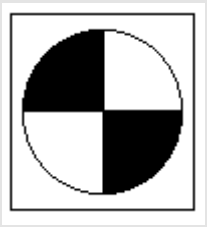
November 2004

Editor:
Roger Edwards

LAKE WISE

A Voice for Quiet Waters



The Oregon Lakes Association Newsletter

President's Perspective

by Mark Rosenkranz

We had a very successful annual meeting in Bend this year with around 45 people attending to hear presentations important to lake users in the state. Almost half of the attendees were new members to the organization. Suttle Lake and East Lake resorts are represented in our membership for the first time. Roger Edwards has written a summary of the meeting elsewhere in this issue so I encourage you to read his article. Thanks too are extended to Joe Eilers of MaxDepth Aquatics, Inc. for his work and financial support for the Conference, and to Leroy Hunter of Solar Bee for their donation.

One of the goals this year is to accelerate our outreach program. We need to introduce the Oregon Lakes Association to groups affiliated with lakes but not necessarily aware of what the OLA can do for them. There are a lot of people who visit lakes for recreational purposes and spend maybe a week or two each year on those lakes. This is the target audience. Since they have chosen to spend their free time and money recreating on an Oregon lake, they have a vested interest in maintaining the quality of the experience. Having a forum to discuss issues related to their experience will be an important part of the OLA in the coming years.

The meeting in Bend brought together scientists and the lake community to discuss topical issues. As more information is learned about lakes and how they are being impacted, it will be important to have open discussion among lake users so we can all work together to monitor the changes. With impacts ranging from climate change, increased user days, watershed development, and water quality impacts it is important to monitor and understand how the lakes are responding. The OLA will be an important conduit for communicating and tracking these very important changes.

Cyanobacteria Dominates Discussion at Annual Conference

OLA had plans already underway for the annual Conference to be held at Bend when the USFS began monitoring central Oregon lakes for cyanobacteria. While these two projects would seem to be unrelated, they wound up complimenting one another. When concentrations exceeded 15,000 algal cells/mL in early samples from Crane Prairie, Suttle Lake, and Lava Lake, the Oregon Department of Human Services was notified and water contact advisories were placed on these lakes. The advisories slowed business at the affected lakes and generated pointed questions about programs where there is not a lot of local experience. The location and late September timing of the Conference provided an opportunity for those involved to discuss the gathered data and try to understand their significance.

Sherri Chambers, the USFS project leader for Diamond Lake began the discussion. She summarized how repeated infestations of tui chub have impacted the trout fishery there, and how the efforts in 1997-2001 to assemble an EIS for a second application of rotenone ultimately failed. Lake closures due to blooms of the cyanobacteria *Anabaena* occurred in 2001-2003 (but not this year) causing State Rep. Susan Morgan to convene a multi agency work group that has successfully resurrected the rotenone plan. This treatment is now scheduled for the summer of 2006. Along the way to this decision, Diamond Lake has undergone intense scrutiny and now serves as a model for lake monitoring. This experience contributed to the decision to sample other central Oregon lakes for cyanobacteria. Other points of interest were the connection made between the chub and the algal blooms, and how the health issue of potential toxic blooms increased the importance of eliminating the chub.

Terry Schrader from ODFW then described how two illegal fish introductions disrupted the ecosystem of Crane Prairie. This reservoir is a Bureau of Reclamation project completed in 1940. The trout fishery that had been established there was disturbed in the mid 1980's with the introduction of large mouthed bass. The resulting competition between these species stabilized after a time only to be upset again by the appearance of the 3 spined stickleback in 1994. While this fish is eaten by both large trout and bass, population studies show declining levels of young trout and bass. The stickleback out competes the young of these species and has also changed the dominant form of zooplankter in the reservoir from the cladoceran *Daphnia* to calanoid copepods. The presence of cyanobacteria in Crane Prairie is not surprising because it is shallow and has phosphate concentrations higher than is commonly found in other Cascade lakes.

Paul Powers, a USFS fish biologist, presented the results of the central Oregon cyanobacteria testing. By the end of summer, cyanobacteria advisories had been issued for Odell and Paulina lakes, and Wickiup Reservoir as well. Samples from Crescent, Davis, East, Hosner, South Twin, and Todd lakes did not produce counts above the 15,000 cells/mL threshold. Cell counts on the affected lakes ranged from 30,000 algal cells/mL at Suttle Lake to 1,200,000 cells/mL at Paulina Lake. The dominant species of cyanobacteria in these tests was *Anabaena flos-aquae*. Analyses for cyanobacteria toxins detected mycrocystin in some samples, but no anatoxin. There was little correlation between cell counts and toxin levels, and this relationship varied with each lake.

Dave Stone is a toxicologist at the Oregon Department of Human Services who explained that the ability of cyanobacteria to produce toxins dangerous for humans is real. The small size of children makes them the most susceptible to ill effects. Exposure can come from ingestion, inhalation, or contact. There are a number of different toxins that can be produced, and a variety of cyanobacteria species are known to have this capability. However, finding a species capable of producing a toxin does not mean that toxins will be present. The trigger for toxin production is not understood, but the likelihood of toxin production increases with cell concentration. Toxins are most likely to be detected as the counts are waning, and toxins can persist in the water after they are released from

ruptured algal cells. Toxins can disrupt the nervous system, cause bleeding in the liver, or produce rashes or allergic reactions. Under some circumstances, exposures can be life threatening. Microcystins are the most commonly detected cyanobacteria toxin. They are hepatotoxins that have moderate stability under environmental conditions. Anatoxins are the other class of toxin that is regularly monitored. They are neurotoxins that readily undergo biodegradation.

After some refreshing presentations on Waldo Lake and Lake of the Woods, Jake Kann, of Aquatic Ecosystem Sciences, resumed the discussion of cyanobacteria. Working under a contract with Josephine County, he reported cell counts greater than 10 million/mL from Lake Selmac after an obvious bloom had occurred there. The park on the lake was closed on August 19th when these first results became available. Toxin samples were positive for microcystin but no anatoxin was detected. Responding to cyanobacteria blooms present a challenge because bloom conditions can change rapidly. Algal cells can form surface scums and can also be dispersed or concentrated by currents and wind action. Representative samples can thus be hard to obtain because the algal cells are in a constant flux. Sampling and analyses are expensive and time consuming, and blooms can literally occur over night, which can make the results of the last sample collected irrelevant by the time they become available. Protecting the public well-being once a bloom is underway requires conservative measures, erring on the side of caution.

Joe Eilers, of MaxDepth Aquatics, proposed an approach to minimize, or at least understand, the occurrence of cyanobacteria blooms. He noted than the blooms are most often found in warm lakes with elevated phosphate levels and planktivorous fish. Cyanobacteria can utilize atmospheric nitrogen so low nitrate levels do not protect lakes from blooms of these algae. The link to fish grazing on the zooplankton population has already been made for the tui chub in Diamond Lake. The zooplankters include non-selective filter feeders that ingest whatever microscopic particles are in the water. Their grazing serves to keep cyanobacteria concentrations in check. When the zooplankters themselves have reduced numbers from fish predation, the cyanobacteria can more easily proliferate. In addition, the digestive wastes of the planktivorous fish return nutrients to the surface waters of a lake where they can be readily utilized by growing algal cells.

Trish Carroll, of the USFS Watersheds Program, is looking at the experience of this summer with interest. Lake resorts cater to large groups of people over a short period of time. These people must be confident they are not at risk by coming to the resort. The public health issue of potentially toxic algal blooms must be taken into account. A higher cell count threshold may still provide this assurance, but given the exponential growth that can occur in a bloom, would a higher threshold make a difference? Is formal cyanobacteria monitoring required or can the visible discoloration of the water at cell counts of 15,000/mL be relied upon as a screening device? Is there a relationship between mid-lake cell counts and the likelihood of beach fouling by wind blown surface scums? Is there any safety in the observation that toxins are more likely to be found in the later stages of a bloom? Because anatoxins are found less frequently than microcystins, would it be appropriate to analyze for anatoxin only in samples where microcystin has been detected? Has methodology research produced a less expensive or quicker analysis for cyanobacteria toxins? Can paying closer attention to lake health better protect public health? These and similar questions will be discussed at a USFS meeting scheduled for this Fall. The answers will form the response protocol for next summer's cyanobacteria blooms.

OLA Welcomes Solar Bee

Corporations that become members of OLA do so because their products and services are designed for lakes or lake users. The OLA Board has made it our policy to offer new corporate members the opportunity to describe their wares to our membership. Solar Bee has accepted this offer so see if the diagrams on the opposite page address any special situations on a nearby lake.

Center for Lakes and Reservoirs

Brazilian Elodea in the Pacific Northwest

Egeria densa (Brazilian elodea) is a submersed freshwater plant native to South America that has become widely naturalized and invasive in the Western US. In Oregon, it is particularly problematic in shallow, coastal lakes; entangling boat props and fishing lines and reducing wind mixing. In the Southeastern US, clearly defined weak points in the life cycle of *Egeria* were determined and exploited to improve management efficacy. To improve management activities in the West, a better understanding of its phenological response to this region is necessary. The goals of this research were to determine if seasonal low points in growth rate or nutrient allocation patterns were exhibited in *Egeria* collected from Western waterways such that weak points in the plant's life cycle could be identified. *Egeria* was collected monthly from Big Creek Reservoir in Newport, Oregon and, unlike plants growing in the Southeastern US that were dormant at extreme high or low temperatures, plants grew year round under moderate temperatures. Minor changes in seasonal nutrient allocation were observed within plant parts, however carbon and sugar were higher in root crowns and older stems during winter months, suggesting these may be important storage organs for this species which only reproduces by fragmentation. Results of this research suggest that *Egeria* growing in coastal Oregon lakes are growing throughout the year, likely due to mild water temperatures observed during the study period (7 to 20º C), and may not exhibit a pronounced weak point in its life cycle. Similar work is currently being conducted on *Egeria* collected from the Sacramento-San Joaquin Delta in California. To date, growth rate of plants collected from California exceeds that of plants collected from Oregon by nearly threefold (up to 0.7 cm/day at 25º C). Plants from California are currently being analyzed for nutrient and sugar content and monthly plant collections will continue through November 2005. This research has been supported by grants from the Washington Department of Ecology, California Bay-Delta Authority, and the Aquatic Ecosystem Restoration Foundation. For additional information contact **Toni Pennington**, toni@pdx.edu.

Curly Leaf Pondweed in Blue Lake

Curly leaf pondweed (*Potamogeton crispus)* has a European origin. It has been supplied for use in aquaria and has become an aggressive weed in lakes, deeper ditches, and canals. The Blue Lake Management Plan developed by the Center for Lakes and Reservoirs, identified *Potamogeton crispus* as a nuisance plant in Blue Lake, Oregon. *P. crispus* mainly propagates vegetatively via turions; storage organs that are compressed shoot apices of the plant. Turions germinate in the fall and develop into a winter-form plant that becomes a spring-form plant in early spring. Turions are produced late spring to early summer on the spring-form plants. The study addressed the phenology of *P. crispus* in Blue Lake to increase the efficacy of chemical control, specifically focusing on when these turions are formed and when they germinate. The sediment was sampled with a Petite Sonar® dredge while a plant rake was used to collect plants. Turions were found germinating 11/06/03 and this will be examined again in the Fall of 2004. Newly formed turions were found in Blue Lake on 4/05/04. Flower buds emerged 4/19/04. Phenological data show March to early May as ideal time period to chemically control *Potamogeton crispus* in Blue Lake. For additional information contact **Steve Wells**, sww@pdx.edu.

CLR Joins Smithsonian to Combat Aquatic Nuisance Species

Officials from Portland State University and the Smithsonian Environmental Research Center signed an agreement on October 26, 2004 to form the Aquatic Bioinvasion Research and Policy Institute, which will be housed at PSU's Center for Lakes and Reservoirs. The Institute will address issues of international trade that allow exotic species to spread beyond their natural range as well as developing management strategies to deal with these foreign invaders. CLR was formed in 2000 to deal with the problems created by plants and animals introduced into aquatic habitats in Oregon.

Data Organization Enhances Its Value

by Roger Edwards

While fetching this issue of Lake Wise from your mailbox, you may have noted the autumn colors of nearby trees. After a pleasant summer, there is starting to be a cold nip in the air as winter approaches. The changing seasons also have an effect on lakes. Many of these effects can be readily measured. To be more precise, all lake measurements are indicators of lake status at the moment of sampling. It is thus not possible to separate seasonal effects from lake monitoring data, which is why it is necessary to qualify measurements with their collection date. Can periodic temperature measurements determine if a lake is getting warmer? Surface temperature will certainly be different if measured in January and July. But this difference is the normal seasonal change, which does not address the question of whether there is more heat in the lake now in comparison to past years. This determination requires a comparison of the present temperature reading to past measurements from the same time of the year. Even this comparison has to be examined carefully before a conclusion can be proclaimed, but we can conclude that monitoring data is most useful when it is organized to reflect seasonal change.

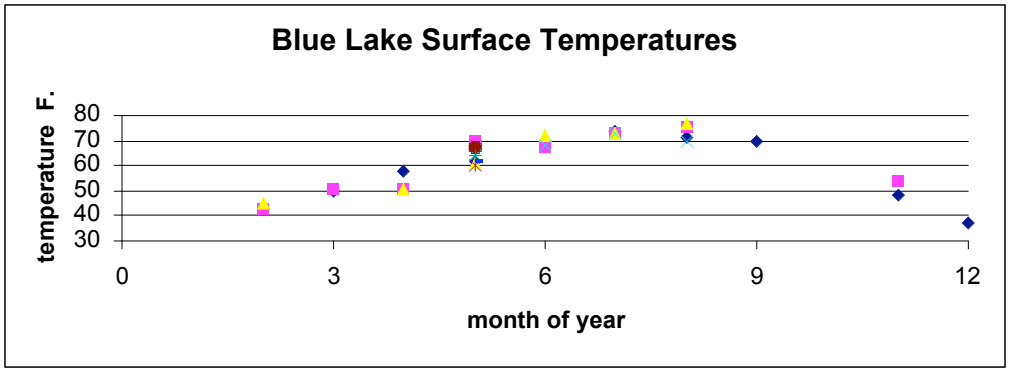
Data organization may not be foremost on the minds of people collecting Secchi depths or analyzing lake samples. But after such programs have been in place for a time, the accumulated data gains value if they are organized into units other than boxfuls. A time series chart or graph is a good first step that shows the variation that occurs between successive samplings. Where repetitive patterns of change appear, these cycles can be grouped together to allow average values to be calculated for the relevant increments. For annual cycles, these increments could be seasons, or even months if there is sufficient data. Completing this exercise means the difference between saying, "The water temperature was 48ºF. last May", or, "The typical water temperature in spring is 50ºF." There is more information in the latter assertion.

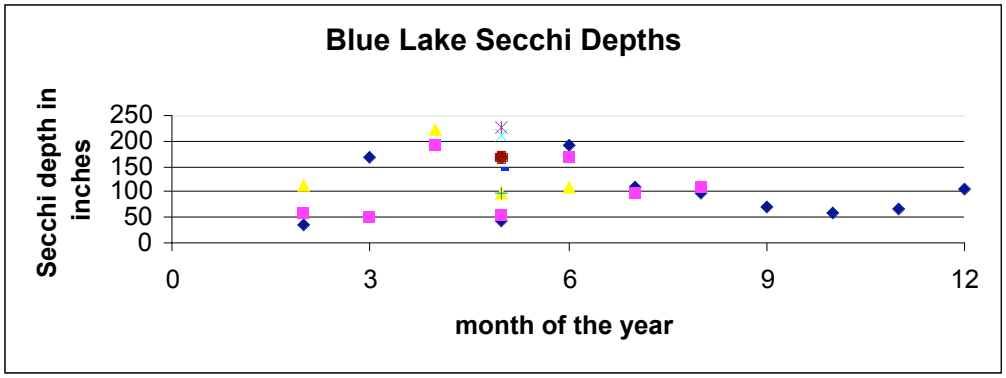
An example of organizing data on the basis of collection date would be illustrative here. A set of historical measurements from Blue Lake in Multnomah County can be used as an example. These data were collected during the years of 1960 to 1977 by at least 8 different agencies as problems with fisheries, weeds, bacteria, and algae blooms drew the attention of lake managers. There were fish kills, both planned and accidental. Herbicide applications were routine until chemical residues were detected in lake sediments. Mechanical harvesting of aquatic weeds proved unsatisfactory so herbicides returned to fashion. It was a tumultuous period, but even so the data collected demonstrates the existence of order.

Scatter plots of surface water temperature and Secchi depth are presented below with the data readings plotted by the month of their collection. There are 32 measurements of temperature and 26 Secchi readings. Most of these measurements were made in late spring or summer. There are 8 readings for both analyses in May. The temperature graph shows a smooth curve rising from the low 40's in late winter to a peak of 77 in August, followed by a decline to winter temperatures. There was just one measurement in September and none in October, but the closeness of the measurements that were made in the other months gives confidence than interpolated estimates would be reasonably accurate for fall temperatures.

The graph for Secchi depths presents a different picture, but even here there are conclusions that can be inferred. The lake appears to have a troubled past. If just the maximum values are considered, then there have been times of very good clarity. But the minimum values show the opposite extreme. Because there are just

single measurements for September to December, and none for January, the only observation that can be made for these months is that more readings are needed. The two April readings were both taken in 1963 so they may not be representative of typical conditions at this time of the year. The large range of existing readings from May would add significance to future May measurements by providing a context for comparison. So while it is premature to attempt a description of the variation in Secchi depths over the year in Blue Lake, organizing the data on hand has provided insight about the lake and pointed out some future monitoring needs.





As more data are accumulated, it becomes possible to perform statistical evaluations. The simplest of these is calculating the average value. For the month of May in Blue Lake, the average, or mean surface water temperature is 64 ºF. and the Secchi depth is 130 inches.

The standard deviation is another statistical tool that is useful for data evaluation. It measures the closeness of fit between the mean value and the individual readings of that mean. The standard deviation of the May surface water temperatures is 3.3 ºF. and it is 69 inches for the Secchi depths. Standard deviation is calculated by subtracting each measured value from its mean, multiplying the difference by itself to eliminate any negative numbers, adding these products, dividing this sum by the number of original measurements, and extracting the square root of this quotient. Most calculators and spreadsheets can perform this calculation.

The importance of the standard deviation comes from probability theory, which states that 99.7% of a normal population lies within three standard deviations of its mean. So if we are satisfied that the May surface water temperatures in Blue Lake have been well characterized, then it would be highly unlikely for a future measurement to be greater than 73.9 (3x3.3=9.9, 64+9.9= 73.9) or less than 53.9 ºF. A future measurement beyond these extremes would be cause for concern. A May measurement greater than 73.9 ºF. would suggest that the lake is warmer than the period of record.

LAKE WISE
The Oregon Lakes Association
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OLA Mission: The Oregon Lakes Association, a non-profit organization founded in 1988, promotes understanding, protection, and thoughtful management of lake and watershed ecosystems in Oregon. For additional information on OLA, to get involved, or to obtain a membership application write to: OLA, PO Box 345, Portland OR 07207-0345

We are also on the web! www.oregonlakes.org

NALMS News

Lake recreation, part 2, is the theme of the Fall 2004 issue of LakeLine, the quarterly magazine of the North American Lake Management Society. Feature articles begin with a discussion of how the environmental impacts of recreational boating are being balanced by improvements in watercraft engines, sanitation requirements, and safety policies. This article is followed by an examination on the physics of boating wakes and prop wash, and a review of the management approach in Rhode Island to deal with jet skis. The lake recreation focus concludes with articles on tournament fishing in Wisconsin, and a report on freshwater scuba diving. The issue also includes an invitation to comment on some proposed elements for a NALMS policy on exotic species. The recently announced partnership between the Smithsonian and Portland State University's Center for Lakes and Reservoirs to address this very topic is sure to be of interest at the NALMS Convention in Victoria. Individual copies of LakeLine can be purchased on the NALMS website, www.nalms.org.

OLA Board Officers for 2005

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Director: Mark Sytsma, (2005), Director, Center for Lakes and Reservoirs.
Director: Joe Eilers, (2005), Owner, MaxDepth Aquatics.
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