LAKE WISE

… a voice for quiet waters

NEWSLETTER FROM OREGON LAKES ASSOCIATION

JUNE 2015

Laurie Carmichael, Newsletter Manager

IN THIS ISSUE

Save the Date! The Oregon Lakes Association is pleased to be holding its fall conference in Klamath Falls this year. October 2-3 at the Klamath Yacht Club (http://kycsail.us/) on Upper Klamath Lake. Please keep an eye on our website http://www.oregonlakes.org as we post details for registration, program, lodging options and special events.

Membership Update:

Being an OLA member is not only a great way to support Oregon Lakes, it is your professional network for the aquatic realm. The Oregon Lakes Association connects limnologists, resource managers, consultants, government agencies, academia, and more. Consider joining today! Privileges of membership include access to the archive of these Lake Wise publications, discounted conference registrations and trainings, and a web listing on http://www.oregonlakes.org. With the increased focus of an online presence, members have the opportunity to connect with other members in a simpler manner. Log in today to see all the OLA members, not just those on the Public Directory. Also, take full advantage of the new Discuss and Post feature of the website.

Bylaws: A recent review of the bylaws has found a few particulars that are inconsistent with current policy. Most of the changes are minor and include updating the number of membership types in the Association, changing the way annual memberships are calculated, and roles of the Executive Committee. Also, since the Association holds its annual meeting at the Conference, there is occasionally a conflict with our bylaws when the Association meets outside the state of Oregon. This occurs, for example, during periodic joint meetings with Washington Lake Protection Association (WALPA), and therefore we need an update to the bylaws. The small change of removing "Oregon" in one section of the bylaws allows the annual meeting to be held at a time or place approved by the board that is in accordance with ORS 65.201 (1) and (3). Proposed changes to the Bylaws of the Oregon Lakes Association recommended by the Board can be found on the website. Please review the proposed changes. An email will be sent out shortly for members to vote on potential adoption of these proposed changes.

Current Bylaws:
http://www.oregonlakes.org/Resources/Documents/Bylaws_Adopted_2011_11_02.pdf

Changes:
http://www.oregonlakes.org/Resources/Documents/Board/Bylaws_revised_2015-02-20.pdf

Proposed Final:
http://www.oregonlakes.org/Resources/Documents/Board/Bylaws_revised_2015-02-20_Clean_Version.pdf

Oregon Lakes in the News

Contributed by Andy Schaedel, Treasurer, and Paul Robertson, President OLA Board

Several Oregon lakes have been in the news lately. The following is a quick summary with a link to the articles for further information:

Lost Lake (Santiam Pass in Linn County): Film and story of Lost Lake, which has a unique outlet – a drain through a hole that goes into a lava tube. See http://www.weather.com/science/nature/news/oregon-disappearing-lake-explained
or https://www.youtube.com/watch?v=wqIhmXJeb5s

Mirror Pond (Deschutes County): The City of Bend and numerous other stakeholders are continuing to explore options for the future of Mirror Pond. Formed by a dam built for power generation, the pond has been filling with sediment since it was last dredged in 1984. In addition to frequent coverage in the Bend bulletin, see http://www.mirrorpond.info/

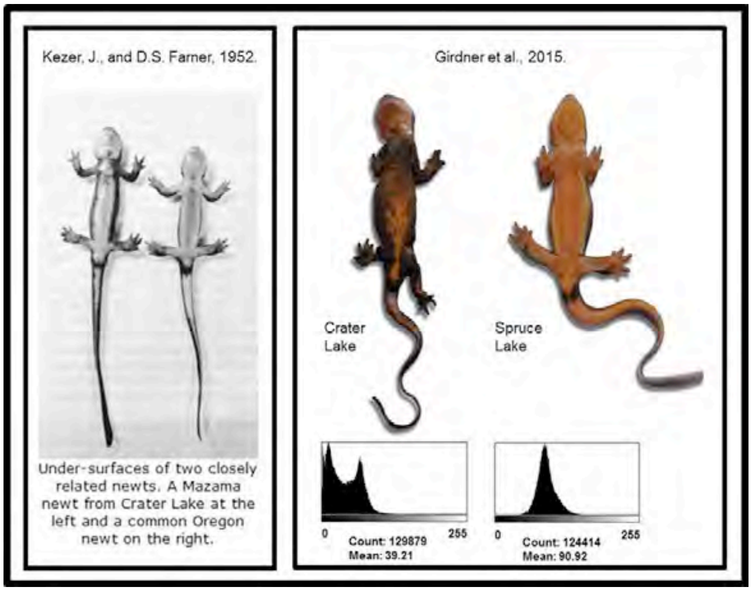
Sturgeon Lake (Multnomah County): Sturgeon Lake is located on Sauvie Island and is an important refuge for migrating waterfowl. After nearly two years of fund raising, West Multnomah County Soil and Water Conservation District has raised $1.6 million as a local match for a $7.5 million U.S. Army Corp of Engineers project to restore Sturgeon Lake's connection to the Columbia River through Dairy Creek in order to address sedimentation issues in the lake and to preserve the lake as a wildlife refuge. See http://www.oregonlive.com/portland/index.ssf/2015/04/sauvie_islands_dying_sturgeon.html or http://www.wmswcd.org

Blue Lake (Fairview in Multnomah County): Last July's norovirus outbreak, which prompted 13 reports to Multnomah County Health Department, likely affected 70 individuals according to CDC, as reported by TIME. See http://time.com/3881612/norovirus-lakes/

Zebra Mussels (Lake Erie Ohio to Ontario Oregon): As reported by the ODFW on April 24, Zebra Mussels were found on the propeller shaft and under the stern of a boat being trailered from Lake Erie. See http://www.dfw.state.or.us/news/2015/april/042415b.asp
Learn more about Oregon's Aquatic Invasive Species Prevention Permit Program: http://www.dfw.state.or.us/conservationstrategy/invasive_species/quagga_zebra_mussel.asp

100 Years later: the impact of introduced Crayfish on native Salamanders in Crater Lake

Contributed by Scott Girdner, Crater Lake NP
Solicited by Gary Larson, Secretary OLA Board



Crater Lake has been protected within Crater Lake National Park and managed in near-pristine condition since 1902, yet this remarkable ecosystem is not immune to the impacts of introduced species. The summer of 2015 marks the 100th year since signal crayfish (*Pacifastacus leniusculus klamathensis*) were introduced to Crater Lake as a food resource for introduced salmonids. The introduced crayfish now threatens a unique population of salamander in Crater Lake and park managers face the challenge of controlling crayfish to conserve the native amphibian.

Prior to the introduction of non-native fish in 1888 and the subsequent introduction of crayfish in 1915, the Mazama newt (*Taricha granulosa mazamae*) presumably occupied a key ecological niche as the top aquatic predator in Crater Lake for thousands of years. The Mazama newt is a proposed subspecies of the rough-skinned newt (*Taricha granulosa*) and is apparently endemic to Crater Lake[2]. Recent studies by the U.S. Geological Survey, University of Idaho, Utah State University, and the National Park Service confirm that the Mazama newt is morphologically, genetically, and physiologically distinct from populations of newts outside the lake[1].

Observations by park biologists through the 1900s suggested a decline in Mazama newt distribution and an increase in signal crayfish abundance. This led to several studies, including investigations of current distribution and relative abundance of both taxa (snorkel and trap surveys), food web overlap (stable isotopes), food availability (benthic insect sampling) and behavioral interactions between crayfish and newts (mesocosum studies)[1]. Results indicate that crayfish have expanded in distribution to occupy nearly 80% of the 31 km (19 mi) rocky shoreline. Newts remain in areas that crayfish have yet to invade but are almost entirely absent in areas occupied by crayfish. Isotopic signatures of carbon and nitrogen in newt and crayfish tissue indicate that the two species eat similar food items and occupy a similar position in the food web, primarily predators of small invertebrates. Abundance of benthic insects was dramatically reduced in locations with crayfish compared with areas of the lake without crayfish. Behavioral mesocosm experiments conducted with newts and crayfish revealed that crayfish prey on newts, displace newts from cover, and likely increase newt energy expenditure and exposure to ultraviolet light and fish predation. This evidence, taken together, suggests that further crayfish expansion will likely cause additional decline in newt abundance and distribution, and could lead to extinction of the Mazama newt.

Conserving this irreplaceable component of Crater Lake's native fauna will be a challenge for park managers. The National Park Service is mandated to preserve and protect natural resources, particularly taxa such as the Mazama newt that are rare, endemic, or unique to parks. Unfortunately, crayfish are extremely difficult to control and nearly impossible to eradicate once established in a lake system[3]. A workshop is scheduled for summer 2015 to bring together scientists and resource managers who have direct experience confronting and managing crayfish invasions and conserving amphibians. The workshop will draw upon the expertise of participants to determine objectives, management options, and a conceptual model of the expected outcomes of alternative actions to control crayfish or otherwise conserve Mazama newts.

Citations:

1. Buktenica, M.W., S.F. Girdner, A.M. Ray, D.K. Hering, and J. Umek. (2015). The impact of introduced crayfish on a unique population of salamander in Crater Lake, Oregon. *Park Science, 31 (2) (In print).*

2. Farner, D.S. and J. Kezer. (1953). Notes on the amphibians and reptiles of Crater Lake National Park. *The American Midland Naturalist 50:*448-462.

3. Stebbing, P., Longshaw, M., & Scott, A. (2014). Review of methods for the management of non-indigenous crayfish, with particular reference to Great Britain. *Ethology Ecology & Evolution*, *26(2-3)*, 204-231.

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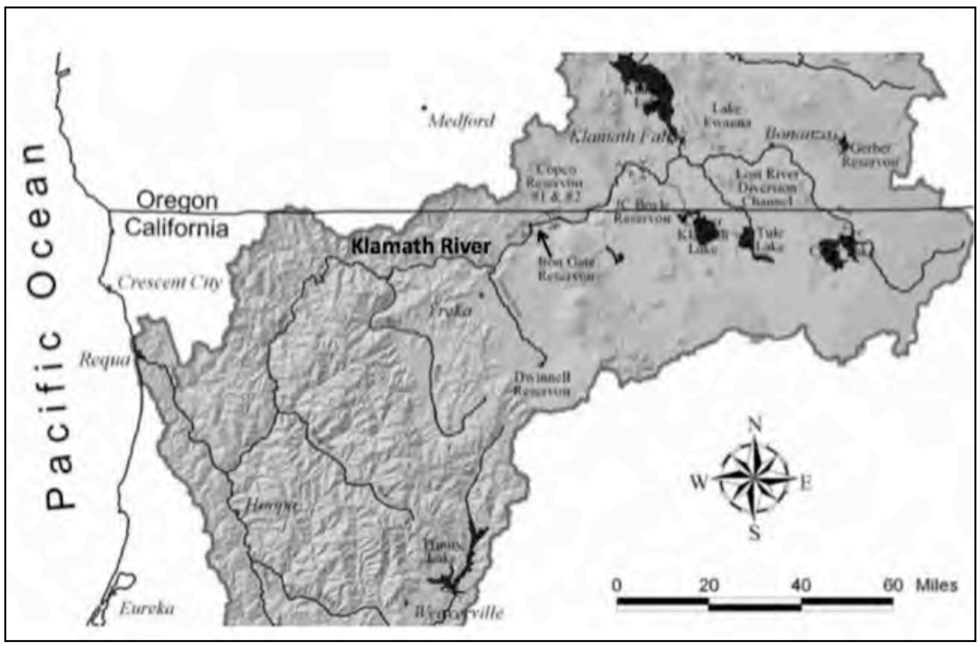
Why we should be concerned about Toxic Blooms in upstream Lakes: transport of toxic *Microcystis* up to 180 Miles in the Klamath River

Contributed by Theo Dreher, OLA Board Vice President



Map of Klamath River Basin: The Klamath River flows from Upper Klamath Lake (at top) south-westwards into California past a series of dams, culminating in Iron Gate (arrow), about 185 miles upstream of the Pacific Ocean. (Map adapted from US Department of Interior)

Rivers are not normally the place one expects to see planktonic cyanobacterial blooms, although they can be host to benthic, mat-forming cyanobacteria (such as *Phormidium*) that can produce the same cyanotoxins we see in lakes. Flowing rivers are not conducive to the growth of bloom-forming cyanobacteria, which thrive in the slow-moving, stratified water found in reservoirs and lakes. Because most of these bodies are connected to outflows, it is easy to imagine that cells will be swept into streams at times. In 2007, attention to this phenomenon was heightened when sea otter deaths in Monterey Bay were linked to microcystin derived from a toxic bloom in Pinto Lake[1]. This required *Microcystis* cells to travel only 10-15 km to the bay. However, in late August 2011, Graham et al. (2012)[2] tracked a *Microcystis* bloom emerging from Milford Lake in Kansas as it flowed in a pulse about 165 miles to Kansas City and the Missouri River, showing that intact *Microcystis* cells can carry microcystin toxin over much longer distances in rivers.

Tim Otten in my laboratory at OSU recently studied the situation in the Lower Klamath River just south of the Oregon border, where elevated *Microcystis* cell counts and microcystin toxin levels are commonly observed in the downstream reaches during the summer months. We set out to distinguish whether the *Microcystis* was in part or mostly endemic in the lower reaches or was continually transported from Iron Gate Reservoir, the last of a series of dams on the Klamath River. We used a genetic tracking approach to identify relationships between *Microcystis* populations at different sites during 2012, when microcystin levels reached about 55 ppb in the reservoir and 3.6 ppb in the estuary some 185 miles downstream. We knew from previous studies that the HAB populations commonly change during the season; with strains that have different genetic fingerprints (genotypes) replacing each other, and the plan was to see
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whether or not the genotypes changed with the same pattern in the river and in Iron Gate Reservoir.

During 2012, the succession of genetically distinct strains was less marked than in previous years, but we did observe changes at an indicator site, termed a single nucleotide polymorphism (SNP). SNP's have been used widely as genetic markers in mapping human genes related to inherited diseases. The SNP's are used as genetic indicators when it is not feasible to study all the genes in an organism. In our case, the SNP we studied was a switch between the nucleotide A and G in position 131 of the DNA for the *cpcBA* phycocyanin gene locus in *Microcystis*. From cell counts, it was evident that *Microcystis* reached its peak in Iron Gate Reservoir in the last week of August, and the same timing was observed throughout the river downstream; by contrast, *Microcystis* reached its peak in Copco Reservoir, just upstream of Iron Gate, a month earlier. As the bloom was developing in July, our DNA sequencing experiments showed that there was a switch from the 131-A SNP to mostly 131-G in Iron Gate Reservoir and at the few downstream sites sampled. Between early and late August, the 131-A SNP again became dominant, and that switch was observed simultaneously at Iron Gate and nine downriver sites over a distance of about 180 miles. These simultaneous changes indicate that Iron Gate Reservoir is the source of most of the downstream *Microcystis*, and that there appear to be no significant areas of endemic HAB growth in the river (these would not be expected to follow the same SNP switch, which did not occur in Copco Reservoir).

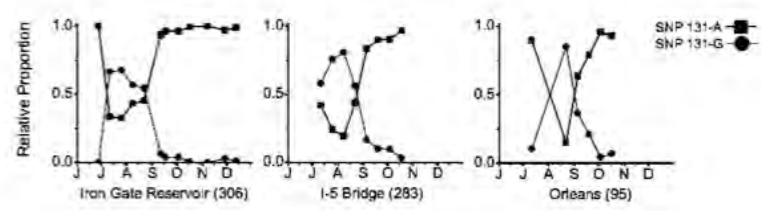
Our results emphasize the ability of toxic *Microcystis* to travel extraordinary distances in free-flowing rivers that themselves provide no HAB habitat. This can be a concern to downstream water utilities that draw on a river for drinking water supplies. It can also result in toxin contamination of harvestable shellfish, which are able to bioaccumulate toxins, both in the river and potentially in nearby coastal regions. Our research is being published in a forthcoming issue of *Harmful Algae*[3].

Citations:

1. Miller MA, Kudela RM, Mekebri A, Crane D, Oates SC, et al. (2010). Evidence for a novel marine harmful algal bloom: cyanotoxin (microcystin) transfer from land to sea otters. *PLoS ONE 5(9):* e12576. doi:10.1371/journal. pone.0012576.

2. Graham, J.L., Ziegler, A.C., Loving, B.L., Loftin, K.A. (2012). Fate and transport of cyanobacteria and associated toxins and taste-and-odor compounds from upstream reservoir releases in the Kansas River, Kansas, September and October, 2011. *Scientific Investigations Report 2012-5129*, U.S. Geological Survey, Reston, VA.

3. Otten, TG, Crosswell, JC, Mackey, S and Dreher, TW (2015). Application of molecular tools for microbial source tracking and public health risk assessment of a *Microcystis* bloom traversing 300 km of the Klamath River. *Harmful Algae* (In press).



Genetic tracking of *Microcystis* populations during 2012 at Iron Gate Reservoir and two river sites, I-5 and Orleans, 14 and 130 miles downstream. The proportions of SNP's 131-A and 131-G are shown for each sampling time.

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Harmful Algae Blooms (HABs) Corner

EPA issues Health Advisories to protect Americans from Algal Toxins in Drinking Water

Contributed by Wayne Carmichael, OLA Board of Director Member.

Summary: Seventeen Years after the World Health Organization (WHO) released guidelines for microcystins in drinking water supplies, the US EPA has released its guidelines for microcystin and cylindrospermopsin. The text of that release, dated 05/06/2015 is given below. OLA will continue to monitor these guidelines and provide updates and comments in future issues of this newsletter.

http://yosemite.epa.gov/opa/admpress.nsf/0/547dc50c15c82aaf85257e3d004d7f67?OpenDocument

WASHINGTON – The U.S. Environmental Protection Agency (EPA) today issued health advisory values that states and utilities can use to protect Americans from elevated levels of algal toxins in drinking water. Algal blooms in rivers, lakes, and bays sometimes produce harmful toxins. Because utilities often use these water bodies as sources of drinking water, EPA has determined algal toxin levels in tap water that are protective of human health based on the best available science. EPA is also recommending how utilities can monitor and treat drinking water for algal toxins and notify the public if drinking water exceeds protective levels.

EPA will issue the final documents containing the health advisory values, recommended monitoring and treatment approaches, and all supporting technical information before summer, which is prime season for algal blooms because of warmer temperatures. Last August a harmful algal bloom in Lake Erie left half-a-million residents of Toledo without drinking water for two days. EPA estimates that between 30 and 48 million people use drinking water from lakes and reservoirs that may be vulnerable to algal toxin contamination.

"Nutrient pollution and harmful algal blooms are among America's most serious and growing environmental challenges," said EPA Administrator Gina McCarthy. "EPA has released health advisory values on algal toxins based on the best available science to ensure the safety of America's drinking water. We will work closely with our partners at the state and local levels on monitoring, treating, and communicating about the toxins, as well as addressing the sources of nutrients that fuel these harmful algal blooms."

Health advisories are not regulations, but provide technical guidance to help state and local officials and managers of water systems protect public health. They identify concentrations of contaminants above which adverse health effects are possible and provide testing methods and treatment techniques.

The health advisory values for algal toxins recommend 0.3 micrograms per liter for microcystin and 0.7 micrograms per liter for cylindrospermopsin as levels not to be exceeded in drinking water for children younger than school age. For all other ages, the health advisory values for drinking water are 1.6 micrograms per liter for microcystin and 3.0 micrograms per liter for cylindrospermopsin. Potential health effects from longer exposure to higher levels of algal toxins in drinking water include gastroenteritis and liver and kidney damage. The health advisory values are based on exposure for 10 days. While briefly exceeding these advisory levels may not indicate an immediate emergency, EPA recommends utilities use treatment techniques to lower levels as quickly as possible. Steps that can protect the public from algal toxins in drinking water include:

- Monitoring source water and drinking water for detection of algal toxins.
- Treating drinking water as necessary to reduce and remove algal toxins.
- Notifying the public that younger than school age children should not drink untreated or boiled water if levels are above 0.3 micrograms per liter for microcystin and 0.7 micrograms per liter for cylindrospermopsin.
- Notifying the public that no one should drink or boil the water if levels are above 1.6 micrograms per liter for microcystin and 3.0 micrograms per liter for cylindrospermopsin.

EPA will seek input from stakeholders on the recommended actions and other information the Agency can provide to best support states and utilities in addressing algal toxins in drinking water. Based on input, EPA may provide additional technical support documents before the peak of algal bloom season.

EPA worked with Health Canada to develop the health advisories. The World Health Organization has indicated it will use the health advisories developed by EPA to reevaluate global recommendations for levels of algal toxins. As the science on the health impacts of algal toxins continues to improve, EPA will track developments and update recommendations as appropriate.

Background

Nutrient pollution of water is one of America's most widespread, costly and challenging environmental problems, caused by excess nitrogen and phosphorus in the air and water. More than 100,000 miles of rivers and streams, close to 2.5 million acres of lakes, reservoirs and ponds, and more than 800 square miles of bays and estuaries in the United States have poor water quality because of nitrogen and phosphorus pollution. Too much nitrogen and phosphorus in water can cause algal blooms, which can turn harmful to humans if they produce toxins. People can become sick from harmful algal blooms if they play or swim in a polluted water body, consume tainted fish or shellfish, or drink contaminated water. Harmful algal blooms can also create dead zones in water, killing aquatic life, raising treatment costs for drinking water, and hurting businesses and jobs that depend on clean water.

EPA recently announced it is developing an early warning indicator system using historical and current satellite data to detect algal blooms. EPA researchers will develop a mobile application to inform water quality managers of changes in water quality using satellite data on cyanobacteria algal blooms from three partnering agencies – NASA, NOAA, and the U.S. Geological Survey.

EPA is working diligently with its partners to combat the nitrogen and phosphorus pollution including:

- Providing states with technical guidance and resources to help them develop water quality criteria for nitrogen and phosphorus as part of their water quality standards for surface waters.
- Working with states to identify waters with nitrogen and phosphorus pollution and to develop Total Maximum Daily Loads (TMDLs) to restore the waters by limiting allowable nutrient inputs.
- Awarding grants to states for operating nonpoint source management programs.
- Administering a permit program that restricts the amount of nitrogen and phosphorus released to the environment from point sources, such as wastewater treatment plants.
- Providing funding for the construction and upgrading of municipal wastewater facilities and the implementation of nonpoint source pollution control and estuary protection projects.
- Working with its state and federal partners on the Mississippi River/Gulf of Mexico Watershed Nutrient Taskforce to reduce hypoxia.

US Army Corps of Engineers pull out of Blue-Green Algae Testing Effort

Summary: **Just as the US EPA posted guidelines for some cyanotoxins in water supplies, the US Army Corps of Engineers has pulled out of the testing efforts for blue-green algae in Oregon and will not send alerts pertaining to potentially toxic blooms.**

Mail Tribune. May. 18, 2015 at 12:01 AM

Federal officials will no longer participate in volunteer advisories against water contact during blue-green algae blooms at Lost Creek Lake and 10 other Oregon reservoirs, opting instead for a year-round education program about identifying potentially unhealthful waters.

The U.S. Army Corps of Engineers will no longer test the reservoir's water to determine whether cyanobacteria levels exceed Oregon Health Authority standards triggering recommendations against water contact when the annual green scum blooms in Lost Creek Lake, Jackson County's largest water body.

Corps officials, likewise, will not test for toxin levels after the algae blooms die off. These tests were the precursors for lifting the volunteer advisories, which typically have hit Lost Creek Lake twice a year since the cyanobacteria levels were first tested for and discovered in 2006.

Despite the regular testing, there are no confirmed cases of human illness from blue-green algae contact at Lost Creek Lake or any other water body in Oregon, though four confirmed dog deaths have been attributed to algae toxins in the Umpqua and South Umpqua rivers.

The change, Corps officials said, comes largely from an over-reliance by the general public on the volunteer postings as the be-all, end-all evidence that the water is safe or not.

For the complete article, see:
http://www.mailtribune.com/article/20150518/NEWS/150519651/101064/NEWS

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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. 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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Come sail with OLA at our October 2-3, 2015 annual meeting in Klamath Falls, located next to beautiful Klamath Lake.
Photo by Wayne Carmichael, OLA Board Member.
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