



LAKE WISE

... a voice for quiet waters

NEWSLETTER FROM OREGON LAKES ASSOCIATION

SEPTEMBER 2015

Laurie Carmichael, Newsletter Manager

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Annual Conference

Contributed by Rich Miller,
OLA Board Member

It's been a long, hot summer... Luckily, Oregon's abundance of beautiful lakes provide a much needed refuge from the heat. Find out more about these lakes and the threats to their health at the **Oregon Lakes Association Annual Conference held at the Klamath Yacht Club in Klamath Falls on October 2nd through the 4th.** Given the importance of Klamath Lake to the culture, ecology, and economy of the region, the theme of this year's conference is "Klamath Lake Perspective: Lessons for Oregon's Lakes". Conference activities will kick off Friday night with a discussion of the Klamath Basin resource management issues highlighted in the film "A River Between Us" as well as a screening of the film trailer. The discussion will be moderated by Chrysten Lambert, Director of the Oregon Water Project for Trout Unlimited, and will include panelists representing water resources, fisheries, and landowner perspectives. A viewing of the film will be presented on Saturday night following a full day of oral and poster presentations on Klamath Basin and other lake-related topics.

The Saturday presentations will be highlighted by a plenary talk by Dennis Lynch, USGS Assistant Regional Director, on his experiences in the Klamath Basin. Dennis has been with the USGS for nearly 35 years and is the lead scientist covering Klamath Basin water issues. Other presentation topics include the occurrence, ecology, genetics and commercial harvest of algal blooms; impacts of fish populations on water quality; different perspectives on lake restoration; and a celebration of the 30th anniversary of the "Atlas of Oregon Lakes". Our OLA scholarship winner Sarah Burnet will present her research on internal nutrient loading in Willow Creek Reservoir. If you're interested in presenting, there are still a few oral and poster slots available. Please submit your abstracts through <http://www.OregonLakes.org> by September 15, 2015 and include your presentation title, author(s) (noting student authors), your preference of a talk or poster, and an abstract of 300 words/3,000 characters or less. Oral presentations will be 20 minutes (15 min plus 5 min for discussion).

Conference activities will wrap up on Sunday morning (weather permitting) with a canoe tour of the Upper Klamath Canoe Trail where we will experience beautiful marsh habitat and abundant wildlife. Please keep an eye on our website as we post details on registration, the technical program, lodging options, and special events. **We look forward to seeing you there!**



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## 2015 Gathering for Conservation at Valley River Inn, Eugene November 2-4, 2015:

Register Online

<https://www.eventbrite.com/e/2015-gathering-for-conservation-registration-17702528740>

**The Gathering** is the venue for both the Oregon Association of Conservation Districts (<http://oacd.org/>) and Network of Oregon Watershed Councils (<http://www.oregonwatersheds.org/>) Annual meetings, and is the one-stop spot for connecting with many watershed councils and conservation districts around the state. The Oregon Lakes Association has been making a concerted effort to reach out to like-minded entities. The Gathering, and more importantly those associated with it, are key as they represent on-the-ground restoration, which can protect Oregon lakes. Last year watershed council and district members from Clatsop County attended and were key participants at our Astoria conference. As we grow this collaboration, OLA is sending our Past President, Stephen Wille to The Gathering and hoping to have Klamath Basin representation from watershed councils and conservation districts at our OLA Conference in Klamath Falls, October 2-4. See: <http://www.oregonlakes.org/event-1930277>

See more details about The Gathering at: <http://www.orcp.org/fall-conference/fall-conference-2015/>

## "Congratulations to our 2015 OLA Scholarship Recipient—Sarah Burnet!"

Contributed by Wayne Carmichael, OLA Board Member

Sarah received a Bachelor of Science degree in 2009 in Environmental Science with a minor in Chemistry from the Huxley College of the Environment, Western Washington University, Bellingham, WA. Her supervisor was Dr. Leo Bodensteiner.

After receiving her B.Sc., Sarah gained experience as a Research Technician at the Cornell Biological Field Station, Great Lakes National Program Office in Bridgeport, NY. This was followed by field work as an Environmental Scientist with Dade Moeller and Associates on a Gulf Coast Project during the BP Deepwater Horizon Oil Spill in Baton Rouge, LA.

Sarah is currently working on her Master of Science in the Department of Fish and Wildlife, College of Natural Resources, University of Idaho, Moscow, ID. Her research topic is "The influence of internal loading on phosphorus mass balance of Willow Creek Reservoir (WCR) OR". Her supervisor is Dr. Frank Wilhelm. The project involves:

- Measuring profiles of oxygen and phosphorus concentrations seasonally at WCR to determine internal loading in the reservoir and estimate whole-lake rates.
- Quantifying the release of Phosphorus (P) from sediments at different sites in the reservoir under anoxic conditions using sediment cores to:
  - i) corroborate rates from the field study and
  - ii) examine if any spatial differences exist, as this is important for models to predict anoxia and internal loading.

Sarah describes her work as important because WCR is plagued by Harmful Algae Blooms (HABs) annually that result in no contact advisories. Because WCR is the only water body available for recreational use within a



60-mile radius, it negatively impacts the local community. To formulate a remediation strategy requires that all components of the P cycle are quantified. She aims to use a visualization tool to summarize the results in an easy-to-understand manner.

Overall, her research will aid in understanding the importance of P released from different locations in reservoirs. This will help inform the design of future P-release studies and will be widely applicable to any lake or reservoir that has anoxic bottom waters. Specific to Willow Creek Reservoir, her research will contribute an important part of the P-mass balance by quantifying the amount of P released from bottom sediments during summer when inflows are low. Understanding this will help identify potential solutions to the ongoing HAB problem in the reservoir.

Sarah will present aspects of her research at OLA's October 2015 annual meeting in Klamath Falls.



## Oregon Lakes in the News

Contributed by Paul Robertson, OLA Board President

### **Water quality impacts reach the fields in Klamath Basin:**

Oregon Health Authority advised irrigators to observe precautions with irrigation waters that may contain cyanotoxins as a result of Harmful Algal Blooms on Upper Klamath Lake, Lake Ewauna, and Agency Lake downstream as far as the California border. When aerosolized, inhalation pathways may put agricultural workers in danger of increased exposure. Read more... at [Herald and News](http://www.heraldandnews.com/news/local_news/agriculture/algae-warning-applies-to-irrigators/article_40f3a142-ea55-5d11-b0c9-e6a34631f0e2.html)

[www.heraldandnews.com/news/local\\_news/agriculture/algae-warning-applies-to-irrigators/article\\_40f3a142-ea55-5d11-b0c9-e6a34631f0e2.html](http://www.heraldandnews.com/news/local_news/agriculture/algae-warning-applies-to-irrigators/article_40f3a142-ea55-5d11-b0c9-e6a34631f0e2.html)

and at [Oregon Health Authority](http://www.oregon.gov/oha/news/Pages/Update%20E2%80%9320Health%20advisory%20on%20Upper%20Klamath.%20Agency%20lakes%20extended%20downstream%20to%20California%20border.aspx).

<http://www.oregon.gov/oha/news/Pages/Update%20E2%80%9320Health%20advisory%20on%20Upper%20Klamath.%20Agency%20lakes%20extended%20downstream%20to%20California%20border.aspx>



Alea Brager looks out over Gifford Lake in the Ollalie Lake Scenic Area.

Photo Credit: Zach Urness / Statesman Journal



Water flows into the Klamath River from Lake Ewauna under this railroad bridge in late July.

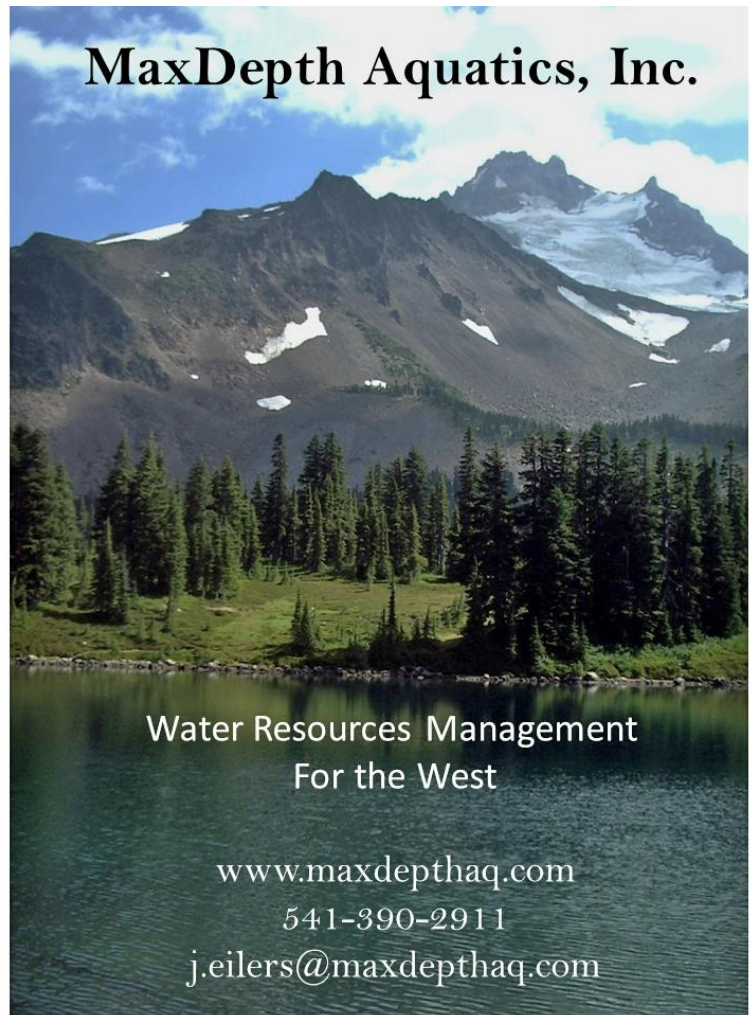
Photo Credit: Holly Owens, Herald and News

**As, Hg & PCBs:** Arsenic recently made headlines as Oregon Health Authority released a new shellfish advisory for softshell clams along the Oregon Coast, but other advisories on the freshwater side also demand notice. Read all about the fish advisories and consumption guidelines for mercury and organic contaminants such as polychlorinated biphenyls, dioxin and certain pesticides.

<http://public.health.oregon.gov/HealthyEnvironments/Recreation/FishConsumption/Pages/fishadvisories.aspx#fish>

**Solitude found!** Summer often yields stories about Harmful Algal Blooms that may dampen the sunniest day and spirit, but take a reprieve with news of solitude found at Gifford Lake in a recent [Statesmen Journal Article](http://www.statesmanjournal.com/story/life/2015/07/03/swim-solitude-glorious-gifford-lake/29669073/). <http://www.statesmanjournal.com/story/life/2015/07/03/swim-solitude-glorious-gifford-lake/29669073/>

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[j.eilers@maxdepthaq.com](mailto:j.eilers@maxdepthaq.com)

## Atlas of Oregon Lakes

Contributed by Dick Lycan, Portland State University,  
and Rich Miller, Portland State University and OLA Board Member

This year is the thirtieth anniversary of the *Atlas of Oregon Lakes* funded as part of the EPA Clean Lakes program and published by Oregon State University Press in 1985. Nearly 7,000 copies were sold before the book went out of print in 2001. The web-based *Atlas of Oregon Lakes* (<http://aol.research.pdx.edu/>), also funded by EPA through Oregon DEQ and developed at Portland State University, went on-line in 2011. It provides access to the data in the 1985 print atlas and to contemporary lake water quality data. The on-line lakes atlas serves both a scientific and popular clientele — fisherman, boaters, and persons with a curiosity about lakes.

Since 2011 there have been a number of additions and improvements to the web site:

- We worked with the Oregon Water Resources Department to improve the coverage of lakes and lake names in the National Hydrography Dataset (NHD), now the standard for indexing water quality data. OLA member Roger Edwards' work on Oregon Lake names was particularly helpful in this regard.
- We added content to the website. The Center for Lakes and Reservoirs added data on aquatic invasive species and information for the public on reporting sightings. We added web links such as those to the Marine Board facilities database and the Oregon Fish and Wildlife regional fishing report.
- The site's downloadable bathymetric maps now can be used in the field with a GPS-enabled hand-held device. Users can download the PDF Maps application by Avenza (<http://www.avenza.com/pdf-maps>), track their location on the downloaded bathymetric maps and add notes and georeferenced photos.
- The user interface has been redesigned to make using the site more intuitive. We welcome suggestions on how to make it more user friendly.

We are looking toward more changes to the website in the next year. At the outset we plan to collect information on-line on the use of the website. We would like to know who is using the site, what features they are using, and what features they are not using or maybe not discovering. We will use this information to guide us in adding features and making the site more usable. We also plan to work

on automating the process for adding more lakes to the website. When the on-line atlas was being developed we leaned heavily on the data from the 1985 print atlas. As we add new lakes, we now need to automate tasks such as delineating drainage basins and reporting the basin characteristics.

The bathymetric data rendered as maps on the website are also available as a spatial database. We have had a number of requests for these data. They are available at no cost for nonprofit uses and can be licensed for commercial uses. We plan to add more bathymetric maps, update some, and refine the rendering of the depth information. We expect to provide on-line tools for downloading the data.

We will make a presentation on the atlas at the October OLA meeting at Klamath Lake. This will be an opportunity to talk about the atlas, our plans and to get feedback from attendees.

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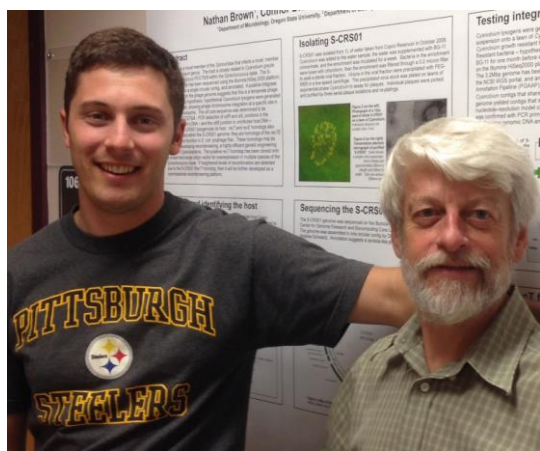
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Identification of *Anabaena* sp. WA102 as the main anatoxin-a producer in Anderson Lake, WA

Contributed by Theo Dreher, Professor, Department of Microbiology, Oregon State University

In 2005, the Washington State legislature established funding for the Freshwater Algae Control Program through the Department of Ecology. A key part of the program is a bloom sample submission program, in which the public can be involved, with toxin analysis conducted through the King County Environmental Laboratory. This resulted in what is likely the best database of cyanotoxin occurrences in the U.S. The database <https://www.nwtoxicalgae.org/Program.aspx> features an interactive map and a searchable listing of scores of lakes with toxin analyses and a qualitative phycological analysis. As is the case in other studies, microcystin is the most commonly detected cyanotoxin, with exceedances of state recreational guideline concentrations (6 µg/L) in about 20% of samples analyzed. Anatoxin-a exceeded the 1 µg/L recreational guideline concentration in about 9% of samples. However, cylindrospermopsin and saxitoxin have rarely been seen in Washington lakes.

Most of the anatoxin-a detections originate from a few lakes, particularly Anderson Lake (south of Port Townsend), Clear Lake (south of Puyallup), and Rufus Woods Lake (behind a dam on the Columbia River upstream of Wenatchee). Anatoxin-a levels have been above 100 µg/L in Anderson Lake on more than a dozen dates since 2009, often in May and June, but sometimes also in July, September or October. We have not seen this type of anatoxin-a occurrence in Oregon lakes.



Nathan Brown and Theo Dreher

Nathan Brown, a graduate student in my laboratory, set out to identify the main producer of anatoxin-a in Anderson Lake and to look at its distribution in the Puget Sound area. From an Anderson Lake bloom sample from 2013, he established a culture of an *Anabaena* with irregularly twisted trichomes (Fig. 1), a morphology reminiscent of *Anabaena flos-aquae* and similar to non-toxic *Anabaena* types commonly seen in Oregon. The *Anabaena* sp.

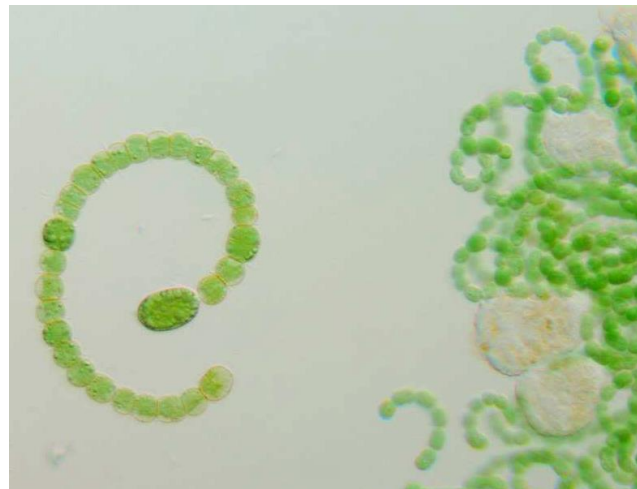


Fig. 1 Photomicrograph of two *Anabaena* morphotypes present in Anderson Lake. The smaller-celled "irregularly twisted trichome" morphotype at right is representative of the anatoxin-a producer *Anabaena* sp. WA102 (cells ~5-7 µm). The larger-celled "regularly coiled" *Anabaena* morphotype at left is not an anatoxin producer.

WA102 culture produces anatoxin-a, and we have determined its entire genome sequence. Although planktonic *Anabaena* species have been renamed *Dolichospermum*, we prefer to retain the *Anabaena* nomenclature because unresolved taxonomic difficulties remain among this group. For instance, the closest relatives of *Anabaena* sp. WA102 — on the basis of known genome sequence data — are two *Aphanizomenon flos-aquae* isolates, although these are quite distinct from *Aphanizomenon flos-aquae* from Upper Klamath Lake. We'll need genome sequences of more isolates in order to be able to decide on a permanent nomenclature for the planktonic *Anabaena*/*Dolichospermum*/*Aphanizomenon* species.

The *Anabaena* sp. WA102 genome has the expected cluster of genes necessary for anatoxin-a production, but no genes for other major cyanotoxins. We determined the entire sequence of 5.7 million bases that make up the genome, rather than following the more usual practice of determining the sequences of the unique genes present (usually >95% of the genome). The remaining minor part of the genome contains repetitive sequences, including many transposons and other genetic elements that can be involved in changing the arrangement or complement of genes. Indeed, a striking insight of our study is that the genomes of two fully sequenced isolates — *Anabaena* sp. WA102 and *Anabaena* sp. 90 — are 90% identical on a fine scale (within shared genes) but essentially randomized in terms of the order of genes in the chromosome. This indicates

that a high level of genome rearrangement is a feature of the evolution of these colonial cyanobacteria. Future studies should explain how this influences their ability to adapt to available environmental conditions.

A number of other cyanobacteria, including a distinct *Anabaena*, *Microcystis*, *Woronichinia*, *Aphanizomenon flos-aquae*, and *Oscillatoria/Planktothrix* can also be present in Anderson Lake when anatoxin-a is being produced. We used single colony analysis and a whole-sample DNA analysis technique termed metagenomics to assess the presence and source of anatoxin-a biosynthetic genes. In samples from late spring of 2012 and 2013, *Anabaena* sp. WA102 was the predominant anatoxin producer in Anderson Lake. Using a genetic signature from the phycocyanin genes, we looked for the presence of *Anabaena* sp. WA102 and closely related strains during the 2013 bloom season in 10 lakes from the Puget Sound area (King, Pierce and Snohomish Counties). Minor levels of cyanobacteria related to *Anabaena* sp. WA102 were found in these lakes, but the populations were very small and only very minor accumulations of anatoxin-a were detected. From a practical viewpoint, this means that it is beneficial to consider steps that prevent the spread of *Anabaena* sp. WA102 from Anderson Lake to other lakes. Our study also provides tools for the specific monitoring of toxic *Anabaena* sp. WA102, and suggests that a simple analysis conducted at the county public health department level could be developed to provide an early warning of likely toxicity. *Anabaena* sp. WA102 has a morphology that is distinct from a non-toxic *Anabaena* also present in

Anderson Lake. Any sharp increase in the prevalence of this "irregularly twisted trichome" morphotype could be used to establish a conditional warning prior to toxin analysis, which often takes a few days.

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Harmful Algae Blooms (HABs) Corner

Contributed by Wayne Carmichael, OLA Board Member

Health Advisories in Oregon:

OPB airs a discussion of Willamette River Ross Island Lagoon HABs on Think Out Loud:
<http://www.opb.org/radio/programs/thinkoutloud/segment/whos-on-algae-duty/>

HAB advisories for recreational waters as of July 31, 2015, are posted at the OHA website
<https://public.health.oregon.gov/newsadvisories/Pages/RecreationalAdvisories.aspx>

- Permanent Advisory: Avoid pools of water in bedrock along the South Umpqua River [view sign]
- Update: Health Advisory on Upper Klamath and Agency lakes extended downstream to Keno Dam 07-29-2015
- Health Advisory issued July 28 for Upper Klamath and Agency lakes (excluding Pelican Bay) 07-28-2015
- Health Advisory issued July 9 for Willamette River's Ross Island Lagoon 07-09-2015



HAB Photo from the Tenmile Lake Biomonitoring Program. Coleman Arm of Tenmile Lake. 8-12-2015. Tenmile Lake is located in Coos County, eight miles south of Reedsport and 0.5 miles east of highway 101. It has experienced heavy blooms of toxigenic cyanobacteria especially *Microcystis* in recent years.

HAB Resources within Oregon:

State Resources:

- Oregon Health Authority: Blue-Green Algae Labs & Expert Contacts List. See: <http://public.health.oregon.gov/HealthyEnvironments/DrinkingWater/Operations/Treatment/Documents/algae/LabsAndExperts.pdf>
- Oregon Health Authority, Harmful Algal Bloom Surveillance Program. See: <http://public.health.oregon.gov/HealthyEnvironments/Recreation/HarmfulAlgalBlooms/Pages/index.aspx>
- Oregon Health Authority, Algae Resources. See: <http://public.health.oregon.gov/healthyenvironments/drinkingwater/operations/treatment/pages/algae.aspx>

Laboratories:

Aquatic Scientific Resource

2225 NW Wheatfield Way
Portland, OR 97229
Phone: (503) 869-5032
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Aquatic Services

42184 Tweedle Ln.
Seaside, OR 97138
(503) 755-0711
Email: wayne.carmichael@wright.edu
Specific services: CyanoHAB consulting, cyanobacteria identification and enumeration

CH2M Hill Applied Science Laboratory

1000 NE Circle Blvd.
Corvallis, OR 97330
Phone: (541) 768-3120
www.ch2m.com

Specific services: Cyanotoxin analysis

Oregon Public Health Laboratory, Oregon Health Authority

3150 NW 229th Ave.
Hillsboro, OR 971254
Phone: (503) 693-4100
www.public.health.oregon.gov/laboratoryservices
Specific services: Microcystin analysis

National HAB News:

Excerpted from “Freshwater HAB News-July 2015”
Office of Science and Technology, Office of Water,
U.S. EPA.

Topics covered include:

- Resources on monitoring for cyanobacterial cells and cyanotoxins in drinking water and recreational waters
- Resources for the prevention of dog HABs poisonings
- National programs on freshwater HABs
- Recent research publications
- Toxic algae and health advisories – July 2015

New and useful links included in the above topics are:

- The link to the states HAB Program; <http://www2.epa.gov/nutrient-policy-data/states-freshwater-habs-monitoring-programs>
- Listing per state of laboratories performing cyanobacteria and cyanotoxin analysis; <http://www2.epa.gov/nutrient-policy-data/state-resources>

The US EPA website for cyanoHABs can be found at: <http://www2.epa.gov/nutrient-policy-data/cyanohabs>

Individuals can sign up to receive “Freshwater HAB News” by contacting

Lesley V. D'Anglada, DrPH, MEH
U.S. Environmental Protection Agency
Office of Science and Technology, Office of Water
1200 Pennsylvania Ave., N.W. (MC 4304T)
Washington, DC 20460
Email: DAnglada.Lesley@epa.gov

Lake Wise

Oregon Lakes Association
P.O. Box 345
Portland, OR 97207-0345

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. For additional information on OLA, write to the address above, or visit our website.

www.oregonlakes.org

OLA and Lake Wise welcomes submissions of materials that further our goals of education and thoughtful lake management in Oregon. OLA is grateful for corporate support that helps sustain the organization. Corporate members are offered the opportunity to describe their products and services to Lake Wise readers. These descriptions are not OLA endorsements and opinions appearing in Lake Wise are not OLA policy statements.

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**See the Klamath Belle on Klamath Lake at our OLA annual meeting held October 2-4, 2015 at Klamath Lake.  
Photo by Wayne Carmichael, OLA Board Member**