CCPO CIRCULATION
"... facilitating innovative research in the coastal ocean."

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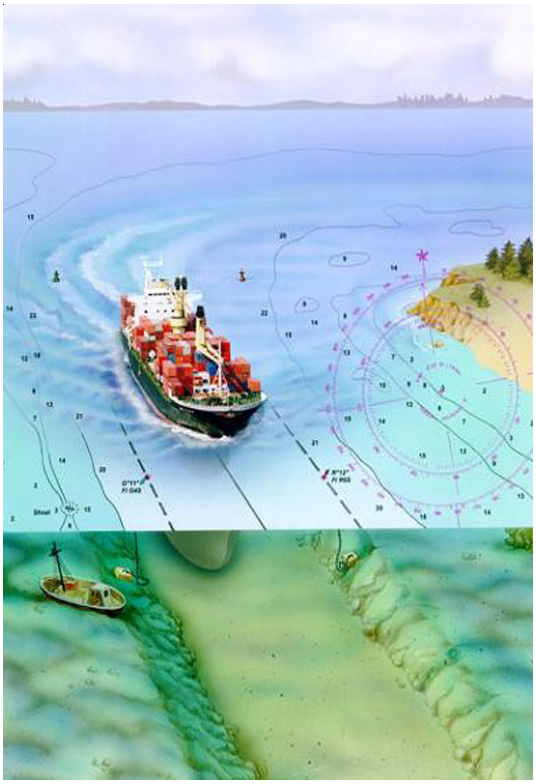
Workshop Promotes Safe Navigation, Training for Marine Pilots

by Richard Moody, Senior Oceanographer

"Could we hold the workshop at CCPO?" phoned JIM DIXON, NOAA's Mid-Atlantic Navigation manager, last March from his office at Nauticus. He was referring to the upcoming three-day National Oceanic and Atmospheric Administration Professional Mariners Workshop scheduled for about 20 participants, both marine pilots and instructors. The CCPO classroom normally accommodates five to 20 graduate students. During the training, a PC and Internet service would be needed at every desk. Upon completion of the course, CCPO would arrange for certificates for each participant, awarding Old Dominion University College of Education Continuing Education credit. And, "Oh, we need to provide breakfasts and lunches during the class and also hold an evening social," he said.

LARRY ATKINSON, CCPO director, looked up at me and said, "Can we do it—10 days from now?" My mind wandered for a minute. I've known Larry for 36 years, and Jim for 34. I said, "Yes."

Two and a half years ago I left the CCPO desk at the NOAA Norfolk office at Nauticus and relocated to Crittenton Hall. While at Nauticus, Dr. Atkinson, Mr. Dixon, Dr. KATE BOSLEY (our NOAA/CCPO shared scientist), and I listed mutually beneficial tasks that Old Dominion University and the NOAA Ocean Service (then National Ocean Service) could accomplish under the sponsorship of the newly formed National Ocean Service/Old Dominion University Cooperative Institute for Coastal Physical Oceanography (CICPO). The last task included in the Science Plan was "American Pilot Association (APA) Training and Certification," a project particularly close to Jim since it promoted safe navigation, the main tenet of another partnership he had established with the APA. The workshop represented the final evolution of that Cooperative Institute task, as well as a goal of the APA/NOS partnership, so it was good to hear that NOAA wanted to host it at CCPO. It promised to offer the pilots "an opportunity to learn how NOAA's National Ocean Service provides navigation products and services," and to showcase the ability of CCPO to host such a workshop on relatively short notice.



Unforeseen dangers to large vessels lurk in the channels. NOAA employs modern technology, like Multibeam and side-scan sonar, to detect them. Figure courtesy of Jim Dixon, NOAA.

APA pilots are individuals who, after years of experience at sea

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as apprentices, act as mobile captains, bringing large vessels into the major U.S. ports. The port pilot is a master at maneuvering large ships into and out of port, or to and from anchorages. He/she knows all the port rules and regulations, including U.S. Coast Guard Vessel Traffic Separation Scheme protocol, schedules of the port, and the prevalent natural conditions of the waterway, i.e., tides, currents, shoals, and weather conditions. He even calculates water density from the water temperature and salinity in order to compute maximum cargo loads allowable given accurate predicted water levels.

A marine pilot is required to hold a U.S. Coast Guard license as master of vessels of unlimited tonnage. Maryland pilots frequently navigate container ships, tankers and freighters the length of Chesapeake Bay to the Chesapeake and Delaware Canal, a distance of some 150 nautical miles. The Navy has its own marine pilots for naval vessels.

On the first day of the workshop, Navy pilots, Richard Garcia and Al Dykes, showed up a half-hour early and before the Webb Center caterers had delivered the "continental breakfast." Due to the joint efforts of STAN DOUGLAS, the Department of Ocean, Earth and Atmospheric Sciences operations manager; CLEO PHILLIPS, CCPO's grants administrator; and yours truly, we arranged for food and the items needed for the evening social. We resupplied soda and bottled water stock after the first morning, learning what it takes to keep a full complement of students supplied with amenities in a warm classroom.

All of the desks were configured for Internet service by JOE RUETTGERS, CCPO's systems administrator, and 22 seats were outfitted with PCs by NOAA-contracted systems whiz Dave Widen. As it turned out, there were just enough PCs to cover all participants.

Jim Dixon guided the class from one topic to another, with the help of NOAA Capt. John Wilder. One of the first "presenters" was our own KATE BOSLEY, who did an admirable job of covering NOAA's Physical Oceanographic Real-time System, PORTS©, an Internet-offered network which displays real-time water levels vs. predicted and other water and meteorological parameters at major port locations around the country, including the Chesapeake Bay. Kate demonstrated her forecast/nowcast (real-time display) model for the bay, named CAFÉ.

Jim Dixon making a point, with Dave Widen and Penny Levine providing guidance.

The three-day course, highlighted PowerPoint presentations on tides and currents, hydrographic surveys, Coast Pilot publications, nautical chart production, and electronic charts. The pilots know all too well that the margins of navigation error are getting narrower with the advent of bigger ships loading more cargo, trying to catch the high tide with the maximum favorable current for optimum commercial profit.

This workshop provided good perspective on the efforts made by NOAA and other agencies, like the Coast Guard and Corps of Engineers, to provide marine pilots with the best navigation tools available. Most valuable were the advances in NOAA technology and navigation products. These products include: multibeam sonar hydrography to detect hitherto unknown least depths, LIDAR (Light Detection and Ranging), side-scan sonar, PORTS©, new additions to Coast Pilot (the bible of coastwise navigation), ENCs (vector electronic charts standardized by the IHO), charts on demand (raster electronic charts corrected with up-to-date Notice to Mariners publications and printed on demand), and ASI, or Automatic Ship Identification system.

While the training ran smoothly, the weather produced rain for the first two days. Our evening social, originally to be held outside on the CCPO lawn, had to be held in the Fireside Room. The "finger food" along with an emergency supply of popcorn, kept the party going strong. The conversation was animated, but eventually exhausted itself after a couple of hours. In spite of a tight timetable, we definitely scored a hit for the Center.

On the third day, the sun came out. Lunch was enjoyed outside for a welcome change at the Center's picnic tables, overlooking a calm Lafayette River. Group pictures were taken and all was well that ends well, except for the cleanup. And, fortunately, it was during spring break, thus normal activities were not disrupted too much. The last comments from the NOAA people were, "Let's do it again!"

Well, at least not for a few weeks.

SEE ILLUSTRATIONS on Page 3

NOTES from the Director.....

This issue of Circulation gives you a taste of the broad range of activities occurring within the brick walls of Crittenton Hall. The theme of "Outreach" is something we all are asked to do and some RFPs insist on it. Outreach falls in the education and service part of our triad mantra of research, education, and service.

The lead article describes the challenge of providing a venue for a short course on safe navigation for marine pilots. For years, I have tried to get more interaction between the commercial world, represented by the pilots; the academic world, represented by us; and the federal world, represented by NOAA. I have found that making this happen is not easy. Nevertheless, this spring we had real pilots from around the U.S. sitting in an academic research environment for a few days. We hope that their presence at CCPO will generate more understanding of the research world we live in.

The two enthusiastically written articles by Shannon Smythe and Ian Downie show the infusion of energy you get when undergraduates and high school students enter our world. Their narrative suggests they did see the complexity of oceanography and were intrigued by it.

By the way, these and other articles illustrate the article acquisition method used by Julie Morgan and Lydia Dalhke. They spot a likely candidate and, using hints of glory and some application of guilt, get an article. To the credit of CCPO inhabitants, we have a tradition of willingly providing copy when asked.

Larry Atkinson

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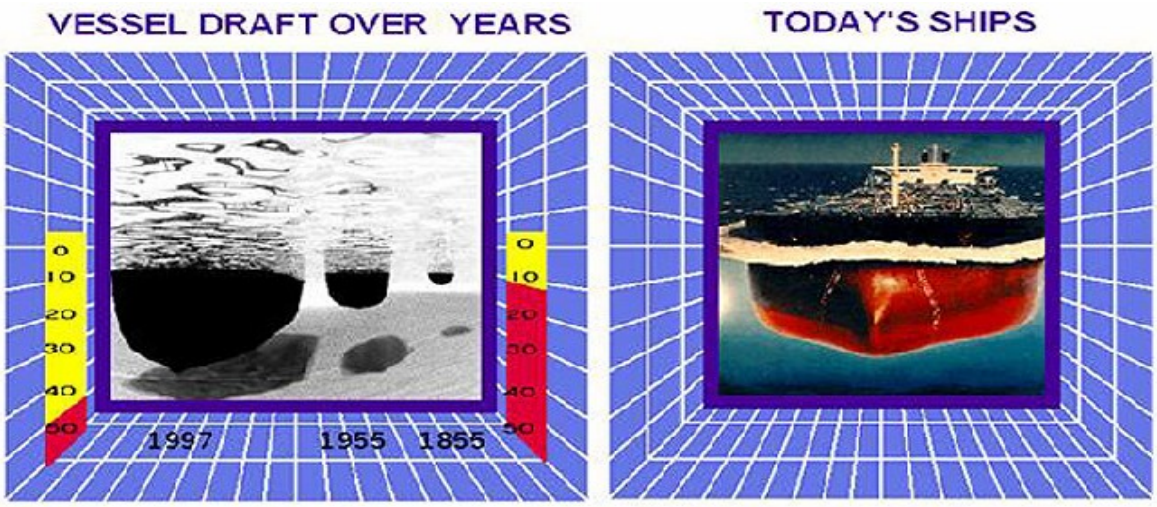

(above) Vessels today are so large and load so much cargo that they must monitor real-time water levels to time their safe passage.

(right) Participants take time out for lunch in CCPO's corner nook.

STUDENT PROFILE

ROSARIO SANAY

ROSARIO SANAY is a graduate research assistant working under the supervision of ARNOLDO VALLE-LEVINSON, CCPO associate professor. Rosario found the perfect match for two of her oceanography passions: pure sciences and the sea. In 1986, she enrolled in the School of Marine Sciences at the University of Baja California, Mexico, where she earned a B.S. degree in physical oceanography. Wanting to pursue her interest in research, Rosario later enrolled in the master's degree program in physical oceanography at the Institute of Marine Sciences and Limnology of the National University of Mexico (ICMyL-UNAM). There, she worked with Drs. Adela Monreal and David Salas on various projects. These projects introduced her to the world of numerical models and gave her the opportunity to participate in several research cruises in the Gulf of Mexico. She also took part in research programs dedicated to the study of the circulation and sedimentation in several coastal lagoons in Oaxaca, Mexico. Meanwhile, Rosario taught several courses in the hydraulic engineering program at Universidad Autonoma Metropolitana (UAM). Rosario earned her master's degree in 1997 with a thesis titled, "Numerical simulation of the circulation of the Chacahua-Pastoría lagoon system." While working at UAM, Rosario met Eugenio Gómez, who knew Arnoldo Valle-Levinson from their joint graduate work at the State University of New York at Stony Brook. Eugenio introduced Rosario to Arnoldo. After talking with Eugenio and Arnoldo about her interest in studying circulation in shallow water systems and numerical models, Rosario applied to the Ph.D. program at Old Dominion University.

In autumn of 1998, Rosario came to the USA to study graduate-level physical oceanography under Arnoldo=s direction. At CCPO, Rosario has found a stimulating environment and plenty of opportunities to sharpen her research and field-work skills. During her time at CCPO, she has participated in research cruises in the Chesapeake Bay (USA), East China Sea (Japan), Gulf of Arauco (Chile), Gulf of Fonseca (Central America), and Guaymas Bay (Mexico). She also participated in a U.S. Southern Ocean GLOBEC cruise in Antarctica with CCPO professor EILEEN HOFMANN. Outside of life at school, Rosario enjoys running, reading, and cooking. Presently, Rosario is concluding her research on wind-induced and buoyancy-driven circulation on coastal plain estuaries, which includes observations and numerical simulations. After graduation, Rosario would like to secure a postdoctoral research position in the USA and then eventually return to Mexico.

QUOTES FROM THE FIELD

From the abstract to Gordon Riley's groundbreaking paper, Mathematical model of nutrient conditions in coastal waters:

"General conclusions are that the usual pattern of exchange between inshore and offshore waters tends to enrich the coastal zone irrespective of enrichment by freshwater drainage, and that nitrate is more likely to be a limiting factor than phosphate, because of its inherently slower rate of regeneration." Submitted by Larry Atkinson.

"It is a piece of ancient Greek wisdom that counting and measuring things is a much surer path to knowledge and understanding than any other."

McCready, S. The Discovery of Time. Sourcebooks Inc. Naperville, IL, 2001.

This appears in the forepiece of the Executive Summary of the NRC Report on the Review of the Gulf of Alaska Ecosystem Monitoring Program 2002.
Submitted by Tom Royer.

Please send your favorite quote to julie@ccpo.odu.edu.

CONGRATULATIONS

CCPO graduate research assistants NANDITA SARKAR and ISAAC SCHROEDER were married on May 31, 2002. The ceremony took place in Lexington, KY, with a reception being held at the home of Isaac's parents. A pre-wedding trip to India gave Isaac the chance to meet Nandita's family. Best wishes to Isaac and Nandita!

COLLABORATIVE EFFORT ON MODELING HARD CLAM POPULATIONS UNDER WAY

The hard clam (Mercenaria mercenaria) sustains commercial and recreational fisheries and aquaculture production from the Gulf of Mexico through Cape Cod. At one time, the clam population in Long Island's Great South Bay produced nearly half the total coastwide landings. This population has greatly diminished since reaching peak abundance in the 1970s. The definitive cause of these declines has not been demonstrated, but there is evidence indicating that early intensive harvesting and recent occurrences of brown tide, Aureococcus anophagefferens, which affects filtration rate, feeding, growth and survival of larvae, juvenile and adult hard clams, have been factors. Environmental conditions, such as temperature, salinity, and phytoplankton species and abundance, may have changed in the 1990s. For example, during the 1990s, mean winter water temperature in Long Island's south bays was 1° C to 3° C warmer than the long-term average.

As part of a research initiative to study the causes underlying the decline in hard clam populations, a team of researchers composed of CCPO scientists EILEEN HOFMANN and JOHN KLINCK, along with Eric Powell and John Kraeuter from the Haskin Shellfish Research Laboratory, Rutgers University; Ray Grizzle from the University of New Hampshire; Monica Bricelj from the Institute for Marine Biosciences, in Halifax, Nova Scotia; and Stuart Buckner from the Environmental Control of Islip, NY, were funded by New York Sea Grant to develop a mathematical model of the growth and development of the hard clam. The objective of the model is to evaluate potential effects of variations in biological and environmental conditions in the Great South Bay portion of Long Island Sound on resident hard clam population levels and production.

Since funding began in March 2001, the modeling team has met several times to work on the hard clam growth model. The result is a working model for an individual hard clam that includes effects of environmental variability and brown tides. One unique aspect of the model is that changes in weight and length of an individual clam are related to the condition of the animal. The rationale for using a length-weight-condition coordinate system for the hard clam model is that it allows growth to be defined as a function of animal condition rather than as a function of animal weight. Thus, changes in condition dictate whether or not the clam can increase length. This approach ensures that clam weight and length remain coupled during a simulation because weight can change without requiring a corresponding change in length. As a result, the clam will not exceed realistic length-weight combinations. This approach represents a change in the way that growth models are formulated for clams and potentially for other bivalve species.

The results of the individual hard clam model are scaled to the level of individual cohorts, which is the group of young individuals produced in a year, by including probability distributions which allow a range of outcomes to be simulated for a given set of environmental conditions. The surviving larvae provide the basis for a yearly cohort. Continued simulation for several years results in initiation of multiple cohorts, which then represent the hard clam populations. The outcome of the simulations can then be compared to observed length frequency distributions for hard clam populations.

The hard clam model is now being used for simulations to understand the effects on hard clam growth and reproduction of: 1) biological factors, such as variations in respiration rate, 2) brown tides, 3) climate and environmental variability, and 4) fishing and natural mortality. The first results from the simulations were presented at the National Shellfisheries Association Meeting in April 2002 and more presentations, as well as publications, are planned for the future.

NEW STAFF PROFILE

CHRISTOPHER (CHRIS) POWELL

CHRIS POWELL started as the new marine technician at CCPO in February 2002. He came from the University of North Carolina Wilmington (UNCW), where he worked as a marine tech for six years. His education includes an M.S. in marine science and six years of on-the-job training in the support of various fields in marine science. At UNCW, Chris was primarily responsible for the operation and maintenance of scientific instrumentation, including ADCPs, CTDs, CTs, a Rosette, Side-Scan Sonar, Sub Bottom Profiler, and a number of in-house systems run by Campbell Scientific data loggers.

Chris's primary duty at CCPO is to assist ANN GARGETT, professor, in setting up and running cabled oceanographic observatories. Currently, Chris is responsible for a 1200 kHz BBADCP from RDI, an acoustic backscatter system from Aquatec Ltd., a Nortek Vector ADV and 2 ocean sensors CTDs, one with autonomous profiling capability. In addition to this duty, Chris is working on an integrated instrumentation system for Old Dominion University's new research vessel, the R/V Fay Slover.

Chris is also setting up a shop in room 128, which, among other things, will be capable of fabricating, repairing and splicing underwater cables. The shop also has the ability to undertake electrical and electronic fabrication and repair projects, as well as the design and construction of specialized equipment. The shop will also contain a library of current catalogs, product info, and marine tech reference material.

Away from work, Chris lives in Norfolk with his wife, Kim. Together, they have spent their first few months working on their rather old apartment and getting out every weekend to see what Hampton Roads has to offer. Chris also enjoys canoeing, fishing, and tinkering in his "shop" at home.

An "Intern"al look at the CCPO

SHANNON SMYTHE

My journey to a summer internship with ARNOLDO VALLE-LEVINSON, CCPO associate professor, began, appropriately enough, in water. A chance meeting in a hot tub last summer led me to meet Jan Smith, the Director/Liaison for the Old Dominion University Career Management Center for the College of Sciences. Jan gave me a tip about an internship with Arnoldo, doing oceanographic work during the fall 2001 semester. Since I am majoring in oceanography for my B.S. degree, I jumped at the opportunity, applied, and interviewed with Arnoldo. Understandably, he wanted someone with better math skills, so he hired another applicant. I was disappointed, but was later happy that I was not working when finals and deadlines came up. Next semester Arnoldo offered me the job , but I had already made too many other commitments to work for him. Finally, at the end of the spring semester, with more help from Jan Smith, I applied for, and was awarded, Arnoldo's summer internship. After my finals were over, I started working on data Arnoldo had collected from the mouth of the Lafayette River.

Trying to learn IDL, UNIX, oceanographic terms and concepts, and refreshing my math skills all at the same time was initially overwhelming. After a few weeks, things started clicking for me and I surprised myself with how much I was learning about programming. IDL's power to perform thousands of calculations on data and graph them in under 30 seconds amazed me. Learning there are five main tidal constituents operating on a body of water was an eye-opener. The cruise on the Chesapeake Bay I participated in surprised me with how much patience was required, but it was not too hard waiting for the next CID cast surrounded by the beautiful bay.

My moment of triumph came when I finally ironed out all the bugs in my first program and looked down at the resulting graph of water flow over four months. I was introduced to the Conservation of Momentum Equation by having to calculate and graph its components for one of the data stations. It is difficult to measure the extent of what I have learned because it has been such a gradual process. Arnoldo and I joked that I should be paying him tuition because I was learning so much! Taking the Oceanography 306 course in the fall should be easy, at least. Arnoldo and everyone in the CCPO building were extremely helpful to me and I really appreciate that. While I am still very interested in the biological oceanography track at Old Dominion University, I realized this summer I like physical oceanography very much. If I can somehow do a double track, it's possible I could supplement the intense computer modeling of physical oceanography with some outdoor field work in biological oceanography.

IAN DOWNIE

I owe much to the science of all things wet. Last winter, my oceanography teacher, Michael Bates of Maury High School, invited me to participate in a statewide oceanography competition called the "Blue Crab Bowl." Mr. Bates had been planning to compete in this bowl for quite a while and had already formed a team of his brightest students (of which I had not been originally a part). Luckily for me, and perhaps for the whole team, one of the team members had to drop out at the last moment, and so I was invited to participate in her place. I had a less than adequate amount of time to prepare and I did not even know for sure whether I would be able to attend the bowl until only a week before it was scheduled. The Blue Crab Bowl's host this year was Old Dominion University and going there gave me my first look at the grounds, which were magnificent! The architecture and floral planning were quite appealing, but back to the subject at hand.

When the Maury team gathered early on that pristine Saturday morning of the bowl's beginning, it was not overly difficult to become wrapped up in the excitement of the competition! Only the schools with the brightest and most clever students would come out this day, and we were to spar with them in a rigorous mental tournament! Along with our anticipation and excitement came their evil twins, doubt and hesitation. These were to be our greatest foes, but nothing could stop us! We felt invincible this day!

Ironically, the first team we played was from Grafton High, the team that would eventually go on to become Virginia's state champions! We tried valiantly against this powerful team and the victory would be theirs, but only by a single question! We went on to other games and were eventually eliminated from the tournament, but we had done far better than any of us had ever hoped for and we went home with pride.

The skill and intelligence possessed by the Maury team has done much for me, and I hope as much for the other members as well. One of the perks of doing well in the bowl was the placement of myself onto next year's Maury Blue Crab Bowl squad as team captain! Another was an offer (which I accepted very willingly) for a summer internship in Old Dominion University's Ocean, Earth, and Atmospheric Sciences Department! I am now currently working under CCPO associate professor, ARNOLDO VALLE-LEVINSON, assisting him in an ongoing project on local waterways that has been in place for almost two years and counting. Oceanography has done much for me, and perhaps one day, I may be able to do as much for it.

Just the *facts*...

PRESENTATIONS AT THE 2002 OCEAN SCIENCES MEETING, HONOLULU, HAWAII

Allen, S.E., **M.S. DINNIMAN, J.M. KLINCK**, and B.M. Hickey, "On vertical advection truncation errors in terrain following numerical models: Comparison to a laboratory model for upwelling over submarine canyons."

AUSTIN, J., "Determining the mean ocean/estuary exchange rate for the Chesapeake Bay."

BLANCO, J.L., P. Barria, J. Castillo, and **L.P. ATKINSON**, "Response of Anchovy (*Engraulis ringens*) off Northern Chile to the 1997-1999 El Niño-La Niña Sequence" (poster).

Boicourt, W.C., **A. VALLE-LEVINSON**, C. Lascara, M. Roman, and S. Chao, "Hydraulic controls in partially mixed estuaries."

Carr, M.-E. and **M.A.M. FRIEDRICHS**, "Primary Production Algorithm Round Robin 3 (PPARR3): Early Results."

Carr, M.-E., **M.A.M. FRIEDRICHS**, and J.K. Moore, "Satellite-based Primary Production Estimates in the Southern Ocean: a Comparative Study."

DINNIMAN, M.S., J.M. KLINCK and W.O. Smith, "A Model Study of Circulation and Biogeochemical Processes in the Ross Sea" (poster).

FACH, B., **J.M. KLINCK, E.E. HOFMANN**, and E.J. Murphy, "Modeling Studies of Antarctic krill survival during transport across the Scotia Sea."

Friedrichs, C. and **A. VALLE-LEVINSON**, "Across-channel tidal velocity and axis-parallel tidal convergence in straight, weakly stratified estuaries."

FRIEDRICHS, M.A.M., R.R. Hood, and J.D. Wiggert, "The Arabian Sea Model Testbed: an Intercomparison of Data Assimilative Ecosystem Models."

GARGETT, A., W. Merryfield and G. Holloway, "Differential Diffusion of T and S in Bi-stable Conditions."

HOFMANN, E.E., "The Southern Ocean Global Ocean Ecosystem Dynamics Program: Results from the First Field Year."

Hyatt, J., **J.M. KLINCK** and **E.E. HOFMANN**, "Vertical fine structure beneath the ice of the western Antarctic Peninsula shelf in austral winter."

KIM, H.-C. and **E.E. HOFMANN**, "Estimation of Primary Production in Antarctic Coastal Waters: A Bio-optical Modeling Study."

KLINCK, J.M., M.S. DINNIMAN, and **E.E. HOFMANN**, "A Model Study of Circulation and Biogeochemical Processes on the West Antarctic Peninsula."

Powell, E.N., E.A. Bochenek, **E.E. HOFMANN**, and **J.M. KLINCK**, "Influence of Environment and Food Supply on Survival of *Crassostrea gigas* Larvae: A Modeling Study."

Prézelin, B.B., **E.E. HOFMANN**, and **J.M. KLINCK**, "Physical Forcing of Phytoplankton Community Structure in Continental Shelf Waters of the Western Antarctic Peninsula."

REYES-HERNANDEZ, C. and **A. VALLE-LEVINSON,** "An analytical estuarine circulation model in an arbitrary bathymetry."

SALAS-MONREAL, D. and **A. VALLE-LEVINSON**, "Volume Fluxes Through the Chesapeake Bay Derived from Sea Level Slopes."

SALIHOGLU, B., E.E. HOFMANN, R.C. Beardsley, and **J.M. KLINCK**, "Hydrographic Distributions in the Marguerite Bay: Seasonal and Oceanic Effects."

SANAY, R. and **A. VALLE-LEVINSON**, "Interaction between wind-induced and density-driven flow in a coastal plain estuary."

SARKAR, N., T.C. ROYER, and **C.E. GROSCH**, "Layer Depth Variability on Decadal and Interdecadal Scales in the Northern Gulf of Alaska."

SAVIDGE, D.K., "Wintertime Shoreward Currents South of Cape Hatteras."

Smith, W.O., **M.S. DINNIMAN, J.M. KLINCK**, and **E.E. HOFMANN**, "Nutrient Processes in a Regional Model of the Ross Sea" (poster).

VALLE-LEVINSON, A., "Reversing circulation patterns in a tropical estuary."

PRESENTATIONS

Bochenek, E.A., E.N. Powell, **J.M. KLINCK,** and **E.E. HOFMANN**, "Influence of Environment and Food Supply on Survival of *Crassostrea gigas* Larvae: A Modeling Study," National Shellfisheries Association Meeting, Mystic, CT, April 14-18, 2002.

GARGETT, A., "Velcro measurements of oceanic turbulent kinetic energy dissipation rate," North Carolina State University, February 4, 2002 and University of North Carolina, Chapel Hill, February 5, 2002.

HOFMANN, E.E., "Oyster models and coupling biological and physical models," Suspension Feeders Workshop, Baltimore, MD, March 18-19, 2002.

HOFMANN, E.E., "Applications of data assimilation in management-oriented models," CRC Community Modeling Workshop, Annapolis, MD, June 5-7. 2002.

HOFMANN, E.E., J.M. KLINCK, E.N. Powell, S.E. Ford, S. Jordan, and E. Burreson, "Climate Variability and Dermo Disease in Chesapeake Bay," National Shellfisheries Association Meeting, Mystic, CT, April 14-18, 2002.

Jin, Z., K. Rutledge, **G. COTA**, B. Smith Jr., W. Su, F. Rose, and T. Charlock, "What CLAMS tells us about the ocean albedo measured at COVE," CERES Science Team Meeting, Brussels, January 21-23, 2002.

Jin, Z., K. Rutledge, **G. COTA**, B. Smith Jr., W. Su, F. Rose, and T. Charlock, "What CLAMS tells us about the ocean albedo measured at COVE," CLAMS workshop, Lanham, MD, February 27-28, 2002.

Kraeuter, J., E.N. Powell, **E.E. HOFMANN, J.M. KLINCK**, R. Grizzle, M. Bricelj, and S. Buckner, "Modeling the Growth of the Hard Clam, *Mercenaria mercenaria*," National Shellfisheries Association Meeting, Mystic, CT, April 14-18, 2002.

MOODY, R.S., "Tidal Theory, Datums, and Introduction to Water Levels Requirements for Hydrographic Surveys." National Oceanic and Atmospheric Administration (NOAA), Center for Operational Oceanographic Products and Services, Chesapeake, VA February 26, 2002.

Powell, E.N., E.A. Bochenek, **J.M. KLINCK,** and **E.E. HOFMANN**, "Influence of Short Term Variations in Food Supply and Critical Periods on Survival of *C. Gigas* Larvae," National Shellfisheries Association Meeting, Mystic, CT, April 14-18, 2002.

VALLE-LEVINSON, A., J.L. BLANCO, and J. Fierro, "Observations of wind effects on exchange flows in a channel constriction of the Chilean Inland Sea," the Second Meeting on the Physical Oceanography of Sea Straits, Villefranche, France, April 15, 2002.