LAKE WISE

... a voice for quiet waters

NEWSLETTER FROM OREGON LAKES ASSOCIATION

DECEMBER 2015

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Please Note:

Print copies of *Lakewise* will no longer be mailed, but downloadable PDF copies are available on our website.

Thank you.

OLA Board of Directors

Focus of 2015 OLA Annual Meeting on Klamath Lake Water Resources

Contributed by Wayne Carmichael, OLA Board Member

The health and future of Klamath Lake water resources was the focus of the Oregon Lakes Association Annual Conference held at the Yacht Club in Klamath Falls October 2-4, 2015.

Given the importance of Klamath Lake to the culture, ecology and economy of the region, the theme of this year's conference was "**Klamath Lake Perspectives: Lessons for Oregon's Lakes**." Conference activities started 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 was moderated by Chrysten Lambert, director of the Oregon Water Project for Trout Unlimited, and included panelists, Dennis Lynch, Dave Hewitt and Scott White representing water resources, fisheries, and landowner perspectives. The full film was shown Saturday night following a full day of presentations on Klamath Basin and other lake-related topics.

The Saturday presentations began for 55 attendees with a plenary address by Dennis Lynch, USGS Associate Regional Director for the NW Region and Program Manager for the Klamath Dam Removal Secretarial Determination. Dennis has been with the USGS for nearly 35 years and is the lead scientist covering Klamath Basin water issues.

Dennis Lynch speaking at OLA Annual Meeting. (Photo by Rich Miller)

Seventeen other topics followed covering: 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." OLA scholarship winner Sarah Burnet presented her masters degree research "Large variance in internal loading rates from spatially separated sediment cores in Willow Creek Reservoir, OR". These presentations were organized into four sessions plus posters and vendor information booths.

Session One: Phytoplankton Ecology included three talks on Klamath Lake, two on toxigenic *Microcystis*, and one on long-term phytoplankton dynamics.

Session Two: Algal Biology had four presentations on Klamath Lake cyanobacteria, three on *Aphanizomenon* and *Microcystis*, which are major waterbloom formers, and one on *Nostoc,* a benthic colonial better known as Mares egg.

***Nostoc*, or Mares egg, Mares Egg Spring, Klamath Lake.**
(Photo by Wayne Carmichael)

Session Three: General Lake Topics included five presentations: an update on the Atlas of Oregon Lakes; worldviews on lake restoration; internal nutrient loading at Willow Creek Reservoir; invasive carp in Malheur Lake; and updates on cyanotoxin testing protocols in the Oregon Health Authority advisory process.

Session Four: Lake Management had five talks on Klamath Lake: wetland restoration; PacifiCorp's role in basin water quality issues; a new approach to setting phosphorus total maximum daily load (TMDL); evaluating nutrient loads to Upper Klamath Lake using turbidity and stream-flow datasets; and commercial harvesting and use of cyanobacteria waterblooms.

Poster Topics: Four poster topics were: trout stocking and harmful algae in a Southern Oregon coastal lake; historical perspectives on Oregon Lakes, reservoirs, ponds and puddles via OLA's Newsletter Archives; aquatic invasive species early detection; and harvesting of Klamath Lake *Aphanizomenon flos-aquae* for nutritional supplements.

Conference activities wrapped up on Sunday morning with a canoe/kayak tour of the Upper Klamath Canoe Trail led by Mike Pakes, US Forest Service park ranger. See the canoe trail website: http://www.fws.gov/refuge/Upper_Klamath/canoetrail.html

Canoe trip from Rocky Point, Klamath Lake.
(Photo by Laurie Carmichael)

OLA thanks all participants and presenters for making our 2015 meeting a success and continuing our tradition of a "Voice for Quiet Waters". We especially thank the sponsoring vendors, New Algae Company, Oregon Technical Institute, YSI and Oregon's Watershed Councils. Special kudos goes to Jim and Stephanie Carpenter for helping us to secure the Klamath Lake Yacht Club for our meeting's venue. See http://www.kycsail.us/

More information on topics, including a PDF copy of the full program, can be found on our website: http://www.oregonlakes.org/event-1930277 PDF copies of the talks can be found under the Members tab, Archived Events tab on the OLA website.

"OLA greatly appreciates their support for our annual meeting expenses."

Oregon Lakes in the News

Contributed by Paul Robertson, OLA Board President

Coastal lakes play role in threatened Oregon coast Coho salmon recovery: The National Marine Fisheries Service is seeking comments on the draft recovery plan for Oregon coast Coho salmon through December 14, 2015. While miles of stream habitat have been a major focus for restoration, lakes and estuaries—as identified in the draft—are key components to the restoration of these threatened fish. Coastal lakes such as Devils, Siltcoos, Tahkenitch, and Tenmile provide an alternative life history for Oregon Coast Coho salmon, and have been shown to provide resiliency to the population. Juveniles overwinter and rear to greater size in these flatwater systems compared to their riverine counterparts, and have greater survivability at sea as a result. The plan estimates $110 million dollars is needed to achieve full recovery.

How to submit comments:

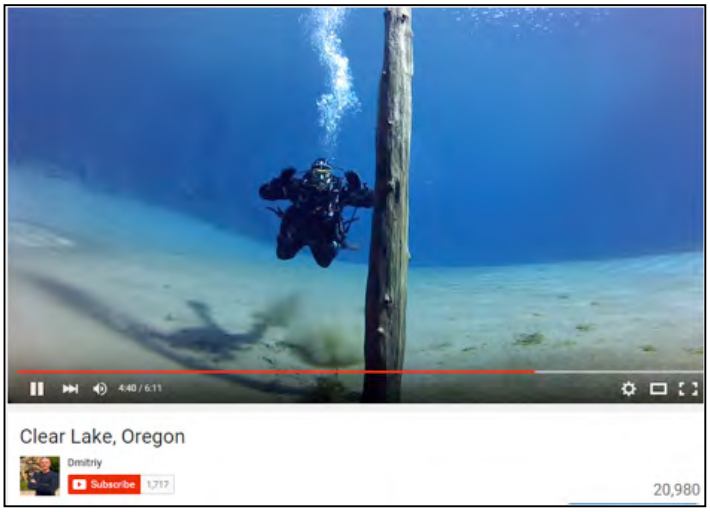
- *Email*: 2015CohoPlan.WCR@noaa.gov Include ''Comments on Oregon Coast Coho Salmon Recovery Plan'' in the subject line of the email. Attachments as PDF, MS Excel or MS Word only.
- *Facsimile*: (503) 872–2737.
- *Mail*: Robert Walton, National Marine Fisheries Service, 1201 NE. Lloyd Boulevard, Suite 1100, Portland, OR 97232.

Proposed ESA Recovery Plan for Oregon Coast Coho Salmon:
http://www.nmfs.noaa.gov/pr/hot_topics/2015/Oct/proposed_recovery_plan_for_coho_salmon.pdf

AP Story:
http://bigstory.ap.org/article/dc51f2269ee54758b5eb1b2b8a3fa361/federal-agency-issues-plan-coastal-coho-salmon-recovery

Clear Lake…a freshwater SCUBA hotspot even at 41°F: The US Forest Service calls it a "lake born of fire". *Atlas of Oregon Lakes* portrays it as "one of the most obvious examples in Oregon of a lake formed by a lava dam", describes a 3,000 year old history of a partially preserved "underwater forest", and reports Secchi Depths to 56 feet. SCUBA divers know it as "one of the most exceptional freshwater dive spots in the United States." And while it apparently shares its name with 10 others in Oregon alone, no matter how you describe it, study it, or dive in it, Clear Lake, Linn County, Oregon has a story to share.

You Tube: https://youtu.be/JRhMegxuT5w
Atlas of Oregon Lakes:
http://aol.research.pdx.edu/lakes/17090004007099
USFS:
http://www.fs.usda.gov/recarea/willamette/recarea/?recid=4399



Ross Island meeting planned: Mike Houck, Director of Urban Greenspaces Institute, and Stephen Wille, Past President of OLA Board, are planning a meeting for the summer of 2016 about Ross Island and its future as a natural area for Portland. For more information, contact Mike Houck mikehouck@urbangreenspaces.org or Stephen Wille SAWille1@gmail.com For a full copy of "Envisioning Ross Island", go to www.urbangreenspaces.org then click on Creating a Healthy Willamette River, Envisioning Ross Island for a PDF file.

Calibration Uncertainty in Water Quality Measurement

Calibrating a water quality sensor is a necessary step in creating measurement results that meet the highest standards of accuracy. Water quality instruments that allow user calibration are common. Because calibrations impact the quality of the data retrieved from the instrument it is important to understand the sources of error that may contribute to calibration uncertainty and make procedural adjustments to minimize uncertainty in a calibration result.

One way to frame and visualize the variables that impact the calibration result is a cause and effect diagram, also known as a fishbone diagram (Figure 1). Such a diagram categorizes causes into groups with similarities. A popular way of categorizing causes is by the 6 Ms: machine, method, material, manpower, measurement, and Mother Nature. With some modification the 6Ms become a useful set of categories for sources of calibration uncertainty. These are: User, How, Sonde, Weather, Standards, and Location.

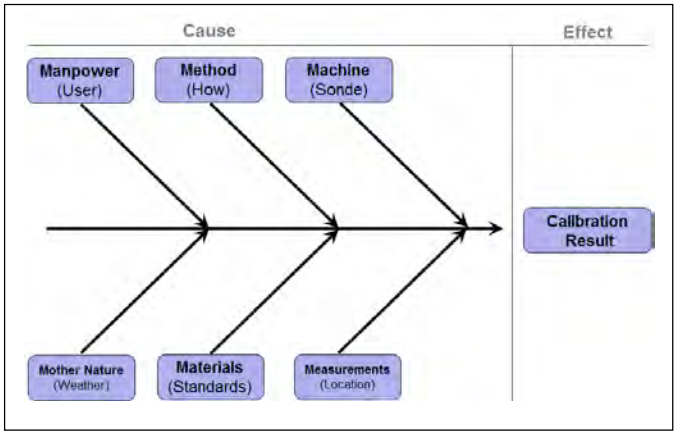


Figure 1: Cause and Effect Diagram Illustrating Categories of Factors that Impact Calibration Results

The manpower category captures attributes of the **user** doing the calibration. Experience, training, and temperament are important. The more *experience* a user has with water quality instrumentation the more likely the user will perform the procedures satisfactorily. However, experience alone is not adequate unless the user has been through *training* in how to do proper calibrations. Patience and diligence are important elements of the user's *temperament*.

The method category captures **how** the user does the calibration. The user may be following a standard operating procedure (*SOP*), a *supplier method* that is recommended by the instrument supplier, or a method dictated by a *regulation*. Sometimes these are the same, but not always. There may be good reasons to do one over another. In any case, follow the method consistently and document the method that was used.

The machine category captures attributes of the **sonde**, sensor, or instrument used to collect data. *Maintenance* is required to make sure the sonde is working the best way. Perform maintenance as needed and as the instrument manufacturer recommends. Instruments that are maintained will stay in good *condition* longer. However, instruments will eventually wear out and a replacement might be required.

Mother Nature captures the elements of the **weather** that can impact calibration results. Generally it is best to calibrate indoors where weather will have a limited effect on sensor calibration. However, sometimes an SOP or the type of measurement (example: dissolved oxygen % saturation) require field calibration. *Precipitation* can contaminate or dilute calibration standards if care is not taken to prevent this. Extreme or varying *temperature* can take the sensors and calibration standards out of thermal equilibrium. *Sunlight* can create interference with optical sensors or create unwanted temperature gradients in the calibration standards due to radiative heating.

Material required to do a successful calibration includes the calibration **standards** used. The *chemistry* of a calibration standard may vary from source to source. For example, some conductivity standards are made from NaCl and some are made from KCl. Each has slightly different responses to changes in temperature. As another example, formazin and polymer bead turbidity standards have different optical properties and will generate different readings from one turbidity sensor to another. Many calibration standards change properties as they age, so be aware of the *expiration* date of the standard. *Handling* may impact a calibration standard too. For example, pH 10 buffer will absorb carbon

dioxide from the atmosphere and become less basic. Therefore it is important to keep the pH 10 buffer container closed to minimize the exposure to carbon dioxide from the atmosphere.

When circumstances allow a choice for the **location** of calibration it is normally better to calibrate indoors in an area dedicated for calibration, such as a laboratory bench. The *stability* of the environment is normally much more conducive to good calibrations because temperature, humidity, and lighting are more controlled than they would be outside. The *comfort* of being inside is more likely to encourage the necessary behaviors for doing a precise calibration. And in a dedicated area there is easier *access* to the tools, materials, and equipment needed to do a successful calibration.

Figure 2 summarizes the factors explained above that impact sensor calibration. When developing a monitoring program consider these factors when developing the processes and methods for calibration.

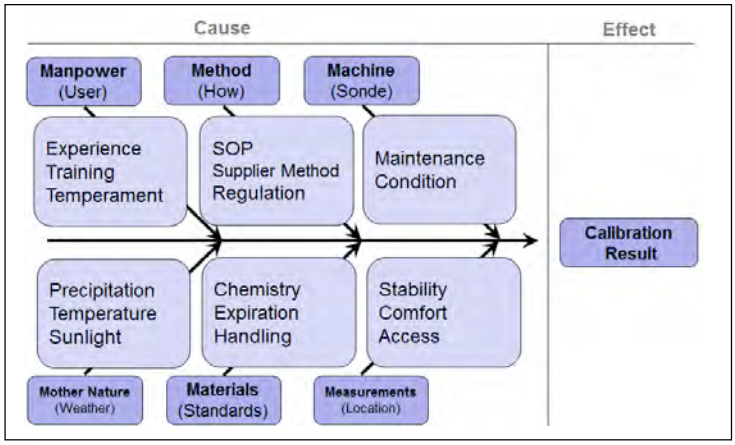


Figure 2 Fishbone Diagram Illustrating Contributors to Variability of Calibration Results

For more information about minimizing uncertainty in calibration of Hydrolab multiparameter water quality instruments, visit www.ott.com or contact the OTT Hydromet Technical Support Team at techsupport@otthydromet.com

OTT Hydromet

The Influence of Long-Term Climate Warming on Lake Thermal Structure: an Oregon Example

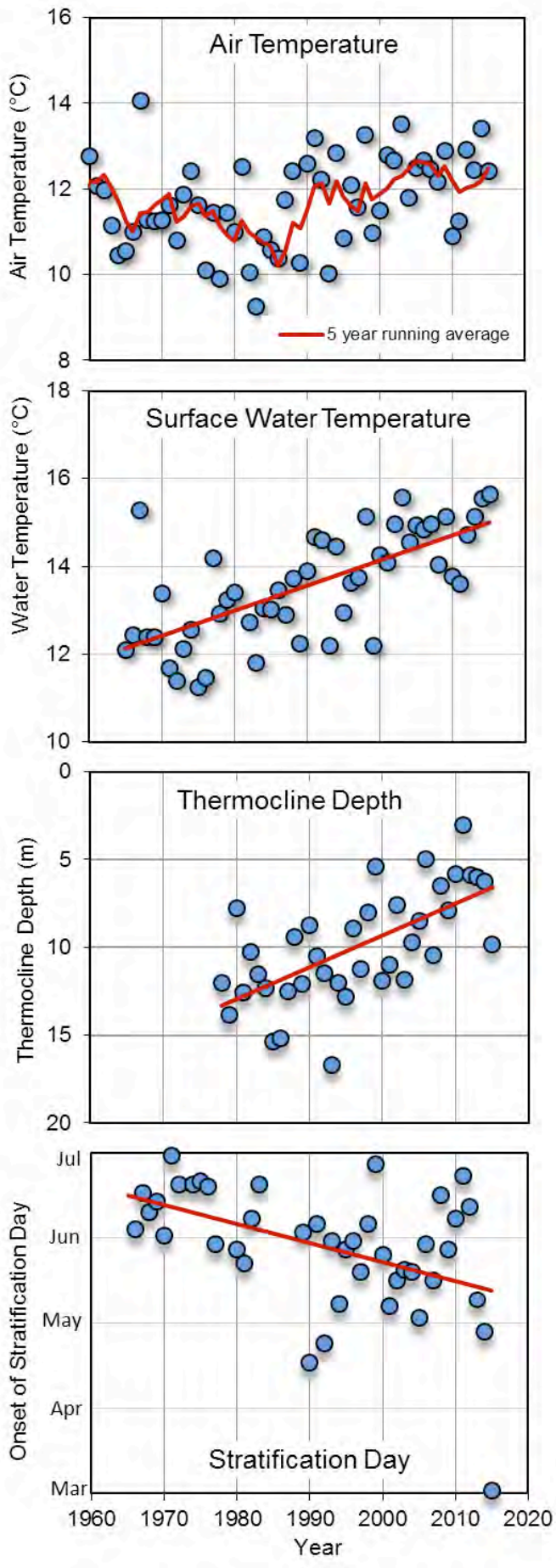
Contributed by Scott Girdner, Crater Lake National Park
Solicited by Gary Larson, OLA Board Secretary

Meteorological-driven processes exert large and diverse impacts on lakes as climate is the driving force for a lakes internal heating, cooling, mixing and circulation. These in turn can affect nutrient cycling, food-web characteristics and other important features of limnology. Trends in climate are thus potential drivers of trends in various limnological variables.

Crater Lake is the deepest lake in the United States and one of the clearest lakes in the world. Like other large temperate lakes, it has periods of vertical mixing in the spring and fall, with strong summer stratification in between. Long-term limnological and climate data from the lake monitoring program at Crater Lake National Park indicates changes through time. Warming air temperature has led to alterations in the thermal structure of Crater Lake over the last 50 years. These trends include warming surface water temperature, movement of the summer thermocline towards the surface, and earlier onset of summer stratification.

Average summer (July-September) air temperature at Crater Lake National Park shows a period of general decline from the 1930's through the mid 1970's, followed by a period of increasing temperature to present. The overall increase in average summer air temperature since the beginning of the lake monitoring program in 1983 was 1.9 °C (3.6 °F).

Summer surface water temperature has increased by 2.8°C (5°F) since record keeping began in 1965. In the 25 years prior to 1990, only 2 years (8%) had mean summer surface water temperature greater than 14°C. Since then, 18 of 26 summers (69%) were warmer than 14°C. The increase in surface water temperature appears to be driven largely by an increase in air temperature,



with air temperature accounting for 73% of the variation in surface water temperature. On average, each 1°C increase in air temperature resulted in a 1°C increase in water temperature.

The thermocline is the depth of transition between the warm water floating on the surface and the colder water below. Detailed temperature measurements within the Crater Lake water column have been consistently made during the summer since 1978. Over these 38 years, the thickness of the warm water floating on the surface in the summer has decreased by approximately 50%, moving closer to the surface by nearly 7 m (23 feet). Trends toward shallower thermoclines have been observed in other large lakes of North America, including Lake Huron, Mendota, and Tahoe. Higher water temperature at the surface of lakes tends to result in shallower thermoclines because warmer water is more buoyant (less dense) making it more difficult for wind to force the thermocline down.

Additionally, warming air temperature, along with less snowfall, appears to be driving a trend toward earlier onset of stratification in Crater Lake. Stratification has moved earlier by approximately 34 days since 1966, albeit with considerable year to year variation. Prior to 1990, stratification began after June 1st 75% of the time (12 of 16 years). Since then, only 27% of years (7 of 26) began later than the beginning of June.

Such changes in thermal structure with changing climate are not unique to Crater Lake but have been noted in several lakes across the country and around the world. Monitoring conditions over a truly long term is necessary to identify trends in thermal structure, but such data are generally not available for most lakes. It is possible that lakes exposed to similar climatological trends are experiencing similar changes in water temperature, thermocline depth, and/or onset of stratification.

Harmful Algae Blooms (HABs) Corner

Contributed by Wayne Carmichael, OLA Board Member

It has now been 45 years since cyanobacteria (blue-green algae) have received extensive research focus regarding their environmental and health risks. During that time we have learned much about the chemical structure, toxicology and detection of their toxins (cyanotoxins), the organisms responsible (mainly the planktic species), their geographic distribution (nearly everywhere) and the organisms affected (all levels—plant, animal and microbes). From all the recent state/federal agency reports and websites, it is now clear that emphasis has moved to the level of monitoring (local, national and international), management, risk assessment, and to a lesser degree, mitigation and regulation. This HABs Corner segment will focus on a few examples at the state (Oregon), national and international level.

Though CDC funding for the Oregon Health Authority HABs monitoring program ended in 2013, OHA continues issuing and lifting advisories, and receiving and documenting illnesses. For the 2015 season, which started March 1, nine alerts have been issued and currently only one is still in effect. See: http://public.health.oregon.gov/HealthyEnvironments/Recreation/HarmfulAlgaeBlooms/Pages/Blue-GreenAlgaeAdvisories.aspx

Policy issues with significant mitigation programs are being worked on for two Oregon locations. The largest, which involves a great deal of federal input, is at Klamath Lake and was covered at OLA's annual meeting at Klamath Falls in October. See the article on our annual meeting in this newsletter issue and on our website at: http://www.oregonlakes.org/event-1930277

The other Oregon location where CyanoHABs are helping to drive mitigation of impacted waters is on the Willamette River in Portland. One mile south of downtown Portland lies Ross Island, a collection of islands including Ross, Hardtack, Toe and East. These islands once measured 1.5 miles long by 0.5 miles wide. After over 75 years of sand and gravel mining, they are now a freshwater lagoon encircled by a thin arc of upland forest. In the past two years the collective impact of development and watershed runoff has created conditions suitable for cyanoHABs. Both in 2014 and 2015, blooms of *Microcystis* producing microcystin have developed, and in 2015 the bloom flowed into the Willamette River, which led to OHA closing the Portland Harbor to water contact activities. See OPB's Think Out Loud interview at: http://www.opb.org/radio/programs/thinkoutloud/segment/whos-on-algae-duty/

The Urban Greenspaces Institute has worked for some time to develop the Ross Island area into an urban greenspace. The environmental impact of cyanoHABs may well help this happen. See: www.urbangreenspaces.org Also see contact details for Ross Island in the "Oregon Lakes in the News" section of this newsletter.

At the national level, the USEPA has revamped its website to include useful information on control and mitigation of CyanoHABs. See: http://www2.epa.gov/nutrient-policy-data/cyanohabs

The US EPA is continuing its inland HAB discussion group webinars, and posts the proceedings at: http://www2.epa.gov/nutrient-policy-data/inland-hab-discussion-group The most recent webinar was on November 5. Those proceedings can be found at: http://www2.epa.gov/nutrient-policy-data/webinar-november-5-2015

The USEPA, in cooperation with the Ohio EPA, has finally set down standard diagnostic procedure to detect the presence of specific types of cyanotoxins, the microcystins. A video was recently sent out that demonstrates how to measure microcystins following the Ohio EPA Total Microcystin Analytical Methodology using an ADDA-ELISA kit. Enzyme-Linked Immunosorbent Assay (ELISA) kits are available for other cyanotoxins and the procedures in the microcystin video are generally applicable to these as well. See: https://www.youtube.com/watch?v=YOWNA6VSQkA&feature=youtube

The USGS published a useful photo guide to cyanobacteria harmful algae titled: Rosen, B.H., and St. Amand, Ann, *Field and laboratory guide to freshwater cyanobacteria harmful algal blooms for Native American and Alaska Native Communities: U.S. Geological Survey Open-File Report 2015–1164*, 44 p. Although the title indicates it was designed for Native Americans, it is a good resource for anyone working with cyanoHABs. The manual guide can be accessed at: http://pubs.er.usgs.gov/publication/ofr20151164

Internationally, note that in October 2016 the 10th International Conference on Toxic Cyanobacteria (ICTC) will be held in Wuhan, China. China's rapid development at the expense of air and water quality has led to

the most severe cyanoHAB events in any part of the world. As a consequence, China now has more research and resources being expended to manage and mitigate cyanoHABs than any other country in the world. See: http://www.ictc10.org/dct/page/1

Sunset at Klamath Yacht Club.
(Photo by Laurie Carmichael)

OLA BOARD OF DIRECTORS

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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.

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.