

Spring 1997

Circulation, Vol. 4, No. 3

Center for Coastal Physical Oceanography, Old Dominion University

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Center for Coastal Physical Oceanography, Old Dominion University, "Circulation, Vol. 4, No. 3" (1997). *CCPO Circulation*. 39.
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CCPO CIRCULATION is published quarterly. For more information or to receive a printed copy (with pictures), via postal mail, contact:

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Fostering Oceanographic Collaboration in Cameroon

Attendees at a colloquium on regions influenced by freshwater, which took place in Liege, Belgium in May 1995, learned about the uniqueness of the coastal ecosystem of Cameroon as explained by Charles Gabche of the Centre de Recherches Halieutiques and Oceanographiques of Limbe (CRHOL), Cameroon. Gabche and a group of colloquium participants held conversations geared towards pursuing an international, multi-institutional, and interdisciplinary collaboration to study the Cameroonian coastal ecosystem. After almost two years of communications through postal mail, a planning visit was held in Limbe from February 18-24, 1997 with the participation of CRHOL scientists, Collins Angwe, George Eyabi, Jean Folak, Charles Gabche, Lucy Nkumbe, George Yongbi, and Joseph Youmbi; CCPO scientist, **ARNOLDO VALLE-LEVINSON**; State University of New York at Stony Brook scientist, Kamazima Lwiza; and University College of North Wales scientist, Alejandro Souza. The participation of Arnaldo and Kamazima was sponsored by the International Programs of the U.S. National Science Foundation (NSF-INT), and the participation of Alejandro was financed by the British Council. The original NSF-INT grant for this planning visit was awarded to Arnaldo and **LARRY ATKINSON**, Director of CCPO. The purpose of this visit was to prepare a working document that would serve as the base for the submission of proposals to various funding agencies.

Cameroon is located on the western coast of Africa between 2 and 4 degrees north in the apex of the Gulf of Guinea. An important portion of the freshwater discharge to the northeastern Gulf of Guinea, the Biafra Bight, enters along the coast of Cameroon. This coastal region is affected by major environmental issues that include loss of fisheries and biodiversity, declining water quality, contaminated beaches, habitat degradation, and related socio-economic problems, such as loss of access to fish harvesting and loss of recreational and tourism amenities. Yet, current knowledge of the oceanographic conditions of coastal Cameroon and the Gulf of Guinea is restricted to anecdotes and sparse information

that suggest the effects of interesting phenomena that are unique to the region.

The interaction between the coastal waters of Cameroon and the high relief of the adjacent land (Mount Cameroon is 25 km from the coast and elevates 4,095 m) causes land-air-sea interactions that yield the second wettest region of the world and the wettest in Africa (>12,000 mm/yr a year in Debundscha). As a consequence, an extensive network of rivers discharge their freshwater along the coast (as a line source) and cause low salinity on the continental shelf. The fate of these buoyant discharges to the coastal ocean is essentially unknown. Little is known about the circulation of the Gulf of Guinea, but due to its proximity to the equator, the hydrodynamics of coastal Cameroon may be weakly influenced by Coriolis acceleration and is probably dominated by the competition between buoyancy forcing and a monsoonal wind regime. Southwesterly winds related to the monsoon coincide with the rainy season and might restrict the estuarine discharges and related pollutants to a thin band along the coast. The Hamattan winds (northeasterlies associated with the dry season) might spread the buoyant water offshore, but their influence on the productivity of the region is unknown.

In addition, the interaction of rivers and ocean along the coast of Cameroon supports extensive mangrove ecosystems that serve as nursery grounds to many species of commercial and ecological importance. These mangroves, however, are threatened because of deforestation by commercial logging of the adjacent areas. They are also threatened by pollution from agrochemicals and other anthropogenic sources.

There are many interesting environmental issues to study in this part of the world. Therefore, in order to improve the understanding of different oceanographic aspects of the coastal area of Cameroon and its influence on the regional oceanography, a multidisciplinary approach is required to link the physical conditions (current velocity, salinity, temperature, winds) to nutrient distributions, to the primary production, and to target species. Such a holistic view of the coastal ecosystem, influenced by freshwater input, is necessary to help coastal managers implement and understand the changes that may result from natural environmental fluctuations (e.g., wind patterns and freshwater influence) and the changes that may result from human intervention (e.g., fishing, industrial, and agricultural activities). This is the effort that multinational collaboration, involving researchers from CCPO, will pursue in the future.

Notes from the Director...

CCPO started with a group of faculty who were focussed more on data analysis than data gathering. With time, CCPO has evolved to include a more diverse group with more observing to balance the modeling. Originally, we had very limited support personnel. In this issue, you will note the addition of two young scientists in the observational area. **LORRAINE HEILMAN** will be working on estuarine observations, and **STEVE GAURIN** will be working on JGOFS field programs in the Antarctic. These young scientists add a new, often humorous or irreverent, and needed dimension to CCPO. We welcome them.

Now that I have mentioned modeling and observations, I will include a quote from Mellor and Bacon that I have always admired:

By no process of sound reasoning can a conclusion drawn from limited data have more than a limited application. Even when the comparison between the observed and calculated results is considered satisfactory, the errors of observation may quite obscure the imperfections of formulae based on incomplete or simplified premises. Given the sufficient number of "if's," there is no end to the weaving of "cobwebs of learning admirable for the fineness of thread and work, but of no substance or profit." The only safeguard is to compare the deductions of mathematics with observation and experiment "for the very simple reason that they are only deductions, and the premises from which they are made may be inaccurate or incomplete. We must remember that we cannot get more out of the mathematical mill than we put into it, though we may get it in a form infinitely more useful for our purpose."

This is from Mellor, J. W., 1955 *Higher Mathematics for Students of Chemistry and Physics*, Dover. The first internal quote is from Francis Bacon and the second quote is from J. Hopkinson.

Larry P. Atkinson
Director, Center for Coastal Physical Oceanography

Welcome

CCPO is pleased to add **LISA AYERS** and **LISA VARNER** to its staff. **Lisa Ayers** is a scientific editor/associate scientist for CCPO research professor, **Louis Codispoti**. She will be working closely with Lou on projects related to the Arctic System Science Ocean-Atmosphere-Ice-Interactions (ARCSS-OAII) Science Management Office. One of her most challenging responsibilities will be to establish and maintain a newsletter for the ARCSS-OAII.

Before coming to CCPO, Lisa attended the College of William and Mary's Virginia Institute of Marine Science (VIMS). There she received a M.A. in Marine Science (with a specialty in fisheries). Her research was the study of fish communities using intertidal marsh areas in the York River. As a graduate student, her assistantship duties included scientific writing and editing, public education, and coordination of public outreach and scientific events.

Lisa Varner is an administrative assistant for CCPO associate research professor **Glenn Cota**. She works closely with Glenn in the administrative aspects and support of his research.

Before working in the research/academic arena, Lisa worked for almost two years as a teller at the Bank of Tidewater, Virginia Beach, VA. Before coming to live in Hampton Roads in 1984, Lisa lived with her family in Pittsburgh, PA. This explains why one of her hobbies include collecting hockey cards, especially Pittsburgh Penguins cards. She loves to watch NHL hockey games and is becoming a Norfolk Admirals fan. Since she is a Pittsburgh Steelers fan, she enjoys watching NFL football games. When there are no games to watch on television, she spends her time rollerblading, playing tennis, fishing, and going to music concerts.

Mentoring on the Internet

During February and March 1997, **BRUCE LIPPHARDT, JR.**, research assistant professor, served as a mentor for Andrew Brentan, a tenth grade student in Mr. Rory Wagner's earth science class at New Trier High School in Winnetka, Illinois. As a surfing enthusiast, Andrew was interested in learning more about ocean surface waves and what kinds of things affect how fast waves move, especially as they approach the beach. Bruce became involved as a "telemmentor" to offer advice and guidance for Andrew's research using Internet electronic mail.

Andrew had six weeks to complete his project. His most difficult task was deciding on the exact research question he hoped to answer. He decided to focus on understanding wave speed, since, as a surfer, he had observed waves that seemed to travel at different speeds. Bruce helped him develop a simple wave model that he could use to plot waves on his computer. After Andrew successfully plotted his model wave, Bruce guided him through some algebraic equations that describe the factors affecting wave speed in deep and shallow water.

Bruce found his mentoring experience to be a rewarding opportunity for him to interact with students who are interested in science. He enjoyed helping Andrew learn something new about the physics of the ocean.

Bruce volunteered to be a mentor through the Internet's World Wide Web (WWW). The telemmentor arrangement was part of the National Science Foundation's {em Learning Through Collaborative Visualization Project} (CoVis), administered by Kevin O'Neill, a Ph.D. student in Northwestern University's School of Education and Social Policy. CoVis has grown steadily over the past five years, and it now involves teachers at roughly 40 schools around the country doing project-based science teaching supported by computing and communications technology. General information about CoVis is on the WWW at <http://www.covis.nwu.edu>.

The CoVis project is looking for volunteer mentors who conduct scientific research or apply science in their daily lives. Ph.D.-level researchers, graduate students, professionals, retirees, or enthusiastic undergraduates with a strong science

background are encouraged to volunteer. Scientists who are interested in becoming mentors can submit their names to a database maintained as a resource for CoVis teachers. A volunteer sign-up form is available on the WWW at <http://www.covis.nwu.edu/mentors/welcome.html>.

Puzzler

The purpose of this new section of *CCPO CIRCULATION* is to record thought-provoking questions and problems that have appeared on comprehensive, qualifying, and candidacy exams. Readers are encouraged to submit their own favorites, as well as to attempt answers to all questions. All communications should be directed to:

wizzard@ccpo.odu.edu. Wizzard will acknowledge the sources of all questions/problems used and will publish selected thought-provoking (not necessarily correct) answers to previous submissions. Below is the first puzzler question, which we will call **Question 97.1**. This question was posed by **Robert O. Reid** of Texas A&M University to **A. D. KIRWAN, JR.** at the latter's candidacy exam.

Question: Take a railroad boxcar suspension spring and compress it to a fraction of its original length. What happens to the energy used to compress the spring?

A. D. Kirwan's answer: This energy is stored as elastic or internal energy in the deformed molecular structure of the spring.

Question 97.1: Suppose you put the compressed spring in a box and fill the box with acid completely dissolving the spring. What happens to the elastic energy? A. D. Kirwan's answer satisfied his committee. What is your answer to **Question 97.1**?

Two New Faces at CCPO

Lorraine Heilman

LORRAINE HEILMAN came to CCPO in January 1997 from the SUNY system where she was splitting her time between teaching Introductory Oceanography at the Maritime College at Fort Schuyler in the Bronx and research at SUNY Stony Brook. After commuting almost 100 miles a day for five months, she decided a change was in order, and now she happily commutes 1.5 miles to Crittenton Hall, home of CCPO.

Lorraine received her B.A. from Franklin and Marshall College in 1992, where she majored in mathematics and minored in French. Finding the job market dimly crowded upon graduation, she decided to change course entirely and become an oceanographer. She finished her M.S. in Marine Environmental Science in 1995 from SUNY Stony Brook, where she worked under the direction of Dr. Kamazima Lwiza. Her research involved a lot of river time in the pristine Hudson River, where she studied the interaction between the physical characteristics of the river and their effects on the transport of vertically migrating larvae. While still a graduate student, she was also involved in a number of other projects including microstructure turbulence, statistical analysis of Peconic Bay brown tide, sediment and nutrient transport in the New York Lower Bay, and anchovy transport up the Hudson River. These varied interests, spurred initially by lack of funding on the project related to her thesis, developed into serious diversions from her thesis.

Immediately after receiving her M.S., Lorraine did what all good oceanographers should. She went to sea for two months with a group of 25 undergraduates to teach them the ways of the scientist while sailing about the Caribbean Sea onboard a two-masted brigantine as an assistant scientist with the Sea Education Association.

When not cruising the high seas, Lorraine likes running, biking, learning the cello, and most recently rock climbing. One of her long-term goals is to bicycle across the United States. Additionally, she has been taking up juggling after

receiving juggling balls as a Christmas gift. Although she isn't juggling fire, knives, or chainsaws yet, she is getting very good at it, and it has become a great stress reliever.

Steve Gaurin

STEVE GAURIN was born during a snowstorm in Syracuse, NY and grew up (with mildly rebellious tendencies) in several different states on the east coast of the USA. Later in life, Steve decided to study mathematics, the language of the Universe, in college at Towson State University.

After graduating from TSU with honors, he decided to avoid getting a job by entering graduate school, where he began pursuing a degree in environmental science at the Florida Institute of Technology. Steve learned a great deal in the process of completing his master's thesis, an ``interesting exercise" in river oxygen modeling. Steve hopes to publish an ``interesting" paper or two from his thesis work sometime this summer.

After finishing graduate school, Steve finally entered the real world by working a year each at the University of Maryland's Horn Point Environmental Laboratory in Cambridge, Maryland and the environmental consulting firm, Versar, Inc. in Columbia, Maryland. However, he may have found his true calling in December 1996 when he moved to Norfolk, VA to work with **Louis (Lou) Codispoti** as an associate scientist. Steve's work includes analyzing hydrographic data from JGOFS Arabian Sea and Southern Ocean process study cruises, assisting in maintaining the Arctic System Science's Ocean-Atmosphere-Ice Interactions Science Management Office (of which Lou is director), being the Codispoti group's resident computer guru, and traveling to scientific meetings (some of which, believe it or not, are west of Chicago! Finally!). Future work-related endeavors include helping Lou and his graduate student, **Vince Kelly**, with testing an in-situ marine nitrate sensor and participating on a cruise, this winter, to the Southern Ocean as part of the U.S. JGOFS program. Steve hopes that his work with Lou will help in the study and analysis of some interesting areas of the earth's oceans and provide some insight into the workings of the global nitrogen cycle.

Not only does Steve have a wry sense of humor, he enjoys rock climbing, playing soccer, playing the guitar, writing poems that could be songs if he were any good at playing the guitar, and scaring himself to death by thinking seriously about becoming a Ph.D. student, and pondering the mysteries of *Jell-O*.

CCPO Researchers Attend Workshop in Chile

A workshop funded by the U.S. National Science Foundation (NSF), as part of the InterAmerican Institute for Global Change Research (IAI) initiative to create Research Centers, took place in Puerto Varas, Chile on March 31 through April 4, 1997. The workshop was convened by **LARRY ATKINSON** and **ARNOLDO VALLE-LEVINSON** of CCPO, jointly with **Carole Seyfrit** of ODU College of Arts and Letters and representing the National Science Foundation, Fernando Jara of Universidad Austral in Chile, and Victor Marin of Universidad de Chile. **EILEEN HOFMANN** of CCPO was also a convener, although she could not attend the workshop. Another CCPO workshop participant was **THOMAS ROYER**.

The purpose of the workshop was to develop a plan and a working document that would lead to a proposal for the creation of a Research Center supported by the IAI. An IAI Research Center will not be a physical location, but a group of institutions that will investigate and implement research on a portion of the IAI Science Agenda. The Research Center, in Chile, will focus on ecological and socio-economic issues in temperate waters of the Austral Chilean Coast and Inland Sea (ACCIS), which is the transitional area between the Chilean fjords and the coastal ocean between 41 and 47 degrees south. The region of the ACCIS supports fisheries and aquaculture industries that contribute significantly to the regional economy and that sporadically are affected by toxic algal blooms. The ACCIS Research Center will be guided by a scientific steering committee that will facilitate interdisciplinary and multi-institutional research with the overarching goal of providing technical advice to policy makers, environmental managers, and industries involved in fisheries and aquaculture to help them make decisions regarding environmental issues. The Research Center will define research priorities, analyze and evaluate projects presented under the ACCIS guidelines,

and maintain and update a database that will be accessible to investigators involved in the Research Center.

The group that gathered in Puerto Varas, 15 km to the north of Puerto Montt in southern Chile, included 26 representatives from Chile, 1 representative from Argentina, 2 representatives from Canada, and 10 from the United States. The unusual aspect of the workshop was the mixture of social and natural scientists. All participants worked to learn each other's discipline, interests, and data needs. It was very interesting to realize how much the participants had in common. The guidelines for the IAI proposals for the formation of Research Centers will be circulated some time in July. To find out more about the IAI initiative and/or the activities to form the ACCIS Research Center, look at their respective home pages: <http://www.nsf.gov/strata/egch/iaipgr.htm> and [http://www.ccpo.odu.edu/~sim\\$atkinson/ACCIS/accis.html](http://www.ccpo.odu.edu/~sim$atkinson/ACCIS/accis.html).

Student Profile: MICHELLE C. PARASO

As a marine science major at Southampton College of Long Island University, **MICHELLE (Shelly) C. PARASO** participated in the Seamester program in the spring of 1994, where she lived aboard a 125-foot schooner, the *Spirit of Massachusetts*. In the fall of that year, she participated in an undergraduate internship at CCPO under **Eileen Hofmann**. As a result of this internship, she worked with **Arnoldo Valle-Levinson**, comparing non-tidal sea level and sea surface temperature variations with meteorological data to determine the influence of atmospheric forcing on the current flow and heat transport between the lower Chesapeake Bay and the adjacent coastal ocean. This work resulted in her first publication (*Estuaries*, 19(3), 1996).

Since graduating Cum Laude from Southampton in 1995, Shelly entered the Master's program at Old Dominion University under the guidance of **Eileen Hofmann**. Here, she is using a coupled host-parasite model to analyze the influence of various environmental stressors (salinity, temperature, and food supply) on the relationship between the disease, MSX, caused by the protozoan parasite, *Haplosporidium nelsoni*, and Eastern oyster populations in Delaware Bay. In addition to her work here at CCPO, Shelly has been the treasurer of the Oceanography Graduate Student Organization. She will graduate this fall and would like to pursue a career which studies the environment's impact on fisheries management.

RAPID Environmental Assessment

In the last few years, there has been a rapid increase in the capability of observation systems to provide high resolution space and time data from estuary and coastal regions. The demand for this data is driven primarily by the management of and response to environmental crises. Obvious examples are pollution containment, storm preparation and protection, and military operations. Indeed, the recent success of military operations in the Mideast is due, in part, to superior knowledge of the environment. In recognition of this fact, NATO now has a new warfare focus on coastal and shallow water crisis response operations.

A major component of this focus is Rapid Environmental Assessment (REA). In order to accelerate this new focus, Old Dominion University, Supreme Allied Command Atlantic (SACLANT), and the Office of Naval Research (ONR) organized the first scientific and technical conference on REA. The conference, held March 10-13 in Lerici, Italy, was organized by **A. D. KIRWAN, JR.** and **LARRY ATKINSON** from CCPO, **Captain Tom Pearson** from SACLANT headquarters, and **Dr. Eric Pouliquin** from SACLANT CENTRE, La Spezia. The general purpose of the conference was to bring together specialists from industry, academia, and the military to explore emerging technologies and methods for rapid collection, assessment, and dissemination of time-critical oceanographic data and prediction products. ODU Provost, **JO ANN GORA**, welcomed the group on behalf of ODU.

1. Vice Admiral Garnett, Deputy Supreme Commander of NATO, set the tone of the meeting in his opening remarks by challenging participants to identify:
2. which topics are most promising for future research;
3. what new organizational structures must be created to implement REA; and

4. what is achievable now with current technology.

Technical sessions explored the roles of remote sensing and in situ measurements, data assimilation and environmental nowcasts and forecasts, and communications on REA operations. **ARNOLDO VALLE-LEVINSON** gave a talk titled, "Rapid Assessment of Mean Current Velocities in the Coastal Ocean." Here he described the results of a rapid survey of the current velocities off the Chesapeake Bay mouth. **BRUCE LIPPHARDT, JR.** presented a paper titled, "Merging Disparate Oceanographic Data," which described new methodology for blending high frequency radar measurements of coastal currents with numerical models. Co-authors were CCPOers **DENNY KIRWAN** and **CHET GROSCH**; Leonid Ivanov of the Marine Hydrophysical Institute, Sevastopol; and Jim Lewis of Ocean Physics Research and Development. These papers will appear in the conference proceedings due out late this year.

Two broad themes emerged from the conference. One was the recognition of numerous civilian applications. All 91 participants left with the sense of a need to develop new partnerships between the military, civilian agencies, and academia to address common REA issues. The second theme was the recognition that REA is truly interdisciplinary. Successful REA uses a "system" approach. For example, when blending observations with models to make nowcasts and forecasts, it is important to take advantage of the synergistic effect of using observations of all variables.

Since this was the first REA conference, it will likely be an important standard for subsequent developments. Even though the conference ended up raising more questions than it answered, it did provide several examples of successful REA forecasts in NATO exercises. The challenge will be to continue this success under a much wider variety of civilian and military scenarios.

Just the facts . . .

Announcements

E. E. HOFMANN and **J. M. KLINCK** are the proud parents of a baby boy, Julius Michael Klinck, born April 3, 1997.

E. A. SMITH and **FRED DOBBS**, assistant professor of the Department of Oceanography, are the proud parents of baby girl, Amelia Richardson Dobbs, born December 19, 1996.

Awards

J. M. KLINCK, 1996 Editor's Citation for Excellence in Refereeing for the *Journal of Geophysical Research-Oceans*. Presented by the American Geophysical Union, at the 1997 AGU Spring Meeting, Baltimore, MD, May 27, 1997.

T. C. ROYER, awarded Professor Emeritus status at the University of Alaska Fairbanks graduation, May 18, 1997.

Grants/Contracts Awarded

G. F. COTA, "Remote Sensing of Ocean Color in the Arctic: Algorithm Development and Comparative Validation," NASA, SIMBIOS, \$640,606, co-PIs are T. Platt, S. Sathyendranth, and W. G. Harrison, all at Bedford Institute of Oceanography, Dartmouth, Canada.

A. D. KIRWAN, JR. "Quantitative Utilization of Lagrangian Data in Numerical Models," ONR, \$49,920.

A. VALLE-LEVINSON "Physical Exchange Processes at the Chesapeake Bay Mouth," VGMSC, \$23,954.

G. H. WHELESS "Physical Processes Near the Chesapeake Bay Mouth & Their Relationships to Biological Recruitment," Virginia Graduate Marine Science Consortium, \$28,538.

Presentations

- L. A. CODISPOTI** ``Biogeochemical Constraints on Primary Production in Sea-Ice," Gordon Research Conference on Sea-Ice Ecology, Ventura, CA, March 3-7, 1997.
- L. A. CODISPOTI** ``Global Change, the Oceanic Nitrogen Budget and You," J. P. McGrath Fund Seminar, Southampton College/Long Island University, March 20, 1997.
- G. F. COTA** ``History and Future of Remote Sensing of Ocean Color in the Arctic," Arctic System Science, Ocean-Atmosphere-Ice Interactions Subgroup meeting, Virginia Beach, VA, May 1997.
- G. F. COTA** ``Remote Sensing of Ocean Color in the Arctic: Prespectives and Prospects," Center for Coastal Physical Oceanography, Norfolk, VA, March 1997.
- G. F. COTA** and S. Saitoh, Hokkaido University, Minato-cho, Japan, ``Bering Sea Bio-Optical Algorithms, ADEOS-OCTS meeting, Yokohama, Japan, March 1997.
- G. F. COTA** ``Arctic Bio-Optical Algorithms," ADEOS-OCTS, Yokohama, Japan, March 1997.
- G. F. COTA** ``Bio-Optical Properties of High Northern Latitude Waters," 7th Annual Joint U.S. Workshop on Ocean Color, Atami, Japan, March 1997.
- G. F. COTA** ``Bio-Optical Properties of Arctic Coastal Waters," ASLO meeting, Santa Fe, NM, February 1997.
- M. A. M. FRIEDRICHS** ``Physical Control of Biological Processes in the Equatorial Pacific: A Data Assimilative Ecosystem Model," Horn Point Environmental Laboratory (HPEL) Seminar Series, April 23, 1997.
- M. A. M. FRIEDRICHS** and **E. E. Hofmann** ``Effects of High Frequency Physical Processes on Phytoplankton Biomass and Primary Production in the Central Equatorial Pacific," the International JGOFS Modelling Symposium, Oban, Scotland, May 20-26, 1997.
- M. A. M. FRIEDRICHS** and **E. E. Hofmann** ``A Data-Assimilative Ecosystem Model of the Equatorial Pacific," the International JGOFS Modelling Symposium, Oban, Scotland, May 20-26, 1997.
- B. L. LIPPHARDT, JR.; A. D. Kirwan, Jr.; C. E. Grosch;** L. M. Ivanov, Marine Hydrophysical Institute; and J. K. Lewis, Ocean Physics Research and Development, ``Merging Disparate Oceanographic Data," Rapid Environmental Assessment: A Science and Technology Conference, Lerici, Italy, March 10-13, 1997.
- A. D. KIRWAN, JR. B. L. Lipphardt, Jr.** and J. K. Lewis of Ocean Physics Research and Development, ``Merging Disparate Oceanographic Data," Office of Naval Research, April 17, 1997.
- R. A. LOCARNINI** and W. D. Nowlin, T. Whitworth, III, and S.-J. Kim, all three at Texas A&M University, ``Water Masses and Circulation of the Ross Sea," the International Conference on the Oceanography of the Ross Sea--Antarctica, Lerici, Italy, March 24-28, 1997.
- A. VALLE-LEVINSON** ``Rapid Assessment of Mean Current Velocities in the Coastal Ocean," Rapid Environmental Assessment: A Science and Technology Conference, Lerici, Italy, March 10-13, 1997.
- G. H. WHELESS** ``Virtual Reality in Oceanography: Challenges and Directions," Annual meeting of The Oceanography Society, Seattle, WA, April 1, 1997.

Publications

L. A. CODISPOTI ``The Limits to Growth," *Nature*, Vol. 387, pp. 237, May 15, 1997.

T. Yoshinari, State University of New York; M. A. Altabet, University of Massachusetts; S. W. A. Naqvi, National

Institute of Oceanography, Goa, India; L. CODISPOTI; A. Jayakumar, National Institute of Oceanography, Goa, India; M. Kuhland, State University of New York; and A. Devol, University of Washington, "Nitrogen and Oxygen Isotopic Composition of N₂O from Suboxic Waters of the Eastern Tropical North Pacific and the Arabian Sea--Measurement by Continuous-Flow Isotope-Ratio Monitoring," *Marine Chemistry* 56, 253-264, 1997.

ADK's Words of Wisdom

"I say not that it is, but that it seems to be; as it now seems to me to seem to be."

Quoted by: Professor Hubert N. Alyea, Princeton University

Professor Alyea, a professor of Chemistry at Princeton, passed away about a year ago. He was one of Denny Kirwan's favorite professors. As Denny puts it, Professor Alyea "was a heck of a scientist and a local legend for his 'Christmas' lecture. It was always packed with people standing in back of the the lecture hall and sitting in aisles. It basically was an hour of explosions, colorful clouds, and enjoyable smells punctuated with witty discussions of the history and chemistry behind the reactions." During Denny's undergraduate years, he briefly washed bottles for Professor Alyea and considered it a great honor. The quote by Professor Alyea was contributed by one of his graduate students in a recent Princeton Alumni Weekly.

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