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Internship Report
Divers Alert Network

It is 8:30AM in Durham, North Carolina. Myself and three travel-weary interns pace the hall of the headquarters of Divers Alert Network, awaiting further instruction. Devon, Patrick, Sam, and I shake hands and introduce ourselves. Their backgrounds and pursuits differed drastically from my own: Devon, a seasoned hard hat diver and medic from Vancouver and student at USC San Marcos; Sam, a pre-med student and paramedic at UNC Chapel Hill; and Patrick, a biology major and lifeguard at University of Indiana. But we were all drawn to this opportunity for the same reason: to develop a better understanding of dive medicine and safety. With a wide swath of dive experiences between the four of us, from 225' heliox dives to dives in locales stretching from the Columbia River, to Samoa, Belize, Galapagos, and the Sea of Cortez, we'd all pretty well covered a good portion of the globe.

Shortly thereafter, Dan Orr, Petar Denoble, Neal Pollock, Jeanette Moore, and Nick Bird welcome us into the conference room. We shake hands, albeit a little intimidated, with the President and CEO, medical officers, and research coordinators of Divers Alert Network. We are also introduced to Shabbar Ranapurwala, a graduate student working toward a masters in epidemiology and public health, who was to be the internship project coordinator working with the help of Mitch Mackey, a previous intern and naval dive instructor, endearingly referred to as 'the guy upstairs in research.'

Our initiation marked the internship program's 14th year of operations, sending young people with an interest in dive physiology, medicine, and research all over the globe to collect data.

From the moment of our arrival to the end of the following week, the days were packed while we spent our time gaining invaluable training and exposure to the diverse and eye-opening research conducted at the organization headquarters, while also gaining an understanding of the history and evolution of DAN.

DAN's beginnings were rooted in the dive community as a collective of loosely organized local and regional rapid response units which quickly grew to assemble themselves on the national level. There had been a deepening interest fueled by the United States Air Force and the UHMS to initiate a search for a medical service and emergency hotline to support the civilian, recreational diving population. In the seventies, the answer to this question lies solely with these early emergency response teams which now operated under the official name National Dive Accident Network.

In 1980, with a grant from the National Oceanic and Atmospheric Administration, NDAN, the only diving emergency hotline, would expand and grow in collaboration with the medical hyperbaric research facilities at Duke University and change its name to Divers Alert Network. Later, it would begin to develop accident insurance which catered exclusively to divers and initiate its first membership organization; it would also provide the first standardized emergency oxygen treatment for divers. As the decades progressed, DAN spanned the globe, becoming an international organization with headquarters emerging on six continents. It was around this time that the network fostered it's now highly acclaimed publication, *Alert Diver*, which contained a wealth of educational resources from accident report analyses to articles highlighting current medical research to fitness and training techniques, in addition to showcasing the work of world-class underwater photographers, all drawing upon the global

recreational dive community. As funding and reports grew, a number of recreational diving studies were also initiated. The member population also grew to more than 250,000.

DAN is known famously for one of the most notable services that it had pioneered: the 24 hour emergency hotline, where the medical professionals at DAN are on-call to respond as calls come in from all over the planet. Impressively, these dive doctors have reported a 70% success rate for diagnoses that are made simply with one phone call.

Delivering the presentation of this illustrious historical account was one of DAN's first members: Dan Orr. Orr, who, with the dedication to the network he had long supported, now leads the organization as president with a mission statement that emphasizes the pursuit of dive medicine, research, education, development and training.

In collaboration with Duke's Center for Hyperbaric Medicine, DAN now engages in state of the art research aimed at understanding the relationship between physiology and dive practices, in addition to refining all aspects of dive safety and medical training.

Throughout the first week, we interns were given curriculum modules for AED use and a refresher course in CPR, advanced oxygen delivery, on-site neurological assessment, hazardous marine life treatment, and ethics training. In addition to these skills, we had been given an elementary look at physics and pressure laws, and anatomy and physiology to see just how they influence contemporary dive research.

Most dive medicine revolves around the presence of extreme environments, compressed gas mixes, and how they interact with and influence the function of our respiratory and circulatory systems. What began with the simple laws and equations of Boyle, Dalton, and

Henry, were quickly expanded and applied to intrathoracic pressure, the alveolar capillary membrane, blood plasma, and hemoglobin.

To coincide with these lessons, medical officer Dr. Nick Bird gave us a more in-depth look at the potential injuries and symptoms related to SCUBA activities and how they translate across various demographics. As novice divers learn through their training, the most common afflictions affiliated with SCUBA diving involve blocks, squeezes, decompression illness or arterial gas embolisms. And what they wouldn't hesitate to agree with is that it doesn't take an extraordinary effort to risk developing these symptoms or injury – but neither does their prevention.

Mid-week, we were given a tour of the Center for Hyperbaric Medicine at Duke University. The huge, labyrinthine complex was several stories tall -one of the largest in the country. Comprised of six hyperbaric chambers and driven by vacuum pumps and compressors to accommodate the multiple chambers. Since its inception, this complex has been used to simulate environments at a broad range of depths and elevations.

Here in the mid-eighties, a team of scientists known as Atlantis III was responsible for sending four divers to a pressure of nearly seventy atmospheres, or a depth of over 2,000 feet. Sending them to depth and slowly decompressing them over a period of one month, they had successfully set an early world record. There have been experiments to replicate the environment at the space station, where they sought to optimize inert gas elimination in astronauts preparing for extravehicular transport. Research has varied from human diving and altitude physiology, with experiments covering immersion pulmonary edema, treatment of decompression sickness and arterial gas embolism, to treatment of diseases and ailments with oxygen including necrotic skin conditions, diabetes, and providing care for burn victims.

Understanding fatalities that occur in correlation with live accidents is of the utmost importance to DAN's medical research team. What they've come to extrapolate from past studies is surprising. Statistically, the trigger to reported accidents has been attributed to three mishaps: insufficient air or gas, entrapment, and equipment failure. The disabling injury leading to death in these cases has been connected to asphyxia, arterial gas embolisms, and cardiac arrest. The vast majority of these incidents can be attributed to operator error. Many fatalities are health related, and diver error is linked to over two thirds of all fatalities. DAN is keeping an eye on the future, expanding on these themes and investigating measures such as health and diving surveys, underwater heart rate monitoring, and pre-dive check interventions. The most recent research has involved the use of nitrox mixes versus air, pre-dive checks, the occurrence of cardiac arrhythmia and aging divers, and various upcoming projects with NASA.

For the interns, this year's project drew upon the use of pre-dive safety check-lists and accident prevention.

Much like how the FAA has a pre-flight checklist, those familiar with all things SCUBA know that good etiquette begins with a thorough check of all gear and gaining familiarity with the person with whom you're diving. Reinforcing the intuitive, the study itself is investigating parallels between the occurrence of mishaps and the attention to dive safety. Study subjects would be required to report their dive profiles, depth, bottom time, tank pressure before and after dive. In addition to this, they would record some medical history and demographic information, recording any pre-existing conditions which could predispose the diver to a number of accidents, date of last dive, average number of dives annually.

To do so, I would once again embark on a road trip - this time to my field location of Wilmington, North Carolina. I was charged with an enormous box, crammed full of manila

envelopes of forms and documents awaiting distribution. I would be based on the Intracoastal, working dockside with the dive emporium 'Aquatic Safaris' aboard their weekly charters. Once settled into this community, the tasks at hand were to recruit participants on the morning they embark on their dive trips. First, I would sign up recruits, collect their signatures on legal releases, and hand them a laminated study form card for them to record their dive information. Once they returned to the dock, I would collect the card and hand them a corresponding questionnaire. The aim was to accomplish one complete envelope daily, which contained thirty successfully recorded dives, and the ultimate project goal was to fill out twenty-five to thirty envelopes. I would meet the divers dockside at the marina and sign-up recruits, eventually accompanying them along charters to better track the data I'd collected.

All four interns would venture to Wilmington for the first weekend to test their abilities with the public. At 7 am, we walked out to the Beach Tender Marina to speak with the early morning divers regarding the study, all the while helping them load their tanks and gear, in our efforts to be as accommodating as possible. Most all of the men and women on the days charters were more than willing to help us accomplish our goal and to support DAN. Needless to say, at this point I was chomping at the bit to explore this part of the country, both above and below the tideline.

Aptly named "Cape Fear," the Carolina coast is a veritable graveyard for ships, as its historical notoriety for its tempestuous weather and deceptive shoals have come to prove. A wreck diving mecca, the Wrightsville Beach area sits on the far side of the Intracoastal, where the skeletal remains of the Alexander Ramsey, the Hyde, the Markham, the John D. Gill, the Rosin, Normannia, City of Houston and the Cassimir wrecks are just a handful of ships which draw divers from all over the globe to explore.

The crew of Aquatic Safaris, my hosts for the summer, was gracious enough to allow me to accompany them on their dive charters when space allowed. This posed an enormous aid in data collection. Participants were more receptive to the study upon seeing that I do, in fact, dive, thus taking the edge off what could be perceived as a 'pencil pusher' persona. A number of other bonuses included the chance to add a few folks to my 'dive family,' as afternoons were spent swapping anecdotes of our travels and hearing about the colorful careers of those I dived with.

The dive sites I would often frequent were the John D. Gill and the Hyde wreck, two of the most popular dive sites in the region. The Hyde, sunk in the late eighties as part of the artificial reef program, has now been reclaimed by the Atlantic Ocean and its inhabitants. An impressive aggregation of sand tiger sharks call this ship home; on a good day you may find yourself hovering above the bow, squinting to see as far as visibility will allow counting thirty, forty sharks before losing count. Their gnarled grimaces are apathetic to the human presence; mutual respect leaves both diver and shark well out of harm's way. The closest you'll get to an encounter with teeth is rifling through the sand to grab a handful of their pearly whites. Glimpses of grouper, grunts, skipjack, amberjack, manta rays, green sea turtles were just a few of the hidden gems lurking amidst these wrecks.

As days, then weeks passed, it was made abundantly clear that the work at hand was far from settling into a routine. There were an increasing number of obstacles which impeded efficient data collection, the most notable factor being weather. Even for the bravest and most opportune diver, rough sea conditions and squalls had blown out several consecutive weekends. From Thursday to Sunday, the end of the work week had traditionally been the most lucrative time for the Aquatic Safaris; weekend warriors poured in from across the state to journey to the

shore. If a storm front was rolling in, this almost guaranteed the cancellation of at least three dive days. This occurred throughout the entire summer.

Another collection caveat was the booking process with which the dive charters operate: the dive boats can't leave the marina if a minimum number of seats aren't booked. That is, if a boat lacked even the bare minimum of bookings, the boat would remain dockside and the entire charter would be cancelled. Weekdays posed yet another challenge. During this time, UNC began a marine science summer program for youths, called 'Marine Quest' which booked, in many cases, a week's worth of charters to further the dive education of kids from middle school to high school. Unfortunately, the age requirement for the study was a minimum of eighteen years of age, so this too narrowed my ability to recruit participants. Tech divers with closed-circuit rebreathers, a common sight aboard the two boats, effectively slowed the data process as they would only record one dive for the day.

Retrieving a fully completed study form and questionnaire became an increasingly rare event. Many divers would appear just minutes before the boat's departure, so many recruits didn't have time to sign up, as they were lost in the scramble to get their gear aboard and still leave the dock on time. In other instances, the divers did not fully complete the questionnaire, disqualifying it for submission. After several discussions and meetings with the study coordinator, it was realized that the initial minimums for data collection would have to eventually be changed to a lower baseline.

Though many days passed where data collection could not be carried out due to the weather conditions, I had made sure my time wouldn't be spent idly. I began to network with individuals I'd met at the DAN headquarters. Having spent time with an NGO affiliated with educating indigenous commercial fisherman to dive and carry out conservation work, I pursued

the chance to see how my connection with the network could assist their efforts. I attended dive club meetings, ventured to the national seashore, wildlife refuges, and aquarium to better educate myself about the local marine ecology, gained an additional dive specialty certification, and plunged my focus into academia and grant writing proposals and ultimately, how to more efficiently meet and maximize the goals of this study with new approaches. Toward the final weeks of the study, an additional intern was recruited in a town a few hours north of Wilmington to continue the study.

Despite the complications and hiccups, the opportunity to develop a relationship with the professionals at DAN and to catch a glimpse at the myriad ways I could further my growth and education was invaluable and I hope to continue to integrate diving into my academic trajectory. With this exposure to DAN, the pursuit of providing the foundation for a career in which I can foster and develop skills as a trained dive medical professional is just one step closer.