LAKE WISE

A Voice for Quiet Waters

Quarterly newsletter from Oregon Lakes Association

SPRING 2014

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Road Salt & Oregon Lakes

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By in vivo fluorometry.

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Dog Deaths and Illnesses from Freshwater Cyanobacterial Bloom Exposure: A Call to Action!

Dr. Theo Dreher, Professor and Chair

Department of Microbiology, Oregon State University

Freshwater harmful algal blooms caused by blue-green algae or cyanobacteria (CHABs) are capable of producing toxins that can cause illness or death in animals and humans. In the Pacific Northwest, elevated levels of two CHAB toxins, microcystin and anatoxin-a, are seen at times. Fortunately, that's not always the case, and we know that at least some recent blooms in Oregon lakes have been non-toxic. We don't yet know enough about local cyanobacterial populations to be fully aware of the risks presented to human and animal health by the annual blooms that are now so common. Increased toxin analyses of bloom samples are only gradually filling in the picture.

Fortunately, acute cyanotoxin poisoning of humans has been rare. The only confirmed deaths have been those associated with contaminated water used at a dialysis clinic in Brazil in 1996. Dog exposures are more common, because they are more apt to drink and frolic in contaminated water. It has even been proposed that dogs are attracted to blooms by the musty and stinky taste-and-odor compounds that are often associated with blooms, and thereby may be fatally attracted to toxin exposure. Contact with a bloom can readily result in scum trapped in the fur, which is then ingested during grooming.

In recognition of the more likely contact of dogs with a toxic bloom, Oregon Health Authority (OHA) recommends much lower guideline values (maximum safe levels) in water for canine versus human recreational exposure: 0.6 µg/L for anatoxin-a and 0.2 µg/L for microcystin for dogs compared with 20 µg/L and 10 µg/L, respectively, for humans. We can think of dogs as unfortunate sentinels that can inform us about the presence of toxins that could be a risk to humans.

A recent comprehensive study of the available information on canine poisonings by freshwater CHAB toxins found evidence for 368 such canine deaths or illnesses across the US in the last 90 or so years (Backer et al., 2013). Of those, 58 were attributed to anatoxin exposure and 51 to microcystin exposure, although the presence of toxin was only confirmed in 22 cases. Most cases therefore must be considered as suspected cyanotoxin poisonings. Recent data compiled in Oregon by OHA shows a similar trend, with only 2 confirmed and 7 possible cyanotoxin canine poisonings among 25 cases between 2008 and 2013. Conversations with dog owners frequently lead to anecdotal reports of unexplained illnesses or death following contact with ponds, lakes or rivers that are blamed on CHABs. The few confirmed cases may truly be the tip of an iceberg of large numbers of cases, but we won't be certain until there is more hard information. The small number of confirmed cases of cyanotoxin exposure is

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DOG DEATHS & CYANOBACTERIAL EXPOSURE (CONTINUED FROM PAGE 1)

likely explained by reluctance to pay for the veterinary and laboratory costs associated with conducting postmortems and toxin analyses. Many cases may not even be brought to a veterinary clinic and would remain unknown.

Cyanotoxins Associated with Rivers

The recent confirmed cyanotoxin poisoning cases in Oregon have been associated with exposure to rivers rather than lakes or ponds. In 2009, anatoxin-a was confirmed in the stomach contents of a dog that died after contact with waters near the confluence of Elk Creek and the Umpqua River in Elkton. In 2010, there was a similar instance after contact with the South Umpqua River at Lawson Bar near Canyonville. Unfortunately, we do not know the source of this anatoxin. This represents a potentially serious public health threat we do not understand, and therefore it is not possible to provide guidance for avoiding human exposure. Small potholes in the bedrock along the margins of the Umpqua, which are flooded by spring flows but then stranded during summer and fall, have been suspected sources. Alternatively, following precedents in France and New Zealand, benthic mat cyanobacteria such as Phormidium may be the source. It is important to identify where the anatoxin that has killed dogs in the Umpqua (and likely in other rivers in Oregon and Northern California, based on unconfirmed reports) is lurking.

Reference: LC Backer, JH Landsberg, M Miller, K Keel and TK Taylor (2013) Canine cyanotoxin poisonings in the U.S. (1920s-2012). Toxins 5:1597-1628.

Contact Dreher Laboratory at OSU to Help Solve A Case

My research group at Oregon State University is conducting genetic analyses of cyanobacterial blooms in the Pacific Northwest, and we are interested in identifying the currently unknown sources of cyanotoxins that have killed dogs after contact with rivers.

Immediately contact the Dreher Laboratory at OSU if you become aware of a case that could be analyzed as described in the side bar. We will visit the exposure site as quickly as possible to make collections for cyanobacterial identification. We will also analyze vomit and diarrhea samples for toxin and cyanobacterial genes.

Contact Information:

email: theo.dreher@oregonstate.edu;

tel. 541-737-1795 or 541-737-4441

STEPS TO CONFIRM EXPOSURE

There are a few key steps needed to confirm cyanotoxin exposure as the cause of canine death AND identify the source:

1. Identification of symptoms consistent with acute cyanotoxin poisoning: rapid-onset vomiting, diarrhea, and tremors or seizures. The diagnosis of probable cyanotoxin poisoning should be made by a veterinarian, perhaps supported by a post-mortem analysis.

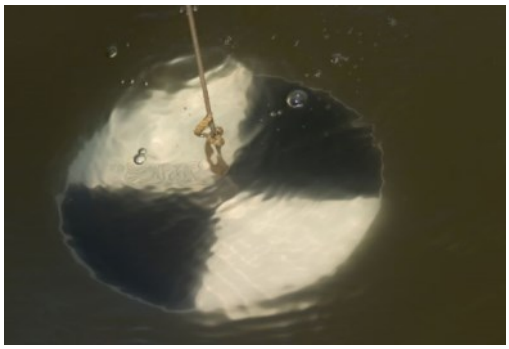
2. Vomit and diarrhea (possibly stomach contents) should be collected, a part frozen, another part refrigerated. Cyanotoxins can be detected in these samples, and the intact or digested cyanobacterial cells that are the source of the toxin should be present.

3. These samples should be analyzed for the presence of toxin, and genetically analyzed to detect and identify the presence of cyanobacteria found in the vomit or diarrhea samples.

4. Samples from the site of exposure should be collected and tested for the presence of toxin and genetic signatures that correspond to the cyanobacteria found in the vomit or diarrhea samples.

Oregon Lake Watch Starts Online Data Entry & Readies for a New Season

Oregon Lake Watch is now set up to allow water quality information to be entered online.



The image above shows a Secchi disk being lowered on a string into the water to determine how clear the water is. Gathering information on water clarity from many Oregon lakes will help scientists learn about the health of our lakes.

Oregon Lake Watch volunteers are also provided with a digital ther-mometer with a probe that can be lowered down to 50' to measure lake temperature.

If you would like to help Oregon scientists gather important information about Oregon Lakes, consider becoming an Oregon Lake Watch Volunteer.

For more information see:

www.pdx.edu/oregon-lake-watch

Training sessions for Oregon lake watch Volunteers to be held this June!
Bend - Eugene - Portland

Oregon Lakes Association Says Thank You, Roger!

Oregon Lakes Association would like to recognize one of its members for outstanding service to OLA over an extended time.

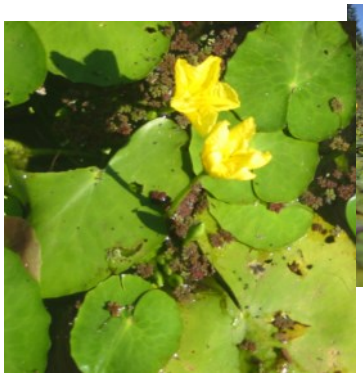
Roger Edwards has served as a board member, Secretary and President of OLA. Since November 2004, Roger has chronicled the efforts of Oregon Lakes Association as Editor of Lake Wise. After 10 years as Editor, Roger completed his last edition in December 2013.

Roger has been reading OLA's newsletters since 1990. He said he was "wooed to the 1992 meeting at Diamond Lake" where Andy Schaedel convinced him to join the organization. Roger has witnessed the OLA's publication evolve from an OLA newsletter to "the Lake Watcher" and finally into Lake Wise in November 1994.

Roger recently said "the research required for newsletter articles made me smarter and the role of editor allowed me to still be useful in retirement."

The Oregon Lakes Association would like to formally express its gratitude to Roger Edwards for serving as Secretary, President and Editor and primary contributor to Oregon Lake Wise for 37 issues.

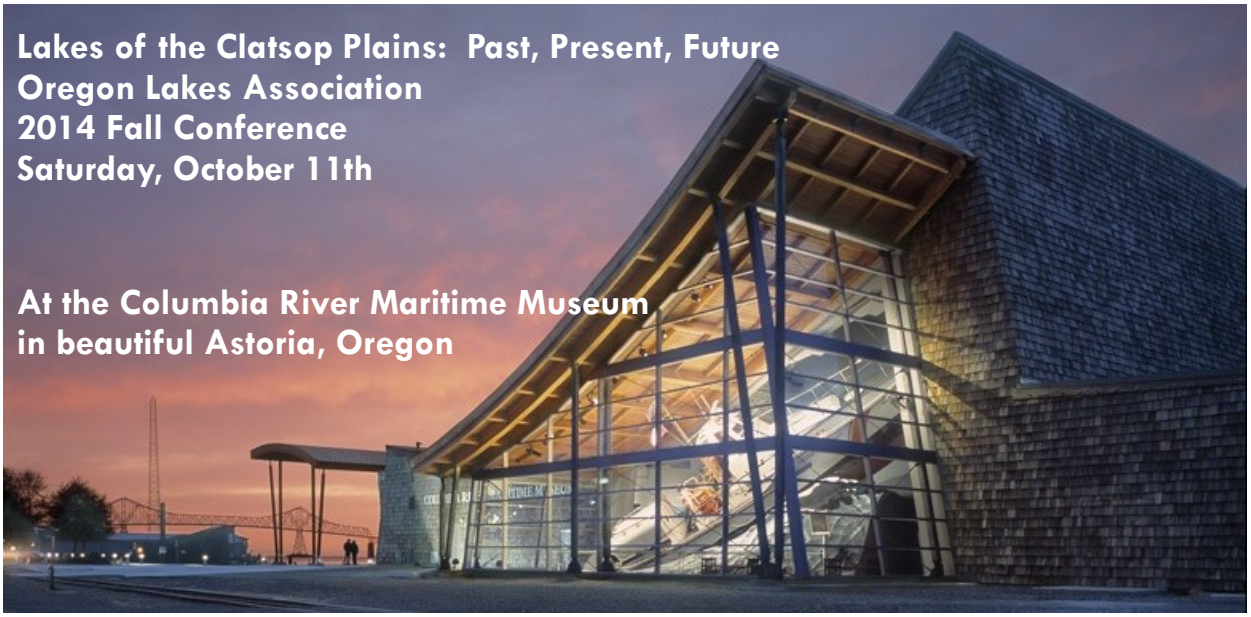
It is the tireless effort of members like Roger that enable OLA to be "A Voice for Quiet Waters."



Yellow floating heart *(Nymphoides peltata)*

Yellow floating heart is an Oregon class-A noxious weed with small, lily-pad like leaves (often with wavy margins and purple undersides); and showy 5-petaled yellow flowers. Found in a limited number of sites in Oregon, but difficult to control. Its seed is likely spread by waterfowl. CALL 1-866-INVADER to report sightings.

MARK YOUR CALENDAR!



Astoria, Oregon, has been selected for the location of the 2014 OLA Fall Conference. All presentations will be in the Kern Room in the Columbia River Maritime Museum. A museum day pass will be included with the conference registration, so feel free to explore the museum during session breaks. Watch oregonlakes.org for registration information.

RAFFLE & SILENT AUCTION

HELP SUPPORT OLA'S STUDENT SCHOLARSHIP WITH A DONATION

Last year's raffle/auction program was great fun and a huge success. All earnings went to support scholarship programs focused on aquatic sciences within both OLA and WALPA. With that in mind, the OLA Board has voiced their support for a repeat event at his year's conference in Astoria.

We are currently soliciting items or services for the bucket raffle and silent auction. Outdoor and recreational equipment were popular items last year, but educational and technical items were also appreciated. **Any contribution will help us support a new generation of water quality advocates, and will provide an advertising opportunity for you as your name and business will be noted in our conference program.**

OLA is a registered non-profit, charitable organization dedicated to supporting scientific and educational efforts to understand aquatic resources. For additional information about our event and the opportunity for corporate sponsorship, please visit the conference registration site at oregonlakes.org. All money raised will be used to fund and support graduate students working on Oregon lakes.

If you have an item or service you would like to donate, please contact either:

Stephen Wille (503-880-4453; sawille1@gmail.com) or

Richard Litts (541-759-2414; tlbp@presys.com).

Oregon Department of Transportation's 5-Year Road Salt Test

Is This an Opportunity to Move the Science Forward?

A recent TV news story about ODOT's 5-year road salting test in Southern Oregon prompted OLA member Larry Blumenstein to pursue the topic further. His prior experience as a Fire Captain/Paramedic with Salem Fire Department and shift captain for the Oregon State Fire Marshal's Regional Hazmat Team 13 made him well qualified to look at ODOT's proposal and review their plan to avoid or minimize adverse impacts to aquatic life in Oregon's lakes. The following is Blumenstein's summary of what he found.

ODOT's "Road Salt Project – Best Management Practices (BMP)" was issued on July 1, 2012. "The Pilot Project is occurring on US 95 between Nevada and Idaho (approximately 120 miles) and on I-5 from MP 0 (at the California border) to MP 11." According to ODOT they are not considering further pilot projects prior to deciding if sodium chloride will be added to ODOT's "tool kit."

Blumenstein spoke with Patti Caswell, ODOT Maintenance Environmental Program Manager, and found that ODOT had no plans to collect water from lakes that may receive salt runoff (there are few lakes along the test routes). If ODOT determines that the toxic effects to the environment are within acceptable limits, road salt will be added to the list of approved deicing chemicals.

Oregon is the last state in the U.S. that currently bans the use of sodium chloride on roads. Caswell said that if OLA had questions regarding the use of road salt, now is the time to ask. Because Oregon is the only state currently banning the use of sodium chloride for road deicing, it stands to reason that ODOT would consult the wealth of existing research when evaluating the potential environmental impact to Oregon. ODOT is a member of Pacific Northwest Snowfighters, an association made up of transportation agencies in British Columbia, Idaho, Montana, Oregon, and Washington. In turn, Pacific Northwest Snowfighters is a member of Clear Roads, an association of 26 states. In 2012, Clear Roads contracted with Barr Engineering to test 8 different commercially available deicing compounds by subjecting a small fish, zooplankton, and algae to various concentrations of deicing chemicals for one week, and ranked each product by relative toxicity.

The Clear Roads Report found that their test agreed with existing literature in that potassium acetate was the most toxic salt type, followed by magnesium chloride, calcium chloride, and finally sodium chloride. When it comes to price, no deicing product is as inexpensive as salt. ODOT currently uses magnesium chloride as a deicing chemical, at a cost 7 times that of road salt. When rated by Clear Roads' toxicity and cost estimates, salt is a clear winner.

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ODOT ROAD SALT TEST

(CONTINUED FROM PAGE 5)

Can salt runoff have an adverse impact on the ecology of a watershed's flora and fauna? It depends on the geology of each region. If road salt ran into Lake Abert from Highway 395 in southern Oregon, by the time the runoff mixed with groundwater and made its way to the lake, it likely would be less concentrated than the lake, which has 12,176 mg/L of sodium and 49,826 mg/L of chloride. On the other hand, if road salt is used on Highway 20 where it passes within hundreds of feet of Suttle Lake, in which sodium and chloride levels are typically below 3 mg/L, decades of road salt use could have an adverse impact.

A 2004-2008 study found that three of seven urban lakes in Minnesota were approaching a year-round average salt concentration of 230 mg/L, which is nationally accepted as a chronic standard for impairment to aquatic habitat. The Minnesota report estimated that it would take 40 years for some lakes to return to normal chloride levels if road salting were completely stopped.

A computer model developed by the U.S. Geological Survey and the Federal Highway Administration, the Stochastic Empirical Loading and Dilution Model (SELDM), could help ODOT and other road maintenance departments in Oregon make the best deicing choices to minimize the impact to the environment. Version 1.0.0 was released in 2013.

If Oregon can enhance its existing watershed mapping information so that deicing chemicals can be modeled with SELDM, the potential problems could be spotted years before they reach toxic levels, giving managers time to modify best management practices and avoid environmental harm while protecting the driving public and our transportation infrastructure.

If ODOT adds salt to their "approved" list, other Oregon counties and cities will logically follow suit. One county is already making inquiries about the use of cheese brine industrial waste as a locally available source of road salt.

More research is needed to prepare Oregon for tough choices between economics, the environment, and public safety. Oregon Lakes Association is considering a discussion panel at our Fall Conference to explore this topic further. If you have questions or ideas, consider attending.

2014 OREGON HARMFUL ALGAE BLOOM (HAB) STAKEHOLDER MEETING

On March 4th, 50 people attended the annual HAB Stakeholder Meeting hosted jointly by OLA and Oregon State University in Corvallis.

Rebecca Hillwig (Oregon Health Authority) reported that reduced OHA funding will limit activities, but OHA will continue to issue and lift advisories with input from lake managers.

Al Johnson (U.S. Forest Service) reported that USFS monitors developed recreational sites, but small lakes with a picnic table might only receive a warning sign. Wilderness areas are not monitored.

Tina Lundell and Shelly Hanson (US Army Corps of Engineers) reported that they are evaluating the benefits of precautionary posting versus testing.

Paul Robertson described the in-house sampling and microcystin toxin analysis protocols at Devils Lake, Lincoln City.

Alex Cuyler (Lane County) reported on the status of S. 1254 (see article p. 7), which would fund HAB research.

Theo Dreher (OSU) presented a report on human and canine cyanotoxin exposure, and a report of his lab's research on the HAB-associated toxicity status of Willamette Valley reservoirs used as drinking water resources.

Richard Litts reported on water quality monitoring at Tenmile Lake, Lakeside.

Copies of most of the presentations are available on the OLA website under the Events tab.

Signage from Siltcoos Lake, 2007. Photo by V. Morgan.

Monitoring Cyanobacteria Harmful Algae Blooms by in vivo Fluorometry

By OLA Board member, Dr. Wayne Carmichael,
Professor Emeritus, Wayne State University

It is becoming increasingly evident that along with many changes in our environment, harmful algae blooms (HABs) are here to stay and we need to learn how to live with them. This means learning at least the basics of the three "Ms"; Monitor, Management, and Mitigate. Doing the first may not be required to tackle 2 and 3, but it will certainly make that task much easier, more effective and less costly. In this context the term *monitor* is suggestive of the use of screening tools that help one to recognize trends. Photosynthetic pigments are an excellent way to monitor and recognize trends in the type and quantity of algae in water bodies. Paraphrasing from a Turner Designs Application Note: "A simple technique for monitoring algae has been in use by oceanographers and limnologists for over 30 years (Lorenzen, C.J., 1966). It is called "in-vivo fluorometry (IVF)," and is based on the direct measurement of the fluorescence of the chlorophyll in the living algal cells. The same methodology is used to detect the phycobilin pigments (phycocyanin and phycoerythrin) of cyanobacteria in water (Arar and Collins, 1992). The benefits of IVF include ease, speed, and the ability to collect large quantities of data. There is no special sample handling or processing required, making IVF ideal for profiling moored and on-line instrument systems for real-time data collection. IVF is the easiest method for collecting large quantities of data but there are variables associated with IVF that can result in errors and interference. The fluorescence for a given cell concentration is affected by a number of factors including the amount of light the cell was exposed to prior to the measurement and variation among different species, physiological states and environmental conditions.

For the most accurate data, IVF data are correlated to quantitative data that can be collected by taking occasional samples that are analyzed for pigment concentration by a technique that is not affected by the conditions of the live sample. Unlike the chlorophylls that have relatively easy and well-established extraction methods, phycocyanin and phycoerythrin are water soluble pigments, which makes extractive methods more challenging. The most common quantitative detection method is high performance liquid chromatography (HPLC). Other methods for quantitation include cell counting and identification and detection of specific cyanobacterial toxins. However, the real-time monitoring of cyanobacteria through fluorometry can serve as an early warning system for potentially hazardous conditions. In addition to potential toxin production, cyanobacterial blooms can also result in water with an unpleasant appearance, and in the case of drinking water, an unpleasant taste and odor. These problems adversely affect water quality and diminish the water's recreational utility. Also of concern are high cell concentrations causing an increase in filter run times in drinking water plants. Thus, monitoring the cyanobacterial population and distribution in lakes, reservoirs and coastal areas is important for resource protection, public health and safety, and overall economics.

One of the first practical solid-state fluorescence instruments that could be used to detect the in vivo fluorescence (IVF) of algal and cyanobacterial pigments in natural waters was developed by Turner Designs (http://www.turnerdesigns.com). This technology represented a new practical and robust tool for researchers and water resources manages to improve monitoring systems, and which could be used to improve water quality and prevent the occurrence of potentially hazardous conditions. Turner Designs' original units were for lab use but over time they developed a full line of field units (http://turnerdesigns.com/products/field-fluorometer). The original Turner Designs technology has been incorporated into equipment from several major water monitoring companies, most notable being Yellow Springs Instruments (now called Xylem; http://www.ysi.com/index.php) and Hydrolab (now Hach Hydromet; http://www.hachhydromet.com/ web/ott_hach.nsf/id/pa_blue-green_algae_by_turner_designs.html).

Cost and limited ease of use has limited many lake monitoring groups from taking full advantage of fluorometers. Fortunately, there are now some units becoming available in the $1000 to $1500 price range. Examples of these less expensive units are those produced by Amiscience (http://www.amiscience.com/). Three basic units are available: the first measures chlorophyll (excitation 440 nm, emission 670 nm), the second measures phycocyanin (excitation 600 nm, emission 650 nm) and the third has two channels so that it can be used to measure both. They are all durable and portable

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MONITORING CYANOBACTERIA HABS (CONTINUED FROM PAGE 7)

and thus able to be taken directly to the site to perform on-the-spot measurements. They are calibrated easily by first measuring a sample that does not contain any fluorescent material, usually just water, then measuring a standard with a known concentration of material. One company that specializes in cyanobacterial harmful algae bloom services and products, including fluorometers, is Beagle Bioproducts of Columbus, Ohio (http://beaglebioproducts.com/4364-2/#lightbox/0/).

In general, all fluorometers are meant to be part of a larger tool kit when being used for environmental monitoring. For example, turbidity and temperature are two major contributors to data errors and need to be corrected for when determining pigment amounts and relating this to cell concentrations. However, the quick sample preparation (often just transferring the sample to a tube) and intuitive fluorometer interface is the easiest way to generate quantitative pigment data that guides management decisions regarding type of algae, degree of water quality impairment and even health risk from cyanobacterial toxins.

References:

Arar, E.J. and Collins, G.B., Method 445.0, *in vitro* determination of chlorophyll *a* and pheophytin *a* in marine and freshwater phytoplankton by fluorescence, *In:* Methods for the Determination of Chemical Substances in Marine and Estuarine Environmental Samples. Environmental Monitoring Systems Laboratory, Office of Research and Development, U.S.E.P.A., Cincinnati, Ohio (EPA/600/R-92/121, November ,1992).

Lorenzen, C.J. 1966. A method for the continuous measurement of *in vivo* chlorophyll concentration. *Deep Sea Research,* 13:223-227.

SENATE BILL 1254 PASSES THE SENATE

S. 1254, the Harmful Algal Bloom and Hypoxia Research and Control Act (HABHRCA) of 2013, was introduced on June 27, 2013, by Senator Bill Nelson [D-Fl], with 18 cosponsors [15D, 2R, 1I]. The bill was passed in the Senate on February 12, 2014 and now needs to go to the House for consideration. This legislation reauthorizes the 1998 HABHRCA and for the first time extends the scope to include inland as well as marine HABs; and hypoxia events. The Environmental Protection Agency would be expected to establish a national program to address freshwater HABs.

This legislation is sorely needed to support research on HABs in lakes and reservoirs, which has been poorly funded. On March 6, 2014, OLA sent a letter asking Rep. Peter DeFazio to support "hold(ing) a legislative hearing and work(ing) to move this bill to the House floor as soon as possible." Please consider sending a note to Reps. Peter DeFazio (travis.joseph@mail.house.gov) or Suzanne Bonamici (eric.ffitch@mail.house.gov) to encourage them to seek committee hearings and a floor vote in the House of Representatives to bring this bill to active legislation.

Secretary and Newsletter Editor Needed

A recent resignation from the OLA Executive Board has opened an opportunity for an interested person (or persons!) to become more involved in the inner workings of OLA. The positions open are **Secretary** and newsletter **Editor**. In the past the position has alternatively been both filled by one or two individuals. The Secretary position, as an Executive Board member, is normally filled through a plurality election by the membership. However, the current unexpired-term Board vacancy can be immediately filled by Board appointment, as can the Editor position.

Briefly, from our Bylaws, the Secretary prepares minutes of all meetings of the Association and Board, maintains all permanent records of the Association (including minutes of Committee meetings), and maintains an accurate listing of members. The Secretary also performs such other duties as may be assigned by the Board, develops an annual chapter report to NALMS, and serves as a member of the Communications Committee (newsletter, website). The Secretary presides at meetings of the Association and the Board in the absence or vacancy of the President and Vice President. Typically, draft minutes are compiled after a Board meeting, submitted to the Board for consensus, and a final version is voted on. As a member of a Standing Committee, the Secretary can also assume the position of newsletter Editor. Committee Chairs and members are appointed by the President in consultation with the Board of Directors, so any OLA member may request to serve on any Committee and therefore serve as the newsletter editor. Members of Standing Committees and other established committees serve until the end of the Board's term and are eligible for reappointment.

For the Editor position, as we transition to an electronically delivered newsletter format, knowledge of desktop publishing would be helpful. For publication, currently Oregon Lakes Association is taking advantage of email broadcasts through its website / member database to distribute the newsletter, but paper versions of the newsletter are still preferred by some in the association. The Editor's primary function for the newsletter will be coordination or articles and layout. A few advertisements are also included as part of sponsorships or corporate memberships. Of course Editors are often great writers too, and as such are encouraged to add articles as well as those coming from the association at large. Once the print version is ready, it is assembled and sent out to 80 or so recipients; all others get a digital copy that the webmaster assembles from the print version. Voila! OLA Lake Wise.

If interested in moving us further into the media world, please contact President Steve Wille.

Lake Wise

The Oregon Lakes Association
Newsletter 2014#1, 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.
