NOAA Teacher at Sea
Rachel Dane
Onboard NOAA Ship KA'IMIMOANA
April 29 – May 10, 2005

Friday, April 29th, 2005
Puerto Ayora, Isla Santa Cruz, Galapagos

Personal Log:
Following 16 hours of travel that brought me to Guayquil, Ecuador, a 2 hour flight has transported me to the northernmost tip of Baltra Island in the Galapagos. The Galapagos Islands is the name given to this isolated group of volcanic mounds, which consists of 19 major islands and scores of inlets located 1000km west of mainland Ecuador. From the air I could observe most of the land mass of the archipelago, which covers 7882 square km. That these islands have so profoundly influenced scientific thought is astounding! The handful of animals that made their way out here have, through isolation, developed into completely unique species without fear of predation.

After a 10 minute ferry ride from Isla Baltra to the northern tip of Isla Santa Cruz, I am driven 42km south to Puerto Ayora, the largest town in the archipelago. The population of this town is growing (too fast!) due to immigration from mainland Ecuador, and now numbers about 12,000 individuals. During the drive I was observing the vegetation and wildlife, and noticed many plants with brightly colored flowers ranging from deep red to vibrant pinks and purples. Also present were a plethora of small, lemon yellow butterflies. Soon, Academy Bay was stretching far out to the east, and anchored peacefully in the turquoise water I spotted what was to be my home for the next 12 days: the NOAA Research Vessel Ka'imimoana (Hawaiian for "Ocean Seeker").

Once dropped off at the pier, I was ferried out to the KA'IMIMOANA (KA) via a local "panga", or water taxi. I was welcomed by Doc, Joe and Sean (more to come about my crew mates!) and given a brief tour of the ship. Eager to explore Isla Santa Cruz, Joe and I headed back to the island with our panga. One of the most popular visitor sites in Puerto Ayora is the Charles Darwin Research Station, which is where I met the giant Galapagos tortoises face to face! The station directs a captive breeding program for several of the 11 remaining subspecies of tortoise, and I was happy to learn that the captive bred animals are generally released to their home islands when they are about 4 years old.

Tired but elated after spending the afternoon at the research station, I enjoyed a meal of delicious fresh sea bass at a local restaurant. My first day in the Galapagos closed after the short water taxi trip back to the vessel, and meeting several more of my helpful and welcoming ship mates. I was lulled to sleep by the gentle rocking of the anchored ship, and the comforting view of stars from the window of my berth.

Monday, May 2nd, 2005
Puerto Ayora, Isla Santa Cruz, Galapagos

Personal Log:
Today is the big day—my first day at sea! I am excited and nervous at the same time; with no experience sailing my main hope is that sea legs will develop quickly for me! As Academy Bay receded behind us I was a bit wistful at having to leave the Galapagos with so much left unexplored, but I am phenomenally happy to have had the experience to travel here and truly hope to return someday.

Much of my afternoon was spent picking the brain of Patrick Rafter, our Ph.D. student from the Scripps Institution of Oceanography. Patrick boarded the KA in San Diego at the start of this cruise, and is amazingly knowledgeable about marine chemistry. He is also super patient with all of my questions, and very fun to chat with! You rock, Patrick! I basically asked him for a crash course in oceanic interactions, and this is what he taught me—too cool!

Essentially, the ocean can be viewed as the shallow, warm "mixed layer" at the surface and the deep, cold ocean. The dividing line between these two is called the thermocline, and it is the level at which a rapid change in water temperature occurs. Think about it as a multi-layered cake, with each water layer maintaining a fairly unique and consistent salinity, density and water temperature. Generally, the mixed layer at the surface is the warmest. In the equatorial pacific this surface layer has a depth of about 100m, and it is this first layer of oceanic cake that NOAA is most interested in studying. Normally, the thermocline that divides the high warm layer from the lower cold layer maintains a gradually increasing easterly slope. Under normal conditions, there is also less convection occurring and less wind is present. However, under El Nino conditions the dividing line between the two layers becomes more level, creating a deeper, warmer top layer. This increase in depth of the top layer affects marine interactions in several ways. First, a much larger percentage of surface water is warmer. Second, more convection is occurring due to the warmer water temperature, and third, more wind is present. One of the major uncertainties that TAO project data is attempting to explain is the cause of this thermocline change.

After a long Monday and a fabulous shrimp dinner, I feel quite tired and ready to call it a day. Tomorrow, Joe will set up my ship email account; I am really looking forward to being in touch with friends and loved ones at home, and also communicating with my students! It pleases me to report that, surprisingly, my stomach feels more settled at sea then it did when we were anchored in the Bay! I'm not feeling 100% yet, but definitely well enough to give the treadmill a try tomorrow—and maybe I can even skip the Dramamine…
Until tomorrow!

Tuesday, May 3rd, 2005

Plan of the Day:
0300: 0.5S CTD
1200: Equatorial mooring repair followed by a deep CTD and an ARGO
1845: 0.5N CTD
2345: 1N CTD

Weather Observation Log: 0800
Latitude: 0 degrees N
Longitude: 94 degrees W
Visibility: 12 nautical miles
Wind Direction: 150 degrees
Wind Speed: 12 knots
Sea wave height: < 1 foot
Swell wave height: 2-3 feet
Sea water temperature: 26.5 degrees C
Barometric pressure: 1013.0
Cloud cover: 2/8 cumulus, cirrus

SCIENCE LOG:
Today is my first full day on the KA'IMIMOANA (KA). After sleepily answering my 3:30 AM wake-up call and quickly grabbing a hot cup of caffeine, I met Shawn and Jay on deck to begin the first CTD cast of this second leg of the KA's journey along the equator. CTD is an acronym for "Conductivity, Temperature, Depth"; it is essentially an analysis of the salinity and chlorophyll levels of a site specific water sample. The casts are performed at each 1 degree change in latitude along the entire TAO array. The CTD "package" consists of 15 cylinders, each about 1.25m high, attached to a sensing apparatus. Based on commands from the deck, this sensing apparatus will open and close the cylinders and provide real-time data of water conductivity, temperature, density and salinity. For the purposes of this morning's sample, the package was lowered to a final depth of 1000m for sample collection. Final depths vary with each cast. Once the cask is deployed, data analysis of the water sample is displayed graphically on a nearby computer—this morning I was able to view a graphical representation of the thermocline for the first time!

Before lunch, I shadow Doc during her weekly safety inspection. What a great opportunity for me to see the inner workings of this impressive vessel! After lunch, the announcement that we have arrived at the site of our first buoy repair comes echoing over the loudspeakers, and it's buoy time!

The equator! For me, it's no longer simply a line around the globe. Not only does the equator represent the dividing line between the northern and southern hemispheres of the earth, but this is also the region where Pacific ocean currents are being extensively studied by NOAA in order for us to better understand the relationship between the oceans

and climate. Essentially, the TAO buoy array acts as a 6000 mile antennae that scientists use to monitor ocean trends.

Donning hard hat and life jacket, I ran to the third deck clutching my zip locked camera and climbed into one of the orange work rafts attached to the KA's port side. We (Dave, Brian, Chris, Matt and I) were gently lowered into the water by attentive crew members, and off we motored to our waiting buoy, about 75m away. Unfortunately, this buoy had been damaged by a fishing vessel so Dave and Brian had some repairs to make. Fish prefer to swim in the vicinity of buoys because schools feed on the growth that accumulates on the underside, and it is quite common for large fishing vessels to tie up to TAO buoys; oftentimes damage occurs in the process. After the repairs were complete, I was enthusiastically invited to jump onto the mooring buoy, and it was the absolute highlight of my day! Since fish like to hang out by the buoys sea birds do too; this was immediately obvious to me once I had hopped onto the platform and was clinging to the rungs of the tower. The entire apparatus was covered from top to bottom with dried guano, and within minutes of climbing and perching on the tower, so was I! Kind of gross; however, this did not prevent me from reveling in the experience of being on the equator and bobbing like a cork, completely and utterly surrounded by water. It felt as though I had stepped into a completely foreign liquid universe. Other than our work boat, the only object in the panoramic view was the KA'IMIMOANA headed towards the horizon. I believe that I could have very happily floated on that buoy for the rest of the day, reveling in the vastness.

Once back in the orange raft, our expert coxswain Chris kicked it into turbo gear and off we sped on a high speed chase, in hot pursuit of our ocean home. Although the KA remained in sight for the entire operation today and although I longed for more time bobbing in the serene, blue stillness of the equatorial Pacific, there was a feeling of extreme comfort in riding to port side of the mighty Ocean Seeker. Looking up, we saw 10 of our crew members peering anxiously over the rails on all decks, ready to work together to bring us home safely.

PERSONAL LOG:
On a daily basis, I continue to be amazed by this ship. So many aspects of life aboard the KA'IMIMOANA are extremely refreshing: that it is a floating home that operates so efficiently through the patience, teamwork and cooperation of all hands, that a hallway passing almost always evolves into a friendly conversation, and that crew members are consistently willing to share their knowledge and experience with me and excitedly teach new information.

Despite my best intentions and despite a 4.5 mile run on the treadmill, I was not able to squeeze in a rest this afternoon. Now it's 10:30pm and I'm feeling exhausted, but too overwhelmed to sleep. This evening I studied the Southern Cross and surrounding constellations with Don. Although I live at the Grand Canyon and regularly study extremely impressive night skies, the stars here rival what I've become accustomed to at home. Thanks to Jimbo's call I watched over 100 squid swarming on our starboard side, and kudos to Tony--his expert fishing skills have ensured that we will all enjoy fresh

calamari tomorrow night! Matt was the first person to introduce me to an actual example of bioluminescence tonight, visible in the ship's wake; thank you, Matt, it was so incredibly cool! I definitely plan on taking him up on his offer for me to borrow the "Blue Planet" series to learn more about deep ocean luminescence. So, brimming with curiosity and excitement, I look forward to the gentle rocking of the ship once I tumble into my bunk later this evening.

Wednesday, May 4th, 2005
DAY 2

Plan of the Day:
0400: 1.5N CTD
0830: 2N Recovery and deploy with CTD, AOML and ARGO
2215: 2.5N CTD

Weather Observation Log: 0800
Latitude: 1 degree N
Longitude: 95 degrees W
Visibility: 12 nautical miles
Wind Direction: 153 degrees
Wind Speed: 10 knots
Sea wave height: 1-2 feet
Swell wave height: 2-3 feet
Sea water temperature: 27.9 degrees C
Barometric pressure: 1013.2
Cloud cover: 5/8 cumulus, altocumulus

SCIENCE LOG:
Last night I ended up falling into bed, exhausted, around midnight. Jim and I spent almost an hour having a super fun conversation about river running in Idaho and the Grand Canyon—I had no idea that he and I were both guides on the main fork of the Salmon River in Idaho! It was a wonderful talk, and I hope to have the opportunity to chat more together.

It's another buoy day; today we will be recovering a damaged buoy and deploying a new one in its place. Each TAO buoy is moored to the bottom of the ocean using Nilspin, which is steel cable surrounded by a protective plastic shield. Old railroad wheels are used as anchors for each buoy in the array. The Nilspin cable is also equipped with sensors at various depths; these sensors transmit data from the ocean to the surface of the buoy. Remember, these buoys constantly collect data on wind speed and direction, air temperature, relative humidity, rainfall, barometric pressure, sea surface and subsurface temperature, salinity, water pressure and ocean currents. The data is gathered and transmitted via NOAA satellites, and is used by scientists all over the world who are studying the relationship between the Pacific Ocean and climatic changes.

Buoy recovery is a fairly labor intensive process that involves lassoing the floating toroid, craning it aboard, spooling in all of its cable, and cleaning the entire apparatus. Being submerged for 6 months at a time, the buoys acquire quite a collection of barnacles! Before a buoy can be recovered the anchor needs to be dropped; a sensing apparatus on its underside is responsible for detecting the "drop anchor" signal transmitted by the ship. In today's case, the recovered buoy will be stored on deck until it is cleaned, painted, and outfitted with new instrumentation; it will then be standing by, ready to replace another buoy on the array if necessary. There was some excitement today during operations when the anchor release signal was not acknowledged by the buoy—the ship's winch was very unhappy about having to haul up the additional 2.5 tons of anchor weight!

Deploying a buoy involves all of the same steps as recovery, but in the reverse order. First, one end of the spooled cable is attached to the bottom of the buoy's 2.5m diameter base. The buoy is then lowered into the water and the cable is unspoooled. Finally, the anchor is dropped. The entire buoy lifting and lowering process is done with the large cranes and winches that the KA is equipped with.

PERSONAL LOG:
All hands involved in the buoy ops functioned together like a well oiled machine. There is no doubt that everyone on board is familiar with their duties and responsibilities, and all know what needs to be done and precisely when it needs to happen in order for the procedure to be successfully executed. It is definitely impressive. Again today, all crew members were more than happy to include me in the excitement, and all were very patient with this rookie sea-goer! Thank you, everyone!

The weather here at the equator is much less humid than I expected. In fact, I find it quite pleasant; maybe because there is always a sea breeze blowing. The inside of the ship sometimes feels like a refrigerator, especially the computer and science labs which are kept cool to maintain the machines.

Teams are made and times are set; let the tournaments begin! For the remainder of the cruise we will be competing against each other in scrabble, cribbage, darts, poker, and a card game called Sequence. My first challenge is tonight at 6:30—Fred and I play cribbage. Personally, I can't wait to see the dart competition as we rock and roll our way to Mexico!