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Center for Coastal Physical Oceanography, Old Dominion University

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Steve and Lou's Excellent Antarctic Adventure: Anectodal Observations of Birds, Ocean, and Human Zaniness at the Polar Front

Louis (Lou) Codispoti's side of the story:

STEVE GAURIN is a wildman! Despite honest descriptions of the horrendous conditions to be expected and the timing of the cruise that would have us away from home on Thanksgiving, Christmas and New Year's, Steve kept on volunteering to go on what we pegged the "homewrecker" leg of the U.S. JGOFS Southern Ocean cruise. I went because of my responsibilities to the hydrographic crew, which is led by John Morrison and myself. Schedule changes had put this cruise right smack in the middle of the holiday season, and it only seemed right that one of the team leaders should be on board. Let's face it, the rest of the hydro-team would probably have assassinated me if I didn't go! Anyhow, we reached New Zealand, more or less in one piece on 23 November, and greeted the *R/V Revelle* (photo) as it returned from the first U.S. JGOFS Revelle leg. As predicted, the scientists on this leg encountered some pretty bad weather.

We departed on 1 December, fully expecting to encounter equally bad weather, but except for a few very brief periods when the winds approached 50 knots, the weather was about as good as it gets in and near the Southern Ocean Polar Front. We only lost a few work hours to bad weather. This kind of made me happy since the Chief Scientist, Professor R. T. Barber, gave me good news and bad news. The good news was that I would be the only person in the scientific crew to get a room all to myself (doubtless a testimony to my easy-to-get-along with personality). The bad news is that the room would be the Chief Scientist's cabin, which is very far forward and very high up. This equates to being near the end of the "lever-arm" for ship's motion. Luckily I am resistant to seasickness, and as already noted, the weather wasn't too bad, so getting this room merely meant that I would not get a good night's sleep for about a month.

The month at sea was mainly consumed with the typical round the clock work schedule with everyone standing a least a 12 hour watch. My work included editing data, making standards for the dissolved oxygen anaylses, helping with the deck work, etc., etc. Getting the big 24-bottle Rosette over and back was always an adventure because of the winds, waves, and the fact that as a new ship, the *Revelle's* gear handling equipment is still being optimized. We did have a Christmas gift exchange and a cribbage tournament (see photo). I regret to say that I was whipped in the first round of the tournament! For some reason, we were not able to organize the poker games that are one of my chief enjoyments at sea! As usual, I overate, and it took me about six weeks at home to get my girth back to the already ample state that it was in when I left!

Since the cruise did not produce enough excitement for Steve, he joined me on an airplane tour of New Zealand in a plane very similar to the one that I fly at home. This plane came complete with a pilot that had the requisite rating for flying in the Fjord country and alpine regions of New Zealand's South Island. He gave me the left seat (traditional seat for the pilot in command), and I was feeling pretty good about myself after taking off from the Christchurch New Zealand airport and handling the plane as we crossed the Canterbury plains. Then came the mountains.... The *good* news is that I was very familiar with this aircraft's capabilities. The *bad* news is that I was very familiar with this aircraft's capabilities. Mine had taken good care of me flying around the mountains of Colorado and up in British Columbia (even when I turned it into an airborne mulching machine taking off from a bush strip), but the New Zealander's apparently have a slightly different attitude about how close you should get to mountains, and now our young and bold New Zealand pilot was at the controls. At one point, when a mountain was filling our windshield, I (trying to be casual), asked him if the mountain concerned him at all. He looked up from the chart he was staring at and said "Why, because it's so close?" At that point, I knew that we were in for an interesting few hours.

Mt. Cook was coming up. It is the highest mountain in New Zealand, topping out at about 12,000 ft. The service ceiling of our airplane with the engine that was installed is 13,000 ft under ideal conditions, so I wondered a bit when our pilot tried to fly over Mt. Cook. Apparently, he thought that I am lighter than I am! I wondered a bit more when our stall warning horn beeped a few times indicating that we were at the maximum angle of attack beyond which the airplane would stop flying and behave more like a stone! I momentarily felt better when the pilot decided to circle Mt. Cook, and then a bit worse when we hit an "air pocket" on the lee side that dropped us fast enough for unsecured items like the pilots cell phone to go airborne (I caught it as it flew by).

The rest of the flight was interspersed with views of some of the most magnificent scenery on the planet, a stop for lunch at beautiful Milford Sound and tales of aviation disasters. I had a enough composure left to fly us back over the lower mountains and to note a landing in Christchurch New Zealand in my logbook. Our pilot was good and had special training for this type of flying, but I did write him a note after I got home with some thinly veiled suggestions about the differences between old pilots and bold pilots!

Several times during the cruise, I asked Steve if he was still happy that he had volunteered, and he kept on saying yes and that he would like to go out on the next leg!!! Similarly, the airplane trip wasn't enough excitement for him and I hear that he went bungee jumping afterwards, but more on that from the madman himself.

Oh my gosh, I have gotten this far and not said anything about the science of the trip. Let's see, first there is the ``paradox of the albatrosses." I spent time everyday watching albatross fly around the ship and never saw them eat anything! I know that they can very efficiently use the vertical wind gradients to stay aloft without having to flap their wings too often, but still you have to eat something sometime. This became kind of standing joke, and those who disliked me enough to try to drive me insane (not exactly a daunting task) would always make remarks about never seeing the albatross feed whenever I came on deck! The albatrosses and their smaller long-winged cousins are a notable feature north of the Polar Front in the Southern Ocean, and I consider the hours that I have spent watching them to be one of the great bonuses of being a field oriented oceanographer. Hey **Mr. Wizzard**, what about asking this albatross question in the *Puzzler* instead of one of your usual thermodynamically oriented teasers in this or the next *CCPO CIRCULATION*? The only problem is that neither you nor I know the answer!

Here's another scientific tidbit. My biological colleagues were puzzled by the massive north-south changes in nitrate/silicate ratios. Silicate and nitrate concentrations in the surface layers at our most southerly stations were about 50 and 27 micromolar, respectively. Then, as we proceeded north and crossed the Polar Front, silicate and nitrate concentrations were about 2 and 22 micromolar, respectively. What happened to the silicate they exclaimed? How come there is so much nitrate left? In the back of my mind, I knew this was no big deal, and when I got home I did three things. First I walked down the hall and talked to **JOHN KLINCK**, CCPO professor. "Hey John," I said, "about how long does it take the deep waters that rise to the surface near the Antarctic continent to migrate north and sink at the Polar Front?" He began to speak standard physical oceanographese, mentioning thinks like "Ekman divergence," etc., and concluded that the net mean velocity towards the Polar Front was on the order of 1 cm/sec. I checked this out by assuming that the net volume transport towards the front in the surface layer would be about half the southward transport of deep water towards Antarctica and came up with a velocity of about 0.5 cm/sec. This is all very rough, but looking at the distances involved, etc., I thought that it was reasonable to assume that nutrient rich waters rising near Antarctica take about three to ten years to reach the Polar Front. During this time, these waters would circle Antarctica, but as a first approximation, it is reasonable to think of the zonal nutrient gradients to be approximately 0 (check a couple of atlases to see the "ring-like" distributions of variables around the Antarctic Continent). Next, I read and re-read a couple of papers (Minas, 1993; Dugdale and Wilkerson, 1998; and Dugdale *et al.*, 1995). These authors make two points relevant to this discussion:

1. in Antarctic waters, the ratio of *Si* to *N* in organic matter is about 2:1 by atoms, and
2. the removal ratio from the upper layers is about 5:1 presumably because biogenic silica sinks like a rock to abyssal depths compared to biogenic *N*, and is therefore not re-cycled as efficiently.

I then looked at early spring nutrient data collected from the Ross Sea during the first JGOFS Southern Ocean process cruise in November 1977 to get an "initial pre-bloom nutrient condition." These data suggested that "new water" rising into the surface layer and starting to move north towards the Polar Front would enter the first spring of its new life at the sea surface with silicate concentrations of about 80 micromolar and nitrate concentrations of about 33 micromolar. After completing these three tasks, I stared at my navel for awhile, and this is what I came up with. Let's take a six-year transit time for waters to rise to the surface, migrate north to the Polar Front and sink. Let's assume that every year (growing season) phytoplankton blooms take up 10 micromolar nitrate and 20 micromolar silicate (the 2:1 ratio). Let's assume that most (65 percent) of the silica produced sinks beneath the zone (upper 300m) where winter mixing and vertical advection would return it to the euphotic zone the next spring. Let's further assume that only 20 percent of the biogenic nitrogen is carried to the "depths of no return" each year. This means that at the end of year one, we would see silicate and nitrate concentrations of 67 and 31 micromolar respectively. At the end of year two, we would see 54 and 29 micromolar, respectively, etc. You can do the rest of the math yourself, but by the end of year 6, the silicate and nitrate concentrations would be about 2 and 21 micromolar respectively. Are the 65 and 20 percent loss rates of Si and N reasonable? Well, I don't think that these numbers will bother you if you look at data on Antarctic sediments, but when you calculate a removal ratio, you get a value of about 6.5 instead of the "Minas *Si*/*N* Removal Ratio" of about 5 (*Si*/*N* by atoms). This doesn't bother me too much given our rough guesses at initial and final conditions, the neglect of processes such as horizontal mixing, experimental errors, etc., but I actually believe that the removal ratios may be higher than 5 because, I do not think that Minas and his colleagues were able to take into account all of the forms of fixed nitrogen which can build up during the growing season and be regenerated during the rest of the year.

So Steve, since people always laugh at this kind of "back of the envelope" calculation, why don't you produce a fancy family of curves that shows what I am trying to say. You will get basically the same result, but more people will think that this is real science. This time, adjust the initial and final conditions by (1) mixing the water column down to the depths where we find winter water; and (2) reducing the initial silicate concentrations by 10 micromolar to allow for the decrease that should occur between the Ross Sea and the open ocean. Doing this will give us initial conditions of 70 micromolar silicate and 30 nitrate and final conditions of 10 silicate and 20 nitrate. [Yes, I shamelessly played with these numbers to get a removal ratio of 6:1 by atoms!] I bet that this family of curves is going to give us a good idea of what plausible uptake ratios of *Si*:*N* uptake might be. You know, if we could actually get good numbers on the removal fractions, I bet that we could also tell the physical oceanographers what the actual transit times are. Those guys need all the help that they can get. [Yes, I cheated and looked at Steve's figure before writing this paragraph!].

Meanwhile, I want to close my part by thanking the scientists and crew of the *R/V Nathaniel Palmer* and the *R/V Revelle* for putting up with me on the two cruises that I mentioned. My sea-going nicknames do not include "Mr. Nice Guy."

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Steve Gaurin's side of the story:

LOUIS (Lou) CODISPOTI is not a morning person! At least, I don't think he is; maybe he's not a night person, or maybe it's just that he doesn't like waking up to the sounds of anti-roll tanks and/or ship anchors clanging against the hulls of research vessels. Anyway, it was hard to keep track of time onboard the stalwart *R/V Revelle* as she steamed seaworthily through the waters of "the rougest ocean in the world" (more on this later). The problem was that we were keeping three different times onboard: "ship time," which equated to local New Zealand time; "local time," which was time where we were and varied by as much as a day because we crossed the International Date Line; and our old familiar favorite, Greenwich Mean Time (A.K.A. UTC). Then there was a floor-waxing time, a time of hunger and confusion, of pungent odors, and increased zaniness.

But I progress. Let me back up and start from the beginning (Norfolk time). Lou and I left our humble hometown on 21 November, nearly missing the flight due to the fact that I left my tickets at home. After 36 hours of travelling, we arrived in Christchurch, New Zealand, on 23 November (love that International Date Line), and immediately set to work practicing crossing the streets. Never quite mastering this, we decided to go and meet the ship as it came into port on 24 November, having just completed the first US JGOFS Revelle leg. The tired eyes and impatient grunts of the scientists onboard heralded two things: an immediate trip to the local bars in port, and of course, the adventure of a lifetime.

I spent the next few days learning how to run the Scripps/ODF oxygen titrator, under the tutelage of Bob Williams, the designer of the apparatus. The titrator and I would get to know each other inside and out over the next month, constituting perhaps my most intimate relationship in years. Anyway, departure was delayed a couple days while new equipment was assembled, shipped, and brought aboard for our leg, and we finally left port on 1 December, with a full consort of 37 scientists and 22 crew. As we left I, discovered the inspiration behind a rather insipid sign on my stateroom door, which read, "WARNING: If you are in this room for a period of 8 hours or more during operation of the bow thrusters, a hearing hazard exists." Bow thrusters, for those unfamiliar, are LOUD devices that steer the ship's bow side-to-side, especially useful when leaving a dock or, as I would soon realize to my ultimate joy, while on-station. Ear plugs became a welcome, if uncomfortable, addition to my sleeping process. Of course the downside to the ear plugs was that they rendered alarm clocks completely useless, and I came to rely on my roommate, Erik Quiroz, veteran of many cruises, as my wake-up call for my midnight-to-noon (ship time) shift. Kudos to Erik for helping me keep my shift, my sanity, and my job.

Well, the cruise was quite the adventure indeed, although I would have liked to have seen a penguin. Albatrosses and petrels followed the ship everywhere, and we saw some icebergs and the ice edge of Antarctica. To me, seeing the ice edge of Antarctica but not actually setting foot on the continent was akin to, well, seeing a place you'd really like to go but not getting to go there. Ah well, it was still wonderful, and yes, worth missing the holidays for. New friends were made, movies were watched, books were read (cover-to-cover... woo), and guitar skills were honed to the point where I can now get through "Ode to Joy" like nobody's business. If I could point to one disappointment I'd have to choose a morbid and rather ridiculous one, that "the roughest ocean in the world" hardly lived up to its billing; only once did I think I might be thrown from my bunk (and that was only because Erik had to shake me to get me to wake up). I was called an unmitigated fool (I'm using some tactful editing here) by the first mate for lamenting this fact, but I wanted to come back with stories of bravery and miraculous survival, not of bow thrusters and ear plugs.

Perhaps this is partly why I sought some adventure after the cruise. We arrived back in Lyttelton, NZ right on schedule, on 3 January. After the traditional immediate trip to the local bars, we all spent a couple days with the next group of scientists to make sure everything was loaded and ready. Then it was time for fun. I decided to travel alone, instead of with a group of friends, because, for lack of a better term, things got weird. This turned out to be a great decision. Lou has already done a prime job of recounting the plane flight, so I won't be redundant, except to say that while he had to deal with the flying cell phone, I was hit in the head with flight manuals, a bottle of water, barf bags (thankfully empty), and anything else that happened to be in the pocket of the seat backs. It was spectacular! After that it was south to Dunedin, New Zealand's most Scottish city, where I rented a bike and rode out to the end of a peninsula where there was a seal and albatross colony, and visited New Zealand's only "castle," actually more of a museum. After Dunedin, I went to touristy Queenstown, where finding nothing better to do, I decided it was time to overcome my fear of plunging head-first into a chasm, attached to a bridge or some other construct by nothing more than a giant rubber band. Just so I would be sure I was really over my fear, and also because I wanted another t-shirt, I did a second bungee jump later in the day. Fun stuff, and finally a story of survival! Next was a glacier hike up the Franz Josef glacier, which was just uncertain enough as to where you could go and how you could get there (and back) to make it really exciting. Then I went sea kayaking in Abel Tasman National Park, which was nice but far from dangerous. Last stop was Kaikoura, where I swam with seals (a blast!) and went dolphin-watching. All in all, a full and exciting trip. Even made a friend or two along the way (human, not sheep, thank you).

Some of my favorite things about New Zealand: no frivolous liability lawsuits (which is why they have bungee jumping everywhere); friendly people; no one dollar bills (one and two dollar coins instead); no pennies; no sales tax; "Giday", "Good on ya, mate!", "Sweet as!", and "Like another pint?" (and pint really means pint there); incredibly varied landscape; low humidity; small cities; lots of wilderness; the world's best rugby team; and of course, the metric system.

Oh, right, Lou wanted me to mention some science. Well, let's see, water below 0C is darn cold, and it has quite a bit of oxygen in it, usually. Oh yeah, groundbreaking stuff. Pulitzer Prize, here I come. For even more science, see Lou's exercise in nutrient uptake and the lovely figure (what, you think Lou does his own figures?) that accompanies it.

So stay tuned for the next adventure, to India and the Arabian Sea (where the cows are sacred and the sheep wonder why).

A family of curves giving the fractions of *N* and *Si* uptake that are exported from the system into the "zone of no return" (depths below the seasonal mixing depth) for different transit times (between upwelling near Antarctica and sinking at the Polar Front) and different ratios of *Si:N* removal by atoms. These curves show the results of a situation in which waters with initial concentrations of 30 **u**M NO3- and 70 **u**M *Si* would be converted to 20 **u**M NO3- and 10 **u**M *Si*, along with the assumption that 10 **u**M NO3- per year are used by photoplankton for growth.

Notes from the Director

This issue features a science travelogue by **LOUIS CODISPOTI** and **STEVE GAURIN**. I've always enjoyed reading about others' Travels (Paul Theroux's older books comes to mind), and it is even more exciting when the topic is the ocean and coastal areas. Lou even wove in some science. Maybe he should consider a new genre of book... the oceanographic science travelogue.

Steve and Lou's article did remind me how we take our academic research fleet for granted. Lou and Steve traveled thousands of miles, stepped onto a sophisticated research ship, sailed into some of the most treacherous seas in the world, and everything (well almost everything) worked, and they were safe. Over the years, the research fleet, under the coordination of the University National Oceanography Laboratory System (UNOLS) and with the support of NSF, ONR, and other agencies and many state institutions, have developed into a reliable, safe, and efficient seagoing system. The next time you go on a UNOLS-coordinated vessel, stop and look around. Talk to the ship's crew and the ship's technicians, note the standardized data gathering systems, and note the safety precautions. Then think about how your research benefits from our research fleet system.

Larry P. Atkinson
Director, Center for Coastal Physical Oceanography

First Blue Crab Bowl Tests High School Student's Ocean I.Q.

Old Dominion University's Department of Ocean, Earth and Atmospheric Sciences hosted the first Blue Crab Bowl on Saturday, February 28. Colleagues from the College of William and Mary/Virginia Institute of Marine Science (VIMS) co-hosted the successful event, which was held in Old Dominion University's new Oceanography and Physics Building. An academic tournament for teams of high school students, the Blue Crab Bowl challenged their knowledge and understanding of all facets of oceanography. To unwind between matches, the students took advantage of a suite of science enhancement activities that included videos about careers in the marine sciences, talks about sharks, aquaria with blue crabs and other sea dwelling critters, and fish printing. After a grueling day of competition among 15 teams from high schools around the Commonwealth, the students from Central Shenandoah Valley Regional Governor's School, Fishersville, VA emerged the victors!

The Blue Crab Bowl was one of 16 regional competitions held across the country as part of the National Ocean Sciences Bowl (NOSB), sponsored by the Consortium for Oceanographic Research and Education and the National Marine Educators Association. Each team winning a regional contest earned an all-expenses paid trip to compete in the national championship of the NOSB in Washington, DC this spring. The Virginia Sea Grant College Program donated additional prizes for the Blue Crab Bowl competitors, including trophies, medallions, books and, for the winning coach, a trip to the National Marine Educator's Association Conference in Puerto Rico.

LIZ SMITH and **ANNE WEST-VALLE** from Old Dominion University's Center for Coastal Physical Oceanography (CCPO) coordinated the Blue Crab Bowl together with Lee Larkin and Irv Wilson from VIMS. **Terry Hickey**, Dean of the College of Sciences of Old Dominion University, welcomed the 150 students, parents, coaches, and volunteers who were packed into the building's largest lecture hall at the start of the day. The Oceanographer of the Navy, Admiral Paul Tobin, was present to congratulate all during the afternoon's awards ceremony. About 40 volunteers from the faculty, staff, and students of Old Dominion University's Department of Ocean, Earth and Atmospheric Sciences, and VIMS served as Moderators, Science Judges, Rules Judges, and Time- and Score-Keepers, among other things, for the matches. Together with a dozen volunteers from outside the University community, these folks were largely responsible for the Blue Crab Bowl's success. Feedback from students and coaches was unanimous: the Blue Crab Bowl was a challenging and fun way to spend a Saturday!

The first place team, Central Shenandoah Valley Regional Governor's School, is shown here receiving their trophy.

The Value of Community Outreach

by Vince Kelly, Graduate Research Assistant

I first learned of the rewards of talking to children about oceanography by observing a tantalizing **Tony Colizzi**, then a graduate teaching assistant of the Department of Ocean, Earth, and Atmospheric Sciences (OEAS), lecture to a group of high school students who where visiting Old Dominion University's student union, Webb Center, for career day. A senior student who frequently capitalized on the department's community outreach program, Tony wielded an arsenal of visual aids and hands-on activities that mesmerized the teenage audience, whom I expected to be far more interested in droopy jeans and body piercing than the difference between phytoplankton and zooplankton. This feat of "teenage attention retention" left not only me but the student's instructor awestruck. However, to Tony, who is presently in Germany completing his student teaching, the trick was simple. No threats of post-lecture quiz, no candy treats for answering "gimmie" questions; he employed the ancient and often forgotten teaching technique of audience participation. "The key is," Tony explained, "you have to present the material in such a way that your audience can relate to it. If you are talking about excess nutrients in the bay, ask them if their parents have lawns and gardens." Even an uncooperative group will be forced to supply the desired response and then you can further entrain them in the discussion by asking if anyone fertilizes their lawns or gardens. "You do!" Tony would exclaim, "Well who can guess where those nutrients go when it rains really hard?" and so on.

A distant light shining from my forgotten past suddenly reminded me that I was already familiar with this technique. "I get it." I exclaimed to Tony. "This is how I used to sell life insurance! I ask a few leading questions, and they blindly walk right into the close. When do we pick up the check?" I asked. Tony quickly reminded me of our non-monetary motivation, which, judging from the satisfied look on his face as we exited Webb Center, was ample reward.

Later that year, Tony requested my help with a group of adults who paid "real money" to hear him talk about oceanography while onboard *The Cindy Lou*, a Rudee Inlet (located in Virginia Beach) charter boat. However, this time I would have to deliver the chemical part of the lecture, which admittedly sent a worrisome chill down my spine. After Tony had warmed the audience with his usual enticing routine, it was my turn to see if I could keep it alive. I started with some "gimmie' questions about the differences between the oceans and rivers and with the unknowing cooperation of the "group know-it-all," I worked right up to "does anyone have lawns or gardens? What kind of fertilizer do you use?" Before I knew it, they were practically fighting one another for the right to answer my questions and prove their superior knowledge of oceanography. To preserve peace at sea, I put the group know-it-all and the others in their place with some fancy jargon about solute diffusion and terminal electron acceptors. As I turned the audience back over to Tony, I was filled with satisfaction knowing I held an adult, paying audience briefly captivated with subject matter I intend to earn my livelihood studying.

Since that memorable first talk, I have had the opportunity to give several others arising from community outreach activities of CCPO and OEAS. However, my most rewarding experience occurred just this February when CCPO hosted 17 eighth and ninth graders along with several chaperons from the Chesapeake Bay Academy. I made a few preparations including a stop to the warehouse for an old GO-FLO bottle, a current meter and plankton net, and vacuumed the water of the basement floor that was still draining in from the recent nor'easter in order to avoid any possible legal troubles resulting from a slip and fall. Shortly after finishing my preparations, **Beverly Scott**, former CCPO office services specialist, called to notify me of a rather large group of teenagers assembling in the parking lot that I should expeditiously bring under my charismatic control (haha). I packed them into the basement (location of CCPO's labs), and promptly started selling oceanography in much the same way I once sold whole life policies to newlyweds. After listing the four oceanography disciplines on my backboard, I asked, "who knows what physical oceanographers study?" And in response to the harmonious cry of "physics," I exclaimed "that's exactly right, but do you think we could be a little bit more specific?" Soon after I heard something about water movements, and I continued to ask if anyone could tell me what the Gulf Stream was and "what's the big deal about it anyway." They grasped the idea of ocean currents distributing heat around the earth and unanimously agreed that this was a process worthy of continued study. The next line of questions, in my arsenal, involved biology and how physical processes "you remember those right" I asked, are involved in transporting larval fish to suitable environments for growth. Upon realization of the importance of such processes, one student remarked that physical oceanographers sounded like "cool people," and after forcing myself to agree, I pleaded, "If you think that's cool, wait until we talk about chemical oceanography."

I continued to lecture for at least another half hour when I decided to fire my heavy artillery. As we filed into **LOU CODISPOTI'S** lab, I asked, "Who wants to see how we measure nitrogen in the ocean?" Still attentive, the group showed almost 100 percent interest and were most impressed (lots of oos and ahs) by the pretty pink color formed during the analysis. When everyone had seen the fancy chemical reaction, we moved on to the new Ocean/Physics Building for a heavily anticipated blue crab feeding from **Jennifer Martin**, lab assistant at the Department of Ocean, Earth, and Atmospheric Sciences. En route, the class instructor, Art Simon, asked me if I was "aware that these children had all been diagnosed with attention deficit disorder (ADD) and that he had just placed several of them (not in attendance) back into standard classes." I shockingly replied that fortunately, I had no idea. Justifiably so, Art was quite pleased with himself for the progress of his students who could now remain focused throughout a 45-minute lecture. As I turned the group over to Jennifer, it occurred to me that I had just sold a lengthy oceanography lecture to a group of teenagers who have difficulty remaining focused. Perhaps some of the lecturing techniques I had learned and my enthusiasm for the subject matter had also played a small role in the group's attentiveness?

After concluding the meeting by urging all the students to take as many science and math courses as possible (which by the way might have been my most unpopular move of the day), I head back to CCPO with a subtle grin on my face that probably resembled the look I saw on Tony's face sometime ago at Webb Center.

I am sure everyone is more than tired of my seemingly relentless emails urging your (students) attendance at Graduate Student Organization (GSO) meetings, faculty candidate meetings, and community outreach requests, but I really must profess that the magnitude of rewards from giving talks to young people justifies your involvement. I have markedly improved my oral communication skills and developed contacts throughout the community. In addition, it's nice practicing my speaking skills on children as opposed to an audience of faculty members.

SeaWiFS Science Team Meeting at CCPO

As part of the scientific effort directed at understanding and using the ocean color measurements obtained from the Sea Wide Field Viewing Sensor (SeaWiFS), the National Aeronautics and Space Administration (NASA) funded several teams of investigators. One team is led by C. McClain (NASA/Goddard Space Flight Center), **E. HOFMANN** (CCPO), M. Lewis (Dalhousie University), and R. Murtugudde (University of Maryland) and is focused on understanding physical and biological interactions in the tropical oceans. Several team members from CCPO (**TONYA CLAYTON**, **MARJY FRIEDRICHS**, **EILEEN HOFMANN**, **JAMES KOZIANA**) joined with scientists from NASA/Goddard Space Flight Center (J. Christian, C. McClain, S. Signorini, M. Verschell) and Dalhousie University (G. Lazin, M. Lewis, D. Turk, X. Zhang) for a two-day (April 20-21) meeting at CCPO to exchange results, discuss ongoing research, and to make plans for future collaborative efforts. Much of the meeting was devoted to discussing the data analysis tools, circulation models, and ecosystem models that have been developed by the team scientists to understand processes affecting ocean color distributions in the Tropical Pacific Ocean. Much progress has been made on the development of a coupled mixed layer and bio-optical model, and lower trophic level and Trichodesium models that will eventually be embedded in a three-dimensional circulation model for the Tropical Pacific Ocean. An objective of the modeling efforts is to understand variability in the western, central, and eastern Pacific Ocean that occurs in response to El Nino conditions. Additional effort has been focused on developing methods for surface glint corrections and understanding the influence of bubbles on light scattering. The next Tropical team meeting will take place in the fall in the not-so-tropical environment of Halifax, Nova Scotia.

Puzzler

The purpose of the Puzzler 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 to answer 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 throught-provoking (not necessarily correct) answers to previous submissions. Before posing this issue's Puzzler question (Question 98.2), Wizzard would first like to answer last issue's Puzzler, Question 98.1.

Answer to Question 98.1: What is the frequency of oscillation of a hydrometer that is dropped into a pail of water?

Wizzard received two responses to Question 98.1. *klinck@ccpo.odu.edu*, relying on experiments from wine making, suggested that if the hydrometer did not break on impact, viscous damping would kill any oscillations before the completion of one cycle. *barry@phys.ocean.dal.ca* reported experimental evidence from beer making and provided a theoretical analysis showing the frequency is proportional to the square root of the ratio of the density of the liquid (ale or lager) to that of the hydrometer. Wizzard agrees with this analysis. The point made by *klinck* about damping also intrigued Wizzard. Many hydrometers have large submerged chambers which offer considerable hydrodynamic resistance when set in motion. Using a linear parameterization for this resistance, it is easily shwon that if the hydrometer cannot execute one oscillation, the drag coefficient must be at least equal to the undamped oscillation frequency deduced by *barry*. Finally, Wizzard suggests *klinck* try softer grapes and *barry* consider experimenting with stout.

Question 98.2. Consider a half a mole of carbon monoxide gase, CO, and a half a mole of N_2 gas. Note that both gases have the same molecular weight 28. Let these mix at standard temperature and pressure so that a mole of gas of molecular weight 28 is obtained. A streaghforward calculation shows that the entropy of the mixture is the sum of the entropies of each constituent before mixing plus entropy of mixing given by $N K \log_e 2$. Here N is Avagadraos's number and K is the Boltzmann's constant. If the half mole of CO is replaced by the half mole of N_2, application of the same methodology gives the same entropy of mixing. But there can be no mixing if the constituents are the same chemical species. Wizzard wants an explanation.

Welcome back DAVID RUBLE!

David graduated from CCPO in December 1996, and then he moved to sunny Florida to work for a bit before coming back to CCPO as a research associate senior for **Glenn Cota**, research associate professor.

Just the *facts* . . .

Appointments

L. P. ATKINSON, Board of Oceans and Atmospheres of the National Association of State Universities and Land-Grant Colleges (NASULGC).

Graduates

Ph.D.: J. J. HOLDZKOM II, dissertation title, "Studies of Warm-Core Rings Using a Particle-in-Cell Method," May 1998, Advisor: **A. D. Kirwan, Jr.**. John took a position as an oceanographer with the Coastal Ocean Laboratory of the National Oceanographic Data Center division of the National Oceanic and Atmospheric Administration.

M.S.: V. KELLY, non-thesis, Advisor: **L. A. Codispoti**. Vince will stay at CCPO and work for Lou as an assistant scientist.

M.S.: M. (Shelly) PARASO, thesis title, "Modeling Environmental Effects on MSX Prevelence and Intensity in Eastern Oyster (*Crossostrea virginica*) Populations," May 1998, Advisor: **E. E. Hofmann**. In February, Shelly took a position as an oceanographer with the National Oceanographic Data Center, NOAA/NESDIS.

Grants/Contracts Awarded

L. P. ATKINSON, "Bridges and Approaches Route 125 over Nansemond River," subcontract from Virginia Department of Transportation through Sverdrup Civil, Inc., $5,407.

E. A. SMITH, $1,000 Travel Award from the IEEE Geoscience and Remote Sensing Educational Intiatives Program to attend the 1998 International Geoscience and Remote Sensing Symposium, Seattle, WA, July 1998.

G. H. WHELESS, "The Establishment of a High Performance Connection to the vBNS for Old Dominion University," National Science Foundation, $135,000.

Presentations

E. E. HOFMANN, "Environmental Variability and Implications for the Oyster Fishery: Modeling Study," plenary presentation, Multispecies Fisheries Research and Management Workshop, Solomons, MD, April 1-3, 1998.

Publications

J. M. Seiner, NASA Langley Research Center and **C. E. GROSCH**, "Mixing Enhancement by Tabs in Round Supersonic Jets," *4th AIAA/CEAS Aeroacoustics Conference*, Toulouse, France, June 1998.

E. E. HOFMANN and T. M. Powell, University of California, Berkeley, "Environmental Variability Effects on Marine Fisheries: Four Case Histories," *Ecological Applications*, 8(1) Supplement, S23-S32, 1998.

E. N. Powell, Rutgers University; **J. M. KLINCK**; **E. E. HOFMANN**; and S. Ford, Rutgers University, "Varying the Timing of Oyster Transplant: Implications for Management from Simulation Studies," *Fisheries Oceanography*, 6(4), 213-237, 1997.

A. D. KIRWAN, JR., **C. E. GROSCH**, and **J. J. HOLDZKOM II**, "Particle-in-cell Simulations of a Lens on an f-plane," *Nonlinear Processes in Geophysics*, 4, 71-91, 1997.

J. M. KLINCK, "Heat and Salt Changes on the Continental Shelf West of the Antarctic Peninsula Between January 1993 and January 1994," *Journal of Geophysical Research*, 103(C4), 7,617-7,636, April 15, 1998.

LI, C.; **A. VALLE-LEVINSON**; K.-C. Wong, University of Delaware; and K. M. M. Lwiza, State University of New York, Stony Brook, "Separating Baroclinic Flow from Tidally Induced Flow in Estuaries," *Journal of Geophysical Research*, 103, 10,405-10,418, 1998.

LI, C. and J. O'Donnell of the University of Connecticut, "On the Residual Flow in Tidal Rivers and Shallow Estuaries," *Chinese Journal of Oceanology and Limnology*, 16(1), 1-8, 1998.

ADK's Words of Wisdom

"Physical oceanography is the observation, description, explanation, and (sometimes) the prediction of the motion and physical thermodynamic structure of the liquid ocean. Its language is fluid dynamics, and it is a branch of physics. It is both theoretical and experimental. It is beautiful."

Joseph Pedlosky, Woods Hole Oceanography Institution

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