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LIMNOLOGY AND OCEANOGRAPHY BULLETIN

ASLO
Association for the Sciences of
Limnology and Oceanography



ABOUT THE COVER IMAGE

The Scripps pier in 1931 at sunset. Image courtesy of the Scripps Institution of Oceanography Archives, UC San Diego Libraries.

Find out about beginnings of oceanography in the United States from a memoir by Martin W. Johnson: The Early Days of The Scripps Institution of Oceanography.



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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.

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THE EARLY DAYS OF THE SCRIPPS INSTITUTION OF OCEANOGRAPHY

EXCERPTS FROM "AN OCEANOGRAPHIC MEDLEY" BY MARTIN W. JOHNSON

Editorial Note: The text presented here are excerpts from a typed, hand-corrected, manuscript by Martin W. Johnson entitled "Those were the days: these are the people: An Oceanographic Medley" and dated 4/23/1980. The text and images are reproduced with the kind permission of the Scripps Institution of Oceanography Archives, UC San Diego Libraries.

ORIGINS

In the early planning of the San Diego Marine Biological Station, the policy of its first director, Dr. W.E. Ritter, was to do intensive local surveys as a basis for further offshore work after the fauna had become adequately known. This was no small task in view of the complexity of marine life. It is, indeed, this complexity and abundance that led to the establishment of biological stations at the coast where the greatest abundance of life is available for comparative purposes in the many specialties that make up marine biology. This is so since it is in the sea that we find the greatest array of major divisions of the animal kingdom. The seventeen phyla, as generally recognized, occur in the sea, and five of these are exclusively marine. Over 40% of the classes are exclusively marine, whereas only about 7% are exclusively non-marine.

But with these coastal efforts, there was obviously a feeling of need to extend the studies further seaward to include the entire environment. This is expressed also by Dr. C.A. Kofoed, co-worker with Ritter in establishing the Biological Station: "...and the plan further contemplates maintaining a vessel large enough to sound, fish and dredge any portion of the Pacific Ocean."

It is not surprising then, that a transition finally occurred, culminating in oceanography, a harmonious composition of various disciplines including the physical, chemical, geological and biological aspects. The Marine Biological station undertook to grow in that direction in 1923, but not without some growing pains associated with recruitment of personnel, lack of adequate sea-going facilities and with an unexpected austerity program necessitated by the economic depression of the thirties.

Although SIO was the first institution of oceanography established in the United States, it appears that in the twenties there was a general increase in awareness of a need for more emphasis on oceanography, either by expansion of established biological stations, or by establish-



Figure 1. Scripps Institution of Oceanography, view from La Jolla Shores Drive, October 1933.

ing independent institutions for this specific purpose. As a result, Woods Hole Oceanographic Institute came into being in 1930; the University of Washington, Department of Oceanography in Seattle in 1932 and at Friday Harbor, Washington by taking over the 29 year old Puget Sound Biological Station. However, unlike the SIO's experience, this conversion at Friday Harbor did not persist and the laboratories there reverted largely to multidepartmental use as the Friday Harbor Laboratories.

ENROUTE TO SCRIPPS

In June 1934 Dr. T. Wayland Vaughan, Director of Scripps Institution, offered me a position as research associate in marine zooplankton, acknowledging the inadequacy of the low salary of \$100 per month. In further correspondence, however, he raised the offer to \$120—the \$20 to pay for rental of one of the campus cottages. I accepted the position, and if needs be, would have done so even at the lower rate, in view of the then nation-wide depression, and in view of the potential Scripps seemed to offer as a part of the University of California and despite the austere budget it was operating with at the time.

In his correspondence of June 9, 1934, Dr. Vaughan made it clear that he was making special efforts to get research headed towards the open sea saying, “We have on the Institution's staff a few people who are not seagoing. I do not intend to add to the staff anybody else who will not work on water.” This was not a deterrent to me because I had already wanted to get out on the Pacific with some of my research, and the plankton program to be worked out was left entirely to me.

Upon my arrival, Dr. Vaughan was ill with tuberculosis and during my bedside visit with him the next day he thoughtfully insisted, for my benefit, that we not shake hands. But we had a good conversation covering the state of affairs at SIO. He suggested that I consult especially with Dr. Eric Moberg and the graduate students Richard H. Fleming, chemist, and Roger R. Revell geologist, regarding sea-going facilities and what cruises, if any, were pending. This I did and although somewhat disappointed in regards to plankton facilities, I was pleased to find a good deal of enthusiasm and sympathetic attitude towards plankton research, as an essential part of oceanography.

This was also the attitude of others on the staff that made up the small but good nucleus for marine research, including the newly added faculty members Dr. Denis L. Fox, biochemist, who was engaged in studies of comparative metabolism of carotenoid pigments of marine animals and Dr. Claude E. ZoBell,

microbiologist, whose research dealt with biochemical reactions of bacteria in diverse environments of the ocean. Joining the biological faculty some years later was Dr. Carl L. Hubbs, ichthyologist, who with his ever present helpmate Laura Hubbs, carried on research projects from fish to whales.

The only staff members actively engaged in plankton studies at the time were Professor W. E. Allen and Easter E. Cupp, phytoplanktonologists. I made it a point to visit Allen shortly after my arrival. In the course of our conversation I mentioned that Vaughan's expectation was that my work would involve study of the zooplankton. To this he approved but remarked, “Nobody talked with me about it.” This being the case, I could not but have some sympathy with his remark in view of the fact that in line with my experience it seemed that there should always be a rather close understanding between phyto- and zooplankton-ologists in planning, collecting and evaluating results. So adding a new worker in plankton might, indeed, have some bearing on his work.

Dr. Francis P. Sumner, another of the original Biological Station staff, had terminated his critical study on the genetics of mice in order to be more in keeping with the newer emphasis on marine research. He was, however, no stranger to marine research in which he had engaged years earlier. His earlier projects dealt with the ecology and physiology of fishes to which he contributed much with regards to the influence that the albino of the background played in pigmentation of the animals. Although he obviously enjoyed his newer projects, he apparently

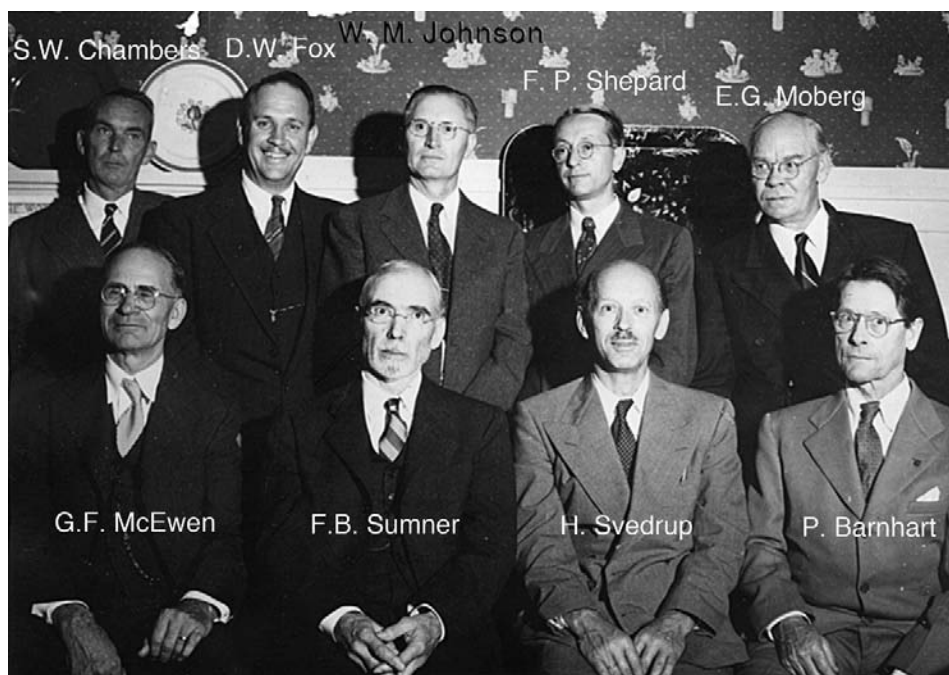


Figure 2. 1937 Scripps Institution of Oceanography: Telepathic Flashes by the Faculty or “A Penny for Your Thoughts.”

First row, left to right: George Francis McEwen: “One must look pleasant”; 2. Francis Bertody Sumner: “What the hell is all this about anyway?”; Harald Sverdrup: “Ah, I have an idea!”; Percy Barnhart: “I wouldn't have believed it!”

Back row, left to right: Stanley W. Chambers: “I suppose this is necessary but it isn't very exciting.”; Denis Llewellyn Fox: “What's Clarke Gable got that I haven't got?”; Martin Johnson: “You can't do this to me”; Francis P. Shepard: “One must be piously tolerant”; Erik G. Moberg: “Wonder if I can find a way out of here?”

retained some mixed feelings towards the shift away from the mice; but, as I learned later, he was good humored about it and even tolerated some disparaging remarks in jest at the shift.

Dr. George McEwen, physical oceanographer and mathematician, was concerned especially with upwelling of cold water along the coast and with oceanic temperatures, etc. and related meteorology. He was, as I also found later, always glad to join biologists in solution of projects needing mathematical analysis. Percy Barnhart, curator of the museum and aquarium, had a major interest in taxonomy of local fishes. The aquarium was kept open day and night and together with the pier, which was open to the public for fishing over the railing, were the main public attractions. Dr. Vaughan, whose personal research interest dealt with living corals, and thus contributed towards his appreciation of the place of marine biology in the overall oceanographic program.

The thirties were austere years and this was much in evidence at SIO in all aspects, including the administrative, academic and physical facilities. Purchases of equipment etc. kept to a minimum and inconveniences were tolerated. On the first floor of Ritter Hall only one telephone was available, placed in the hallway, to serve three faculty members. Travel funds were short. I recall Vaughan one year called Fox, ZoBell and me to his office to explain that he had only about \$75.00 to spend on us for a trip to Seattle to present papers at the AMS meeting there; we could divide it between us or let one have the whole sum. We decided to use it jointly driving to Seattle in ZoBell's car and sharing the driving expenses. But so far as I know everyone on the SIO payroll received their monthly pay check promptly. It was hand delivered by Tillie Genter who made the rounds and if no one was present to receive the check it was left face down on some laboratory or office table. Tillie was an inspiration to everyone's honesty and good will.

Conspicuous at SIO during the depression was the U.S. Works Progress Administration (WPA) which provided some hiring relief for assistants, etc., some professional in nature, others for routine menial tasks. Although the program was

intended mainly as a stop-gap relief for people caught without employment, most workers that I knew of were conscientious and anxious to learn. In applying, a few had overestimated their training or ability for a specific job. A most notable WPA helper in my division was Mrs. C. Painter who helped translate Sven Ekman's 1935 "Tiergeographie des Meeres."

ZOOPLANKTON AT SIO

The importance of zooplankton to a study of marine biology and oceanography has long been recognized and from the early founding of the Biological Station it was given major attention. By 1923 when SIO was established, a good deal of pioneering research in zooplankton had been done, especially by Dr. Calvin O. Esterly, a nonresident on the staff from Occidental College. His publications dealing with taxonomy, coastal distribution, seasonal occurrence and diurnal vertical migrations of copepods, the commonly major component of plankton, were of great aid to me before and after joining Scripps. His investigations, including copepods from San Francisco Bay, spanned about two decades during which he listed 48 genera and 147 species, 56 of which were new to science. Included in his surveys were also euphausiids and ctenophores.

Ellis L. Michael, a resident on the staff for about sixteen years, worked mainly on chaetognaths, the arrow worms that are sometimes dominant in the plankton. His most significant contributions deal with the vertical migrations that the animals undergo in relation to environmental conditions.

Dr. Ritter's interest, as one might expect in view of his concern with biological philosophy, was with protochordates such as *Enteropenusta* with a planktonic tornaria larva that suggests an evolutionary relationship to echinoderms by way of some of their similar appearing larvae. Included also in his research were studies of the planktonic Larvacea.

Although Dr. C. A. Kofoed became head of the Department of Zoology at Berkeley in 1910, he continued contact with the

Biological Station and continued with plankton work started there. This culminated in two monographs one on the "Unarmored Dinoflagellates" with Olive Swezy and one with A. S. Campbell entitled "A Conspectus of the Marine and Fresh-water Ciliata Belonging to the Suborder Tintinninea, with Descriptions of New Species Principally from the Agassiz Expedition to the Eastern Tropical Pacific 1904-1905."

In the work of the Biological Station, rather little attention was given to life histories of invertebrates with planktonic larvae. Only one on copepod larval development was worked out by H.E. Murphy and although Dr. B. M. Allen carried on some excellent fundamental ecological studies on the adult of the



Figure 3. Scientists and crew on deck of RV E.W. SCRIPPS during the Gulf of California Expedition, 1939.

commercially important California spiny lobster, the ecology of the planktonic larval stage was not considered; most likely because of lack of adequate collecting facilities.

Beginning a few years before SIO was established and about up to 1934 there was a lull in active zooplankton research. This no doubt resulted in part by the selling of the Biological Station's boat the "Alexander Agassiz" in 1917, leaving mainly the pier for what collecting could be done there. The "Scripps" was acquired September 1925 and was used to some extent for collecting at the five and ten mile stations, but the samples were apparently not used for population studies.

ON THE COMING OF A NEW DIRECTOR

Some time before Dr. Vaughan's retirement in September 1936, he called a staff meeting to announce the appointment of Dr. Harold U. Sverdrup, of the Geophysical Institute at Bergen, Norway, as his replacement as director. Although the staff had not been consulted beforehand, no voices were raised in either objection or approval. Personally I had a feeling of both surprise and elation. Firstly because I had heard much about him, through news reports, as an Arctic explorer associated with the ice-locked drift of the "Maud", but had not the least thought that he might be a candidate. Secondly, it was a forceful reminder to me of my attempt fourteen years earlier in 1922 to visit the "Maud" while she was docked in Seattle's Lake Union for repairs after having been freed from the ice and proceeded south through the Bering Strait. I was attending the University at the time and it seemed a rare opportunity to see the ship and if possible to talk with Dr. Sverdrup or members of his party. But from the dock I was unable to arouse anyone on the ship and was further frustrated by a dog aboard that paced me from bow to stern as I walked the dock. Although I failed in my main objective, there was at least some satisfaction in having seen the "Maud." In relating all this to Dr. Sverdrup at SIO, he kindly presented me with a photograph of himself, crew members, and the dog aboard ship.

The choice of the new director was timely for Scripps during its transition to an oceanographic institution. His oceanic experiences and personal participation in cruises after he came here was a good stimulus to traditional oceanographic research. He made it a high priority concern to obtain a good seaworthy vessel to replace the "Scripps" that was destroyed in 1936 by a tragic explosion while at dock. Dr. Fleming participated actively in this search for a new ship and I recall taking a cruise with Sverdrup and Dick to tryout the "Novia Del Mar" owned by Robert P. Scripps. She had no oceanographic gear aboard but I brought a net along and made a good routine plankton haul to have something to show for the day.

The outcome of the search resulted in purchase of a sailing yacht owned by the movie actor Lewis Stone. Renamed the "E. W. Scripps" and converted for oceanographic work, she was a good ship but with a low free board and a heavy winch placed forward she was sometimes pretty wet until the bow was built higher.

This serves to recall a stormy night while running a line of stations about 125 miles off Point Conception. Scientists on board consisted of Sverdrup, Fleming and myself. As usual, we took turns at watch, six hours off, six hours on except where sampling operations demanded more time on. My turn to stand

watch between stations that night with Herb Mann included the small dark hours of the night when the wind freshened and occasional waves began breaking over the bow. In tending a forward hatch I did a sort of momentarily thrilling body-surfing act along the deck to the pilot house. This was not too bad, but our troubles for the night were not yet over. There was a good deal more plunging through unexpectedly high waves when suddenly we heard, above the water noise, a siren as if a ship was bearing down on us, probably a coast guard cutter coming up astern. However, we could see no ship lights anywhere and finally realized that it was our own siren that had been shorted and kept screeching until Herb, after some time below deck, could find the short and make corrections. So far as I recall, neither Sverdrup or Dick was awakened by all this, which shows how sea-hardened they were. It also illustrates a type of routine not too uncommon in oceanography.

EDUCATION AT SIO

When I came to Scripps there were only a few graduate students engaged in research towards a higher degree under the guidance of a faculty member to whom they served, largely nominally, as assistants. No regular formal lecture courses were given on the campus at the time. Degrees other than oceanography could be granted by departments on other campuses to which Scripps could contribute.

In 1936 the faculty initiated a course in general oceanography in which several of us participated with lectures. It was customary for those giving lectures to join the students as auditors in a following lecture given by some other faculty member in his oceanographic specialty. This was useful mainly during the first flush of enthusiasm. Lack of an integrated text in oceanography was a serious handicap. This led Dr. Sverdrup, Dr. Fleming and me to write such a text after having abandoned an earlier idea of preparing only a syllabus for class use.

To write such a text was, of course, an arduous task with much burning of midnight oil while at the same time caring for other duties. In contracting with Prentice-Hall we had at first envisaged a book of five or six hundred pages, but it soon became evident that oceanography is too large a subject to be presented so briefly. This increase in length led to some grumbling by the publishers but they relented and agreed to publish at a loss if necessary. It came off the press in 1942 with 1087 pages and, after a period of U. S. government restrictions on some foreign sales, received worldwide acceptance. In recalling the satisfying toil involved in writing my portion of "The Oceans," there is always brought to mind also the hours spent by Miss Ruth Ragan, librarian, who expertly typed what we brought to her.

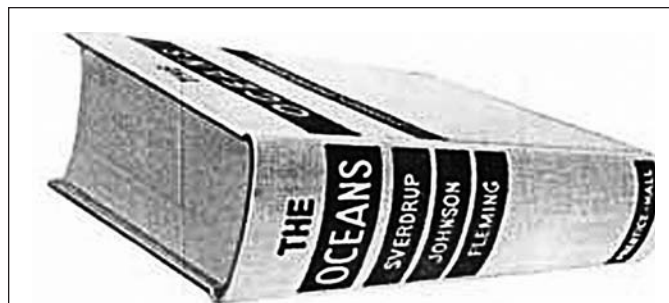


Figure 4. The classic oceanography reference: The Oceans.

POST-WAR ZOOPLANKTON RESEARCH AT SIO

The increase in post-war oceanic research involving zooplankton has been nearly world-wide, probably inspired in part by an awareness of the need to know more about the sea as a source of food for the fast growing human population. Interesting too is the fact that more attention than previously is concerned with the life history of individual species to ascertain the living requirements of the critical larval stages. Widespread interest in the deep scattering layer was a further impetus to zooplankton study. The present brief review will, however, be limited mainly to work in which SIO took a conspicuous part or in which staff or students have participated. It suffices also to show that the original intent of extending the marine studies seaward has been realized, probably beyond the fondest hopes of Dr. Ritter and others when establishing the Biological Station in 1903 and in later proposing its transition to a full-fledged Oceanographic Institution.

It is gratifying to note that at SIO this open sea research on both phyto- and zooplankton has had a sustained growth in the past three decades, and that there has been a pertinent integration of effort, in the physical and biological aspects on the various cruises by staff and students. Summary review of some these efforts will be found in the various SIO Annual Reports. For plankton studies see especially the sections on the Marine Life Research Group.

In this acceleration of oceanographic research, Scripps has provided leadership in the formation and direction of certain cooperative oceanic and biological surveys in which zooplankton collecting and analysis has been a major part.

OUTREACH TO FUTURE UNDERGRADUATES: MENTORING THAT MAKES A DIFFERENCE

Gwen Noda, former co-Director, COSEE-West, University of California Los Angeles; **Linda Chilton**, Education Program Coordinator, University of Southern California (USC) Sea Grant Program and Program Coordinator, COSEE-West, USC; **Mark Friedman** Science Teacher at Animo Leadership Charter High School, Lennox, California; **Linda Duguay** Director of Research USC Wrigley Institute for Environmental Studies and Director of USC Sea Grant Program

If educators and scientists are interested in increasing the number and diversity of students who pursue careers in STEM (Science, Technology, Engineering and Math) fields, then we need to capture their attention as early as possible – ideally, starting before kindergarten—and keep their interest at least through the completion of a bachelor's degree. Not only is it critical to get them interested, it is critical in making sure they are prepared: “The education children receive from preschool through high school is foundational and critical. For STEM, quality preparation is a prerequisite for later success” (National Academies 2011). The latest point that we may still have a chance to attract and hold onto students is in early high school. By the time they are high school juniors and seniors, it is too late because they have most likely already chosen a

major and decided to which colleges or universities they will apply (<http://www.nsf.gov/nsb/sei/edTool/edTool.html>, <http://www.insidehighered.com/news/2010/02/17/stem>, http://www.nap.edu/catalog.php?record_id=12984).

Some of the challenges in K-12 classrooms in California include:

1. required content that is defined by the National and State education standards,
2. increasing pressure on educators to have their students score high on standardized state exams (resulting in ‘teaching to the test’),
3. curriculum requirements for

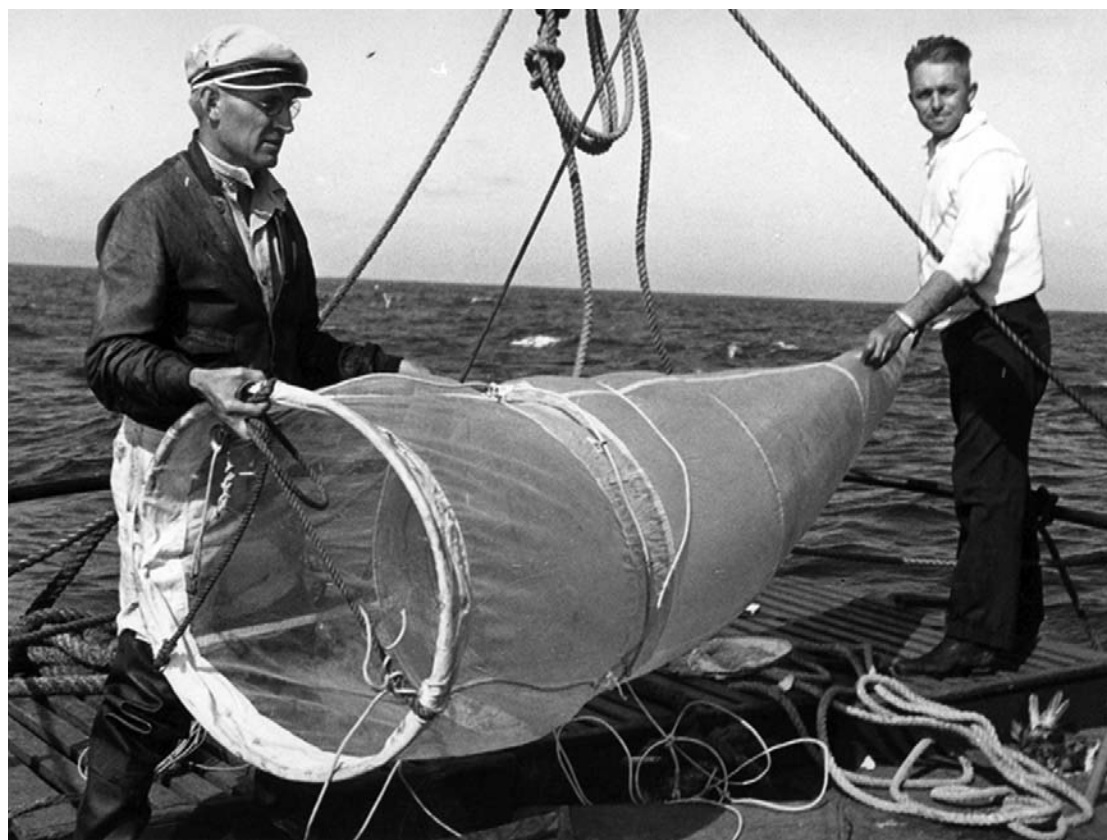


Figure. 5. Martin Wiggo Johnson and Earl Myers with a plankton net aboard RV SCRIPPS.

student graduation such as high school 'Biology' in California (typically part of 10th grade) and 4. if students want to attend a University of California (UC) school, that biology course (and many other courses) must meet special requirements' (called "A-G" for UC's) for admission.

Recognizing these constraints and working towards the goal of utilizing that last chance to draw the interest of students into STEM subjects, a marine biology course designed to be taught in lieu of the standard California high school biology course was created by Mark Friedman, science teacher at Animo Leadership Charter High School (mfriedman@animo.org), in collaboration with other Los Angeles area high school teachers and with assistance from COSEE-West staff. The effort began in December 2007 and was publicly released on the COSEE-West website in November 2009 with the goal that we would periodically add and update the course to be inclusive of a diversity of marine sciences content and to try to keep up with our changing understanding of marine science. The entire course is free, online, and available for download at: <http://www.usc.edu/org/cosee-west/curricula.html#teachmarinebio>.

The course focuses on marine life and includes lesson plans, labs, activities, games, lectures, and web interactives. Marine examples are included at almost every opportunity, except for in the human physiology component of the California state standards. Marine biology is a subject of high interest to students and can be an effective 'hook' to capture and enhance student interest. Although the course is developed to teach all required California Biology education standards, it can be adapted by teachers outside the state to suit their needs or parts of it can be used to infuse marine science into existing courses. We have given presentations about this course at five science education conferences and have always filled the room with teachers interested in implementing the course in their schools.

For a one-page summary about developing the marine biology course, check out: http://www.usc.edu/org/cosee-west/decadalreview/CW_Highlight_Marine_Bio_Course.pdf.

Two outcomes to date have included an increase from 5% of Animo high school graduates to 25% of graduates pursuing pre-medical or other science degrees at university and an increase in teachers offering marine biology courses in 9th, 10th, and 12th grades on their campuses.

The course was created, in part, by utilizing current ocean sciences research provided by scientists who work with COSEE-West and who have presented at public lectures, worked with K-12 teachers in workshops, assisted aquarium and museum educators in communicating science to the public, taught in online courses, as well as various other COSEE-West programs. These scientists have a variety of reasons for participating (including fulfilling their NSF broader impacts statements) as well as differing amounts of time to dedicate to outreach education.

You can read about some of our scientist partners and their participation in COSEE-West at: <http://www.usc.edu/org/cosee-west/forscientists.html>.

Scientists are very busy individuals and do not have a lot of extra time each term after applying for grants, conducting research, publishing papers, teaching and mentoring undergraduate and graduate students, chairing committees and departments, and attending conferences. Even a short amount of a scientist's time could go a long way to influence students' interest in STEM subjects. Since students of all ages can benefit, scientists can choose to work with any age group they feel comfortable addressing. "In primary school — and continuing into middle and high school years — developing an awareness of STEM careers can provide inspiration for students that can be reinforced in mathematics and science courses. School districts can introduce students to STEM careers, starting even in pre-school, through awareness activities that would include speakers (role models), activities, field trips, participation in science or



Fig. 1 The whole school becomes engaged in marine science through special presentations.

engineering programs, and links to summer programs. (National Academies 2011).

Scientists should consider reaching out to a local school. It does not have to take a lot of time. It could be as short as a visit to a classroom of students for show and tell of an artifact or piece of equipment or to a conference of science teachers to share with them your passion about your research. It could be working with teachers to improve or create new lessons to teach current science research to their students. It could be working with your local museum or aquarium on communicating scientific findings to the public, either by lecture or assisting in providing or interpreting science content for new exhibits. And of course, we would love your assistance with continuing to add to this course and keep the science up-to-date. Helping to keep the science high school curriculum current and relevant to students' lives helps keep high school science interesting (for students and teachers)!

Don't forget that those enthusiastic undergraduates and graduate students, whom you are currently mentoring because they were inspired when they were younger by scientists and/or teachers, can be valuable assistants in your outreach efforts. If you need more ideas on how to get involved, contact your local school or nearest NSF-funded COSEE center (<http://www.cosee.net/centerlinks/>).

TOGETHER WE CAN MAKE A LASTING IMPACT ON STEM PROFESSIONS.

If you would like to assist COSEE-West in connecting scientists, teachers and students to communicate current ocean sciences research, particularly in updating or adding science content to the 'Teach Marine Bio Instead of a Basic Bio' course, please let us know.

For questions please contact the individuals below:

- The Marine Biology course: Mark Friedman, Animo Charter High School, mfriedman@animo.org.
- Ways to get involved with COSEE-West, including contributing to the course: Dr. Rachel Kennison, co-Director of COSEE-West, rlk@ucla.edu
- COSEE-West or the COSEE Network: Dr. Linda Duguay, PI, COSEE-West at USC and past chair the of COSEE Network, duguay@usc.edu

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Have you or an ASLO colleague received an award or other honor recently? Tell us about it!! bulletineditors@aslo.org

ASLO NEWS

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



During this relatively quiet period between our summer board meeting and the Ocean Sciences meeting in February we have continued the overhaul of the ASLO Operations Manual. If anyone suggests you undertake such an activity yourself, my professional advice is to run – fast! ;) This has turned out to be a much bigger job than I had anticipated, requiring a close look at all aspects of ASLO's operations from staffing

to meetings to travel to publications to awards. My hope is that the final document will be useful roadmap for the many ASLO members that volunteer their time on the board and all the various committees. We are getting there!

About the time you receive this Bulletin, the 2012 membership renewal notices will be going out. In the past several years ASLO has revamped its membership in a number of ways. The cost for receiving a printed journal was increased significantly to fully cover the cost of the delivery. We now have an Early Career Professional category. After much discussion, Early Career is defined as a non-student members who received their highest degree within the last 10 years. The reduction in fees is to acknowledge that the first several years after the Ph.D. can be lean ones and ASLO wants to support our members during this time.

We also have an Emeritus Member category with no membership fee, if no journal is taken. Emeritus members are those sixty-five years of age or older who have been members of ASLO for at least twenty years. The hope is that we can keep these members engaged because they have so much to offer in terms of mentoring and experience and the society has much to offer as they transition to the next phase of their professional life!

You will also see a Sustaining Membership (add \$100 US to whichever membership category you select) and a Lifetime

Membership (one time charge of \$2000). The revenue from these categories will go into the ASLO Endowment in support of the long-term financial health of the society. Supporting the society in this way will allow us to continue to fund great initiatives like the emerging issues workshops and student travel awards.

Plans for future meetings are also going strong. Ocean Sciences in Salt Lake City is going to be wonderful! ASLO will once again be subsidizing childcare for ASLO members. Our first meeting in Asia at Lake Biwa, Japan, is shaping up to be quite the event! We have increased travel support for students and early career members to Japan to help with the increased travel costs. Finally the planning committee for the ASLO meeting in New Orleans is also hard at work on a number of exciting new ideas for ASLO's return to the Big Easy in 2013.

SOMETHING TO THINK ABOUT—STUDENTS AS CUSTOMERS

I finished my undergraduate degree at the University of Miami in 1986 and started my first faculty position in 1994. Somewhere in that time there seemed to be a shift from students who felt honored to be there to students who were buying a product and felt they could dictate what the product looked like. This trend seems only to have continued, fueled by the increasing importance placed on student evaluations. As an example, a few years ago one of my students noted that there was no lecture on whales and that he really wanted one. I explained that it really was not appropriate for the course. He responded that that may be true but he needed to let me know that he would note my refusal in his course evaluation. I won't tell you my response.

The upside of this trend is that more students feel empowered and want to have a say in their education. Empowering students is great! The downside is that, to quote a commentary in *Nature* last year – “Students have neither the wisdom nor experience to know what they need to know” (Petsko 2010 *Nature* 468: 1003). Who could better craft a curriculum or course to serve the best interests of students than a room full of faculty who collectively have a couple hundred years of professional experience in the field? I encourage instructors at all levels to think strategically about what they need to teach to prepare their students for their future – not to appease some administrator – not what is easy for them to lecture on – and not to win a student popularity contest. I further encourage students to keep an open mind and trust in their faculty recognizing that some courses or topics are like high fiber foods – they may not be your first choice but there will come a time when you are glad you took them.



Deborah A. Bronk
ASLO President

MESSAGE FROM THE EDITORS OF THE BULLETIN

John Dolan, Marine Microbial Ecology, Station Zoologique, Laboratoire d'Océanographie de Villefranche, Université Paris6 CNRS UMR 7093, 06230 Villefranche-sur-Mer, France; **Adrienne Sponberg**, ASLO Public Affairs Office, 10410 Kensington Parkway, Suite 216, Kensington, Maryland 20895 USA; bulletin-editors@aslo.org



ASLO has gone through some changes in recent years, most notable perhaps is the self-recognition that ASLO is an important international scientific society with a remarkably diverse membership. This in large part motivated the name change approved by the membership in the last vote. The *Limnology and Oceanography Bulletin*, as the official means of communication to the membership, has also seen a lot of changes. While the *Bulletin* now may look more like a magazine, its role is unchanged: to inform and serve the membership of ASLO. To better achieve the goal it would be very helpful to know your opinion—what you like or dislike about the *Bulletin*! Don't hesitate to contact us. This is your publication. Although it is not indexed by ISI, the *Limnology and Oceanography Bulletin* nonetheless reaches literally thousands of aquatic scientists

four times a year. Got an idea for an article? Is there a book you'd like to review? Have you been to an interesting workshop? You know where to find us: bulletin-editors@aslo.org.

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 live in interesting and challenging times and water issues continue to be major players. There are lots of interesting things happening within the “general population” that come from your research and science. 2011 has been designated as the “Year of the River.” One is that dams are coming down all over the world. Seems like in many cases, they were bad ideas. Close to 1,000 dams have been removed in the

U.S. since 2000. This is good news for fish and other wildlife as well as kayakers, fisherman, and hikers. And these dams delivered very small amounts of energy, if any. The biggest dam removal project in the U.S. is the removal of the Glines Canyon Dam and Elwha Dam, both across the Elwha River in Washington State. This will result in 70 miles of river and streams now open to all five species of salmon! Unfortunately, other countries such as Brazil, India and Laos are building dams that will be most destructive to their environments.

Oceans are also running the risk of depleting our supply of seafood. Just ten species represent 85% of the fish we eat. Barton Seaver, fellow with the Blue Ocean Institute has written the Seafood Decision Guide to help consumers make ocean friendly selections of fish they eat. He also has a cookbook out called *For Cod and Country*.

All that being said, ASLO is more important. Renewals have started so be sure and renew your membership and encourage others to join ASLO. ASLO membership remains stable at around 4,000 total members with about 23% students. We are now also tracking early career professionals and reviewing ways to help them as they move through their careers.

ASLO also has opened up members to other new categories, more benefits for retired and emeritus members, professionals and students from developing countries, and our ever important, students.

In 2012 there will be two important meetings, the Ocean Sciences Meeting in February in Salt Lake City, Utah, and the summer meeting, with an emphasis on lakes and rivers as well as “blue water,” at Lake Biwa, Japan in July. Each will have wonderful opportunities to meet with other scientists—both geographically and in scientific discipline areas.

We look forward to your membership renewal and to seeing in 2012 at one or both of our ASLO meetings!



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



THE WEATHER OUTSIDE IS FRIGHTFUL....

As this issue goes to press, we've already seen snow in the D.C. area (not to mention an earthquake and hurricane, but I digress....). The chilling weather may be symbolic as the atmosphere in D.C. has been decidedly less warm towards science in recent years. I saw this first-hand this fall when three ASLO members – Bob

Chen, Greg Cutter and Wally Fulweiler – and I participated in the Geosciences Congressional Visits Day on Capitol Hill. GeoCVD is an annual event organized by the Geosciences Working Group, which is led by the American Geological Institute (AGI) and includes societies such as ASLO and AGU. I've participated in these types of events for over a decade now (as have my colleagues in other societies), but we all struggled to get appointments with members and their staff this year. While we wound up doing well with last-minute scheduling, the conversations we had on Capitol Hill that day have me thinking the staffers just didn't want to have to sit through another meeting and tell more people more bad news. While the staff we met with were enthusiastic and receptive to our message, there was a sense of defeat in the air—the prospects for the federal budget are not good, to put it lightly. A Representative from Massachusetts met with our group and lamented the “anti-science” attitude that many members of Congress have expressed to him personally.

While it would be easy to throw our hands up in the air, mutter words about how politicians don't understand science, the reality is that the vast majority of research in aquatic science—at least in the U.S.—is funded using public money. Without the support of lawmakers, funding will not increase to meet the demands of society. Particularly given the current budget situation, scientists need to make their voice heard and garner the support of both lawmakers and the public who elect them. The debt agreement requires major cuts to discretionary spending. While none of us would dispute the value of the National Science Foundation, as its budget has grown to nearly \$7 billion, it has shown up on the radar screen of those wishing to cut spending. About this time last year, I wrote about NSF becoming the GOP's first “YouCut” target (<http://www.aquaticsci.net/?p=419>), an initiative inviting citizens to peruse the NSF database and submit grant numbers of “questionable” grants for review. While that initiative probably won't get that far, the reality is that support for science is declining as the budget situation worsens. The science policy community was caught by surprise this fall when the Senate mark of the science spending bill fell far short (\$181 million, to be exact) of the amount proposed by the House (which matched President Obama's request). Scientific societies, including ASLO, issued urgent action alerts for scientists to contact their Senators and express support for NSF funding. Word from the House appropriators, who want to give NSF the higher figure, is that their colleagues in the Senate aren't hearing enough support from their constituents.

If you have not already signed up for the ASLO Policy Action Network, please do so through the ASLO website at <http://www.aslo.org/forms/panform.html>. Many of our action alerts are done in partnership with the American Institute of Biological Sciences; you may also sign up to receive alerts of hot issues (we promise we are very selective about these; if you are hearing from us, it's a big issue!) through the AIBS Legislative Action Center <http://www.capwiz.com/aibs/home/>. The Legislative Action Center is a fast and effective way to make your voice heard, as it contains letter templates that only require you to enter your address; it hunts down your members of Congress for you!

OCEAN SCIENCES 2012: DROP IN AND SAY HI!

As I mentioned in a previous column, we've got a lot of great education and outreach activities planned for Salt Lake City. Many are still taking shape, but all will be included on the Ocean Sciences Meeting 2012 website <http://www.sgmeet.com/osm2012/>. One I am most excited about is our drop-in outreach consulting booth in the Exhibit Hall in partnership with COSEE. We're also thrilled that scientist-turned-filmmaker Randy Olson will be joining us again for a video workshop. There will be a panel discussion about the challenges of communicating science to the public featuring some incredible speakers, including social scientist Dan Kahan whose work I highlighted in my last column. There will be a bit of something for everyone at the meeting and I hope to see you there!

FEATURED L&O E-LECTURE: PALEOLIMNOLOGY BY JOHN SMOL

Smol, John P. 2009. Paleolimnology: An introduction to approaches used to track long-term environmental changes using lake sediment. *Limnol. Oceanogr.* e-Lectures, doi:10.4319/lo.2009.jsmol.3

John Smol's L&O e-Lecture is entitled "Paleolimnology: An introduction to tracking long-term environmental changes using lake sediments" (doi:10.4319/lo.2009.jsmol.3). The overall goal of this lecture is to provide limnology (and oceanography) students an overview of the various methods and approaches currently

being used by scientists to study the timing and magnitude of environmental changes affecting aquatic systems at time scales of decades, centuries, and millennia. The lecture includes the steps that paleolimnologists follow in their sedimentary analyses, including core collection, core sampling, dating, and a summary of the main indicators and climate proxies. Smol has also integrated into the lecture slides that highlight research that he and his co-workers have undertaken over the years. The lecture concludes with three case studies: the history of lake acidification, the occurrences of drought on the prairies, and the nature of climate change in the Arctic.

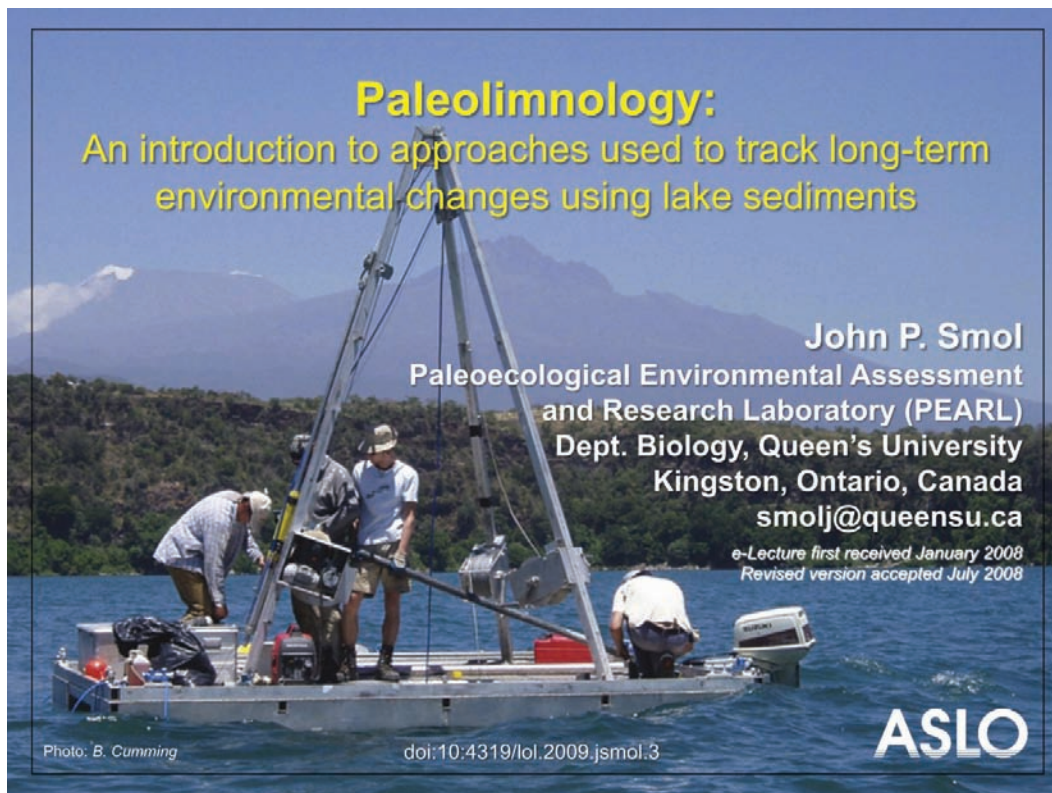
ABOUT THE E-LECTURE AUTHOR

John P. Smol is a professor in the Department of Biology, with a cross-appointment to the School of Environmental Studies, at Queen's University (Kingston, Ontario). He also holds the Canada Research Chair in Environmental Change and is a 3M Teaching Fellow. John founded and now co-directs the Paleocological Environmental Assessment and Research Lab (PEARL) - a group of over 30 students and other scientists dedicated to long-term studies on lake ecosystems. John is also editor-in-chief of the international journal *Environmental Reviews*, series book editor of the *Developments in Paleoenvironmental Research* volumes, as well as on the editorial boards of a number of other journals, including *Limnology and Oceanography-Methods*.

SMOL'S THOUGHTS ON THE L&O E-LECTURE SERIES

"I am a strong supporter of the L&O e-Lectures publication series because I believe teaching is a natural extension of our research

programs. If research is knowledge creation, then teaching is knowledge communication, and both are intimately linked. Effective communication in the classroom (and elsewhere) is greatly facilitated by effective visual presentations. Teachers tend to accumulate a large number of excellent teaching slides for their particular areas of research, but are often lacking in material for areas outside their immediate interests. Sources such as the L&O e-Lectures publication series are tremendous resources that can improve our teaching, increase student interest, and in the process engage a more educated citizenry. By the same token, I am always pleased to see my material being used by a broader scientific community."



Opening of John Smol's L&O e-Lecture is entitled "Paleolimnology: An introduction to tracking long-term environmental changes using lake sediments"

GETTING TO KNOW YOUR L&O ASSOCIATE EDITORS

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

The next time that you browse an issue of *L&O*, we hope that you will take a moment to peruse the list of Associate Editors (AE) on the inside of the *L&O* front cover. These are the people whose hard work determines what is published in *L&O*. ASLO acknowledges the important work that these people do for the society; AEs are featured in each issue of the *Bulletin*.

The role of the AE is that of an impartial judge—to fairly assess the reviewers' comments and guide the author's next steps. About every two weeks an AE is assigned a new manuscript. His or her first task is to select reviewers; this delicate job requires profound knowledge of both science and politics (the often conflicting relationships among people in a society). When the reviews are received, the AE digests that input along with his or her own assessment of the manuscript to arrive at a decision. It is unfortunately quite common for reviewers to recommend very different fates for a paper, which puts the AE in the uncomfortable position of having to make at least one of the reviewers and perhaps the author unhappy. For *L&O*, the AE's final job is to edit accepted manuscripts, suggesting wording and organizational changes to improve clarity.

L&O AEs work at the highest level of our profession. Being an AE is a very demanding job, and we are extremely fortunate that these people devote so much time to the ongoing challenge of making *L&O* the leading journal in the aquatic sciences.



JAMES J. LEICHTER

James Leichter is an associate professor in the Biology Section of the Scripps Institution of Oceanography, University of California at San Diego. His research focuses on the impacts of physical and biological interactions for nutrient availability, energy and carbon acquisition, recruitment dynamics, and ecological change in subtidal marine environments.

He works in a wide variety of habitats including the temperate rocky subtidal, tropical coral reefs, and recently in Antarctic benthic communities. He is particularly interested in long-term physical and ecological observations, manipulative experiments, and macro-ecological patterns and processes. As an Associate Editor, Leichter will mainly handle manuscripts on biological effects of physical forcing mechanisms in shallow subtidal systems, and ecological responses to environmental time series.

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).



BERTRAM BOEHRER

Bertram Boehrer leads the Limnophysics Group at the Helmholtz Centre for Environmental Research – UFZ in Magdeburg (Germany). He also teaches at the Faculty for Physics and Astronomy at the University of Heidelberg (Germany). He is physicist by training and has graduated with a master's thesis from the University of Heidelberg

on the internal waves in Lake Constance and a PhD thesis from The University of Western Australia on convection. In the 1990s and early 2000s, he had dedicated his work to the pressing environmental concerns of lakes coming into existence in open pit mines of former East Germany. Recent scientific publications comprise quantifications of lake stratification such as thermobaric effects, meromixis, consequences of chemical transformations and global change for the stratification and deep recirculation of lakes.



INGRID OBERNOSTERER

Ingrid Obernosterer obtained her PhD thesis at the University of Groningen, The Netherlands, and she is a CNRS scientist at the Laboratoire d'Océanographie Microbienne in Banyuls sur mer, France. Her research lies at the interface between marine biogeochemistry and microbial ecology, with particular focus on the bacterially-mediated cycling

of marine dissolved organic matter (DOM). Her interests include the effects of photochemical transformations on the biological availability of DOM, the degradation of different sources of DOM, and the coupling of the carbon and iron cycles. Recently, she has integrated the study of microbial diversity into her research to better understand the functional roles of bacterial groups in DOM cycling. She conducts her research in the Mediterranean Sea, and in naturally iron-fertilized regions of the Southern Ocean.

MEMBER NEWS

Editors' Note: We are always pleased (but rarely surprised!) when we receive word about ASLO members being recognized for their accomplishments. We try to pass the word on, but we need your help! If you or a colleague has received a significant honor, please drop us a line to alert us to the honor (and earn bonus points by submitting a write-up to announce the news).

LIMNOLOGIST STEPHEN CARPENTER AWARDED 2011 STOCKHOLM WATER PRIZE

ASLO member and director of the University of Wisconsin-Madison Center for Limnology Stephen Carpenter is the 2011 recipient of the Stockholm Water Prize. Frequently referred to as the “world’s most prestigious prize for outstanding achievements in water-related activities,” the Stockholm Water Prize honors individuals, institutions or organizations whose work “contributes broadly to the conservation and protection of water resources and to improved health of the planet’s inhabitants and ecosystems.” The Stockholm Water Prize Nominating Committee cited Carpenter’s contributions in helping us understand how we affect lakes through nutrient loading, fishing, and introduction of exotic species: “Professor Carpenter has shown outstanding leadership in setting the ecological research agenda, integrating it into a socio-ecological context, and in providing guidance for the management of aquatic resources.”

Read the full citation here: <http://www.ssiwi.org/sa/node.asp?node=1111>

PAST-PRESIDENT CARLOS DUARTE RECEIVES ICES PRIX D'EXCELLENCE

ASLO Past-President Carlos Duarte has been bestowed the prestigious Prix d'Excellence by the International Council for the Exploration of the Sea (ICES). The Prix d'Excellence is ICES's top award and recognizes the highest level of achievement in marine sciences. It is usually presented every three years. ICES Awards Committee Chair Dr. Edward Houde said Duarte's “broad reach extends to all parts of the globe where he has conducted research on marine ecosystems, especially the flux of carbon, microbial ecology, and comparative analysis of ecosystems.” Duarte heads the Department of Global Change Research at the Mediterranean Institute of Advanced Studies in Mallorca, Spain, and the UWA Oceans Institute. He recently led the Spanish Malaspina 2010 Expedition that sailed the world's oceans to explore biodiversity and study the impacts of global change on ocean ecosystems.

Read more at: <http://news.ices.dk/news/Pages/prix-d'excellence.aspx>

OCEANOGRAPHER NANCY RABALAIS RECEIVES HEINZ AWARD

ASLO member and executive director of Louisiana Universities Marine Consortium Nancy Rabalais has been awarded the Heinz Award for the Environment in 2011. The Heinz Family

Foundation honored Rabalais “for her pioneering research of severe oxygen depletion in the Gulf of Mexico and commitment to reduce water pollution through education and public policy.” Teresa Heinz, chairman of the Heinz Family Foundation, said, “Dr. Rabalais’ hard work, research and courage have driven remarkable discoveries in what we know about ‘dead zones’ – one of the most significant environmental problems facing the oceans. She simultaneously advances the state of our knowledge of the causes and consequences of dead zones and helps develop public and private responses to those challenges.”

Read more: <http://www.heinzawards.net/recipients/nancy-rabalais>

MEETING HIGHLIGHTS

MUSIC JAM AT THE 2012 OCEAN SCIENCES MEETING

Greg Cutter, Dept. of Ocean, Earth, and Atmospheric Sciences, Old Dominion University, Norfolk, Virginia 23509; Bill Landing, Dept. of Earth, Ocean, and Atmospheric Science, Florida State University, Tallahassee, Florida 32306

There are many parts to a successful Ocean Sciences Meeting, but in addition to great scientific interactions, food and music are crucial components everyone remembers. At the 2010 Meeting in Portland we hit on a winning formula for music – YOU provide it! Yes, that's right, you. The 250+ people who pushed their way into Portland's Green Dragon for the first Ocean Sciences Jam Session serve as witnesses. We recognized that many world-class ocean scientists are also top-notch musicians, so give them a stage and let the good times roll! And, they did well until the wee hours – we had blues, rock, soul, and country, guitar wizards, bass players, a certain infamous saxophonist, drummers, harmonicas, jazz singers, and who can forget the ukulele and sing along rendition of Country Roads? It's a no-brainer – everyone had a great time, the music was incredibly good, and it was cheap – let's do it again!

So, on Tuesday, 21 February, we've provided a venue to show off these talents after a day of science – the Second Ocean Sciences Jam Session 2012. The place: Lumpy's Downtown, a large (3 stories) sports bar serving tasty adult beverages and good pub food, and only one block from the Convention Center (www.lumpysdowntownslc.com)! The time: 8pm till ?. The entertainment: YOU! Well, we'll have a local band to provide continuity and the sound system, and you can sit in or take over (in 2010, the band let us use their drums, guitar and bass; they just sat down and enjoyed). The plan: None! It's your show so whatever happens, happens (hence the name – Jam)! Actually, Bill Landing and I will do a bit of impromptu arranging of sets, but it's far from organized. What to bring: your instrument(s), sticks, harp, voice, etc. and a willingness to share your talents. The cost: Once again there will be no cover, but I'll be coming around with a bucket to collect a tithing to take care of the local band and set up – I'd say \$5 each. It's on the honor system, but I'm pretty persuasive too, just ask anyone in the GEOTRACES program! You can buy as much food and drink as you want, or don't want.

Let's make it fun and successful – please bring your instrument to the meeting or arrange to borrow what you need (what are friends for?), maybe rent something (Summer Hays Music, 801-268-4446; www.summerhaysmusic.com). Let's fill Lumpy's up and make some noise! Questions? Email Greg (gcutter@odu.edu)

FRESHWATER ADVANCED AQUATIC SENSOR WORKSHOP: SENSORS, PLATFORMS, AND DATA MANAGEMENT

Amy Lee Hetherington, Department of Natural Resources, Cornell University, 122 Bruckner Hall, Ithaca, NY 14850 (Tel: 917-570-6126; alh11@cornell.edu); **Renee F. Brown**, Department of Biology, University of New Mexico, Albuquerque, NM 87131 (rfbrown@sevilleta.unm.edu); **Adrienne George**, College of Marine Science, University of South Florida, St. Petersburg, FL 33701 (adrienneg@usf.edu); **Sandra R. Villamizar**, School of Engineering, University of California, Merced, CA, 95343 (svillamizar_amaya@ucmerced.edu)

Advanced aquatic sensors have the potential to revolutionize science by providing access to data at unprecedented spatial and temporal scales. However, deployment and operation of these sensors and acquisition and analysis of these data pose significant challenges. Additionally, aquatic sensor technology is developing rapidly yet mechanisms and opportunities for training researchers and students in these new technologies are limited. As a result, the Global Lakes Ecological Observatory Network (<http://www.gleon.org>) and the Great Lakes Partner of the Alliance for Coastal Technologies (<http://act-us.info>) conducted the Freshwater Advanced Aquatic Sensor Workshop: Sensors, Platforms, and Data Management. The September 11-13, 2011 event, hosted at the University of Michigan Biological Station (UMBS), in Pellston, Michigan, addressed several important aspects of instrument selection and deployment as well as data collection, management, and quality assurance. The workshop

brought together an international community of scientists, information technology experts, engineers, field technicians, graduate students, sensor manufacturers, and other leaders in aquatic sensor technology to provide an overview of the major phases of sensor deployment and operation, as well as, to highlight the available cyberinfrastructure to support acquisition, management, storage, and publication of the resulting data sets. Workshop participants learned through interactive seminars and hands-on demonstrations about the resources available to aid them in their sensor infrastructure design and operation.

The environmental monitoring buoy, a platform for deploying advanced aquatic sensors, was a centerpiece of the workshop. In September 2010, the UMBS deployed an instrumented buoy in Douglas Lake that monitors 17 different air and water parameters. Like many similar platforms around the globe, buoy data are transmitted via cellular telemetry to a publicly accessible website (<http://umbs.lsa.umich.edu/research/>) where they supplement over 100 years of manually collected data on Douglas Lake for use by scientists and the local community. In addition to the UMBS environmental monitoring buoy, leading scientists and engineers showcased innovative new hardware and trained participants in the deployment and operation of aquatic sensor technologies. Representatives from various manufacturers, including Campbell Scientific, NexSens Technology, WET Labs, and YSI, showcased emerging private-sector technologies. In addition to buoy-based technologies, scientists from the University of Michigan Ocean Engineering Laboratory demonstrated alternative technologies, including a remote-controlled lake bottom mapping boat, autonomous underwater vehicles that take measurements along a programmed path, and other remotely operated underwater vehicles.

This workshop highlighted the need for continued training in the use of advanced aquatic sensors. The complementary missions of the two organizations provide a common interest which can be used to generate new collaborations and stronger networks. Also,

the workshop provided opportunities for graduate students and researchers in the initial stages of their careers from diverse regions and backgrounds to not only gain skills in acquiring and applying data derived from state-of-the-art aquatic sensors, but also to interact with senior researchers and industry leaders. The workshop fostered close interaction between participants and will undoubtedly lead to opportunities to further advance individual research, but also to collaborate across disciplinary and geographic boundaries on future efforts.

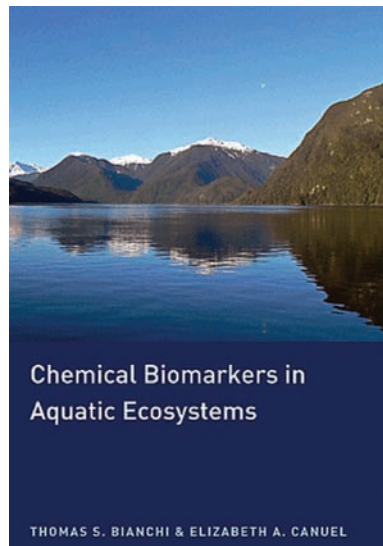


The 2011 Freshwater Advanced Aquatic Sensor Workshop Participants. Image by Dom David.

BOOK REVIEW

BIANCHI, T.S., AND E.A. CANUEL. 2011. *Chemical Biomarkers in Aquatic Ecosystems*. ISBN: 9781400839100, 392pp., \$ 95.00

Reviewed by **Patrick Mayzaud**, *Laboratoire d'Océanographie de Villefranche sur mer, UMR-CNRS 7093, UPMC. BP. 28, 06230 Villefranche-sur-Mer, France; mayzaud@obs-vlfr.fr*



As stressed in their introduction, biomarkers have been extremely useful over the past decades in clarifying the origin and the fate of organic compounds. The authors state that their motivation in writing this book is that existing information is too diffuse and difficult to use as textbooks for advanced undergraduate and graduate courses. The book is designed primarily as a resource for undergraduate and graduate level classes and

to a lesser extent for researchers in limnological, estuarine, marine and environmental sciences. One of the strengths of this book is the unity in style which originates from the courses taught by both authors. The resulting structure of each chapter around specific class of compounds makes the reading relatively easy, with a clear choice for a dominant geochemical point of view. The book is divided in 14 chapters and, all but three, have the same structure of background information, presentation of the class of compound, origin, pathways of synthesis and evolution and application cases.

The first chapter provides a general overview of the synthesis of chemical markers from an evolutionary point of view. Despite the great complexity of this domain of research, the presentation is limited to what is needed to understand the link between biology and biomarkers. This is an original approach which should be of great interest to students which may not be familiar with evolutionary biology. May be the part on cellular membrane of eukaryotes is a bit short with no mention of the peculiar structure of chloroplasts and its relationship with photosynthesis.

The second chapter provides a historical perspective on the use of biomarkers in aquatic ecosystems. The transition from bulk descriptions towards modern analytical techniques as well as the importance of structure and stability of molecules in the description of modern and/or ancient ecosystems is well illustrated.

Chapter 3 is a presentation of the basic principles around the application of stable isotopes in natural ecosystems. Test cases are presented concerning lakes, river–estuarine continuum and the Open Ocean. This chapter is very informative and should be very useful in a fast growing and fast changing scientific domain.

The fourth chapter is a review of analytical methods and a presentation of corresponding instrumentation. Considering that students are the primary readers, it is not surprising that the authors focussed on the most recent methods and instruments. The risk is to give the impression that nothing can be done if one does not have access to a complete analytical platform. Some historical perspectives would have been useful for non student readers.

Chapter 5 covers carbohydrates from the simple sugars to the complex polysaccharides. Chemical structures and biosynthetic pathways are well illustrated and the part on methods is really comprehensive. It is unfortunate that the link between marine phytoplankton diversity and carbohydrate molecular diversity was not considered and that the main polysaccharide from diatoms (cryso-laminarin) is not even mentioned.

Chapter 6 is concerned with proteins and amino acids. Structure and distribution of the 20 amino acids constitutive of proteins is presented with examples on phytoplankton and sediments. The part on biosynthetic pathways reviewed in a condensed format is found in biochemistry text books but will be extremely useful to most readers. Methods included both HPLC and electrophoretic procedures but no mention is made of HPLC analysis of native proteins. The application of these biomarkers to lakes, river–estuarine continuum and ocean waters covers a small part of the literature but convey the right message to the students.

Chapter 7 covers the biogeochemical significance of nucleic acids in the context of both organic nitrogen and phosphorus cycles. It also examines the molecular tools used for bacterial characterization and phylogeny. The information in relation to the various biota considered in this book is very limited and it is obvious that this biochemical class of constituents has been underestimated in many biogeochemical studies. The part on molecular characterization of contemporary microbial communities is at the same time a must and disappointment. It is a must because no modern studies on bacterial populations can ignore molecular tools and their contribution to phylogeny and the definition of markers of origin. It is a bit disappointing because the actual state of art is a bit more complex. No mention is made of the role of viruses in DNA variability in the environment despite the large body of literature over the past decade.

Chapter 8 deals with lipids from the fatty acid perspective. Background information and biosynthetic pathways are well summarized but the analysis section lacks a broader perspective. Methods are a bit more diverse than mentioned and a lot can be done by coupling capillary gas chromatography and classic chemical approaches. I always feel uneasy when no mention is made of the people who pioneered the field. Knowledge of the large body of reviews by R.G Ackman, who co-developed capillary GC for marine oil in the 70's and 80's, would be an asset for most students interested in this field. The part on applications reviews the role of fatty acid as biomarkers in Lakes, River–Estuarine continuum and ocean. This section is mostly focussed on the biogeochemical view point and the importance of prokaryotes as source of signature. The section on trophic relationship is a bit short and covers very partially the large body of work over the past 20 years. Trying to understand the trophic relationships in aquatic systems without a good grip of nutrient status is a bit difficult. Besides the view is clearly “mid

latitude ecosystems” and barely applies to higher latitudes. QFSA is the only quantitative approach thus far, but implications could have been better developed. Besides why limit the question of models to quantitative models? Nothing on alternative models such as SIMCA or PLS discriminant analyses for qualitative or semi-quantitative estimates. They all have advantages and limitations, but if the topic needs to be addressed one should be a bit exhaustive. The part on phospholipid-linked fatty acid (PLFA) as chemotaxonomic markers of bacteria is quite comprehensive but recent work on phytoplankton could bring more relevance to a topic which seemed limited to bacteria.

Chapter 9 covers a group of cyclic isoprenoid markers: sterols, hopanoids and triterpenoids which are key tools in many geochemical studies to estimate algal and higher plant contribution to the diagenetic processes. This chapter, though short, is an excellent review.

Chapter 10 is concerned with the group of biogenic hydrocarbons. After a short review on the chemical structure and analytical methods, hydrocarbon biomarkers are divided into two groups: alkane and alkene as well as isoprenoidal hydrocarbons and their abundance used to discriminate between algal, bacterial and terrigenous vascular plant sources.

Chapter 11 focused on several classes of polar lipids: alkenones, phospholipids and ether lipids. These classes provide various very useful markers of origins in sediment but also of paleotemperature. Intact polar lipids are considered in the context of bacterial populations but interesting information could have been

used from phytoplankton, mainly in cold waters where massive blooms can sediment quite rapidly and supply information from their phospholipids and glycolipids constituents.

Chapter 12 deals with photosynthetic pigments as primary markers of primary production and autotrophic organisms. Application to different ecosystems and limitation are discussed as well as models (CHEMTAX) to provide proxies of relative abundance of different phytoplankton populations.

The last two chapters cover quite specific chemical biomarkers: lignins, Cutins and suberins on the one hand and anthropogenic markers (Aromatic hydrocarbons, PCBs, etc) on the other hand. The first group is very useful to trace vascular plant inputs to aquatic systems while the second one traces human industrial activities. Both chapters are excellent introduction to substances and markers which are not usually considered in many text books.

As indicated earlier, this book is intended primarily for academics and graduate students but also targets researchers in limnological, estuarine, marine and environmental sciences. As it stands, this textbook can be considered as a reference for students interested in biomarkers. Despite some minor reservations, it is a major source of well organized information and will help the reader navigate through a large body of literature. I am convinced that doctoral students and young scientist beginning in this field will consider it as a basis for organizing their future interests. One of the main assets of this book is its readability, which makes it an excellent manual that I would recommend to any readers interested in chemical markers.

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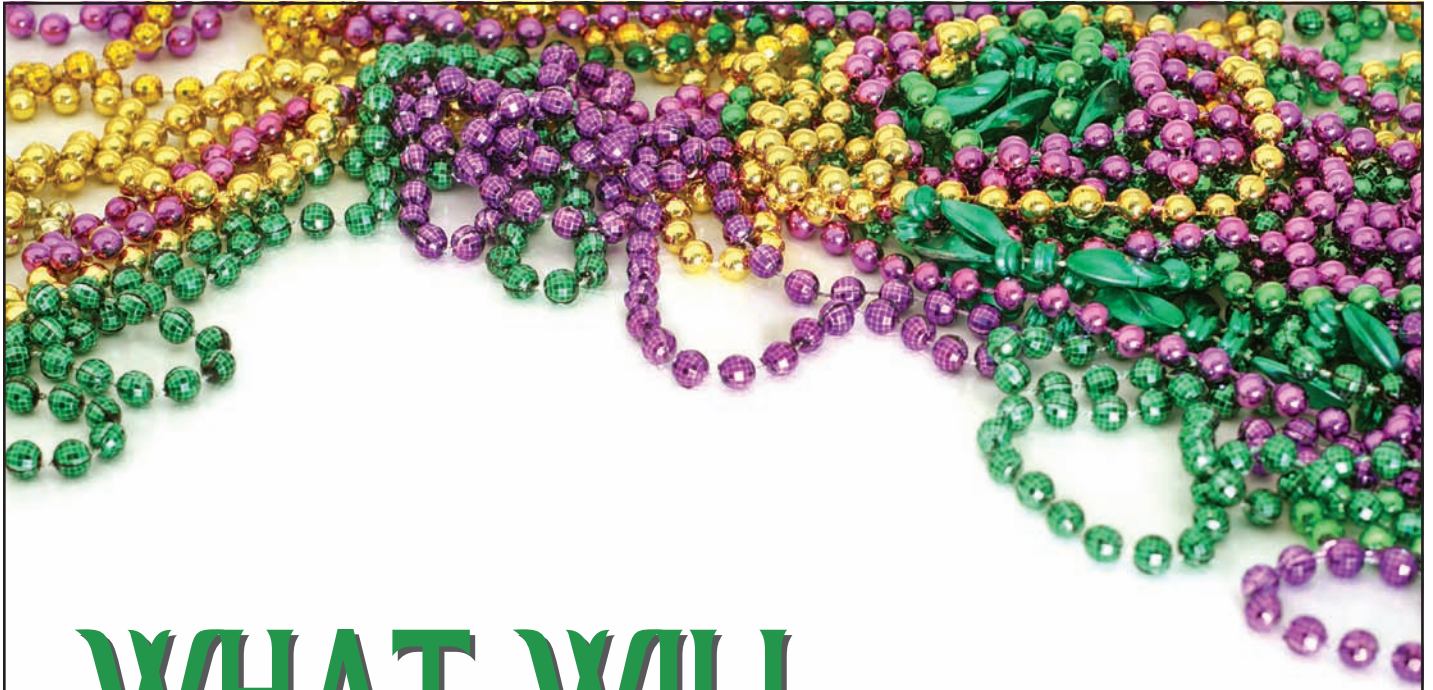
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