

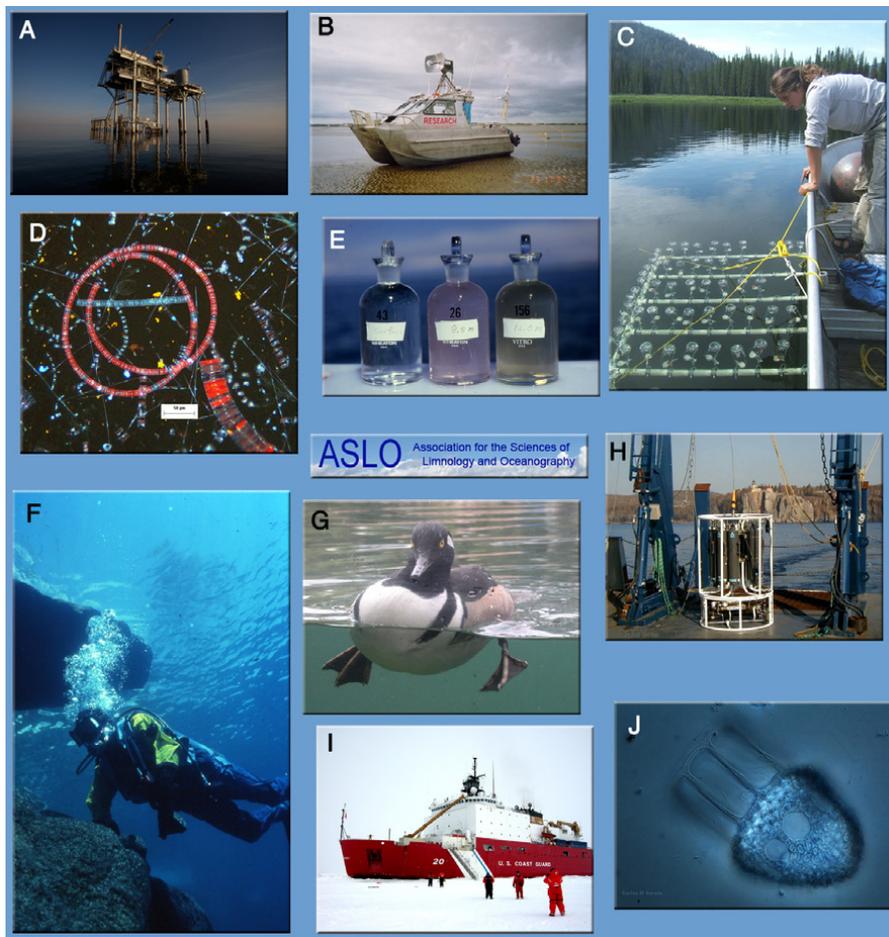
Volume 21(4) November 2012

LIMNOLOGY AND OCEANOGRAPHY BULLETIN

ASLO
Association for the Sciences of
Limnology and Oceanography

ABOUT THE COVER IMAGE

A handful of the over 2000 images in the ASLO Image Library. See Rob Condon's article about the Image Library on Page 106.



Samples from the ASLO Image Library. A. Platform off Mississippi Delta, GOM (credit 'Caleb Izdepski'), B. High and Dry (credit 'stevens'), C. Bioassay experiment to assess DON bioavailability, Sawtooth Mountains, ID (credit 'Wayne Wurtsbaugh'), D. Spring diatoms western Arctic Ocean (credit 'sheere'), E. Stratification of Purple-Sulfur Bacteria in Great Salt Lake, Utah (member 'Wayne Wurtsbaugh'), F. Fish habitat SCUBA survey in Lake Tahoe, California (member 'Wayne Wurtsbaugh'), G. Hooded merganser (credit 'Ray Denner'), H. Sampling Lake Superior near Two Harbors, MN (member 'limno'), I. USCG Healy, Bering Sea, ice liberty (credit 'sheere'), J. *Dictyocysta elegans var lepida* (credit 'Carlos M. Garcia') Composition by J. R. Dolan

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EMERGING ISSUES WORKSHOP REPORT

The following report is from an *Emerging Issues Workshop*, an ASLO-sponsored event connected with a special session of an ASLO meeting. The workshops focus on emerging or controversial issues, and/or are designed to integrate knowledge and research across communities. How does it work? Any ASLO member may submit a proposal for an emerging issues workshop for review by the ASLO *ad hoc* committee for Emerging Issues. ASLO provides funding for up to two such workshops to cover the supplemental costs such as food, lodging and the venue for participants arriving early or staying late relative to the main ASLO meeting. The organizers of funded workshops agree to prepare a summary report for publication in *Limnology and Oceanography Bulletin*.

CAUSES AND CONSEQUENCES OF BIODIVERSITY LOSS ACROSS GLOBAL ECOSYSTEMS

Christopher T. Filstrup, Iowa State University, Ames, Iowa, USA; filstrup@iastate.edu; **W. Stanley Harpole**, Iowa State University, Ames, Iowa, USA; harpole@iastate.edu; **Adam J. Heathcote**, Iowa State University, Ames, Iowa, USA; aheathco@iastate.edu; **Jonathan Shurin**, University of California-San Diego, San Diego, California, USA; jshurin@ucsd.edu; **Michio Kondoh**, Ryukoku University, Otsu, Shiga, Japan; mikondoh@rins.ryukoku.ac.jp

An ASLO-sponsored Emerging Issues Workshop on biodiversity loss and its impacts on ecosystem functioning across ecosystem types was held following the 2012 ASLO Aquatic Sciences Meeting in Otsu, Shiga, Japan. The workshop was associated with ASLO Special Session SS62 entitled “Biodiversity-ecosystem functioning relationships across trophic levels and gradients in the context of global change.” Faculty, postdoctoral

researchers, and graduate students from the USA, Canada, Germany, Japan, and Hong Kong participated in the workshop to discuss this important, and often overlooked, issue facing aquatic ecosystems.

Biodiversity loss directly and indirectly affects societal well being (Millennium Ecosystem Assessment 2005) by altering ecosystem functioning, goods, and services. In a recent meta-analysis, the effects of biodiversity loss were similar in magnitude to the effects of environmental changes on two ecosystem functions, production and decomposition (Hooper et al. 2012). Biodiversity loss coincides with many anthropogenic disruptions to aquatic ecosystems, such as acidification, eutrophication, harmful algal blooms, and coastal hypoxia, although the reciprocal effects of biodiversity loss on ecosystem functioning are poorly understood. Despite the importance of this issue, two times as many articles were published from 2000 to 2012 on biodiversity and ecosystem functioning in terrestrial ecosystems compared to aquatic ecosystems according to a recent ISI Web of Science search (see Figure 1).

Workshop participants identified the need for a cross-systems synthesis, noting that the biodiversity-ecosystem functioning field has matured such that several meta-analyses have been recently published, but cross-systems comparison of the central tendencies of published biodiversity experiments has not been addressed. We formed the objective to produce a higher-level synthesis of the literature to identify consistent patterns in biodiversity loss where systems are impacted by similar global change drivers and where losses of biodiversity have similar consequences on ecosystem functioning, and to identify varying degrees by which causal factors differ both within and among freshwater, marine, and terrestrial

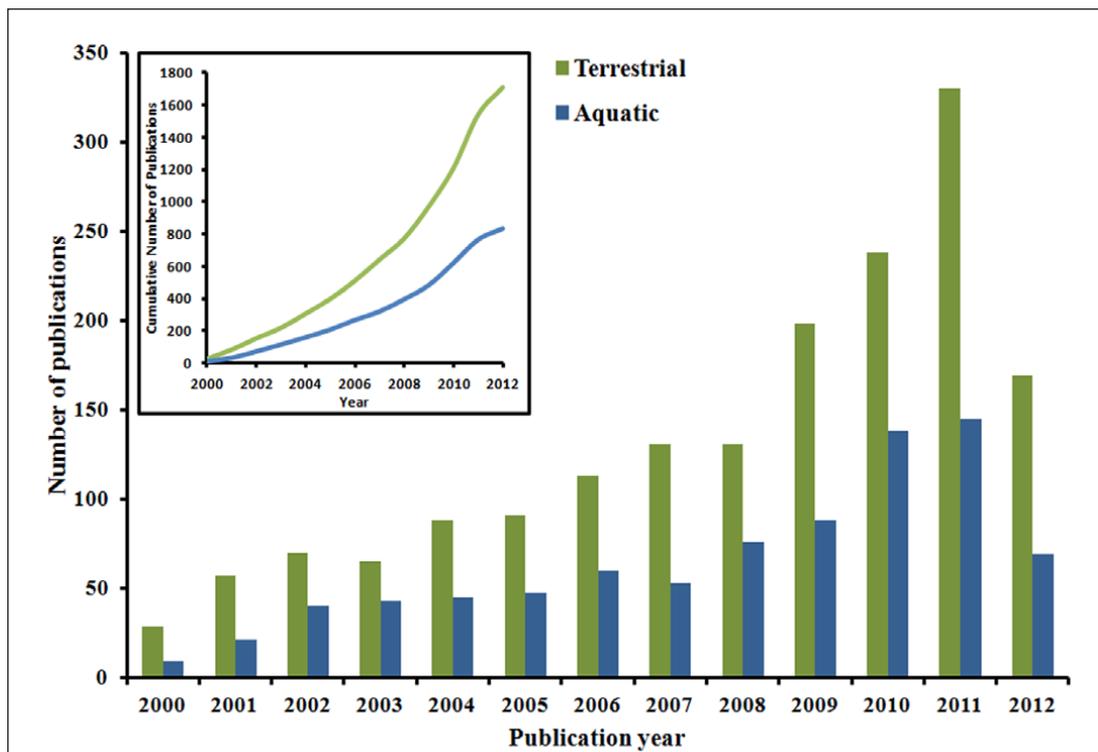


Figure 1. Number of publications on biodiversity-ecosystem functioning relationships in terrestrial and in aquatic ecosystems per year from 2000 to 2012. Publications are based on an ISI Web of Science search performed on 10 September 2012 for the topical search terms “biodiversity” and “ecosystem function” and “terrestrial” followed by “biodiversity” and “ecosystem function” and “aquatic”. Inset figure shows the cumulative number of publications for terrestrial (1,710 publications) and for aquatic (835 publications) ecosystems since 2000.

ecosystems. Our discussions during the workshop focused around the following four themes:

- 1) **Differences in global change drivers among ecosystem types:** Various aquatic ecosystems, such as streams/ rivers, lakes, coastal oceanic, and open oceanic, and terrestrial ecosystems select for different organismal traits due to differences in ecosystem properties and structure. Different global change drivers may have greater impacts on biodiversity loss in different ecosystems. For example, temperature may have a strong influence on biodiversity across ecosystem types due to its influence on metabolic processes, whereas phosphorus may be more important in freshwater aquatic ecosystems (see Figure 2).
- 2) **Differences in global change drivers within ecosystem types:** Ecosystem types are affected by varying degrees of environmental heterogeneity in space and time, and also differ in their stability. Individual systems of a similar type may be more strongly influenced by different global change drivers depending on the spatial and temporal scales being studied. For example, regional differences in weather patterns and geology may result in different drivers having a greater impact on biodiversity in individual systems. For aquatic ecosystems, large water bodies should be more strongly buffered against rising temperatures and short-term temperature fluctuations compared to smaller water bodies, which may experience greater biodiversity losses as a result.
- 3) **Variability in biodiversity and ecosystem functioning responses to drivers within and among ecosystems:** In addition to measured biodiversity responses to global change drivers differing both within and among ecosystems, the variability in biodiversity responses may also differ greatly. The degree of variability in various functions may depend on the focal organizational level of the study. For example, metabolic functions at the organism level, such as primary productivity, may respond similarly, whereas responses at the community or ecosystem levels, such as biodiversity, may vary due to differing constraints on biota.
- 4) **Influence of interactions among drivers and between biodiversity loss and drivers:** Multiple global change drivers may interact to modulate (i.e., dampen or enhance) their combined influence on biodiversity, and biodiversity may in turn produce positive and negative feedbacks with different drivers. Multiple interactions create complex responses in biodiversity and ecosystem functioning, such as state changes, regime shifts,

thresholds, and non-linearities. For example, increased temperature can increase salinity resulting in a state change from a freshwater to a brackish system with synergistic effects on freshwater organisms (Thompson and Shurin 2012), and can also increase the occurrence of harmful algal blooms (Paerl and Huisman 2008).

The ASLO-sponsored Emerging Issues Workshop provided support and a mechanism to establish a new global, interdisciplinary team of scientists interested in biodiversity research and the impact of biodiversity loss on ecosystem health. Currently, we are drafting a cross-systems comparison manuscript for publication in *Limnology & Oceanography* on similarities and differences in biodiversity effects on ecosystem functioning of aquatic and terrestrial ecosystems. Participants from this workshop will continue to collaborate on future projects and will seek additional funding sources to host future workshops. We welcome new members to this collaboration, so please contact the organizers if you are interested in participating in future research endeavors.

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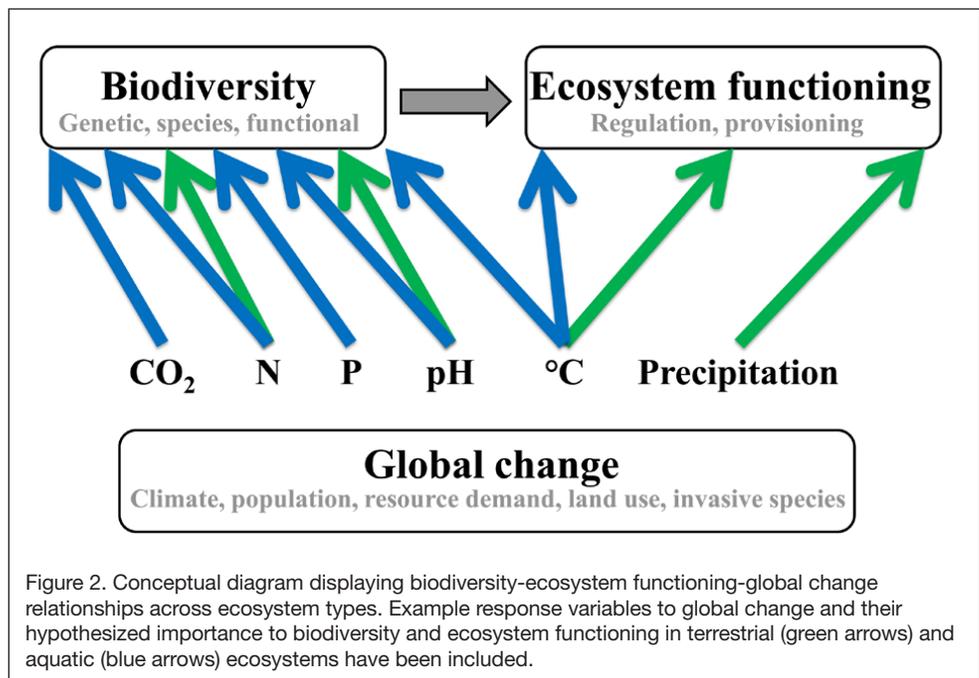


Figure 2. Conceptual diagram displaying biodiversity-ecosystem functioning-global change relationships across ecosystem types. Example response variables to global change and their hypothesized importance to biodiversity and ecosystem functioning in terrestrial (green arrows) and aquatic (blue arrows) ecosystems have been included.

The Limnology and Oceanography Bulletin

The Association for the Sciences of Limnology and Oceanography is a membership-driven scientific society (501(c)(3)) that promotes the interests of limnology (the study of inland waters), oceanography and related aquatic science disciplines by fostering the exchange of information and furthering investigations through research and education. ASLO also strives to link knowledge in the aquatic sciences to the identification and solution of problems generated by human interactions with the environment.

Editors:

Adrienne Sponberg, 10410 Kensington Parkway, Suite 216, Kensington, MD 20895, USA

John Dolan, Microbial Ecology, Laboratoire d'Océanographie de Villefranche, CNRS & Université Paris VI, Station Zoologique, B.P. 28, F-06230 Villefranche-Sur-Mer, France

E-mail: bulletin-editors@aslo.org

ASLO Business Manager:

Helen Schneider Lemay, ASLO Business Office, Waco, TX, 76710, USA,
Tel: 254-399-9635 or 800-929-2756,
Fax: 254-776-3767, business@aslo.org
<http://www.sgmeet.com/aslo>

Advertising: Helen Schneider Lemay, ASLO Business Manager, Tel: 254-399-9635 or 800-929-2756; business@aslo.org

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The *L&O Bulletin* publishes brief articles of broad interest to the ASLO membership, Letters to the *Bulletin* (typically responses to articles), and ASLO News on a quarterly basis. Information on the preparation and submission of articles and letters can be found on the ASLO Web site (www.aslo.org). It is recommended that you contact the editors before preparing an article or letter.

ASLO NEWS

MESSAGE FROM THE PRESIDENT

John Downing, Iowa State University, 251 Bessey Hall, Ames, IA 50011-1020, USA;
downing@mail.iastate.edu



It was only a few months ago that many of us came back from an historic ASLO meeting on the shores of Lake Biwa, Japan. The meeting featured participants from 42 countries, including 302 students and 411 Japanese scientists. Meeting organizers Michio Kumagai, Kazu Kogure and Jotaro Urabe have summarized this exciting meeting in this issue of the *Bulletin* (See Page 108). Also note that the plenaries and award talks can be viewed on-line at: <http://aslo.org/meetings/japan2012/plenary.html> and <http://aslo.org/meetings/japan2012/awards.html>. We are hoping to be able to offer increasing video content so that some of our 4000+ members from 65 nations who cannot get to a meeting can also enjoy some of the science.

The quality of the research presented at the Biwa meeting was outstanding and exciting, the events were excellent and well organized (see photo of Debbie Bronk and me getting ready to pound in the lid of a barrel of sake), and the meeting resulted in about 600 new ASLO members, many of them working in Japan, China, Korea, and other Asian nations. Japan is now the second ranking nation in ASLO membership, slightly edging out Canada. Congratulations to the organizers, Kazu Kogure, Michio Kumagai, Jotaro Urabe, and Masumi Yamamuro, as well as all the other committee members, volunteers, sponsors, supporters, and of course the Schneider Group for logistical support so far from Texas! The quality of this meeting is a credit to the organizers and the many ASLO members who went beyond their traditional geographical and scientific borders. I hope that our new members from Asia stay active in ASLO and find membership an important asset to their careers.

BOARD MEETING NEWS

Prior to the scientific meeting at Lake Biwa, the Board met for nearly two full days. Two of the major topics of discussion were the membership survey and ACE (ASLO's Comprehensive Evaluation). The membership survey is being summarized by Adrienne Sponberg elsewhere in this issue of the *Bulletin* (See Page 104). More than 500 members responded in the first three days, and almost 1200 members (81%), lapsed members (15%), and those who were not sure (3%; how can you not know?) responded before the closure of the survey. 96% of members approve of ASLO's management and direction and 97% approve of the quality and scope of the publications. Members find that the most important aspects of ASLO are (in order) quality publications, meetings and networking, professional development opportunities, and policy, education, and outreach initiatives.

As I mentioned in my message in the last issue of the *Bulletin*, ACE is a close examination of ASLO's business model taking open access in scientific publication into account as well as changes in scientists' needs for services from scientific societies. In the first phase of this, several ASLO members met with experts in scientific publication to hear their views on upcoming challenges and opportunities for scientific societies. The next phase of this work is to perform a detailed strategic assessment of ASLO to find ways in which the Society can better and more efficiently serve its members and mission. This assessment will be underway by winter 2012-2013.

STRATEGIC PLANNING

When I hear about strategic planning in my university, my eyes glaze over and I think mostly of a long and tedious exercise that results in a plan to be ignored systematically by all but those who drafted it. This is perhaps because, as Mark Abbott, Dean of Oceanic and Atmospheric Sciences at Oregon State University, said in his plenary at OSM 2012 in Salt Lake City, "...academics report only to God...sometimes." ASLO has a long-standing tradition of effective strategic planning, however. The ASLO Board is nearing the close of our 2009–2014 strategic plan. >90% of all the action items suggested by the strategic plan have been completed and are now part of ASLO's routine program. Some notable accomplishments include:

- The change of ASLO's name and strengthening of our international orientation
- Enhancement of the diversity of ASLO in science, geographical representation, and culture
- Maintenance of our quality publications and launching several new ones (*L&O Fluids and Environments*, *eLectures*, *eBooks*)
- Creation of the Consortium of Aquatic Science Societies and increased cooperation among Consortium members
- Enhanced meeting outreach, networking, and more cross-cutting science



Figure 1. Left to right, John Downing, Yukiko Kada (Governor of the Shiga Prefecture), and Debbie Bronk, getting ready to open a sake barrel with hammers. PS. It was really good and we hardly splashed any of it! (Photo courtesy of M.S. Downing)

- Creation of the Council of Editors to strengthen and enhance ASLO publications
- Strengthened support of students and early career scientists
- Integration of new tools for communication for scientific outreach, and society management
- Support of programs to bring undergraduate students to scientific meetings
- Creation of new avenues for exchange of public policy information
- Creation of a financial plan, investment strategy, and emergency fund to ensure activities through times of economic hardship
- Offering two new awards to honor great scientific and educational accomplishments by our members

This strategic plan also inaugurated ASLO's Guiding Principles, which, along with our mission statement, guide the Society toward cost-effective member services and the highest quality scientific products (see <http://aslo.org/information/principles.html>).

VISIONING ASLO'S FUTURE

An important part of any strategic plan is thinking about what ASLO needs to be in 10 years. It is hard to chart a course if you don't know where you are going. The ASLO Board is working on this vision, trying to predict how our sciences and the science enterprise will be changing, and what this means for the services ASLO must provide. Please let me (president@aslo.org) know your vision for the future of ASLO and we will try to integrate it into the strategic plan. Jim Elser (president-elect@aslo.org) is chairing the Strategic Planning Committee, and either of us would be so happy to hear from you. The Facebook page (<https://www.facebook.com/group.php?gid=6579841375>) is a great place to discuss your vision with other ASLO members, too.

NEW AWARD FOR EARLY CAREER MEMBERS INAUGURATED

The Early Career Committee, chaired by Roxane Maranger, has created a new award, especially to honor members who have shown cross-the-board excellence within 12 years of receiving their terminal degree. The award is suitably named for two wonderful ASLO members who made extraordinary and broad-based contributions to the aquatic sciences, beginning in the early stages of their careers. The *Yentsch-Schindler Early Career Award* will honor young aquatic scientists for outstanding and balanced contributions to research, science training, and broader societal issues such as resource management, conservation, policy, and public education. It is named for Clarice Yentsch, oceanographer, scientist, and professor at Nova Southeastern University, and David Schindler, limnologist and professor at the University of Alberta. Clarice was a co-founder of the Bigelow Laboratory for Ocean Sciences (with her late husband Charles), is an enthusiastic educator at all levels, and a consultant, and scientist. David began his career with landmark eutrophication research at Canada's Experimental Lakes Area that bridged across research, education, and public policy, and

has remained a strong voice for bold and broad-based science. It is wonderful that this award will honor young oceanographers and limnologists at a critical point in their careers. I am grateful to Clarice and David for allowing their names to be associated with this new award. The first Yentsch-Schindler Early Career Award will be presented at the 2013 Aquatic Sciences meeting in New Orleans.

BIG TIME IN BIG EASY

Our next meeting is in New Orleans in a few months. What a great meeting is in store for us in New Orleans! Although the opening reception is unlikely to have much sake, Deidre Gibson, Hans-Peter Grossart, Nancy Rabalais, Kam Tang, and an energetic organizing committee assure us that the reception will feature Big Chief Mardi Gras, a Brass Band, and a traditional Second Line. Read the full article below (See Page 110) and get ready to head to New Orleans. I hope to see you there!



John Downing
ASLO President

MESSAGE FROM THE BUSINESS OFFICE

Helen Schneider Lemay, ASLO Business Office, 5400 Bosque Blvd., Suite 680, Waco, TX 76710-4446; Tel.: 254-399-9635 or 800-929-2756, Fax: 254-776-3767; business@aslo.org



Dear ASLO Members:

We are always interested in ways to conserve and be “friendly” to the environment. Personally, we are putting solar panels on our home and looking at a hybrid car. As we were doing research on these projects as well as the cost savings involved, we came across lots of interesting information. Here are some things that I found:

- The American Council for an Energy Efficient Economy (aceee.org) ranks cars using sources like the Argonne National Laboratory for vehicle-related data.
- Useful apps: eMONITOR (powerhousedynamics.com); OFFSET4POOR.COM and WALK SCORE (walkscore.com).

com/iPhone) are fun sites to visit. GREEN.BIZ.COM gives information about companies and their environmental policies.

- In the July/August 2012 issue of *Sierra*, there was an article about Ted Johnson who has studied ocean thermal energy conversion for 25 years. His theory is to use the gap between the warm surface water and the cold deeper water to produce renewable power. The water would generate electricity and then be returned to the ocean. The company, Ocean Thermal Energy Corporation, is currently working on a plant in the Bahamas to be completed in 2014.

There are also many exciting things have been happening within ASLO:

- The call for papers has been issued and closed for the 2013 ASLO Aquatic Sciences Meeting at New Orleans, Louisiana. Although the recent hurricane brought lots of water and wind, the city faired really well with no significant damage. The meeting will be held 17-22 February.
- ASLO membership remains a very good value. Membership renewal notices will be coming out soon. We also ask that you encourage your library to subscribe to the L&O journals.
- Check out our new membership categories on your renewal form. ASLO is now offering two- and three-year memberships within the regular membership categories -- with a \$10 discount! Life-time membership is also available -- no more renewing!
- ASLO will be participating in an all aquatic sciences meeting 18-22 May 2014 with the Society For Freshwater Science (formerly NABS), Phycological Society of America and the Society of Wetland Scientists. The meeting will be an “all society” meeting and will be held in Portland, Oregon.
- ASLO continues to venture into the publishing of electronic books and is continuing the web-based lectures series.
- Also in 2014, the Ocean Sciences Meeting will be 23-28 February in Honolulu, Hawaii, USA.

We also would like to welcome the new ASLO board members, Wally Fulweiler, Claudia Benitez-Nelson, Peter Leavitt, and Amy Burgess. The ASLO board is a wonderful and energetic group of volunteers who work hard for you and ASLO.

Be sure to contact any of us at the ASLO business office if there is anything with which we can help. That’s what we’re here for!



Helen Schneider Lemay
ASLO Business Manager

MESSAGE FROM THE PUBLIC AFFAIRS DIRECTOR

Adrienne Sponberg, ASLO Public Affairs Director, 10410 Kensington Parkway Suite 216, Kensington, MD 20895, USA, sponberg@aslo.org



As this issue hits your inbox, those of us in the U.S. will be at the tail end of a presidential election year. Those who live in “swing states” will be glad that the pollsters will quit calling every other day to get their opinion on the candidates. ASLO polled its own members earlier this year and I’ve summarized some of the results in an article in this issue. Having attended more than a dozen board meetings in the past

10 years, I can attest that the ASLO Board spends a good bit of time trying to determine which services are most important to ASLO members. The results of the survey confirm many of the assumptions (or perhaps I should say “educated guesses”?) recent decisions have been based upon. Some results, though, were less expected; such as the volume of comments from respondents saying they had no idea that ASLO offered various services. There is still a lot of information to be gleaned from the survey, and it will be a useful tool for the board and committees to consult in the future.

NOW ONLINE: PANEL DISCUSSION ON “THE CULTURAL GAP BETWEEN SCIENTISTS AND THE PUBLIC”

If you missed it at the 2012 Ocean Sciences Meeting in Salt Lake City, you can now see the exciting panel discussion titled “The Cultural Gap Between Scientists and the Public” as a podcast and learn more about why we are failing to communicate urgent environmental concerns to the general public. The moderator was Richard Harris, the Science Correspondent for National Public Radio, and the panelists were Dan Kahan from Yale Law School and Max Boykoff from the University of Colorado Center for Science and Technology Policy. The podcast consists of about 4 minutes of introduction, a 20 minute presentation by Kahan, a 20 minute presentation by Boykoff, a 15 minute discussion among the panelists, and a lively hour-long response and discussion to questions from the audience. You can see the podcast at: <http://udcapture.udel.edu/podcast/watch.php?c=531>

SEE YOU IN NEW ORLEANS!

As you’ll see below in the “Meetings Highlights” section, the 2013 Aquatic Sciences Meeting in New Orleans will offer something for everyone! In addition to the excellent science and networking you’ve come to expect from ASLO meetings, there will be an abundance of professional development workshops and opportunities. And of course, plenty of education and outreach activities, including the return of the “S-Factor” trio of Randy Olson, Brian Palermo, and Dorie Barton from 2012 Ocean Sciences (See Page 113).

MESSAGE FROM THE WEB EDITOR: ASLO OPTS OUT OF JSTOR FOR LOCKSS

Paul Kemp, School of Ocean and Earth Science and Technology, University of Hawaii; Honolulu HI 96822; webeditor@aslo.org



ASLO entered electronic publishing in 1996 (only one year after its first web page was posted!) with the publication of a “web appendix” to an article in *Limnology and Oceanography*. By 1999, entire issues of *L&O* were published on the website. In 2001, ASLO became the second science publisher to offer authors an option to have their articles appear in open access.

From the beginning of its venture into electronic publishing,

ASLO has been committed to making its publishing content widely available. The vast majority of its electronic publications are available in open access, including the first 53 years of *L&O*, the first seven years of *L&O: Methods*, and the first 20 years of the *L&O Bulletin*. In keeping with this philosophy, ASLO has participated in archival programs designed to ensure perpetual access to the content of research journals. ASLO was one of the early members of JSTOR (Journal Storage), an archiving program founded in 1995. JSTOR was created to provide a means for libraries with limited storage space to store digital copies of their journal collections. It grew into a well-maintained, user-friendly means for science publishers to archive their journal content in an alternate location, ensuring that the hard work of authors would remain available even if the publisher ceased to operate.

In recent years, an alternative approach has developed. LOCKSS (Lots of Copies Keep Stuff Safe) is an international, library-based community initiative with the goal of preserving web-published materials for tomorrow’s readers. Freely available LOCKSS software allows libraries to keep a local copy of electronic journals to which they subscribe, provided the publisher has granted permission. The LOCKSS system is both user- and publisher-friendly. If a user wants to view an article by a participating publisher, the user normally will be directed to the publisher’s website. However, if that primary website is not available the user is redirected seamlessly to the nearest backup site in the LOCKSS system. LOCKSS is a wonderful example of cooperation between libraries and publishers, who together build a repository of information that is maintained safely against any calamity. The more electronic copies of a journal that exist, the more likely it is that one of them will not be corrupted! In 2010, ASLO joined the LOCKSS community, and the LOCKSS network now archives its publications.

The ASLO Board of Directors and the editors of the ASLO publications agree that LOCKSS fully satisfies ASLO’s goal of keeping its publications available for the near and far future. Because it is largely redundant with the JSTOR archiving system, and in our view LOCKSS provides superior service to readers, we have decided to end our participation in JSTOR.

All material already archived in the JSTOR collection will remain there, and of course all of it is available on the ASLO.ORG website as well.

THE RESULTS ARE IN: 2012 ASLO MEMBER SURVEY

Adrienne Sponberg, ASLO Director of Public Affairs, 10410 Kensington Parkway Suite 216, Kensington, MD 20895, sponberg@aslo.org

INTRODUCTION

As the 2009–2014 ASLO Strategic Plan is reaching its endpoint, the ASLO leadership has been busy preparing for the next Strategic Plan. One of the eight guiding principles set forth in the current strategic plan is that ASLO will “learn what services members want, and shall offer these services at a reasonable cost.” Carol Baldassari and Elizabeth Osche at the Program Evaluation and Research Group (PERG) at Lesley University

helped to design the 2012 ASLO Member Survey to learn what services members want. Because the board wished to look carefully at the needs of different segments of the ASLO membership, the survey was designed so that results can be sorted by the member’s geographic region, career stage, and typical salinity (note: results regarding salinity will be explored in more detail in a future issue of the *Bulletin*). While much of this demographic information is collected each year during the membership renewal process, linking it to the survey responses, without compromising anonymity, allows for examining trends within subgroups of the membership.

BASIC DEMOGRAPHICS OF ASLO MEMBERS

Nearly 1200 current and former members of ASLO responded to the survey, a 23% increase over the number of responses to the last survey conducted in 2004. 81% of responses were from current members, 15% from non-members, and 3% from people who weren’t sure what their current membership status was. Responses were predominantly from members at academic

institutions (72%). The next largest sector of respondents was government (10%), followed by independent research institutions (8%), business (3%), and other (5%). The breakdown is similar without students included in the analysis: academic institutions (70%), government (13%), independent research institution (9%), and 4% in business and in other. The geographic distribution of ASLO members responding to the survey is consistent with the breakdown of the full membership (Fig. 1).

WHY MEMBERS BELONG

The role of scientific societies has diversified substantially in recent decades. When asked why they belong to ASLO, two-thirds of participants identified five or more important reasons for belonging to the society, and 30% of respondents identified eight or more reasons for belonging to ASLO. In their *Bulletin* columns and addresses to the membership, each recent ASLO Presidents have noted that the number and diversity of member services of the society have grown significantly. Based on the survey responses, these programs are used and enjoyed by a significant percentage of the membership (Fig. 2).

While the types of services offered to and expected by ASLO members have diversified, future revenue sources are increasingly uncertain as the publishing world moves towards open

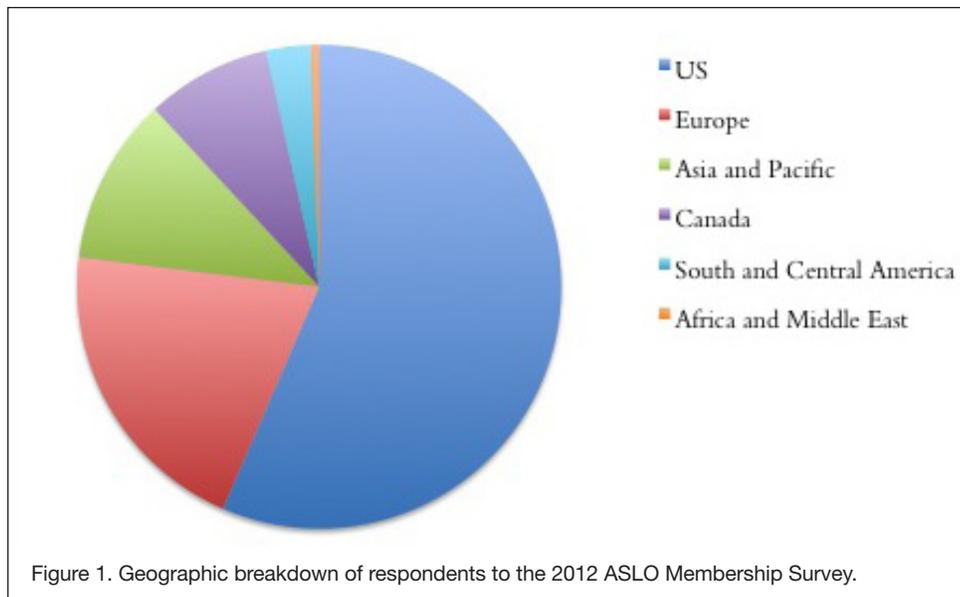


Figure 1. Geographic breakdown of respondents to the 2012 ASLO Membership Survey.

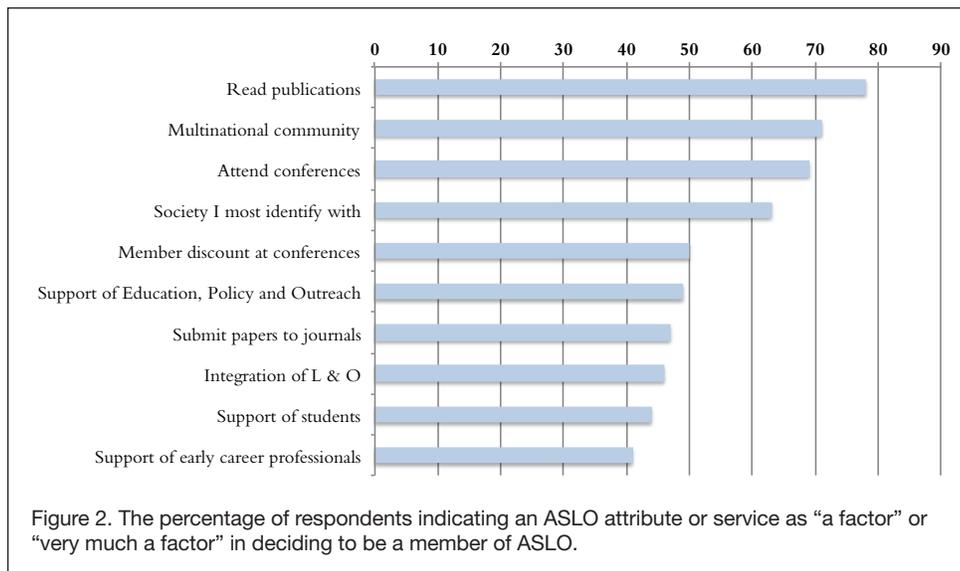
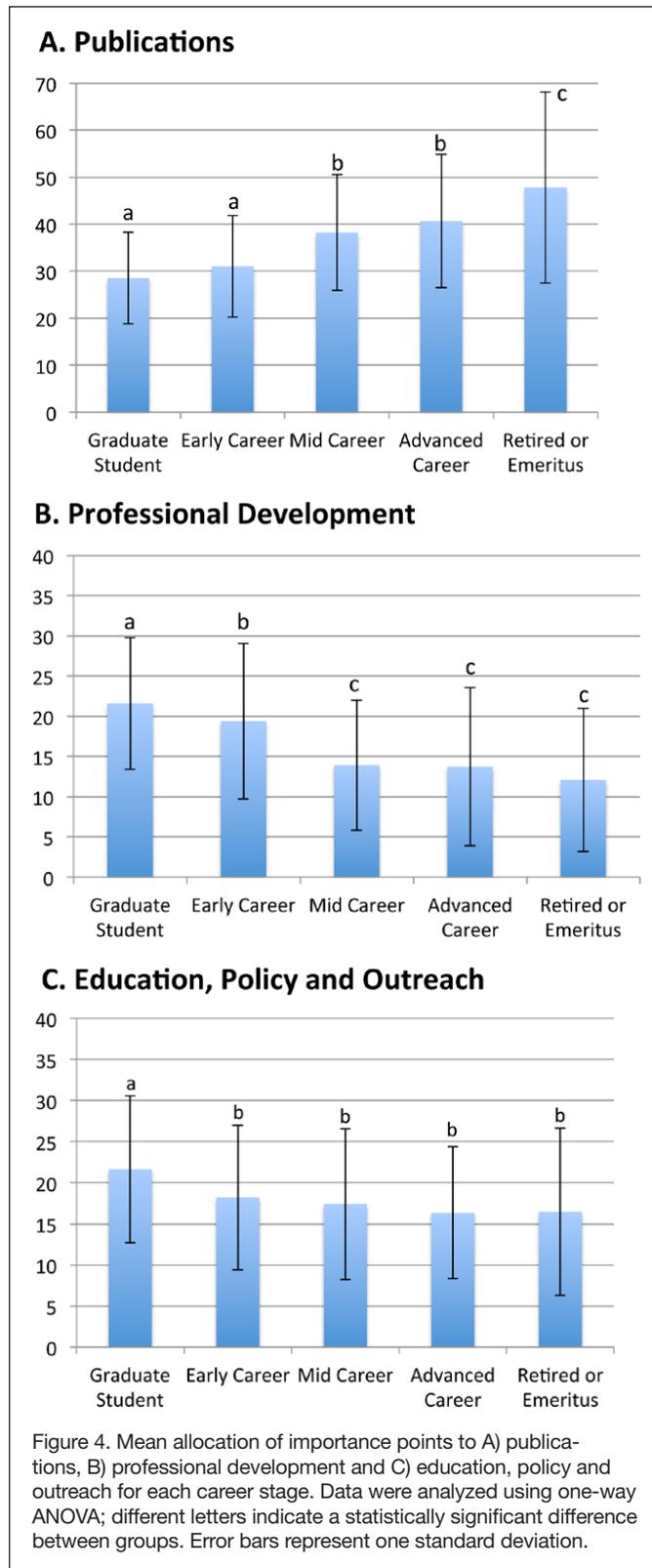
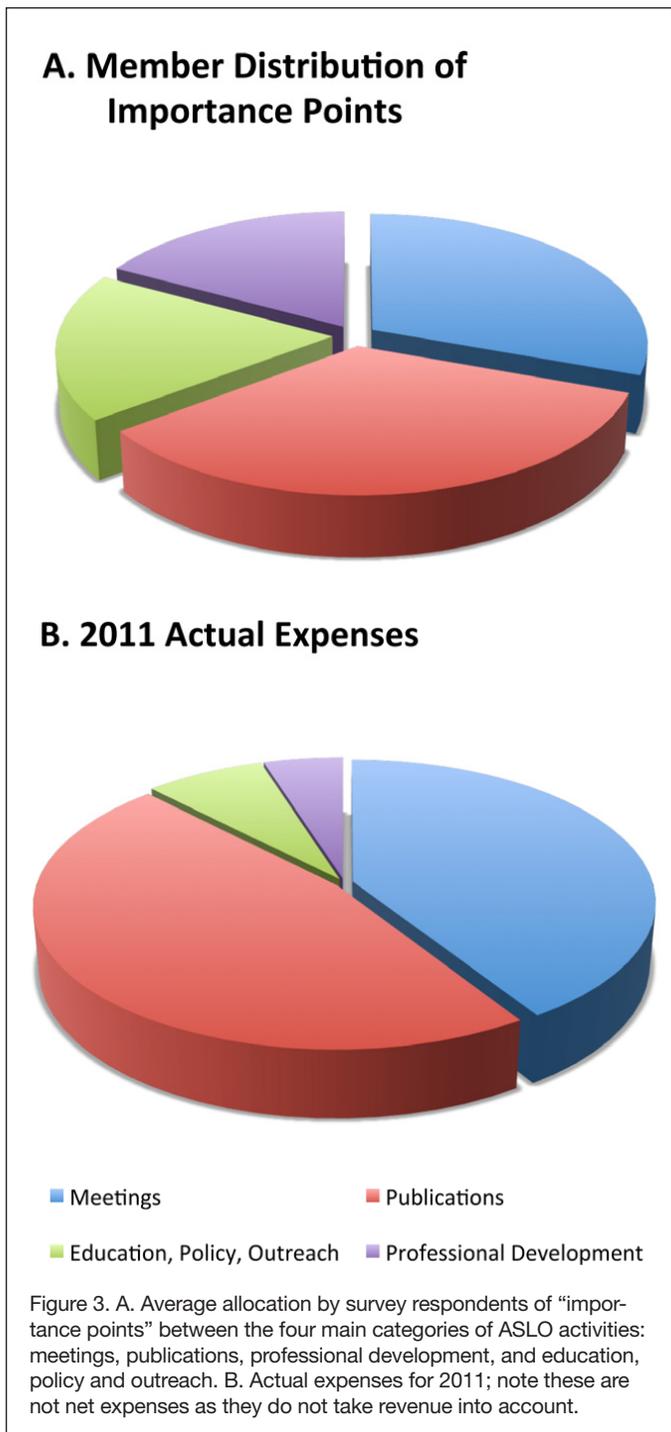


Figure 2. The percentage of respondents indicating an ASLO attribute or service as “a factor” or “very much a factor” in deciding to be a member of ASLO.

access. When setting the society's operating budget, the board gauges member interest in various programs and allocates funds accordingly. The 2012 ASLO Membership Survey provided an opportunity to gauge member priorities directly by giving members 100 "importance points" to allocate to four key areas: meetings, publications, professional development, and education, policy, and outreach. The average distribution from the member survey is not far from what the board actually budgeted for expenses in 2011 (Fig. 3). Note the figures only include budgeted expenses and do not take into account revenue generated by those activities.

Member priorities vary significantly as a function of career stage. While meetings were equally important to members at all stages of their careers, there were significant generational differences for all other categories. Longer-standing members placed a significantly higher priority on publications than junior members (Fig. 4A). Conversely, junior members placed a



higher priority on professional development (Fig. 4B). Finally, graduate students allocated significantly more importance to education, policy and outreach than members in other career stages (Fig. 4C).

MAKING MEETINGS MORE ACCESSIBLE.

Survey responses indicate that meetings are very important to the membership and are the preferred venue for professional development and other membership services. Travel grants to attend ASLO meetings and professional development workshops offered at ASLO meetings were the most valued resources by student and early career members. While the networking that takes place at ASLO conferences would be hard to replace at a distance, there is broad interest among respondents (>70%) in viewing recordings of plenaries and award talks at ASLO conferences. (Note: many of these talks have been recorded in previous meetings and are available on the ASLO website via each conference's main page.)

A meeting related issue that the board has discussed at length in recent years is whether or not ASLO should subsidize childcare for conference attendees. Even though only 15% of respondents have young children, 82% of respondents indicated support for providing the service. Respondents also provided many insightful comments and suggestions regarding how ASLO can make meetings more accessible for those with family obligations. There were numerous additional comments regarding meeting location, timing, and cost, which the board and the meetings committee will take into consideration in planning future events.

SUMMARY

Responses to the 2012 ASLO Membership Survey were very positive with an "approval rating" for the society of 96% - slightly higher than it was in 2004. Members provided an abundance of thoughtful comments on nearly every aspect of ASLO's suite of member services. Many members indicated that they were not aware of many of the services that ASLO already provides. To that end, ASLO will be increasing an emphasis on communication tools, including a redesign of the website, use of social media and other tools (e.g. this article in the *Bulletin*.) Overall, the survey results indicate that ASLO is on a solid trajectory consistent with the needs of its membership; the comments provided in the survey will provide a lot of food for thought for the development of the society's next Strategic Plan.

THE ASLO IMAGE LIBRARY - [HTTP://ASLO.ORG/PHOTOPOST/](http://ASLO.ORG/PHOTOPOST/)

Rob Condon, Chair, ASLO Image Library; rcondon@disl.org

A PICTURE TELLS A THOUSAND WORDS...

"Use a picture, it tells a thousand words" is a century long phrase coined by a newspaper editor in the early 1900s to highlight the power of imagery in publicizing issues by the media. As scientists, we also rely heavily on images to tell a story about our research, we use them as a teaching tool, in presentations, press releases and



publications, in scientific communication as well as preserving history.

In this and forthcoming issues of the *L&O Bulletin*, we will be showcasing the ASLO Image Library, through pictorials that will highlight the benefits and scope of the library as a resource by focusing on hot topics and emerging issues in limnology and oceanography research. We begin by highlighting jellyfish blooms, a

topic that has received global media attention over the past two decades and the debate is ongoing as to whether blooms have increased globally. For example see the report on the Emerging Issues Workshop from the ASLO Aquatic Sciences meeting in San Juan "Implications of increased carbon supply for the global expansion of jellyfish blooms" in Vol 20, June 2011 of the *Bulletin*.

Everyone can do their part to help raise awareness and to improve growth and service of the Image Library. Given the ease and quality at which digital images and video can be generated on smartphones and iPads and rapidly disseminated through social media there is no reason why the library cannot expand in volume and scope. In particular, there are currently few videos in the library and the majority of images are from freshwater regions. There is a need for members to contribute more marine and oceanic images as well as 'topical' images such as from events like the Deepwater Horizon oil spill.

There are many easy ways members can contribute to the Image Library. These may include:

1. Linking personal Facebook pages to the ASLO Facebook page,
2. Encouraging contributions from online community lists (e.g., Scuttlebutt) and international web based projects (e.g., Jellywatch),
3. Linking cruise blogs and research pages to the Image Library

I encourage all members to visit and more importantly contribute to the library, if we all contribute one image or video by the end of the year then this resource will more than double in size. I hope you enjoy the images. Thanks for your support.

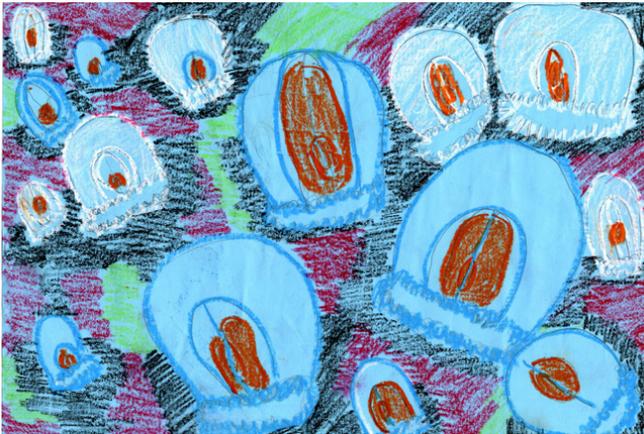
OUTSTANDING L&O REVIEWERS

Everett Fee, *Limnology & Oceanography* Editorial Office, 343 Lady MacDonald Crescent, Canmore, AB T1W 1H5, Canada; lo-editor@aslo.org

Peer review is a crucial component of modern science. The fact that *L&O* is able to utilize the services of the best scientists as reviewers allows it to be a leading journal in the aquatic sciences. However, these individuals seldom get the recognition they deserve for this selfless work. Therefore, the *Bulletin* cites outstanding reviewers that Everett Fee, *L&O* Editor, feels deserve special recognition for their overall reviewing efforts. The ASLO membership extends its sincerest appreciation and thanks these three outstanding scientist(s).



Many gelatinous organisms form large blooms in nutrient poor, open ocean environments, but some taxa, such as salps pictured here off the coast of New Zealand, can produce very large fecal pellets that sink rapidly thereby increasing carbon export to depth. Photo credit: Seacology.



Artwork is a great way to involve and educate early childhood and elementary school children about global science issues. Pictured here is one of the winning entries of the 1st International Jellyfish Art Contest conducted by the NCEAS Global Jellyfish Group in 2010. The contest was hugely popular attracting over 500 drawings from 16 different countries around the world. Photo credit: Kanon Kanbayashi, Age 6 from Japan.



Very little is known about the role of jellyfish in food webs but several studies suggest that jellyfish such as the Portuguese Man-O-War (*Physalia* sp.) and medusae (*Cyanea* sp.) may be important prey for fish and turtles and also facilitate commercial fish recruitment by protecting juvenile fish from predation. Photo credits: Rob Condon and Beth Condon.



Thousands of giant jellyfish (*Nemopilema nomurai*) clog fishing nets in Japan and at least two vessels have capsized as a result. This region has experienced an increase in these massive jellyfish over the past decade. Photo Credit: Shin-ichi Uye.



Jellyfish are beautiful creatures, and are typically the most popular exhibits displayed in public aquarium around the world. Jellyfish are housed in special circular aquaria called planktonkriesels. This image is of the west coast sea nettle (*Chrysaora colorata*), which blooms seasonally in Monterey Bay. Photo credit: Rob Condon



In a recent publication, Carlos Duarte and his colleagues suggest increased artificial hard substrate could be related to potential increases in jellyfish in coastal regions worldwide (*Frontiers in Ecology and the Environment*, 2012; doi:10.1890/110246). Coined the 'Trojan Horse' hypothesis, it is believed that these structures could provide additional habitat for microscopic, benthic polyps that produce medusae. Pictured here are thousands of *Aurelia* polyps from the Inland Sea of Japan. Photo credit: Shin-ichi Uye.



PAUL BUKAVECKAS
Paul Bukaveckas is a Professor of Biology and Environmental Studies at Virginia Commonwealth University in Richmond. His research career has been devoted to Production Limnology studying the factors which constrain primary production in diverse inland waters and the role of primary producers in material and energy cycles. He received his

PhD at Indiana University working with Don Whitehead and did a post-doc at the Institute of Ecosystem Studies with Gene Likens. Paul has studied acidification effects on Adirondack lakes, phytoplankton communities of the Great Midwestern Rivers and, currently, harmful algal blooms in the James River Estuary. Along the way he has enjoyed sabbaticals at Klaipeda University (Lithuania) and the University of Western Australia (Perth).



MIKE PATERSON
Mike Paterson has worked since 1992 as a Research Scientist at the Experimental Lakes Area (ELA) in northwestern Ontario, Canada. He completed his Ph.D. at Dalhousie University and his Master's at Indiana University. Mike's research involves team-based, whole-lake experimentation to study the effects of human activities including hydroelectric reservoir development, eutro-

phication, contaminants (especially mercury), climate change, fish introductions, and aquaculture. Although Mike's research specialty is plankton communities, he has worked on everything from gas exchange to fish populations.

ASLO'S LIFETIME & SUSTAINING MEMBERS

ASLO would like to thank the following who have generously decided to become Lifetime and Sustaining Members.

LIFETIME MEMBERS

Deborah Bronk
College of William and Mary/VIMS, Physical Sciences

John Downing
Iowa State University, Ecology, Evolution, and Organismal Biology

Kunshan Gao

Roxane Maranger
Université de Montréal, Biology

Milla Rautio
Université du Québec à Chicoutimi,
Département des sciences fondamentales

Johan Schijf
UMCES/Chesapeake Biological Laboratory

Dennis Swaney
Cornell University, Ecology and Evolutionary Biology

2012 SUSTAINING MEMBERS

Daniel Conley
Lund University, Dept. of Geology

Katie Droscha
MSU Limnology Lab, Michigan State University

James Elser
Arizona State University, School of Life Sciences

Jian Gao
Jinan University

Nancy Grimm
Arizona State University, Life Sciences

Robert Heath
Kent State University, Biological Sciences

Nafisat Ikenweije
Federal univ of Agric. Abeokuta, Nigeria,
Dept. of Aquaculture & Fish.Mgt.

James Kitchell
University of Wisconsin - Madison

Tomohiro Komorita

Joseph Montoya
Georgia Institute of Tech, Biology

Sybil Seitzinger
International Geosphere-Biosphere Programme

David Siegel
University of California - Santa Barbara, ICES & Geography

A. Wood
University of Oregon, Institute of Ecology and Evolution

MEETING HIGHLIGHTS

ASLO AQUATIC SCIENCES MEETING AT OTSU/LAKE BIWA

Michio Kumagai, Kazu Kogure and Jotaro Urabe; Co-chairs of the 2012 ASLO Aquatic Sciences Meeting at Otsu/Lake Biwa

With more than 1200 participants, the 2012 ASLO Aquatic Sciences Meeting at Otsu on the shores of Lake Biwa, Japan, was an exciting event that brought together limnologists and oceanographers from 43 different countries. We had 693 oral presentations and 265 poster presentations, plus eight distinguished plenary talks and six memorable award talks. The talks covered diverse topics and were all excellent "voyages of discovery" enjoyed by all participants. ASLO has posted videos of the award and plenary presentations on the ASLO web site



for members who were not able to attend this meeting and missed these wonderful talks (<http://aslo.org/meetings/japan2012/plenary.html> and <http://aslo.org/meetings/japan2012/awards.html>).

The ASLO-Japan Aquatic Sciences Meeting began with a public symposium on Sunday afternoon, July 8 2012. The theme of this symposium was “Follow the Water: from Mother Lake to Mother Earth”. After a welcome by Dr. Michio Kumagai, co-convener of ASLO-Japan, Dr. Yukiko Kada, Governor of Shiga Prefecture, began

the symposium by talking about her personal background in research on the cultural history of lakes, and about the environmental management policies by the Shiga Government for Lake Biwa, with emphasis on the need to achieve “harmonious co-existence with the lake environment”. Prof. John Downing, the President of ASLO, then introduced four key aspects of the hydrosphere that are of vital relevance to all humankind: (1) water is among the most important and strategic resources; (2) limnologists and oceanographers follow the water wherever it goes to solve water problems and increase water knowledge, (3) water knowledge is key to solving many of society’s biggest problems; and (4) lakes and other waters are the mother of life on Earth and essential to health and prosperity. Mr. Andrew Mehring, a representative of the students invited to the World Student Lake Meeting at Lake Biwa, described many facets of the water crisis that is being faced around the world, illustrating his talk with field data submitted by students. Prof. Warwick Vincent, representative of the ASLO-Japan scientific committee, described the dramatic ecosystem changes being caused by climate change in the Arctic, and suggested that the holistic

approach put forward by the “Father of Limnology” François A. Forel, provides an inspiration for environmental management in the future. Mr. Brian Williams, a famous landscape painter living by Lake Biwa, addressed the “Mother Earth to Mother Lake” concept by describing his unique ‘curvature’ approach towards landscape art, and the importance of landscape beauty as an indicator of environmental health. After a period of questions from the audience, a jazz performance was presented by Mr. Akira Sakata and his group to accompany the screening of his remarkable film of *Daphnia* (Japanese name is *Mijinko*, meaning an infinitely small creature).

The opening ceremony for ASLO-Japan was held in the main hall of the Lake Biwa Opera House immediately after the public lectures and performance. The president of ASLO, the governor of Shiga Prefecture, the president of SIL and the co-chair of ASLO-Japan gave addresses, welcoming distinguished guests from the House of Councilors, the House of Representatives, the Shiga Prefectural Assembly, the Otsu City Council and all ASLO participants. The Redfield Lifetime Achievement was presented to Prof. Maciej Gliwicz and Prof. Winfried Lampert, after which Prof. Nancy Grimm gave the opening plenary talk on Global Environmental Change and the Water Challenges of Cities.

After the opening ceremony the participants were treated to an invigorating Japanese drum performance (See photo below.), which greatly pleased (and awakened!) the crowd. This was then followed by a reception in which the Governor of Shiga prefecture, the outgoing president of ASLO and the incoming president joined forces to break open a barrel of sake, which was then served to participants. The evening continued with a tasting and assessment many types of local sake, food and music.

In addition to the excellent award plenary and session talks, and poster presentations, many ASLO delegates participated in a variety of cultural activities including flower arrangement, the famous Japanese tea ceremony, and recitals with traditional instruments such as the koto (Japanese harp) and the biwa (a guitar-like instrument from which Lake Biwa derives its name). We received many e-mails from participants who greatly enjoyed all of the presentations and performances. Eight guided excursions and a night of dinner cruising on the lake were also well attended.

An exciting closing ceremony took place on the final day, 13 July; many people stayed to the very end to participate in an ASLO lottery event, in which there were many winners! We deeply appreciate the (past, current and next) presidents of ASLO, science and local meeting committee members and the ASLO business office staff for their extremely hard work to make this important meeting a success. The ASLO-Japan Aquatic Sciences Meeting has certainly provided an important boost to limnology and oceanography in Asia, and we are very pleased to see that it has led to many new friendships and collaborations throughout the world.



Japanese drum performance after the opening ceremony.

BIG TIME IN BIG EASY: 2013 AQUATIC SCIENCES MEETING

Under the theme “Learning for the Future,” ASLO’s 2013 Aquatic Sciences Meeting will be held on 17–22 February 2013, at the Ernest N. Morial Convention Center in New Orleans, Louisiana. The meeting will bring together scientists, engineers, students, educators, policy makers and other stakeholders to learn from the past and look to the future of aquatic sciences. Organizers for this meeting are making sure that attendees not only benefit from the science presented during the meeting, but that they have opportunities to become engaged in the city itself.

As an ASLO tradition, this meeting will feature an opening reception on Sunday evening. This one will be a unique welcome to the city. It will kick off with The Mardi Gras Indian Show of seven performers including a Big Chief Mardi Gras Indian, a Brass Band, and a Second Line.

To enforce ASLO’s dedication to education at the K–12 level, ASLO 2013 meeting organizers will host a Teacher Expo on Thursday, 21 February 2013, and invite K–12 teachers to attend *Limnology and Oceanography 101* mini-lectures, attend scientific poster sessions in the Exhibit Hall, and visit an array of Aquatic Science Education Resource Tables. Registration is FREE for teachers to attend the expo. In addition, ASLO Education Committee is calling for volunteers to become “Scientists in Schools” and present their research to local K–12 classrooms during the conference week. If you are interested, please contact Bob Chen at bob.chen@umb.edu.

Organizers are inviting scientists (broader impacts), curriculum developers, and educators to share their limnology and oceanography educational resources. If you would like to present your educational materials at a resource table, ASLO is happy to offer a complimentary table. Please indicate your interest by completing the exhibitor registration form on the Website. There is no charge, but you must make arrangements in advance of the meeting.

The meeting will include a unique artist exhibition featuring sculpture and paintings on the “Gulf of Mexico”, drawn from the Gulf Coast community. A student art exhibition will be for artists age 6 to 14. Local artists and students will be exhibiting their art Monday through Thursday at the Convention Center.

Presentations and discussions are planned to involve prominent local historians, geographers, and/or sociologists/anthropologists who will profile three aspects of south Louisiana: New Orleans biogeographical history; South Louisiana people and landscapes, and a sociological retrospective of the visit by two sisters (Katrina and Rita). The thematic tapestry they will weave is a one of an adaptive culture living within a changing landscape they shaped, bent, or are confined by.

ASLO 2013 meeting will offer a mentoring program designed for novice meeting attendees, students, or early career scientists. Mentees will be matched one-on-one with an experienced scientist who can help mentees navigate the meeting. You may indicate your interest in being a mentor or a mentee when you register for the meeting.

This meeting will also introduce two exciting and potentially dangerous sessions for ASLO 2013, with the aim of stimulating discussion on the topic of the morning plenary among conference participants. These new sessions will have a format, with

only three speakers in each session. Each speaker will have up to 10 slides and six (6) minutes (strictly enforced) to be speculative, creative, thought provoking, and to encourage attendees to think outside of the box on the topic of the associated plenary. Each speaker will have an additional four (4) minutes for questions. These sessions are not necessarily the venue to introduce new results. Rather they are a stage to put forth speculative ideas about how our science can affect the larger picture and to unleash your creativity to get the community talking. The ASM 2013 Tick Talk Sessions are Climate Change Science and Communication and Geo-Engineering of Aquatic Systems.

Finally, one optional evening event is planned, a hosted reception at the Aquarium of the Americas with food, fun, and accompanying background music by a jazz trio.

Volunteer opportunities are abundant still in this part of Louisiana. ASLO is calling all research labs, teams, or organizations to work with members of the local community in their efforts to rebuild the city of New Orleans. Please visit websites included at <http://www.aslo.org/neworleans2013/volunteering.html> to find out how to get involved.

For more information on these and other aspects of the meeting, please go to: <http://www.aslo.org/neworleans2013/>.

THE 2014 OCEAN SCIENCES MEETING RETURNS TO HONOLULU

The biennial Ocean Sciences Meeting, co-sponsored by ASLO, TOS, and AGU, will be held in Honolulu, Hawaii on February 23–28, 2014. Because of increasing evidence of multiple human impacts on the oceans, this is a critical time for the largest international assembly of ocean scientists to share their results on research, application of research, and education. What better place to hold the meeting than an island in the middle of the Pacific Ocean, where there is emphasis on mauka to makai (ridge to reef) connection, the ultimate in ecosystem-based management; where there is interest in combining traditional knowledge with western science; where islands are in threat of disappearing from sea level rise; and where East meets West.

For OSM2014, ASLO is the lead organization. The co-chairs for the meeting are Jon Sharp (University of Delaware) representing ASLO, Mel Briscoe (Ocean Leadership Consortium) representing TOS, and Eric Itseweire (NSF) representing AGU. Planning for the meeting is underway and there will be a call for members to submit ideas for topical sessions in January or February 2013.

HOLLYWOOD COMES TO THE NEW ORLEANS 2013 AQUATIC SCIENCES MEETING

ASLO will once again bring Hollywood to aquatic sciences at the 2013 Aquatic Sciences meeting; this time with multiple opportunities for meeting attendees to see for themselves how tips and tricks from Hollywood can improve their work. As a highly trained scientist, you may find it a bit odd to seek input from Hollywood types. But, what if advice came from a former scientist? Dr. Randy Olson is a scientist-turned-filmmaker who

left a tenured professorship in marine biology for Hollywood; he has returned to provide communication advice to the environmental and public health science communities and in 2009 published his popular book, "Don't Be Such a Scientist: Talking Substance in an Age of Style." He has been assisting the ocean sciences community for a number of years and has helped at ASLO meetings specifically since 2008. Randy will be coming to New Orleans for multiple workshops and sessions and is bringing help from Los Angeles. Randy, as an actor and independent filmmaker will be assisted by Hollywood veterans Dorie Barton (actress and story line consultant for screenwriters) and Brian Palermo (actor and improv acting instructor).

Based on the excellent and overwhelmingly positive feedback from the 2012 Ocean Sciences Meeting, this crew will return and will offer their advice in multiple formats. We are planning an all-day, limited participation, workshop on Sunday before the meeting formally begins. At this workshop, those selected will work in small groups learning more about how to capture an audience's attention at the beginning of any presentation (talk, video, written article), acting skills to keep the audience's attention, and how to weave a storyline throughout the presentation to make the audience interested. On Monday, the S-Factor team will be attending the science sessions (and taking notes, but not names) in preparation for a Tuesday lunch workshop on improving science presentations. Based on what they observe in sessions on Monday, the team will highlight communication strategies that you can use in preparing your 15 minute science talks. And last, but not least, check the schedule for the timing of another installment of the popular film analysis workshop, S-Factor 3 (see ad below). More information on the workshops can be found on the meetings web page. These events are being organized by Jonathan Sharp (University of Delaware) and Adrienne Sponberg (ASLO).

STUDENT PRESENTATION AWARD WINNERS FOR THE 2012 OCEAN SCIENCES MEETING

Award certificates were given to 40 students out of the 1079 Student Presentations Judged. This represents just under 4%.

(*) Indicates that this student is a member of ASLO.

*Mary Abercrombie, University of South Florida College of Marine Science, St. Petersburg, Florida, USA

Matthew Archer, RSMAS, University of Miami, Miami, Florida, USA

*Jamie Becker, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts, USA

Erik Behrens, Helmholtz Centre for Ocean Research Kiel (GEOMAR), Kiel, Germany

*Sara Bender, University of Washington, Seattle, Washington, USA

*Katlin Bowman, Wright State University, Dayton, Ohio, USA

*Carolyn Buchwald, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts, USA

*Heidi Burdett, University of Glasgow, Glasgow, United Kingdom

Nuria Casacuberta, Universitat Autònoma de Barcelona, Cerdanyola del Vallès, Spain

Adam Darer, University of Rhode Island, Graduate School of Oceanography, Narragansett, Rhode Island, USA

*Julien Dekaezemacker, IRD - Aix Marseille University - LOPB, Marseille, France

Laura Dover-Good, Oregon State University, Corvallis, Washington, USA

Darren Dunlap, University of South Florida, St. Petersburg, Florida, USA

THE S FACTOR 3



The S Factor 3 is coming to New Orleans!

Full-day Communication Workshop - Film Workshops - Panel Discussion on Improving Science Presentations
Check the 2013 Aquatic Science Meeting Website for Times and Locations

Bethanie Edwards, MIT/WHOI Joint Program, Woods Hole, Massachusetts, USA

Peter Gaube, Oregon State University, Corvallis, Oregon, USA

*Miriam Goldstein, Scripps Institution of Oceanography, UCSD, La Jolla, California, USA

*Elizabeth Harvey, University of Rhode Island/GSO, Narragansett, Rhode Island, USA

*Santiago Herrera, MIT/WHOI, Woods Hole, Massachusetts, USA

Jeanna Hudson, Virginia Institute of Marine Science, Gloucester Point, Virginia, USA

Rebecca Jackson, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts, USA

*Tonya Kane, University of California–Los Angeles, Los Angeles, California, USA

*Yizhen Li, North Carolina State University, Raleigh, North Carolina, USA

*Matthew Long, University of Virginia, Charlottesville, Virginia, USA

A.S. Madison, University of Delaware, School of Marine Science and Policy, Lewes, Delaware, USA

Sarah Moffitt, University of California at Davis, Davis, California, USA

Hilary Palevsky, University of Washington School of Oceanography, Seattle, Washington, USA

Noel Pelland, School of Oceanography, University of Washington, Seattle, Washington, USA

Sylvia Rodriguez–Abudo, University of New Hampshire, Durham, New Hampshire, USA

Dimitry Smirnov, CIRES – University of Colorado, Boulder, Colorado, USA

Chelsea Spier, University of the Pacific–Ecological Engineering Research Program, Stockton, California, USA

Samantha Stevenson, University of Hawaii at Manoa, Honolulu, Hawaii, USA

Nobuhiro Suzuki, Graduate School of Oceanography, University of Rhode Island, Narragansett, Rhode Island, USA

*Elizabeth Tobin, University of Washington, School of Oceanography, Seattle, Washington, USA

Erin Urquhart, Johns Hopkins University, Baltimore, Maryland, USA

*Steven van Heuven, University of Groningen, Groningen, Netherlands

Lael Vetter, University of California–Davis, Davis, California, USA

Binbin Wang, University of Wisconsin–Milwaukee, Milwaukee, Wisconsin, USA

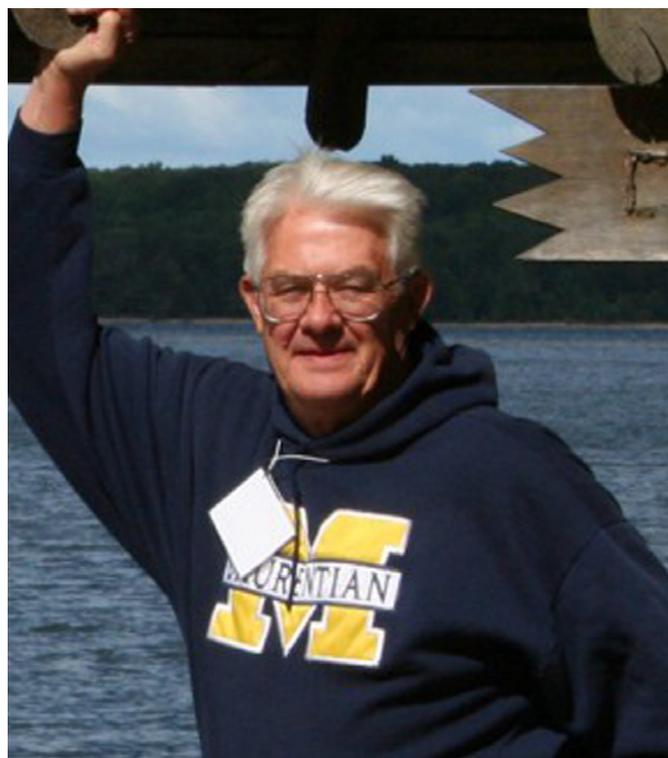
Adrean Webb, University of Colorado at Boulder, Boulder, Colorado, USA

Inger Winkelmann, University of Copenhagen, Copenhagen, Denmark

Zhaoru Zhang, Texas A&M University, College Station, Texas, USA

OBITUARY EUGENE F. STOERMER (1934–2012)

R. Jan Stevenson, Michigan State University, East Lansing, MI; Norman A. Andresen, Andresen Consulting LLC, Ypsilanti, MI; J. Patrick Kociolek, University of Colorado, Boulder, CO; Russell G. Kreis, United States Environmental Protection Agency, Grosse Ile, MI; Edward Theriot, University of Texas, Austin, TX; Marc L. Tuchman, United States Environmental Protection Agency, Chicago, IL; Julie A. Wolin, Cleveland State University, Cleveland, OH



Eugene Stoermer in 2007.

Professor Eugene F. Stoermer died in early 2012 in Ann Arbor, Michigan, after a two year battle with esophageal cancer. From small town Iowa roots, Stoermer became mentor, collaborator, and friend to many diatomists and limnologists around the world. Born in 1934 in Gillette Grove, a very small town in northwestern Iowa, Stoermer grew up in the southern border of what some refer to as the Great Lakes region of Iowa. Stoermer attended Iowa State University for his undergraduate degree in Geology, where John Dodd encouraged him to pursue study of diatoms for a graduate degree in Botany. With aid of a McHenry Fellowship, Stoermer was able to travel to the Philadelphia Academy of Natural Sciences to work with Charlie Reimer and Ruth Patrick at the forefront of North American diatom research. With this new scientific expertise in hand, Stoermer returned to Iowa and joined several colleagues to use another newly developed technology, electron microscopy, to study the structure, taxonomy, and ecology of diatoms with a new level of resolution. Stoermer finished his Ph.D. in 1963 with a dissertation applying diatom

stratigraphy to the paleolimnology of West Lake Okoboji, one of the Great Lakes of Iowa, located just north of where he was born.

Stoermer started his long career with the University of Michigan in 1965 in a position with the Great Lakes Research Division. There he met Claire Schelske, with whom he shared a partnership that lasted almost four decades. In 1971, Schelske and Stoermer published their silica depletion hypothesis in *Science*, which proposed that phosphorus enrichment stimulates diatom production that leads eventually to silica depletion in the water column. Subsequent experimental work by Schelske and Stoermer, as well as decades of research by limnologists around the world, have shown how this process is a key determinant of algal problems resulting from anthropogenic eutrophication of lakes. Over the years, Stoermer and Schelske collaborated to produce more than 50 papers and reports on research characterizing rates of eutrophication in lakes, mostly Great Lakes, and relating changes in biodiversity and biogeochemistry to that eutrophication. Their last joint publication was in 2006 with a study, "Inferring consequences of low-level phosphorus enrichment in the Great Lakes from biogenic silica accumulation in sediments."

Stoermer with his colleagues, 26 graduate students, and a few creative technicians, pioneered research in Great Lakes limnology, paleolimnology, and diatom taxonomy, systematics, and ecology. Keys to Stoermer's success were his amazing breadth of knowledge and encyclopedic memory, his ability to think across disciplines, and his ability to inspire students as well as colleagues. During the early part of his career, he utilized geological and botanical concepts to advance paleolimnology, electron microscopy and diatoms to advance diatom taxonomy, and diatoms and limnology in the study of lake eutrophication. Then his work with graduate students launched diatom systematics and ecology onto its modern path. Using mathematical advances in statistics and morphometrics, Stoermer pushed his students to study relationships of diatoms to their environment, quantitative variation in diatom shape and ornamentation to distinguish taxa, and quantitative methods for relating similarities in taxa to resolve phylogenetic relationships. Stoermer's discipline provided the rigorous scientific backbone for research of diatom taxonomy, systematics, and ecology. His insight, even during causal conversations, provided the often unrecognized foundations for paradigm shifts in these disciplines.

Stoermer's lasting leadership in diatom research, his second love, was evident in the devotion of his students as well as his great support of the broader scientific community. Stoermer was very generous with his time to help people from around the world. In particular, he had extensive collaborations in China and Russia that led to working with many faculty and students from China as well as early work in Lake Baikal. Stoermer was a teacher as well as a scholar. In recent years, he taught a course at Shanghai Normal University on freshwater diatom systematics and ecology, that emulated a course that he started at Iowa Lakeside Laboratory when he was a post-doc in the 1960's, returned to teach for 10 years in the 1990's, and that is still taught annually by some of his students. Stoermer authored over 200 publications with these collaborators. In addition, he served as Presidents of the Phycological Society of America and the International Society for Diatom Research as well as an editor of *Diatom Research*.

Stoermer's first love? His family. Gene is survived by his wife Bobbie, whom he married in 1960, his three children and five grandchildren. They all lived in or near Ann Arbor to share the last years of his life.

We, his first graduate students, commemorate his life and career, with the same scientific backbone that he instilled in us. Eugene F. Stoermer will be greatly missed, but his legacy will live in scientists around the world as a result of a shared dedication with his colleagues for the science they strive to advance.

EXAMPLES OF EUGENE STOERMER'S SCIENTIFIC WORK

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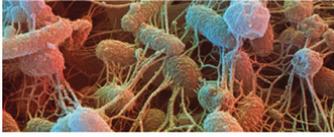
BOOK REVIEWS

DAVID L. KIRCHMAN. 2012. *Processes in Microbial Ecology*. Oxford University Press. ISBN13: 9780199586929, ISBN10: 0199586926, Paperback, 368 pages, \$49.95.

Reviewed by Lars J. Tranvik, Limnology, Department of Ecology and Genetics, Uppsala University, Sweden; lars.tranvik@ebc.uu.se

The field of microbial ecology is in rapid development. In recent years new journals have been launched, and the mass of new approaches and techniques presented at scientific meetings is overwhelming. General textbooks lag behind, being either major works in ecology or microbiology with only brief sections on microbial

processes in microbial ecology



DAVID L. KIRCHMAN

ecology, or simply not up to date. Moreover, there is a need for an integrated presentation of the topic that integrates terrestrial and aquatic microbial ecology. “Processes in Microbial Ecology” is an attempt to fill all these gaps.

In addition, as pointed out in the preface, it is written with a broad audience in mind, including biologists with little knowledge of microbiology, and chemists who don't know too much about biology. This

is a challenging task, but David Kirchman is a very experienced author and editor in microbial ecology.

The introductory chapter sets the scene, and starts at a basic level. Compelling reasons are given why the study of microbial ecology is important, and there are some very brief overviews of the methods of microbial ecology, and the functional and taxonomic groups of microorganisms. Here we also meet for the first time the text boxes. These boxes provide a range of topics on methods and concepts in microbial ecology, but also give interesting “side stories”, e.g. on what “dino” means in “dinoflagellate”, and the relevance of geomicrobiology for the preservation of stone statues. We learn that the famous microbiologist Jacques Monod was active in the French resistance against German occupation during World War II, and another text box tells us that another Nobel Prize winning scientist of relevance for microbial ecologists, Fritz Haber, the inventor of the synthetic nitrogen fertilizer, was involved in the production of poisonous gases used in World War I. In the introduction, one of the text boxes is titled “is prokaryotes a bad word?”, and presents the pragmatic use throughout the book of “prokaryote” as a term for “bacteria and archaea”, which are in many situations only known as “non-eukaryotes”. The text boxes are generally a valuable and very inspiring part of the book, but in some cases the need of brevity makes them a bit superficial. An example is a box in the second chapter, which in less than 100 words present the limiting factors for biomass and growth and a bit of history of science, involving presentations of Liebig and Chapman.

The second chapter describes the composition and structure of microbes, followed by a chapter on the physical-chemical environment of microbes. Thereafter a series of chapters presents microbial primary production, and degradation of organic matter. The following chapter on the control of microbial growth and biomass is an excellent presentation of complex patterns. Chapters on predation, viruses, and community structure are followed by a chapter on genomes and metagenomes, which is a very useful overview for the beginner. Anoxic environments are treated in a separate chapter where redox reactions, methanogenesis and methanotrophy are introduced. The nitrogen cycle has its own chapter, while other elemental cycles are integrated where appropriate in the other parts of the book. This is probably a reasonable strategy in a book focusing primarily on ecology rather than biogeochemistry, considering the various microbial

transformations (including redox reactions) involving nitrogen, and the importance of these reactions for the overall productivity of ecosystems. The two final chapters of the book give an introduction to geomicrobiology, and an overview of symbiosis.

Taken together the various chapters of the book comprise a remarkable and broad overview of microbial ecology. I am impressed by how it presents and synthesizes a topic with many dimensions in a relatively short format, still rich in detail. In chapters dealing with metabolism and physical-chemical conditions theory is discussed at a relatively detailed level, e.g. presenting equations of relevance for temperature dependence (Arrhenius equation) and viscous forces (Reynolds number). In analogy, I think a deeper presentation of ecological theory would be of interest. For example, the famous claim by Baas Becking, that “everything is everywhere, but the environment selects” is presented, but other views on microbial biogeography are only very briefly mentioned. Here, a presentation of meta-community dynamics could be interesting. Likewise, the paradox of plankton is presented but the principle of competitive exclusion, which it builds on, would deserve to be explained, including the importance of niche overlap. However, it is fairly easy but not completely fair to make a list of missing information. Given the limited space and the audience the author has in mind, I think the book is a good compromise.

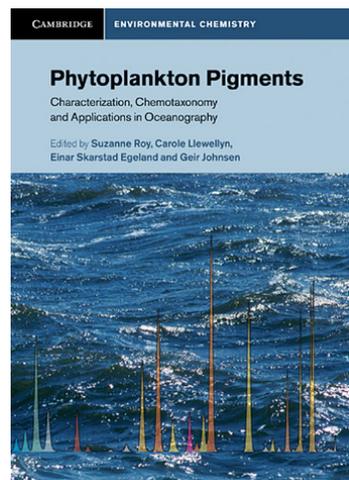
A major strength of the book is its ambition to integrate aquatic and terrestrial microbial ecology. There is no “soil chapter” or “ocean chapter”, but various chapters integrate across habitats – this is good approach. At the same time the merging of terrestrial and aquatic ecology is also a dimension of the book where there is room for improvement. It is not surprising that the author, as an experienced aquatic scientist, has more to say about aquatic systems. Still, I would have appreciated more information on topics such as mycorrhiza, and the role of microbes in soil formation. Regarding grazing in soils, arthropods, which are major grazers of fungal hyphae, are only briefly mentioned. The chapter on growth and production presents some patterns of how production and generation times of primary producers and heterotrophic bacteria correlate in aquatic systems. It would be interesting to see a similar presentation of how microbial biomass and activity varies across the vast range of soil types that they inhabit.

The webpage of the publisher presents “Processes in Microbial Ecology” as “an ideal text for advanced undergraduate and graduate students in microbial ecology and related fields”. Moreover, in the preface the author expresses his hopes that experienced soil microbiologists will find it useful to learn from discoveries in lakes and oceans, and that aquatic microbial ecologists will learn from the progress in terrestrial research. I agree, and think this book should be on the shelf of everyone who performs teaching or research with any connection to the role of microorganisms in nature. In conclusion, I think “Processes in Microbial Ecology” successfully meets the challenge to communicate the broad field of microbial ecology to a wide range of potential readers. Again, the book successfully integrates terrestrial and aquatic microbial ecology, but some aspects of terrestrial systems deserve more attention. The previous book edited by Kirchman, “The Microbial Ecology of the Ocean”

from 2000, with a substantially different version published in 2008, gives promise that perhaps “Processes in Microbial Ecology” may also develop further. Until that happens, there is no doubt that this version is the best buy for anyone looking for a general textbook in microbial ecology.

SUZANNE ROY, CAROLE LLEWELLYN, EINAR SKARSTAD EGELAND AND GEIR JOHNSEN (eds). 2011. Phytoplankton Pigments: Characterisation, Chemotaxonomy and Applications in Oceanography. Cambridge University Press, ISBN 978-1-107-00066-7, 845 pp Hardcover \$140.00

Reviewed by **R. Fauzi C. Mantoura**, Centre for Marine Science University of Paris VI – Sorbonne, 4 Place Jussieu, 75005 Paris, France; fauzi.mantoura@upmc.fr



Oceanographers and marine biologists have used chlorophylls (Chls), carotenoids (Car) and other photosynthetic pigments for over half a century to discover and track the distribution, chemotaxonomy, productivity, photophysiology and fate of phytoplankton in the world's oceans.

This book is an impressive update and expansion of the 1997 Volume: *Phytoplankton Pigments in Oceanography* (Edited by

S. W. Jeffrey, R. F. C. Mantoura and S. Wright) SCOR WG78, UNESCO Press. It includes recent discoveries of several new algal classes and their pigments, important new analytical and chemometric developments, and innovative applications in oceanography. The book still targets pigment oceanographers and marine biologists and includes seven sections (1) Algal chlorophylls and carotenoids, (2) Methodology guidance, (3) Water-soluble pigments, (4) Applications in oceanography, (5) Future perspectives, (6) Aids for practical laboratory work, and (7) Phytoplankton pigments data sheets.

The four editors have superbly integrated and cross-referenced the contributions of 46 renowned authors and scattered literature within the 15 chapters, 8 Appendices and the now-famous Pigment Data Sheets. In effect, the book expands upon all the core and essential pigment data of the 1997 Volume, addresses key gaps (eg marine phycobiliproteins, mass spectrometry, analytical quality control ...) and introduces new aspects (molecular biology, biosynthesis ...) with the same comprehensive authoritative and fully cross-referenced approach as the 1997 volume. It is an invaluable reference book for students, researchers and professionals in marine and freshwater biogeochemistry. This hardback of 845 pages sells for \$140 which, when compared to the commercial price of one pigment standard (up to \$500!) also represents good value. The contents

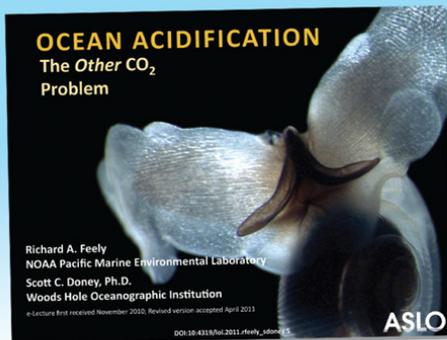
and highlights of the 15 chapters and appendices are summarised below:

- 1) Microalgal classes and their signature pigments, by S.W. Jeffrey, S.W. Wright, and M. Zapata, is an extensive update on the 1997 book featuring 122 new references setting out past and current phylogenetics of 24 newly reclassified prokaryotic and eukaryotic phytoplankton in relation to pigment chemotaxonomy and oceanography.
- 2) Recent advances in chlorophyll & bacteriochlorophyll biosynthesis, by R.J. Porra, U. Oster, and H. Scheer, is a comprehensive account of biosynthetic pathways and UV-vis spectra of all Chl a, Chl b and Chl c derivatives in phytoplankton including the recently discovered Chls (DV Chl e, Chl f, BChls, [Zn]-BChl a). A biochemist's benchmark !!
- 3) Carotenoid metabolism in phytoplankton, by M. Lohr, focuses on biosynthetic pathways, key enzymes and genes leading to the formation of carotenes, xanthophylls, retinal and their derivatives.
- 4) New HPLC separation techniques, by J.L. Garrido, R.L. Airs, F. Rodriguez, L.V. Heukelem, and M. Zapata, encompasses the analytics and comparative strengths of 26 published HPLC methods (1991-2006) for phytoplankton Chls & Cars in marine pelagic and epibenthic samples. Excellent discussion of HPLC separation mechanisms (polarity, ion-pairing, molecular size, π -bonding, temperature etc....) with helpful guidelines for resolving complex samples and co-eluting pigments (eg MV- & DV-Chls, Cars isomers), B-Chls and phaeopigments.
- 5) The importance of a quality assurance plan for method validation and minimizing uncertainties in the HPLC analysis of phytoplankton pigments, by L.V. Heukelem, and S.B. Hooker, is an impressively detailed step-by-step explanation of quality assurance plans developed by NASA-sponsored pigment HPLC labs, so as to yield analytically uniform data for calibration and validation of SeaWiFS satellite. This is a benchmark example of how to design and execute AQC for pigment HPLC in major oceanographic programmes, time series observations and water quality monitoring. A very useful lexicon of HPLC terms, symbols and equations for quantitative HPLC are also included in an Appendix.
- 6) Quantitative interpretation of chemometric pigment data by H.W. Higgins, S.W. Wright, and L. Schluter, is a chapter which introduces the merits of chemometric analyses of the large HPLC pigment datasets (≤ 70 Chl & Car pigments/sample) obtained during oceanographic surveys (100-1000 samples) so as to obtain quantitative chemotaxonomic biomass groupings of phytoplankton in the ocean. The iterative and judicious use of pigment markers and inter-pigment ratios essential for chemometric budgets, are very well presented, taking into account the effects of irradiance, nutrient concentration. Finally, strength/weakness comparisons of HPLC chemotaxonomy with microscopy and flow cytometry are clearly presented.

- 7) Liquid chromatography-mass spectrometry, by R.L. Airs and J.L. Garrido, represents a new theme compared to the 1997 book. It is an excellent review of the application of HPLC-mass spectrometry (MS) and its variants (FAB-, APCI-, ESI- and MALDI-MS) to the unambiguous structural identification of Chls and Cars in phytoplankton and photosynthetic bacteria. A lot of new MS spectra now included the pigment datasheets (Part VII) of the book.
- 8) Multivariate analysis of extracted pigments using spectrophotometric and spectrofluorometric methods, by J. Neveux, J. Seppala, and Y. Dandonneau, explains that UV-vis spectra of pigment extracts can now be chemometrically and accurately resolved in terms of component Chl and Car pigments by the digital analyses of entire UV-vis or Fluorescence spectra instead of at 3 wavelength of the traditional 'trichromatic' procedure. A renaissance of inexpensive shipboard alternative to HPLC! An appendix of simultaneous equations for Chl a & Chl b is presented by R. J. Porra.
- 9) Phycobiliproteins, by K.-H. Zhao, R.J. Porra, and H. Sheer, is a superb overview which demystifies (using color figures) the complex structures, biosynthesis, phylogeny, photophysics, isolation and analyses of phycobiliprotein pigments abundant in the cyanobacteria, cryptophytes and red algae.
- 10) UV-absorbing 'pigments': mycosporine-like amino acids (MAAs), by J.I. Carreto, S. Roy, K. Whitehead, C.A. Llewellyn, and M.O. Carignan, focuses on these compounds now recognised as UV-photoprotective pigments widely distributed in marine phytoplankton. Their occurrence, biosynthesis and analysis in marine phytoplankton are reviewed. Tables of UV and MS properties for 23 MAAs are also tabulated.
- 11) Pigments and photoacclimation processes, by C. Brunet, G. Johnson, J. Lavaud, S. Roy, is a comprehensive and succinct review of the mechanisms and dynamics of pigment variations in phytoplankton in response to changes in light regime (irradiance, spectrum, duration). The dynamics of pigments in the photoprotection, photoacclimation (xanthophyll cycle) and photosynthesis are thoroughly discussed together with applications to vertical mixing of phytoplankton.
- 12) Pigment based measurements of phytoplankton rates, by A. Gutierrez-Rodriguez and M. Latasa, concerns the use of pigments in tracking phytoplankton growth using the ^{14}C pigment-labelling technique and also serial dilution bioassays are comprehensively reviewed. Remote sensing and in situ active fluorescence techniques are also summarised.
- 13) In vivo bio-optical properties of phytoplankton pigments, by G. Johnsoen, A. Bricaud, N. Nelson, B.B. Prezelin, and R.R. Bidigare, introduces the photophysics of light

ASLO 2013 Aquatic Sciences Meeting New Orleans, Louisiana

Join Us for a Limnology & Oceanography Town Hall
"L&O e-Lectures: An Effective Approach for Addressing Broader Impacts"



Several funding agencies now require proposals to not only provide justification for the intellectual merit of their work, but must also include a plan for activities demonstrating the **broader impacts** on society. For many, the task is arduous and elusive, with outcomes difficult to assess. **L&O e-Lectures**, a new publication from ASLO, offers a fresh and effective alternative for addressing societal benefit requirements by providing a high impact venue for publication in lecture format. The lectures can be used at the post-secondary level, or for the public at large. Over the past year, the L&O e-Lectures website has received over 40,000 hits and this number is growing exponentially. If, for example, just 1% of these hits were to result in e-Lecture downloads by post-secondary instructors, that would amount to approximately 400 instructors using these e-Lectures to teach their courses. As university class sizes range anywhere from 20 to 150 students, this translates to reaching 8000 to 60,000 students. The net outcome of publishing in L&O e-Lectures is win-win: a researcher submits their findings for publication in *L&O*, *L&O Methods*, *L&O e-Books* or *L&O Fluids in the Environment*, and can also submit a companion publication in *L&O e-Lectures*.

This Town Hall will introduce one of ASLO's newest peer-reviewed publications, *L&O e-Lectures*, and will provide a forum to discuss publishing opportunities.

Hosted by **Jennifer Cherrier**, Florida A&M University and Editor-in-Chief, *L&O e-Lectures*

For more information about *L&O e-Lectures*, visit www.aslo.org/lectures
 contact **Jennifer Cherrier**: lolectures-editor@aslo.org, or **Jason Emmett**: lolectures-manager@aslo.org

absorption, scattering and fluorescence in phytoplankton cells, detritus, dissolved organic matter and seawater; this is prerequisite reading for understanding photosynthesis and optical remote sensing.

- 14) Optical monitoring of phytoplankton bloom pigment signatures, by G. Johnsen, A. Moline, L.H. Pettersson, J. Pinckney, D.V. Pozdnyakov, E.S. Egeland and O.M. Schofield, focuses on satellite remote sensing algorithms and in situ sensors for ocean colour, active and passive fluorescence and detection of marker pigments in phytoplankton and HAB blooms. An appendix listing the toxins and pigments of HAB species is also presented.
- 15) Perspectives on future directions, by C.A. Llewellyn, S. Roy, G. Johnsen, E.S. Egeland, M. Chauton, G. Hallegraeff, M. Lohr, U. Oster, R.J. Porra, H. Scheer, and K.-H. Zhao is an interesting listing of recent trends and emergent challenges involving pigments: discovery of Chls, BChls, Cars and new functional biogeochemistry, advanced analytics and 'omics technology, micro-algal biofuels, biotechnology, climate.

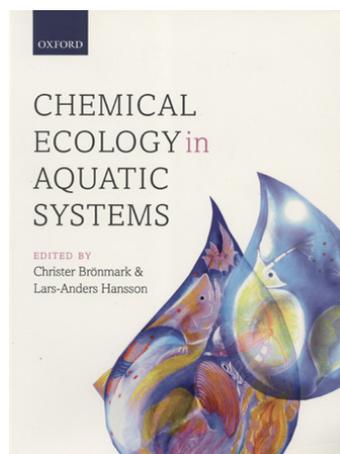
The appendices include an "Update on filtration, storage and extraction solvents" by J.L. Pinckney, D.F. Mille, and L.V. Heukelem, which is an excellent and pragmatic guidelines to good pigment practice. "HPLC instrument performance metrics and validation", by A.R. Neeley, C.S. Thomas, S.B. Hooker, and L.V. Heukelem, reviews selection criteria and guidelines for HPLC hardware optimised to different pigment applications and methodologies. The "Minimum identification criteria for phytoplankton pigments" by E.S. Egeland is an important refinement of the 1997 guidelines. "Phytoplankton cultures for standard pigments and their suppliers", by S. Roy, S.W. Wright, and S.W. Jeffrey, consists of an expanded listing of reference microalgal strains, their pigment content and their suppliers. The last appendix is "Commercial suppliers of phytoplankton pigments" by E.S. Egeland, and L. Schluter, gives a full listing of suppliers of 45 pigment standards (Chls and Cars, not phycobiliproteins), their origins, types (crystalline vs solution Standards) and their costs.

Also includes are extensive "Data Sheets" to aid in the identification of phytoplankton carotenoids and chlorophylls, by E.S. Egeland, J.L. Guarrido, L. Clementson, K. Andresen, C.S. Thomas, M. Zapata, R. Airs, C.A. Llewellyn, G.L. Newman, F. Rodriguez, and S. Roy. The section is 157 pages (also available online) of key molecular data (IUPAC name, abbreviation, structure, formula, mol weight, occurrence), HPLC chromatograms, UV-Vis spectra in solvents and HPLC eluants, extinction coefficients and mass spectra, compiled for 47 carotenoids and 21 chlorophylls with 182 references. Unfortunately, phycobiliproteins and MAA pigments are not included.

Even though better coverage of paleopigments, chlorophyll degradation products and flow cytometric detection would have been desirable, this is still an outstanding reference book on marine phytoplankton pigments, their analyses and biogeochemistry. Like its predecessor, this book will become the quality bench mark for marine chlorophyll and carotenoid pigments over the next decade.

CHRISTER BRÖNMARK AND LARS-ANDERS HANSSON (eds). 2012. Chemical Ecology in Aquatic Systems. Oxford University Press, ISBN13: 9780199583096, 336 pp, \$70

Reviewed by **Thomas Kjørboe**, National Institute of Aquatic Resources, Technical University of Denmark, tk@aqu.dtu.dk



Life in the ocean unfolds in a world that is difficult for us to access, and we cannot sense many of the hydromechanical and chemical cues to which aquatic organisms are attuned. As a consequence, our understanding of aquatic life is rudimentary compared to our understanding of terrestrial organisms and we have been rather slow in learning how aquatic organisms orient in a cue landscape that is so different from the landscape we

perceive. This book reviews progress made during the past ca. 20 years in understanding how aquatic organisms produce, perceive, and respond to chemical cues and signals, how cues and signals are transmitted, what the ecological implications are, and what the identity and properties of the involved signal/cue molecules are. This is a multi-authored and mainly well edited volume (e.g., many cross references between chapters). Unlike many such volumes, it is not the result of a workshop, but rather the result of the efforts of hand-picked authors, apparently selected to produce a coherent presentation of the field of aquatic chemical ecology. The efforts culminated in a workshop aimed at fine-tuning the chapters and the result is this book. The effort is partly successful. However, one problem that this book shares with most other books consisting of chapters written by different authors is that each chapter has to set the scene (again). Thus, the advantage of collecting the expertise of many minds is partly offset by the disadvantage of starting more or less from scratch in each chapter, and by quite some redundancy in the book. Another severe limitation of this book is the biased selection of topics with emphasis on 'large' animals and plants. Microbial chemical ecology is almost entirely absent from this volume. After all, the biology of the oceans is entirely dominated by microbes. And chemical signals and cues are maybe in particular important to aquatic microbes, since osmotrophic organisms (bacteria, phytoplankton) often feed on the very same cues that help them navigate in an aquatic world. Hence, important phenomena, such as chemotactic behavior and quorum sensing are (almost) entirely ignored. Hence, the title of the book is somewhat misleading. It is as if there are two very different communities studying aquatic chemical ecology, and that there are very few signals that cross the barrier between them. That is a pity, because the two communities could learn from one another.

Aquatic chemical ecology is to a large extent really 'behavioral ecology', because the chemical cues and signals have, in many cases, and when it comes to aquatic animals, in most cases, not been identified and cannot be visualized, but have been inferred only

from the behavior of the involved organisms. The postulation of a waterborne cue is often the only way that one can understand certain behavioral observations. One would never think of calling a book on the behavioral ecology of birds 'Visual Ecology of Birds'. This just illustrates that our intuition for chemical cues and signals in watery environment are weakly developed. Hence, an important effort in the past has been to demonstrate that a particular behavior can be explained only by the existence of a chemical cue or signal. While the identification of in particular defense chemicals in (aquatic) plants has a rather long history, attempts among aquatic ecologists to also try to identify the active molecules involved in animal interactions is a more recent priority, which now maybe will advance faster due to the development of new approaches. The relative infancy of the field should not be mistaken for its unimportance. In fact, many biological interactions in the ocean can only be understood in the context of chemical cues and signals, and insights in the workings of the chemical interactions can help us understand the workings of marine ecosystems. Hence, the topic of this book is important.

The book has 18 chapters. It appropriately starts with a useful chapter on how chemicals are distributed in water and picked up by organisms. Its perspective is mainly from that of sedentary or slowly moving large benthic organisms, and largely ignores the very different situation applying to small and planktonic organisms. Hence, the chapter mainly emphasizes advective processes (e.g. currents) and only briefly mentions diffusion, a constraint partly dictated by the bias of the book mentioned above. The chapter explicitly states that it is a "biologist's view of odour dispersal in water", but would have benefitted from contributions from a physicist to avoid some misunderstandings and naïve or wrong calculations. Chapter 2 is a general chapter on what information can be deduced from chemical signals and cues, and this chapter is then followed by a series of chapters that explore the use of chemical cues and signals for more specific purposes: mate and kin recognition and finding (3, 4), habitat recognition (5), navigation and orientation (6); and then many chapters dealing with various aspects of predator-prey interactions: chemical prey location (7), chemical predator detection and induced defenses, with emphasis on either morphological defenses (8) alarm substances (9), behavioral and life history defenses (10), or chemical defenses against herbivores (15) and carnivores (16). Intermixed are chapters on the 'neuroecology' of predator-prey interaction that talks briefly about the neural mechanisms involved in chemodetection but mainly tells interesting stories about the identity of food attractants in lobsters and crabs (11), a chapter on the evolution of chemical defenses (12), and one on how to identify defense chemicals (13). There is also a chapter on allelochemicals (14), i.e., how aquatic plants poison their competitors. Finally there is a chapter on the interfering effects of pollutants (17), and a final forward looking chapter that closes the volume (18, written by the editors).

Most of the chapters are well written and are informative reading. One drawback, however, that applies to many chapters (there are interesting exceptions) is that they are long lists of examples with rather little synthesis. While many of the examples are reports of interesting and fascinating stories, the general concepts that some readers (including me) would be more interested in learning and discussing are harder to extract. Also,

because most chemical ecology of aquatic animals has been made using crabs, lobsters, and fish as study organisms, it becomes a bit monotonous to read the entire volume. There is also quite some overlap in the contents of the individual chapters, which further exhausts the reader. Finally, there are elements of *déjà vu* in the reading of some animal-oriented chapters, in particular if one has read the recent multi-authored volume on "Chemical Communication in Crustaceans" (Breithaupt & Thiel, Eds., Springer, 2011). This being said, the chapters are likely to be entertaining and useful reading for newcomers to the field.

I found the sections discussing more principal aspects of chemical signaling the most interesting. For example, how do alarm substances evolve? Chapter 9 discusses several hypotheses. Natural selection acts on the individual, not the population or the species. Alarm substances that are released by the consumption or injury of an individual will warn other individuals of the same species such that they can seek protection. But the individual itself does not benefit, and the development of alarm substances should not be favored by natural selection. Several mechanisms can explain how alarm substances developed nevertheless. For example, some fish produce substances in their epidermis to protect them against skin infection; on injury these substances are released, and conspecifics have learned (in the course of evolution) to interpret this as danger. There are similar problems in understanding chemical defenses and the use of allelochemicals in plankton organisms. Why are toxic algae toxic? Much of the theories to explain chemical defenses and allelochemical interactions have been developed for terrestrial plants and systems, but due to differences in life forms and environments (unicellular phytoplankton drifting in water vs. multicellular and highly differentiated sedentary terrestrial plants), these theories simply do not apply to aquatic organisms and it remains difficult to understand how chemical defenses and allelochemical interactions developed in phytoplankton. If defense and war substances released in the environment benefits the entire population, and if there is a cost associated their production, cheaters would prevent the evolution of such traits. Chapters 14 and 15 provide nice overviews and discussion of these problems, but it becomes apparent that new theoretical development is needed. Also, one wonders why the chapter on allelochemical interactions describes interactions between plants only. Inclusion of marine bacteria might provide some interesting clues. Chemical warfare is in particular prevalent in bacteria that are attached to particles. Through cell divisions of attached cells, clusters of related bacteria stay together, and the benefits of warfare molecules (antibiotics) are shared mainly among kins. This makes sense, but also emphasizes the need for an explanation of warfare chemicals in unicellular plankton. There is also an interesting review and discussion of the ecosystem effects of infochemicals (Chapter 10) and a general discussion of the evolution of induced defenses (chapter 12). One chapter has been written by a chemist (13) and provides a different but refreshing account on how defense chemicals can be identified. Most of the less-topical chapters have concluding section that tries to synthesize and conceptualize their many examples, and there is something good to say about every chapter, and every chapter is read-worthy.

Overall, I can recommend this book as a good introduction to newcomers in the field of aquatic chemical ecology. Most scientists already in the field will pick specific chapters, and few will read the



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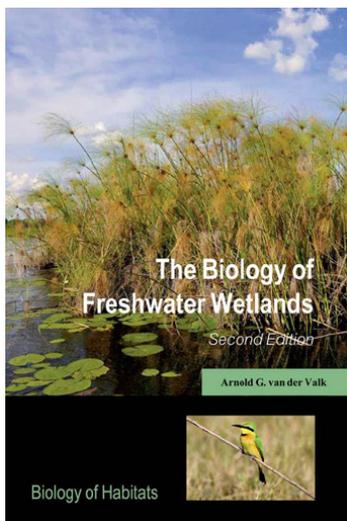
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book in its entirety. Those that do may find it somewhat long and exhausting reading due to the problems mentioned above.

ARNOLD G. VAN DER VALK 2012. *The Biology of Freshwater Wetlands (2nd Ed.)*. Oxford University Press, ISBN-13: 978-0199608959, 312 pp, \$54

Reviewed by **Charlotte L. Roehm**, National Ecological Observatory Network (NEON Inc.) Boulder, CO 80301; croehm@neoninc.org



The field of wetland ecology has increased significantly over the past several decades with a shift towards defining the value, functions, services and management of wetlands. Before the introduction of wetland protection laws in the 1970's, most wetlands were regarded either for their economic benefits (energy sources, construction materials, timber ect.) or as wastelands that were drained for the expansion of agriculture. The changing perception of wetland values

has meant that society now has a better understanding of their worth. With an increase in threats from invasive species and climate change, the careful restoration and creation of wetlands is critical. This book is timely and a fundamental reference of wetland processes, functions and management approaches.

I had the fortune to review the 1st edition of the "Biology of Freshwater Wetlands" by Van der Valk (2006), a well respected ecologist with extensive years of experience working in diverse wetlands across the globe. It was exciting to see such a concise short text that covers a broad range of topics in enough detail to stimulate further, in depth, exploration into particular areas of wetland science, but also with enough breadth to not let the reader get caught up in overwhelming scientific language.

In his 2nd edition, Van der Valk has captured this same essence and structure, and furthered it by outlining how those processes (Chapters 2-6) are impacted by current and very pertinent wetland issues and management approaches (Chapters 7-10). Each new chapter (7-10) touches upon an important aspect of wetlands (invasive species, restoration and creation and global climate change), their current status and their future. The proliferation of invasive species in wetlands has caused a substantial decline in biodiversity and consequently in the functions and values of wetlands. A large part of the success of the restoration, creation and protection of wetlands in the future will be, in part, dependent on the impacts of global climate change on such ecosystems.

The introductory chapter contains a strengthened discussion regarding nutrient concentrations and trophic gradients within wetlands. This largely defines the biotic distribution and characteristics of the plants and soils. In addition, a section on secondary gradients, soil genesis and hydric soils has been expanded in

Chapter 2 "Water and Soil". This is fundamental for better defining the stringent connectivity between hydrology and biology (primary and secondary gradients) and is necessary to enable a more complete understanding of the functioning of wetland ecosystems.

The following Chapter on "Microorganisms and Invertebrates" remains a solid part of the book. More emphasis has been put on the uniqueness and diversity of organisms in wetlands. Table 3.1 shows the major assemblages of microbiota in wetlands. Table 3.2 shows the different adaptation approaches used by aquatic invertebrates for feeding, outlining the unique nature of biota in these environments. This chapter further benefits from a refined description of mycorrhizae in wetlands and their role under different trophic conditions.

Chapter 4 "Wetland Plants and Animals" also remains solid and engaging. Table 4.2 is a nice addition delineating the pathways of adaptation of various macrophytes to flood conditions across a gradient of plant types (submersed to free-floating and emergent). This remains a pivotal feature for defining wetland resilience to disturbances. The most important traits of wetland plants, namely, aerenchyma systems, tolerance to soil toxins and barriers to radial oxygen loss from roots are clearly summarized. Further discussion of additional adaptations such as anatomical, morphological and physiological and primary characteristics that enable certain plants to survive flooding are critical (heterophylly, vegetative or clonal growth ect.) (see Helophytes, Box 4.1). Concepts of clonal growth are well linked to Chapter 7 regarding invasive species.

Spatial and temporal patterns and processes are central to most ecological systems. In Chapter 5, Van der Valk addresses spatial patterns at multiple scales and looks at the importance of drivers at each scale. At a large regional scale the patterns (composition and distribution) are dependent on connectivity with other wetlands, evolution, migration and climate. At the fine and local scale, patterns are governed by water depth and competition. At plant level, population responses create 3 types of change: Maturation; fluctuation; and micro-succession. These concepts are discussed both within wetland landscapes and across wetland types. The author also outlines autogenic versus allogenic induced changes and the importance of these distinctions for invasive species.

Succession in ecology remains at the core of ecological science. This chapter clearly discusses the difference in micro- and macro- succession of temporal patterns with long-term, often permanent, changes related to macro-succession and short term changes (that can co-occur with macro-succession) of potentially reversible situation caused by environmental conditions such as wet-dry cycles. This probes current thoughts regarding how to better capture and model the lag effects and timing in ecological processes. While not a new concept in ecology, the complexity of such an effect has not been satisfactorily addressed.

Chapter 6 "Wetland Functions" reflects the increased awareness of both the functions and values of wetlands and is a good introduction to the final chapter (10). Van der Valk discusses the role of algae in the net annual productivity of a wetland despite their much lower standing crop relative to macrophytes (Table 6.3) and stresses the cyclical nature (temporal) of such estimates and the interdependency of macrophytes and algae (spatial). A table with the most current figures of carbon stocks in global

wetland types would be a valuable addition here given the author alludes, in several chapters, to the relative contribution of vegetation and soils in wetlands to carbon stocks and how this ratio changes across latitudinal and trophic gradients.

The nutrient cycling section of this book remains strong. It covers enough detail for a beginner in wetland science by providing diagrams and descriptions of the main processes and organisms involved in those processes. Box 6.1, provides a good overview of basic biogeochemistry of complex oxidation-reduction processes and pathways in wetlands. In addition, Van der Valk has added a more recent but important pathway in the nitrogen cycle, ANAMMOX (Anaerobic Ammonium Oxidation to dinitrogen gas). Given wetlands experience extensive periods of anoxia, this process may prove to contribute a large portion of N₂ loss from wetlands. The section on the sulfur cycle remains somewhat underrepresented. While sulfate reduction in anoxic environments is one of the least energetically favorable pathways, the end product of hydrogen sulfide not only results in bad odors, but when accumulated it can become toxic to wetland biota and cause increased acidity in the soils and overlying water column.

The updates found in the first 6 chapters have greatly enhanced this book. While a few more recent references would have made the book even better, the author presents a compelling text book that covers the fundamentals of ecological processes and functions in wetlands.

In the last 30 years or so there has been an increased awareness about invasive species. A discussion of both plant and animal invasives and the differences between exotic and native species is presented (Chapter 7). Two theories of species invasion are put forward: landscape sink/disturbance hypothesis; and the superior competitive hypothesis. Van der Valk argues that plant invasive establishment is often the result of a disturbance, followed by the ability for an opportunist to establish and dominate which is dependent on common traits of the invasive species, such as tolerance, efficiency use, vigor, allelopathy ect.. Many recent references have been included that are related to specific traits in plants. Several examples of animal invasives are also discussed and the author clearly shows that animal invasives do not necessarily require disturbances in order to become established.

The impacts that invasives have on wetlands range from partial to complete destruction of a wetland ecosystem, to creating fundamental changes in wetland functions (i.e. to form monotypes which alter habitat structure and lower biodiversity, change nutrient cycling, change productivity and alter food webs) are captured. Some approaches to control invasive species are presented and the limited success and often limited resources and inefficiencies of current chemical, mechanical and biological eradication approaches are well discussed.

The perception of invasives may be changing. When is a native invasive considered an invasive versus simply a form of ecological succession that is better adapted to current environmental conditions? As long as wetlands can perform certain functions and maintain a given value, the author suggests that managing the co-existence of native and invasive species or keeping invasives completely out may be a better use of

resources rather than trying to eradicate the problem once established. This is revisited at the end of Chapter 10.

Due to the history of wetland loss and consequent protection laws, wetland restoration and creation has become a large focus of current land management, conservation and research initiatives. A majority of these initiatives fall under either historical restorations, which aim to re-establish previously existing plants, or functional restorations which attempt to establish wetlands that can provide a desired service. Given the numerous multitudes of approaches that can be used to restore and create wetlands and their site specificity, the author exemplifies two case studies with different planning and implementation approaches (Chapter 8).

This chapter encapsulates previously discussed issues concerning plant succession, and notes that restoration and creation of wetlands could be in fact envisaged as a form of direct succession. However, caution is required since invasives may quickly become dominant in restoration/creation projects. Van der Valk weighs on the fact that establishing the desired conditions is often the most difficult and uncertain part of restoration and creation projects and detailing the success of such requires a period of monitoring and assessment.

Wetlands play a vital role in global climate change and the global carbon budget due to both their high carbon sequestration rates (15-33% of global carbon stocks) and emissions of carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O). Despite the relatively small coverage of wetlands globally (~3%), the impact of global climate change may alter their roles and functions. With a continued focus on the biology of wetlands, the author appropriately addresses both the direct (temperature, precipitation and atmospheric CO₂ concentrations) and indirect (e.g. hydrology and sea level rise) effects of climate change on species composition, migration and extinction. The latter part of the chapter neatly summarizes these concepts by looking at two case studies (Prairie potholes and the Louisiana coastal marshes) and details the changes in wetland habitat quality.

The final Chapter "The Value and Future of Wetlands" provides a good summary of the book, by bringing together concepts from each chapter. A clear definition of functions (ecological functions), services (economic functions), and values of wetlands is provided. Table 10.1 summarizes these concepts and presents applicable valuation and assessment methods used to define these. This is critical for placing wetlands and their conservation and protection within the context of economic services by stressing the true societal and economic values they provide. A list and brief discussion of major U.S. and foreign legislation and its impacts on wetlands is also provided.

Van der Valk attractively summarizes "The main goal of the 'wise use' of wetlands is to allow their sustainable utilization ... for the benefit of people in a way that is compatible with the maintenance of their ecological character." The future of wetlands will depend on both management approaches and economic growth. Van der Valk provides a unique and detailed look at wetland functions and services. This book is an excellent starting point for developing such understanding and is accessible to undergraduate and beginning graduate students, land managers and any person interested in furthering their knowledge of these complex but compelling ecosystems.



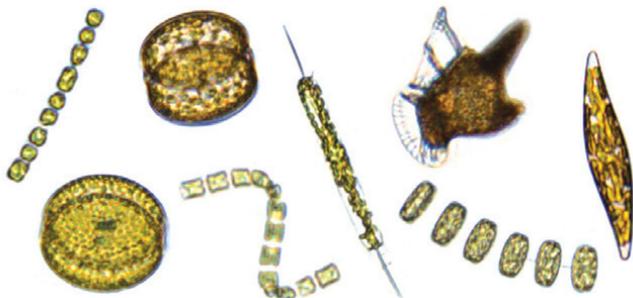
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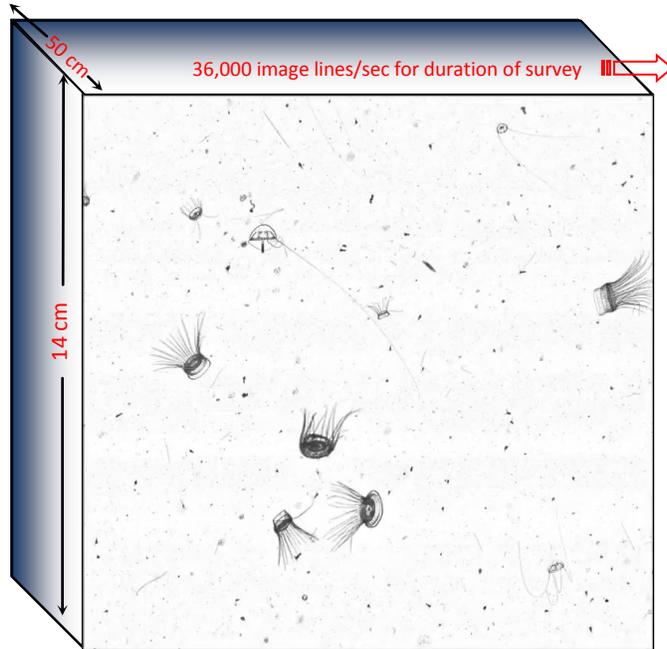
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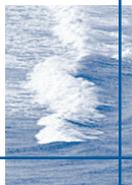
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