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BULLETIN

ASLO

Association for the Sciences of Limnology and Oceanography

The job market for PhDs in aquatic science is changing. See Inside.

IS IT TIME TO REDEFINE THE "ALTERNATIVE" CAREER PATH FOR ECOLOGISTS?

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Graduate programs in ecology tend to emphasize academic careers for Ph.D. candidates, while viewing non-academic careers (e.g., those in government, non-governmental organizations, and industry) as "alternatives." Here, we demonstrate that although the number of Ph.D.'s granted in ecology has increased nearly 3-fold since 1966, less than 20% of those graduates obtain jobs in academia within 5 years of graduation. Furthermore, while it takes a median of 3 years following receipt of a Ph.D. to obtain a tenure-track job in ecology, high variability in recent decades means that Ph.D. graduates have an approximately equal chance of spending anywhere from one to more than five years in soft-money, post-doctoral positions. In sum, the majority of Ph.D. graduates in ecology do not end up in academic careers, and those that eventually do will spend a significant yet variable amount of time in soft-money and temporary positions. We therefore argue that academia is the new alternative career, and that ecology as a discipline would benefit from tailoring graduate training to include skills relevant to non-academic careers while also increasing transparency about the career paths of Ph.D. recipients.

Obtaining a Ph.D. is a serious commitment for students in time, energy, and years of reduced potential earnings; as well as a significant investment for society, with costs for training a graduate student in ecology averaging $150,000[1] (Oklahoma State University 2012). In many graduate programs, the main career goal following a Ph.D. is an academic, tenure-track position, and student training reflects this goal (Freeman et al. 2011, Sauerman and Roach 2012). Non-academic positions, including science positions within government, non-governmental organizations, and the private sector, are perceived by many as less desirable or prestigious, and such positions have traditionally been characterized as "alternatives" to the primary career path for doctoral students.

The emphasis on academic positions, however, reflects neither the reality of today's job market nor the preferences of many Ph.D. graduates (Sauermann and Roach 2012). As a result, a system focused primarily on preparing students to be competitive in academia may provide training misaligned with what students want or need to succeed in non-academic careers (Blickley et al. 2012). If so-called alternative careers (Jaschik 2013) are in fact those most sought after (and obtained) by Ph.D. recipients in the ecological sciences, then continued emphasis on academic research careers may be providing a disservice to graduate students in ecology.

1 Calculated based on the average graduate stipend in ecology and evolutionary biology, assuming 14% fringe benefits, 30% overhead, and 5.5 years of study.

To determine how career pathways of Ph.D's in ecological sciences have shifted over time, we examined both the proportion of Ph.D. graduates in ecology that obtained tenure-track academic positions and the length of time between obtaining the Ph.D. and securing a tenure-track position. We focused on academic positions not because we believe they should be the gold standard for career paths for ecologists, but rather to frame our results in terms of the existing paradigm that emphasizes academic careers over all others. We hope this analysis will spur further discussion on how academic training can most effectively meet the needs of new doctorate holders amid a shifting career landscape.

HAS THE NUMBER OF NEW PH.D.'S AWARDED IN ECOLOGY CHANGED IN RELATION TO THE PROPORTION OF TENURE-TRACK POSITIONS AVAILABLE?

We collected time series data on the number of doctorates awarded from the National Science Foundation (NSF) online database WebCASPAR (https://webcaspar.nsf.gov/). Data were aggregated at two levels: the broad level of Life Sciences, including biological, agricultural, environmental, and health sciences; and the more refined level of Ecology, including ecology, evolution, and population biology. Both levels were included to compare the proportion of doctorates in post-doctoral and tenure track positions, which were only available at the broader level of Life Sciences.

The number of people earning doctorate degrees in the Life Sciences has increased nearly threefold between 1966 and 2010 (Fig. 1A). In general, periods of increase were punctuated by periods of little or no growth. The steepest increase in number of new doctorates awarded occurred recently; between 2003 and 2010 there was a 33% increase in the field. Trends in the Life Sciences as a whole and the subfield of Ecology were strongly correlated ($r = 0.89$; $n=19$; $p<0.0001$). Ecology showed a slightly higher rate of growth than the broader categorization, especially in more recent years (2003 to 2010) when the number of Ph.D. ecology degrees awarded increased by 77%.

We also examined time series data on the proportion of Life Science doctorates employed in post-doctoral and tenure track positions from the NSF Survey of Doctorate Recipients (SDR). The SDR collects longitudinal data on individuals who earn science, engineering, or health (SEH) doctorates from U.S. academic institutions (NSB-12-01). In contrast to the growth in new doctorates awarded, the proportion of doctorates in the Life Sciences employed in tenure track academic positions declined between 1993 and 2008 (Fig. 1B). A total decline of

2.5% - 3.0% was similar for those graduates 1-3 years and 3-5 years following completion, respectively (1-3 year $R^2 = 0.74$, $F_{1,7} = 17.41$, $p = 0.006$; 3-5 year $R^2 = 0.73$, $F_{1,7} = 16.60$, $p = 0.007$).

HAS THE LENGTH OF TIME BETWEEN OBTAINING A PH.D. AND A TENURE TRACK POSITION CHANGED IN THE PAST 4 DECADES?

We administered a web-based survey to quantify the length of time between obtaining a Ph.D. and a tenure track position in ecology. The survey consisted of 10 questions and respondents were asked to self-identify as ecologists by stating their area(s) of expertise. The survey link was emailed to several ecological organizations, social media pages, and to faculty, departmental, and professional society list-serves. The intended audience was Ph.D. recipients in ecology in North America who had obtained tenured or tenure-track academic positions in the ecological sciences, and survey responses were filtered to meet these criteria. Respondents were included only if their Ph.D. was received prior to 2009. Our survey was intended to measure the time it takes to get a tenure-track academic position, assuming that the respondent was attempting to obtain such a position for the entire period of interest. As a result, responses indicating >10 year gaps between receipt of the Ph.D. and tenure-track position were removed given comments indicating that these people had followed "non-traditional" career paths, i.e. employment outside academia prior to a later return.

A total of 903 respondents responded to the survey, of which 454 met the filtering criteria. The median time between receiving a Ph.D. and obtaining a tenure-track academic position increased from a minimum of 0-1 year in the 1970's to a maximum of 4-7 years in the mid-1980's, and has remained fairly constant at 3 years since about 1990 (Fig. 2). Variability across all years was high. Not surprisingly, trends in the duration of years spent in post-doctoral positions followed similar patterns. Median time spent in a post-doctoral position was lowest in the 1970's and, using either metric, the time spent between obtaining a Ph.D. and a tenure-track position was highly variable, particularly for people who received their Ph.D.'s after the 1970's (Fig. 3). As a result, ecology Ph.D. recipients since the 1980's have had an approximately equal chance of spending one year or more than five years in post-doctoral positions (Fig. 3). In contrast, ecology Ph.D. recipients prior to 1980 were much more likely to spend less than three years in post-doctoral roles. Low sample size for people receiving Ph.D.'s prior to 1975 (n = 17), however, suggests that additional research is needed to fully characterize these patterns.

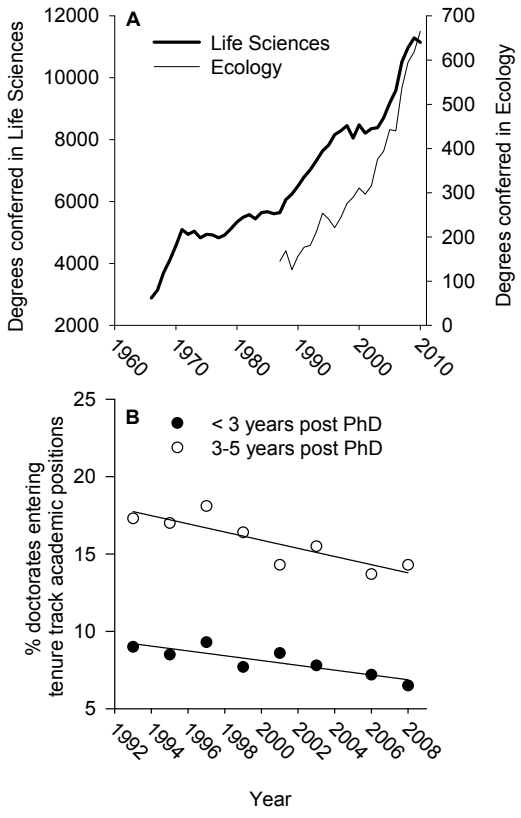

Fig 1A. The number of doctorate degrees awarded in the Life Sciences (left axis; biological, agricultural, environmental, and health sciences) and the subgroup Ecology (right axis; ecology, evolution, and population biology) have increased nearly threefold between 1966 and 2010. **Fig 1B**. The proportion of new doctorate holders entering traditionally academic positions has declined since 1992. Source: WebCASPAR query of IPEDS completion survey data and Table 3-20 (NSB-12-01)

THE ROLE OF ACADEMIC TRAINING AMID A SHIFTING CAREER LANDSCAPE FOR NEW ECOLOGISTS

In ecology, as in most scientific disciplines, the number of Ph.D.'s granted has increased dramatically over the past 50 years. In the life sciences, this increase has occurred without a concomitant increase in tenure track academic positions, and therefore an ever-decreasing percentage of Ph.D. graduates obtain the academic jobs for which they were primarily trained. Less than one in five (< 20%) Ph.D. graduates obtained academic positions at any time between 1993 and 2008 (Fig 1B). This trend is even more apparent in the biological sciences as a whole over the past 40 years; while 55% of Ph.D.'s in biological sciences entered academic jobs in 1973, in 2008 the percentage of Ph.D. recipients in academic positions had dropped to 14% (Cyranowski et al. 2011). These statistics belie a simple fact: there are more Ph.D. graduates than there are academic positions available in ecology. Although we were unable to obtain data on a similar scale documenting career paths of Ph.D. recipients in oceanography, a smaller scale study on oceanographers reported that approximately 50% of Ph.D. recipients in ocean sciences and 65% of Ph.D. graduates in physical oceanography were employed by educational institutions following graduation (Brix et al. 2003). These proportions, despite only representing a single year (for ocean sciences) or a single institution (for physical oceanography), suggest that oceanographers may have a greater chance of obtaining tenure-track positions than their ecologist or life-science counterparts. Still, these data suggest that up to half of Ph.D. recipients in the broader field of ocean sciences are pursuing careers outside of academia. This trend will likely continue, as overextended principal investigators rely on graduate students and post-doctoral positions to produce the publications required

by granting agencies and promotion committees (Freeman et al. 2010, Cyranowski et al. 2011).

For those who obtain tenure-track positions, it currently takes a median of 3 years following completion of a Ph.D. to get an academic job, with that time often spent in post-doctoral positions. This is not a particularly new phenomenon; the median time between Ph.D. and tenure track has remained nearly constant since the 1980's. However, the high degree of variability in the time between Ph.D. completion and employment in academia means that some people will get job offers immediately following (or even prior to) defending their dissertation, while an approximately equal number may spend five or more years as soft-money researchers before obtaining a tenure-track academic position.

The declining availability of academic jobs per Ph.D. graduate and the several years lag between Ph.D. and tenure track positions are not necessarily reasons for despair. However, a lack of awareness of the career prospects that await new Ph.D. recipients and the strong institutional emphasis on skills required for academic jobs to the detriment of other valuable skills may leave new ecologists surprised at their inability to obtain permanent positions following graduation. Several steps are necessary to improve graduate training and align expectations of new Ph.D. students to the current status of career options for ecologists. To this end, we offer recommendations for prospective students, Ph.D. candidates, advisors, department heads, and university deans to move forward in training Ph.D. students.

First, graduate programs and graduate advisors must increase transparency about their capacity to prepare students for success in the contemporary job market. To do so, graduate programs in ecology should provide up-to-date data on the career paths of program alumni 2, 5, and 10 years post-graduation. This type of information is almost always freely available for law schools and business schools, but seldom available in Bioscience departments (Freeman et al. 2001). Individual advisors also must encourage honest discussion about expectations of search committees filling an academic position. For example, potential Ph.D. candidates with academic aspirations should know that to publish the number of peer-reviewed articles expected to successfully compete for research positions in ecology could take up to 8 years publishing in journals with an approximately 80% rejection rate (Statzner and Resh 2010). Such information could possibly deter some potential Ph.D. candidates from enrolling in graduate study in ecology. Indeed, some have argued that the current levels of Ph.D. enrollment are neither justified nor sustainable given the current job market, and that the time has likely come for institutions to rethink Ph.D. programs, perhaps drastically reducing the number of students admitted and degrees granted (Taylor 2011). Such top down controls have already been proposed at some institutions. For example, the recent draft strategic plan for the Krieger School of Arts and Sciences at Johns Hopkins University proposes reducing graduate student enrollment across all departments by about 25% over five years, while concurrently increasing graduate student support for those enrolled (Flaherty 2013). While reductions in enrollment should increase the likelihood of an academic career path for those with doctorates, a Ph.D. offers the opportunity to develop valuable skills that are relevant to a wide range of career options. Thus, independent of reductions in admissions to graduate programs, increased transparency about academic job prospects and adaptation of graduate training to the realities of the career landscape for ecologists are desirable.

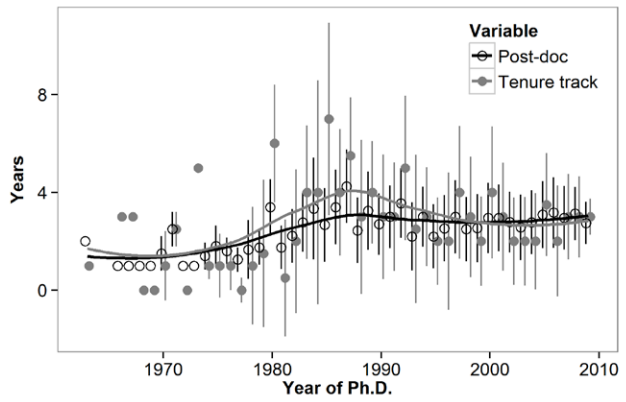

Fig 2. Median (+/- standard deviation) number of years between receiving a Ph.D. and obtaining an academic, tenure-track position (grey, closed circles) and years spent in post-doctoral positions (black, open circles) from survey of 454 ecologists. The median time spent in a post-doctoral position was lowest in the 1970's although the time spent between obtaining a Ph.D. and a tenure-track position has remained highly variable. Lines are smoothed polynomial regression. Points are dodged for clarity.

Our second recommendation is that graduate training of ecologists should emphasize skills relevant to job prospects both within and outside of academia. The latter may be difficult for many faculty graduate advisors, as they are by definition part of the ever-decreasing percentage of those who obtained academic professorships and often have not been widely exposed to other career options. Graduate programs should provide alternatives to over-specialization while promoting cross-disciplinary study, collaboration, and opportunities to develop practical skills and outputs (Taylor 2011). Emphasis on a narrow set of skills most relevant for academia is not only to the detriment of young scientists who may ultimately end up in non-academic fields, it can also reduce the quality of science as creativity is diluted, risks are minimized, and the dissemination of scientific knowledge becomes less effective (Brischoux and Cook 2009, Statzner and Resh 2010). By offering training that is relevant to a wide range of disciplines, adaptive graduate programs have the opportunity to prepare their alumni to produce far-reaching impacts to science and society.

Finally, and perhaps most importantly, the onus falls on Ph.D. students themselves to tailor their training in order to maximize the benefits of their degree and prepare for the current job market. As our data underscore, most Ph.D. students will follow a career path that differs from that of their advisors. Students must therefore understand what skills will be most important in their future careers and proactively seek mentorship and training to gain skills to increase their cross-sector marketability (see Blickley et al. 2012). High-level skills such as critical

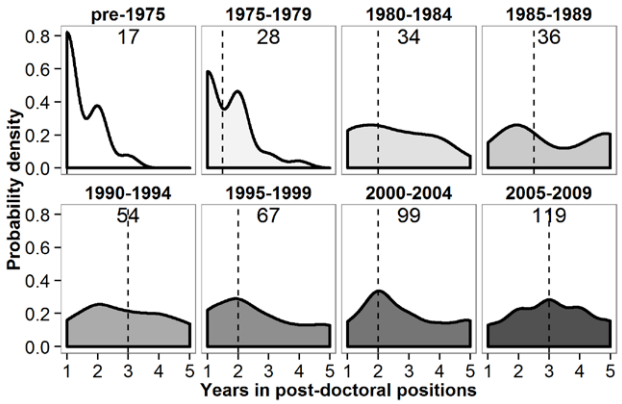

Fig 3. Probability density of duration of time spent in post-doctoral positions prior to obtaining an academic, tenure-track position in ecology. Ecology Ph.D. recipients were more likely to spend less than three years in a post-doctoral position prior to 1980 than since. Dashed lines are medians (note that the median for pre-1975 is 1), numbers in panels are sample size for each time period.

thinking and problem solving; technical skills in statistics, computer programing, and writing; and experience teaching, supervising employees, and managing projects are all important components of most Ph.D. programs that are relevant to a wide range of career options. Opportunities for professional development and training in such areas are often available to graduate students through the broader university community, professional society meetings, and other venues, and students should be encouraged to take advantage of these opportunities. As a contributor to an online career discussion board for graduate students succinctly summarized (Check 2007): "If you aren't thinking about 'alternative careers' before ever setting foot in graduate school, then you're being foolish."

It is imperative that those interested in pursuing a Ph.D. in ecology educate themselves and approach their graduate career with an open mind about the myriad career options following degree completion. It is equally important for mentors, graduate programs, and institutions to recognize the reality of academic career paths and encourage the development of skills necessary to succeed in a range of potential careers. As academia becomes the new "alternative" career for ecology Ph.D.'s, graduate programs and institutions must adapt to reflect this reality.

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CONTROVERSIAL NSF LEGISLATION GETS HEARING

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Editors' Note: This article was originally published in the ASLO Aquatic Science Policy Report. If you are not a current subscriber but would like to receive periodic, focused updates on aquatic science policy, sign up at: http://aslo.org/mailman/listinfo/pan

On 13 November, the House Committee on Science, Space, and Technology's Subcommittee on Research and Technology held a hearing to review the proposed discussion draft of the *Frontiers in Innovation, Research, Science, and Technology (FIRST) Act* and to discuss federal research and education priorities for the National Science Foundation (NSF), the National Institute of Standards and Technology (NIST), the White House Office of Science and Technology Policy (OSTP), and interagency science, technology, engineering, and math (STEM) programs. FIRST was authored by Chairman Lamar Smith (R-TX) who chairs the full House Committee on Science, Space and Technology.

FIRST would replace the America COMPETES Act, which passed in 2007 and in 2010 with broad bipartisan support. While COMPETES is due for reauthorization, many science advocates in Washington have spent much of the year hoping a reauthorization bill would not come forward. Former House Science chairman Bart Gordon told attendees at the AGU Science Policy Conference in June that he would rather COMPETES not be reauthorized than have an authorization with damaging clauses, preferring the "do no harm" approach. Gordon was referring to policies in a leaked draft bill, the High Quality Research Act, which would have required each funded grant to be certified as being in the "national interest." The leaked bill elicited a large outcry from the science community, Democratic members of the Science Committee and the White House (see previous ASLO Policy Report story http://www.aquaticsci.net/?p=997).

The FIRST Act expands on that requirement, adding in six specific goals (economic competitiveness, health and welfare, scientific literacy, partnerships between academia and industry, promotion of scientific progress and national defense) and requiring that the names of staff who approved the grant as well a justification for each grant be published on the NSF website. Smith alluded to this provision in his opening remarks, stating: "Government employees and their program managers should be accountable to the American taxpayer for their funding decisions. They should explain why grants that receive taxpayer funding are important research that has the potential to benefit the national interest. It's not the government's money; it's the people's money. Enhanced transparency and accountability isn't a burden; it will ultimately make NSF's grant award process more effective."

Ranking Member of the Full Committee, Eddie Bernice Johnson (D-TX) was "puzzled" by the draft legislation, noting that "this draft seems to be dominated in both tone and volume by everything that some of my colleagues believe NSF and scientists are doing wrong, and contains very little in the way of a vision for the future." For more information about the grant certification provision, see Jeffrey Mervis's ScienceInsider article (http://news.sciencemag.org/funding/2013/11/house-hearing-skates-over-big-disagreements-nsf-reauthorization).

Another trigger point in the legislation is the provision dealing with open access to research data and publications. While the NIH open access policy has an embargo period of up to one year, the FIRST Act suggests a length of 24 months but would allow each agency to extend up to 36 months total after consultation with stakeholders. The week prior to the hearing, eleven library and publishing groups cosigned a letter opposing the provision, which they say is "completely out of line with the policies in wide use around the world." Full letter available at: http://sparc.arl.org/sites/default/files/OAWG%20FIRST%20Letter_0.pdf

Hearing witnesses and Democrats on the subcommittee expressed other concerns with the draft bill, including the lack of provisions to help spur regional innovation; the changes to NSF's merit review process; and the lack of a broadening participation provision to encourage women and minorities to enter STEM fields. The legislation also does not contain authorization levels for future fiscal years. Subcommittee Ranking Member Dan Lipinski (D-IL) expressed concern over the impact of flat or unknown budgets at science agencies on the next generation of investigators: "If we continue to let science funding stagnate across the Federal Government the long term effects on our scientific competitiveness will be catastrophic. Agencies and universities won't be able to plan, some of the best and brightest will give up and leave their labs, and the younger generation will see what their mentors are up against and decide against a career as a researcher altogether."

The draft bill, hearing webcast, testimony and statements on the FIRST Act are accessible at: http://science.house.gov/hearing/subcommittee-research-and-technology-hearing-keeping-america-first-federal-investments

LETTERS TO THE EDITORS

BRIDGING THE SALTY DIVIDE, PART 2

***John Marra**, Brooklyn College of the City University of New York; Jfm7780@brooklyn.cuny.edu*

I have some thoughts regarding the essay by Kavanaugh et al. (2013) in the May issue of the *Bulletin* that considered the differences between limnology and oceanography. I'm not convinced that the authors of the essay have arrived at the reason for the divide in citations, and in the two associated sciences. Certainly, they've identified the symptoms, but in my opinion they miss two key aspects of the divide.

Limnologists and oceanographers have the same objectives, and ask the same questions. Indeed, biological oceanography's

paradigm originated with limnology: Lindeman's 'trophodynamics', where energy flow and nutrient cycling are fundamental, and the population ecology is aggregated into P, Z, and N. And both limnology and oceanography are, like astronomy, inductive sciences. Experiments can't normally be carried out. That changed in the 1970s for limnologists, working in the Experimental Lakes Area (Schindler 1990). Oceanographers weren't able to do the same until 20 years later with the IronEx cruises (Coale et al., 1996) and the ability to chemically 'tag' a water mass. So, if it's not currently the fundamental nature of the science, what is it? In my opinion, the differences arise from two things: funding and scale.

Both biological oceanography and limnology originated in the late 19th century, but were driven by different concerns, and therefore different funding sources. Biological oceanography arose out of the need to understand changing fish catches (Mills, 1989). Its parent discipline, oceanography, developed in the 20th century in response to the military and to maritime commerce (the bathythermograph and sonar are examples), and became associated with government institutions. Limnology originated with the science of ecology. Small ponds and lakes were considered models for demonstrating ecological principles. After WWII, oceanography was essentially a soft-money (grant supported) science, and remained that way for the next several decades. Biological oceanography also developed as a soft-money science. The three biggest US institutions in those days, Scripps Institution of Oceanography, Woods Hole Oceanographic Institution, and Lamont-Doherty Geological Observatory were all supported through government research grants, and with tenuous connections to (respectively) UCSD, MIT, and Columbia. Only a handful of universities had academic departments in oceanography, and many of those had adjunct labs with soft-money science programs. The Office of Naval Research (ONR) supported Gordon Riley and his colleagues at WHOI and then at Yale after the War through the 1950s. The two largest oceanographic institutions in the 60s, 70s, and 80s were Scripps and the Bedford Institution of Oceanography (BIO), and each housed a famous research group, the Food Chain Research Group (FCRG) at Scripps, and the Marine Ecology Laboratory at BIO. MEL was part of a government lab, and the FCRG was supported by state and federal funds. There were many smaller groups and laboratories contributing significantly to ocean science, all supported through government grants. The only counterparts on the limnology side were the Freshwater Institute in Winnipeg, a Government of Canada lab, and the Great Lakes Environmental Research Laboratory, part of NOAA.

Meanwhile, any biology or ecology department in colleges and universities might have room for a limnologist or two, making the academic opportunities much greater for limnology than for oceanography. Oceanographers were, in most cases, working for the government, or supported by the mission agencies such as ONR and the Dept. of Energy. Limnologists were teaching, and constrained to an academic schedule. ASLO complied with the limnologists for annual meetings. Up until the early 1980s, the annual meetings were always held at universities after the academic year ended. Attendees stayed in student dorms; costs were low. In the early 80s the Ocean Sciences meetings arrived, the first of which was held at a hotel in San Antonio, TX, in February 1982.

I remember during my graduate school days, a fellow student who was interested in the diel feeding behavior of mesozooplankton, and planning for a cruise. He consulted with an ecologist who worked in lakes, and who told him that he would need to sample 10 depths over 200 m at least 7 times a day, not realizing the impossibility of that regimen using plankton nets from an ocean-going research ship. What might be a tractable ecological problem in lakes quickly becomes intractable at sea. Sampling the ocean was, and is, at a vastly different scale. And scale influences funding. Sampling at ocean scales requires large vessels that no university can support without considerable federal funds. Oceanographic research can take years to plan and conduct.

Perhaps the two watery sciences will converge. Biological oceanography has many new sampling and analysis tools to address questions of ecology, and that move us beyond identifying variability, looking for 'hot-spots' in productivity, and trying merely to catalog what's in the ocean. And as for lakes, in the ocean there are instances where trophic cascades can be identified, and phytoplankton community structure can be explained ecologically, and not simply in terms of a chlorophyll-a response to water column dynamics. Similar to the famous question posed by Hairston, Smith, and Slobodkin (1960) on why the earth is green, we can now ask, "Why is the ocean blue?" And, what regulates community structure in the phytoplankton (Follows et al. 2007, Marañón et al., 2013)? On the other hand, lakes are isolated, individual entities, each with their own history. Redfield stoichiometry can exist over ocean basins, but could easily change from lake to lake.

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

ASLO NEWS

MESSAGE FROM THE PRESIDENT

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

When friends ask me how it is to be ASLO President, I tell them it is wonderful but a bit like a giant game that is somewhere between monkey-in-the-middle and dodge ball, but played with e-mail. Our current bylaws rest responsibility for the day-to-day management of the Association on the President. Therefore, in ASLO, many decisions end up being processed directly by the person in this office. This means that the ASLO President and Board do a lot of management and have less time for governance, the big-picture stuff. Through my work on the Board of the Council of Scientific Society Presidents, I learned that very few societies are structured in this way. Most have Executive Directors to whom many day-to-day functions can be delegated – and these are normally people with skills in business, meetings, publications, promotion, and a host of other abilities not normally found in the sorts of diverse volunteers and paid editors who have helped to make ASLO great. But these are the skills and abilities needed to keep ASLO lively and sustainable for generations of aquatic scientists to come.

ASLO'S NEW EXECUTIVE DIRECTOR

A process was started a few years ago to see how ASLO might best position itself within the changing landscape of publication, scientific meetings, and training opportunities, to provide the best value to ASLO members long into the future. This process was called the ASLO Comprehensive Evaluation (ACE) and harnessed several of the tenets of "ASLO's Guiding Principles" to map a plan forward. This process has been detailed in this column a few times over the last year or so. We hired the expertise we needed, ranging far beyond that found in our volunteer board and executive, to not only plan strategically, but to seek ways to adapt ASLO to the changing environments faced by our members.

This long and careful process was meant to find ways in which the excellence of ASLO's past might be leveraged to ensure a vibrant and sustainable future. The ACE report, now distributed to all ASLO members, indicated several major areas in which changes will be helpful to ASLO and her members: improving business management, improving publication strategies, improving governance, and finding ways of staying small while competitively functioning as a larger organization. When the preliminary results of the ACE report were presented to the ASLO Board at the New Orleans meeting in February 2013, the Board recognized that accomplishing several elements of ASLO's needs would require expertise and work-time far beyond that possible with our current paid contractors or volunteer Directors. It was thus resolved to hire an Executive Director (ED) by enlisting the assistance of knowledgeable consultants, creating a job description, forming a search committee, and seeking candidates.

The job description of the ED is a person who will be "responsible for the oversight of the Society's operations, with a focus on the management and development of the society's

publications portfolio. The ED serves and promotes the interests of the members of the society guided by directives of the Board of Directors and as such initiates, oversees, coordinates and organizes efforts to realize the mission of society." The required qualification included: strong background in the scholarly publishing industry, including scientific journal management, marketing and sales, editorial and production, and revenue models; ability to support the leadership of a complex nonprofit organization including an understanding of the responsibilities and constraints of such an organization; experience reporting to, working closely with, or serving on a Board of Directors; and proven analytical skills with ability to evaluate needs and develop and implement effective solutions independently. The search committee was chaired by Peter Jumars and included a variety of ASLO members. Many applications were received, discussed, and ranked before several Skype interviews were used to narrow the field of candidates. Finally, three candidates were interviewed in person by a subset of the search committee; the position was offered to and accepted by the top candidate in December 2013.

I am delighted to announce that Ms. Teresa Curto was selected unanimously by the search committee to be ASLO's new ED. Comments from the search committee indicated that she has a steady and serious approach with strong potential for being an effective leader and partner in solving future problems faced by the ASLO Board. She was detailed, analytical, and insightful in her questions about ASLO's needs and her compatibility with them. She has an impressive command of scaling in journals management and the approaches most feasible for an organization of ASLO's size. She effectively outlined how she would go about learning ASLO's culture and needs in the process of developing an effective management approach. She indicated a strong appreciation for the clear value of existing contractor contributions to the success of ASLO and emphasized the need to understand ASLO's culture and build strong, collaborative relationships.

Teresa has spent the majority of her 20+ year career in senior operational and financial management positions at professional non-profit educational and medical associations, including the International Reading Association and Radiological Society of North America. She has also been the Managing Director of the Optical Science Center for Applied Research at Delaware State University. She has a host of skills and experiences that will build on ASLO's outstanding past to forge a strong and sustainable future. We have arranged for Teresa to have an office in Oceanography within the College of Earth, Ocean, and Environment of the University of Delaware – directly between New York City and Washington DC where much of science society business and publishing happen. Importantly for Jim Elser and all future ASLO Presidents and Boards, Teresa's skills and abilities will free the volunteer ASLO President and Board to govern the society rather than spending so much time on day-to-day management. When you have a moment, please send Teresa an e-mail (execdir@aslo.org) and welcome her to the ASLO family.

ASLO'S NEW BOARD MEMBER

Gerhard Herndl, one of ASLO's shining stars and this year's Hutchinson medalist, was elected to the ASLO Board as a member-at-large (MAL) in 2012. Last summer, Gerhard's administrative responsibilities at his home institution became too onerous for him to assist the Board to his satisfaction, so he resigned from the Board with great regret. ASLO bylaws stipulate that the number of MALs is determined by the number of ASLO members so his vacancy needed to be filled. Luckily, the bylaws indicate that in such a case the ASLO Board may appoint a new MAL to fill out the remaining term of the departing MAL. The ASLO nominating committee suggested Howard Browman to fill this position. Howard is a long-time ASLO member, native of Canada, who is currently a Principle Research Scientist at the Norwegian Institute for Marine Research in Storbø, Norway. Prior to that, Howard was Scientific Director at Inter-Research Science Center and held a variety of academic and research posts in Canada. Howard is editor-in-chief of the *ICES Journal of Marine Science* and a section editor for *PLOS ONE*. He is also a member of the International Advisory Board of the Committee on Publication Ethics, the ASLO Publication Committee, a member of the Editorial Policy Committee of the Council of Science Editors, a member of the Committee on Publication Ethics, and has held a broad range of editorial and advisory roles across the science publishing industry. Howard was a member of the ASLO ACE Committee where he brought substantial clarity and insight. Howard Browman was appointed unanimously as MAL through June 2013. Please join me in thanking Howard for his dedication to ASLO and his willingness to continue by serving as MAL (HowardB@IMR.no)!

ROBIN ANDERSON, E-BOOKS EDITOR RESIGNS

In July 2010, Robin Anderson took on the massive challenge of building an e-Books program for ASLO. This was an extremely ambitious step, which we had hoped would be an additional source of ASLO revenue while adding to the wide range of products and services that ASLO members enjoy. In her resignation letter, Robin notes that the field of e-Book publishing is evolving rapidly and even those who are involved with this industry full-time cannot predict what a stable business model might be for a smaller publisher such as ASLO. Robin also recommends that we turn this question over to our new ED for recommendations and suggests the need for dedicated marketing and business management expertise. Robin's resignation is effective April 30, 2014, after completion of the two book projects underway (EcoDAS IX and EcoDAS X). It is a testament to her dedication to ASLO, and to the program, that she wishes to remain as EIC until all pending projects have been completed. On behalf of the Board, I want to express our gratitude to Robin. She has shown great courage in taking on this challenge and we owe her a debt of gratitude for laying the foundations of the program.

EXCITING BYLAWS REVISIONS ;-)

Paty Matrai, ASLO Treasurer, suggests there is nothing that can clear a room faster than the discussion of budget and finance. I would suggest that bylaws revisions might be a close competi-

tor. In brief, our bylaws need to comply not only with the wishes of ASLO members, but, because we are a Wisconsin-based non-profit corporation, they also need to comply with Wisconsin non-profit law, non-profit best-practices, United States Federal laws, and laws and regulations of the United States Internal Revenue Service (the IRS). A year ago, I suggested in my column in the ASLO Bulletin, that we would be voting on bylaws revisions by spring 2013. Along with our former attorney, I began to work on the needed revisions (an example of one of the types of tasks an ASLO President will not have to do now that we have an Executive Director!). Ed Schneiderman, our stalwart attorney for many years, had health problems that precluded completing this job. I continue to work on draft revisions with our new attorney (Brian Anderson of DeWitt, Ross & Stevens, Madison, Wisconsin – Brian helped to draft current Wisconsin non-profit law) and have presented a draft to the Board for comment. More revisions will need to be made before a clean and clear draft can be recommended to the ASLO membership for vote later this spring. Most changes are issues of compliance with legal norms, but there also will be reorganizations for clarity and removal of contradictory language as well as some substantive issues to make ASLO work better for the members. I am sorry to burden members with a vote on bylaws but sound governance requires clear bylaws and sustainability requires ASLO to work within the legal norms required by law and best practices.

PLEASE VOTE ON NEW OFFICERS AND NEW MEMBERS-AT-LARGE

All of the governance of ASLO is assured by hard-working volunteers. These are the people who think about the future of ASLO and how to make it a better society of our members. This spring, we will be electing a new President-elect, a new Treasurer, four members-at-large, and a new student member. Debbie Bronk has been an outstanding President in all phases of the office. Paty Matrai has been Treasurer for two wonderful terms and has done a superb job at organizing finances and showing us temporal trends in revenues and costs. Anya Waite and Paul del Giorgio have done outstanding work on several key dossiers and will be leaving ASLO better than they found it. Howard Browman (see above) will get the same chance between now and the end of June! Alli Fong has been a highly energetic student Board member and has done great things with student programs. The energy and integrity these fine people have put into this volunteer work is amazing – we owe them our thanks. Now, please be sure to vote to refill their positions with great ASLO members who will help to continue ASLO's legacy of excellence. This year, you will be directed to candidate statements on-line instead of in the *Bulletin*, because of increasing demand for space in this high-quality publication. Also worthy of note is that this spring we will be electing one member more than the number rotating off the Board. This is because ASLO is a growing society (now 4806 members!) and our bylaws set the number of MAL positions based on membership.

AN EXCITING AND BUSY YEAR FOR ASLO MEETINGS

This issue of the *Bulletin* will likely appear shortly before the Ocean Sciences Meeting (OSM) in Honolulu (February 23-28) and the next issue of the Bulletin is scheduled to appear shortly before the Joint Aquatic Sciences Meeting (JASM) in Portland (May 18-23). At this writing, the registration for the OSM is 5200, a wonderful attendance for this 17th biennial OSM. This meeting is co-sponsored by ASLO, the Oceanography Society, and the American Geophysical Union. The meeting has 175 sessions as well as plenaries and a panel discussion moderated by National Public Radio's Richard Harris. Thanks to Jon Sharp for doing a superb job as ASLO's representative on the OSM committee.

The JASM is an historical inaugural meeting co-sponsored by some of our partners in the ASLO-co-founded Consortium of Aquatic Science Societies (CASS). Our partners include the Society for Freshwater Science (SFS), the Phycological Society of America (PSA), and the Society of Wetland Scientists (SWS). The theme is "Bridging Genes to Ecosystems: Aquatic Science at a Time of Rapid Change." To build discussion, the meeting will have five plenary-themed sessions, one to accompany each of the plenary presentations. The meeting will also have a keynote address by filmmaker and long-time ASLO contributor and friend, Randy Olson (author of the new book entitled *Connection: Hollywood Storytelling meets Critical Thinking*). Roxane Maranger and John Harrison have been doing a terrific job as ASLO's reps for this diverse and exciting meeting.

Because we have two meetings in the span of four months, we will be having two meetings of the Board of Directors between February and May 2014. If there are matters that you would like me to bring to the Board of Directors, please let me know by 24 January (Honolulu board meeting) or 18 April (Portland board meeting). Our principle ASLO Business Meeting will take place at the Honolulu OSM meeting this year but we will also have an informational meeting at the Portland JASM meeting.

PLEASE GET IN TOUCH

If there are questions you have, suggestions you would like to make, or other ideas about how ASLO could work better for you, please do not hesitate to call or write. As always, I would appreciate hearing from you about anything having to do with ASLO, ASLO publications, ASLO meetings, or anything else concerning our mutual society. Email me at president@aslo.org, Skype me at asloprez, use the forum (http://aslo.org/forum/), phone me at +01 515 294 8880, or post a comment or question on the ASLO Facebook site http://www.facebook.com/groups/limnology.oceanography/.

Sincerely,

John

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*

Happy Belated New Year to everyone. ASLO continues to be a strong and vibrant society. It is your society so be sure that your membership is renewed and that you encourage your coworkers and colleagues to join.

2014 is the year of collaboration for ASLO. We will have two meetings in 2014 and both are joint with sister societies. February 23-28, ASLO will meet in Honolulu, Hawaii with TOS and AGU for the Ocean Sciences Meeting. The summer meeting will be held May 18-23 in Portland, Oregon and is jointly sponsored by SFS, SWS, and PSA. Both meetings are expected to draw large audiences and, of course, in doing so, leave large carbon footprints. We recognize this and are working to provide ways to offset these footprints as well as to meet in facilities that support the environment.

Below are some facts about the Hawaii Convention Center (HCC). In the next *Bulletin*, I will highlight the Oregon Convention Center. The HCC was opened with respect for the Hawaiian environment and implemented efforts to conserve Hawaii's natural resources. The center received the Green Event Award for 2012-13 and been recognized for its recycling efforts.

Some of those efforts:

- Controlled lighting and air conditioning that is computer based to eliminate use when not needed.
- Energy-efficient and environmentally-friendly lighting.
- Light motion sensors to assist with energy conversation.
- Building design to all the trade winds to circulate throughout the building to lower air conditioning use.
- Automatic dispensers in all restrooms.
- Drip irrigation and xeriscape plants to minimize water use.
- Recycling of glass, plastic, aluminum, and paper plus containers for batteries, copper wire, and metal recycling.
- Green waste is composted and recycled into mulch.
- Product purchases support local businesses wherever possible.
- Chemicals used are ecologically friendly.
- Coffee served is locally grown and produced.
- Food waste is either composted or used for animal feed locally.
- Food that is not consumed is donated to Harbor House and Kids Kitchen programs.
- Disposables used in food service are biodegradable and compostable.

We hope to see you at one of the 2014 meetings. If we can be of help in anyway, contact the business office.

Helen Schneider Lemay

ASLO Business Manager

MESSAGE FROM THE PUBLIC AFFAIRS DIRECTOR

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

ACADEMIA: THE NEW "ALTERNATIVE" CAREER?

This issue's lead article is one that I hope students and advisors will read, discuss, and act upon. As I've relayed through this column before (see Volume 22, Issue 1: http://www.aquaticsci.net/?p=950), preparing students for a variety of career paths is a necessary part of "advancing the sciences of limnology and oceanography." It truly does take a village! Other scientific societies have noticed these changes as well. When I participated in the American Institute of Biological Sciences (AIBS) Council meeting in December, attendees repeatedly noted the need for better training for graduate students that will prepare them for a variety of career paths. Some attendees at the meeting noted that many of their best graduate students were expressing ~~dismay~~ disgust at the academic career path and indicating they had no desire to go that route.

On the surface, this may seem a mere challenge of education solved simply by providing better training for graduate students. However, many attendees at the AIBS Council Meeting noted the issue goes far deeper than that and is becoming a major policy issue. The Johns Hopkins plan to slash graduate admission by 25% over the next five years has turned the heat up on the national debate regarding graduate admissions. While most people agree that the academic research system is broken at some level, the fingers are pointing in many directions – at university administrators, at the tenure process, at funding agencies, etc.

Scientific societies are in a unique position to address this challenge. ASLO can contribute to the policy component by fostering conversation and awareness among our members regarding the overall state of graduate education, tenure, and policies that may be inadvertently contributing to what some have called a "glut" of Ph.D.'s. ASLO provides some education about career options for graduate students through workshops, training opportunities, and resources on a variety of careers. For those attending the Joint Aquatic Science Meeting in Portland this May, consider attending the panel discussion on careers I'm

hosting, which should provide a window into the world outside of academia and answers to some of your questions about life outside of academia.

I'd love to hear your feedback on what ASLO can do to help prepare aquatic scientists for diverse careers. Students and early career members, what else would be helpful? Should the Meeting Mentor Program be expanded or modified to include mentors who are not academics? Advisors, how can ASLO help you prepare your students for today's job market?

ASLO COMMENTS ON DRAFT NSF LEGISLATION

Research funding is the fuel for the aquatic science enterprise. Last year, some interesting policy proposals emerged from Capitol Hill (see article, p6) regarding authorization of the National Science Foundation (NSF), the primary aquatic science funding agency in the U.S. ASLO and 88 other scientific organizations, societies, and research universities signed a letter to the House Science Committee regarding several provisions of the draft legislation. The letter was organized by the Coalition for National Science Funding (CNSF) and can be viewed, along with other policy letters endorsed by ASLO, at http://aslo.org/policy/advocacy.html.

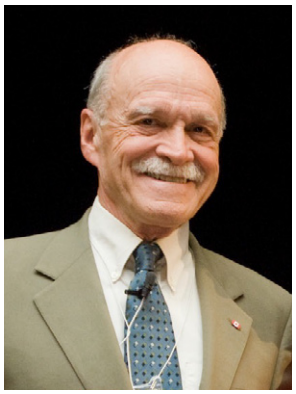
Of note to all ASLO members is the proposal to allow a two-year embargo period for publications under a federal open access policy. As President John Downing has relayed in many previous *Bulletin* columns, subscription revenues enable ASLO to produce high quality publications as well as the other many services ASLO provides to its members and the field. A review of 110+ recent papers published in *L&O* indicate that 90% would fall under an open access policy if the U.S. were to adopt one. Given the relatively long half-life of papers in our field, a short embargo period could severely threaten subscriptions and possibly even ASLO's existence. ASLO sent a letter to policy-makers in support of the longer two-year window included in the discussion draft of FIRST. The letter may be viewed at: http://aslo.org/policy/advocacy.html.

OUTSTANDING L&O REVIEWERS

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

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

JOHN HOBBIE



John Hobbie is a Senior Scholar at the Marine Biological Laboratory, Woods Hole, and is retired from positions of Director of the Ecosystems Center and of Director of the Arctic LTER Project. His early research interest was in arctic limnology but during a postdoctoral period at Uppsala (1963-65) he teamed up with another postdoc, Dick Wright, to develop techniques for measuring the role of heterotrophic bacteria in lakes and oceans. A later paper established that there were 10^6 bacteria per ml in most lakes and oceans. In the past 8 years he has teamed up with his son, Erik, to use ^{15}N to measure transfer of nitrogen from ectomycorrhizal fungi to shrubs and trees and to compare the ecology of aquatic and terrestrial bacteria. They argue that aquatic bacteria are good models of the ecology of soil bacteria and many of the apparent differences result from methological artifacts. He has edited and written books on microbial ecology, estuaries, arctic limnology, natural history of arctic Alaska, and the changing ecology of tundra, streams, and lakes in northern Alaska.

DAVID MONTAGNES

David Montagnes is a Reader at the University of Liverpool, where he has been for almost 20 years, after emigrating from Canada. David's career began with the study of microzooplankton dynamics, especially ciliates, in the field and laboratory. His work includes species description, method development, and biomass and ecological rate measurements, all of which have been directed towards appreciating the role of microzooplankton in freshwater and marine food webs. More recently, David has expanded his interests to focus on using protozoa as model organisms to assess fundamental ecological issues such as habitat fragmentation and population model parameterisation. To see what he and his group are up to see: http://pcwww.liv.ac.uk/~pelagic/index.htm

ASLO ED REDUX?

Pete Jumars*, Chair of the ad hoc Search Committee for the ASLO Executive Director*

ASLO has a new Executive Director. A few of us recall that ASLO had an Executive Director in its early years of seeking a public policy role. Fewer will recall that the reason for the title was to give access and respect around the D.C. policy circuit. The ASLO policy role is now well established and in good hands under Adrienne Sponberg's able leadership as Director of Public Affairs.

Although the ED title is the same, the job is very different. That ASLO needs an ED is good news. While the majority of scientific societies have contracted, ASLO membership remains strong, and its operations have grown substantially. ASLO now does close to two million dollars of business each year and oper-

ates four distinct journals. There is simply too much day-to-day business and decision making for a volunteer Board to manage. Without someone with perspective and detailed understanding of production over all of ASLO's publications, it is impossible to achieve economies of scale. ASLO would clearly benefit from some professional attention to branding. The Board needs good, professional input on issues such as how to balance affordability of meetings and potential income from meetings in the context of ASLO's journal income and expenditures. The Board does get such input from its editors and its business office, whose perspectives are particularly valued because Board members, with the exception of the President, are short timers—but none of these people is tasked to develop or implement a perspective over all of ASLO's activities.

ASLO received 20 applications for the position. The search committee whittled down the list to 6 for Skype interviews and finally 3 for long, in-person interviews. These highly qualified people made it clear to us that ASLO would be an attractive society for which to work. The members know that, but it is reassuring to hear the perspectives of professionals unaffiliated with ASLO who know other organizations and conclude from cold, hard analysis that ASLO continues to have great growth potential.

It is indeed a privilege and a pleasure to introduce to ASLO Teresa Curto, the unanimous choice of the search committee. Our unanimity is quite a testament, as the search committee would have been pleased to see ASLO hire any of the three final candidates. Teresa comes to ASLO from Delaware University, Dover, where she managed the Optical Science Center. From 2005 to 2010, Teresa rose to Assistant Director for Publications at the International Reading Center in Newark, Delaware. Teresa is looking to get back closer to her roots with the Radiological Society of North America, Baltimore, where she oversaw print journals and helped launch a video journal.

The committee chose Teresa in part for her journals management and other business skills and obvious sensitivity to ASLO sensibilities and traditions. We invite you to seek her out at the Ocean Sciences Meeting in Hawaii and to keep filling her sponge with information about what ASLO members value and what they want. If you miss her there, her office, through the gracious help of Dean Nancy Targett, will be in the College of Earth, Ocean, and Environment. That puts her in easy striking distance of both New York City and Washington, D.C., when development opportunities for ASLO arise. Please join me, the search committee and the ASLO Board in giving Teresa a warm welcome.

STRATEGICALLY PLAN TO CHECK IN ON THE ASLO STRATEGIC PLAN

***James J Elser**, President-elect and chair of ASLO Strategic Planning Committee; president-elect@aslo.org*

Any vibrant organization that has its act together has a Strategic Plan and actively relies on it to chart its course. I'm happy to say, then, that ASLO has a Strategic Plan (it's right there under the "Home" tab on the ASLO web site). The plan you find there was created in 2009 and has formed the basis for the activities of the society for the past five years. In fact, at the 2012 Board meeting at Lake Biwa a rough accounting of the execution of the strategies / activities laid out in that plan indicated that >95% of them had been put into action! While the impact and effectiveness of some of those activities may still be playing out, already in ASLO we see the benefits; for example: the establishment of the Consortium of Aquatic Science Societies (CASS); the development of our early career honor, the Yentsch-Schindler Award; Emerging Issues workshops; and the deployment of several new ASLO-branded publications (e-Books, e-Lectures, and L&O Fluids and Environments). But all good Strategic Plans have a shelf life and this one has had a good run. It's time for a new one.

This duty falls to ASLO's Strategic Planning Committee (SPC), whose chair is the President-Elect. Luckily, the committee also includes some competent members: Past President Deb Bronk, Treasurer Paty Matrai, Member-at-Large Anya Waite, and Student Member-at-Large Alli Fong. What have we done so far?

We began with some feverish readings of various articles and books on organizational innovation, with a bit of inspiration from the book *Race for Relevance* (ASAE/Jossey-Bass Series) about the rapidly changing challenges in publication, communication, and demographics that confront today's professional associations. Importantly, we received input and recommendations from the ASLO Comprehensive Evaluation (ACE), which was executed in 2011-12 by a committee chaired by Member-at-Large Paul del Giorgio, as well as from comprehensive data from the 2012 membership survey. Next, during the recent Aquatic Sciences meeting in New Orleans, I solicited ideas for the new Strategic Plan from anyone who ventured too close to the ASLO booth in the poster hall. These were compiled into a document that the SP has been drawing on for inspiration. The SP has also gathered input from all of ASLO's standing committees, charging them with responding to these four questions:

- Where should ASLO be 10 years from now?
- What will be different? What will be the same?
- What new areas should we be moving into and which areas should we leave behind?
- What are the pathways ASLO should follow in reaching this "ASLO+10"?

These pieces of feedback have also been fed into the SP hopper. Optimistically, I posted some invitations for SP inputs to the still-largely-secret ASLO Forum (http://aslo.org/forum/); those

invitations are still open so feel free to post your ideas there! You can be first!

The SP committee then embarked on a series of online meetings to discuss the SP and especially to focus on its stated goals in light of the changing nature of our field, the demographics of international aquatic researchers, the world of publications, and many other dimensions. This has led us to produce a more focused set of SP goals that were brought to a weekend SP brainstorming meeting held in Washington DC in October and attended by ~12 members of the Board. Those two days were spent in highly stimulating discussions and included a meeting with staff members from the American Institute for Biological Sciences (AIBS), which recently completed its own strategic planning process. The SPC came away with yet more ideas and feedback to bring to bear as it creates the new 2014 Strategic Plan. We then began to meet online every two weeks to further advance the draft SP.

What is coming next? During the weeks leading up the 2014 Board meeting at the Honolulu Ocean Sciences meeting, the SPC will develop a draft version of the new SP goals and primary strategies. Then, in Honolulu, these will gain Board feedback and approval and the process will then focus on the specific tactics and performance metrics that will be assigned to each strategy. These final pieces will then be further refined and, it is hoped, approved by the Board around the time of the Portland Joint Aquatic Sciences Meeting (JASM) in May 2014, or soon thereafter.

ASLO is seeking partners in outreach and education projects. Do you have educational materials you'd like help distributing on-line? Contact the ASLO Public Affairs Office (via sponberg@aslo.org) to discuss a partnership with ASLO.

A NEW ASLO STRATEGIC PLAN WILL BE BORN. *Alright, so how can you get involved?* At Honolulu and at Portland, the ASLO booth will be a central place where we will once again gather feedback, but this time on the emerging 2014 SP draft Goals, Strategies, and Tactics. Your ideas will be welcome. The threads on the ASLO Forum will remain open and perhaps this article will spur some traffic. As always, members of the Board welcome your input by whatever means you wish to use (Facebook, ASLO Forum, phone, email, fax, letter, or semaphore signals).

With a new Strategic Plan, ASLO will be more strongly positioned to serve its members and to advance our science even more effectively.

ASLO 2014 ELECTIONS

The terms of the ASLO Board of Directors are staggered to ensure that experienced Board Members are always present. Elections are conducted by electronic ballot each spring (instructions to be sent via email and will be posted on the web site); a written ballot can be sent upon request from the ASLO Business Office (business@aslo.org). In Spring 2014, you will be voting for President-elect, Treasurer, Student Board Member, and **three** Members At Large.

An electronic ballot, with instructions for voting, will be emailed to all ASLO members. You may also go to http://aslo.org/members/forms/ballot.html to vote. *All candidate statements will appear online only this year.* You may read the statements online at: http://aslo.org/elections/. The candidates for each position are listed below. Please remember to vote when you receive your ballot!

President
- Jennifer Cherrier
- Linda Duguay

Treasurer
- Phil Taylor
- Ben Twining

Student Board Member
- Emi Fergus
- Jenna Spackeen
- Grace Wilkerson

Member-at-large (Three vacancies)
- Takashi Asaeda
- Perran Cook
- Miguel-Ángel Mateo
- Elizabeth Minor
- Craig Stevens
- Kim Wickland
- Alex Wyatt

MEETING HIGHLIGHTS

COMMUNITY COLLEGE FACULTY AT ASLO AND OCEAN SCIENCES: BUILDING THE OCEAN SCIENCE 2YC COMMUNITY

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The approximately 1200 community colleges in the United States play a crucial role in STEM education. Forty-three percent of U.S. undergraduates attend a community college (American Association of Community Colleges, 2011), and almost one half of Americans who receive bachelor's degrees in science and engineering, and one-third of recipients of science or engineering master's degrees, attended a community college at some point during their education (Tsapogas, 2004). Community colleges are also important in teacher preparation; about 40 percent of the nation's teachers, including those in STEM fields, completed some of their mathematics or science courses at community colleges. Community college (2YC) faculty thus play an important role in geoscience education, and oceanography or some type of ocean science is part of the curriculum at many community colleges. These courses are taught by a diversity of faculty some of whom have graduate degrees in the ocean sciences, others are teaching these courses outside of their primary discipline. One common feature of these faculty is that few of them have access to professional development opportunities to learn of new developments and discoveries in the ocean science field.

To address this issue, and to continue our efforts to build an ocean science 2YC community, we received funding from the National Science Foundation (NSF) to facilitate the attendance of twenty-two 2YC faculty at the 2013 ASLO meeting in New Orleans. We offered a Sunday workshop that focused on best practices for preparing workforce and transfer students in two-year colleges for ocean science careers. The workshop goals and program details can be seen at: http://serc.carleton.edu/sage2yc/workforce/workforce2013ASLO/program.html In addition we sponsored a paper and poster session on opportunities and challenges of teaching introductory oceanography to undergraduates, thus providing an opportunity for the 2YC attendees, (along with others) to present their work that focuses on their teaching experiences. Participants valued the opportunity to network with others who teach oceanography, to learn about current research in ocean sciences, make new contacts and discover resources to utilize in their teaching.

Building on the success of the 2013 meeting NSF has again provided us with resources to bring 2YC faculty to the 2014 Ocean Sciences meeting as part of our efforts to build the Ocean Science 2YC community. In addition to the regular Ocean Science meeting opportunities 2YC faculty (both those sponsored by NSF and others who plan to attend the meeting) will be offered a Sunday workshop focusing on oceanography teaching resources and practices in the two-year colleges. The workshop will explore successful models for teaching oceanography topics to non-majors and will focus on tested models and strategies for effective teaching. Topics for inclusion are using on-line data, interactive activities, active learning, and research opportunities for 2YC students. We have also sponsored a paper and poster session on undergraduate ocean science education in the 21st century: an exploration of successful practices that has provided the 2YC faculty and others opportunities to showcase their expertise. Those interested in learning more about the developing Ocean 2YC community are invited to contact Jan Hodder - jhodder@uoregon.edu and Allison Beauregard - beaurega@nwfsc.edu

Twenty-two community college faculty attended the 2013 Aquatic Science Meeting in New Orleans to network, learn about current research in ocean sciences, and discover resources to utilize in their teaching.

xFOCE: LONG-TERM IMPACTS OF OCEAN ACIDIFICATION IN SITU

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Laboratory studies have considerably advanced the understanding of the tolerance or response of individual species to ocean acidification in the past 15 years. This approach, however, provided little information concerning the response of natural assemblages of interacting species, in which the direct impacts of ocean acidification as well as their cascading indirect consequences (e.g. changes in the intensity of interaction strengths among predators or competitors) may be evident. Free Ocean CO_2 Enrichment experiments (FOCE; Kirkwood et al., 2011) are a key tool to investigate the long-term (several months to

more than one year) response of natural communities to ocean acidification. This technology provides precise control of pH within *in situ*, partially open, experimental enclosures (e.g., Kline et al., 2012).

With support from the BNP Paribas Foundation and the French Embassy in Washington D.C., a group of present and future FOCE users and engineers met in Villefranche-sur-mer (France) in November 2013. FOCE systems and the results obtained so far were reviewed: dpFOCE deployed in deep waters offshore California (Jim Barry), cpFOCE deployed on the Great Barrier Reef (David Kline), eFOCE in operation in the NW Mediterranean Sea (Erin Cox and Paul Mahacek), swFOCE to be deployed in Californian coastal waters (Bill Kirkwood), and antFOCE to be deployed in the Australian sector of Antarctica (Donna Roberts and Jonathan Reeve).

There is little doubt that, although challenging from engineering and logistical point of views, current FOCE experiments will provide crucial data for understanding the response of communities to ocean acidification. However, ocean acidification is not the only change affecting the global ocean. Changes in temperature and oxygen concentration are also key parameters controlling marine ecosystems. It is anticipated that the next generation of FOCE systems will include options for oxygen and temperature control. Meeting participants have identified key engineering and scientific issues and discussed preliminary plans for manipulating several of these variables *in situ*, including nutrients.

This informal group, called xFOCE, has organized to publish a paper providing guidelines and best practices information for future users and to prepare a Wikipedia entry on "Free Ocean CO_2 Enrichment," now online. The xFOCE group is open and welcomes any scientist planning to develop a FOCE system. MBARI will release an open source package to transfer FOCE technology to interested researchers. This package will comprise all engineering information required to develop cost effective FOCE systems.

The xFOCE web site provides additional information on the current FOCE systems, meetings and expected products (http://xfoce.org).

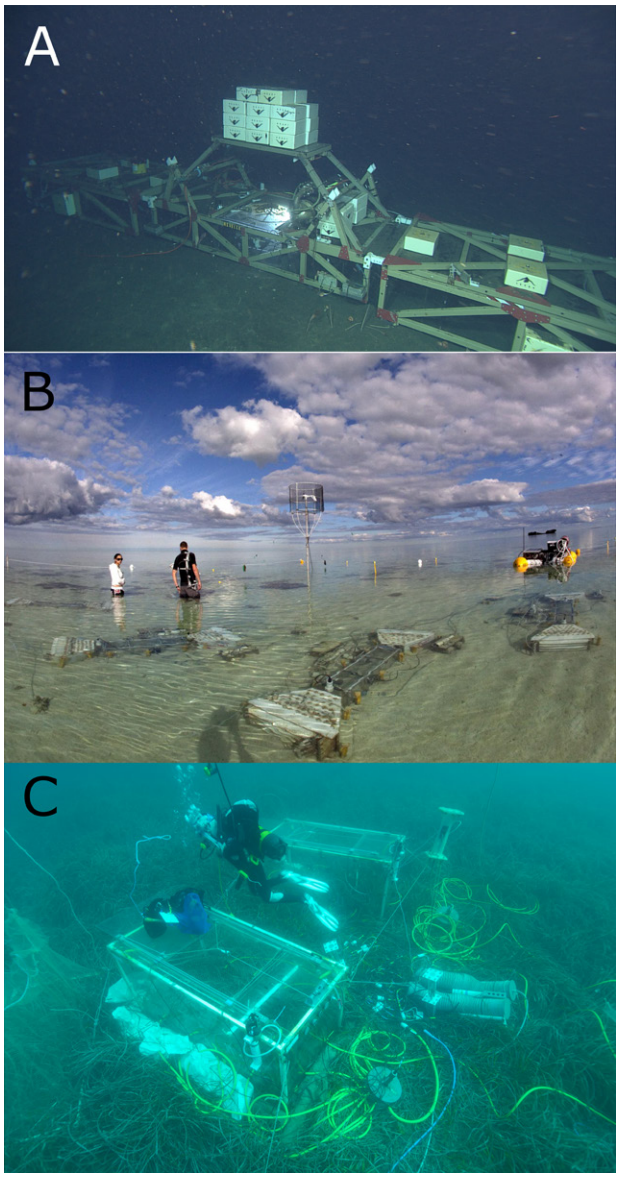

Fig A: The deep FOCE (dpFOCE) instrument, deployed for 17 months at 900 m depth offshore California, used a flume concept for maintaining greater control over the experiment volume while still permitting the introduction of natural seafloor sediments, organic material, and nutrients.

Fig B: The coral proto FOCE (cpFOCE), deployed at Heron Island (Great Barrier Reef), used replicate experimental flumes to enclose sections of the reef and dose them with CO_2-enriched seawater using peristaltic pumps with computer controlled feedback dosing.

Fig C: The European FOCE (eFOCE) system, currently deployed in the bay of Villefranche-sur-mer (France) at about 12 m depth and 300 m offshore to investigate the effects of acidification on *Posidonia* seagrass beds, comprises two open-top enclosures as well as a surface buoy housing the electronics as well as the production of CO_2-enriched water.

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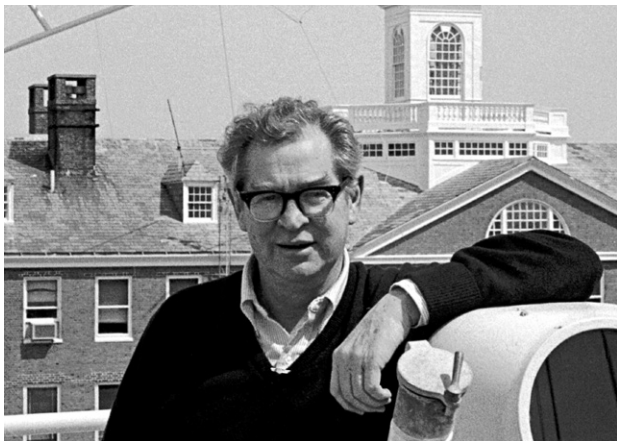
OBITUARIES

JOHN H. STEELE, 1926-2013

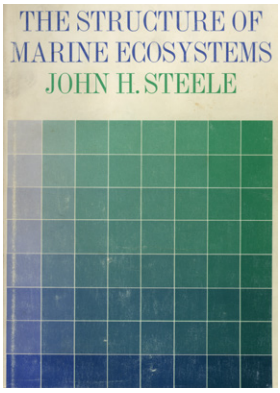
***Louis Legendre**, Sorbonne Universités, UPMC Univ Paris 06, UMR 7093, LOV, Observatoire océanologique, F-06230, Villefranche/mer, France; legendre@obs-vlfr.fr*

John H. Steele passed away on 4 November 2013, a few days before reaching his 87th birthday. John was born in Edinburgh, Scotland, in 1926. After studying mathematics at the University College, London, he conducted research in aeronautical mechanics for the Royal Air Force from 1946 to 1951. He then joined the Marine Laboratory in Aberdeen, Scotland, which is dedicated to fisheries management, and was awarded a Doctor of Science degree from the University College, London, in 1963. He was director of the Woods Hole Oceanographic Institution for 12 years, from 1977 through 1989. He continued to be a very active researcher during his years as director of the largest oceanographic facility in the World, after which he happily returned full-time research until this year. During all these years, he served as member or Chair of boards and committees of several organizations in United States and Europe. Examples of the latter are his chairmanship of the Scientific Committees of the European Network of Excellence EUR-OCEANS from 2005 to 2008, and the European project SESAME (Southern European Seas: Assessing and Modelling Ecosystem Changes) from 2006 to 2011. During his rich career, John H. Steele received many honours that include election to the Royal Society of Edinburgh in 1968, the Alexander Agassiz Medal of the U.S. National Academy of Sciences in 1973, and election as Fellow of the Royal Society of London in 1978.

John H. Steele was a true giant of oceanography. His key role was to bring about the final transformation of biological oceanography into a fully quantitative and mathematically based discipline. The turning point for the oceanographic community was the publication of his book *The Structure of Marine Ecosystems* in 1974, where he explained his mathematical approach and applied it to field data. From that point on, biological oceanography could use the lingua franca of other scientific disciplines, mathematics. From that point on, also, John Steele was among the international leaders of the ocean science community. He never stopped developing new ideas and quantitative approaches for such diverse topics as fisheries management, the functioning of large and small-scale marine ecosystems, and the role of oceans role in global climate change. He also played a leading role in the development of international oceanographic projects that included ocean physics, chemistry and biology.



John H. Steele. Photo courtesy of Woods Hole Oceanographic Institution.



The Structure of Marine Ecosystems. Many of us have Steele's book, dust cover well worn, in our personal libraries.

One may think that a man with such international scientific stature as John Steele was exclusively focused on research, and generally intimidating to approach. Nothing would be farther from reality. Indeed John and his marvelous wife, Evelyn, were the most genial and hospitable people, who enjoyed life and loved exploring a variety of topics with friends and acquaintances during their numerous trips throughout the world and over good meals. For those who had the privilege of meeting him, John was the model scientist and the ultimate gentleman. We miss him.

CHI-SHING WONG, 1934-2013

***Robie Macdonald**, Pêches et Océans Canada, Institut des sciences de la mer, Boîte postale 6000, Sidney, C.-B. V8L 4B2 Canada; Robie.Macdonald@dfo-mpo.gc.ca*

Dr. Chi-Shing Wong, known by most of his associates as CS, was widely recognized as one of Canada's leading ocean geochemists. He came to Canada's west coast in the early 1970s and set up an atmosphere-ocean CO_2 facility, initially within Energy Mines and Resources, Canada, briefly with Environment Canada but ultimately with Fisheries and Oceans where he remained until he retired in 2009. CS had an exceptional capability to recognize an important science problem, to engage with the international community working on it, and to find the funding to support a meaningful contribution to that problem by Canada. In those early years, when few of us worried about time series, CS recognized the opportunity afforded by the west-coast weather-ships to initiate the first atmospheric CO_2 time series at an oceanic station (Station Papa). Perhaps this would be no surprise to those who knew him well, given that two of his heroes were Roger Revelle and Charles Keeling. This atmospheric time series was accompanied by an ocean chemistry time series, the value of which has grown exponentially with time.

While maintaining the carbon-cycle work in the NE Pacific Ocean, CS recognized the emerging revolution in ocean trace-metal geochemistry toward the end of the 1970s. With

impeccable foresight, he included a cutting-edge clean room as part of design of the chemistry wing in the new Institute of Ocean Science at Patricia Bay, and immediately used this facility to conduct research on the cycling of elements in seawater using mesocosm enclosures moored in Saanich Inlet – bag work, as it was frequently termed. This enclosure work, led by Tim Parsons, presented the opportunity of researching metal cycles as they affected – or were affected by – biological cycles. CS recognized clearly the extraordinary opportunity presented by this setting, not only to research the cycles of metals in constrained ocean systems, but also to attract a community of leading international scientists from, for example, Japan, Germany, Britain, and the USA. From this basis, CS brought about a NATO Advanced Research Institute in 1981 out of which came a turning-point book – "Trace Metals in Sea Water." His chosen co-editors formed a cadre of who's who in ocean geochemistry, including Ed Goldberg, Ed Boyle, Ken Bruland and JD Burton. If one pages through the papers included in that NATO book, one will find virtually the entire community who produced the first real understanding of elemental cycling in world oceans.

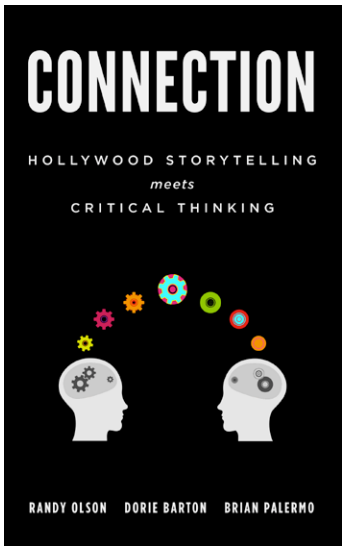
In the early 1980s another quiet revolution was occurring consequent to the development of sequential sediment trap technology, which presented some of the first glimpses of rapid connectivity between upper ocean and abyss mediated by particle flux. Again, CS recognized the value of collecting a time series at Station Papa and, against all fiscal odds, managed to maintain that observatory from 1982 to 2006. Establishing this observatory was prescient, given the changes now occurring in the ocean's CO_2 system, and it well illustrates CS's astute geochemical eye and remarkable tenacity. CS authored or co-authored well over 100 papers spanning several oceans and far more topics than highlighted here. He received numerous awards including Fellowship of the Royal Society of Canada (FRSC, 1999), but perhaps his favourite would have been the AAAS Newcomb Cleveland Prize for the most outstanding paper in Science (Quay, Tilbrook and Wong, 1991). This particular paper could not have been written without the baseline ocean section extending from the Gulf of Alaska to the Southern Ocean during the Hudson 70 cruise. Looking back on all these accomplishments, I think it fair to say that CS has firmly established himself as an icon in Canadian ocean science.

C.S. Wong. Photo by Emmy Wong

BOOK REVIEWS

Olson R., Barton D., and B. Palermo. 2013. **Connection: Hollywood Storytelling meets Critical Thinking**. Prairie Starfish Productions. ISBN-978-0615872384202 pp. US$14.99
*Reviewed by **Jennifer Cherrier**, Associate Professor, School of the Environment, Florida A&M University, 1515 Martin Luther King Jr. Blvd, Tallahassee FL 32307; jennifer.cherrier@famu.edu*

*Science is relevant to society **AND** as scientists we strive to effectively communicate our work to each other and to those outside our field **BUT** although we may all like a good story we have never been formally trained to craft our messages so I am **THEREFORE** **grateful** [this is my one word] to Randy Olson, Dorie Barton , and Brian Palermo for teaming up to co-author 'Connection: Hollywood Storytelling meets Critical Thinking' to provide us with the tools and direction that many of us critically need. (J. Cherrier's one sentence summative statement using the ABT template)*



A mouthful, but a critical first step toward pulling together a story's narrative arc according to Olson, Barton, and Palermo's *Connection: Hollywood Storytelling meets Critical Thinking*. This book is engaging and extremely accessible. It provides a compelling rationale for why scientists should translate their messages as well-structured and relatable stories. It also provides the necessary tools to do it. I highly recommend this book to any scientist interested in learning how to communicate more effectively-whoever their target audience.

As scientists we have important messages to convey whether it be to collaborators, to our students, to program managers, government officials, or the public at large. Unfortunately, we often miss the mark. We leave those we're speaking to scratching their heads wondering what we just said. As our aquatic resources come under increasing human pressures, the need for scientists to communicate our research in a language that's digestible to others both inside and outside of our community is becoming even more critical (i.e. see J. Cohan's 2013 Science News article *Great Presenters Lighting Up the Auditorium* http://www.sciencemag.org/content/342/6154/78.full or N. Baron's 2010 book *Escape from the Ivory Tower* http://islandpress.org/ip/books/book/islandpress/E/bo8053066.html). In *Connection*, Randy Olson suggests that the root of the problem is that scientists are stuck in a 'nerdloop.' He says that "rather than come down from out of [our] heads into the more practical, simple real world side of communication" we oftentimes instead get "tangled up in endless webs of information" which has us

spinning out of control in "cerebral outer space" and unable to get our messages across to others.

Fair enough. Guilty as charged. Try as I might, I know I have fallen prey to this nerdloop conundrum and am sure we can all attest to having unfortunately witnessed it first-hand at many an ASLO meeting. To get buy-in and acceptance from our peers we feel compelled to convey all the complex nuances our own respective 'splendid esoteric obscurities':

> "Henceforth, I will lovingly use the phrase "splendid esoteric obscurity" to connote any subject that you are passionate about and have probably dedicated literal years of your life to. Basically, whatever subject you feel is not being communicated well enough that it drove you to read this book is your 'splendid esoteric obscurity'." (Brian Palermo, *Connection*)

In *Connection* Olson, Barton, and Palermo have provided valuable tools to add to our communication toolkit to break the nerdloop and help scientists put together stories that can relate. This isn't the first run for this talented team- *Connection* had its genesis from a series of 'Connection Storymaking Workshops'. Olson recruited Barton and Palermo as co-instructors over three years ago to conduct a series of these workhops for various professional organizations. I'm very pleased to report that ASLO was one of these, thanks to the foresight of workshop organizers Jonathan H. Sharp and Adrienne Sponberg, funding from NFS, and the support of the ASLO Board.

Olson is a marine scientist Ph.D, turned Hollywood writer/director. He is one of our own- trained in the world of science speak. He has experienced first-hand how, in most cases, our training has left us ill-prepared to share our message with 'people'. He saw a critical need for scientists to get out of their 'heads' and learn how to communicate our findings to the public. He was wise enough to realize that he couldn't do it alone- that he needed help from some masters in communication, Hollywood experts who make their living telling and relating stories. He capitalized on his Hollywood connections and enlisted the help of Barton and Palermo. Barton is a professional actor, script consultant, and writing coach. Palermo is a writer and professional actor as well with a wide range of performances in TV, film, and comedy. What I believe contributes to the overall success of this book is that the authors all use the power of their voice and personal experience to draw the reader in and make them want to continue to read and learn more. They use their own personal stories to teach the reader how to write a good story (do as I say and watch how I do it!).

Olson begins the book by providing an overview for how to get started on translating a message into a good relatable story. He provides the basic steps for 'roughing in' a story using the 'Word, Sentence, Paragraph (WSP) Model' and explains how it works and can be applied to telling a story. He focuses on the 'WS' portions of this model and elaborates on how it is essential first to identify the one word that relates to your story and then from that develop one sentence that sums up what your story is about. He proposes the use of the 'And, But, Therefore (ABT) narrative template' to flesh out this summative sentence and provides many examples for how to do it (for quick reference see R. Olson's recent *Science Letter Science Communication: Narratively Speaking* http://www.sciencemag.org/content/342/6163/1168.1.full). The book then transitions into the 'P'-paragraph- portion of the WSP model and Olson turns over the authorship reigns to Barton whom he refers to as the 'cerebral part of the team'. Barton leads the reader through the process of developing this paragraph or, in the language of Hollywood, the 'Logline'- the story synopsis.

Barton states that "story is a set of details about a person's (or persons') experience, arranged in a deliberate structure, which gives it specific meaning and universal appeal. Story structure is a process in which a hero does something challenging in order to gain something crucial." This is our task then, to create this structure for a message we want to convey. In her section of the book, Barton goes into detail on how to achieve this narrative structure and provides several examples for how to develop a Logline, which when completed can be expanded into a fully developed story. The Logline is the framework around which Hollywood writers organize their stories and what they use to pitch their stories to people in the TV and film industries. It's also a perfect tool for scientists to use to structure and translate their messages into stories- a tool that we need to use. But, the authors point out, a well structured story in and of itself is not the full recipe for an effectively communicated story - there's one last necessary ingredient: the story must be relatable, has to be relevant and the audience has to be emotionally connected to it. For this the authors turn to Palermo- the visceral part of the team- the one who, through the use of improvisation tools and examples, guides the reader from the head to the gut. Palermo contends that "connecting is communicating effectively" and unless the audience "actively listens and comprehends" what a story teller is saying "there has been no communication- just politely patterned noise." So if Barton is the cerebral portion of the team and Palermo is the visceral, Olson must be the circulatory system that connects the two. Olson follows Palermo by pulling together the head and gut under the umbrella of the WSP Model (the circulatory system) and provides some excellent scenarios for how it would be applied to shape a story. The book closes with sage advice from Olson regarding the development and telling of your story: follow your intuition and keep it simple. He states if you use the tools provided in this book "you will stand a pretty good chance of finding the simplicity in what you want to say. And with that simplicity, you too, will achieve 'the ultimate sophistication' as a teller of stories."

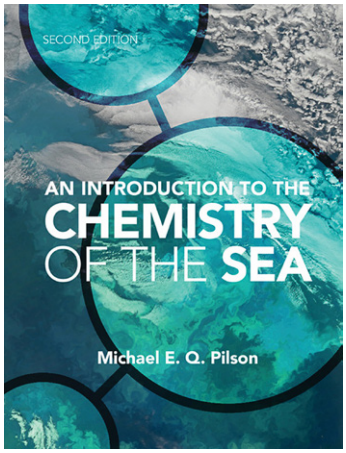
I had the good fortune to participate in one of the 'Connections Storymaking' workshops last year in New Orleans and I directly benefited from the unique perspective Olson and his team bring. By traditional science meeting standards the workshop was unconventional- it surely moved our group out of our collective 'science' comfort zone. It was also however, most definitely fun and inspirational! If the goal of the *Connection* team and the workshop organizers was to create a shift in how ASLO members would communicate our science and, if my reaction is a litmus test for other ASLO members, I'd say it succeeded with flying colors! Last spring I had the chance to apply those lessons for general public 'Green Drinks'

talk, a science cafe type of venue. I have to say it was one of the most difficult talks I've yet prepared but it was also one of the most rewarding. I had a great time giving the talk and was able to translate my message into a story that the audience really seemed to connect to. Not perfect but it was a great start. So, I am thrilled that Randy Olson, Dorie Barton, and Brian Palermo have written this book so that I and others can continue to hone our storytelling skills. On a related note, it took me a bit longer than expected to read through *Connection* to prepare for this review. It took me longer not because it was difficult, but because I was taking notes and working on my story as I read along. A good sign! *Connection*, together with great other great resources like Nancy Baron's *Escape from the Ivory Tower*, provides scientists not only with a path forward towards effective science communication but also with the tools to get it done. Thank you!

My only (selfish) issue with the book is I wish that the table of contents were more detailed. This would greatly enhance its navigability for future reference.

Pilson, M.E.Q. 2013. **An Introduction to the Chemistry of the Sea, second edition**. Cambridge University Press, ISBN 978-0-521-88707-6. 524 pp. $80.

Reviewed by ***Mary I. Scranton****, School of Marine and Atmospheric Sciences, Stony Brook University, Stony Brook New York 11794-5000; mary.scranton@stonybrook.edu*



The second edition of "An Introduction to the Chemistry of the Sea" by Michael E.Q. Pilson is a text designed for upper division undergraduate or introductory graduate courses in marine geochemistry. Pilson has been teaching an introductory marine chemistry course like this for many years at the University of Rhode Island and it is clear he has thought long and hard about the best way to make this very broad field accessible to students from a variety of backgrounds, and to emphasize the relevance of marine geochemistry to students with other interests. The focus of the book is on the water column rather than the sediments but otherwise is quite comprehensive. As a second edition, in places the references are heavily biased toward the mid-1990s although some recent papers are cited. Since the goal of the book is to provide a basic knowledge of marine geochemistry, this is not a fatal flaw and is probably inevitable for a text which needs to be kept to a reasonable length, but for specific topics, supplemental recent readings will be called for (particularly for graduate students). I noticed this especially in the trace metal and organic geochemistry chapters.

A particularly appealing aspect to this text is the inclusion of quotes and historical introductions to each topic in each chapter, which clearly lay out how the science in the particular area evolved, where questions still exist and likely research that will be needed to answer these questions. This has the advantage of making the field seem alive to the student, rather than giving the sense that all important knowledge is now at hand. However in sections where the cited references are several decades old, it is often unclear whether the open questions remain open and what areas are the ones of truly recent research. Pilson does let the student know which related topics are coming up in future chapters, and describes many of the relevant methods used. He also does an excellent job of imbedding important chemical principles in the relevant sections rather than overwhelming the student with thermodynamic detail at the beginning of the book. The text is conversational in an appealing way, with quotes from a variety of sources and asides about the origin of words and ideas. Throughout I felt Pilson was standing nearby explaining topics to me. Therefore, this book is a particularly good choice for a "mixed" class of budding chemical, biological, physical and geological oceanographers. I particularly liked the use of what used to be called "back of the envelope" calculations to compute, for example, the potential fertility of a sample from the nutrient content or amount of water that must circulate through the ridge crests to cool the crust.

Other valuable features that will make this book an excellent reference for any oceanographer are (1) extensive figure captions that lead the reader through the figures, complete with citations to the original literature, (2) discussions of the uncertainties embedded in various measurements and calculations, (3) very extensive appendices which include things like solubilities, acid dissociation constants and other useful facts, as well as in depth discussion of certain topics that normally would not readily fit into the text, (4) a short annotated additional reading list at the end of each chapter and a 33 page extensive reference list in the back of the book, (5) a glossary, (6) a good index, (7) boxes and tables in some chapters working through calculations and (8) questions for each chapter which give the student a chance to work through the kinds of problems discussed in the text (although the problems are not mere repetitions of what was done in the text).

Chapters 1-3 introduce the reader to marine geochemistry through a review of the history of chemical oceanography and ocean circulation, a general discussion of the properties of water (into which is embedded a discussion of H and O isotopes in water), a discussion of the concepts of salinity and density (complete with the most recent equations for the equation of state of seawater), and some discussion about the need for accuracy of measurement. These sometimes dry but essential topics are covered in an engaging way and many basic principles are included as part of the discussion. Appendices on the physical properties of seawater and on various properties of gases are more complete than are available in other texts and represent valuable reference material.

Chapters 4-6 cover the major ions and the concept of residence time, the processes controlling gas solubility and exchange, and some basic principles of physical chemistry needed to understand the behavior of salts in concentrated solution.

This section emphasizes general understanding of concepts over detailed physical chemical calculations. The presentations are relatively intuitive and do not require much background in advanced chemistry, although more detail is found in the appendices.

Chapter 7 covers the carbon dioxide system in detail, and includes the usual discussion of calculation of the various system parameters as well as a nice section on anthropogenic carbon dioxide. Much of the relevant physical chemistry is removed from the main part of the text but is present in the appendices. Appendix E includes a presentation of acid-base buffering, air-sea exchange of carbon dioxide and a very brief discussion of isotopic terminology. Appendix F presents a very nice discussion of the confusing topic of pH scale as well as values for dissociation constants for a number of species important in ocean alkalinity. Appendix G discusses specifics of calcium carbonate solubility and Appendix H goes into more detail on the effects of pressure on the various equilibrium constants.

Chapters 8 and 9 are relatively traditional presentations of the processes controlling the distribution of the major nutrient elements (C, N, P, and Si) and of trace elements. The nutrient sections have been updated to include mention of new nitrogen fixers and anammox (but do not mention dissimilatory nitrate reduction to ammonium). The trace metal chapter is structured very much like that in previous texts and reviews, but for most elements, references end in mid 1990s (date of first edition). Although sections on mercury and iron have been at least partially updated, the section on the role of ligands is superficial and does not cite any recent work. However the chapter does reference some more recent reviews in the annotated references at the end of the chapter.

The remaining chapters are less detailed than those in the first section of the book, but provide additional breadth to the text. In Chapter 10 radioisotopes are discussed, with the bulk of the chapter focusing on a few uranium series isotopes (Th-234, Rn-222 and Pb-210) and 14-C. Chapter 11 discusses marine organic matter with a very general discussion of the cycle of organic carbon in the ocean, including new production, the importance of both dissolved and particulate organic matter, and other sources of organic matter. The chapter introduces the reader to some methodological issues as well as the age of organic matter in the ocean and a few specific compounds and their uses as tracers. However, I found no mention of the various recent theories of what controls the sinking flux of carbon and many of the specific examples are dated (eg. discussion of vitamins, lignins, trace metal ligands).

Chapter 12, on anoxic marine environments, describes the basic processes which result in oxygen depletion. This chapter is brief and discusses the ocean oxygen minima rather than truly anoxic basins other than the Black Sea which is the only anoxic system mentioned by name. The chapter discusses the sequence of microbial processes that takes place as oxidants are depleted, but does not discuss processes in any detail. More up-to-date references would have been valuable in this section, which might be revised in a future revision as a "processes in the presence of low oxygen" chapter. Extensive studies in systems like the world's oxygen minimum zones (OMZs), Baltic and the Cariaco Basin (among others) have been carried out in recent years and the importance of expanding hypoxic areas suggests that a more complete treatment of this area could be useful.

The last three chapters take the basic principles developed so far and move toward global geochemical budgets. Chapter 13 discusses exchanges at land-ocean, air-sea, ridge-ocean and sediment-water boundaries, emphasizing the factors which have an impact on a geological time scale. Chapter 14 is a brief discussion of the possibility of extracting valuable substances from the sea, which includes some interesting thoughts about the needs of indigenous peoples for salt as well as a more geochemical discussion of the precipitation of various salts upon evaporation. This chapter, while interesting, lacked a section on "drugs from the sea" and seemed a bit out of place, located in the text as it is between a chapter on geochemical mass balances and a chapter on history of the ocean. The final chapter (15) presents a very brief introduction to the geochemical history of the ocean, again emphasizing the very long term rather than shorter (eg. glacial) cycles.

In spite of inevitable omissions due to the need to keep the text size and cost under control, this is an excellent book that will be of great value to many courses on the chemistry of the ocean.

BRIDGING GENES TO ECOSYSTEMS:

AQUATIC SCIENCE AT A TIME OF RAPID CHANGE

MAY 18–23 / OREGON CONVENTION CENTER

A JOINT MEETING OF FOUR LEADING AQUATIC SCIENTIFIC SOCIETIES

SOCIETY FOR FRESHWATER SCIENCE

PHYCOLOGICAL SOCIETY OF AMERICA

SOCIETY OF WETLAND SCIENTISTS

ASSOCIATION FOR THE SCIENCES OF LIMNOLOGY & OCEANOGRAPHY

Humans rely on water, for our well-being, our livelihoods, our recreation. With increasing human population and accelerating climate change, social and scientific concerns over sustainable water resources are growing.

Scientists strive to understand how natural biological and chemical processes support the health and integrity of aquatic ecosystems. But to be effective, knowledge must be communicated in a clear and understandable fashion with the public and policy makers.

In response to emerging water-related challenges, a ground-breaking meeting of four aquatic science societies will be convened in Portland Oregon on 18–23 May, 2014. The first ever, Joint Aquatic Science Meeting (JASM), has the theme **"Bridging Genes to Ecosystems: Aquatic Science in a time of Rapid Change."**

This meeting will foster integrative understanding and collaborations to advance scientific discovery and enhance communication in many interlinked areas:

- Genetic diversity and ecosystem function
- Recycling nutrients and carbon
- Understanding landscape connections to aquatic ecosystems
- Conservation and sustainability of freshwater ecosystems
- Communicating science to managers, policy makers and the public

FOR MORE INFORMATION, PLEASE CONTACT THE CONFERENCE MANAGEMENT OFFICE: JASM14@SGMEET.COM OR VISIT THE MEETING WEB SITE: WWW.SGMEET.COM/JASM14

Important Dates

JUNE 2013
Call for Sessions Issued

JULY 2013
Session Nominations Closed

NOVEMBER 2013
Call for Abstracts Posted
Registration Opens

FEBRUARY 2014
Abstract Deadline

MARCH 2014
Call for Student Volunteers

APRIL 2014
Presenters Notified of Acceptance
Student Volunteers Notified of Assignments
Program Schedule Posted

18–23 MAY 2014
Meeting

PLENARY LECTURES AND PRESENTATIONS

RANDY OLSON
Scientist & Filmmaker

GINGER ARMBRUST
University of Washington
Microbial Ecology

STUART BUNN
Griffith University –
Australian Rivers Institute
Global Water Policy

PAT SORRANO
Michigan State University
Landscape Limnology

LAUREL LARSON
University of California – Berkeley
Connectivity, Landscapes

JULIAN OLDEN
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