely affect the shrimp and fly populations, and impact birds too.

Over its long lifetime of over a million years or more, the lake ecosystem has had to adapt to variable conditions created by climate. Twenty thousand years ago, during the Pleistocene, it was hundreds of feet deep and fresh. Over the past 5,000 years, it has likely at times been similar to what it is today, being shallow and salty, and at other times it was deeper and fresh, and even supported fish. When conditions were good, people even lived along the shore in small villages, but not in the past 300 years, according to archaeologists.

Figure 4. View of the south end of Lake Abert, July 30, 2014. At that time, a broad band of brilliant-white alkali salts blanketed the shore and the water was blood red from halophilic microorganisms that bloomed in the lake.

In some ways, the lake is in a sweet spot. Its productivity is high, resulting from concentrated nutrients, producing a high abundance of food for migratory water birds. The current low water levels enable birds to readily secure brine shrimp and alkali flies along the shallow shore. But under these conditions, the lake is highly vulnerable to dry conditions creating low water levels and high salinities that can severely impact its ecosystem. The Oregon Lakes Association will continue to monitor and report on conditions in the lake in an effort to understand how climate and upstream water diversions affect it.

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The Oregon Lakes Association Mission

OLA, a non-profit organization founded in 1990, promotes understanding, protection and thoughtful management of lake and watershed ecosystems in Oregon. Serving entirely through volunteer efforts, the Oregon Lakes Association puts on an annual conference, publishes a tri-annual newsletter, sponsors Harmful Algal