



New Mexico Scuba Center Newsletter



December 2011

As a full service dive center we measure our success through your continued safe and enjoyable diving. We provide professional instruction , quality equipment, and world wide dive adventures

Stacey and Si

It has been a good year at the NMSC. Despite a slowed economy, we have seen a steady flow of new divers coming to us for their open water certification. Some have immediately traveled to the far away parts of the world such as Bali, Indonesia. One followed her dreams, quit her job here in New Mexico and moved to the US Virgin Islands to pursue a degree in marine biology. Check out the article on the Blue Hole (special offer!).

The dive center sponsored trips have been super as reported to us by those who dove. Dive sites included San Clemente, Bonaire,

and recently the Philippines. Stacey included a travel article for the latter. More trips are planned. And, if you have that one special trip in mind let us set it up for you. In the long run, we think you will find your vacation more enjoyable, less stressful, and potentially less expensive.

We have an exciting year before us in travel. We will also begin offering special prices on equipment when bought as a package—stay tuned!

Come join us on December 24 for egg nog (w/o grog) & cookies. we wish all of you a very happy holiday season.

Holiday hours:
 December 24 until 3 PM EGG NOG!!
 December 25: closed
 December 31, until 3 PM
 January 1: Closed

Winter hours:
 10:00 to 6:30 M to F
 9:30 to 5 on Saturday

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February 18 at the West Mesa Aquatic Center

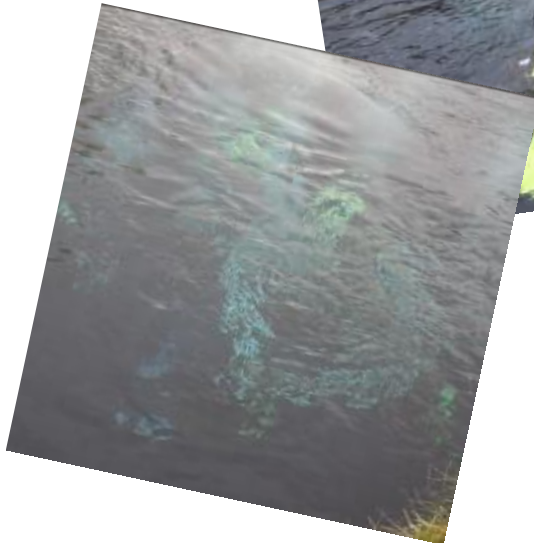
The Blue Hole



Ah, the Blue Hole! Many of us remember our first open water dive at the highly fabled dive site in Santa Rosa.

Why do they call it the Blue Hole? Possibly for its clear water, and intense blue as one stares down at the just discernible bottom 80 feet below. Of course, after the first hit of Texas and Colorado divers those waters became a little less clear and blue. Or perhaps it is so called due to its constant 62 degrees. Cold on a summer day, surprisingly balmy on those mid winter days when one has to chip the ice off their second stage.

In any event, I have fond memories of cold water jetting down the back of my 7mm wet suit, and an instructor who *assured me* that the emergency swimming ascent was a necessary skill. Later, the trauma of crawling from the depths to the surface was partially offset by the swig of victory champagne and the Neptune leap from the rocks above.





**Season
special**

Get an open water certification for \$225. Normally this costs \$285. Purchase before December 31, 2011 and have until December 31, 2012 to complete.



We arrived in paradise after 36 hours of travel, which included a 16+ hour flight and a three hour island tour. Transfer from the plane to our first resort in Cebu added "excitement" in the form dodging motor scooters and, what appeared to be, mini-bikes the locals also use for transportation. It reminded me of something you see on the National Geographic Channel. We were all tired, hungry and in the need of a change of clothing. The hotel staff greeted us with a cold beverage and led us quickly to our rooms while we tried to figure out the time of day or night we were living in. Given the all of the time zone changes, it was a daunting task (10 hours earlier back home or 11 hours when day light savings time happened).

The local time ruled: lunch time. Lunch had to be better than the mysterious meals that they served us on our flights. Most of us resorted to the airline survival bags they received from New Mexico Scuba Center filled with candy, etc. After a wonderful lunch and a briefing we all realized we were in paradise and we all relaxed, unpacked and some did a shore dive before dinner. Finally bedtime, sleep, and dreams about the critters we would see.

Our first day of diving was a little bit a challenge. Two of our fellow travelers use wheelchairs (David and Karen). Dave can walk but needs his chair for support so he needs it on the boat and Karen cannot walk but does not need her chair on the boat. The boat we were diving from was a small outrigger and everyone needed to wade into the water from shore and climb up the ladder. Not a problem for David, but Karen had to be carried out and then lifted on to the boat using the lifting harness that we developed. As for the wheelchairs the resort custom built a box for David's wheelchair so it would not slide around, and Karen left hers on shore.

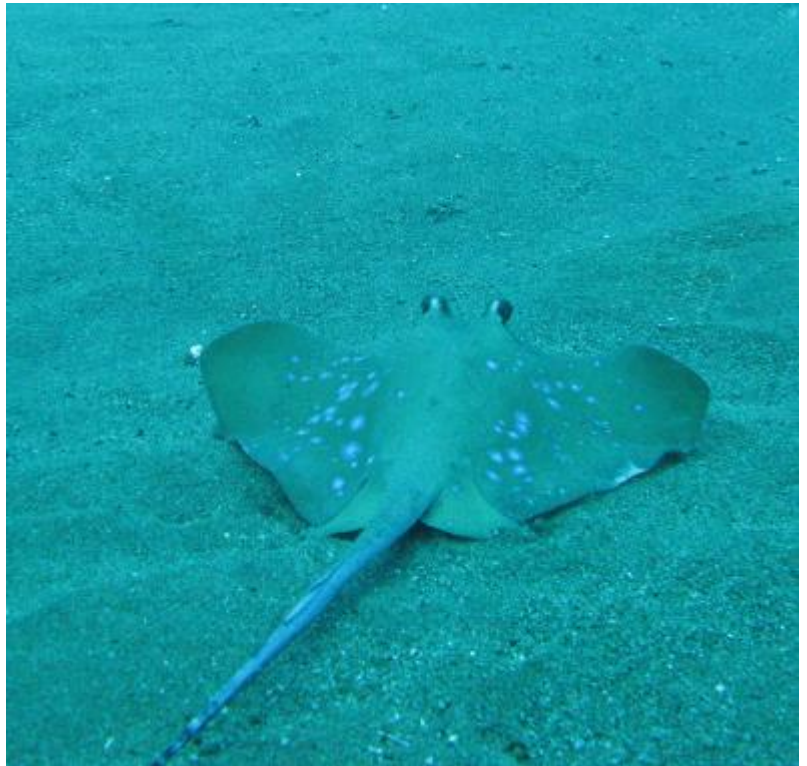
Now it was time to let the diving



begin. After our morning dives we would have lunch we would review the pictures and video and match them up to the critters in the books. We did the same after the afternoon dives. We were like school kids at the library and had our noses buried in the books all of the time. Of course, there was some time for a massage in the evenings.

It is hard find one single dive that was better than another. Some of the highlights of diving in Cebu were the Blue Ring Octopus, frog fish, all of the different clown fish and the school of at least a "Bazillion" (we counted all of them) sardines. We also went out not only once but twice to see the infamous Mandarin Fish, they were out bowling and were no where to be found. .

Once our time was up in Cebu we packed up and awaited our transfer to Dumaguete.



Instead of the usual transfer by car and then either by boat or plane, we had a private pickup at our dock. We all had our luggage out before breakfast and by the time we finished it was all loaded up. All we needed now was our dive gear. We said our goodbyes and were off to our next adventure. By boat the transfer from one island to another is usually four hours. We did it in seven hours; however we dove several times along the way. What a relaxing way to move from one place to another. When we arrived in Dumaguete we checked in, our luggage was delivered to our rooms, our dive crew took care of our equipment and before we knew it, dinner time. Dinner time at both resorts were around sevenish and we all seemed to be in bed no later than 9 each night. Of course we all asked the same question "Why don't we do this at home?"

Each day was an adventure in itself. Out

of our six days of diving we did three local, which was mostly muck and the other three days at the famous APO island. Muck is lots and lots of little critters. While diving APO we came across a turtle that was having the lunch special of the day: Anemone. We all watched as this turtle promptly ripped out the Anemone and proceeded to eat it. The clown fish were not real happy and continually attacked the turtle who in turn had to swat away the now homeless clown fish. This was some of the best 20 minutes that I have spent underwater in a long time.

When we were not diving / eating / sleeping / identifying critters / napping/ or just plain relaxing many of use managed to pamper ourselves in luxury with the spa.

When it came time to leave we were



all saddened and agreed we could do this for another week - we knew we all had a great time.

It is always hard to remember what critters we saw, but this is just a sampling:

Blennies, butterfly fish, damselfishes, frogfishes, garden eels, goatfishes, gurnards, lizard fishes, Moorish idol, needle fishes, puffers, razor fishes, sand sivers, scorpion fish, seahorse, snappers, soles, squirrel fish, stargazers, triggers, wrasses, angelfish, spadefish, surgeon fish, tangs, unicorn fish, anemone fish, grouper, shrimp goby, cow fish, clown trigger, filefish, ghjost pipefish, eels, rays, mandarin fish, crabs, cuttlefish, feather dust-ers, hermit crabs, octopus, mantis shrimp, porcelain crabs, sea cucumbers, squids, flatworms, decorator crabs.





"The dive tables and algorithms are estimates from statistical studies. Hence, variables such as age, body characteristics, illness, drug or alcohol use, and so on detract from the safe bottom time estimates."



In diving there are certain things we must observe to assure continued and safe dives. One we learn from our first days of diving is the adage "too deep, too long, too quick"-the terrible 2's. When we overstay our bottom time for the depth and ascend too quickly we expose ourselves to decompression sickness (DCS) or more commonly called the bends. A DCS or its companion, an air gas expansion, injury might seem to be potentially the cause of many diving fatalities, they are not. The Diver Alert Network (DAN) stated recently the most significant triggering event changing a routine dive into an emergency is amazingly running out of breathing gas! But our focus in this discussion is DCS and managing its risk.

When we dive we increase the partial pressure of each gas we inhale proportionate to the depth we descend (recall Boyle's Law on pressure/volume and Dalton's Law on partial pressure). As the partial pressure increases, the amount we absorb first in our blood and then in our tissues increases (Henry's Law on partial pressure and gas solubility). Nitrogen is the culprit for DCS. While it diffuses relatively quickly from our blood during the breathing cycle, it diffuses much more slowly into and out of our tissues.

In 1907 the physiologist John S. Haldane postulated the effect of nitrogen saturation in human tissue. In his work, he deter-

mined nitrogen diffuses into different tissues such as bone, organ, and so on at different rates. Using half life or the time to become 50% saturated, he estimated the time it would take nitrogen to move into and out of different tissue types, or compartments as he phrased it. His work established the first dive decompression tables. Today our dive tables and dive computers use algorithms related to Haldane's early work.

There is an important point. The dive tables and algorithms are estimates from statistical studies. Hence, variables such as age, body characteristics, illness, drug or alcohol use, and so on detract from the safe bottom time estimates (table or computer). As DAN points out, the triggering mechanism for DCS is not fully understood. A smart diver increases his or her odds by avoiding voluntary factors such as drinking, dehydration, or diving fatigued; and, accepting and adjusting to other factors such as age or health to reduce bottom times accordingly. Controlled ascents (deco stops if needed) are essential to allow nitrogen to adequately diffuse sufficiently from tissue (rapid ascents allow bubble formation in tissue). Deep and safety stops are prudent and increase the odds in our favor.

In the Fall 2011 *Alert Diver* (DAN) is an

article by one diver, Gary Mace, describing his DCS incident entitled "Bent in Chuuk." For those who don't know, Chuuk (also known as Truk Lagoon) is the site of the Japanese supply ships sunk in World War II during Operation Hailstorm. The wrecks vary in depth from the recreational diver depths to the extended range depths requiring decompression stops, gasses such as tri-mix, and/or rebreathers (Mr. Mace used a rebreather). The article is a very good read and offers some good insights, which I will discuss.

Mr. Mace arrived in Chuuk following a very long and tiring flight from Miami, to Houston, to Guam, and finally to Chuuk. Having made a similar flight to Palau last year, I can assure you the "noodle factor" is pretty high. And like Mr. Mace, I can also assure you the desire to dive is also high. In his case, still tired and not fully adjusted to the time zone change (14 hours) he arose and dived the next morning. While his first dive day remained in the 100 foot region, the next dive day he dove deeper to 151 feet with a bottom time of 110 minutes--he was on a rebreather! As he described it, the next dive was a more moderate dive to 127 feet for 76 minutes.

Following his last dive, he went to his room onboard the *Odyssey* to rest before dinner. In about one hour, the first DCS symptoms appeared. They continued to progress to the point of his near physical incapacitation. He was put on oxygen and the ship returned to Chuuk, where he was transported to nearest medical facility, which he described very well in his article. Suffice to say, it wasn't the Mayo Clinic. Unfortunately, there were no personnel to operate the hyperbaric equipment. He was given demerol for the pain. The medical personnel also assessed him as very dehydrated, and they worked to put fluids back in his system.

The following day a paramedic and registered nurse flew in from the US Navy's Dive Locker medical facility in Guam, transported him back to Guam, and treated him in a hy-

perbaric chamber. Fortunately, Mr. Mace survived the ordeal and will dive again.

Mr. Mace relayed the doctor's assessment that fatigue and dehydration were the major factors leading to his DCS. The DAN sidebar offered some follow on thoughts too. While dehydration and fatigue were certainly factors, the overall triggering mechanisms in DCS remain not fully understood. Hence, evaluation of the factors that led to this event should consider the total exposure and gas loading.

Finally, Mr. Mace offered this extra bit. The cost for his transport was \$60,000 and medical treatment was another \$10,000. Chuuk, like many other parts of the world, could not offer the care we would expect. Whether one chooses DAN or another dive insurance, the point is obvious.

The potential for DCS requires us to be diligent in our dive plan and execution, and conservative in our dive time as our health and physical condition may warrant. Preparation includes emergency planning such as having the means (for example DAN insurance), available first aid (oxygen), and access to qualified treatment (the nearest medical facility). In the US, poor emergency planning is often offset by ready access. But in the more exotic locations, planning could be the difference between life and death.

"The DAN magazine *Alert Diver* is an excellent source of safety as well as interesting travel articles. When you purchase DAN insurance, you also receive the magazine."



Truk Lagoon and the "ghost fleet"

SURFACE INTERVAL: FIRST STAGE

In the last issue of the NMSC newsletter, we examined the second stage operation and care. This article completes discussion of the air delivery system with focus on the first stage regulator.

The first stage regulator reduces the tank pressure to an intermediate pressure (IP) and delivers it to the second stage. Nominally, the intermediate pressure (IP), is 125 to 145 psi. The IP remains more or less constant throughout the tank pressure range from 3000 psi to 200 psi.

There are two designs for first stage regulators: *diaphragm and piston.* Both employ the same principle, which is to compare mechanically the internal IP to the outside (ambient) pressure and maintain the IP at its nominal pressure. Regulators have low pressure (LP) and high pressure (HP) ports for equipment connection such as a second stage regulator at the LP port and a submersible pressure gauges (SPG) on the HP port.

When buying a regulator, one should consider the number of ports they will need. Newer regulators have multiple HP and LP ports.

The breathing cycle. As the diver demands air the action reduces the pressure initially in the second stage. This action in turn reduces pressure in the IP chamber of the



Scuba Pro MK 25 First Stage (piston)

first stage. The reduced IP results in an imbalance between the ambient and internal IP causing a valve to open between the HP and IP chambers. Once demand is met the IP chamber repressurizes until the ambient and the IP are in equilibrium, which also closes the HP to IP valve.

The diaphragm regulator, as the name suggests, has a diaphragm between the external environment (water or air) and the internal, sealed chamber. The regulator's external chamber is open to the environment and ambient pressure. A spring seats upon the outer diaphragm face and anchors to the regulator housing. The spring tension (adjustable) establishes the IP by the force it exerts on the diaphragm in addition to the ambient pressure.

The internal IP chamber opposes the compressing spring and ambient force by pressuring to an *absolute pressure* equaling the combined compressing spring force and ambient pressure. For example, if the diver is at 33 feet the ambient pressure is approximately 30 psi and the spring adds another 145

"The first stage regulator reduces the tank pressure to an intermediate pressure (IP) and delivers it to the second stage."



The DIN fitting shown here is very common outside the United States, and should be a consideration for the world diver.

psi for a total of 175 psi. When the internal IP chamber equals 175 psia (absolute), the diaphragm does not distend in either direction and the internal and external pressures are in equilibrium. During the breathing cycle, the diaphragm movement opens and closes the HP to IP valve.

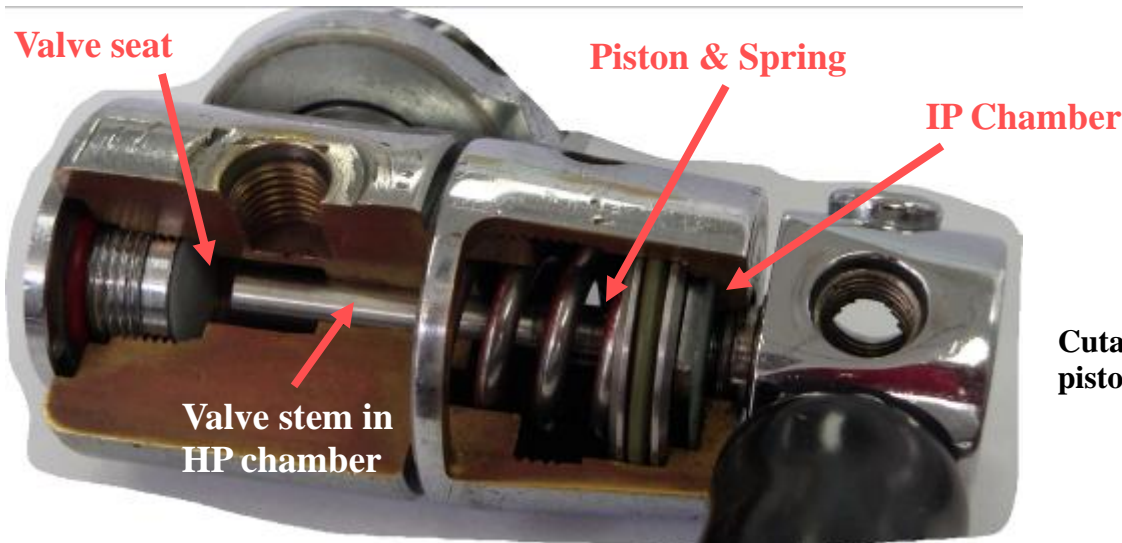
The piston regulator has a free-floating piston moving within the regulator housing. The interior piston side is dry and pressurized to IP. The exterior piston side is exposed to the environment, and a spring seats on its face (anchored against the regulator body). A stem on the piston passes through an internal bushing seal and connects the IP chamber to the HP chamber. The stem seats within the HP chamber closing the HP to IP flow. When the internal and external pressures are in equilibrium, the piston remains in position. During the breathing cycle, the piston movement results in the stem seating and unseating, which is the HP to IP valve.

Regulators can be balanced or unbalanced. Essentially, a balanced regulator uses the IP air and springs to assist in opening and closing the HP to IP chamber valve. In a balanced regu-

lator, breathing effort remains constant at depth and throughout the normal operating range of tank pressures from 200 psi to 3000 psi. The unbalanced regulators have higher breathing effort both at depth and as tank pressures decrease.

As an experiment, I recently measured the second stage "cracking effort" (breathing resistance) and first stage intermediate pressure for a piston unbalanced and a balanced piston and diaphragm regulator. Cracking effort is measured using an instrument called a Magnahelic. For a primary second stage, values are typically between 1.0 and 1.6 (most prefer 1.2). The results were interesting. For the unbalanced regulator as the tank pressure decreased, the intermediate pressure decreased and the cracking effort increased. At 3000 psi, the IP was 137 psi and the cracking effort was 1.8. At 2000 psi, the IP was 140 psi and the cracking effort at 2.0. At 1000 psi the IP was below 120 psi and the cracking effort was estimated in excess of 2.5 psi. By contrast, the IP and cracking effort for both piston and diaphragm balanced regulators remained virtually unchanged from 3000 psi to 200 psi.

"Whenever the first stage regulator is not on the tank, a dry disk cap should cover the HP orifice."



Cutaway of a first stage piston regulator.

If water does enter the inside, don't try blowing it out. Trapped water in the regulator can be pushed into the SPG (or air integrated computer) causing damage.



Diver ascending from the depths of Truk Lagoon

If one's budget allows, a balanced first stage (diaphragm or piston) should be the first choice. Dive center rental equipment is usually the less expensive version. Either type is safe and reliable.

First stage regulators provide varying degrees of environmental protection. If diving in cold or highly turbid water, the diver should select equipment such as a sealed design or specifically designed for cold conditions.

Care and maintenance of the first stage is important for proper operation, equipment longevity, and diver safety. Keeping the regulator interior dry (especially salt water) is important. *Whenever the first stage regulator is not on the tank, a dry dusk cap should cover the HP orifice. At the end of day, rinse the regulator in fresh water (remember the dusk cap!). Professionally service the regulator annually, at the manufacturer's suggested interval, or following exceptionally heavy use.*

Perform an acceptance check at the dive center following air delivery system service.

Operation. Remove the dust cap, inspect the HP orifice filter for debris or heavy discoloring (normally dull gray), and attach. When pressurized, there should be no air escaping from the regulator. One exception is minor leaks (small bubbling when in the water) from the HP orifice and tank connection. If in doubt, change the tank or don't dive.

One should only use the regulator in the manufacturer's range of specified conditions and environments. Regulators used for greater than 40% EAN must not be used for lower oxygen

mixes such as ambient air.

If water does enter the inside, don't try blowing it out. Trapped water in the regulator can be pushed into the SPG (or air integrated computer) causing damage. Rather, hang the regulator with HP orifice down, remove port plugs, and let water run out/evaporate. Salt water is corrosive, and the regulator should be taken in for service at the first opportunity.

First stage regulator issues are rare. Properly serviced and cared for regulators will assure many safe and enjoyable dives.



New Certified

Master Divers: Richard Wachowski,
Michael Nasr

Open Water Divers: Cheryl Hldgon-Holloway,
Judy Prestano, Kelcey Tiejen, Charles Newman,

**Congratulations and
Happy Diving!**

“SSI offers a very broad selection of continuing education courses such as NITROX, Advanced Open Water, Stress & Rescue, and Dive Leader

Continuing Education this month

Remember We use December as a clean up month, we do not start any classes we just finish them up for the end of the year.

We will start new classes right after the new year.

Bubbles & Brats—December 18, 2012

Adaptive Events & Classes

January 6—8, 2012: Dive Leader & Buddy class—Atlanta GA

January 20-22, 2012 : Dive Leader & Buddy class—Albuquerque, NM

February 18, 2012: Davey Jones Locker Challenge

March 30– April 1, 2012: Dive Leader & Buddy Class—Albuquerque, NM

May 25-28, 2012: Dive Leader & Buddy Class—Huntsville, TX



Specials

OPEN WATER CLASS CERTIFICATION

Regular Price \$285.00 - Holiday Special price \$225.00. Class has to be purchased by December 31, 2011 and has to be completed by December 31, 2012.

All T-Shirts 50% off—when they are gone they are gone.

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Not just an adventure of a
lifetime, but a lifetime of
adventure

nmscuba.com

*Photos courtesy of
Stacey Minton and
various others*

*We are looking for contributors and
encourage you to share stories, travel notes,
and/or photos.*

Upcoming Travel

Barbados: February 4—11, 2012

\$1975.00 + air

Curacao: April 28—May 5th 2012

\$2,725.00

Florida Wreck Trek: July 14—22, 2012

\$1,725.00 + air

Hawaii—Kona: September 21—28, 2012

\$2,295.00

BVI: November 3, 2012

\$ TBA



Curacao

Call us for details!