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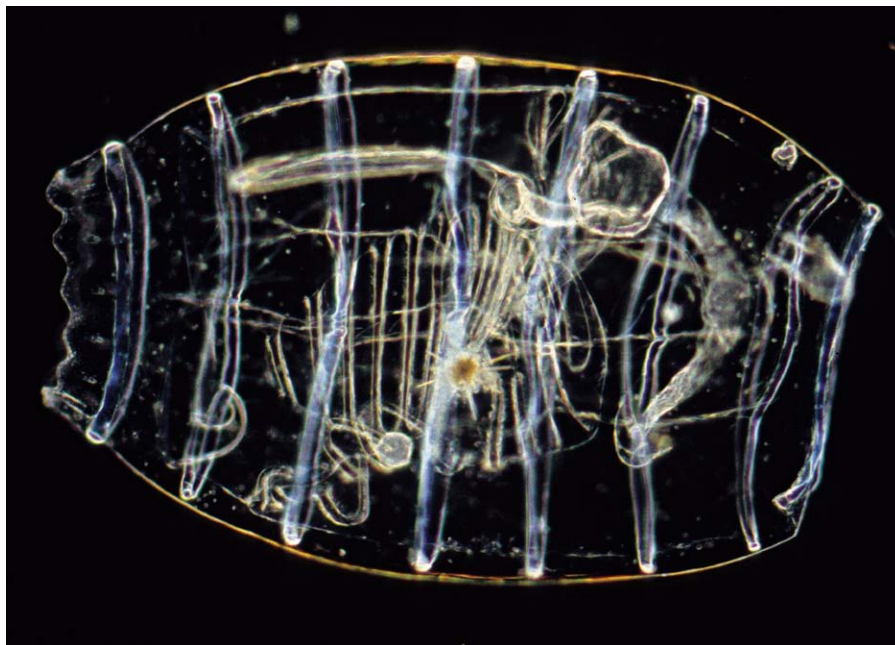
LIMNOLOGY AND OCEANOGRAPHY BULLETIN

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ABOUT THE COVER IMAGE

Doliolum nationalis, a gelatinous zooplankter. Read about the changing roles of gelatinous zooplankton in the emerging issues section. (Image by Albert Calbet.)



SPECIAL SECTION: ASLO EMERGING ISSUES WORKSHOPS

Allochthonous and Autochthonous Contribution to Consumers	34
Role of Aquatic Networks in the Boreal Carbon Cycle	36
The Microbial Carbon Pump	37
Implications of Increased Carbon Supply for the Global Expansion of Jellyfish Blooms	38
Integrating Terrestrial and Aquatic P Science	39

ARTICLE

Why doesn't the public accept scientific consensus (a.k.a. "Why won't they listen to us?") by A. Sponberg	40
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ASLO NEWS

2011 Election Results	42
Message from the President	42
Message from the Business Office	43
Message from the Public Affairs Office	44
<i>Limnology and Oceanography:</i> <i>Fluids and Environments</i> publications now online!	45
Outstanding L&O Reviewers: A. Folkard and J. Kostka	45

MEETING HIGHLIGHTS

ASLO-Biwa Summer Meeting on track for 8-13 July in Otsu, Japan	46
Student Activities at the 2011 Aquatic Sciences Meeting	47
Student Presentation Award Winners: 2011 Aquatic Sciences Meeting	47
2012 Ocean Sciences Meeting Plenary Speakers Announced	48

MEMBER NEWS

John Smol receives <i>Nature</i> award for mentoring	49
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BOOK REVIEW

"The Algal Bowl, Overfertilization of the World's Freshwaters and Estuaries" reviewed by L. Schaffner	49
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The Limnology and Oceanography Bulletin

The American Society 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.

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SPECIAL SECTION - EMERGING ISSUES

WHAT IS AN EMERGING ISSUES WORKSHOP?

An Emerging Issues Workshop is a unique ASLO event connected to a special session of an ASLO meeting and takes place immediately before or after the meeting. These one or two-day workshops are meant to focus on emerging or controversial issues, and/or are designed to integrate knowledge and research across the different communities of researchers which make up ASLO. The proposers of all special sessions of the ASLO meeting are contacted and asked if they are interested in applying for workshop funding. At least one of the organizers must be an ASLO member in good standing. The proposals for Emerging Issues Workshops are reviewed by the organizing committee and co-chairs of the meeting and up to four workshop proposals are selected. The ASLO funding represents a maximum of \$20,000 US that can be distributed equally among up to four Emerging Issues Workshops for each meeting. Eligible costs may include costs of meeting rooms, and the added costs of travel, hotel and food for participants arriving early or staying late for the workshop. The workshop participants are expected to represent the demographics of ASLO and should include students and early-career scientists. The organizers of Emerging Issues Workshops agree to produce (within a month following the meeting) a summary report in a format that can be published in the *Limnology and Oceanography Bulletin*. They may be asked later to furnish a list of any publications resulting from the Emerging Issues Workshop. Ideally, a review paper should be submitted to one of the ASLO journals: *Limnology and Oceanography*, *Limnology and Oceanography: Methods*, *Limnology and Oceanography: Fluids and Environments*.

ALLOCHTHONOUS AND AUTOCHTHONOUS CONTRIBUTION TO CONSUMERS: EMERGING ISSUES WORKSHOP REPORT

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At the June 2010 ASLO-NABS conference held in Sante Fe, New Mexico, ASLO sponsored an "Emerging Issues Workshop" on the topic of allochthonous support of invertebrate and fish production in lakes, streams and estuaries. Graduate students, postdoctoral researchers, and junior and senior faculty from Hong Kong, Australia, Brazil, Canada, USA, Sweden, Finland, Austria, and South Africa participated in the workshop.

Ecologists have long been fascinated by interfaces, and the exchange of material across the aquatic-terrestrial boundary holds special interest for aquatic ecologists. Although small streams have classically been considered to be dominated by allochthonous inputs, during the last decades there has been evidence of the trophic importance of relatively small fluxes of algal production for consumers in headwater streams (Mayer and Likens 1987, Thorp and Delong 2002, Bunn et al. 2003, Brito et al. 2006, Lau et al. 2009). Conversely, a recent study conducted in several small forest lakes concluded that a relatively small flux of terrestrial particulate carbon supported $\approx 50\%$ of zooplankton and fish production (Pace et al. 2004). The goal of our workshop was to bring together the stream and lake research communities to explore the empirical support for these paradoxically diverging trends. The estuarine ecologists brought an interesting perspective to this discussion - which illustrated the need for clarified definitions within the allochthonous versus autochthonous framework.

The workshop will, we hope, ultimately produce one or more perspective papers exploring the role of allochthonous carbon in supporting higher trophic level consumers in diverse ecosystems. These analyses will take a first principles approach with an emphasis on defining the challenges and approaches utilized in investigation this topic. First, we have to consider why this topic is an important research question. It has long been known that inputs of dissolved terrigenous carbon compounds profoundly influence the chemical and physical environmental

of aquatic systems by, for example, affecting light attenuation which in turn influences where and how much primary production occurs and whether UVR will damage biota. Humic substances also modify heat retention, stratification and oxygen availability, as well as the bioactivity of certain toxic substances and bioavailability of nutrients. For reasons that are still unclear, humics may inhibit the growth of some cyanobacteria and promote the growth of other phytoplankton such as cryptomonads and especially *Gonyostomum semen*. Anthropogenic activities greatly modify watershed characteristics that affect the fluxes of nutrients and organic carbon to rivers and lakes. Research on where and how allochthony modifies aquatic food web processes will help us to better predict how climate and land use change will affect organic carbon export from watersheds to river and lakes and how this in turn will affect upper trophic level production in aquatic systems.

Our synthesis will compare the mass fluxes of terrestrial and algal basal resources across aquatic systems. Many studies have claimed terrestrial carbon inputs greatly outweigh autochthonous production in many oligotrophic lakes. However, an initial meta-analysis suggests otherwise (see Figure 1). However, a comparison of the energetic content of allochthonous and autochthonous basal resources, as well as the vulnerability of this matter to enzymatic attack by microbes and herbivore digestive systems is required. The lignocellulose that dominates the biomass of terrestrial vegetation is extremely resistant to rapid degradation, a property which may have an evolutionary basis.

Many studies have noted a large fraction of nutrient-poor lakes and streams are “net heterotrophic,” but it is currently unclear whether this classification provides insight into the basal resources that provide the energy and biochemical building blocks that support production of higher trophic levels. It is

entirely possible for the system to be net heterotrophic due to microbial respiration of terrestrial carbon inputs and still have a very large portion of fish production supported by an algae-herbivorous invertebrate pathway (Thorp and Delong 2002). Moreover, the role of organisms at intermediate trophic levels, including hetero- and mixotrophic protists, in conveying allochthonous material to subsequent consumers still remains to be elucidated. It has also been commonly concluded that terrestrially derived dissolved organic carbon is very important in the “metabolism” of aquatic systems because it is often the most prevalent form of organic carbon in these systems. But many other fields of science consider the most prevalent forms of carbon to be the least important precisely because they remain (and therefore have not been metabolized). By comparison, examining the rubbish bin at a fast food restaurant would provide an insight into what might have been consumed at that establishment, but it would also provide an even better insight into the recalcitrant forms of organic matter that fluxed through but were not consumed there. The substrates that are near or even below detection levels might be the most important for microbes in natural systems because they are being used as fast as they are being supplied.

Many methodological challenges are known and remain to be overcome. For example, it is nearly impossible to obtain a definitive measure of the stable isotope ratio of phytoplankton carbon within the seston or POM of lakes and estuaries. Various workarounds for this problem are fraught with assumptions that, if challenged, may alter conclusions from classic studies. There is a great need for transparency and established best professional practices vis-à-vis assumed parameter values in stable isotope mixing model calculations. Although stable isotopes are the most commonly used method in studies of allochthony, recently studies employing dietary biomarkers, in particular consumer fatty acid profiles, add considerably to our ability to differentiate between terrestrial and aquatic basal resources (Lau et al. 2009). Fatty acid biomarkers even make it possible to distinguish subsidies by particular algal and bacterial groups because these usually differ tremendously in their fatty acid composition. Lipid biomarkers are also promising because they provide powerful insights into the particular fatty acids that are known to be growth limiting and associated with important physiological functions in aquatic invertebrates and fish. Fish production in particular may be highly dependent on specific basal producers that synthesize biochemically high quality organic matter including large amounts of essential long carbon chain unsaturated fatty acids. All carbon is not created equal, and specific biochemicals synthesized by particular primary producers may have an inordinate influence on the productivity upper trophic levels.

Terminology can become confused depending on how ecosystems are delimited for study. Estuarine ecologists note that in their systems allochthonous inputs of freshwater riverine diatoms are likely a very high quality

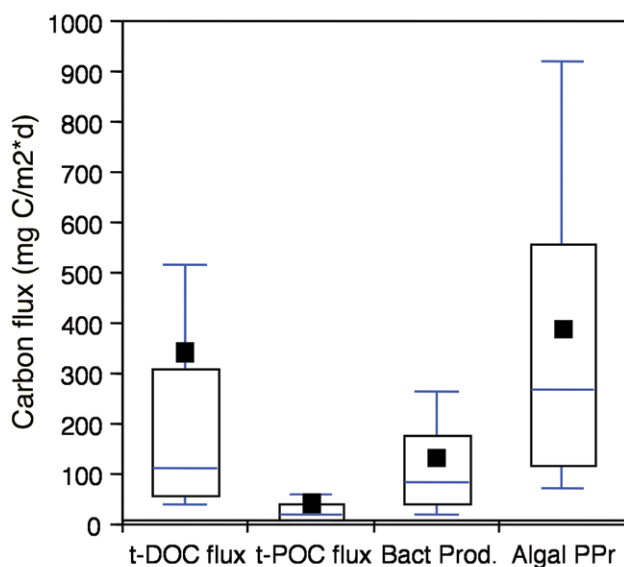


Fig. 1. A compilation of carbon flux values for oligotrophic and mesotrophic lakes from various sources. The t-POC flux was calculated as the mean \pm SD of observed eolian fluxes plus 10% of the t-DOC flux. The bacterial production was calculated relative to algal primary production.

basal resource whereas autochthonous *Phragmites* and *Spartina* production are most likely very poor quality. Similarly, salmon nursery streams often have very productive fisheries not because they are usually located in forests and receive large leaf litter inputs, but because allochthonous salmon eggs and flesh from marine sources are directly consumed by invertebrates and especially juvenile fish in these systems. These observations clearly show it is not the label that we associate with a particular basal resource that matters, but its biochemical composition. There is still much we do not know about allochthonous subsidies to consumer production in aquatic food webs and considerable need and opportunity for innovative field and laboratory studies. By adopting a broad first principles based approach, we hope our synthesis will lead future investigators to explore novel and provocative hypotheses. Hopefully we will understand this topic in far greater depth one decade from now than we do today.

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ROLE OF AQUATIC NETWORKS IN THE BOREAL CARBON CYCLE: EMERGING ISSUES WORKSHOP REPORT

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An ASLO-sponsored Emerging Issues Workshop on the Role of Aquatic Networks in the Boreal Carbon Cycle was held at the Puerto Rico Convention Center prior to the 2011 Aquatic Sciences meeting in San Juan, PR, in February 2011. The two-day workshop included boreal aquatic scientists from six countries, constituting a wealth of expertise in physical, chemical

and biological processing and storage of carbon in inland waters, greenhouse gas exchange, remote sensing, and the geographic distribution and areal coverage of inland waters. Over the course of the workshop, all participants had the opportunity to discuss regional integration of their research in the context of the boreal carbon cycle. Most also presented their more specific research findings in the associated session S46: The Role of Inland Waters in the Carbon Cycle of the Boreal Forest Biome, held at the ASLO conference later in the week.

There is increasing awareness and recognition of the global importance of inland waters as integrators of landscape and climate features, processors of carbon (C) in the landscape, sinks and sources of atmospheric C, and in the delivery of C to oceans. These roles are especially profound in boreal regions characterized by high aquatic surface coverage, complex interconnected hydrological networks, and local areas of organic permafrost susceptible to thaw. The workshop explored current research on boreal aquatic biogeochemistry and its importance in the context of the regional C cycling. Assessing the importance of aquatic biogeochemistry in the boreal C cycle involves interpreting information from a multitude of diverse inland waters, scaling this in space and time, and quantifying its regional importance. All of these steps represent major challenges. Recent evidence also suggests that boreal aquatic networks exhibit overall patterns in C processing that cannot be directly derived from their individual components, so integration of studies and of research results at multiple scales is of utmost importance. Recognizing the challenges, discussions centered around four general topics:

- 1) *Mechanisms underlying major biogeochemical processes.* Topic one discussions addressed Dissolved Organic Carbon (DOC) bioavailability, photoreactivity, other DOC decay mechanisms, and the spatial heterogeneity of metabolic processes within and among lakes.
- 2) *Patterns and regulation of aquatic carbon dioxide and methane exchange with the atmosphere.* The second topic discussion subjects included the build up of greenhouse gases under ice in winter, and subsequent release in spring time; the role of boreal lakes in the mineralization of terrestrial organic carbon; water column respiration; and scaling of physical and geochemical controls on greenhouse gas exchange.
- 3) *Patterns and regulation of aquatic C storage:* The C-storage topic included discussions of the links between sediment metabolism and carbon storage in lakes; spatial patterns of C accumulation and long-term accumulation rates; and relations among water chemistry, lake morphometry, land use and land cover, and climate in lake C accumulation.
- 4) *Patterns of aquatic C cycling across the boreal landscape:* Discussion addressed issues such as DIC cycling and transport by large river basins; effects of landscape position on C cycling and carbon gas emissions; the abundance and distribution of lakes, rivers, and streams; and remote sensing applications to understanding boreal aquatic C cycling were discussed in this topical session.

The ASLO-sponsored workshop was part of the ongoing activities of the International Federation of Aquatic Boreal Research (IFBAR), an initiative that was launched by the workshop organizers in 2010 to facilitate communication and collaboration between international research groups working in aquatic biogeochemistry across the boreal biome (for more information please contact del_giorgio.paul@uqam.ca). The EIS workshop was successful in bringing a diverse group of aquatic scientists together to focus on boreal aquatic ecosystems and in building new collegial relationships among participants. Workshop attendees left with a mission to organize and publish these results in a review paper in *L&O* on The Role of Aquatic Networks in the Boreal Carbon Cycle and in a series of papers in a special issue of *Global Biogeochemical Cycles*. The goal is to have this special issue published by the end of 2012.

THE MICROBIAL CARBON PUMP: EMERGING ISSUES WORKSHOP REPORT

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The ASLO Emerging Issues Workshop on the Microbial Carbon Pump, in conjunction with the second meeting of the Scientific Committee for Oceanic Research (SCOR) working group (WG134), was held in Puerto Rico February 19–20, 2011. This

event was associated with the ASLO special session S55 on “The Microbial Carbon Pump: A multidisciplinary focus on origins, cycling and storage of dissolved organic carbon (DOC) in the ocean.” Forty scientists and students (including the working group members) from 12 countries attended the workshop.

Marine DOC, equivalent in quantity to the total amount of carbon in atmospheric carbon dioxide, is an important component in global carbon cycling and climate change. The majority of DOC in the ocean is recalcitrant, with an average age of ~5000 years, constituting sequestration of carbon in the ocean. However, the mechanisms controlling the generation and removal of the recalcitrant DOC (RDOC) are largely unknown. The SCOR working group members had previously illustrated the Microbial Carbon Pump conceptual framework in an article in *Nature Reviews Microbiology* (Jiao et al. 2010) and referred to in *Science* as an “invisible hand behind a vast carbon reservoir” (Stone 2010).

The ASLO-sponsored workshop focused on round table discussions on the following topics: 1) The biological origins of persistent DOC and its relationship with the recalcitrant DOC (RDOC) pool, 2) Analytical approaches to identification and quantification of the sources, sinks, and structural characteristics of RDOC, 3) Characterization of major fractions of DOC, 4) Supply of DOC from seabed seepage, and 5) GeoChips based high-throughput monitoring of C cycling related genes.

There was an important discussion on the nature of biologically resistant dissolved organic matter and the marine RDOC reservoir because biologists and geochemists have different understandings and views e.g., on the time scales of RDOC production. Another issue raised was how much of the DOM that is transformed by the microbial community becomes



Forty scientists and students (including the working group members) from 12 countries attended the ASLO Emerging Issues Workshop on the Microbial Carbon Pump, in conjunction with the second meeting of the Scientific Committee for Oceanic Research (SCOR) working group (WG134).

finally recalcitrant compared to the total. Another discussion addressed the contribution of fossil DOC and how far this is important for the understanding of the age of RDOC. An exchange followed about analytical approaches that are required to identify and quantify the sources sinks and structural characteristics of RDOC.

As outputs, we are planning a booklet on the Microbial Carbon Pump to be published by the Science /AAAS Business Office in May 2011, which will include 10 previously published *Science* papers covering the topics of microbial control of oceanic carbon flux, production of RDOC by bacteria, chemical characteristics of DOC, community genomics of microbial assemblages, and radiocarbon ages of organic compounds; and 10 new articles by the WG134 members addressing the following subjects: 1) Biological carbon sequestration and carbon fixation, 2) The effects of bacterial activity on DOC composition, 3) The recognition of functional bacterial groups as energy and carbon sources, 4) Bacterial respiration of DOC under changing environmental conditions, 5) Viral-lysis mediated redistribution of DOC, 6) Linking DOC export from the euphotic zone to microbial community structure, 7) Molecular characterization of DOC and constraints for prokaryotic utilization, 8) Spectroscopic characterization of DOC and 9) Application of GeoChips in monitoring carbon cycling and mechanistic modeling of DOC degradation. In addition, a special section on the Microbial Carbon Pump in *Applied and Environmental Microbiology* will be published in mid-2011, and a review paper in *Limnology and Oceanography* addressing the origins of RDOC, DOC fractions and their reactivity, and analytical characterization of RDOC will be completed later this year.

To progress research addressing the Microbial Carbon Pump, joint cruises along environmental gradients will be proposed, typical areas are the West Pacific Warm Pool and the Arctic regions. Research proposals are currently being prepared for the UK Natural Environmental Research Council and the Chinese Ministry of Science and Technology. If funded, these would request IMBER endorsement. A research project under the PIRE/Dimension programs has been submitted to the National Science Foundation of USA. If funded, these platforms will further promote exchanges and collaborations across disciplinary, organizational, institutional and geographic boundaries.

The next WG134 workshop addressing microbial transformation of DOC will be held in conjunction with the ISME conference in Copenhagen in 2012, and we are also planning to hold a session within the next IMBIZO conference. For more information about the SCOR WG134, visit the SCOR website or WG134 website at: <http://mme.xmu.edu.cn/mcp/eindex.asp>.

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IMPLICATIONS OF INCREASED CARBON SUPPLY FOR THE GLOBAL EXPANSION OF JELLYFISH BLOOMS: EMERGING ISSUES WORKSHOP REPORT

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Jellyfish, also known as gelatinous zooplankton including cnidarian medusae, ctenophores, and pelagic tunicates, appear to be increasing in numerous locations around the globe, often with dramatic consequences for ecosystems and human activities. Not all jellyfish populations will respond to global changes in the same way, so understanding the mechanisms involved in these changes is of paramount importance. Prior to the ASLO Aquatic Sciences Meeting in San Juan, Puerto Rico (13-18 February 2011), a group of scientists from diverse disciplines, including many from the National Center for Ecological Analysis and Synthesis (NCEAS) Jellyfish Working Group, met to discuss the

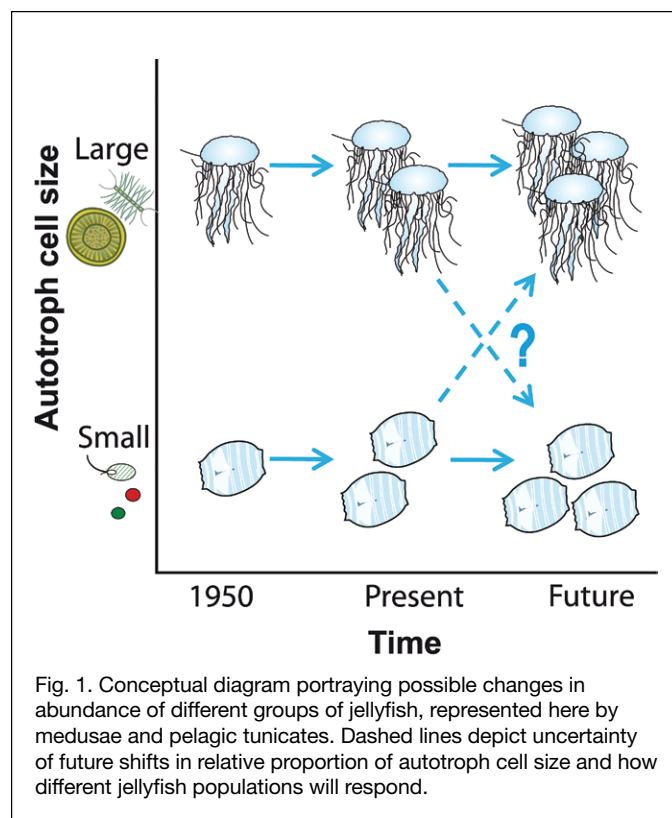


Fig. 1. Conceptual diagram portraying possible changes in abundance of different groups of jellyfish, represented here by medusae and pelagic tunicates. Dashed lines depict uncertainty of future shifts in relative proportion of autotroph cell size and how different jellyfish populations will respond.

implications of changing oceanic productivity and the associated effects on global jellyfish populations. The motivation for the emerging issue workshop was to address the growing body of evidence that suggests phytoplankton biomass and rates of primary production are shifting in response to climate change and how such changes might affect gelatinous zooplankton (Moline et al. 2004; Richardson and Shoeman 2004; Montes-Hugo et al. 2009). The primary product of the workshop will be a contribution on the topic for submission to *Limnology & Oceanography*.

Initial discussions revolved around the 'desertification' of open ocean biogeographical provinces (e.g., the expansion of oceanic gyres), the expected shift to phytoplankton communities dominated by small cells, and the increased importance of the microbial food web (Polovina et al. 2008; Moran et al. 2010; Sarmento et al. 2010). These changes may favor organisms such as pelagic tunicates (e.g., larvaceans and thaliceans) that can effectively feed on a wide range of prey sizes (>0.1 – $1000\ \mu\text{m}$) (Flood and Deibel 1998; Sutherland et al. 2010). The topic of our discussions quickly evolved to include other regions of the marine environment, such as continental margins and edges of oceanic gyres (including high latitudes), and the predicted effects of ocean warming on other types of jellyfish, such as scyphozoans and ctenophores. The complexity of the discussion underscored the need to reassess conceptual models of how various bottom-up processes affect different types of jellyfish, which are often grouped based on taxonomy. It became apparent that we needed to explore groupings of jellyfish from a functional perspective rather than a taxonomic one. To achieve this, we examined similarities and differences in a wide variety of categories such as diet, metabolic demand, reproductive strategy, life history, etc. using representative taxa.

After coming to a consensus regarding the definitions and characteristics of functional groups of jellyfish, we began to evaluate their integration and compartmentalization in conceptual food webs based on two established models – Thingstad et al. (2008) and Parsons and Lalli (2002). Parsons and Lalli (2002) suggested that changes in the composition of primary producer communities affect jellyfish differently than fish. However, not all jellyfish are expected to respond to changes in the food web in the same way. Advances in research on jellyfish are revealing that the trophic linkages between primary producers and jellies are more complex than previously thought. For example, the scyphozoan medusae *Catostylus mosaicus* satisfies $>87\%$ its daily carbon requirement consuming large ($>5\ \text{mm}$), emergent zooplankton like *Lucifer* sp. instead of small copepods (Pitt et al. 2008). This represents a challenge that this group will continue to address – how to integrate our newly defined functional groups of jellyfish into an updated conceptual framework of the linkages between trophic levels.

It is clear that climate change will affect regional and global primary production, which in turn will impact other organisms that compete for resources. The mechanisms involved and the transitional processes leading to different production regimes, however, are less explicitly understood. As we delve into new hypotheses regarding these linkages, we will examine these ideas in the context of published case studies and datasets from a variety of ecosystems around the globe. Ultimately, we hope that

our multi-disciplinary approach will help to develop a deeper understanding of the relationships involved when considering carbon flows to jellyfish and other consumers, from which future hypotheses, models, and research will benefit.

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INTEGRATING TERRESTRIAL AND AQUATIC P SCIENCE: EMERGING ISSUES WORKSHOP REPORT

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Understanding the biogeochemical cycling of phosphorus within both terrestrial and marine ecosystems is critical for answering a suite of questions that range from eutrophication to climate change. Yet the dynamic interplay between these systems has been difficult to assess. One source of difficulty is that soil and aquatic scientists studying P inputs and cycling use disparate terminology, and their research programs often

have dissimilar objectives. Furthermore, terrestrial and aquatic scientists rarely attend the same meetings to discuss their research, so a cohesive message for decision-makers has never been developed. Regulatory decisions are usually based on water quality measurements, and the link between soil P management and downstream water quality is difficult to quantify. In light of this, the objective of this emerging issues workshop was to bring together soil, freshwater and marine scientists to initiate a dialogue about the similarities and differences in P-related issues within each discipline. Organized by Barbara Cade-Menun (Agriculture & Agri-Food Canada), Thad Scott (University of Arkansas) and George Bullerjahn (Bowling Green State University), the emerging issues workshop was held following the 2011 winter ASLO meeting, which contained a week filled with P presentations, including two P-focused scientific sessions.

The workshop was attended by 35 scientists from throughout North America and Europe, ranging in experience from beginning students to senior scientists. The day began by dividing into disciplinary groups (oceans, freshwater, terrestrial); each group was then asked to describe the P-related issues in their discipline and their perception of the role of other disciplines (e.g. agriculture) in their discipline's P issues. These small group discussions were followed by five oral presentations that centered on P in different ecosystems: 1) The oceans by Adina Paytan, University of California at Santa Cruz, 2) Freshwater lakes and watersheds by Pete Richards, Heidelberg University, Ohio, 3) Streams and rivers by Helen Jarvie, Center for Ecology and Hydrology, United Kingdom, 4) Wetlands by Curt Richardson, Duke University, and 5) Soil and agricultural by Andrew Sharpley, University of Arkansas. Following the presentations, the small groups reformed by discipline to discuss any changes in their thoughts or perceptions of P issues based on the presentations. The morning closed with each group presenting the notes from their small groups to the entire workshop group, followed by more discussions. The lunch break allowed mingling and conversation across disciplines. The afternoon alternated between small group (again grouped by discipline) and whole group discussions. The general focus for the afternoon discussion was: What are the big questions remaining for P research in your discipline? Other discussion topics for the afternoon included addressing policy/monitoring concerns, ways to continue interdisciplinary discussions on P in the future, and possible sources of interdisciplinary funding for collaborative research projects.

Four key points emerged from the workshop discussions:

- 1) There were common themes in the presentations from the distinct disciplines concerning sources of P, delivery, and bioavailability.
- 2) Regardless of the system (marine, freshwater, terrestrial), high spatial and/or temporal variability in P exists. All disciplines noted that P may be in excess in some locations and limiting in others; a single P concentration may indicate limiting or excess P in different environments or under different conditions, making it difficult to determine a single concentration value to use for management.

- 3) Among the disciplines, there are methodological strengths and weaknesses. There are good, well-established methods to determine total P and available P (with definitions of "available" varying among disciplines). All disciplines also have fractionation schemes to separate P in sediments/particulates/soil into various P pools. However, the definition of these P pools varies among disciplines, and the fractionation methods are more chemically rigorous in some disciplines than others. No equivalent fractionation scheme exists for dissolved P. There has been a more wide-spread use of ^{31}P -NMR spectroscopy in soil science to characterize P forms than in other disciplines, so there is a better understanding of organic P forms in terrestrial systems than in the aquatic disciplines. Marine scientists are more advanced in their use of ^{18}O as a phosphate tracer than other disciplines, especially soil science.
- 4) There are different factors driving P research among disciplines. In freshwater and terrestrial systems, management drives P research, while marine systems are less concerned with management, and focus more on pure research.

While the biogeochemical cycling of P is complex and continues to be an important issue in both aquatic and terrestrial disciplines for a variety of different reasons, there was consensus among all attendees that there is a need for interdisciplinary, collaborative research projects and regular interdisciplinary meetings or workshops, to develop a comprehensive scientific framework for understanding and managing sources and cycling of P and potential impacts on all types of aquatic ecosystems.

WHY DOESN'T THE PUBLIC ACCEPT SCIENTIFIC CONSENSUS? (AKA "WHY WON'T THEY LISTEN TO US?")

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

As President Obama took office in 2009, the scientific community was full of optimism. Obama vowed in his inaugural address to "restore science to its rightful place." His Cabinet appointments were consistent with that pledge: he appointed renowned scientists to head the Department of Energy and the National Oceanic and Atmospheric Administration. He also established a new post of climate advisor within the White House, to be filled with a veteran administrator of the Environmental Protection Agency. At the other end of Pennsylvania Avenue, both houses of Congress had climate change legislation high on their priority list. It appeared that the debate over whether the climate was changing had finally been settled, and the conversation was moving to the next step: how to halt or reverse the trends.

In the span of two years, however, everything has changed. The American Congress is once again debating whether climate

change is real or as Senator Inhofe put it, “the greatest hoax perpetrated on the American people.” The House passed a budget for FY2011 that would have eliminated funding for many climate science programs, including the IPCC. The decrease in public concern over climate change isn’t a solely American trend. A 2010 poll by the BBC found that climate skepticism was on the rise in the UK as well.

What happened? The scientific evidence for climate change has not eroded in two years, if anything it has gotten stronger. The scientific community has provided reams of data showing evidence of climate change. Lauded experts have testified and written numerous public letters about the reality of climate change. So why doesn’t the public believe the science?

Talking with ASLO members, it’s clear that there’s a sense of frustration in our community regarding the public’s lack of acceptance of scientific consensus regarding climate change. Perhaps even more disturbing, the problem goes deeper than a lack of acceptance: an active – and loud – contingent of climate skeptics denounce the scientific evidence as false and accuse scientists as having an agenda and seeking to deceive the American public. The widely publicized stolen emails from the University of East Anglia in the UK – “Climategate” – created tangible ammunition for those arguing that climate scientists’ claims were driven as much (or more) by agenda than data. The negative effects of Climategate on public opinion were significant: polling data showed a ten-point drop in trust in scientists between 2008 and 2010 (Leiserowitz et al *working paper*). (The silver lining is that scientists still remain the most trusted source of information about the climate.)

While we’ve all got our theories as to why the public doesn’t believe in climate change, social scientists have actually tested some of them. Earlier this year, I attended a meeting for scientific societies to discuss how we can better communicate climate science to the public. As part of this meeting, a panel of social scientists spoke about research regarding public acceptance of scientific consensus. Their research provides a lot of insight into why our current approach is failing. In a nutshell, we’re forgetting that the information we’re sending out is being processed by humans, not computers. And those humans have values and ideals that alter their perception of “scientific fact.” Dan Kahan of Yale Law School is part of a team of social science researchers who study the phenomenon of “cultural cognition,” which he defines as “the influence of group values — ones relating to equality and authority, individualism and community — on risk perceptions and related beliefs” (Kahan et al 2011). In a widely circulated opinion piece in *Nature* (Kahan 2010), Kahan explains “people find it disconcerting to believe that behavior that they find noble is nevertheless detrimental to society, and behavior that they find base is beneficial to it.” He notes that people who value economy and commerce, for instance, “tend to dismiss evidence of environmental risks because the acceptance of such evidence would lead to restrictions on commerce and industry.” This behavior works in the reverse as well; researchers have found that people who are more “communitarian” and who are “suspicious of commerce and industry” – are less likely to participate in an activity that benefits the environment (something they would consider “noble”) if they are told it will save them money (something they would consider “base”).

The cultural cognition group has conducted a series of studies gauging how the public perceives scientific information, and in the process, they’ve nearly debunked the myth that a “scientific illiterate” populace is to blame. Their research shows that the more scientific literacy people have, the more polarized they are in their conclusions. Another disturbing finding of the group was that people’s acceptance of the executive summary of the Intergovernmental Panel on Climate Change (IPCC) report varied based on what recommendation they were shown along with the summary (i.e., people were less likely to accept the key findings if the recommendation to reduce greenhouse gas emissions was the recommendation shown to them.)

The researchers also found that the messenger may be as – if not more – important than the message: if the “expert” presenting the information is someone the individual feels holds their same values, respondents are more likely to believe them (Kahan et al 2011). The crux of the issue, according to Kahan, is that people will “maximize the state of belief that makes their life go well.” For instance, for someone living in a very conservative neighborhood, dismissing climate change makes their social life simpler. This trend is one reason climate science needs a new set of “spokespeople” and why the unusual suspects such as religious leaders could be key to swaying public opinion on climate science.

Just because some segments of the public don’t identify with scientists, does not mean the community should give up, however. While we are unlikely to change people’s values and intrinsic beliefs, Kahan says scientists should continue to engage the public and “find a way to talk about it that doesn’t threaten them.” Kahan also believes timing can play a key role: he says the scientific community needs to get the messages out to the public *before* pre-conceived notions (often times marketed to the public by interest groups) can be formed by the public.

That said, the panel didn’t think it was too late for climate change and emphasized that carefully crafted (and tested!) messages can go a long way. Given the scope of our communication problems, though, it is clear we can no longer try to solve this problem alone. Ed Maibach, Director of the Center for Climate Change Communication at George Mason University, believes the best approach is to have a trio of experts working on any form of public communication – the climate scientist (the content expert), a decision scientist (to advise on how the public will react to messages and test audience response to the message), and a communication specialist (to package and distribute the message to the appropriate audiences).

To some of you, this may seem a bit much. After all, data is data and data doesn’t lie, right? Scientists shouldn’t need to “spin” or “package” the data; it should speak for itself. For many years, the scientific community’s approach to communicating science to the public has focused on putting more and more data in front of the public: send more experts to testify before Congress, write more letters to the editor of big publications, and get more publicity around scientific reports and assessments. The rationale is that eventually the mound of evidence will be so large, they will *have* to believe it. While these are all valuable – and necessary – activities, the studies presented by social scientists suggest that quantity of evidence may not really matter

when it comes to swaying public opinion. Even more disturbing, drowning the public with evidence, may polarize the issue even further (Kahan 2010).

So where do we go from here? As with many problems, the first step is acknowledging there's a problem. The more natural scientists that are aware and cognizant of the social science research regarding how the public perceives scientific information, the more scientists will realize the utility and value of putting more effort and resources (including bringing in communication experts) into how we present data to the public. Given the dire warnings we issue to the public regarding climate change, it may be time for our community to put our money where our mouth is and start investing in the research and resources that will solve the climate change communication crisis. If we've learned nothing in the last two years, we now know how critical public opinion is to addressing environmental issues.

(Note: I'm unable to do full justice to the many experiments and conclusions reached in the studies referenced, so I highly recommend reading them as well as other papers and reports posted by the Cultural Cognition Project (<http://www.culturalcognition.net>) and the Center for Climate Change Communication (http://www.climatechangecommunication.org/resources_reports.cfm). These papers would make for a lively discussion at your institution's journal club or equivalent.)

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- A. A. Leiserowitz*, E. W. Maibachb, C. Roser-Renouff, N. Smitha, E. Dawsonc Climategate, Public Opinion, and the Loss of Trust. A working paper; available online at: http://www.climatechangecommunication.org/images/files/Climategate_Public%20Opinion_and%20Loss%20of%20Trust%281%29.pdf

ASLO NEWS

ELECTION RESULTS

The results of the 2011 election are in! Congratulations to the newest members of the ASLO Board: Paul Del Giorgio and Anya Waite (members-at-large) and Allison Fong (student representative). Paty Matrai was re-elected as ASLO Treasurer

The membership voted to approve the change of ASLO's name to the Association for the Sciences of Limnology and Oceanography.

The proposal to change the early career committee from an ad hoc to standing committee was approved.

The changes in wording regarding the elections to clarify the number of candidates on the slate was approved.

MESSAGE FROM THE PRESIDENT

Deborah A. Bronk, Dept. Physical Science, Virginia Institute of Marine Sciences, The College of William & Mary, Gloucester Point, VA USA; bronk@vims.edu



As we watched the tragedy unfold in Japan our thoughts have been with our friends and colleagues there. The news to date has been good with our members safe and accounted for. We continue to pursue ways the society can assist our colleagues in the aftermath of this tragedy and welcome suggestions from our members. We further encourage members who wish to help to donate to the Japanese Tsunami Relief Fund

coordinated by the Consortium for Ocean Leadership (<http://www.oceanleadership.org/2011/tsunami-relief-fund/>).

Initially the Board was concerned that the planned meeting in Lake Biwa, Japan in summer 2012 would be too much of a burden for the planners there. As you can see from Warwick Vincent's report in this issue (See Page 46), however, the meeting committee is more excited than ever about ASLO's arrival!

In publication news, ASLO's newest addition to our portfolio of journals, *Limnology & Oceanography: Fluids & Environments*, is up and running under the capable leadership of Joe Ackerman! The content is free to members, so check it out at <http://www.aslo.org/lofe/>. Read more about *L&O:F&E* on Page 45.

In other publication news, ASLO has been approached by a number of institutions that wish to purchase a single subscription for multiple campuses. Our current policy is one campus for one subscription but the Board is undertaking an evaluation of how other publishers deal with this issue and what the economic ramifications are for altering our current policy. Stay tuned!

ASLO has also been looking for ways to network with scientists in developing countries. Along these lines ASLO now offers reduced membership fees and meeting registration fees for people in non-OECD countries. Help us get the word out!

One new activity that the Board is undertaking is a more organized approach to document storage and archiving. Webmaster Paul Kemp developed a new on-line system for the Board to use to log in documents for easy search and retrieval. We are now in the process of providing metadata for all digital documents so that they can be included in the new system. As part of this organizing activity, ASLO is pulling together boxes stored in archives at the University of Wisconsin, some that go back to the birth of the organization in the 1930s. These documents will also be cataloged, scanned, and eventually put in the same on-line repository. Eventually this repository will serve as

a valuable tool for historians interested in the development of our discipline through time.

As part of a broader economic analysis of the society for planning and fundraising purposes, the Board voted to slightly revamp our membership categories, adding three new ones—recent degree recipient, sustaining member-individual, and sustaining member-institutional. The reduced membership fee for recent degree recipients is designed to assist our student members during the potentially financially lean years after they receive their degree. The two sustaining member categories allow members and institutions that wish to support our work to do so. Look for these new categories on the 2012 membership renewals!

In closing, it is that time when the Board must bid goodbye to two of our member-at-larges—Michelle Wood and Jim Cotner. Michelle took on the monumental task of chairing the Awards Committee during a time when we conducted a complete overhaul of the awards procedures. Jim served as Chair of the very important Publications Committee. On behalf of the entire Board we thank them for all they have done for the society!

SOMETHING TO THINK ABOUT – SCIENCE IS JUST PART OF THE JOB!

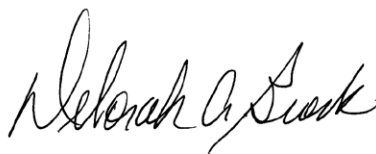
In life there are a handful of really, really big days! For someone with aspirations in academia, the day you get that phone call offering you your first faculty position is one such day! You arrive at your new institute full of enthusiasm and walk into that empty lab that you are quite sure you will be able to turn into a cutting edge facility in a matter of months. It was not too long after that point that I had the shocking realization that science was suddenly only part of the equation—I was not building a lab—I was building a business.

Researchers need money to keep their labs going – so we write proposals. We need people to help do the work – so we write job descriptions, advertise, interview, negotiate and finally hire. We need to keep everyone fed year after year so we do short-term and long-range planning. We need to keep things moving forward and copacetic so on any given day we may wear the hat of psychologist, arbiter, motivator. Those scientists working for a consulting company, NGO or agency also need these skills and in some cases more so. My question is – when in our science training do we learn to do these things? In most institutes – we don't.

I posit that this is a huge void in how we train our students because their long-term success in science is as much a function of their ability to succeed at the business of science as it is in conceiving and answering important scientific questions. I encourage everyone who is engaged in graduate education to think broadly about the full range of skills students will need and to develop courses, seminars, or informal meeting groups accordingly. Learning to effectively manage yourself and others will likely increase your scientific productivity, and it will definitely make it a lot more fun to go into work each day!

In closing I'd like to suggest a new academic tradition. As a new faculty member in your new mostly-empty lab, you will no doubt reach for something routine that should be there but is not. For me it was pH paper. All labs have pH paper! Well they

don't if you don't have the research funds to purchase it or the forethought to order it. In the spirit of the wedding shower and the bridal shower I think we should start throwing new faculty showers. Everyone can bring some "gift" from their lab, be it pipette tips, counter paper, glassware or...pH paper. You can burn through supply funds quickly when you are starting with nothing so this would provide supplies that you do not need in bulk but are useful nonetheless. It is also a great way to meet the new scientist on the block and make them feel welcome!



Deborah A. Bronk
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



Do we have a new name? Whether we are the American Society of Limnology and Oceanography or the Association for the Sciences of Limnology and Oceanography, we still will be ASLO!

What an exciting meeting we had in San Juan, Puerto Rico. Over 1700 scientists gathered to present their science—all while enjoying the wonderful culture, beautiful weather, and unique atmosphere of San Juan. A special

thank you to the committees, both scientific and local, for making this a very special and memorable meeting.

Following the journals and membership benefits, the opportunities afforded by meetings are among most important benefits of belonging to ASLO. Many ASLO meetings are already in the planning stages.

The next ASLO meeting will be the Ocean Sciences Meeting held jointly with TOS and AGU, 20-24 February 2012 in Salt Lake City, Utah. The call for sessions has been issued and will be closed by the time of this Bulletin. Abstract submission and registration opens later this summer, and the deadline for early registration and abstract submission is 7 October. Requests for auxiliary meetings and town halls are also due at that time. (Requests will be accepted based on the order of receipt, and no requests will be accepted inside of 30 days prior to the meeting.)

Emerging Issues Workshops have become an important part of ASLO meetings. Session chairs are invited to submit proposals to conduct workshops to further investigate and discuss their session's

topic. So far, ASLO has funded six such workshops and has made a commitment to continue this funding at future ASLO meetings.

Providing daycare options and grants to parents is another new ASLO initiative. Organized through the Early Career Committee and initiated in San Juan, five families used this service for a total of eight children. The children even made a flag that now hangs in the business office. See the fun activities they did at: <https://picasaweb.google.com/laurieloolala4325/20110415?feat=email#>. Please take advantage of this opportunity to bring your children and still experience the science presented at the meeting. Watch for more grant information on the next ASLO meeting Web sites.

ASLO has also launched a new journal, *L&O: Fluids and Environments*. The journal is electronic only, and best of all, free to all ASLO members. ASLO now has a wonderful bundle of journals for you. Please encourage your libraries to subscribe. Subscription to the new journal is through our partnership with Duke University Press. Information about all subscriptions can be directed to the ASLO business office (business@aslo.org)

ASLO continues to support undergraduates and minorities as well as scientists in developing countries. ASLO supports the 157 ODEC countries by offering free student membership and a \$20 membership for scientists. The memberships include on-line subscriptions. Please pass this vital information along to your colleagues in these countries and have them contact the ASLO business office about free membership.

I may sound as if I am repeating myself, but no matter the name, we are still ASLO, and we will be here for you. Enjoy your summer! See you in February in Salt Lake City.



Helen Schneider Lemay
ASLO Business Manager

MESSAGE FROM THE PUBLIC AFFAIRS OFFICE

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



It's been a busy start to 2011 for the ASLO Public Affairs Office. Below are a few of the major activities I've been undertaking on behalf of ASLO this year. As always, if you have ideas for how ASLO can help you – the members – achieve your education, policy or outreach goals, please contact me at sponberg@aslo.org.

AQUATIC SCIENCES 2011 ACTIVITIES

The flu may have kept me from personally attending the 2011 Aquatic Sciences meeting in Puerto Rico, but the show

went on! I hope many of you were able to attend some of the outreach and education-focused events at the meeting. The first event on the docket was a video-making workshop/film festival hosted by Randy Olson on Sunday. The workshop featured several short films that were submitted prior to the conference. All of the videos, as well as Randy and others' comments on the videos, can be viewed online at www.aquaticsci.net. Plans are underway to continue hosting Randy's workshops at ASLO meetings, so if you missed the one in Puerto Rico, there will be more opportunities in the future.

At the poster session on Tuesday, we tried something new and included a hands-on demo station for teaching physical concepts in oceanography. The activities were developed as part of a Centers for Ocean Sciences Education Excellence (COSEE) collaboration between scientists and education specialists, and were implemented in two undergraduate courses and in four, week-long workshops for middle- and high-school science teachers. The activities are available in English, Spanish, French and Catalan in electronic format (pdf) on the web site: http://www.tos.org/hands-on/teaching_phys.html. We've received excellent feedback from the session and plans are underway to do the activity again at Ocean Sciences 2012, so if you're looking for new ways to teach undergraduate students about physics, keep an eye out for it!

GLOBAL EDUCATION AND OUTREACH

As the board's motion to change the name of the society illustrates, ASLO is committed to serving its global membership. How we can serve our members outside the U.S. has been a constant topic of conversation since I joined ASLO ten years ago. In February, the board created an *ad hoc* committee on global education and outreach to formalize that conversation. The *ad hoc* committee, which will be chaired by Peter Williams from Bangor University, UK, is still in the embryonic stages but will examine the demography of ASLO and the activities of ASLO to see where we are succeeding – and where we could improve – in terms of serving the full membership. Your ideas and suggestions are very welcome (you can send them to Peter or me).



At the ASLO 2011 poster session on Tuesday, we tried something new and included a hands-on demo station for teaching physical concepts in oceanography. The activities were developed as part of a Centers for Ocean Sciences Education Excellence (COSEE) collaboration between scientists and education specialists.

LIMNOLOGY AND OCEANOGRAPHY: FLUIDS AND ENVIRONMENTS PUBLICATIONS NOW ONLINE!

Josef Ackerman, Editor in Chief, *Limnology and Oceanography: Fluids and Environments*; Integrative Biology, University of Guelph, Guelph, ON, Canada N1G 2W1; lo-fe-editor@aslo.org

I am pleased to report that the first articles in ASLO's new journal, *Limnology and Oceanography: Fluids and Environments* (*L&O:F&E*), are now online! We are really excited about the quality of the contributions and the diversity of subject matter that has been submitted, reviewed, and published. The key feature linking these articles is the fluid dynamic interaction with biology, chemistry, and/or biogeochemistry in an aquatic system. Readers will also note that we have published a number of articles which have used numerical methods to address these important interdisciplinary topics.

Access to *L&O:F&E* is free to all ASLO members via <http://www.aslo.org/lofe>, where you will find a bright and colourful new format with images of fluids and environments. The screen shot of the journal's homepage (Fig. 1), shows *L&O:F&E*'s masthead with tabs for accessing the current volume, editorial board, and submitting a manuscript. Submission guidelines, e-mail alerts, help, as well as links for libraries are provided on the right just above clickable logos for ASLO and Duke University Press.

The main purpose of the homepage is to present a list of recent articles and articles in production. The titles of the recent articles link directly to the articles, which appear in full text format so you can read them on any device with a web browser – a very handy feature! The article menu on the right provides the ability to search Google Scholar and PubMed, use your favorite Social Bookmarking Apps, email the article, navigate through the text, and, of course, view the PDF version. If this looks and feels familiar, it is because *L&O:F&E* is published using the Highwire platform.

A few words about the PDF version of the articles are in order. As indicated above, the format is bright and colorful with a readable font, and the frames on the page are easily changed by dragging the cursor. We have strived to help the reader with a number of features, such as having all in-text citations linked to the "Reference" section. Color figures appear throughout and are free of charge (!), which has enabled many of the authors to explain the sometimes complex nature of the results and analysis in an accessible manner. The article menu is also present.

We have also strived to make *L&O:F&E* accessible to every aquatic scientist by ensuring that the "Significance to Aquatic Environments" appears as the last section of each article. This section explains the relevance of the study without the technical terms that oftentimes discourage more general readers. I encourage all aquatic scientists and educators to read the "Significance to Aquatic Environments" section. We are also making a lay version of the abstract available on the homepage for the public and are developing mechanisms by which to distribute these to K-12 and other educators. If you have any suggestions on this process, please email me (lo-fe-editor@aslo.org).

I would like to thank all the authors, reviewers, associate editors, and supporters on the ASLO Board and at Duke University Press for their help. I would also like to encourage all potential authors to submit their best work to *L&O:F&E*. Please be sure to visit the *L&O:F&E* homepage, as we are planning a number of improvements in the future.

Cheers,
Joe Ackerman

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, each issue of the *Bulletin* will cite 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 two outstanding scientist(s).

ANDREW FOLKARD

Dr. Andrew Folkard is a senior lecturer (approx. = Associate Professor) in the Centre for Sustainable Water Management, at the Lancaster Environment Centre, Lancaster University, UK. He is an environmental hydrodynamicist, working in lake, river and coastal environments. His research interests are in two main areas: hydrodynamic transport

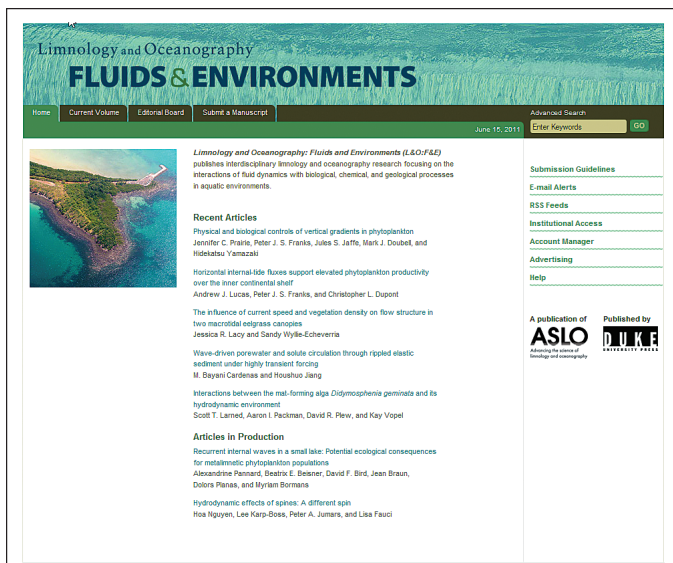


Fig 1. The *L&O:F&E* home page.

and mixing in stratified waters and their influence on nutrient pathways and plankton population dynamics; and flow-biota interactions, in particular flow interactions with seagrass, river vegetation and bivalve filter feeders.



JOEL KOSTKA

Dr. Kostka joined the Oceanography faculty at Florida State University in 1999; and he will become professor of Biology and Earth & Atmospheric Sciences at the Georgia Institute of technology in August 2011. His research focuses on the role of microorganisms in ecosystem function, especially in coastal marine environments. He has studied microbially-mediated

nitrogen removal from shallow sediments of subtropical to polar ecosystems for a number of years. Most recently, he has been studying hydrocarbon-degrading bacteria and the bacterial community response in Gulf of Mexico beach ecosystems impacted by the Deepwater Horizon oil spill. He teaches courses in microbial ecology, biogeochemistry, and oceanography. His website can be found at <http://www.joelkostka.net>.

MEETING HIGHLIGHTS

ASLO-BIWA SUMMER MEETING ON TRACK FOR 8-13 JULY 2012 IN OTSU, JAPAN

Warwick F. Vincent, Centre for Northern Studies, Department of Biology, Laval University, Quebec City, QC G1V 0A6, Canada; warwick.vincent@bio.ulaval.ca

Japan is renowned for its welcoming hospitality to visitors and the 2012 ASLO Summer Meeting at Otsu, on the shores of Lake Biwa, is shaping up to be one of ASLO's most hospitable meetings ever. It is also a chance for ASLO members to show their support to Japanese limnologists and oceanographers,

as Japan rapidly recovers from the earthquake and tsunami disaster in March of this year. I had an opportunity to call in to Japan in early April 2011 on my way back from the Arctic Science Summit Week in Seoul, South Korea, and was able to participate in one of the local organizing committee (LOC) meetings in Otsu for ASLO-Biwa. It was impressive to see the level of support for the ASLO-Biwa meeting at all levels, from the Prefecture (equivalent to State) Governor, the Mayor's office, the Oceanographic Society of Japan, the Japanese Society of Limnology, lake and ocean research institutes, and local citizens.

One of the first items on the LOC agenda was setting dates for the many excursion options that have been organized for the meeting. These range from walking tours of beautiful Kyoto (15 minutes by train from the conference venue) and daily boat excursions to the Biwa-ko Museum dedicated to ancient lakes of the world, to a tasting tour of Lake Biwa's famous sake breweries, planned (thoughtfully!) to take place after the final science sessions on Friday. The LOC has reserved a magnificent lakeside opera house for the plenary and poster sessions, and already has a myriad of other planning details well underway including confirmation of the superb line-up of plenary speakers, the production of maps of jogging/running/bicycling trails along the lake, organization of local food options for lunches, printing options for people who do not want to travel with their posters, and mixer activities for ASLO students and early career scientists.

Of course the recent earthquake-tsunami disaster was on everyone's minds, but the LOC members were unanimous in their resolve that ASLO-Biwa is fully on course and will go ahead in 2012 exactly as planned. Otsu is in the south west of Honshu, the main island of Japan, whereas the disaster was in the north east of this island. Otsu and Kyoto were unaffected, and I saw no evidence of any impact in the area. Even the electricity is on a separate grid and frequency in West Japan relative to East Japan, and so power shortages in Tokyo had not affected the Kyoto-Osaka and associated western region. Otsu remains a very safe place, and is well away (hundreds of miles) from the earthquake and aftershocks zone.

Every Japanese person I met was confident that the recovery process will continue rapidly, including the sealing up and decommissioning of the Fukushima nuclear plant. The final word goes to Jotaro Urabe, chair of ASLO-Biwa, and a professor at Tohoku



Fig. 1. The full scientific committee of the Biwa 2012 meeting.

University in Sendai-city, which was at the epicenter of the earthquake and many aftershocks. Jotaro wrote on April 6, 2011:

"Amazingly, everything is recovering here at Sendai-city, including water supplies, electricity, in-city transportations, sewage system and supplies of city-gas and gasoline, although the coastal areas hit by the tsunamis are still damaged. In our Tohoku University, most of our colleagues and students are back and are now doing usual work in their lab and office, although some labs lost expensive equipment due to the quake. These days, many colleagues and students frequently go to the coastal areas to help the local citizens who survived. It's my feeling that the city areas will soon recover fully within a month due to the large efforts of many people... Finally, we are very delighted to have encouragement and support from many people everywhere in the world after the quake and tsunami. If oceanographers and limnologists would like to encourage and show their support to the Japanese people, the best way is to visit Otsu and join ASLO-Biwa in 2012."

STUDENT ACTIVITIES AT THE 2011 AQUATIC SCIENCES MEETING

Kimberley Keats and Luana Pinho, ASLO Student Board Members, studentreps@aslo.org

A number of student activities were held during the 2011 Aquatic Sciences Meeting in San Juan, Puerto Rico, from February 13–18, 2011. These activities included four lunchtime career development workshops, a student social mixer, and a book raffle. In addition, 60 students received ASLO Student Travel Grants, 22 students received ASLO Local Student Grants, and 23 students were presented with ASLO Outstanding Student Presentation Awards. ASLO presentation awards were given to the top 5% of student presentations as evaluated based on the clarity/effectiveness of presentation, quality of experimental design, clarity of conclusions, and innovation/scientific insight. Award recipients receive a certificate of recognition and a \$100 award from ASLO.



Fig. 2. Some of the scientific program committee enjoying the surroundings in Otsu. From left to right, Michio Kumagai (one of the co-chairs of ASLO-Biwa), Helen Schneider Lemay (ASLO Business Office) and some of the scientific program committee members, Jean-Pierre Gattuso, Warwick Vincent, Dietmar Straile, Sally MacIntyre and Jim Elser. Image by Jim Elser.

Congratulations to all of the award recipients! We would like to thank the ASLO Business Office and all those participants who helped make these events possible. We would especially like to thank the volunteer judges and session chairs who evaluated student presentations, as well as the workshop panelists: Cindy Lee, Stony Brook University; Alex Enrich Prast, Universidade Federal do Rio de Janeiro; Josef Ackerman, L&O Fluids and Environments; Paul Kemp, L&O Methods; and Ada Monzon, Univision Puerto Rico. In addition, we greatly appreciate the continued support of exhibitors who kindly donated items for our book raffle: Oxford University Press (Ian Sherman), University of California Press (Charles Crumly), Springer (Martine van Bezooijen), Elsevier (Jennifer Radda), and Fluid Imaging Technologies (Harry Nelson).

We hope that all students who attended the Aquatic Sciences Meeting were able to participate in the student activities, and we look forward to organizing some great events for the upcoming Ocean Sciences Meeting in Salt Lake City, Utah, USA, and the ASLO Summer Meeting in Lake Biwa, Otsu, Japan! If you have any questions/concerns or suggestions for future student activities, please feel free to contact us at studentreps@aslo.org.

STUDENT PRESENTATION AWARD WINNERS: 2011 AQUATIC SCIENCES MEETING, SAN JUAN, PUERTO RICO, USA

- Dana Borg, The Ohio State University, Columbus, Ohio, USA
Natural Variability of Trace Metals in Two Species of Sclerosponges from Palau and Saipan
- Rebecca Briggs, University of Hawaii, Honolulu, Hawaii, USA
Quantifying Labile Organic Phosphorus in Suspended Particulates and Aquatic Sediments: An Adaptation to the Sedex Method for Selective P Extraction
- Lindsay Brin, Brown University/Marine Biological Laboratory, Providence, Rhode Island, USA
Nitrogen Loss Pathways in Coastal and Shelf Sediments: Beginning to Define Controls in New England as a Model System
- John Casey, University of Hawaii, Honolulu, Hawaii, USA
Interannual Dynamics of Carbon Partitioning Within the Sargasso Sea Picoplankton Assemblage
- Joanna Gyory, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts, USA
Turbidity as a Cue for Synchronous Reproduction in the Barnacle Semibalanus Balanoides
- Lara Henry, University of South Florida, St. Petersburg, Florida, USA
Metabolism of an Antarctic Solitary Coral, Flabellum Impensum, and The Deep-Sea Stony Coral, Lophelia Pertusa
- Frédéric Le Moigne, National Oceanography Centre, Southampton, United Kingdom
Does a Ballast Effect Occur in the Ocean?
- Monica Moritsch, Shannon Point Marine Center, Milwaukee, Wisconsin, USA
Allelopathic Interactions of Green Algae Ulva Lactuca and Ulvaria Obscura and Phytoplankton in Macroalgal Blooms

- Jessie Motard-Côté, University of South Alabama, Dauphin Island, Alabama, USA
Dynamics and Phylogenetic Affiliation of Dimethylsulfoniopropionate (Dmsp)-Degrading Bacteria in Arctic Waters
- Drew Sieg, Georgia Institute of Technology, Atlanta, Georgia, USA
Species-Specific Effects and Partial Characterization of Allelopathic Compounds Produced by the Red Tide Dinoflagellate, Karenia Brevis
- Erik Sperfeld, University of Potsdam, Potsdam, Germany, USA
Simultaneous Limitation of Daphnia by Two Essential Lipids: Different Types of Co-Limitation
- Ximena Velez-Zuazo, University of Puerto Rico, San Juan, Puerto Rico, USA
MTDNA Analysis of Exotic Lionfish in Puerto Rico Support Origin from U.S. East Coast Invasion
- Roberta Challenor, University of Alabama at Birmingham, Birmingham, Alabama, USA
Impacts of Ocean Acidification on Growth and Behavior of the Ecologically Important Coastal Sea Urchin Lytechinus Variegatus
- Marie Cheize, Université Européenne de Bretagne, Brest, France
Development of a Voltammetric Method to Measure Iron Organic Speciation in Rainwater
- Kendyl Crawley Crawford, NOAA Living Marine Resources Cooperative Science Center, Hampton University, Hampton, Virginia, USA
Ontogeny of Visual Ecophysiology in Black Sea Bass (Serranidae: Centropomus Striatus)
- Serena Donadi, Department of Marine Benthic Ecology and Evolution, CEES, University of Groningen, The Netherlands
Scale-Dependent Effects of an Ecosystem Engineer Determine the Spatial Distribution of Bivalves in an Intertidal Ecosystem
- Abigail Noble, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts, USA
Dissolved Cobalt Distributions in a Full-Depth Ocean Section Across the South Atlantic Ocean
- Elena Lara, Institut de Ciències del Mar (CSIC), Barcelona, Spain
Establishing Temperature Thresholds and Tipping Points on Bacterial Carbon Fluxes Through Viruses And Protist in the Arctic Ocean
- Daniel Obenour, University of Michigan, Ann Arbor, Michigan, USA
Understanding the Causes of Gulf of Mexico Hypoxia: A Geostatistical Approach
- Santiago Salinas, Stony Brook University, Stony Brook, New York, USA
Transgenerational Plasticity in an Estuarine Fish and Its Relevance to Climate Change
- Carlos Javier Sanchez, The University of Washington, Seattle, Washington, USA
Student Stories: Developing Effective Multimedia Content
- Jennifer Sunday, Simon Fraser University, Burnaby, British Columbia, Canada
Adaptation Potential to Ocean Acidification: Differences in Genetic Variation and Demography Are Key
- Katherine Turner, University of Washington, Seattle, Washington, USA
Head Shrinkers: A Short Film to Target a Broad Audience

2012 OCEAN SCIENCES MEETING PLENARY SPEAKERS ANNOUNCED

Continuing the tradition of having outstanding speakers, organizers of the 16th Ocean Sciences Meeting recently announced the plenary presenters who will participate in the 2012 meeting next February in Salt Lake City. The following speakers have been confirmed to date:

Dr. Mark R. Abbott

Dean, College of Oceanic and Atmospheric Sciences
Oregon State University
Corvallis, OR
Topic: Graduate Education in the Ocean Sciences

Dr. Kelly J. Benoit-Bird

College of Oceanic and Atmospheric Sciences
Oregon State University
Corvallis, OR
Topic: Causes and Consequences of Heterogeneity of Organisms in the Ocean: From Phytoplankton to Dolphins

Dr. Demian D. Chapman

School of Marine and Atmospheric Sciences
Stony Brook University
Stony Brook, NY
Topic: Biology in a Bowl: Studying sharks to save them from becoming shark fin soup

Dr. Michael (Mick) Follows

Department of Earth, Atmosphere and Planetary Sciences
Massachusetts Institute of Technology
Cambridge, MA
Topic: Modeling Marine Microbes: From Molecules to Ecosystems

Dr. Christopher M. Reddy

Woods Hole Oceanographic Institution
Woods Hole, MA 02543
Topic: How did we do? Academia's contributions to the Gulf of Mexico oil spill

The 2012 Ocean Sciences Meeting will be held 19–24 February 2012 at the Salt Palace Convention Center in Salt Lake City, Utah. This joint meeting is an international gathering of more than 4,000 attendees and is being sponsored by The American Society of Limnology and Oceanography (ASLO), The American Geophysical Union (AGU) and The Oceanography Society (TOS).

For questions about the scientific program, please contact the meeting co-chairs: Mel Briscoe (TOS), mbriscoe@oceanleadership.org; Eric Itsweire (AGU), eitsweir@nsf.gov; and Mary Scranton (ASLO), mary.scranton@stonybrook.edu.

For practical and logistical information, contact the conference manager: Helen Schneider Lemay at helens@sgmeet.com or call (800) 929-2756 from the U.S. and Caribbean or (254) 399-9635 from all other locations.

Following with the society agreement, The Oceanography Society is the lead organization for this meeting. For more information about the 2012 Ocean Sciences Meeting, please contact Jennifer Ramarui, Executive Director, The Oceanography Society, jenny@tos.org or call 301-251-7708.

MEMBER NEWS

JOHN SMOL RECEIVES *NATURE* AWARD FOR MENTORING

Canadian biologist and ASLO member John Smol was presented one of two 2010 *Nature* Awards for Mentoring in Science (Canada). Smol, Fellow of the Royal Society of Canada (FRSC), received the mid-career award. Smol is a professor in the Department of Biology at Queen's University, Kingston, Ontario, where he is also holder of the Canada Research Chair in Environmental Change. The lifetime achievement award was presented to another aquatic scientist, Chris Wood, FRSC, a professor in the Department of Biology at McMaster University (Hamilton, Ontario) and Canada Research Chair in Environment and Health.

Launched in 2005, the annual *Nature* Awards for Mentoring in Science recognize outstanding scientific mentorship and focus on a specific country or countries each year. 2010 focuses on Canada and more than 50 nominations were submitted for the two awards. John Hepburn, Vice President, Research and International, at the University of British Columbia, Vancouver, led the panel of judges for the award. He said during judging that the most striking statistic in Smol's nomination package was his success rate: "He has never failed with a grad student -- never. He has had 62 grad students, and none have withdrawn or failed. That's mentoring."

Smol, who has received several prodigious awards in the past two years, says this award is "especially precious to me as it was driven by my former students and other colleagues, who remain my close friends." Smol takes great pride in how well his students have done and notes "I've learned more from them than they've learned from me."

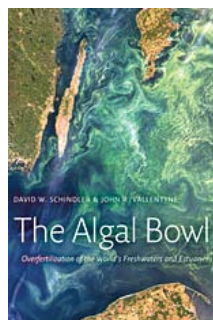


John Smol receives *Nature* mentoring award from Philip Campbell (Editor-in-Chief, *Nature*, right) with Nobel Laureate John Polanyi. (Photo by Julie Heather Photography)

BOOK REVIEW

SCHINDLER, D.W. AND J.R. VALLENTYNE. 2008. *The Algal Bowl, Overfertilization of the World's Freshwaters and Estuaries*. ISBN 9781844076239 344 pp.

Reviewed by **Linda C. Schaffner**, Virginia Institute of Marine Science, Gloucester Point, VA 23062; linda@vims.edu



Eutrophication is an increasingly widespread phenomenon of freshwater lakes, estuaries and coastal marine ecosystems. The future for these systems seems uncertain as human activities continue to increase the nutrient flows that lead to degraded water quality, harmful algal blooms, fish kills and the expansion of "dead zones." In their book *The Algal Bowl, Overfertilization of the World's Freshwater and Estuaries*, authors David W.

Schindler and John R. Vallentyne endeavor to explain concepts and scientific results in ways that can be understood by policy makers, students and others who are interested how human activities are resulting in the degradation of water comparable with the degradation of land that occurred in the 1930s with the development of the American Dust Bowl.

In Chapter 1 the authors define important terms used in the biological classification of lakes and introduce the major factors involved in human-caused eutrophication. A section called "A Brief History of Eutrophication" summarizes the evolution of human effects and scientific understanding of eutrophication processes in lakes over the last century. Factors that influence the extent to which nutrients set the stage for eutrophication by stimulating plant growth in lakes are also summarized. The key role of phosphorus rather than nitrogen as the limiting nutrient in freshwater systems is introduced.

Four case studies presented in Chapter 2 are used to show how nutrients derived from human activities changed three relatively large lakes – Lake Zürich, Lake Erie, and Lake Winnipeg, and a series of small lakes in Wisconsin ("the Madison lakes"). Despite differences in physical and biological characteristics, size, hydrography and geologic settings, the examples document how the addition of nutrients, mostly from municipal and agricultural wastes, was associated with the development of symptoms often observed in human-influenced lakes worldwide – algal blooms, changes in species composition, oxygen depletion and fish kills.

Chapter 3, called "Lakes are Made of Water," provides an excellent tutorial on the unique properties of water and describes how temperature, density, solar radiation and wind influence the vertical circulation of lakes. Chapter 4, "How Lakes Breathe," discusses factors that regulate the balance of carbon dioxide, oxygen and organic matter in lakes, as determined by photosynthesis and respiration, food web structure, decomposition in the hypolimnion, buffering capacity and gas exchange. Chapter 5 begins with an interesting description of discovery of phosphorus, "The Morning Star," and then explores the many roles of phosphorus in living organisms and the biosphere, its potential toxicity, and the myriad ways it is used by humans.

The next few chapters document major milestones in the history of eutrophication up to about mid-20th century when much of the phosphorus input to lakes from humans was associated with sewage and detergents. Chapter 6 discusses the transition in human approaches to dealing with the effects of cultural eutrophication — from using toxic compounds to kill algae, to sewage diversion schemes, to the development of methods to remove nutrients from sewage. Chapters 7 and 8 take us further by providing detailed accounting of the history of the 1969-70 detergent phosphate controversy and the issues associated with the possible replacement of phosphorus in detergents with the compound NTA.

Chapter 9 gives a very useful summary of the results from hypothesis-driven whole lake experiments that allowed scientists to test their ideas about the relative importance of phosphorus, nitrogen, carbon and other factors, such as gas exchange, in the eutrophication process. Evidence for the key role of phosphorus in limiting lake productivity was mounting during this initial period of ecosystem-level experimentation, as was the understanding that lakes respond to nutrient enrichment from their catchments and that the residence time of water in lakes was a critical factor. Experimental approaches in small lakes also led to the first insights that the magnitude of eutrophication was affected by a lake's biological community composition.

Chapter 10 focuses on how the cumulative effects of nutrient inputs, climate warming, reduced water flows, damage to aquatic communities and land-use changes in the catchments of lakes have exacerbated the eutrophication issue. Here we begin to see budgets detailing the contributions of nutrients and pathogens from point and non-point sources, estimates of how climate changes affect water renewal times in lakes, and figures showing relationships between human activities in lake catchments and the biology of lakes. At the end of this chapter the authors summarize by stating that the “science of managing eutrophication is quite well known.” and emphasize the importance of effective communication of scientific information to decision makers.

Chapter 11 takes us back in time via the record preserved in lake sediments. Sediments are the “muddy archives” (also the title of the chapter) of the history of lakes before they were heavily influenced by humans and before modern limnological methods and monitoring programs began. The beginning of the chapter discusses methodologies used in studies of sediment cores. The remainder of the chapter presents a case study of Lac la Biche (Alberta, Canada). A paleolimnological study of the sediments from this lake revealed a history of increasing eutrophication and associated changes in the biological community of the lake that eventually led to the algal blooms that got the attention of residents around the lake.

Given the limited methods available for recovering culturally eutrophied lakes (Chapter 12) and the complexity of the problems associated with nutrient inputs and other human-induced changes in lakes and their catchments the authors suggest (page 234) that “it is prudent and cost-effective to prevent eutrophication in the first place.” The case histories presented in this chapter demonstrate that attempts to recovery lakes have often been costly and that recovery times have been slower than hoped.

Many of the eutrophication problems seen in freshwater lakes, such as algal blooms, “dead zones” and fish kills, have also

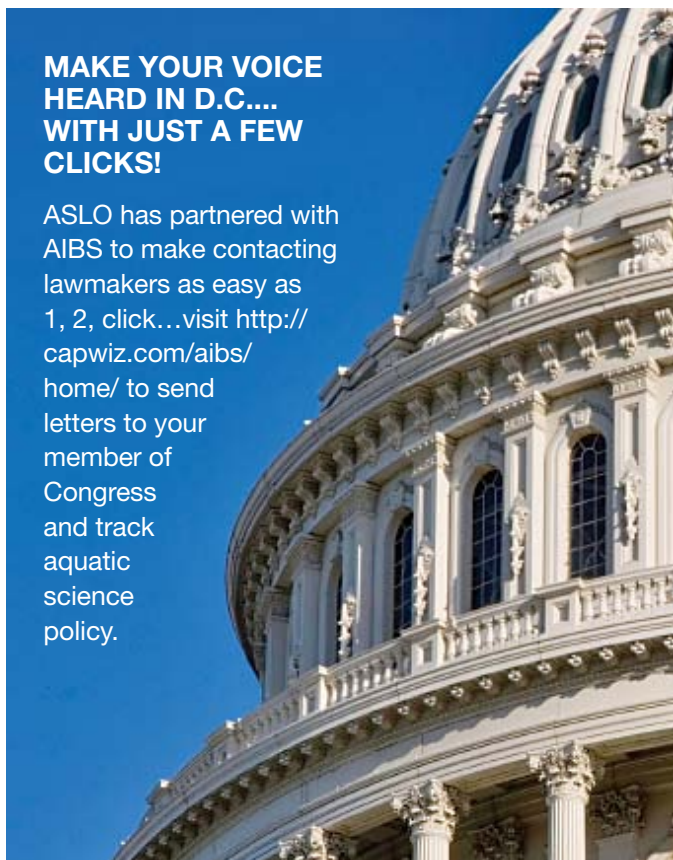
been observed in estuaries and other coastal habitats worldwide. Yet, despite its subtitle, only a very small portion of the book focuses on estuaries and coastal zones (Chapter 13). The authors suggest (page 244) that, although most coastal ecosystems show symptoms nitrogen limitation, “There is still confusion over whether nitrogen limitation means that nitrogen, rather than or as well as phosphorus, should be managed to reduce algal blooms [in coastal ecosystems].” This debate has major implications for policy-makers since controlling anthropogenic sources of phosphorus to coastal systems is far more tractable than controlling nitrogen sources associated with human activities. While the authors of *The Algal Bowl* clearly lean towards phosphorus control as the most cost effective way to halt eutrophication of some coastal areas (e.g. Stockholm Archipelago; see also Schindler et al. 2008. P. Natl. Acad. Sci. USA 105: 11254-58), others have suggested that “improvements in water quality of many freshwater and most coastal marine ecosystems requires reductions in both nitrogen and phosphorus inputs.” (Conley et al. 2009. Science 323: 1014-1015; see also Howarth et al. 2011. Front. Ecol. Environ. 9: 18-26). Conley and colleagues provide evidence that controlling phosphorus inputs to freshwater, while ignoring large anthropogenic inputs of nitrogen, may serve only to move the problem downstream to estuarine and coastal ecosystems where N becomes limiting.

In the last chapter of the book the authors step back to look at eutrophication in the broader context of the many environmental changes associated with human activities on Earth. They ask why, in the face of thousands of scientific studies, humans have not acted to prevent or reverse the eutrophication problem. They note that fragmented governance structures and a lack of communication of relevant scientific information to regulators and the public are obstacles to progress. Finally, they offer some practical solutions, such as preserving natural riparian habitat and drainage patterns, better farming practices, and a rethinking of how we use water and dispose of human wastes, as potential means of reducing eutrophication.

Reading *The Algal Bowl* has given me considerable insight into the processes leading to eutrophication of lakes, the history of human effects, the biology of lakes, the value of whole-system manipulations, and the complex interplay of factors that may influence the development of public policy. I agreed to review the book mostly because, based on the title, I expected a comparative discussion of eutrophication processes in freshwaters and estuaries. Trained as an estuarine ecologist, and with no formal training in limnology, I had much to learn about freshwater — and I did. The book does not, however, provide much in the way of comparisons of lakes and estuaries or considerations of the linkages of freshwater, estuarine and marine systems. In the end I had to go elsewhere to develop a synthetic understanding of the latest thinking on the roles of nitrogen and phosphorus in eutrophication processes in lakes, estuaries and coastal waters and the effects of nutrient enrichment of freshwaters on aquatic ecosystems downstream. I recommend *The Algal Bowl* to anyone who wants to learn more about eutrophication processes in freshwater systems, but urge those who are looking for greater understanding of how nitrogen and phosphorus contribute to eutrophication in estuarine and coastal marine systems to read recent papers on the topic, such as those cited above.

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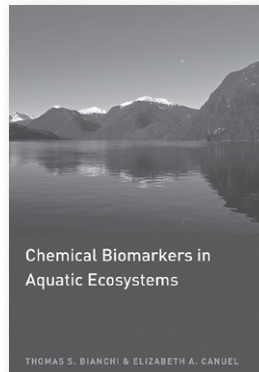
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—Philip A. Meyers, professor emeritus, University of Michigan

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