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Center for Coastal Physical Oceanography, Old Dominion University

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Coastal Oceanographic Research Experiences in Chile

The coastal ocean of Chile spans a range of latitudes, from °S to °S, not found in any other single country in the world. As such, this coastal region encompasses a huge diversity of systems with varied dynamical regimes. In the semi-arid region of the north, the main mechanisms driving the coastal ocean currents appear to be the wind and the buoyancy from heat fluxes. This results in environments which oceanographically resemble those of Baja California and Southern California. To the south, there is an inland sea equivalent in size to the area of approximately two Chesapeake Bays. Freshwater discharge and intense tidal currents combine with wind forcing as predominant forcing agents there. This environment resembles the coasts of British Columbia and Southern Alaska. In the past year, researchers from CCPO have participated in week-long cruises in each of these two environments.

In March 1997, **ARNOLDO VALLE-LEVINSON**, assistant professor, and **R.C. KIDD**, marine technician with the Department of Oceanography, participated in a study with Julio Moraga and Jorge Olivares from the Universidad Catolica del Norte and Jose Luis Blanco, from the Institute for Fisheries Development in Chile. After a tense wait to claim their instrumentation at the cargo section of the airport in Santiago, they studied the basic circulation patterns of three bays of northern Chile (around °S). They carried out measurements in Bahia Coquimbo, Bahia Herradura, and Bahia Guanaqueros as part of an effort to achieve manageable development without altering the natural resources around the shores of these bays. The bays have different dimensions and bathymetry and are located in a semi-arid region of beautiful scenery. The bays represent popular tourist destinations and sites of industrial development. This was the first time that a current profiler was towed in coastal Chilean waters. The study was motivated by the desire to apply modern technology to current velocity measurements as the current profiles were combined with density profiles. Initial results from those studies indicate that the spatial resolution provided by the towed current profiler allowed identification of a pair of counter-rotating gyres in the mean surface flow of one of the

bays. This result has important implications for the flushing rate of the bay. The mean flow had complex vertical structure as it moved in different directions in response to the density stratification.

In January 1998, the same people participated with Fernando Jara, Doris Soto, and Carlos Molinet from Universidad Austral de Chile (at the time) in a study of the largest fjord of the Inland Sea. This time, Arnoldo and R.C. carried the instrumentation with them to avoid any delays at cargo. They conducted three 12-hour studies at different locations of Canal Puyuhuapi. This area is of great ecological importance because it is subject to red tide events, and it supports extensive salmon aquaculture and shellfish industries. These industries need to understand the flow patterns for optimal location of their culture centers and for possible pollution impacts. With these issues in mind, the group of researchers looked at the flow structure associated with the interaction between tidal forcing and stratification over a combination of sill and geometry contraction during the first day. This study aimed to assess the influence of the sill-contraction on controlling the exchange of water between two upper portions of the fjord. Of particular interest are the potential impacts on the basin located upstream, where potential human development may take place at the head of the fjord. This study was framed by the beautiful scenery of the area and close encounters with Magellan penguins, porpoises, sea lions, rainbow trout, and salmon. Imagine savoring the delicacies of fresh salmon and rainbow trout cooked in lime juice and surrounded by emerald-green waters and snow-capped mountains... unforgettable.

The second day took the researchers to the confluence of Canal Puyuhuapi and Canal Jacaf. Red tide blooms in the Jacaf could be transported to the Puyuhuapi. This hypothesis requires studies of the circulation in the confluence of the two channels. On this day, the researchers were not as lucky in terms of weather conditions and worked under gale-force winds and heavy rains. This made for a fascinating data set. On the third day, while studying circulation patterns in the Bay of Cisnes to evaluate potential aquaculture sites, measurements were suspended temporarily due to gale-force winds, stronger than the day before, that blew through the area. Nonetheless, the researchers were rewarded by a data set that included the influence of a freshwater pulse from the Rio Cisnes and caused measured salinities that ranged between 2 and 31. These trips to the north and south of Chile produced exciting information that should help environmental decision-making in these parts of the country. In addition, the information derived from these efforts should advance our understanding of certain aspects of temperate bays and fjord dynamics.

Notes from the Director

The string of nor'easters we experienced this winter reminds me again how little we know about variability in the coastal ocean. This year, we have had nor'easters with their strong winds and tidal flooding, but we have had no real cold air outbreaks. This is in contrast to recent years when the storms were accompanied by cold air outbreaks.

We all know that this kind of variability in air and water temperatures, runoff, wind, and flooding must result in considerable variability in coastal ecosystems. Yet the only routine marine measurements we have is water temperature. Salinity is ignored, yet it can tell us so much.

We lost our system for monitoring salinity with the demise of light ships and tide gauge observers 10 to 20 years ago. Salinity would be an excellent first order indicator of the effects of land use variations on the coastal ocean. It would also be helpful in evaluating the effect of increasing continental runoff. We should be watching the coastal ocean.

Why, then, can't those of us on the coast cooperate to at least start some kind of monitoring to complement the small effort going on now so that in a few years we will have the start of a record?

Larry P. Atkinson
Director, Center for Coastal Physical Oceanography

Two New Faces at CCPO

Christina Senior

CHRISTINA SENIOR came to CCPO in November 1997 as an administrative assistant working for associate research professor, **Glenn Cota**. Christina works closely with Glenn on grant administration and in support of his research activities. Since Christina's arrival at CCPO, she has already proven to be a major asset. Most recently, she helped coordinate the NASA Lwn/Rrs Workshop (article in this issue), which was held at CCPO on December 11 and 12.

Christina was born and raised in New York. She attended college to study business and has plans to finish her degree. Before coming to CCPO, she worked in a veterinary hospital to pursue her interests in caring for animals. Christina is a member of several dog breed clubs and is a rescue volunteer. She currently has two dogs: Rommie, a Doberman, and Maggie, a German Shorthaired Pointer that she has shown and is currently competing in hunt tests with. She also has six pheasants, which she raised from hatchlings. Only two pheasants have names: Elvis, because he's the king; and Cool Hand Luke, who happens to be a girl, but who was appropriately named since she was a very good escape artist in her younger age. Christina also enjoys horseback riding, sports (especially hockey and baseball), hiking, biking, and crafts.

Joseph E. Ruettgers

JOSEPH (Joe) E. RUETTGERS is CCPO's new computer systems engineer. He comes to us from ODU's Department of Computer Science, where he was the assistant systems engineer. He started at ODU as a full-time student, majoring in computer engineering. Before starting back to school, Joe was in automobile sales for over nine years. His experience and interest in compute rs comes from working for Memory Bank and hours of home hacking and experimenting. One thing you will find different in Joe, compared to other people, is the effort he puts into trying to make things work for each individual person at CCPO. He believes that, although it is impossible to please everyone at once, it doesn't mean you can't try.

Joe has many other talents and participates in outside activities, such as Boy Scouts, boating, bicycling, and scuba diving, just to name a few. If you would like to get in touch with Joe, he can be reached at joe@ccpo.odu.edu.

Community Outreach

CCPO recently hosted 44 nine- and ten-year-old students from Mrs. Alvarez's and Mrs. Baggett's fourth grade classes at Baylake Pines School in Virginia Beach. The students, who are learning all about oceanography and the Chesapeake Bay in their science classes, came to CCPO with a very good idea of basic concepts, like how the tides work and what makes waves.

Starting with a welcome aboard from Center director **LARRY ATKINSON**, the students were given a tour of the computer center by CCPO's system administrator, **JOE RUETTGERS**. Joe explained the complexities of the CCPO network and explained how file servers and client systems worked. Next, the students got a brief overview of the NOAA mission by **KATE BOSLEY**, CCPO's resident NOAA/National Ocean Service modeling expert. **CATHY LASCARA**, research assistant professor, then presented a general overview of oceanography in the Chesapeake Bay and told the group about her recent field work using the Scanfish data collection device. Finally, the groups were treated to a flythrough of the Chesapeake Bay with the Immersadesk by research assistant professor, **GLEN WHELESS**, in the ODU Virtual Environments Laboratory. **CAROLE BLETT**, CCPO administrator, and **MARTHA WHELESS**, CCPO volunteer, served the kids a snack of donut holes and juice just to make sure their sugar levels were kept at the highest levels for the bus ride home! **RUSSELL BURGETT**, research associate, was tour guide and special coordinator during the children's visit.

After the visit, Glen received email from one of the student's teachers, Mrs. Alvarez. She commented that ``we had a great educational experience on our field trip. You all deserve a big hand. The kids loved it.'' It was a pleasure hosting this outreach activity and letting these bright students experience some of the fun that can be found working in a

scientific field like oceanography.

My Experience at Biosphere 2

by John M. Klinck, Professor of Oceanography

I was happy to attend an annual organizational meeting of two groups coordinating Antarctic research which took place at *Biosphere 2* near Oracle, Arizona on December 1-5, 1997. The two groups were iAnZone (International Antarctic Zone), coordinated by Arnold Gordon, and ASPeCt, coordinated by Stephen Ackley. These meetings are an attempt to coordinate national physical oceanographic and sea ice measurement programs in the Antarctic so that the efforts are mutually supportive. More on the meeting in a bit, but the meeting site deserves some comment. We were given a special tour of the facility as part of the meeting, although tours are available to the general public for a fee.

Biosphere 2 was created by private funds to demonstrate a self-sustaining ecosystem including humans. The name, *Biosphere 2*, implies that it is a scale model of the earth, the first biosphere. In the enclosed ecosystem, all biological products were to be recycled; however, energy (electricity) was supplied to the enclosure. There were two times when the enclosure was occupied by humans and sealed (one for 18 months and another for 1.5 months). A number of problems occurred including draw-down of oxygen (fertile soil added near the end of construction absorbed considerable oxygen), personal difficulties among the biospherians, and the labor required just to grow food.

These difficulties cast a pall on the results from these first experiments, so all studies in Biosphere were reorganized in 1996 and put under the operational control of Columbia University and a board of scientific advisors. This new phase of activity considers manipulative experiments of enclosed ecosystems to answer questions of current relevance. One major activity concerns how much carbon dioxide is absorbed by rain-forests, for example. This requires some changes in the enclosure, mainly the separation of the biomes, since it was found that there was a significant moisture flux from the rain-forest to the desert, with the obvious changes of both biomes.

Biosphere 2 is located near the town of Oracle, Arizona with a population of about 1000 and is about a 30-minute drive north of Tucson or a 90-minute drive south of Phoenix. In spite of seeming isolated, the lights of suburban Tucson are visible at night from the restaurant at Biosphere, reminding everyone of encroaching urbanization. The clear air and absence of city lights, at least for the present, yield a spectacular night sky that I had forgotten since moving to Norfolk, with its humidity and street lights.

The *Biosphere 2* enclosure is basically a very large greenhouse covering about 3.15 acres. Inside are five biomes (rain-forest, savannah, desert, marsh, ocean), as well as a separate human habitat and agricultural area. The original inhabitants tried to grow their own food, but the biospherians all lost considerable weight. Maybe living off the land is not the romantic activity it is portrayed to be by city dwelling Americans.

Biosphere 2 is a very active place with considerable monitoring equipment, as well as machinery to move air and water from place to place. Just cooling the facility in the hot Arizona summer is a considerable feat. The tour through the mechanical spaces reminded me of the spaceship in the first Alien movie--dark, dripping water, windy, noisy.

Animals and plants for each biome were chosen from around the world (Brazil, Madagascar, Carribean Sea). The original idea was to have a balance in each of the biomes, but there was a fly or two in the ointment. Actually, ants. The whole enclosure was quickly overrun with ants, which killed off most of the other insect life, including the pollinators. Apparently, the plants that require intervention for procreation are on their own or depend on the kindness of passing humans. Animal life, except ants and fish, in the enclosure was not evident.

The ocean biome, based on a Carribean coral reef, has a volume of a million gallons and a maximum depth of 25-feet and contains tropical fish, invertebrates, and flora. From the greenish color of the water, the phytoplankton are quite happy. The ocean includes a wave-maker to keep things moving a bit and a research vessel (rubber dinghy) for oceanographic sampling. At intervals, the evaporated water is replaced with distilled water mixed with Instant Ocean, a

product familiar to owners of salt water aquaria.

The facility is no longer sealed from the local environment. Air is pumped in at intervals to maintain an earth-like atmosphere inside--just like nudging to climatology in ocean circulation models. Even in its sealed state, the daily exchange with the outside was estimated at about 1 percent, so this is a somewhat leaky enclosure.

If travel to Arizona is not in your budget at present, you can travel virtually to *Biosphere 2* through their web site (www.bio2.edu), where you will find information on research programs and staff. Numerous graphics show you some of the wonders described here. It is even possible to get plots of quite a number of conditions in two of the biomes over the last few days to two weeks. Real travel to *Biosphere 2* is facilitated by a visitor's center, a hotel, restaurants and cafes, and the inevitable gift shops.

Oh, the meeting? I am out of space so that will have to wait for another time.

NASA Workshop at CCPO

In December, CCPO hosted a two-day, NASA-sponsored workshop on alternative optical observational techniques for ground-truth measurements of ocean color satellites. The workshop was organized by James Mueller, Professor at San Diego State University's Center for Hydro Optics and Remote Sensing (CHORS), and by **GLENN COTA**, research associate professor at CCPO. The workshop was sponsored by NASA's SIMBIOS (Sensor Intercomparison and Merger for Biological and Interdisciplinary Oceanic Studies) project to promote a critical evaluation and comparison of current optical techniques. There were over 20 workshop participants and observers from Canada, France, Japan, Taiwan, and the United States, representing academic, government, and commercial organizations.

The ocean's color depends primarily on the relative composition of phytoplankton, soluble colored materials, and suspended sediments. Backscattered light near the sea surface causes subtle variations in ocean color, which can be detected from space by satellites. Algorithms are developed from concurrent observations on optical and biogeochemical properties to retrieve concentrations of phytoplankton chlorophyll and other constituents. In-water optical profiles have been the standard technique for estimating water-leaving radiance, the signal measured by satellites. Acquiring optical profiles is time intensive and provides very limited spatial coverage. Hence, techniques for above-water optical mapping from a streaming vessel are highly desirable. A number of slightly different approaches are being utilized. Problems with both above-water and in-water were considered. Correction schemes for both types of observations are being improved and implemented.

Recommendations were made for compilation of larger, more diverse comparative data sets, more rigorous analyses of existing data sets, further observations and modeling, and the development of improved measurement protocols. It was concluded that much remains to be done, but that above-water observations hold great potential.

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.

Answer to Question 97.3: This problem was discussed in ``Mixing in Inland and Coastal Waters'' by H. B. Fischer, E. J. List, R. C. Y. Koh, J. Imberger, and N. H. Brooks, Academic Press, 1979, page 170. The authors argue that the cooling creates a shrinking of the fluid volume which lowers the surface level (by a small but gravitationally significant amount). The total potential energy (same mass at a slightly lower lever) is decreased, releasing kinetic energy for the convective motions.

Since Wizzard never received an answer from anyone on this question, Wizzard assumes this one was a stumper. Chalk one up for the Wizzard!

The first puzzler question of 1998, **Question 98.1**, was submitted by Professor William Lindberg, Chairman, Department of Mechanical Engineering, University of Wyoming.

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

My Overnight Trip on a Nuclear Submarine

by Larry P. Atkinson, Director

A few months ago, I took advantage of an opportunity to make an overnight trip on the *USS NORFOLK*, a Los Angeles class nuclear attack submarine at the Norfolk Naval Base, Norfolk. The trip was arranged by **RICHARD WHALEN**, ODU's director of military activities. Since ODU works closely with the Navy, Mr. Whalen arranges trips on Navy vessels to give ODU personnel a sense of what it is like going out to sea and to see how the Navy operates.

Our adventure began when the *NORFOLK* left the dock at about 0900 on Monday, December 8, 1997. After crossing the shelf, we submerged at 1500, resurfaced at 0400 on Tuesday, and disembarked at 1100 on Tuesday.

When first boarding, we walked across another submarine to get to the *NORFOLK*. As I approached the crewman standing at the hatch, I suddenly realized that this is not like boarding a research ship. One step down and that is the last I will see of the sky. After boarding and descending through two or three decks, I realized I had just entered a machine.

When moving around the sub, I found the passageways so narrow that you could not pass a person without touching, and both people were forced to turn their bodies sideways. In fact the only compartment I saw with any room to stretch out was the torpedo room. The wardroom, designed to hold 10 officers, doubled as the infirmary/surgery room. I experienced this first-hand during my lunch when a crewman sought medical attention from the ship's corpsman in one corner of the tiny wardroom. It was a bit disturbing to eat lunch while watching and listening as the crewman spitted out teeth and blood resulting from an accident he had while stowing equipment. Memories of the movie, *Hunt for Red October*, flashed before my eyes as I watched the injured crewman being taken off the sub by helicopter.

The sub's ladders and hatches are very narrow, accommodating only one person at a time. When moving around the ship, I was constantly making way for someone else. I was never alone and never more than 2--3 feet from another body. Even the captain's stateroom was small, located just a few feet forward of the control room. His stateroom doubled as his office as well, so there were often several visitors crowded inside, busy in discussion.

As we proceeded seaward across the continental shelf, the crew rigged the ship for dive. At the dive point, with 200 fathoms of water beneath the keel, I heard the classic submarine claxon sound, followed by ``Dive, Dive" announced over the ship's loudspeaker. We submerged and leveled off at a depth of 150 feet while the ship's trim was evaluated by members of the control room watch team. It struck me that the submarine was quite similar to an airplane, operating in a three dimensional ocean.

While onboard, it is hard to tell whether the submarine is moving. Unlike a research vessel, I couldn't readily determine the bow from the stern. Later in the evening the ship did ``angles and dangles," using pitch angles of nearly 30 degrees and roll angles of almost 10 degrees to determine whether all of the ship's equipment was stowed properly.

The movie *Hunt for Red October* contains many scenes of the *USS DALLAS*, (another Los Angeles class submarine) that accurately show the arrangement of the ship's sail, fairwater planes, and interior compartments. In the movie, the ocean was often calm and nearly flat at the surface. During my at sea experience, however, we had 4- to 6-foot seas running across the deck, with some water coming down the hatchway when at the surface, while the crew members were topside, preparing the ship for dive.

I was most excited when I was allowed to steer the submarine, and I found it was a lot like flying. Steering and diving the ship takes two people; the helmsman controls both the rudder, for course changes, and the fairwater planes (mounted on the sail) for depth changes. The sternplanesman controls only the stern planes, mounted at the stern, near the rudder. The stern planes are used only to control the pitch angle of the ship as it changes depth. I had a chance to try my skills as the helmsman, changing course by turning a small steering wheel, which controlled the rudder, and pushing or pulling on a control stick to move the fairwater planes for depth changes.

While changing depth from 150 to 600 feet, the submarine's ballast was not changed, but it was "flown" through the water using the fairwater planes. Before going onboard, I had no idea how fast or how deep these submarines could go. On my trip, the ship routinely went to a depth of 600 feet and traveled at speeds of up to 30 knots. This impressed me! Noise levels inside the ship from the nuclear propulsion system were very low and vibration was almost non-existent.

During the afternoon, I got time to go check out my sleeping area. I was assigned to a small compartment that had nine bunks: three stacks of three. The total free floor space was about 10 square feet. Thus only one person at a time could comfortably stand in the room. My bunk was a bottom one. On research vessels, most people prefer the bottom bunk, but on a sub, bottom means about two-inches off the deck. The entrance to the bunk was about two-feet long. This made it so my feet would be in a tunnel with my head at the entrance. I stashed my gear in the slot and decided to figure out how to get into the bunk later.

Learning how to use the ship's ``heads" (toilets) was interesting. The heads have very impressive valves that work like many on ships. I was warned not to try to flush the head if there was a red warning sign posted on the valve. The sign is posted to indicate that the waste tanks are being blown overboard, using 700 psi compressed air. If you attempt to ``flush" during this operation, a stream of ``material" (putting it nicely) will spout up out of the flush valve. The officer told me it would be quite entertaining, if I wanted to try it.

The control room (conn) is the main control station for the ship's watch team. It contains two periscopes (one is a spare), various antennas next to the periscopes, the dive team (helmsman, sternplanesman, and diving officer) navigation plotting, depth sounding equipment, and fire control equipment for operating the ship's torpedo and missile systems

The *NORFOLK* was submerged in corrosive salt water at high pressure with little information about where it was located, yet it was both safe and comfortable. I found the ship's design and operation very impressive. Later I was told more about the crew's training and readiness testing, as well details about maintenance of the ship's equipment. Maintenance on the ship is probably more strictly monitored than that for many commercial aircraft.

Submarines ``see" primarily with sound. This seems obvious, but it was striking to realize it once I was onboard, submerged. While submerged, the sonarmen are constantly listening (the ship is nearly always in passive mode, not actively ranging). The sonar displays show frequency time plots on which the sonarmen ``tag" contacts. Each sonar contact gets a code assigned to it, and it is identified. Most contacts are whales or merchant ships. While we were onboard, the crew staged a mock attack, ``targeting" a merchant ship so that it appeared on a radar-like screen in the control room.

Since the sonar system only provides a target bearing, the crew must analyze bearing information over time to develop an estimate of the target's range. Once they are confident in their estimate, a target solution is transferred to the guidance computer on the Mark 48 smart torpedo. For this mock attack, the actual torpedo was replaced by a simulator, or ``mock torpedo in a box." Torpedos are launched by compressed air and exit the torpedo tube with an acceleration of five to six g's. The torpedo engine accelerates it to 65 knots, and it begins to ``home in" on the target. The torpedo trails a cable 30,000 yards long and sends information back to the sub as to what it is doing. On the screen you can see the torpedo target the ship, arm itself about five seconds before impact, and then impact the target. The ship has many safeguards to assure that the torpedo does not accidentally attack them. During the torpedo run, they can reprogram it, but I was told that the torpedo is so smart they rarely need to. During torpedo launch, only the sound of rushing air in the torpedo tube can be heard. A crewman told me the sound is exactly the same as you would hear if a torpedo was in the tube.

Our next experience was to stand in the sonar room and listen to sounds made by ``biologics." It was surprising to constantly hear sounds made by whales or snapping shrimp, as well as merchant ships passing overhead. A whole new view of the ocean emerges --- one that everyone would appreciate.

By 2300 on Monday, we all ended up in the wardroom, exhausted, discussing the day. One by one we headed off to bed. I was reluctant to head to bed, since I had yet to figure out how to get into my bunk. Finally, I approached the bunk, got on the floor and squirmed in like a snake. Of course, once I was comfortable in the bunk, I realized that I had to go to the bathroom, so I was forced to squirm back out. After squirming back in once more, I realized that the bunk above me was only about five inches from my nose. Twinges of claustrophobia ran through me, until I realized that I wasn't going to be able to sleep. I got out of the bunk, and spent the rest of the night sitting in the wardroom. Sometime around 0300, the ship surfaced for our return to the harbor. I noticed that one of the crew had vacated a mid-level bunk with a bit more headroom, so I dozed there for an hour or so.

We were impressed by the fact that the officers and crew dress very nearly alike once they leave the dock. They all don dark blue jump suits with only small insignia attached to determine their rank. They treat each other much differently than officers and crew on surface ships. If an enlisted man needs to get by in a passage, the captain moves aside without a word or a salute.

When returning to the Chesapeake Bay, we were again in the wardroom watching the scene from the periscope on a TV monitor. At about 1100, we were in calm waters near the Norfolk Naval Base, and we were sent topside to be transferred to a waiting tugboat. Since the submarine is shaped like a tube, it was difficult for the tug to approach. A ladder was laid between the sub and the tug. We said our good-byes, walked across the ladder, and boarded the tug. From there we watched the sub maneuver and return to sea. This time they were going out for 10 days of testing.

CONGRATULATIONS Marjy and Carl Friedrichs

on the birth of their second son, William. Will was born Thursday, March 6, 1998 and weighed a healthy 7 lbs., 8 oz. Marjy is a graduate student with CCPO and Carl works at the Virginia Institute of Marine Science.

Just the *facts* . . .

Grants/Contracts Awarded

L. P. ATKINSON, ``Wind and Buoyancy-driven Shelf Processes," Office of Naval Research, $14,000.

G. F. COTA, ``Arctic Ice Algal Bio-optics and Sea Sediments," Office of Naval Research, $20,042.

E. E. HOFMANN, ``Crassostrea virginia Pathogens in Chesapeake Bay Oyster Populations: A Dual Disease Simulation Model of Parasite-Host Interactions Over a Large Spatial Scale," Maryland Department of Natural Resources, $23,077.

E. E. HOFMANN, ``Evaluation of Marine Productivity in the Tropical Pacific and Atlantic Oceans Using Satellite Ocean Color and Numerical Models," NASA Langley Research Center, $119,046.

E. E. HOFMANN, ``Multidimensional Data Assimilation for Physical-Biolgical Models," Office of Naval Research, $46,153.

A. D. KIRWAN, JR., ``Quantitative Utilization of Lagrangian Data in Numerical Models," Office of Naval Research, $145,070.

G. H. WHELESS, ``Synthesis of Sabre-related Research Results," Virginia Graduate Marine Science Consortium,

$6,850.

Presentations

W. Fraser, Montana State University, and **E. E. HOFMANN**, ``Euphausia superba Longevity and Implications for the Structure and Function of the Antarctic Marine Ecosystem," International GLOBEC Open Science Meeting, Paris, France, March 17-19, 1998.

E. E. HOFMANN, ``Predictive and Modeling Capabilities," Plenary presentation, International GLOBEC Open Science Meeting, Paris, France, March 17-19, 1998.

E. E. HOFMANN, ``Predictive Modeling for Coastal Marine Ecosystems," Coastal Trainee Program Lecture, Woods Hole Oceanographic Institution, January 28, 1998.

E. E. HOFMANN, ``Environmental and Biological Interactions and Consequences for Larval Transport," Biological Oceanography Seminar, Woods Hole Oceanographic Institution, January 29, 1998.

E. E. HOFMANN and **J. M. Klinck**, ``What it is Like to be an Oceanographer," presented to Mrs. Powers 4th Grade Class, Bangert Elementary School, New Bern, NC, December 17, 1997.

E. E. HOFMANN, **J. M. Klinck**, **R. A. Locarnini**, **B. A. Fach**, and E. Murphy of the British Antarctic Survey, Great Britain, ``The Importance of the Southern Antarctic Circumpolar Current on Biological Transport in the Scotia Sea," International GLOBEC Open Science Meeting, Paris, France, March 17-19, 1998.

A. D. KIRWAN, Jr., ``Rapid Environmental Assessment: Physical Oceanographic Aspects," University of Wyoming Mechanical Engineering Seminar, February 19, 1998.

A. VALLE-LEVINSON, **C.-Y. Li**, **T. Royer**, and **L. P. Atkinson**, ``Flow Patterns at the Chesapeake Bay Entrance, SUNY at Stony Brook, December 3, 1997.

Publications

M. M. Dekshenieks, University of Rhode Island; **E. E. HOFMANN**; **J. M. KLINCK**; and E. N. Powell, Haskin Shellfish Research Laboratory, ``A Modeling Study of the Effects of Size- and Depth-Dependent Predation on Larval Survival," *Journal of Plankton Research*, Vol. 19(11), 1,583-1,598, 1997.

E. E. HOFMANN and **C. M. LASCARA**, ``Overview of Interdisciplinary Modeling for Marine Ecosystems," In: *The Sea*, Eds., K. H. Brink and A. R. Robinson, John Wiley Sons, Inc., Vol. 10, 507-540, 1998.

Hooker, S. B., NASA/Goddard Space Flight Center; R. P. Mied, Naval Research Laboratory; J. W. Brown, RSMAS University of Miami; and **A. D. KIRWAN, JR.**, ``Remote Sensing of Dipole Rings," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 35(6), 1,394-1,399, 1997.

C.-Y. LI and J. O'Donnell, University of Connecticut, ``Tidally Driven Residual Circulation in Shallow Estuaries with Lateral Depth Variation," *Journal of Geophysical Research*, Vol. 102(C13), 27,915-27,929, December 15, 1997.

Photo Caption: Cathy Lascara (in middle) gives virtual reality presentation at the Ocean Sciences Meeting.

Papers presented at the *1998 Ocean Sciences Meeting*, San Diego, CA, February 9-13, 1998.

L. P. Atkinson, **A. Valle-Levinson**, F. Jaro of the Universidad Austral de Chile, and H. SEPULVEDA, ``Climatology of the Austral Chilean Coastal Inland Sea (ACCIS) and Adjacent Coastal Waters."

CLAYTON, T. D., **E. E. Hofmann**, and C. R. McClain, NASA/Goddard Space Flight Center, ``Variability in CZCS-Derived Pigment Distributions on the Southeastern U.S. Continental Shelf."

G. F. COTA; W. G. Harrison and T. Platt, Bedford Institute of Oceanography; and S. Sathyendranath, Dalhousie University, ``OCTS Ocean Color and AVHRR Observations in the Labrador Sea."

L. W. Cooper, Oak Ridge National Laboratory; **G. F. COTA**; L. Pomeroy, University of Georgia; and J. M. Grebmeier, University of Tennessee, ``The Distribution of the Quasi-conservative Tracers, NO, PO and O in the Bering Strait Region in 1993."

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Photo Caption: John Holdzkom can't help but smile for he received the "gold star" for best student paper for his session. Congratulations to John on this special honor!

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ADK's Words of Wisdom

"The chief source of problems is solutions."

Eric Sevareid

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